

Optimising energy efficiency finance in emerging economies in Southeast Asia

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A thesis submitted for the degree of a Doctor of Philosophy

July 2016

Certificate of original authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as part of the collaborative doctoral degree and/or fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Verena Streitferdt, 22nd of July 2016

Abstract

This thesis investigates the relationship between public and private sector efforts to optimise energy efficiency finance initiatives in an emerging country context, using Thailand as a case study.

Demand-side energy efficiency measures could significantly reduce pressures on energy systems in emerging economies in Southeast Asia while at the same time reducing greenhouse gas emissions. Rapidly increasing energy needs, combined with dependence on fossil fuel imports have put energy systems in the region under pressure. Due to high urbanisation growth rates, and comparatively inefficient industries, demand-side energy efficiency measures could be part of the solution.

The lack of external energy efficiency finance for industry and building owners is a major barrier, but reports and country examples contain mixed messages about how to best overcome this challenge. The dominant discourse around energy efficiency finance originates from international organisations who advocate for the public sector to focus all efforts on maximising private sector investments. However, developed country experience and some emerging country examples, suggest that the problem is more complex. Therefore, this thesis focuses on how to optimise energy efficiency finance.

Thailand serves as a case study due to the range of energy efficiency initiatives designed and implemented in that country since the early 1990s. Transition studies and Multi-Level Perspective, were chosen as the theoretical framework and heuristic tool for the analysis. Qualitative data in the form of interviews with forty-eight experts from government, the private sector and academia form the core of this research. The research found that in Thailand, after more than 10 years of public sector support for energy efficiency finance initiatives, success in the private sector has been limited. Challenges identified include: (1) a lack of de-risking measures (2) renewable energy projects receiving most funding; (3) lack of guidance from the Central Bank of Thailand and (4) missing cross-coordination with relevant ministries to create additional demand for energy efficiency finance services. Suggestions for next steps are provided.

The main finding from this research is that EEF in an emerging country context will never be transitioned 100% to the private sector, but will be reliant on long-term consistent support from the public sector. Policy makers and international organisations must therefore carefully evaluate the existing framework conditions before choosing which energy efficiency finance initiatives to support. The Multi-Level Perspective analytical framework could provide such an analytical tool to further unleash the energy efficiency potential in Southeast Asia.

Acknowledgements

I would like to thank the following agencies for providing me with financial support during my research: The University of Technology, Sydney for the UTS President's Scholarship, the Hildegard-Dinter Association for a travel fund, the Thai-German programme: Energy Efficiency Development Plan (TGP-EEDP) implemented by the 'Deutsche Gesellschaft für Technische Zusammenarbeit' (GIZ) and the Energy Research Centre of the Netherlands (ECN) for some short-term work opportunities in Thailand. One of the project workshops was co-hosted by Nexant, an international consulting firm, at its Bangkok regional office and another was co-hosted by an EU SWITCH-Asia Programme: Greening the Thai Automotive Industry.

My supervisory team saw the best and worst of me during the three and a half years of this endeavour. Their persistence, commitment and knowledge brought me here, so I am forever grateful to: Pierre Mukheibir, for always being available, process-orientated and cheerful; Timon Wehnert, for ad hoc deep analytical discussions at the most exquisite places; Mick Paddon for introducing me to social research and perfecting my English skills with his impeccable vocabulary; and David Crossley for work inspiration, crucial content insights and sharing with me his expansive network in Thailand and the rest of Asia. I cannot express enough how grateful and privileged I feel to have had this support, and in my next job I will miss having the 'four wise men' around me. Also, I would like to thank John Revington for providing a grammatical and typographic edit of the final thesis draft.

Also, my sincere thanks go to the professors, Dr. Surapong, Dr. Menke and the colleagues at the Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology in Thonburi and to the Thai-German programme: Energy Efficiency Development (TGP-EEDP) (GIZ) for their support. JGSEE graciously hosted me during my field trips. The JGSEE team and professors welcomed me to join professorial lunches and activities, and provided contacts and references. In particular, I would like to thank my three research assistants, Khun Phapada, Khun Krib and Khun Pan. Without their constant reflection and attentiveness this research would not have been possible. TGP-EEDP also provided me with a work space and due to their insightful discussions and contacts this research received its rich data. In particular, my gratitude goes to Khun Monthon for giving me analytical support, to Tom for facilitation to the programme director Milou Beerepot for her thought-provoking comments. Finally, I would like to thank Peter Du Pont for co-publishing with me a paper and all his support during my research.

In Berlin, in particular I would like to thank the Wuppertal Institute for Climate, Environment and Energy for hosting me during my three-month writing internship. Their collegial feedback during roundtables and joint lunches was invaluable. In particular, thanks to Florian Mersmann for MLP brainstorming, Shritu Shrestha for best lunches and Kristina Wagner for her flexible and competent assistance.

Thanks also to my medical support team who kept my health going, especially in the last two years after I contracted dengue fever. Thanks to Margaret for continuously re-energising my body after another dengue relapse, to Trish and Adrienne for nurturing food and conversations, to Tienne, Sinden and Paul for keeping my body and mind

flexible, and to Mira for helping me to experience again the joy of exercise through her contemporary dance classes.

Being a gypsy, friends at home and far afield are the nurturing ground on which I thrive. Internationally, I would like to say thanks to Jana for accountability and park yoga, to Kerstin for constant reflection and diet tips, to Anna for being the best Cambodian host and German adventurer, to Mari for her big Italian wedding, to Budi for her taste buds, to Michael for hosting and reflection time, to Odit for inspiration and to Bernie for long friendship and consistency.

In Berlin, I would like to thank Birgit for an alternative home, to Bere for bike and lunch escapes, to Alex for accommodation and insightful discussions, to Astrid and Kofi for the best rooftop terrace pizza experience, to Juergen and Anja for shelter and kids' distraction, to Silvia for fun activities and best conversations, to Anja for her clear mind, and to Manolo and Christian for Berlin adventures.

In Thailand, my particular thanks go to Martina and Nikola for incredible experiences, such as their newly born son Silvan, good food and great conversations, to Hala for hosting me, for sharing her network and for ad hoc dinners and coffees, to Robert for fun jogs and eating activities, and finally to Khun Ampawa for her hospitality, friendship and passion for her work on sustainable energy.

In Australia, very special thanks go to my flatmates for their hospitality and patience; to Ro for her continuous friendship, regardless of my constant travelling, our invaluable discussions around politics, gender and beautiful walks in Sydney and its surroundings; and to Jay and Louise for hosting me on and off in their beautiful Bronte home, distracting my mind with sharing beautiful 'film' moments, pinning me down to work and also giving me warnings to rest when they saw my health decline.

Further, I would like to thank the community of the Institute for Sustainable Futures and the Faculty of Social Sciences, in particular my pod neighbours Dana, Louise, Emilia, Tanja and Isabel for friendly smiles and chats; Jessica and Tara for friendship and hot chocolates; Chrisanthi and Matt for being loyal writing buddies; Reba for best lunch breaks; Reza for calming walks and delicious Iranian food; Laure-Elise for sharing her worries which made mine seem small; and Judy for coffees and walks and being a life inspiration. Besides university, I would like to thank Doris for best girls' outings; Jerome for shelter and calm perspectives; Janina for her passion for dance, her friendship and her open mind; Austin, Cenk and Alex for lovely memories; and Toni for her adaptiveness and sharing with me a beautiful new experience.

Faraway but always with me in spirit I also would like to thank: my family. The whole family 'Moritz' for our yearly meetings which give me the feeling of groundedness; Dorit and Lothar for cheering calls; my dad and Lucia for our skype conversations; my brother Tobi for wheelchair traveller and time management tips; and my mum, for inspiration, commitment and beautiful spa experiences when most needed – without your constant support I would not be here.

But finally, and most importantly I would like to thank the many Thai and Thai-based international professionals who participated in the interviews and roundtable discussions. Their sharing of their deep experiences with Thailand's energy efficiency policies and programs was invaluable to the success of this research.

I dedicate this thesis to **love** and **hope**:

Love for my brother, Tobias, as without our shared passion for travel this PhD would never have become reality, and

hope to Southeast Asia that it will demonstrate to the world that prosperity and resource efficiency can be achieved together.

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List of relevant publications

The analysis of the public energy efficiency finance mechanisms in Thailand discussed in Chapter V of this doctoral thesis have been published and are under review. The publications are listed below:

- 1) Streitferdt, V. & Chirarattananon, S. 2015, 'Energy Efficiency Finance Support in Thailand: Lessons learned from the Energy Efficiency Revolving Fund', *Journal of Sustainable Energy & Environment*, vol.6, pp. 21-26.
- 2) Streitferdt, V., Chirarattananon, S. & Du Pont, P. 2016, 'Lessons learned from Studying of Public Initiatives to support Energy Efficiency Financing in Thailand from 1992 to 2014', *Energy Efficiency* () 1-19. DOI: 10.1007/s12053-016-9492-1

List of acronyms

ADB	Asian Development Bank
AFD	French development agency
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of South East Asian Nations
BOI	Board of investment
CHUEE	China Utility-Based Energy Efficiency Finance Programme
CIMB	Commerce International Merchant Bank
CSR	corporate social responsibility
DANIDA	Denmark's development cooperation
DEDE	Department of Alternative Energy Development and Energy Efficiency
DFID	Department for International Development
DSM	demand-side management
EE	energy efficiency
ECFT	Energy Conservation Foundation of Thailand
EECT	Energy Efficiency Centre of Thailand
EEDP	Energy Efficiency Development Plan
EEF	energy efficiency finance
EforE	Energy for Environment Foundation
EGAT	Electricity Generating Authority of Thailand
EERF	Energy Efficiency Revolving Fund
EERS	Energy Efficiency Resource Standards
ENCON	energy conservation
EPC	energy performance contracts
EPPO	Energy Policy and Planning Office
ESCO	energy service company
ESC	energy supply contracts
ESI	electricity service industry
FTI	Federation of Thai Industries
GEF	Global Environment Facility
GHG	greenhouse gas
GIZ	German technical development cooperation
GS - EPCs	guaranteed savings – energy performance contracts
IDB	Inter-American development Bank
IFC	International Finance Corporation
IFCT	Industrial Finance Corporation of Thailand
IMF	International Monetary Fund
IPEEC	International Partnership for Energy Efficiency Corporation
IPCC	Intergovernmental Panel on Climate Change

JGSEE	Joint Graduate School for Energy and Environment
KfW	Kreditanstalt für Wiederaufbau
ktoe	kilotonne of oil equivalent
kWh	kilowatt hour
MEA	Metropolitan Electrification Authority
MLP	multi-level perspective
NAMA	nationally appropriate mitigation action
NEPO	National Energy Policy Office
OECD	Organisation for Economic Cooperation and Development
PEA	Provincial Electrification Authority
PTT	Petroleum Authority of Thailand (PTT) Public Company Limited
RE	renewable energy
SS – EPCs	shared savings – energy performance contracts
SME	small and medium enterprises
SME Bank	Small and Medium Enterprise Development Bank of Thailand
SOP	Standard Offer Program
TGO	Thailand’s Greenhouse Gas Organisation
TGP-EEDP	Thai-German programme: Energy Efficiency Development Plan
THB	Thai Bath
TIS	technology innovation systems
TM	transition management
UK	United Kingdom
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
US	United States of America
USAID	US Foreign Assistance programme
UTS	University of Technology, Sydney

Glossary

Asian developing and emerging economies	Asian developing and emerging economies are characterised by rapid economic growth, high urbanisation, and high levels of poverty (APEREC 2013). This definition deliberately includes both developing and emerging economies, as energy systems are especially challenged during the transition from a developing to an emerging economy. They differ for example in the support they receive from international organisations.
Demand-side energy efficiency measures	These are measures which reduce the energy consumption of consumers, for the same productive output, or providing higher energy services or production for the same amount of energy consumption. Energy Efficiency measures include improvements to the existing infrastructure stock of industry and buildings as well as the provision of energy-efficient solutions for new projects in the industry and building sectors (Selmet 2012).
De-risking measures	These are measures which help investors and EE service providers to manage specific types of risks. These measures can be, for example, loan guarantees, insurance, or foreign exchange/liquidity facilities. The public sector could directly provide the finance or provide the finance to a financial institution at a subsidised rate (Venugopal 2012).
Energy efficiency	Energy efficiency is defined in this thesis either consuming less energy for the same productive output, or providing higher energy services or production for the same amount of energy consumption (Selmet 2012).
Energy efficiency finance	Energy efficiency finance means funding energy efficiency projects for demand-side measures within the industry, building, residential and public sectors (Taylor 2012).
Energy efficiency finance initiatives	EEF initiatives are public and private sector efforts to provide financial tools to provide external EEF to customers in the industry and building sectors (Taylor 2012). Some have defined these as supply-side policies to support EEF. However, due to the confusion about the terms demand-side and supply-side energy efficiency the term supply-side policies will not be used in this thesis.
Energy efficiency projects	Energy efficiency projects are projects that use less energy for the same service than previously consumed (previous performance). This can be measured compared to the existing practice of that industry or standards (if available in the country).
Energy supply contracts	In ESC, the ESCO provides specific energy efficiency services for an agreed fee. In this model maintenance and operation stays with the ESCO company and the customer pays the ESCO for the electricity for a

long period of time (10-15 years). The output is measured in verified megawatt hours provided to the customer by the ESCO, but does not involve a performance contract (MacLean & Purcell 2014; Würtenberger 2012).

External energy efficiency finance	External EEF here means all funding that does not directly come from corporations' earnings, but always uses third parties to mobilise finance. These third parties could for example be banks, leasing companies, ESCOs (Taylor 2012).
Framework conditions	National circumstances in a country that influence EEF initiatives: electricity sector (electricity price, EE regulations, institutional set-up); finance sector (institutional set-up, regulations), but also external pressures or underlying cultural and political circumstances. The framework conditions in the theoretical language used are the landscape and the regime(s) level.
Framework conditions	These are the national circumstances in a country that influence EEF initiatives. For the electricity sector, they include: electricity prices, EE regulations, institutional set-ups. For the finance sector, they include: institutional set-up, and regulations. They also include external pressures or underlying cultural and political circumstances. The framework conditions in the MLP framework are defined at the level of the landscape and the regime(s).
Guaranteed savings – energy performance contracts	In guaranteed savings – energy performance contracts the ESCO guarantees to the customer a certain amount of energy savings; any revenues that are generated beyond those energy savings are kept by the ESCO (Crossley & Wang 2013).
Landscape	Landscapes are defined by transition studies as external pressures and non-changeable framework conditions. Thus the landscape is defined as the 'whole set of impacts outside the level of niches and regimes, which have influence' (Lachman 2013, p.271). It also includes the 'deep structural relationships' of society (Baker, Newell & Phillips 2014, p.794). So, in this research landscape conditions can include (1) fluctuations in oil prices; (2) financial crises; (3) national, regional or international political pressures (e.g. from the IMF); (4) the political system, (5) corruption and (6) cultural characteristics.
Niche	A niche is a protected space where technological innovation can evolve and develop towards penetrating the dominant market structures (Kemp, Schot & Hoogma 1998). For this research, energy efficiency finance for the building and industry sectors is defined as the 'radical social innovation', and the niche is defined as the existing EEF initiatives (Witkamp, Raven & Royakkers 2006, p.2).

Private sector energy efficiency finance models	Energy efficiency finance models are defined as primary transaction structures that have been created by the private financial sector to reap the business opportunities of the EE investment niche market (MacLean & Purcell 2014; Würtenberger 2012).
Public energy efficiency finance mechanisms	Public energy efficiency finance mechanisms (PEEFMs) are 'arrangements amongst institutions and market players to finance and implement energy efficiency projects' (Kats et al. 2012). In this thesis the focus is on external funding that leads to EE implementation by the industry and commercial building sector (Taylor 2012).
Regime	A regime is 'a variety of mutually reinforcing and entrenching cognitive, social, economic, institutional and technological processes that sustain existing trajectories of development' (Smith, 2007:p.428). So, in this research the electricity and the financial regimes are the core focus of the analysis.
Shared savings energy performance contracts	Under the shared savings energy performance contract model the ESCO and the customer share the cost savings from implementing the EE measures at an agreed percentage for a fixed number of years (Crossley & Wang 2013).

Chapter I: Introduction

The sustainable development in Asian developing and emerging economies is challenged by the rapid economic development, and by the reliance of these economies on fossil fuels. Sustainable development is defined as development that satisfies needs of the present but does not limit the needs of future generations (United Nations 1987). Thus, sustainable development tries to achieve a balance between the social, economic and environmental needs of the people (Daly 1996). The majority of the countries in the Asia-Pacific region are net energy importers and energy demand has increased rapidly in the last three decades (UNESCAP 2012c). Increases in global energy prices and reliance on fossil fuels have led to vulnerabilities, especially in Asian developing and emerging economies. Asian developing and emerging economies are characterised by rapid economic growth, high urbanisation, and high levels of poverty (APEREC 2013). The term developing and emerging economies is deliberately used in this thesis, as it was found that the shift from developing to emerging country has particular challenges for the energy system, especially when it comes to support from international organisations. For example, in 2011, UNESCAP (2012) estimates that 42 million people in Asia and the Pacific were impoverished due to international oil and food price increases (UNESCAP 2012). Further, the use of fossil fuel is contributing to climate change and thus to increases in the frequency and intensity of natural disasters. In 2011, more than 170 million people in Asia and the Pacific were affected by natural disasters (UNESCAP 2012). As demonstrated above, and as recognised within the United Nations' sustainable development goals, energy security and reliability has an impact, not only on the economy but also on sustainable development overall (UNDP 2014).

Internationally, increased energy efficiency (EE) has been acclaimed as the approach with the greatest potential to increase energy security, while at the same time reducing GHG emissions. EE is defined in this thesis by either consuming less energy for the same productive output, or providing higher energy services or production for the same amount of energy consumption (Selmet 2012). The International Energy Agency estimates that adopting EE measures worldwide would lead to 50% of the reduction needed to keep average global temperatures to less than three degrees above pre-industrial levels (IEA 2011b).

Demand-side EE has the potential to be particularly suitable to developing and emerging economies in Asia, since the potential to reduce the consumption of energy in industry and in buildings appears high. This is mainly due to the rapid increases in urban population and the resulting need for new built infrastructure, and a relatively inefficient

industry sector (ADB 2013a). EE measures include improvements to the existing infrastructure stock of industry and buildings as well as the provision of energy-efficient solutions for new projects (Selmet 2012).

Studies which focus on developing countries have identified several micro and macro barriers for EE which co-exist in parallel and interact with each other (Sorrell et al. 2011; UNIDO, 2011). For example, imperfect information on available technologies and EE reduction potential, and hidden costs, such as those involved in maintenance, the disruption of the production lines and staff training, have been identified (Ghosh 2001; Hasanbeigi, Menke & Du Pont 2009). In developing countries one of the main barriers identified was lack of access to capital within the industry and building sectors (Sorrell, Mallett & Nye 2013)

International organisations and development banks have promoted the maximisation of private sector investments (ADB 2013a; Farrell et al. 2008). The donor and development bank literature focuses on how EEF initiatives could be shifted from public sector initiatives towards the private financial sector, mainly due to the limited public sector funds in developing and emerging economies (Selmet 2012). So far research on how the public sector could support the provision of external EEF services in a developing and emerging country context is still very limited.

Considering the constraints facing governments and the commentary from international organisations on developing and emerging economies, the challenge external capital within the industry and building sectors has been chosen as the focus of the research in this thesis. External EEF here means all funding that does not directly come from corporations' earnings, but always uses third parties to mobilise finance. These third parties could for example be banks, leasing companies, ESCOs (Taylor 2012). This thesis seeks to contribute to the literature by exploring the relationship between the public and private sector efforts to optimise EEF initiatives in an Asian emerging country context.

1.1 Relevance and complexity of external EEF

There are not many studies that consider external EEF initiatives, particularly in developing and emerging economies. Most studies come from international development organisations (Limaye et al. 2012; Taylor 2012; Taylor et al. 2008; Wang et al. 2013). They have identified several financing barriers to EEF initiatives. The main

challenges mentioned are: (1) insufficient information, (2) the fact that a multitude of actors are involved in developing financial services and (3) high transaction costs (Limaye et al. 2012; Taylor et al. 2008). Therefore, it is argued that the public sector needs to play a part in efforts to overcome the barriers.

1.1.1 International discourse

The conceptual discourse, shaped by development banks and international organisations, focuses on how the public sector can help to shift EEF initiatives to the private sector. The rationale is that with increased development, countries would move away from grants to more private sector financing. Five types of EEF initiatives have been identified to assist in that process: (1) EE funds; (2) utility programmes; (3) dedicated credit-lines; (4) risk-sharing programmes; (5) performance contracting systems via energy service companies (ESCOs).

The push for private sector involvement and for changes at the national level needs to consider the interests of international organisations, especially development banks. Between 1991 and 2010 the Global Environmental Facility (GEF) spent US\$473 million on EE projects in developing and emerging economies. These projects were implemented by several organisations (Yang 2013). In 1992, UNDP implemented 95 global projects on EE in 55 developing countries (Selmet 2012). Most of these projects involved co-funding by several development banks. Between 2002 and 2006 the United Nations Environmental Programme (UNEP) and the World Bank focused on investigating EEF schemes (Taylor et al. 2008). Between 2003 and 2010, the Asian Development Bank (ADB) focused their EE attention mainly on the supply side (energy generation and distribution), and provided US\$260 million to external finance facilities for EE projects in the industry and building sectors (ADB 2011).

In development studies and political economy literature, the interests of international organisations are explored. Development studies scholars have described in detail how the World Bank and other international organisations took part in shaping policies and forming institutions in developing and emerging economies, mainly to further their own economic interests (Cammack 2002; Escobar 1995; Gill 1995). In the 1970s the International Monetary Fund (IMF) and the World Bank provided loans to help developing economies respond to rapid growth of the infrastructure and energy sectors. However, this resulted in increased annual interest payments of World Bank loans from around US\$1.1 billion in 1970 to about US\$18.4 billion in the 1980s (Bates 1988). The loans were conditional on policy reforms that mainly opened up the economies and ensured resource exports to the developed countries (Escobar 1995). Also, it has been claimed

that international climate negotiations have followed the old imperialist paradigm of developed nations furthering their own interests rather than providing selfless development assistance (Agrawal, Narain & Sharma 1999). Also, in transition studies, the self-interest of donors was noted by Meadowcroft (2005, p.496) 'Technological change has long been a political battleground'. Therefore, a discourse shaped mainly by international development banks needs to be scrutinised with care and reflection.

1.1.2 Experiences of EEF initiatives in the developed countries and selected emerging economies

A brief overview of EEF mechanisms in developed countries and recent grey literature from developing and emerging economies, reveals a more diverse picture. It suggests that EEF mechanism can be very diverse and depend on conducive framework conditions within a country to induce investments.

1.1.2.1 Diversity of EEF initiatives

A diverse range of EEF initiatives could be identified from existing literature, with up to 18 different 'models and strategies' in the US (Kats et al. 2012; MacLean & Purcell 2014; Würtenberger 2012). In particular, developed countries give more prominence to public sector -driven initiatives such as the Property Assessed Clean Energy financing mechanisms in the US (MacLean & Purcell 2014). Further, the analysis of seven sample countries (Australia, Germany, the US, China, India, Indonesia and Mexico) also revealed a broader diversity and also indicated that this diversity is dependent on the type of customer targeted the targeted customer. Which type of customer is targeted also depends on the political priorities in emerging countries. Further, regardless of their development status, countries are still providing de-risking support. In addition, the private sector investments do not provide all of the finance for EE initiatives in any of the countries examined (Schröder et al. 2011; Wang et al. 2013).

1.1.2.2 Context matters

Some policy reports have suggested that besides the specific EEF mechanisms implemented, an enabling environment also needs to be created to encourage investments. For example, (Taylor 2012) explains that without guidance from Central Bank of China no banks would develop funding options for EE, as it is such a small niche market.

Thus, the complexity revealed by the issues identified above confirms the need to investigate: *'How can energy efficiency finance best be optimised in Asian developing and emerging economies?'*

1.2 Multi-level perspective –opportunity to analyse broader influences

The complexity of the transdisciplinary problem of EEF means there is a need to explore the interrelationships between the finance and electricity sectors, and the interplay of international influences and the political system. Consequently, understanding how public sector policies might support the growth in EE initiatives requires a robust analytical framework.

Transition studies, in particular those which utilise the analytical framework of Multi-Level perspective (MLP) for their analysis, enable a differentiated analysis across different levels of a socio-technical problem. Transition studies, which originated in European sustainable policy research, use a systemic lens to analyse the social and technical challenges of sustainable initiatives. They are able to cut across different disciplines (van den Bergh, Truffer & Kallis 2011; Ison 2008). Most importantly, besides providing analytical tools to assess the sustainable initiatives itself (the niche level), MLP also includes an analysis of the prevalent framework conditions (the regime level) and external influences (the landscape level) (Geels 2005). The challenge of EEF is a socio-technical problem, given the diversity of EEF mechanisms and models (technical) as well as the multitude of stakeholders (Social) that need to be involved. Further, literature suggests that framework conditions and international influence need to be recognised. Therefore, transition studies seem as a suitable discipline for this research.

Despite some criticism of MLP, it is still considered as a useful heuristic tool for this thesis, especially to explore wider framework conditions besides the EEF initiatives. MLP traditionally focuses on a technology innovation and not on a social service (Geels 2005). Also, most MLP research is focused on Europe (Markard, Raven & Truffer 2012). Some observers have questioned the relevance of some of the theoretical aspects of MLP to the developing and emerging country context (Verbong et al. 2010). Also, the importance of political relationships, international influences and the political system, which are so important in developing and emerging contexts, have not been sufficiently conceptualised in this framework (Genus & Coles 2008; Hansen & Nygaard 2013; Meadowcroft 2005). However, recent research has tried to break up some of MLP's stringent theoretical applications by: (1) focusing on social sustainable initiatives (Witkamp, Raven & Royakkers 2011). (2) increasing the amount of research in Asian developing and emerging economies (Berkhout et al. 2010) and (3) trying to identify the link between MLP and political economy analysis (Avelino 2011; Lawhon & Murphy 2012). Also, MLP has only been used in this research as a heuristic tool, and

discussions were enriched with insights from the political economy and development studies literature.

The boundaries of the research are illustrated in Figure 1, which shows the focus of analysis on each level (niche, and regime and at landscape). The niche that this research will analyse is external EEF initiatives, namely the public sector EEF mechanisms or the private sector EEF models. The relevant regimes that have been identified are the electricity and finance sectors, which are influenced by the landscape which consists of external events, such as oil prices on the one hand but also ‘deep structural relationships’, such the political developments and cultural characteristics (Climate and Development Knowledge Network 2014, p.794).

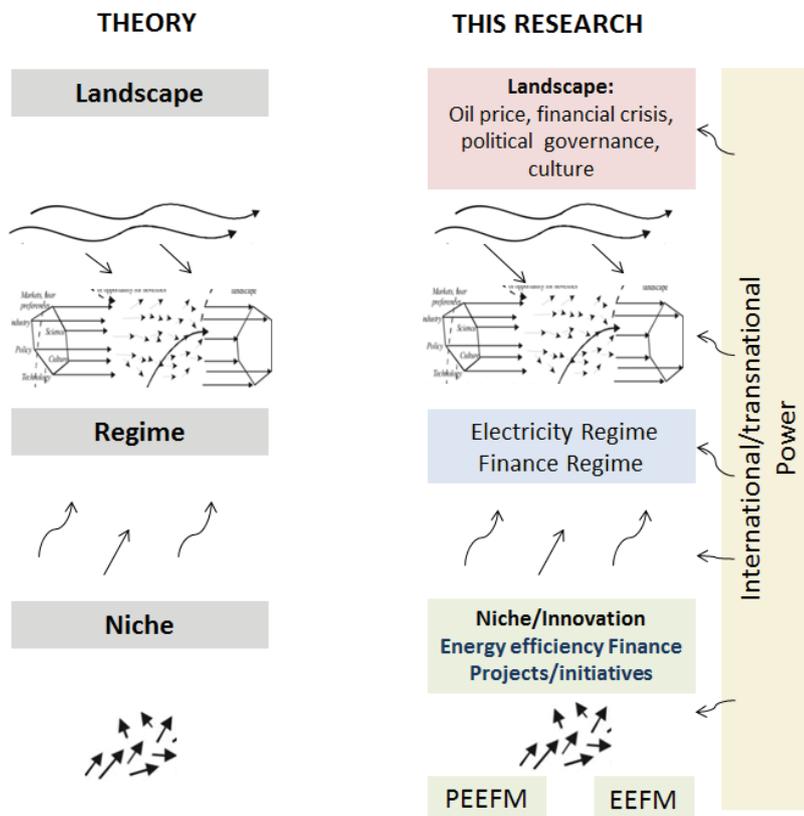


Figure 1: Multi-level perspective on transitions (adapted from Geels & Schot 2007)

1.3 Research areas

The thesis seeks to contribute to the design and analysis of sensitive policy interventions to support the provision of EEF services. Therefore, the overall research question is: ‘

‘How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?’

Informed by the MLP framework and the choice of a case study approach, the overall research interest is broken down in four areas of in-depth research:

- 1) public sector EEF mechanisms that directly provide EEF services
- 2) private sector EEF models that provide EEF services and their relation to the public sector initiatives
- 3) the ways in which framework conditions influence the outcomes of EEF service provision and success
- 4) the relationship between private and the public sector EEF initiatives and how the overall supply of EEF initiatives can be further optimised.

The discourse of international organisations and development bank suggests that sustainable initiatives start from the public sector and after a period of time move into the private sector (Selmet 2012). Therefore, the research firstly focuses on the public sector initiatives started.

The next focus is on private sector EEF models and the extent to which public sector support has assisted their development. So far, studies that investigate the breadth of private sector EEF models in an emerging country context, have been limited to China, Brazil and India (Taylor et al. 2008).

Finally, the influence of national framework conditions and how they have influenced EEF initiatives is investigated. Particular attention has been paid to the electricity and financial sectors, political system and international influence.

Returning to the overall research interest, the relationship between public and private sector EEF initiatives are discussed and further suggestions for actions will be made.

1.4 Methods and data collection approach

1.4.1 Case study

Thailand has been selected as a case study due to its vast experience with public sector EEF mechanisms, being an Asian emerging economy and its openness to sharing information. Due to prominent public sector EEF mechanisms, such as the Energy Efficiency Revolving Fund (EERF) in 2004 and the ESCO Fund in 2006, Thailand has implemented public sector EEF mechanisms that can be analysed (Gruening et al. 2012). Due to rapid economic development and high rates of urbanisation, Thailand has moved from a developing to an emerging economy in only two decades. Finally, the Thai government, in particular due to the Association of South East Asian Nations (ASEAN) cooperation, seeks opportunities to demonstrate and share experiences (Pongphisoot 2014).

1.4.2 Semi-structured interviews

Qualitative semi-structured interviews were the core data collection method for this research. Accessible quantitative data on EEF initiatives is rarely available in developing and emerging economies (Batterbury, Forsyth & Thomson 1997). Also, this research seeks to explore experiences on learning and shared goals of the stakeholders. Therefore the core of the data collected is qualitative (Denscombe 2010). Forty-eight semi-structured interviews were conducted with government, the private sector representatives, consumers and international consultants (Kvale & Brinkmann 2009). Two World Cafes, one on ESCO finance and energy performance contracts, and one on the small automotive industry, were conducted to enable a broader discussion with relevant stakeholders (Brown & Isaacs 2007). Further, for triangulation, important legislative documents from the Thai government were used.

An adaptive research approach was taken to adjust the research focus according to circumstances encountered during the field trips. As this research is situated in an emerging economy, where data can be scarce and difficult to access, an adaptive research approach was taken. An adaptive research approach allowed for a continuous process of reflection and re-design of the analytical framework, depending on the findings (Holling 2001). Therefore, overall three field trips were conducted with different foci: (1) a scoping trip to set up the research and connect to local institutions; (2) Field trip I that focused on the public sector EEF mechanisms that exist in Thailand and (3)

Field trip II which focused on the private sector EEF models. Overall, the researcher spent eight months in Thailand.

For exchanges with local stakeholders several tools were used for verification of interpretations and to disseminate and discuss the findings in the local context. Entry and exit seminars for each field trip allowed for discussions with key local experts that ensured a transfer of knowledge and to validate the findings. Especially for the second field visit, close collaboration with two research assistants allowed for cultural interpretations and the translation of necessary secondary documents. Further, mid-term field trip evaluations were conducted to allow for academic feedback on the data collection process. All of these initiatives ensured the collection of rich data for the analysis.

1.5 Definitions

Cutting across the disciplines of energy engineering, economics and policy, there are several terms and concepts that have different meanings within each discipline. This section will clearly define the most important terms and concepts that are used in this thesis. In addition, the glossary provides a summary of these terms and concepts for easier access.

1.5.1 Content-related terms

- **Demand-side EE measures**
Measures that encourage consumers of energy to reduce their consumption patterns via changes to behaviour or technology (Selmet 2012). This results in the use of less energy to produce the same output. Demand-side EE measures include improvements to the existing infrastructure stock of industry and buildings as well as the provision of EE solutions for new projects in the industry and building sectors (Selmet 2012).
- **External EEF**
External public sector funding that leads to EE implementation by the industry and commercial building sectors (Taylor 2012). External EEF here means all funding that does not directly come from corporations' earnings, but always uses third parties to mobilise finance. These third parties could for example be banks, leasing companies, ESCOs (Taylor 2012).
- **EEF initiatives**

Public and private sector efforts to provide financial tools for the provision of external EEF to customers in the industry and building sectors (Taylor 2012). Some have defined these as supply-side policies to support EEF. However, due to the different meaning of the terms demand-side and supply-side EE among energy engineers the term supply-side policies will not be used in this thesis. EEF initiatives consist of public sector EEF mechanisms and private sector EEF models.

- **Public sector EEF mechanisms**

Public sector EEF mechanisms are defined as ‘arrangements amongst institutions and market players to finance and implement EE projects’ (Kats et al. 2012, p.4).

- **Private sector EEF models**

Private sector EEF models are defined as primary transaction structures that have been created by the private financial sector to access the business opportunities of the EE investment niche market (MacLean & Purcell 2014; Würtenberger 2012).

- **De-risking measures**

De-risking measures are measures which help investors and EE service providers to manage specific types of risks. These measures can be, for example, loan guarantees, insurance, or foreign exchange/liquidity facilities. The public sector could directly provide finance or give finance to a financial institution at a subsidised rate (Venugopal 2012).

1.5.2 Definition of terms used in the theoretical framework

Some terms used in the theoretical framework of transition studies, might conflict with the common usage of these terms; they will also be defined below and in the glossary.

- **Framework conditions**

These are the national circumstances in a country that influence EEF initiatives. For the electricity sector, they include: electricity prices, EE regulations, institutional set-ups. For the finance sector, they include: institutional set-up, and regulations. They also include external pressures and the political system. The framework conditions in the MLP framework are defined by the levels landscape and regime(s).

- **Landscape**

Are defined by transition studies as external pressures and non-changeable framework conditions. It is defined as the ‘whole set of impacts outside the level

of niches and regimes, which have influence' (Lachman 2013, p.271). It also includes the 'deep structural relationships' of society (P. Newell et al., 2014, p. 10). So, in this research landscape conditions can include (1) fluctuations in oil prices; (2) financial crises; (3) national, regional or international political pressures (e.g. from the IMF); (4) the political system, (5) corruption and (6) cultural characteristics.

- **Regime**

A regime is 'a variety of mutually reinforcing and entrenching cognitive, social, economic, institutional and technological processes that sustain existing trajectories of development' (Smith, 2007:p.428). So, in this research the electricity and the financial regimes are the core focus of the analysis.

- **Niche**

A niche is a protected space where technological innovation can evolve and develop towards penetrating the dominant market structures (Kemp, Schot & Hoogma 1998). For this research, EEF initiatives is defined as the 'radical social innovations', and the niche is defined as existing EEF initiatives, may they be initiated by the public or from the private sector (Witkamp, Raven & Royakkers 2006, p.2).

1.6 Contribution to knowledge

This study contributes to the body of knowledge on public sector policies that support EEF initiatives in an emerging country context. Using Thailand as a case study, the thesis provides an in-depth analysis of the development of EEF initiatives over time, and of how the relationship between public and private sector support has changed. Some lessons learned from the evaluation of two prominent public EEF mechanisms are outlined. Finally, three private sector EEF models are analysed in detail regarding their public support needs. Further, the thesis also identifies initiatives that could further support EEF in Thailand.

This research specifically demonstrates that governments need to constantly evaluate and balance their long-term support for the EEF initiatives. Further, they need to create enabling EEF framework conditions (the context). Only then might private sector EEF services increase. However, the findings in this study reject the note that public sector support can eventually cease completely.

The research strengthens the emerging argument that framework conditions have a crucial role to play in the choice of EEF initiatives. Further, in line with recent calls for policies for EEF that create a market, three distinct next steps for the Thailand case study are highlighted. Given that MLP was useful as an analytical tool, an adapted framework for further analysis of EEF in emerging economies is presented.

The findings are relevant for three reasons. Firstly, in international energy and climate policy debates, the push for private sector involvement has been loud, but has not provided a detailed analysis of how and why this needs to be done in particular situations.

Secondly, the results are interesting for policy makers and stakeholders in the Thailand case study and possibly other Southeast Asian countries. Obtaining EEF has long been recognised as one of the barriers to achieving EE implementation. Thus, the lessons identified in this thesis might also be useful for other countries in the Southeast Asian region.

Finally, this thesis contributes to the academic discussion around the application of transition studies frameworks in a developing and emerging country context.

A more detailed elaboration of the specific contributions to knowledge is provided in the conclusions.

1.7 Thesis outline

As Figure 2 indicates, the rest of the thesis is structured in nine chapters.

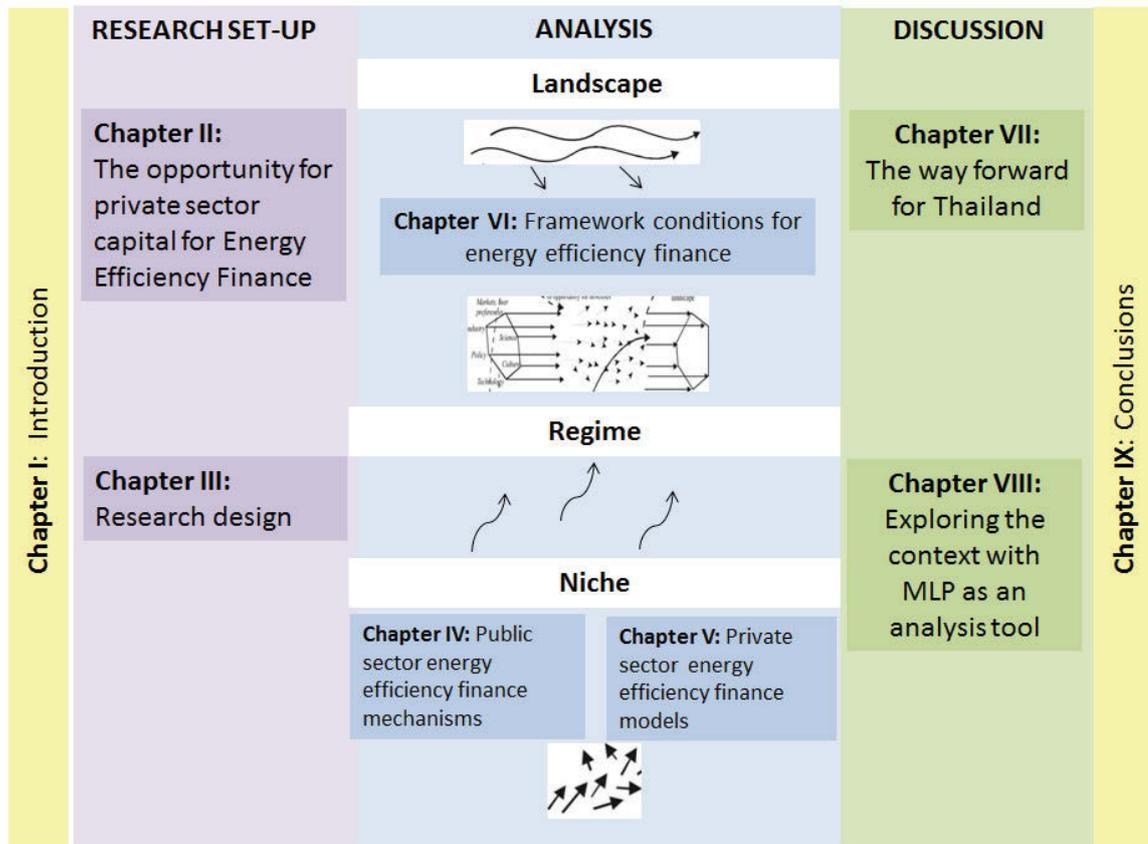


Figure 2: Graphical overview of the thesis structure

Chapter II provides the rationale for the research focus on EE. The current challenge the Southeast Asian region faces in regards to energy security and global climate change impacts is firstly discussed. Then an argument that demand-side EE can be a solution is presented. An overview of the international literature defines the multiple barriers to EE and narrows in on the barrier of insufficient external capital, which is particularly relevant in emerging economies. Then, the current state of knowledge is presented in regards to overcome this barrier in developing and emerging economies. The dominant discourse of international organisations is challenged by some empirical literature evidence from selected developed and other emerging economies.

Chapter III then elaborates on the research approach, the theoretical framework and the methods used in this research. A case study in Thailand was seen as the most suitable way to address the research question. Due to the transdisciplinary nature of the question, transition studies, and in particular a multi-level perspective, were chosen as the theoretical framework. Further, considering some valid criticism of the model adaptations are introduced. The second part of the chapter focuses on the qualitative methods chosen for this research and how they were applied over the course of the three field trips in the Thailand case study. Finally, the adaptive research approach was

explained and the measures that were taken to ensure data validity and exchange of local knowledge of Thai stakeholders.

Chapter IV provides an overview of the public sector efforts made in the Thailand case study to support EEF at the niche level. Firstly, an overview over time of the development of public sector EEF mechanisms will be presented. Then an in-depth analysis will outline in more detail some lessons learned from two public sector EEF mechanisms, namely the Energy Efficiency Revolving Fund (EERF) and the ESCO Fund.

Chapter V investigates what impacts the public sector activities had so far on the development of private sector EEF models at the niche level. Firstly, a literature review demonstrates the various private sector EEF models that can exist for different actors and customers. Then, an in-depth case study of three models existing in the Thailand case study will provide specific knowledge on the current status and its challenges: (1) EE-lending; (2) EE leasing; (3) ESCO-arranged finance.

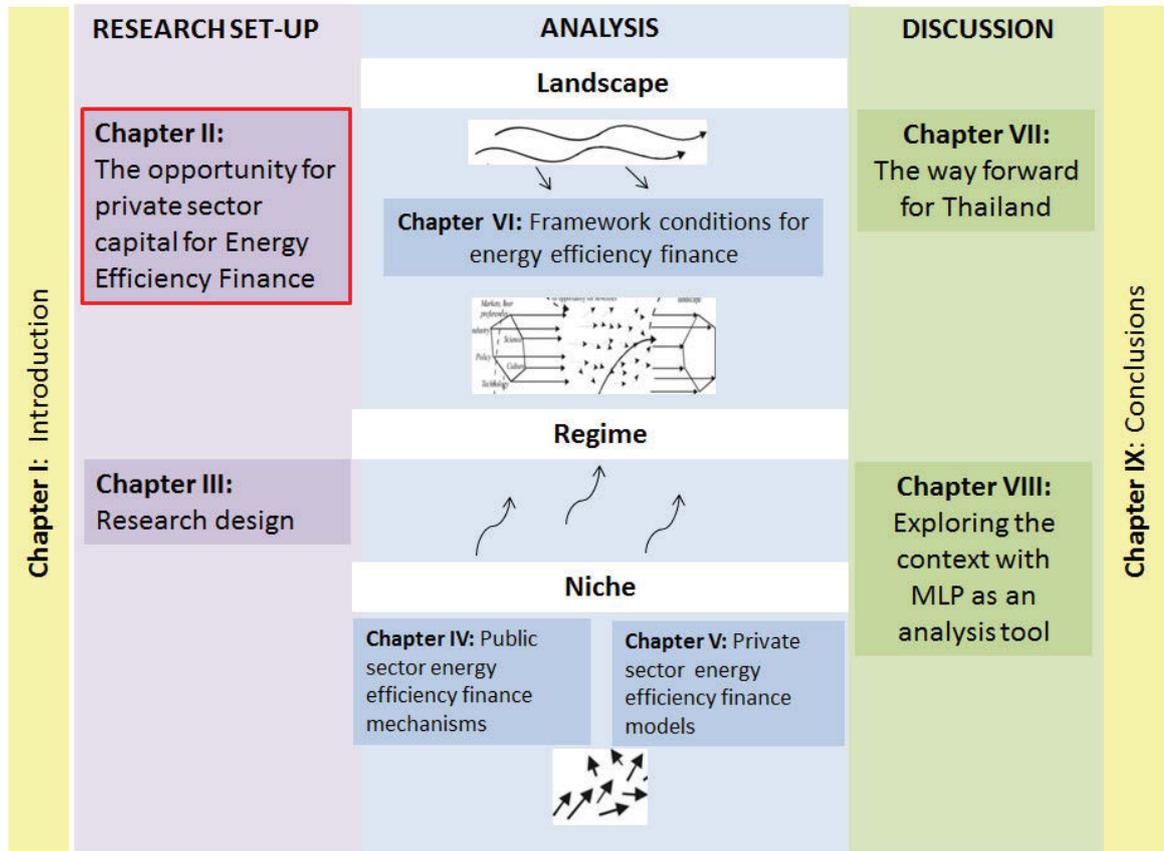
Chapter VI will then consider the national framework conditions, described by the regime and landscape and what factors might influence the current fragile position of private sector EEF models in Thailand. It starts with an overview of the electricity and finance sectors development and the external influences that have impacted on them over the last fifty years. Attention will be paid to the influence of the political system and international factors. Finally, the current state of EEF initiatives will be explained via these regime findings.

Chapter VII provides suggestions about how the Thai public sector could support EEF further. First, the recommendations from the interviewees for next steps in the Thailand case study will be presented. Then, reflecting on the broader framework conditions and exit workshops, three options will be discussed more in-depth, namely the establishment of a guarantee mechanisms, the set-up of utility programmes and finally the development of a public building sector programme.

Chapter VIII will reflect on how useful the analytical framework of MLP was for the analysis, and which aspects were challenged by its application in an emerging country context. The first section elaborates on which parts of the framework were useful and which ones were not. Then a suggestion is made regarding what aspects should be included in an analytical tool that provides guidance for the future design of public sector support mechanisms in Southeast Asia.

Chapter IX summarises the main findings and outlines the contribution of the thesis to the literature and to policy development. Moreover, it discusses the limitations of the thesis, and suggests areas for future research in the field.

Chapter II: The opportunity for private sector capital for Energy Efficiency Finance



2.1 Introduction

Ensuring energy security is challenging in Asian developing and emerging economies, due to rapid economic growth which causes an increase in energy demand, energy import dependence and recent increases in the number and intensity of natural disasters (UNESCAP 2012c).

Demand-side energy efficiency (EE) initiatives offer attractive solutions to this challenge. They are cost effective, have lower climate change impacts compared to other energy supply options, and have a high potential in Asia and the Pacific (ADB 2015c; Anbumozhi 2009; IEA 2012). Demand-side EE is defined in this thesis as the reduction of the energy consumption in the industry and building sector, for the same productive output, or providing higher energy services or production for the same amount of energy consumption. EE measures include improvements to the existing infrastructure stock of industry and buildings as well as the provision of energy-efficient solutions for new projects in the industry and building sectors (Selmet 2012).

A shortage of capital within the industry and building sectors has been identified as one of the main barriers to EE implementation in developing economies (Sorrell, Mallett & Nye 2013). This research focuses on external energy efficiency finance (EEF) as a means of providing access to finance to industry and building owners in emerging economies. EEF herein is defined as external funding for energy efficiency projects for demand-side measures within the industry and building sectors (Taylor 2012). External EEF here include all funding that does not directly come from corporations' earnings, and which uses third parties to mobilise finance. These third parties could for example be banks, leasing companies and energy service companies (ESCOs) (Taylor 2012).

Literature on EEF initiatives in developing and emerging economies is limited and is dominated by the discourse of international donor and development banks regarding how to maximise private sector capital. This line of argument was reignited recently by the international climate finance discussion when talking about how developing and emerging economies with limited public budgets can reduce and adapt to the impacts of climate change (Selmet 2012; Venugopal 2012).

Some emerging findings from grey literature suggest that the situation is more complex. A more differentiated discussion around optimising the relationship

between the public and the private sector to optimise EEF in a developing and emerging context is needed.

Therefore, this thesis addresses the overall research question: *'How can energy efficiency finance best be optimised in Asian developing and emerging economies?'*

A comprehensive literature review of relevant literature and policy briefs forms the content of this chapter. First, a detailed barriers analysis to EE was conducted using google scholar with using various key words such as energy efficiency AND developing countries or energy efficiency AND barriers. Then, a google search was conducted to identify EEF mechanisms and models. As journal papers are limited policy briefs and reports from development cooperation were included in the literature research. Only four publications from Europe and America could be identified that provide comprehensive lists of private sector EE financing models (ADB 2015b; Kats et al. 2012; MacLean & Purcell 2014; Würtenberger 2012).

Finally, an in-depth literature review, using google scholar, of seven countries was conducted to provide an indication of the current stages of EEF globally. Rather than attempting to provide a holistic global or even national overview, countries were selected which (1) cut across different development stages (developed and emerging economies)¹; (2) were well documented; (3) were innovative EE financing examples and (4) involved different framework conditions (e.g. the political system). Therefore, in the end three developed countries, Australia, Germany and the United States, and four emerging economies, China, India, Mexico and Indonesia, were chosen.

This chapter therefore starts by outlining the relevance of demand-side EE in Southeast Asian developing and emerging economies and discuss the problem of insufficient capital and the resulting need for external EEF initiatives. Overcoming this problem is crucial for realising the EE potential in the region. This is followed by a discussion on the limited literature on EEF initiatives in developing and emerging economies, a discourse which is dominated by international organisations. A brief glimpse of the diversity of EEF initiatives based on research that focuses on developed and selected emerging economies is presented. Finally, a discussion of the research

¹The development status is defined in accordance with the IMF categorisation: https://en.wikipedia.org/wiki/Developing_country.

gap and overall research question concludes this chapter. Thus, this chapter provides the rationale for the research focus on EEF.

2.2 Energy efficiency as a win-win situation for emerging economies?

Energy security remains a significant development challenge in many developing and emerging economies. In 2012, Benoit Lebot, then climate advisor for United Nations Development Programme (UNDP), noted ‘energy is the blood vein of a nation’ and crucial for its prosperity and development.² A correlation between growth in electricity consumption and economic growth can be observed in many countries (Ferguson, Wilkinson & Hill 2000; Yoo 2006). As discussed above, and as recognised within the United Nations’ sustainable development goals, energy security and reliability influences not only a nation’s economy, but its overall development (UNDP 2014). Moreover, energy requirements are growing - a global sustainability report from the UN Secretary-General’s High Level Panel on Global Sustainability predicted that world energy demand will be 45% higher in 2030 compared to 2012 (United Nation’s High-Level Panel on Global Sustainability 2012). Over the last two decades, energy security has been threatened in Asian developing and emerging economies.

Energy security, due to rapid fossil fuel-based economic growth and an increase in the number and severity of natural disasters, poses a crucial development challenge to rapidly developing Asian economies. Asian developing and emerging economies are characterised by rapid fossil-fuel based economic growth, high urbanisation, and high levels of poverty (APEREC 2013). Also, it was found that the shift from developing to an emerging country has particular challenges concerning international support for the energy system. The majority of the countries in the Asia-Pacific region are net fossil fuel importers and thus very vulnerable to global oil price fluctuations (UNESCAP 2012c). For example, the United Nations Economic and Social Commission for Asia and the Pacific (2012b) estimates that 42 million people in Asia and the Pacific were impoverished due to international oil and food price increases in 2011 alone. Moreover, fossil fuel consumption is contributing to climate change and thus to increases in the frequency and intensity of natural of disasters. In 2011, more than 170 million people in

²Comment during his presentation at the A2energy efficiency summer Study in Sydney, 28th of February 2013. http://www.slideshare.net/UNDP_RC_Dakar/benoit-lebot-plenary-session-28-feb-2012-morning-v1p accessed at [9_4_2013]

Asia and the Pacific were affected by natural disasters (UNESCAP 2012a). Therefore, over the last two decades energy security has been threatened in Asian developing and emerging economies (UNESCAP 2012b).

Global leaders and international development organisations have committed to support developing countries and stress the importance of the private sector (IPCC 2014; UNFCCC 2013). At the 15th COP session of the UNFCCC in Copenhagen 15 developed countries pledged to provide US\$100 billion to developing countries for climate change mitigation and adaptation by 2020. This US\$100 billion is to come from a wide range of sources, particularly the private sector (Ottmar et al. 2013; UNFCCC 2014). It is believed that improvements to the efficiency of the use of resources, and increasing investments in green capital, can provide a lot of business opportunities for the private sector (UNESCAP 2012c).

The World Energy Outlook 2012 report recognised that energy efficiency (EE) could offer the ‘greatest potential of any single strategy to abate global GHG emissions from the energy sector’ (Selmet 2012). As can be seen in Figure 3 the IEA, in its efficient world scenario, estimates that adopting worldwide energy efficiency measures could provide up to 50% of the emissions reductions needed to prevent global temperatures from rising by more than 3 degrees Celsius above pre-industrial levels.

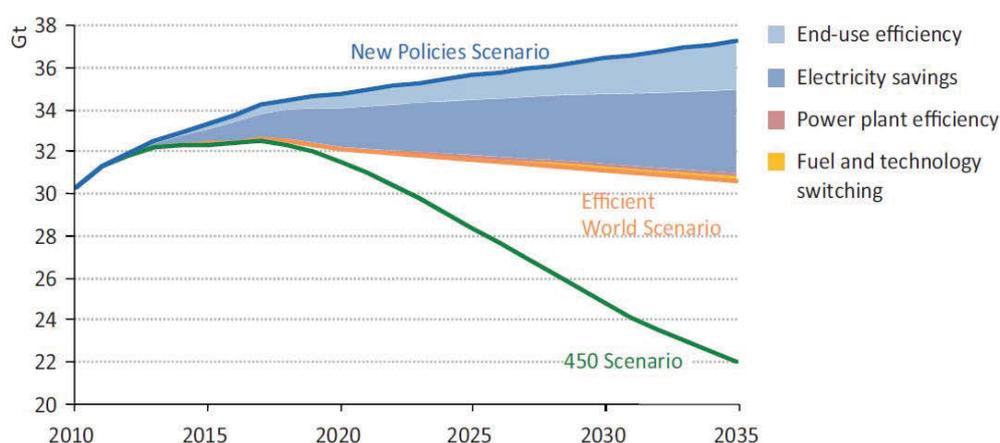


Figure 3: Energy related CO₂ emissions by scenario and abatement measures (IEA 2011b)

EE measures that reduce energy consumption have a high potential to reduce GHG emissions in Asia. EE is achieved by either consuming less energy to produce the same output, or providing higher energy services or production for the same amount of energy consumption (Selmet 2012). According to Selmet (2012) the main potential in EE lies in:

1) optimisation of the production/distribution of energy (supply-side energy efficiency), mainly the distribution system, power generation plants and 2) on the demand side, encouraging retail consumers of energy to reduce their consumption patterns via changes to behaviour or technology.

In Asian countries, industry tends to be inefficient and the amount of infrastructure which could be designed in an energy efficient manner is increasing rapidly. Under these conditions, a focus on demand-side energy efficiency measures is appropriate (Anbumozhi 2009; UNESCAP 2012c; United Nations 2004) (Anbumozhi 2009; UNESCAP 2012c; United Nations 2004).³

Demand-side EE measures have a high potential in Asia and the Pacific. Demand-side EE is defined to reduce the energy consumption of consumers, for the same productive output, or providing higher energy services or production for the same amount of energy consumption. EE measures include improvements to the existing infrastructure stock of industry and buildings as well as the provision of energy-efficient solutions for new projects in the industry and building sectors (Selmet 2012). In Asia and the Pacific, (the second-least urbanised region in the world) the proportion of the population living in urban areas increased from 33% in 1990 to 43% in 2011 (UNESCAP 2012a). This provides another opportunity for the implementation of EE technologies in the built environment. In 2008 it was found that the industry and commercial building sector accounted for more than 70% of all energy use and more than 85% of electricity use in the region (ADB 2011). Developing and emerging economies that optimise their EE will face the Jevons paradox, namely that even though EE gains are made via technological or consumer behaviour advances, overall energy consumption still increases as the overall demand is still growing (Sorrell 2009). But this thesis does not focus on overall energy reduction but on maximising EE efforts in the face of increased energy use. Figure 4 shows that the energy intensity of the Asia-Pacific region is still significantly higher than that of developed countries (APEC 2013). Electricity is wasted in Asia due to inefficient industrial processes and the use of obsolete technologies (Anbumozhi 2009).

³ The general arguments for energy efficiency overall are cost-effectiveness and the creation of new business development opportunities.

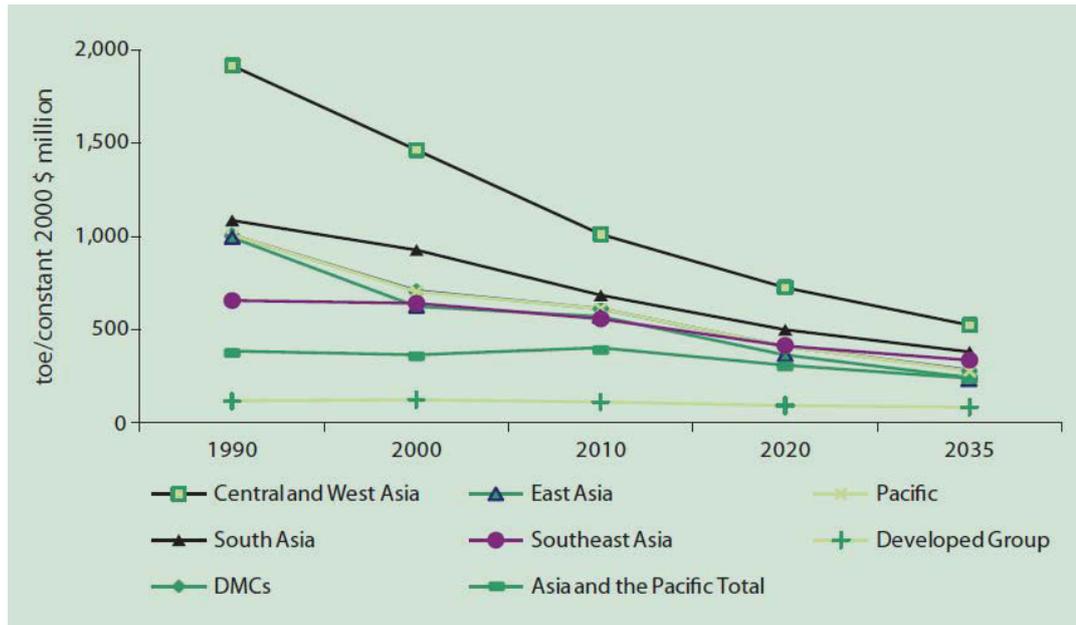
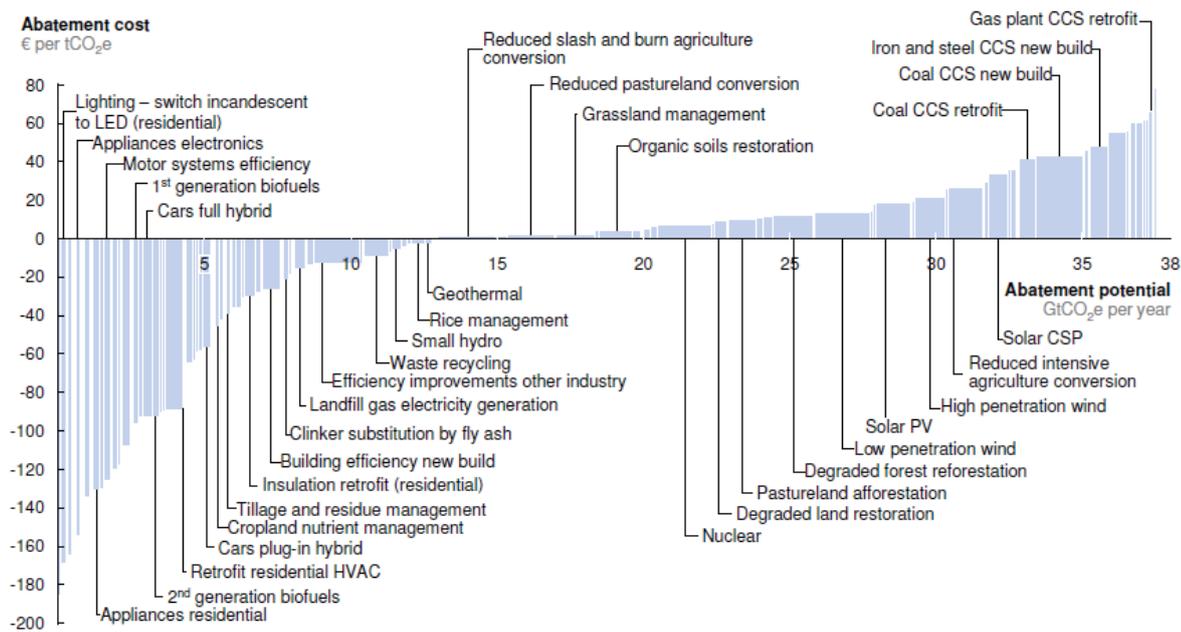


Figure 4: Energy intensity by region (1990–2035) (APEC 2013)

The private sector should have an interest in EE measures, as besides reducing energy consumption, they reduce energy costs. As Figure 5 illustrates, GHG abatement costs due to energy efficiency projects are negative, meaning that the energy savings can pay for the investment over time (Enkvist, Dinkel & Lin 2010). Thus, businesses will save on energy costs when implementing energy efficiency measures and this can offset any required investments. It has been estimated that in Southeast Asia, 12% to 30% of the emissions reductions which the region needs to make by 2020 could be achieved by efficiency gains that could also provide energy savings of between US\$15 billion and US\$43 billion (ReEx Capital Asia 2011). Further, investment costs for saving energy far exceed those of investing in additional capacity. A megawatt saved through the use of energy efficient industrial equipment will cost half, (or less) the cost of creating a megawatt of coal-fired generating capacity (ADB 2011). Therefore, EE is in the private sector's interests.

As the above discussion demonstrates, demand-side EE can provide win-win outcomes for Asian developing and emerging economies. Thus, it is a good example to use to demonstrate how the private sector can get involved in financing a global good.



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO₂e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.1

Figure 5: Global GHG abatement cost curve beyond business as usual – 2030 (Enkvist et al. 2009)

2.3 Lack of access to capital: an important barrier to EE

Despite EE possessing a very high potential to provide cost-effective win-win solutions for energy policy problems, its implementation has so far been quite limited. According to the IEA (2012), roughly half of the cost-effective EE potential in the industry sector and four-fifths of the EE cost-effective potential in the building sector worldwide have not yet been realised.

A number of commentators have identified several barriers to energy efficiency, namely: (1) imperfect information; (2) risks; (3) split incentives; (4) hidden costs, (5) bounded rationality and (6) lack of access to capital (Sorrell, Mallett & Nye 2013; UNIDO 2011). Barriers have been defined as ‘mechanisms that inhibit a decision or behaviour that appears to be both energy and economically efficient’ (UNIDO, 2011: p.86). Most of the literature has focused on the stakeholder barriers (micro-level) and only recently the importance of enabling frameworks (macro-level) has been recognised (UNIDO 2011). For example, in 2010 it was found that within the APEC region \$105 billion was spent on energy subsidies (APEC 2012). Appendix I provides a concise synthesis of the globally identified EE barriers at the micro and macro levels. It needs to be noted that in practice all end-use consumers of energy, are confronted with more than one type of barrier. A

multitude of barriers co-exist in parallel and interact with each other (Sorrell, Mallett & Nye 2013).

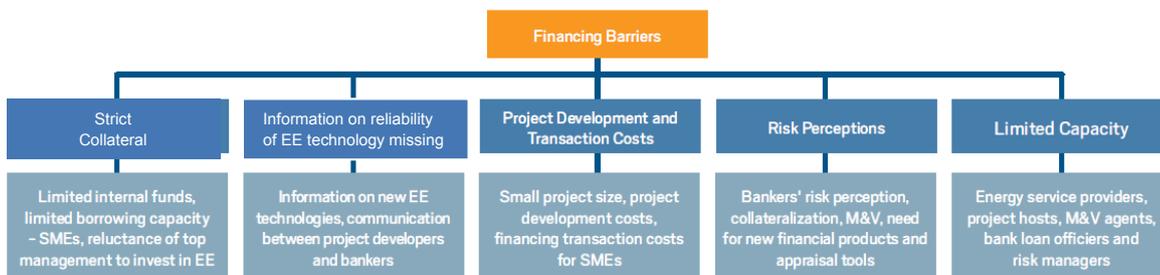
Several cross-country studies found that in developing countries the problems of imperfect information and insufficient access to capital were the main barriers identified (Sorrell, Mallett & Nye 2013). In a survey a survey in which 96 firms in developing countries were asked to rank the barriers they faced Insufficient access to capital and inadequate public sector policies were the major barriers identified (UNIDO 2011). The implementation cost barrier was cited in another study across nine developing countries as the highest-rated type of barrier in 105 plants (Luken & Van Rompaey 2008). Researchers have also found that there are differences in the barriers faced by small and medium enterprises and large firms. Small industries and building owners are less likely to be able to generate the necessary upfront finance by themselves. Larger firms often cannot convince steering committees to use their borrowing capacity (on-balance finance) for energy efficiency projects (Limaye et al. 2012; Taylor et al. 2008; UNIDO 2011).

The research in this thesis focuses on the barrier to access capital for cost-effective energy efficiency measures in the industry and the building sectors since the capital flow into these sectors has been recognised as a big challenge. Studies have indicated that the gap between the energy efficiency investment needed in developing economies and the EEf actually provided is large (Farrell et al. 2008; IEA, 2012). According to the Asian Development Bank (ADB), while \$211 billion was invested in clean energy globally in 2011 (of which \$59 billion was in Asia and the Pacific), only 11% of the total (US\$23.9 billion) was invested in “energy-smart” technologies such as energy efficiency systems and devices (ADB 2013a). Also, in light of the recent climate change mitigation finance discussions on leveraging private sector finance, a focus on access to finance is appropriate (Selmet 2012). Therefore, this study focuses on the barrier of ‘lack of access to capital’, and which models and mechanisms can help to overcome this barrier.

International discussions around EE finance have increased over the last five years. In late 2013, probably as a result of the IEA World Energy outlook report, the EU Energy Efficiency Financial Institutions Group was established to shed light on how to overcome barriers to providing long-term financing for energy efficiency (International Development Finance Club 2013; IPEEC 2015). Recent interest was spurred by the G20 Energy Efficiency Finance Task Force Group, which was founded in 2014 and has so far produced a report and a dialogue process. The G20 countries, which include developed and emerging economies, face similar issues, which is the reason why the voluntary

energy efficiency investment principles for G20 participating countries, the ‘G20 Energy Efficiency Investor Statement’ and the Financial Institutions’ Declaration of Intent on energy efficiency’, have been endorsed by the G20 member states (IPEEC 2015).

In particular, this thesis focuses on barriers to external EEF. Given the hesitance of firms to invest into EE in an emerging country context and the importance of the SME sector with limited funds in SEA, access to external EEF is the focus of this thesis (ADB 2013b; Taylor et al. 2008). External EEF here means all funding that does not directly come from corporations’ earnings, and always uses third parties to mobilise finance. These third parties could, for example be banks, leasing companies or ESCOs (Taylor 2012). As Figure 6 indicates, finance for EE projects is challenged by several barriers which are discussed below.



Source: Compiled by authors based on review of IEE studies and programs and interviews with IEE experts.

Figure 6: Financing barriers to industrial energy efficiency (Limaye et al. 2012)

The collateral requirements of banks are often strict and exclude SMEs from funding. SMEs have weak balance sheets and lack the collateral required by banks (Kolstad 2016). Also, banks only lend to existing customers which makes it difficult for new customers, such as energy service companies (ESCOs) to get access (Taylor et al. 2008).

Financial institutions do not have enough access to information about the viability of EE technologies. Financiers lack reliable knowledge on the performance on EE technologies and even lack the energy consumption data of buildings and industries (benchmarking) (Kolstad 2016). In emerging countries, where EE technology is new and mainly imported, knowledge and information is limited and often out of date. Also, end users are unfamiliar with EE technologies (Venugopal 2012). This can lead to problems. For example in India, a plant imported a second-hand co-generation power facility that had been phased out in Germany, but was still accepted by the Indian government (Yang 2006).

EEF projects require complex management and can involve high transaction costs. EE projects need relatively small investments, which limit possible profits to financing institutions. A multitude of actors are involved in EEF projects. They need to be able to communicate and they need to have the necessary capacity to understand the technicalities (Ward 2010). For example, project developers who are focused on the technical aspects of projects do not know how to prepare a project proposal in accordance with lenders' criteria (Ward 2010). Again, this problem is worse in developing and emerging economies, where markets are new and trust has yet to mature between the different stakeholders. For example, international ESCOs lost interest in investment in India after they recognised the high amount of capacity building that would have been necessary to convince potential customers to enter into contractual arrangements (Sarkar & Singh 2010). This leads to increased transaction costs.

External EEF requires complex project development and thus leads to high risk perception from the finance sector. New financial product development is necessary, as funding comes from 'invisible' resource savings. The asset cannot be refinanced via the sale of its products (energy efficiency savings) and this is a problem under conventional investment strategies (Taylor et al. 2008).

Finally loan officers and risk managers are not knowledgeable in EE technologies and EEF business models, and lack the skills and knowledge needed to convince the CEOs of firms that EE investments are an important business area (Limaye et al. 2012).

Additional risks for EE investments exist in developing and emerging markets. Besides the general political and macroeconomic risks common in these economies, *low carbon specific risks* hinder investment. The term 'low carbon specific investment risks' refers to the uncertainties associated with policies and the immaturity of mitigation technologies, for example EE technologies. Public sector financing instruments such as concessional loans tax incentives and guarantee mechanisms can influence EE investment decisions. However, these policies can change quite rapidly, which might be a hindrance to making long-term investment decisions (Venugopal 2012).

2.4 Public support mechanisms for EEF

As indicated above, there are many barriers to the provision of external EEF by the private sector, especially in developing and emerging economies. In those countries, international organisations, bilateral development and developing banks play an important role in pushing sustainable innovations. Below, recent conceptual and normative discussions around EEF initiatives will be provided.

The literature, and reported experience in regards to EEF initiatives in developing and emerging economies, are limited and originate from donor agencies and development banks. It was found that donor agencies are the main source of most information on EEF initiatives in developing and emerging economies. In 1992, UNDP implemented 95 global projects on energy efficiency in 55 developing countries (Selmet 2012). Between 2002 and 2006 UNEP and the World Bank focused on investigating EEF schemes (Taylor et al. 2008). Between 1991 and 2010 GEF spent US\$473 million on EE projects in developing and emerging economies (Yang 2013). Between 2003 and 2010, the ADB, which was mainly focused on EE on the supply side, also provided US\$260 million to external finance facilities for EE projects in the industry and building sectors (ADB 2011). Comprehensive overviews or summaries of EEF initiatives have been provided by international organisations or development bank employees (Limaye et al. 2012; Sarkar & Singh 2010; Selmet 2012; Taylor et al. 2008; Wang et al. 2013). For example, (Wang et al. 2013) provides a clear summary of EEF initiatives with the clear objective of unleashing the maximum amount of commercial finance.

The conceptual discussion in the donor and development bank literature focuses on how EEF initiatives could be shifted from public sector initiatives towards the private financial sector. The main reason for this focus is that public sector funds in developing and emerging economies are limited. As Figure 7 illustrates, with increased development, countries could move away from providing grant finance to concessional loans and then later to public-private partnerships. Public-private sector partnerships are supported mainly by donors and development banks (IEA, 2010b: p. 122). Finally, the argument is that as overseas development assistance (ODA) comes to an end the private financial sector provision for EEF should dominate (Sudo 2012). Therefore, the dominant discourse from donor and development bank agencies is that the public sector needs to push EEF into the private financial sector in the short term, so that in the long term the private sector can provide EEF services.

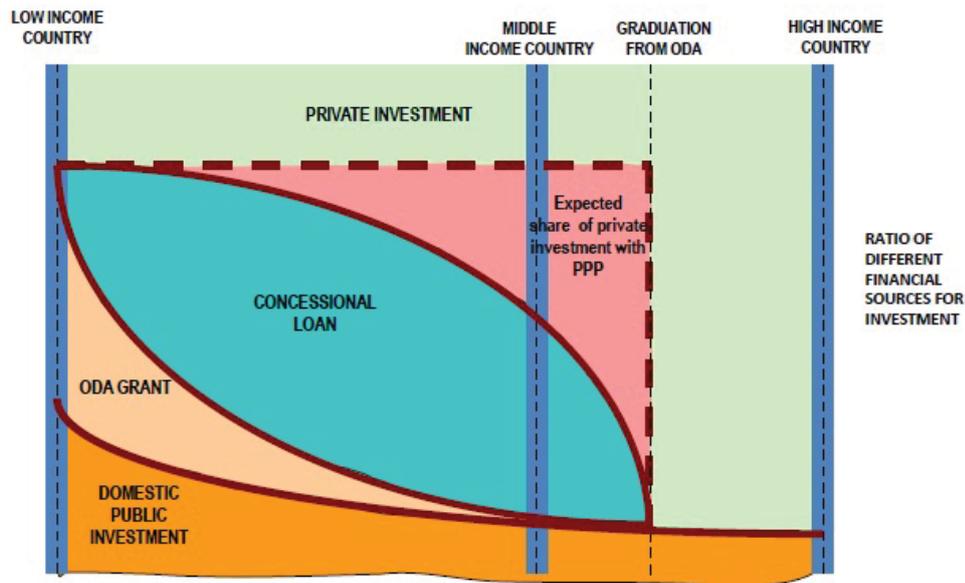


Figure 7: Conceptual figure of shift from public sector funded EE measures to private sector investment (Selmet 2012; Sudo 2012)

Based on their experience in implementation, donors and development banks have identified several innovative financing mechanisms. These depend on the composition of the financial markets and the barriers they address. As can be seen in Figure 8, Wang et al. (2013) identified a sequence of seven EEF initiatives:

- EE funds which are mainly provided by government and can be used for technology subsidies or SME EE implementation
- utility programmes which provide partial finance via the public sector but are mostly paid by private consumers, for example via on-bill financing
- dedicated credit lines which use public sector finance but try to leverage private sector capital to finance EE projects
- risk sharing programmes such as guarantee mechanisms for financial institutions
- performance contracting systems via energy service companies (ESCOs) (Here the public sector needs to provide support with technical capacity building, such as standard auditing and contract templates.)
- equity funds which could ultimately leverage large amounts of private sector finance (Wang et al. 2013).

Table 1 shows each of the mechanisms and which barriers to EEF they address.

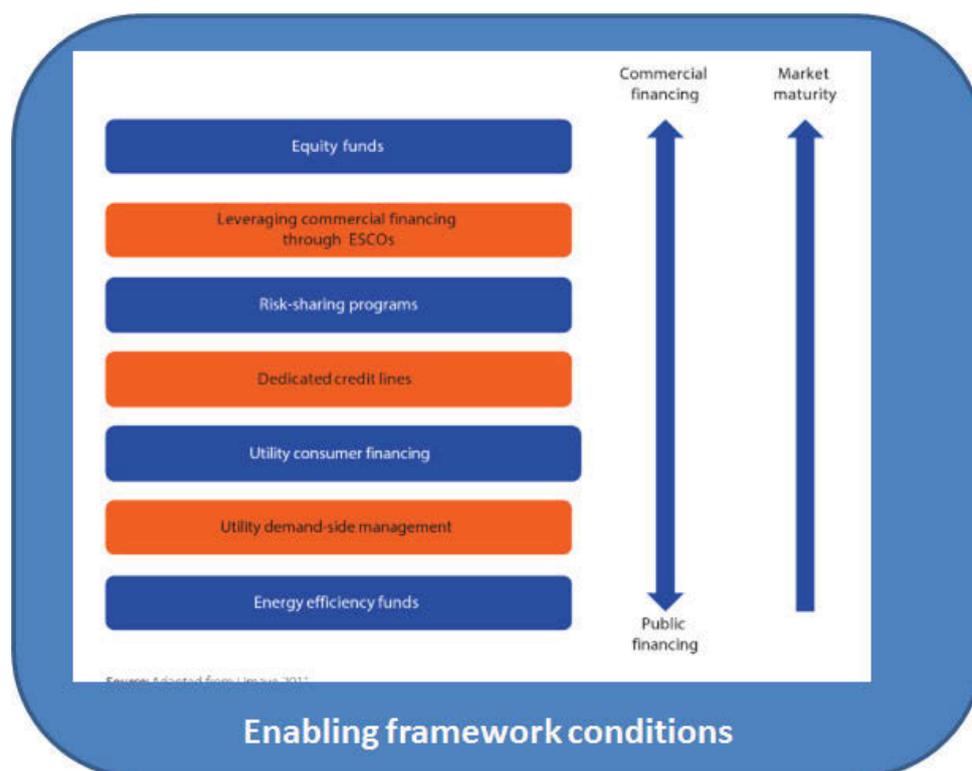


Figure 8: Range of public and private sector EEF (adapted from (Wang et al. 2013))

Table 1: EEF initiatives and barriers addressed (Wang et al. 2013)

Financing mechanism	Barriers to financing EE projects				
	Funds availability	Information, awareness, and communication	Project development and transaction costs	Risk assessment and management	Lack of capacity
Energy efficiency funds	Provide funds for investments in EE	Generally include TA to increase awareness by banks, energy users, and ESCOs	n.a.	n.a.	Enhance capacity of banks, energy users, and ESCOs
Utility DSM	Provides utility funds for investments in EE	Utility will generally conduct information and promotion campaign	Some reduction in project development and transaction cost due to utility's scale of operations	Utility may provide technical assistance to customer and lender	Utility may provide capacity building to energy service providers
Utility consumer financing	Provides the consumer the ability to pay for the EE investment through the utility bill	Utility will provide information to consumer	Cost of collection is reduced by using utility billing system	Low risk of nonpayment by use of utility billing mechanism	n.a.
Dedicated credit lines	Leverage bank financing for EE projects	Generally include TA to increase awareness of banks, energy users, and ESCOs	Some reduction in project development and transaction cost due to standard forms and templates	Uses banks' appraisal criteria and innovative financial products	TA enhances capacity of banks, energy users, and ESCOs
Risk-sharing programs	Reduce banks' risk perception and achieve high leverage	Generally include TA to increase awareness of banks, energy users, and ESCOs	Some reduction in project development and transaction cost due to standard forms and templates	Uses banks' appraisal criteria and stimulates innovative financial products	TA enhances capacity of banks, energy users, and ESCOs
Leveraging of commercial financing (ESCOs)	Accesses debt funds from private banks or FIs for EE projects	ESCOs provide information to energy users and to banks or FIs	Some reduction in project development and transaction cost due to ESCO activities	Most of the technical and financial risk is assumed by ESCOs	Government programs generally include ESCO capacity building
Equity funds	Access private equity and venture funds to provide equity funding for projects or ESCOs	n.a.	n.a.	Reduce project risks and ESCO risks by providing equity capital	n.a.

Note: DSM = demand-side management; FI = financial institution; n.a. = not applicable, that is, does not address barrier; TA = technical assistance.

The experience of implemented EEF initiatives highlight the importance of de-risking mechanisms and enabling framework conditions to assist the shift away from grant-based programmes. Experience from international EEF programmes situated in

Southeast Asia indicates that to support EEF further, the following items are important: 1) de-risking mechanisms; (2) enhancing market creation project pipelines;

In recent emerging grey literature, there is a sense that besides specific support mechanisms for EEF initiatives, it is also important to investigate and address some of the broader framework conditions that can have an influence on EEF.

For example, Taylor (2012) argues for the liberalisation of the financial markets so that the maximum diversity of EEF services can be provided (Taylor 2012; Wattana, Sharma & Vaiyavuth 2008). International organisations seem to influence the electricity regime and the finance sector and directly shape EEF mechanisms and models. Also interesting was the finding that stability of political systems was important for the success of EEF (DeT'serclaes 2010; Verbong et al. 2010). Therefore, Table 2 summarises some of the factors found that seem to influence EEF from a broader framework perspective.

Table 2: Important framework conditions for EEF

	Factors that influence the enabling environments of EEF initiatives
Electricity sector	<ul style="list-style-type: none"> ▪ Available EE technology and capacity (international relations) (DeT'serclaes 2010) ▪ Government regulations on EE (targets, standards and research) (DeT'serclaes 2010; Taylor 2012)Geographical coverage of the electricity system (Verbong et al. 2010) ▪ Institutional energy governance and the influence of international organisations (power relations) (Baker, Newell & Phillips 2014; Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Raven, Schot & Berkhout 2012; Sarkar & Singh 2010; Taylor et al. 2008) ▪ High energy price creates market demand for EEF (DeT'serclaes 2010) ▪ Customer demand for EEF (efficiency status) (Limaye et al. 2012)
Finance sector	<ul style="list-style-type: none"> ▪ Capital is available(Wattana & Vaiyavuth, 2007) ▪ Diversified banking sector, with experience in small-scale finance (Taylor et al. 2008) ▪ On-lending regulations are supportive of EEF ▪ Green energy legislation exists (Taylor 2012) ▪ Capital available (Wattana, Sharma & Vaiyavuth 2008) ▪ Institutions and international organisations' influence (Unger 1998)
Political system/legal governance	<ul style="list-style-type: none"> ▪ Stable political systems make investment viable (DeT'serclaes 2010; Verbong et al. 2010); ▪ Sovereign risk in emerging economies can hinder investment (DeT'serclaes 2010) ▪ Contract enforcement needs to be strong to be able to outsource (Taylor et al. 2008). ▪ Influence of international organisations (Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Sarkar & Singh 2010)

Reflecting on the findings of development and political economic studies, namely that donor and development organisations have been known to act in their own interests, there is a need for a broader investigation of the topic. Extensive literature has described how the World Bank and other international organisations play a part in shaping the policies and forming institutions in developing and emerging economies (Bates 1988; Escobar 1995; Gill 1995). For example, Cammack (2002, p.157) argues that the World Bank has been successful in establishing a new 'neoliberal orthodoxy' striving towards capitalist accumulation at a global scale while disguising this objective behind discussions around poverty and inequality reduction. Therefore, a broader review of literature on EEF in developed and other selected emerging economies was undertaken and the results are discussed below.

2.5 EEF initiatives world wide

This section compares the international discourse about EEF initiatives with experiences in developed countries and selected developing and emerging economies.

While limited in number, developed country literature indicates a rich diversity of EEF initiatives. Only four publications from Europe and America could be identified that provide comprehensive lists of private sector EE financing models. Würtenberger (2012, p.7) categorises ten different 'strategies', Kats et al. (2012) identifies in his US analysis 18 'models and strategies', the Asian Development Bank (2015) identifies six and MacLean and Purcell (2014) identify 11 different models. The relationships between private and public sector schemes vary. Three publications focus on private sector EEF models, of which one also discusses public sector strategies to support those. Lastly, one paper identifies public sector initiatives in which the private sector plays a part (ADB 2015b; Kats et al. 2012; MacLean & Purcell 2014; Würtenberger 2012). An overview of the different EEF mechanisms and models is provided in Appendix II and a detailed discussion of the different mechanisms and models will follow in Chapter IV and Chapter V. Public sector EEF mechanisms are defined in this thesis as 'arrangements amongst institutions and market players to finance and implement energy efficiency projects' (Kats et al. 2012). and private sector EEF models are defined as primary transaction structures that have been created by the private financial sector in response to the business opportunities in the niche market of EE investment (MacLean & Purcell 2014; Würtenberger 2012).

Seven countries were selected by the researcher to provide an indication of the current stages of EEF globally. Rather than attempting to provide a holistic global overview, countries were selected which (1) cut across different development stages (developed and emerging economies)⁴; (2) were well documented; (3) provided innovative EE financing examples and (4) involved different framework conditions (e.g. the political system). Therefore, in the end three developed countries, Australia, Germany and the United States, and four emerging economies, China, India, Mexico and Indonesia, were chosen. Table 3 provides an overview of these seven different countries, their framework conditions and public or private sector offers of EEF initiatives. The seven countries analysed reveal a diverse picture of EEF initiatives, with very limited success so far in moving EEF over to the private sector.

The findings from this broader literature review are discussed after Table 3. The analysis focuses on: (1) the diversity of different mechanisms, (2) whether framework conditions influenced the choice or structure of EEF initiatives, (3) the relevance of international organisations and (4) whether changes to the development status of countries are associated with an increase of private sector EEF models.

It was found that in developed countries EEF initiatives are often accompanied by larger public sector programmes and that they cater for specific customers.

In developed countries, in many cases public sector programmes often seem to drive the direction of the development of EEF initiatives. For example, in Australia the white certificate scheme that targeted electricity utilities, influenced the demand for EEF (Crossley 2005). Most of the ESCO-arranged finance projects in the US rely on customers from the public building sector, due to utility programmes focused on the public building sector (Goldman, Hopper & Osborn 2005). For example, the Property Assessed Clean Energy programme in the US allows local governments to fund energy improvements for multi-family houses (MacLean & Purcell 2014).

Also, the diversity of EEF initiatives is since each EEF initiative serves a certain customer type. Table 3 indicates the customer groups served by particular models. For example, on-bill financing, will cater to the public and residential sector, whereas loans and EE funds are more likely to serve the industry and commercial sectors. Further,

⁴The development status is defined in accordance with the IMF categorisation: https://en.wikipedia.org/wiki/Developing_country.

where SMEs form a significant part of the national economy, countries focus on SMEs with their EEF initiatives. For example, in Germany, several EEF initiatives focused on SMEs after a survey found that the primary barriers to EE implementation in SMEs were a lack of capital and high investment costs (Fleiter, Schleich & Ravivanpong 2012). Further, in Mexico, the Inter-American Development Bank provides a special EE loan to SMEs (IDB 2011). In India several EE funding programmes focus on the SME sector, as the SME sector contributes significantly to India's economy (Wang et al. 2013). Due to their minor role in the overall economy in the US and China, SMEs have only recently received support for EEF (Hayes et al. 2012; Wang et al. 2013).

Table 3: Overview of global EEF initiatives

Country	EE policies	Fin. policies	Public sector EEF Mechanism	Customer					Private sector EEF mechanisms	Customer				
				I	C	R	P	SME		I	C	R	P	SME
Australia	EE targets, Building standards		White certificates (demand-side management) Soft loans/ guarantees	X	X				Green investment banks	X	X			
Germany	EE targets, Building standards, EU labelling		Tax incentives Grant programmes for refrigerators Soft loans for retrofits	X	X		X		Soft loan insurance		X			X
United States of America	EE targets, Appliance/building standards, Taxes, Energy data programs		Energy efficiency resource standards EE funds Municipal bonds			X	X	X	On-bill finance Loans for SMEs ESCO-arranged finance			X	X	X
China	EE targets, Standards labelling Energy management	banks dominate Green credit policies	Utility (DSM) EE funds Soft loan, guarantee ESCO support				X		Leasing Loans ESCO arranged finance	X	X	X		X

Country	EE policies	Fin. policies	Public sector EEF Mechanism	Customer					Private sector EEF mechanisms	Customer				
				I	C	R	P	SME		I	C	R	P	SME
India	EE targets, Standards, Labels, High electricity prices	High risk of EE technologies	Energy savings obligations (DSM), White certificates, SME loans, Super ESCO guarantees			X	X		ESCO arranged finance Loans	X	X			
Mexico	EE target, Electricity prices subsidised, Standards	Banks conservative in lending practices	DSM Housing NAMA, EE funds, Soft loans Green bonds	X	X	X			On bill finance Insurance Bank loans			X	X	
Indonesia	EE targets, Electricity prices subsidised, Standards and labels, Tax incentives	Banks, Roadmap for sustainable finance in Indonesia	Soft loans (ADB)	X	X		X		ESCO equity Fund				X	

(Fin.: Financial; I: Industrial sector; C: Commercial building sector; R: Residential sector; P: Public building sector; SME: Small and Medium Enterprises)

2.5.1 Importance of framework conditions

The diversity of energy efficiency finance mechanisms/ models is influenced by the framework conditions. In particular, the priorities of governments as well as the composition of the financial market will decide the EEF outcome. For example, in the US, which follows a policy that causes least impact for the industry, EE projects mainly focus on utility-led projects (Hayes et al. 2012). India, with its political bottom-up strategy, focused on local EEF. China, with its top-down strategy, has since the early '80s directly targeted the large, inefficient and polluting industries, with standards and EEF offers (Yang 2006, p.3108). In Mexico, the focus for EEF has been on SMEs and the residential building sector rather than large industry and commercial buildings (Climate Action Tracker 2012). Germany put out a strong political goal of *Energiewende* and has promoted a fleet of policies with continuous financial support via the German development bank (KfW) since the '80s, focused on SMEs (Schröder et al. 2011). Due to differences in the political systems of countries like Australia, India, China and the US, city and state government went further than the national governments to support for EEF initiatives (Dunstan, Langham & Ison 2009; International Development Finance Club 2013; Limaye et al. 2012).

Even though finance guidelines from central banks are seen as important, there is still very limited evidence of central banks providing such guidance. Of the selected countries, only China had public sector regulations to incentivise sustainable financing. China's policy requires financial institutions to consider environmental standards in their lending practices and to limit their funding of high energy, heavy polluting industries. Besides the above mentioned problems associated with providing an accurate assessment of environmental standards, the measure raised awareness within banks of sustainable business practices (Zhang, Yang & Bi 2011). Indonesia has developed a roadmap to sustainable finance and reviewed its fiscal policies to identify regulatory options to increase sustainable investments into energy efficiency (Ministry of Finance 2015; Otoristas Jasa Keuangan 2015). However, only 51% of Indonesian businesses have cheque or savings accounts, which indicates the necessity for grants or other financial arrangements rather than loans (UNEP 2015).

2.5.2 Prominent role of international organisations

International influence on EEF initiatives could be observed in all emerging economies, not only at the level of EEF initiatives but also in relation to framework conditions.

All the EEF initiatives in China, India, Mexico and Indonesia had initially been supported by international organisations, most notably the World Bank (Limaye et al. 2012; Taylor 2012). For example, India started out with grant finance, then moved to internationally supported concessional loans, while most recently internationally supported guarantee mechanisms have been introduced (Limaye et al. 2012). Many de-risking mechanisms have received strong support from international financial organisations such as the ADB, the International Finance Corporation (IFC) or the Global Environment Facility (GEF). These institutions not only provided funds, but also assisted in the technical capacity building of banks by supporting marketing strategies and underwriting criteria development. The China Energy Conservation II Program is an example of a country offering such a guarantee mechanism (Wang et al. 2013). At the last Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Paris an initiative was started to assist developing countries to prepare EEF projects. A GEF seed-funded project with US\$2 million and about US\$100 of co-funding is from relevant development banks is under preparation⁵. Further, a recently launched IDB programme in Mexico supports ESCO companies to act as aggregators of standardised EE projects that can then be transferred to green bonds (IDB 2015).

Sometimes the effectiveness of the international efforts needs to be scrutinised. For example, in India between 2006 and 2011 at least six different internationally supported financing programmes were identified. In Indonesia there have been 18 such programmes since 2008 with an overall budget of US\$54 million (Ministry of Finance 2015). In an overview of EEF initiatives in India it was mentioned that the KfW credit line for EE did not have as much uptake as other programmes, as its criteria of implementation were stricter than for other EEF offers (Limaye et al. 2012). Problems with monitoring were also noted, as it was mentioned that some programmes in India did not monitor the actual energy savings achieved (Limaye et al. 2012). Also, in Mexico it seems that most international organisations are currently focusing on the residential building sector which necessitates strong coordination from the Mexican government to avoid inefficiencies (IDB 2011).

International influence on national framework conditions was also noted. International organisations have significantly influenced the institutional set-up of electricity systems. For example, Mexico's electricity system was influenced by the World Bank via loans and structural reforms, causing a centralisation/nationalisation of the electricity system,

⁵ Comment by a GIZ staff 14.11.2016

which was only opened up through a privatisation reform in 2013 (Jano-Ito & Crawford-Brown 2016).

2.5.3 Continuous public sector support needed

Comparing Table 3 to the broader literature review suggests that the public sector remains a strong partial financier for EEF initiatives in emerging` economies. The role changes overtime from finance intensive to de-risking measures. For example, in Germany, the German development bank KfW still has a major role to play when it comes to incentive mechanisms (Schröder et al. 2011). Germany, the US, India and China have demonstrated that public sector support for ESCO-arranged finance can be a powerful accelerator of commercial EE finance (Wang et al. 2013). However, they have also demonstrated the wide variety of ESCO businesses, ranging from small-scale housing projects in Germany, to large industrial EE projects in China (Wang et al. 2013). In Germany a private sector insurance company has taken over guarantee provision for EE projects (IPEEC 2015). Equity funds are still very rare, with Indonesia and India being front-runners. India is currently developing the Venture Capital Fund for Energy Efficiency and in Indonesia there is a private sector equity fund for ESCOs (Wang et al. 2013). However, due to the 2008 global financial crisis, private sector equity investment remains rare and the combination of public and private sector finance might be administratively challenging (Wang et al. 2013). Most countries have recently focused on de-risking mechanisms with their public sector EEF support. Five out of the seven countries studied had developed guarantee/insurance mechanism over the last five years. Australian banks mentioned the importance of the Clean Energy Finance Corporation which provided a guarantee and quality assurance to build up internal technical capacities.⁶

2.6 Research gap and overall research question

The literature on EEF mechanisms and models is still quite limited, even in developed countries. Currently, international donor organisations and development banks lead the discourse by providing their hypothesis that public sector support should focus solely on maximising private sector investments.

⁶ National Australia Bank's comment during the presentation session of 'innovative Financing for Energy Productivity' at the 2016 Australian Summer Study on energy productivity held from the 24th of February to the 26th of February in Sydney, Australia.

However, a preliminary analysis of the literature on the seven sample countries regarding their EEF initiatives brought four interesting results: (1) Each country has different initiatives for different customers. (2) Framework conditions seem to play a significant role in informing the EEF initiatives. (3) International organisations influence the development of EEF initiatives in emerging economies. (4) Even in developed countries private sector EEF initiatives are not dominant and are still dependent on public sector support, especially regarding de-risking measures.

Therefore, this thesis focuses on an in-depth emerging country analysis to explore further the public and private sector relationships which support EEF in an emerging country context. The overall research question is:

'How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?'

2.7 Conclusion

This chapter presented the rationale for why this thesis focuses on external EEF initiatives in an emerging country context.

It was argued that demand-side EE has a high potential to assist in the energy security challenges many Southeast Asian economies face at the moment. Due to the high-energy intensity of current industries, combined with rapid growth of the built environment, demand-side EE seems an attractive option. Demand-side EE is also seen as an effective strategy to reduce greenhouse gas emissions cost-effectively.

However, implementation has been slow, and one of the main challenges identified was the lack of access to capital within the industry and building sectors. Therefore, the question of how to enable external EEF initiatives in developing and emerging country contexts in Southeast Asia forms the core of this thesis.

Current literature on EEF initiatives in developing and emerging economies is limited to material from international donors and development banks. They entirely focus on efforts on how to promote and maximise private sector capital.

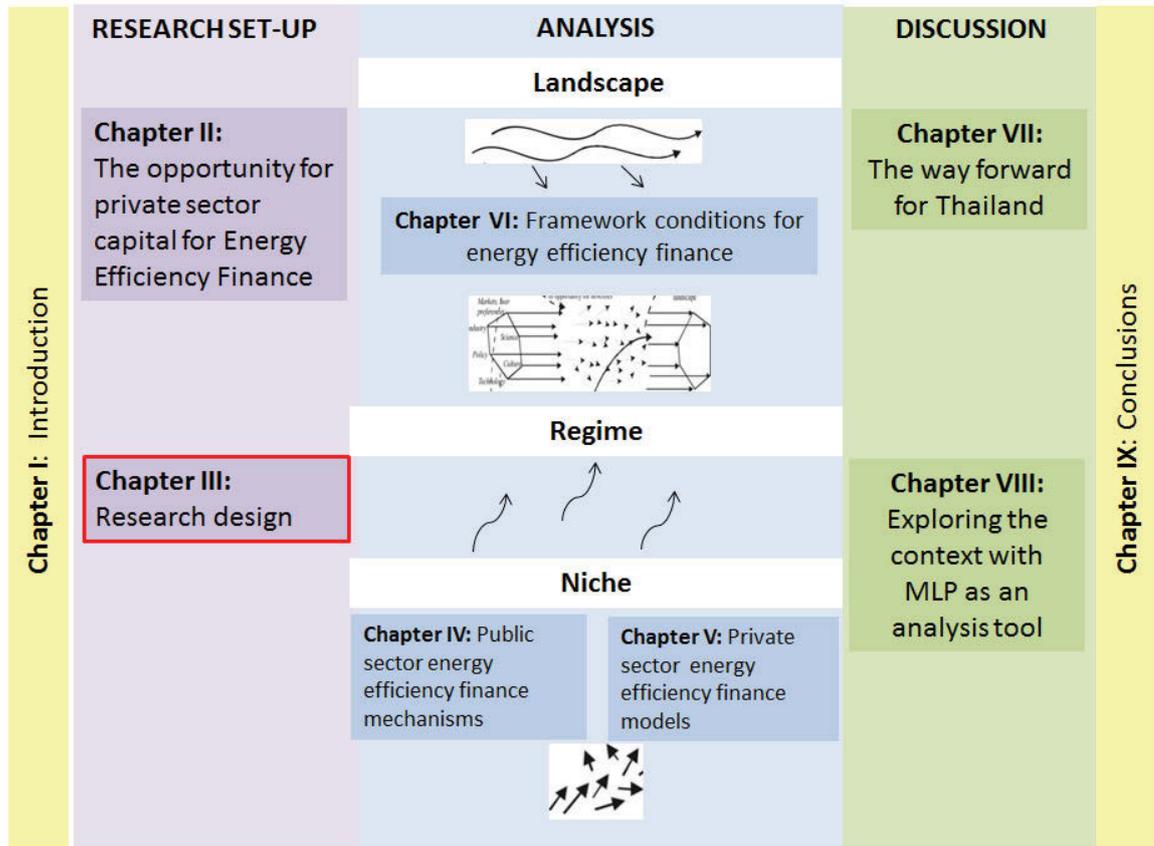
Contrasting this dominant discourse with a broader literature review suggests a much more complex picture. The examination showed that EEF initiatives are diverse, and vary depending on customers. It also showed that often, long-term public sector support

provides demand for external EEF. Further, the importance of framework conditions and international organisations in influencing the choice of EEF was noted. Finally, it was noted that even in developed countries, EEF initiatives are driven by the private sector, especially regarding the provision of capital to SME customers.

Therefore, the results of this literature review suggest that one needs to look for the optimal public/private sector relationship to support EEF over time. Therefore, the research question of this thesis is: *'How can energy efficiency finance best be optimised in Asian developing and emerging economies?'*

The next chapter will further elaborate on how this research attempts to answer this research question by undertaking a qualitative in-depth case study of one Asian emerging economy.

Chapter III: Research design



3.1 Introduction

This chapter provides information on the research approach, theoretical framework and methods used in this research, given the complex problem outlined previously.

The previous chapter outlined the following areas that are addressed by this research and are for identifying an appropriate research approach:

- The literature review revealed the transdisciplinarity of the problem, especially in the inclusion of the engineering, finance and policy spheres. The interaction between them is important.
- There are particular transdisciplinary framework conditions within the electricity and financial sectors that are needed to create a demand for EEF.
- International organisations and their interests need to be considered in the analysis.
- Besides individual public sector initiatives, the combined impact on the prevailing practices is of interest.

Therefore, this chapter argues why a case study and transition studies as the research discipline seems appropriate. A case study seemed the most appropriate approach, combined with a theoretical framework of transition studies. In particular, multi-level perspective (MLP) and strategic niche management (SNM) have been chosen as the frameworks for the analysis. Also, how these frameworks were applied to the case study is outlined, and what changes to the framework were introduced to address some of the criticisms is explained.

The second part of the chapter discusses the qualitative methods chosen for this research. Expert interviews were the primary data source for this research. Further, a rigorous triangulation with secondary literature, expert entry and exit seminars and two world cafes strengthened the results from the interviewee's analysis. In Addition, the evolution of the adaptive research approach used in the three field trips to Thailand is explained.

Thus, this chapter outlines the overall research design used in this PhD research.

3.2 Thailand as a case study

Thailand was selected as a case study to determine the 'best information possible' (Denscombe, 2010, p. 35). This country is an interesting case study of the Southeast

Asian region, due to its experiences with innovative public sector finance mechanisms for EE investments under its Energy Conservation Promotion Fund (Gruening et al. 2012). Several public EEF mechanisms, such as the Energy Efficiency Revolving Fund (EERF) and the Energy Service Company (ESCO) fund, provide an appropriate platform for research (Gruening et al. 2012). Over the last two decades, Thailand has also been a transforming economy. Due to rapid economic development and high rates of urbanisation, Thailand has moved from a developing to an upper middle-income country in only two decades. The Thai government aspires to become an influential player in the ASEAN region (Pongphisoot 2014). Therefore, many policy documents are available in English, and national authorities welcome international researchers.

A case study is a powerful tool when looking at a 'contemporary phenomenon in a real-life context' (Schwandt 2007, p.28). In particular, it is suitable when 'a 'how' or 'why' question is being asked about a contemporary set of events, over which the investigator has little or no control' (Yin, 2003: p.9). Case studies have been used in a vast array of research, especially in transition studies (Geels & Raven 2006; Van der Laak, Raven & Verbong 2007; Quitzau, Hoffmann & Elle 2012). Due to the limited examples of public sector EEF mechanisms in the region, as well as the particular focus on learning, networks and relationships, which are hard to analyse quantitatively, the in-depth analysis option of a case study is appropriate (Denscombe 2010). Case study methodology has been critiqued for its data intensity and, in the context of transition studies, its focus on long-term transitions in the past (Geels 2011; Genus & Coles 2008). However, due to the use of real-life evidence and a wide range of data collection methods, these problems have been minimised in this research (Gibbert, Ruigrok & Wicki 2008; Yin 2003).

3.3 Transition studies and MLP

Transition studies have been chosen as the overarching research discipline for this research. Transition studies were developed to include both social and technological aspects in sustainability transitions. Transition studies are defined as the exploration of 'the socio-technical transitions to an environmentally sustainable economy' (van den Bergh, Truffer & Kallis 2011, p.2). By taking a systemic view of the social factors influencing technology transitions, it endorses an interdisciplinary research approach (van den Bergh, Truffer & Kallis 2011). Thus, it delineates itself from other transformation and innovation studies due to the focus on social factors affecting technology transitions and providing concrete methods and tools to analyse them (van

den Bergh, Truffer & Kallis 2011; Geels 2004; Ison 2008; Rip & Kemp 1998). So instead of focusing on one innovation and how it penetrates the market, transition studies explore an innovation that leads towards sustainable development and how it could be mainstreamed into the existing economy. For example, central topics are how to 'stimulate major environmental innovation trajectories that are environmentally benign and socially equitable' and how to 'transfer all relevant areas of science to policy preparation and democratic decision-making' (van den Bergh, Truffer & Kallis 2011, p.2). As of September 2015, about 1400 articles that focused on transition studies had been published in peer reviewed journals. 41% of those focused on energy generation (Geels 2015). Thus, transition studies are compatible with the problem addressed in this research – how the financial challenges of the technical EE projects can be facilitated by governments in emerging economies.

The critique of Eurocentrism about this research discipline has, in recent years, been mitigated by a steady increase in non-European focused research. This research discipline was started in the Netherlands through large public sector funding that should develop a cross-discipline government approach to guide sustainable transitions. Therefore, most transition studies research papers focus on sustainability transition in the European region (Markard, Raven & Truffer 2012). However, the uptake of transitions terminology in international publications in the last five years suggests a growing global interest (IEA 2009; Markard, Raven & Truffer 2012). Also, the increase of non-European members of the Sustainability Transitions Research Network (STRN) from 70 in 2011 to 300 in 2015 is an indication of a growing research community outside of Europe. Twenty of the research network members of the Sustainable Transitions Network in 2011 were from Asia, Africa and South America and their number had increased to 140 by 2015 (Geels 2015). Compared to the overall member number of over 1000 in August 2015, this is a small but steadily growing number. Also recently a particular research network has been focusing on transition studies in emerging and developing economies (Geels 2015). Given that transformation and innovation studies also do not have a particular focus on developing and emerging economies, the criticism of Eurocentrism needs to be kept in mind but does not exclude the usage of transition studies for this research.

Within transition studies, a multi-level perspective (MLP) as a heuristic tool and SNM for niche analysis has been chosen as the analytical framework to guide the research.

3.3.1 Multi-level perspective

The multi-level perspective focuses on describing the evolution of sustainable initiatives over time, including the struggle against existing practices and external influences (Geels 2005). As illustrated in Figure, three levels of the socio-technical system are analysed: the protected space of innovation (the *niche* level), existing prevailing practices (the *regime* level), and external factors that might open up practices towards accepting innovations (the *landscape* level) (Van den Bergh et al. 2011). Initially, MLP was mainly used in the examination of long-term socio-technical transformations such as the transformation from the carriage to the car (Geels 2005). More recently it has been applied in a variety of different contexts, from policy advice to research in developing and emerging economies (Hansen & Nygaard 2014; Onsongo & Schot 2015; Raven, Schot & Berkhout 2012; Sengers & Raven 2014). For example MLP was used by Onsongo and Schot (2015) to investigate a mobile phone-based innovation that is central to the transformation of the financial services industry in Kenya. Given the importance of framework conditions in creating the demand for EEF and the identified importance of political set-ups and institutions, the use of MLP seems to be appropriate for this research.

Other theoretical frameworks of transition studies were considered less suitable than MLP. Markard, Raven and Truffer (2012) identify four main theoretical frameworks of transition studies: transition management (TM); technology innovation systems (TIS); strategic niche management (SNM) and the multi-level perspective (MLP). TM actively supports the process of integrating sustainable public sector policies into existing policy frameworks. Therefore, it was not suitable as an analytical tool for this research. TIS do not have a focus on the private sector but takes a system perspective. "System" in TIS is defined in relation to innovation only and not to the broader provision of human needs (Jacobsson & Bergek 2011). Also, TIS focuses on the technological diffusion and does not provide a broader context analysis. SNM, which analyses the progress of sustainable initiatives over time, has useful niche analysis tools but overall seems too focused on the initiatives themselves, without accounting for broader context, external influences and the relationship with the prevalent practices (Berkhout, Smith & Stirling 2004; Caniëls & Romijn 2008). Finally the multi-level perspective seems most suitable due to its multi-level analysis (Grin, Rotman & Schot 2010).

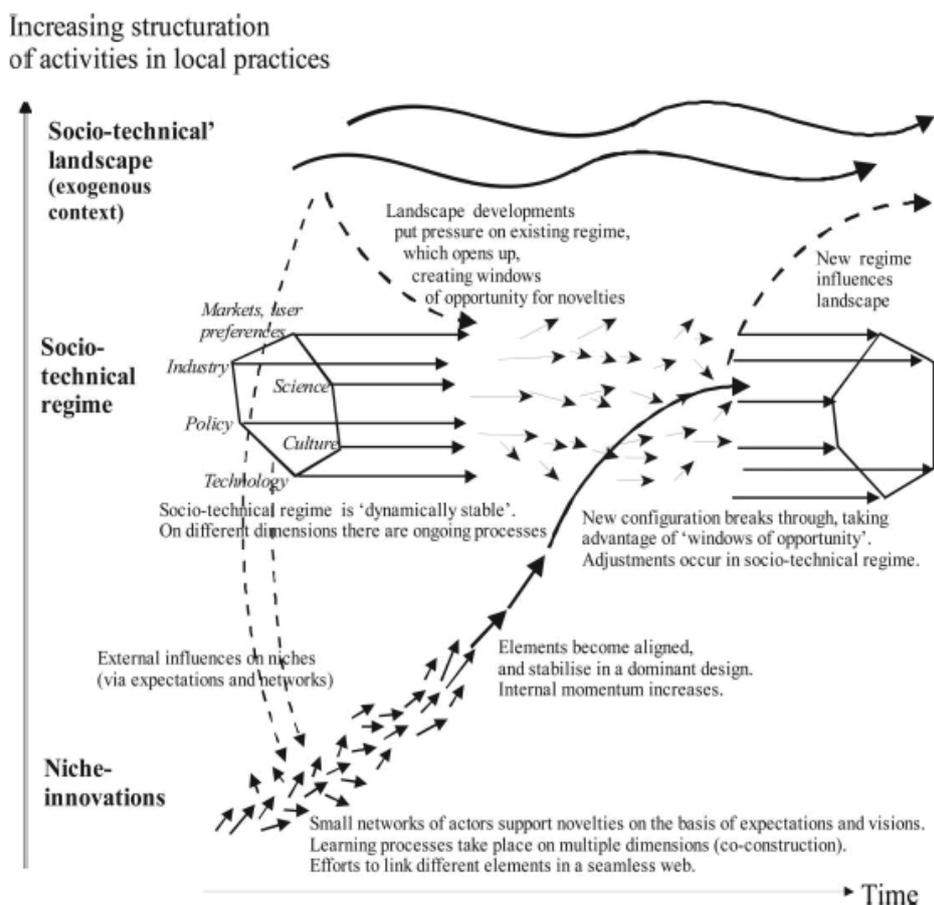


Figure 9: Multi-level perspective on transitions (Geels & Schot 2007, p.401)

3.3.2 Criticism of MLP

Despite its noted benefits, MLP is not without its critics. The main criticisms of MLP which seem relevant for this research are that it focuses on technological transitions, that so far there have been a limited number of MLP studies in developing and emerging economies, and that the analysis of agency/interests and politics is inadequate.

3.3.2.1 Focus on technological rather than social service transitions

Some critics note that so far MLP research has mainly focused on technological transitions. So far, MLP research has focused mainly on technological transitions, such as the change from carriages to cars or from sailing to coal powered ships (Geels 2005). Therefore, it might be difficult to apply the framework to a service such as the provision of EEF. However, in recent years research topics have also included 'radical social innovations' (Witkamp, Raven & Royakkers 2006, p.2). Berkhout et al. (2010), for example, looked into social entrepreneurship as a 'radical social innovation'. Therefore,

this research defines EEF initiatives as a *'radical social innovations'* and as the niche in MLP level approach.

3.3.2.2 *Developing/emerging economies*

Recent research in developing and emerging economies has found that some challenges are associated with applying the MLP framework to the developing and emerging country context. The main challenges found were in regards to the assumptions of a stable regime, and national autonomy and the limitations related to analysing the agency/interests of important stakeholders. As will be explained below, the researcher will therefore only use MLP as a heuristic tool to identify and expose dynamics.⁷

Recent research findings suggest that in a developing and emerging country context transition theory concerning regime analysis needs to be revised. In MLP literature, the regime is assumed to be stable and embedded in a resilient system, and that the instability of a regime provides a 'window of opportunity' (Geels & Schot 2007). However, research in India demonstrated that regimes that are constantly unstable, mainly due to political reasons. This makes it difficult for a niche to penetrate and establish itself in an existing regime (Verbong & Geels 2010). Geels et al. (2015) recently recognised the importance of broader framework conditions. He describes them as and characterises them as deep structures and exogenous changes 'static landscape characteristics do not determine actions, but provide opportunity structures that make certain actions easier than others' (Geels et al., 2015: p.6). As political instability is a characteristic of many countries in Southeast Asia, this aspect needs to be considered.

Also, the assumption of the national autonomy of governments needs to be revised in a developing and emerging country context. An extensive body of literature has described how the World Bank or other international organisations take part in shaping policies and forming institutions in developing and emerging economies (Bates 1988; Cammack 2002; Escobar 1995; Gill 1995). Raven, Schot & Berkhout (2012) and Hansen and Nygaard (2013) have indicated that even at the niche level in developing and emerging economies, transnational influences play an important role. (Raven, Schot & Berkhout 2012) have recommended attention be paid to transnational influences at all levels of

⁷ Recent discussions at the International Sustainability Transition 2015 conference revealed that there is a researchers in developing and emerging fear that MLP might become another, ill-fitting framework of analysis that is just transferred from the north to the south (Stirling 2014).

the MLP analysis. Thus, this research has paid particular attention to international organisations and their activities at all MLP levels.

3.3.2.3 Relationships, interests and politics

Another relevant critique of MLP is that the analytical framework is too 'techno centric', meaning that it focuses too much on the technological requirements rather than the social ones. (Genus & Coles 2008). This criticism comes particularly from political economists. Meadowcroft (2005) postulates that 'technological change has long been a political battleground'. Newell has examined energy transitions in the context of climate policies in emerging countries by analysing the distribution of authority in the incumbent regime (Baker, Newell & Phillips 2014; Newell 2013; Phillips & Newell 2013)., Newell (2013) found it useful to: look into the institutional set-up and how it changes overtime, include informal decision-making processes, and account for the relationships between the state and capital and the state and the international institutions.

Despite a lot of efforts to show the linkage between power/agency and transition studies, so far the conceptualisation of these aspects into the theoretical frameworks has been limited. Geels (2011) replied specifically to the criticism of the lack of agency in MLP by stating that "agency has always been present in the MLP", but also admitted that agency/interests might have been less researched so far (Geels 2011, p.30). Many scholars have focused on the definitions of power within MLP (Avelino & Rotmans 2009; Grin, Rotman & Schot 2010, p.315; Kern 2014). However, these definitions are theoretical and provide different definitions of power at the different MLP levels rather than suggesting some analytical categories that can be included in the analysis. Basically, one central publication is missing that really illustrates how in an MLP analysis, power and interests could be studied. For example, by looking into the regime and industrial connections at the regime level or including transnational influences at all three levels (Geels 2014; Hansen & Nygaard 2013).

3.3.2.4 Limitations in analysis of how to further support the niche

MLP has been criticised as not having a forward-looking approach to the analysis of the niche-regime relationship. In other words, it gives a reflective account on what can be called a successful transition, analytical tools to plan how to get there are however limited (Genus & Coles 2008).

Some guidance on when a niche has penetrated exist. Geels and Schot (2007) argue that sustainability initiatives are fully developed when (a) the design represents all of the learning processes associated with implementation (b) powerful actors are involved in

the network; (c) price signals have improved the viability of projects and (d) the market share of the sustainable technology is between 5 and 20% of the original market. Further, Geels and Schot (2007) developed four transition pathways, namely the transformation path, the de-alignment and re-alignment path, the technological substitution path and the reconfiguration path. In **Error! Reference source not found.** each transition pathway is outlined and the main actors and relationships are given. However, besides an identification of the pathway there is limited information available on how to promote niches within that pathway.

Table 4: Main actors and (inter)actions in transition pathways (Geels & Schot 2007, p.414)

Transition pathways	Main actors	Type of (inter)actions	Key words
1. Transformation	Regime actors and outside groups (social movements)	Outsiders voice criticism. Incumbent actors adjust regime rules (goals, guiding principles, search heuristics)	Outside pressure, institutional power struggles, negotiations, adjustment of regime rules
2. Technological substitution	Incumbent firms versus new firms	Newcomers develop novelties, which compete with regime technologies	Market competition and power struggles between old and new firms
3. Reconfiguration	Regime actors and suppliers	Regime actors adopt component-innovations, developed by new suppliers. Competition between old and new suppliers	Cumulative component changes, because of economic and functional reasons. Followed by new combinations, changing interpretations and new practices
4. De-alignment and re-alignment	New niche actors	Changes in deep structures create strong pressure on regime. Incumbents lose faith and legitimacy. Followed by emergence of <i>multiple</i> novelties. New entrants compete for resources, attention and legitimacy. Eventually one novelty wins, leading to restabilisation of regime	Erosion and collapse, multiple novelties, prolonged uncertainty and changing interpretations, new winner and restabilisation

If one looks more broadly in the transition studies discipline some further aspects can be found that contribute to the penetration of the niche into the regime. Also, good to note that recently the transition studies community is trying to draw out broader lessons out of individual niche analysis (Luederitz et al. 2016):

- Niches cannot penetrate a regime because: (1) troubleshooting takes time; (2) a mismatch with the existing regime; (3) regime actors oppose innovation. ‘Windows of opportunity’ arise when instability of the regime arises (Grin, Rotman & Schot 2010, p.26)
- Lack of capacity building within a niche (Geels & Raven 2006): Standardisation, codification, demonstration of best practices, knowledge exchange among actors (conferences, workshops, technical journals) etc.
- Particularly in ongoing transitions, instruments need to be diverse and adaptable over time (van den Bergh, Truffer & Kallis 2011).

- Importance to develop national public sector programmes (e.g. market creating instruments, such as cap and trade systems) or programmes that focus on one specific technology (e.g. PV roof programmes in the EU (Andersson & Jacobsson 2000; Van der Loo & Loorbach 2012; Suurs & Hekkert 2012).
- EE regulatory, innovation and environmental policies and instruments need to be integrated (van den Bergh, Truffer & Kallis 2011; Paraskevopoulou 2012).
- Niches can be promoted by Market-based approaches such as tax-credits and guarantees (Van der Loo & Loorbach 2012)
- Political decisions have a direct impact to the outcome of energy related niches (Van der Loo & Loorbach 2012).

However, so far, the conceptualisation of these findings in analysis tools that could guide transition analysis is limited. Recently, grassroots innovation scholars have started to expand SNM analysis to also include identity and group formation within the internal niche analysis (Seyfang & Haxeltine 2012). Also, transition scholars have started to analyse the experimenting of sustainability transitions which point towards a close incumbent regime analysis (Sengers, Wieczorek & Raven 2016)

3.3.3 Response to the criticism

Given the criticism of MLP and the geographical location of this research, MLP has only been used as a heuristic tool to provide a lens for analysis at the three different levels: (1) landscape; (2) regime and (3) niche.

This research is located in an emerging country context and focuses on a ‘social radical innovation’, namely EEF initiatives. Given the criticisms raised above, the researcher has paid particular attention to:

- whether the analytical framework can be applied to a social innovation such as EEF
- whether landscape factors such as the political situation and cultural norms have an impact of regime stability or window of opportunity
- particular attention is paid to the influence of international organisations. In this regard the analysis of the system transformation from the perspective of time. analysis seems important. Thus, the research pays particular attention to the evolution of institutions and actors over time (Poole 2011).

Given the criticism of MLP above, I have decided to use the frameworks of MLP and SNM in a complimentary fashion. Still the main focus is on MLP, with complementing the niche analysis with the SNM criteria. From the MLP tool especially the development

of the niche and regime developments overtime, its analysis framework over three levels and its regime analysis tool via seven dimensions was used. The SNM criteria learning, stakeholders and joined vision assisted the in-depth niche analysis.

The combination of MLP and SNM has been suggested by other scholars previously (Schot & Geels 2008). Other researchers have also combined the approaches. For example, the following authors have stated to use MLP analysis, but at the niche level also integrated the SNM criteria learning, actors and joint visions/expectations (Hansen & Nygaard 2014; Sengers & Raven 2014; Verbong & Geels 2007). Others have used SNM as their main analytical framework and provided overview overtime of the regime and landscape events (Van der Laak, Raven & Verbong 2007; Rehman et al. 2010; Verbong et al. 2010).

3.3.4 Strategic Niche Management

Strategic niche management focuses on the analysis of an innovation as it evolves to mainstream practice. Three main factors were identified as crucial in the potential of an innovation to become mainstream and penetrate the dominant system (Geels, Raven & Raven 2006):

- Learning processes at multiple dimensions to develop knowledge and generate alignment
- Establishing social networks around the technology, to allow feedback from users, government officials and special interest groups
- The articulation of expectations and visions to receive attention and provide a direction for further development

Strategic niche management has been critiqued as too focused on the micro-level with limited orientation towards the niche - regime dynamics or external factors influencing the innovation (Berkhout, Smith & Stirling 2004) (Caniëls & Romijn 2008). Therefore, this research uses the SNM framework only for the niche analysis and relies on MLP for a broader understanding of the other levels.

The next section describes the scope of the research by outlining the different levels of MLP in the research context.

3.3.5 Application to the research context

Below the boundaries of this study are defined and the adaptations made are described. These are also explained in the text below, and illustrated in Figure 10.

The niche that this research will examine is EEF initiatives, namely public sector EEF mechanisms and private sector EEF models. As illustrated in the literature review, the problem of EEF is a socio-technical problem, given the diversity of EEF mechanisms and models (technical) as well as the multitude of stakeholders (social) that need to be involved.

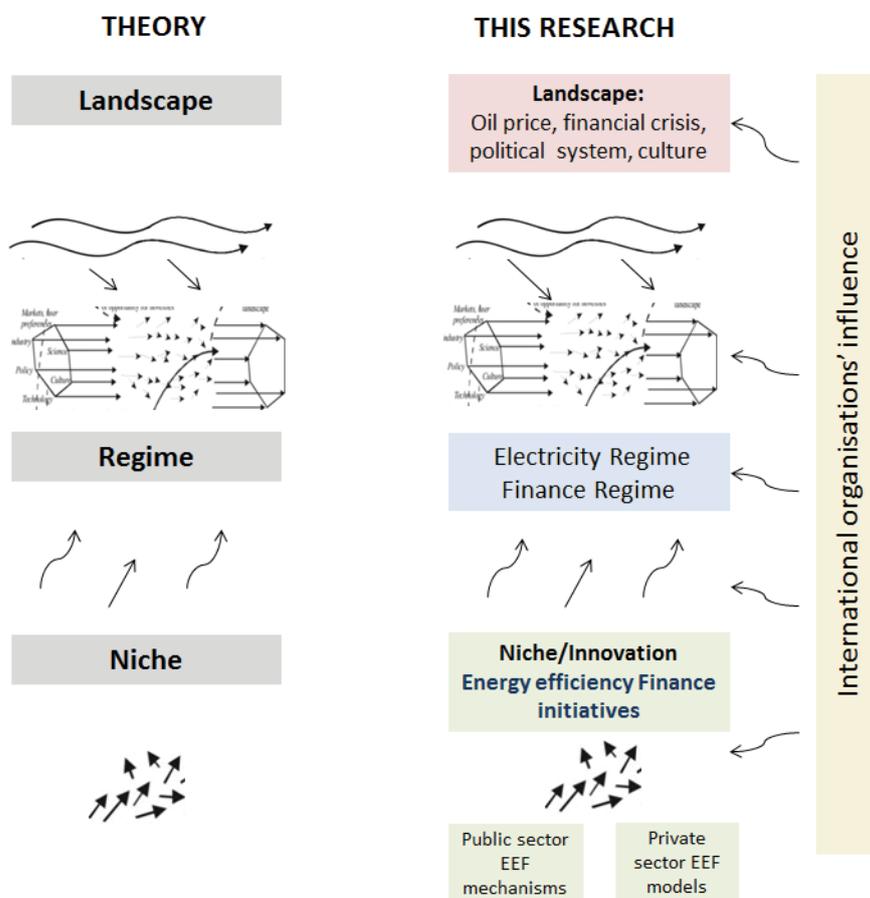


Figure 10: Multi-level perspective on transitions (adapted from (Geels & Schot 2007)

Thus, EEF initiatives are a ‘radical social innovation’. The niche is a protected space where technological innovation can evolve and develop towards penetrating the dominant market structures. ‘Niches were instrumental in the take-off of a new regime and the further development of a new technology’ (Kemp, Schot, & Hoogma, 1998, p.184). Niches are important as they provide ‘locations for learning processes’ (Geels, 2002: p.1261). They provide the ‘seeds for change’ (Geels, 2002: p.1261). They can be

also initiated by regime actors (for example government), as long as the protected initiatives go against the current regimes (Raven, Schot & Berkhout 2012).

Therefore, in this research, niches are defined as external EEF initiatives for the building and industry sector, consisting of public sector EEF mechanisms and private sector EEF models (Slote et al. 2014). Public sector EEF mechanisms can still be called a niche as the initiatives go against current finance sector practices. External EEF means all funding that does not directly come from corporations' earnings, but always uses third parties to mobilise finance. These third parties could, for example, be banks, leasing companies or ESCOs (Taylor 2012).

Niches were analysed following SNM criteria. Niche analysis of SNM focuses on the learning that takes place, the networks that are created and the institutional embedding of the initiatives via joined vision and expectations among the stakeholders (Smith 2007). The learning process is differentiated in first and second order learning or the quality of learning and quality of institutional embedding (Grin, Rotman & Schot 2010; Smith 2007). The actor/networks of each experiment are analysed in regards to their agency/interest's relationships using political economy analysis. Attention is paid to the variety of agency/interests and authority due to public sector discussion or institutions. Steering these niches was also emphasised to be dependent on the knowledge, agency/interests of important stakeholders and their shared vision/goals (Voß et al. 2007).

The separate, but linked socio-technical regimes analysed in this research are the regimes of the financial and electricity sector of Thailand. A regime is defined as 'a variety of mutually reinforcing and entrenching cognitive, social, economic, institutional and technological processes that sustain existing trajectories of development' (Smith, 2007, p.428). Thus, the regime is usually 'locked-in' and thus difficult to penetrate by innovative approaches (Grin, Rotman & Schot 2010, p.19). A regime has been defined to consist of seven components: (1) technology; (2) techno-scientific knowledge; (3) regulations and rules; (4) infrastructure; (5) industry structure; (6) markets and user patterns; and (7) cultural and symbolic meaning influencing the regime's pathway (Geels 2005). The focus of analysis in traditional MLP has mostly been on one regime and analysis of multiple regimes is not as common (Fam et al. 2014; Geels 2005; Onsongo & Schot 2015). In this thesis two regimes are considered, namely the electricity regime and the financial regime. Figure 11 illustrates the financial sector regime that includes investment regulations, the banking culture, and prevalent financial business models. Figure 12 explains the electricity sector regime. The complexity of the electricity regime

and within it the EE market becomes apparent. Also Figure 12 illustrates the multiple stakeholders who are involved and the variety of areas that need to be considered to understand the prevalent regime.

The relationships and interests between the actors of the regime will also be analysed using political economy analysis. Attention is paid to the variety of economic, discursive and institutional relationships. Special attention is given to the influence of international organisations. Also the thesis analyses who would be the losers and winners of EEF shifting from a niche level into the dominating markets, so to identify possible opponents (DFID 2009; Grin, Rotman & Schot 2010).

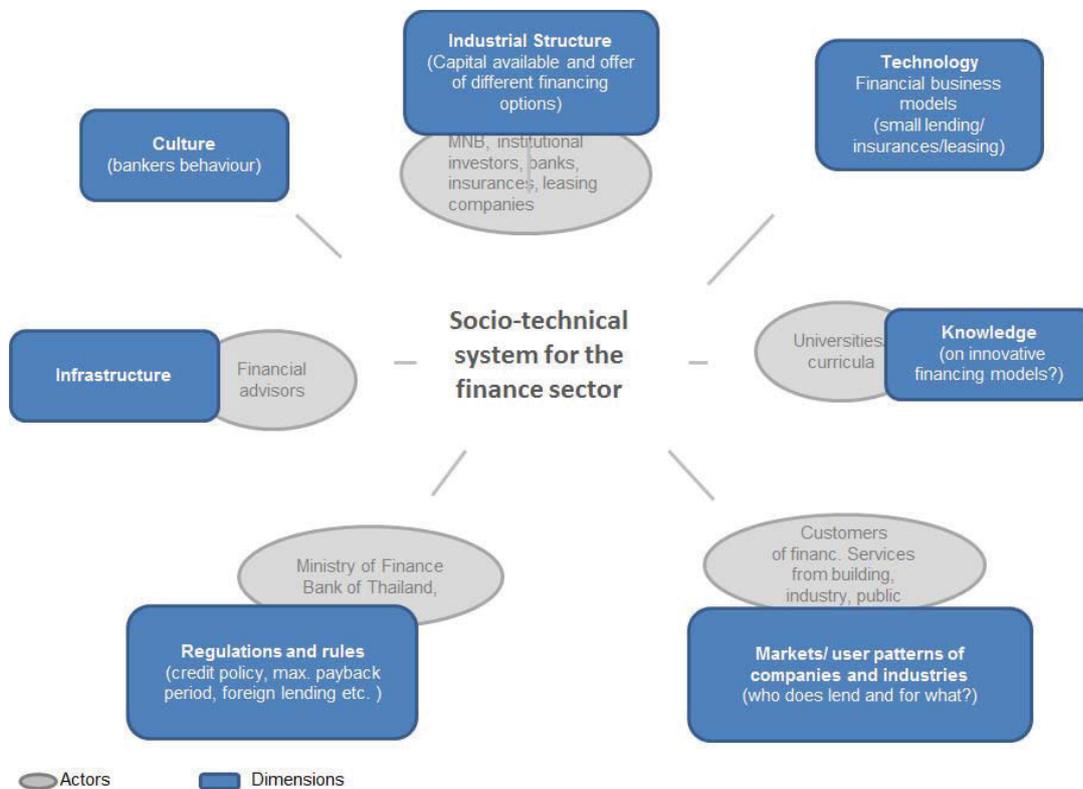


Figure 11: Socio-technical trajectories of the finance provision and consumption

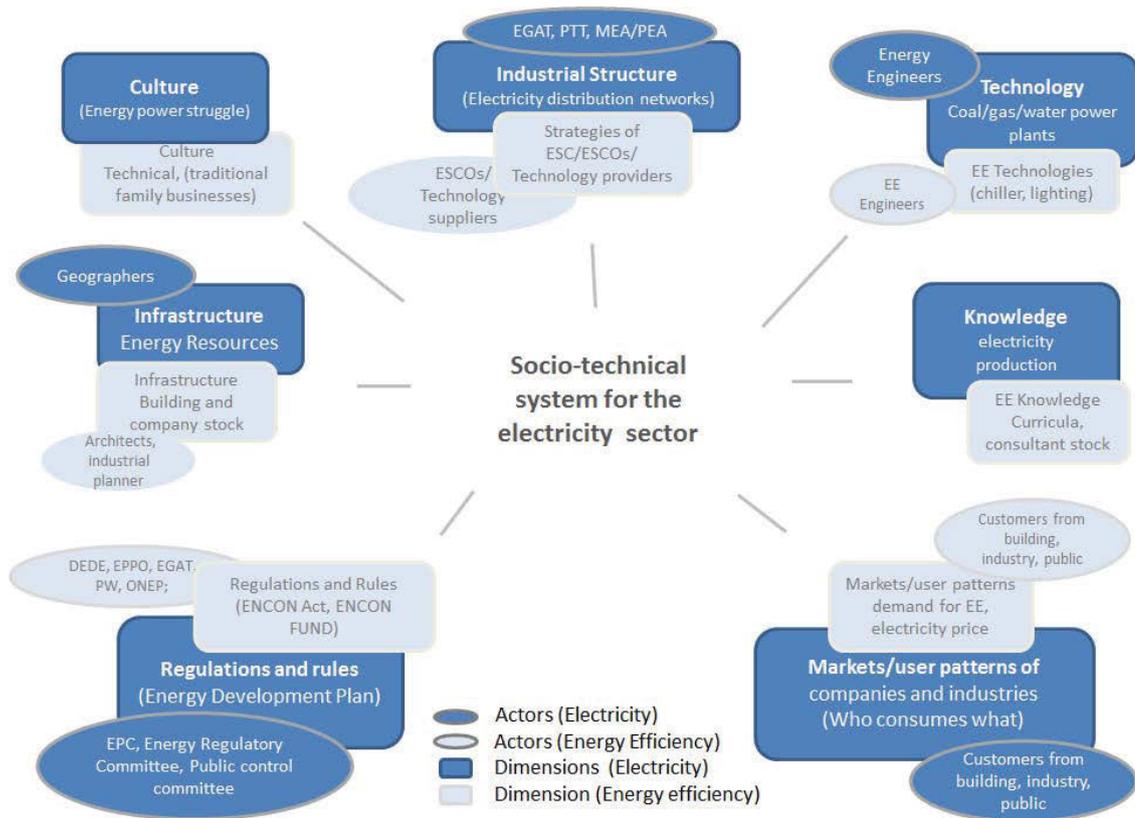


Figure 12: Socio-technical trajectories of the electricity and EE provision and consumption

External pressures and non-changeable framework conditions make up the landscape of this research. The landscape is defined as “the whole set of impacts outside the level of niches and regimes, which have influence” (Lachman 2013, p.271). The theory says that landscape events can be so powerful that they lead to destabilisation of the socio-technical regime and thus to change (Van den Bergh et al. 2011). The landscape can also consist of the ‘deep structural relationships’ of society (Baker, Newell & Phillips 2014, p.794). So the state of civil society, the political system, environmentalism in the population, and industrial circumstances can all be accounted for at the landscape level (Geels et al. 2015). In this research, landscape events could be: (1) fluctuations in oil prices; (2) financial crises; (3) national, regional or international political pressures (e.g. from the IMF); (4) the political system, (5) corruption and (6) cultural characteristics.

The next section will provide an overview of the methods chosen for this research and explain the process of data collection.

3.4 Research approach

The following section will outline the methods chosen for this study and provide an overview of the data collection and analysis processes.

The primary source of data used in this research was semi-structured interviews, complemented with World Cafes. Further, secondary data was collected and analysed for triangulation purposes and broader context investigations. Due to difficulties of remote access to data and data scarcity, a qualitative approach was used.

Entry and exit seminars, as well as collaboration with a local university and researchers, helped to understand the cultural context and also overcome any language barriers. For validation and knowledge sharing, entry and exit seminars at the start and the end of each field trip were conducted. Further, close collaboration with the King Mongkuts University in Thonburi ensured academic supervision in the field and mitigation of cultural and language-related obstacles in the research.

The data was collected using an adaptive research approach, over an overall period of eight months in Thailand between 2013 and 2014. The adaptive research approach allowed for reflection and change of research focus and methods during the field work period. Field Trip I focused on the public sector EEF mechanisms and revealed the existence of some private sector initiatives. Thus, Field Trip II focused on those initiatives. Further, due to cultural considerations, the methodological approach of using interviews and several World Cafes was changed to conducting more interviews and only two World cafes.

3.4.1 Methods

The data in this research is primarily qualitative. It was found that in developing economies data is scarce and might lack validity (Batterbury, Forsyth & Thomson 1997). Further, evaluation documents for public sector programmes, as well as the strategy papers of financial institutions might contain sensitive information and could therefore be inaccessible (Denscombe 2010). Also, at the niche level, learning and expectations are the focus of the analysis, and this data is qualitative in nature. Hence, qualitative research methods were chosen.

The primary sources of data for the research were interviews and 48 semi-structured interviews with key experts in the field were conducted. Research interviews 'attempt to understand the world from the subjects' points of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations' (Kvale &

Brinkmann 2009, p.1). As the focus of the research was to gather information of past experiences with public sector interventions and understand the relationships and interests of actors/networks this definition suits well. Further, a semi-structured interview style was chosen, so that the researcher could adapt the schedule according to the experience of the interviewee. Semi-structured interviews have been used extensively in policy and transition studies in developing and emerging economies (van den Bergh, Truffer & Kallis 2011; Sullivan 2011; UNEP 2006).

Key experts were selected that could illuminate the several aspects addressed in this research. Criteria for the selection of key experts were extensive experience in the Thai electricity or finance sector and in particular with EEF experience. Further, the attempt was made to achieve a good balance between academia, government, private sector, NGOs and donor representation. Guidance from key experts in the entry workshops at the start of each field trip were used to identify initial interview partners for Field trips II and III (Denscombe 2010).. Interviews were also used to recommend other relevant stakeholders for interviews. The interview partners were contacted by the research assistants via email, phone or letter. An information sheet was provided prior to each interview. For the protection of the interviewees, a consent approval process was used, and their identities were kept anonymous.

Test interviews prior to the field trip and with German technical development organisations (GIZ) personnel in the country verified the appropriateness of the questions in the Thai cultural context. A roundtable was conducted prior to the first field trip with staff from the Institute for Sustainable Futures which resulted in changes to three interview questions. Further, Thai GIZ staff provided further feedback on the interview schedule during a trial interview in Bangkok. The second interview schedule was tested with a hired research assistant in Bangkok. The focus group schedule was tested with a group of Thai research students at the Joint Graduate School for Energy and Environment (JGSEE).

For triangulation and broader context analysis, secondary data in the form of documents was collected and analysed. Legislative, media and NGO documents were used to supplement and triangulate some of the statements made by interviewees (Denscombe 2010). Also, the documents were helpful for establishing the broader context of the regime analysis. The documents were either recommended by the interviewees or found during in-country literature review searches. Only published academic documents and government policies were selected (Genus & Coles 2008).

Where possible, group discussions in the World Café format were conducted to allow for broader discussions on EEF from a customer/stakeholder perspective. The World Café methodology is a simple, effective, and flexible format for hosting large group dialogues (Brown & Isaacs 2007). It also facilitates learning processes among the participants due to the joint discussion process.

3.4.2 Ensuring validity of the data

An adaptive research approach was taken. As the research was located in an emerging economy with limited data, where English was a second language and culture differed from the researcher's an adaptive research approach was followed. Particular care was taken to avoid any misunderstanding and ensure the quality of the data results. Entry and exit seminars, collaboration with a research consultant and mid-term evaluations were the main quality assurance instruments used.

An adaptive research approach was chosen due to data scarcity and the need to work in a different culture and language. Remote available data on EEF in the Thailand case study provided conflicting findings on how far EEF initiatives had shifted towards the private sector. Thus, an overall plan for the research seemed difficult right from the start. Consequently, an adaptive research approach was chosen. This allowed for a continuous process of sharpening the research focus during the empirical data collection process. This approach has been noted to be particularly useful in a developing or emerging economies context, where data is scarce (Batterbury, Forsyth & Thomson 1997). Therefore, the first field trip was followed by a phase of reflection that then informed the focus for the next field trip. The reflection step allowed the collection of more meaningful data and also built relationships and capacity with relevant stakeholders.

Entry and exit workshops with previously identified key experts provided initial interviewees, validated the findings and ensured the transfer of knowledge to relevant local stakeholders. Six distinguished experts from academia, government and the private sector participated in the entry and exit seminars that were used to collect initial guidance and verification in each field visit. This approach provided, on the one hand, an opportunity for the researcher to validate the results, and, on the other hand, to inform key stakeholders of the results. It was believed that these results could influence the stakeholders' behavior. Inducing actual change in the behaviour of research participants has been recommended by transdisciplinary research scholars (Mitchell, Cordell & Fam 2015). The entry and exit seminars were found to be highly useful in a culturally diverse and data scarce research context.

The collaboration with research assistants, particularly in the second field trip, reduced the risk of misunderstandings during interviews and enabled the researcher to understand Thai documents and statements. The interview language was English, but to ensure the interviewees' comfort a Thai research assistant was always present during the interviews. Only two of the 48 interviewees needed translation assistance. One of the World Cafés took place in Thai, but due to simultaneous translation and a detailed documentation in English, which was provided by each of the Thai facilitators, the content of the discussion could be captured. All interviews and World Cafés were recorded and transcribed. However, most of the interviewees were not fluent in English:

'I don't remember how many foreign, how many places that I been to just to telling my experience in this revolving fund, this is another one could be on the record, very happy to do so' (G1).

Therefore, after each interview the research assistant was consulted to check whether the main messages of the interviewee were understood. These were written down in a brief summary directly after each interview.

Further, mid-term field trip evaluations during Field Trips I and II provided academic feedback on the data collection process from the researcher's supervisors. The first mid-term evaluation provided inputs regarding the number of interviewees and the second evaluation suggested that the World Cafés be conducted earlier than first planned as they were intended to integrate the results of the interviews.

By taking all these measures, good research results were obtained, even though the researcher was in a country where a different language was spoken and a different culture practiced. The next section will provide a chronological narrative of the research trips undertaken to the Thailand case study.

3.4.3 Data collection process

This section describes in detail the research trips undertaken for the Thailand case study. It also explains the evolution of the research focus that resulted from the preliminary analysis of the data from Field Trip I. The details of each field trip and details about the data collection approach (interview schedules, testing and choice of participants) are explained below.

The three case study research trips to Thailand lasted a total of eight months and they took place from 2012 to 2015. Figure 13 illustrates the focus of each research trip and shows how the different field trips informed the research questions. The objective of the

one-week scoping trip was to identify a support structure and discuss acceptable research methods. Field Trip I focused on the evaluation of the public sector EEF mechanisms found in the Thailand case study. Field Trip II focused on the private sector EEF models. It examined whether they were sustainable and what other measures might be needed. In addition, particular attention was paid to the framework conditions in the electricity and financial sectors. Below, each research trip will be discussed in detail.

‘How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?’

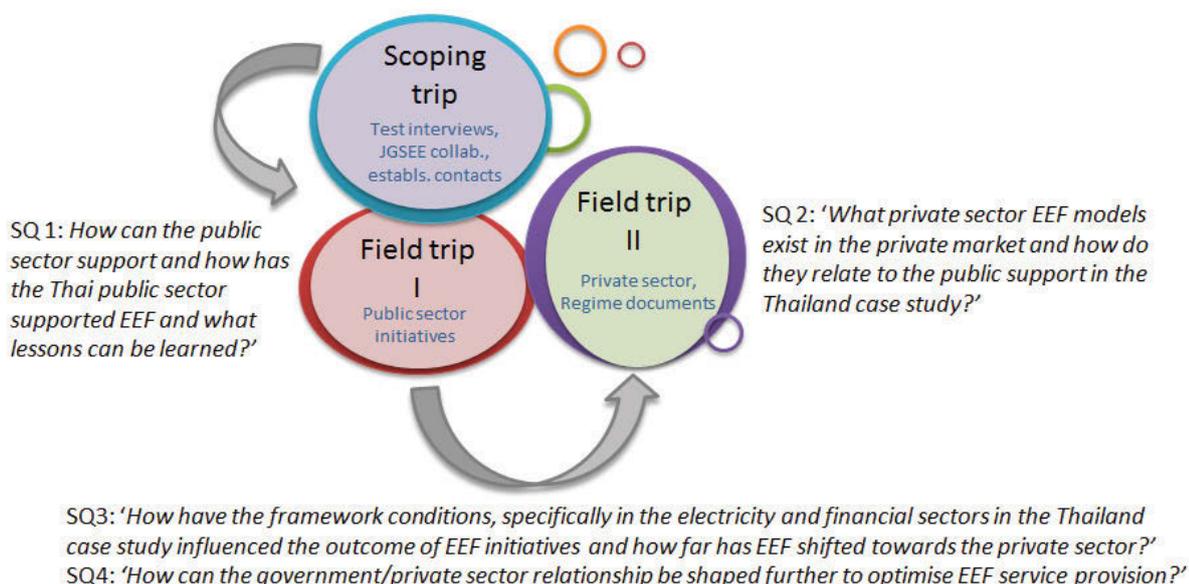


Figure 13: Field trips and the evolution of the research questions

The scoping trip to Thailand took place from the 17 to 25 September 2012. Besides attending some workshops, which were facilitated by the German technical development organisation (GIZ), several interviews were conducted with academics, and government and UN representatives. The scoping trip found that the researcher could be hosted and interviews facilitated by the Joint Graduate School for Energy and the Environment (JGSEE) from King Mongkut’s University in Thonburi. Also, local academic staff confirmed that interviews could be conducted in English and that a collaboration with a Thai research assistant for making appointments and translation of documents would be necessary. Lastly, contacts were made with individuals and organisations that were interested in the topic. The contact with JGSEE, with its good reputation among Thai government and private sector stakeholders, was a crucial step for the participation of relevant officials in this research.

Field Trip I marked the start of the empirical data collection. The focus was on evaluating public sector EEF mechanisms and related policies. The field trip was conducted from 4 August to the 16 September 2013 with the objective of preparing an in-depth policy analysis of the public sector EEF mechanisms undertaken. A research assistant was hired from King Mongkut’s University of Technology Thonburi to assist in making appointments and translating documents. It was found that senior, high-ranking government officials would not participate in a World Café. Thus, the number of individual interviews was increased from 4–8 to 20. The backgrounds of the interviewees, as well as the codes used for the analysis, can be seen in **Error! Reference source not found.** The interview schedule (see Appendix III) was based on the regime criteria of MLP and the niche criteria of strategic niche management (Hermans 2013). Further, entry and exit seminars with selected senior experts and academia from the consultant, private and government sectors verified some of the findings and triggered engaged discussions among participants. Lastly, legislative documents were collected to triangulate some of the interviewee results. The content of the interviews was focused on policy rather than private sector uptake. The lack of consultation with customers was criticised in the exit seminar.

Table 4: Categorisation of the 20 interviewees of Field Trip I

Stakeholder	#	Stakeholder	#
Academia (professors consulting on public sector EEF mechanisms) (A1; A2)	2	Government (EE related officials) (G1; G2; G3; G4)	4
Banks (with EE portfolios) (B1; B2)	2	International (organisations supporting EEF) (IO1; IO2; IO3)	3
Customer (of EE finance) (C1)	1	Independent EE Consultants (IC1; IC2; IC3; IC4)	4
Facilitation bodies (for EE such as ESCOs, foundations) (F1; F2; F3; F4)	4		
Totals	9		11

The main focus of the six month-long Field Trip II was on the private sector (customers and financial institutions). Further, documents were collected that could be used for triangulation and for the national framework analysis. Field Trip II began on 6 August 2014 and ended on 30 January 2015. It identified the private sector EEF models that had been implemented. Further, it assessed whether they met the needs of the customers, and investigated customers’ experiences of EEF provision overall. In addition, the private sector’s perspectives on past and recent public sector policy support were analysed. Twenty-nine interviews were conducted with a clear focus on financial institutions, energy service providers and customers (Appendix IV; V and VI). For further descriptions of the interviewees please see Table 5.

Table 5: Categorisation of the 29 interviewees of Field Trip II (E: Energy related; F: Finance related)

Stakeholder	#	Stakeholder	#
ESCOs (ES1, ES2, ES3)	3	International (4Finance) (IO4, IO5, IO6, IO7)	4
Banks (B3; B4)	2	Independent Consultants (3Energy; 2Finance) (IC5; IC6; IC7; IC8; IC9)	5
Leasing companies (L1, L2)	2	Energy service providers (ESP1; ESP2; ESP3)	3
Customer (C2, C3)	2	Academia (1Energy, 2Finance) (A3, A4, A5)	3
Government (4 Energy) (G6, G7, G8, G9, G10)	5		
Total	14	Total	15

Private sector EEF models selection process

Reflecting on Thailand's local conditions, regulatory framework and public sector support six possible private EEF models were identified:

- loan; loan plus expert guarantee
- add-on loans
- EE leasing
- loans from private sector investors
- on-bill finance
- ESCO-arranged finance via shared saving EPCs or via Energy supply contracts.

As mandatory label standards and standard offer programmes do not exist, Transforming Markets programmes and *Energy Saving Purchase Agreements* were excluded. Certified green building label and preferential terms for Green/EE buildings were excluded, as even though building standards do exist in some developing and emerging economies, they are not enforced. Carbon finance, which so far has been mainly delivered by the Clean Development Mechanism (CDM) was excluded, as only a very limited number of EE projects exist under the CDM (Miller 2008). Lastly, the Property Assessed Clean Energy EEF mechanism was excluded, as the Thailand case study has no property tax bill that allows loans for EE projects.

The list of possible private EEF models was empirically investigated in the Thailand case study, and after reflecting on the findings regarding public sector support, combined with consultation of practitioners, the list for in-depth analysis was narrowed

down to three existing private EEF models: (1) loans (+ expert guarantee; add-on); (2) ESCO- arranged finance and (3) EE-leasing.

Table 6 shows that only three existing private EEF models could be identified in the Thailand case study. Utility (on-bill) financing is still at an experimental stage and public sector procurement regulations seem to be the main hindrance to upscaling this approach. The voluntary programme for on-bill financing is a public sector initiative of a utility called the Provincial Electricity Authority (PEA). The PEA aims to provide ESCO services to universities. However, it only started two years ago, and memorandums of understanding with a university and hospital have just been signed and have encountered problems with payments due to government regulations. Private sector investor activities for renewable energy (RE) have started to develop but the amount still seems too small for EE investments. During the workshops and interviews it was mentioned that several equity funds exist to promote RE funding. However, as they are recent they prefer to invest in predictable technology such as RE. During the entry workshop and throughout the research no evidence of state/municipal loan/green bonds could be found.

Therefore, from the seven possible EEFMs, only three were found to exist in the Thailand case study:

- loans (+ expert guarantee; add-on)
- ESCO- arranged finance
- EE leasing.

Table 6: EEF models found in the Thailand case study

Property Type/Sector							
Market	large		SME		MUSH	DOD/Federal	Residential
Segment/ Financial	Commercial	Corporate/Industrial	Medium & large	Small			Single Family Multy Family
Solution							
Direct Bank Loan	X m(CimB Thai; K-Bank)	x (Cimb Thai/K-Bank +Afd)	x CIMB Thai; K/bank +Afd				
Loan +Expert Guarantees	X K-bank	X K-bank	X K/bank				
Add-on loans	x (K-Bank)	x(K-Bank)					
ESCO Finance							
Shared savings	X	X					
ESC		X					
Leasing	X	X					
ON BILL	voluntary programme	voluntary programme			voluntary programme		

Two World Cafes were conducted. The first World Café focused on ESCO-arranged finance and energy performance contracts. It was conducted on 28 November 2014 with 20 key experts from academia and industry. It focused on the challenges and



Figure 14: World Cafe on ESCO-arranged finance

barriers to the ESCO-arranged finance model. After a brief keynote presentation on ESCO-arranged finance experiences in China, two discussion groups were held following the World Cafes methodology. Discussion topic 1 was: Challenges and barriers of energy performance contracting. Discussion topic 2 was: Existing public sector support and public sector support needed in the future for ESCO-arranged finance (see Figure 14). Thai facilitators and lunch were provided by a Thai-German Programme on Energy Efficiency Development and the international consulting firm NEXANT provided the meeting space (see terms of reference at Appendix VII). A trial discussion round was run with four students of JGSEE on 25 November 2015. The discussions were recorded. These were then used as data for the analysis of ESCO finance and its way forward.

The second World Café focused on the experiences of SMEs from the automotive industry, which were potential EEF customers (Greening the Thai Automotive Industry agenda is attached in Appendix VIII). 24 SMEs and the automotive association shared their knowledge and experience of



Figure 15: World Cafe with SMEs of the Thai automotive industry on their experience with EEF initiatives

ESCO businesses and EEF. After a brief keynote presentation of the ESCO association, three discussion groups were conducted (see Figure 15) that followed the World Café methodology and focused on the following questions: Question 1: What finance models do you currently use for technology investment and who makes the decision to invest? Question 2: Who needs to be convinced to invest in EE in your company? And Question 3: What should be improved regarding government initiatives for EEF? The workshop was held in Thai, and simultaneous translation was available. The GIZ Programme provided Thai facilitators, simultaneous translation and the venue. The facilitation and questions were trialled with GIZ staff on 12 December 2015. A summary report provided the main discussion points of each question. This was then integrated into the analysis of the EEF initiatives.

The extended time taken for Field Trip II, and the assistance of two Thai speaking research assistants, enabled a detailed analysis of how EEF was offered, and the identification of relevant literature for triangulation and national framework analysis.

3.5 Analysis of the field trips and adaptation of the research questions

Overall the interviews were coded systematically according to criteria of the MLP/SNM frameworks as illustrated below.

For the presentation of the results in Chapter IV, V, VI and VII certain quotations were chosen selectively from people who have particular relevance due to their professional background or experience. Also, the citations of interviewees excerpts were selected to provide a good illustration of the point made. Below a detailed description of the field trips and the analysis will be provided.

Field Trip I focused on the public sector EEF mechanisms that aimed to leverage private sector investment. Therefore, it focused on the research question:

Sub-question 1 (SQ1): *'How has the Thai public sector supported EEF and what lessons can be learned?'*

The interviews were coded systematically, with nodes capturing specific events, influencing factors over time and in-depth analysis of the niche criteria. Also, the starting dates of different initiatives were recorded on a timeline. The analysis over time was applied to understand the sequence of events of the public sector EEF mechanisms, and to understand its current status of EEF (Verbong et al. 2010). Further, interviews were coded systematically according to the niche criteria of SNM: (1) learning and capacity building (2) networks and (3) shared vision. Due to the discussion around international influence, a particular node was created on international influence (Hansen & Nygaard 2013). Due to the findings and comments from experts during Field Trip I, a new sub-question was developed that focused on private sector activities. During Field Trip I, it had become apparent that recently several private sector EEF initiatives had emerged. Therefore, a new sub-question was developed:

Sub-question 2 (SQ2): *'What private sector EEF models exist in the private market and how do they relate to the public sector support in the Thailand case study?'*

The analysis of the interviews from Field Trip II focused on the private sector EEF models identified in the Thailand case study, namely EE lending, leasing and ESCO-arranged finance. According to the SNM criteria for niche analysis, the interviews were coded so that each business model could be analysed according to the SNM criteria: Learning and capacity building, the development of networks/actors and shared vision/expectations. Further, the questions of whether first order or second order learning had happened, and whether this had an impact on the sustainability of the initiatives, were examined (Grin, Rotman & Schot 2010).

Throughout Field Trips I and II, attention was paid to the national framework conditions and events, as they seemed important for the outcome of EEF initiatives. Thus, the following research question was formulated:

Sub-question 3 (SQ3): *'How have the framework conditions, specifically in the electricity and financial sectors in the Thailand case study, influenced the outcome of EEF initiatives?'*

All interviews were thus coded according to the landscape events and regime characteristics. The regime was coded according to the seven dimensions of: (1) technology; (2) techno-scientific knowledge; (3) regulations and rules; (4) infrastructure (5) industry structure (6) markets and user patterns and (7) cultural and symbolic meaning influencing the regime pathway (Geels, 2005). As regime changes, can be observed over a 50-year time frame, an analysis overtime of the electricity and financial sector since 1950 was conducted and three distinct periods analysed (Geels, 2005). Separate to the dimension analysis, a literature review of grey literature in Asian emerging economies provided important framework conditions. As can be seen in **Error! Reference source not found.** to note that all the items of the aspects important at the electricity and finance regime could be attributed to a dimension of the MLP framework as shown with the numbers in brackets.

Table 7: Important framework conditions for EEF

	Factors that influence the enabling environments of EEF initiatives
Electricity sector	<ul style="list-style-type: none"> ▪ Available EE technology and capacity (international relations) (DeT'serclaes 2010) (1;2). ▪ Government regulations on EE (targets, standards and research) (DeT'serclaes 2010; Taylor 2012)(3). ▪ Geographical coverage of the electricity system (Verbong et al. 2010) (4). ▪ Institutional energy governance and the influence of international organisations (power relations) (Baker, Newell & Phillips 2014; Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Raven, Schot & Berkhout 2012; Sarkar & Singh 2010; Taylor et al. 2008) (5). ▪ High energy price creates a market demand for EEF (DeT'serclaes 2010) (6) ▪ Customer demand for EEF (efficiency status) (Limaye et al. 2012)
Finance sector	<ul style="list-style-type: none"> ▪ Capital is available(Wattana & Vaiyavuth, 2007) (4) ▪ Diversified banking sector, with experience in small-scale finance (Taylor et al. 2008) (1). ▪ On-lending regulations are supportive of EEF (3). ▪ Green energy legislation exists (Taylor 2012) (3). Capital available (Wattana, Sharma & Vaiyavuth 2008) (4). ▪ Institutions and international organisations' influence (Unger 1998) (5) & (7).
Political system/legal governance	<ul style="list-style-type: none"> ▪ Stable political systems make investment viable (DeT'serclaes 2010; Verbong et al. 2010); ▪ Sovereign risk in emerging economies can hinder investment (DeT'serclaes 2010) ▪ Contract enforcement needs to be strong to be able to outsource (Taylor et al. 2008). ▪ Influence of international organisations (Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Sarkar & Singh 2010)

Following the findings of the empirical literature review on important framework conditions, political developments and influence of international organisations were coded with separate nodes. Finally, the regime analysis provided the information whether these important aspects were conducive or not conducive in Thailand.

Finally, considering the overall research question, during Field Trips I and II this section reflected on the recommendations from the interviewees on how the public sector could support EEF initiatives further in Thailand. Thus, the final sub-question was:

Sub-question 4 (SQ4): *'How can the government/private sector relationship be shaped further to optimise EEF service provision?'*

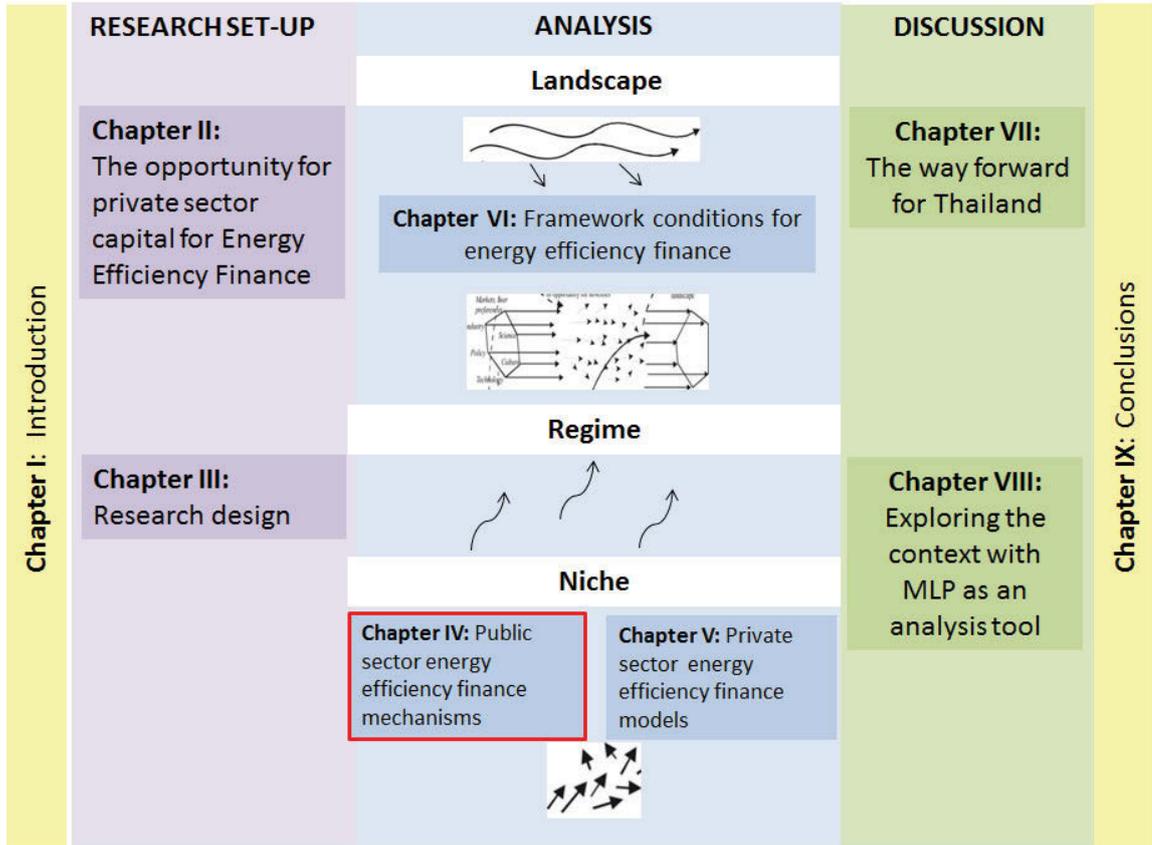
3.6 Conclusion

This chapter provided information on the research design of this PhD research. The rationale for using transition studies, in specific multi-level perspective as a heuristic, analytical tool and strategic niche management for niche analysis was presented. Further, it was explained why qualitative methods, such as semi-structured interviews and World Cafes were chosen.

The data collection process was described, as was the adaptive research approach that sharpened the research focus over time. The usage of entry and exit seminars as well as secondary literature for triangulation of findings was outlined. Finally, the analysis via transcription and coding index was described.

Given that the research took place in a developing and emerging country context, it needs to be seen whether the analytical framework provided useful insights. This is explored in the next three chapters that describe the results of this study. First, the niches will be analysed by looking at the public sector efforts to promote EEF will be evaluated and then their impact on the private sector provision is examined. Finally, the national framework conditions (regime/landscape analysis) will be examined to try to explain why private sector offers are still limited.

Chapter IV: Public sector energy efficiency finance mechanisms



4.1 Introduction

This chapter forms the first of three results chapters, with its particular focus on the niche analysis of public sector EEF mechanisms implemented in Thailand.

As the literature review indicated, knowledge to support EEF is still limited, with most of the literature on developing and emerging economies originating from international development organisations (Limaye et al. 2012; Taylor et al. 2008; Wang et al. 2013). As can be seen in Figure 16 the focus seems to be on EEF initiatives that can support large investment projects facilitated via banks or ESCOs. Also, the discussion centres on how the public sector can increase the amount of private sector EEF models, via guarantees or support for banks. For example the UNDP and the ADB provide partial performance guarantees to enable ESCOs to borrow from commercial banks (Dixon, Scheer & Williams 2011). In China, the second phase of an ESCO support programme focused on building the capacity of banks to lend to ESCOs and change procurement structures to allow for ESCO finance to take place (Dixon, Scheer & Williams 2011).

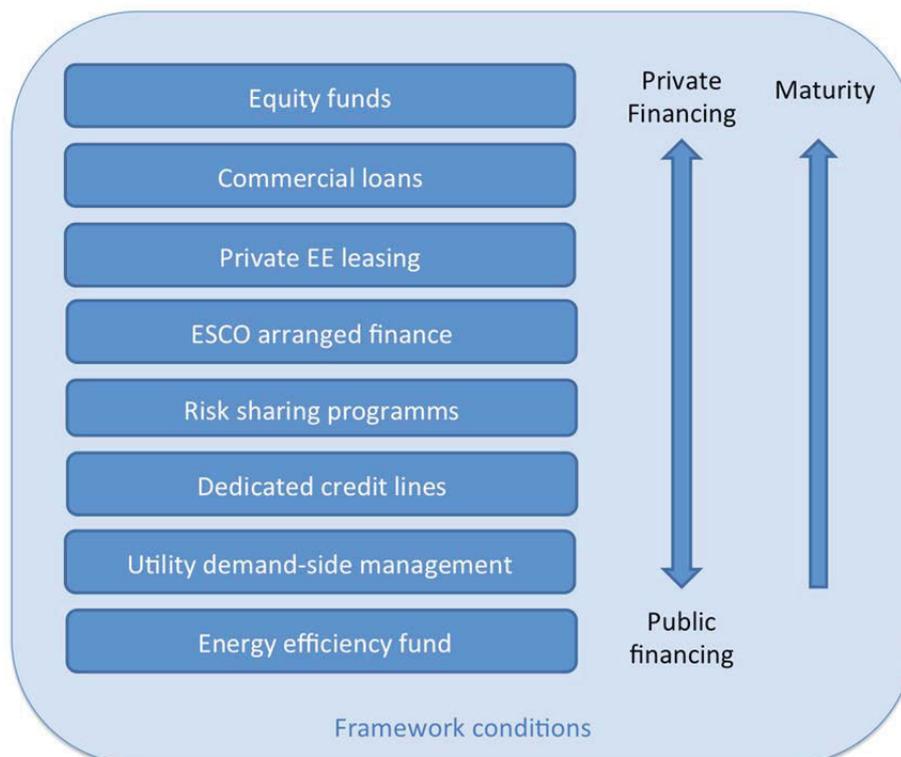


Figure 16: Range of public and private sector financing (adapted from (Wang et al. 2013))

Multilateral development banks and international development organisations have put forward a one-sided view promoting development driven by private sector investment.

The core of the knowledge is grounded in empirical data from international organisations, which needs to be scrutinised.

A broader overview of experiences in developed countries and in some emerging countries indicated a more diverse discourse. The importance of public sector programmes and long-term public sector support became apparent. In particular, it was noted that public sector programmes create further demand for external EEF initiatives. In China, GEF and the Chinese government established three super ESCO companies with grant funds who then developed about 173 energy performance projects (Dixon, Scheer & Williams 2011). Also, it became clear that the type of target group influences the choice of EEF initiatives and that in an emerging country context, the types of private sector EEF models used does not depend only on the maturity or development status of a country, it also depends on the broader framework conditions, such as the political system and governments priorities. For example, in Mexico the focus was found to be on SMEs and the residential building sector rather than heavy industry and commercial buildings, as they were not perceived to need assistance from the Ministry of Energy or the Ministry of Environment (Climate Action Tracker 2012).

As the first point of analysis, this chapter therefore focuses on public sector efforts to support the niche of EEF. It answers the Sub-question (SQ1): ‘What public sector EEF mechanisms have existed in Thailand, how have they changed over time *and* what lessons can be learned?’ Public sector EEF mechanisms are defined as ‘arrangements amongst institutions and market players to finance and implement EE projects’(Kats et al. 2012, p.4). Here, the focus is on external public sector funding that leads to EE implementation by the industry and commercial building sectors (Taylor 2012).

Firstly, the public sector support for EEF in Thailand is described over time. Even though the focus here is on the niche analysis, regime shifts or landscape events are mentioned if they had a direct impact on the offer of public EEF mechanisms. A more detailed regime and landscape analysis will be provided in Chapter VI. After the overview over time, a more detailed investigation of two public sector mechanisms, namely the Energy Efficiency Revolving Fund (EERF) and the ESCO Fund is presented. For the in-depth niche analysis, the SNM criteria development of actors/networks, learning and capacity building and shared vision/goals were used (Smith 2007).

The analysis over time identified three distinct periods of public sector EEF development:

- 1) 1992–1997 (the public sector moves forward)
- 2) 1997–2012 (shared public–private sector initiatives)
- 3) 2012–now (fragile private sector).

The in-depth niche analysis of the two public sector EEF mechanisms provided several key lessons: (1) Mechanisms need to be dynamic and focus on private sector capacity building (2) It is better to deal with EE and RE in separate financing initiatives; (3) Most potential customers such as medium to large SMEs and ESCOs were not reached.

Also, the results demonstrated that the public sector, with support from international organisations, played a decisive role in Thailand in starting EEF efforts. Specifically, international organisations initially played a crucial role in the development of EEF initiatives, but due to institutional shifts failed to provide long term capacity in the Thai public sector.

The transfer towards private EEF models is the focus of the next results chapter (Chapter 5).

4.2 Public sector efforts to support energy efficiency finance from 1992-2014

This section will provide an overview of the different public sector EEF support efforts that have been implemented in the Thailand case study over the last 20 years (see Figure 17) and will try to identify whether a shift from public sector EEF mechanisms towards private sector EEF models has occurred.

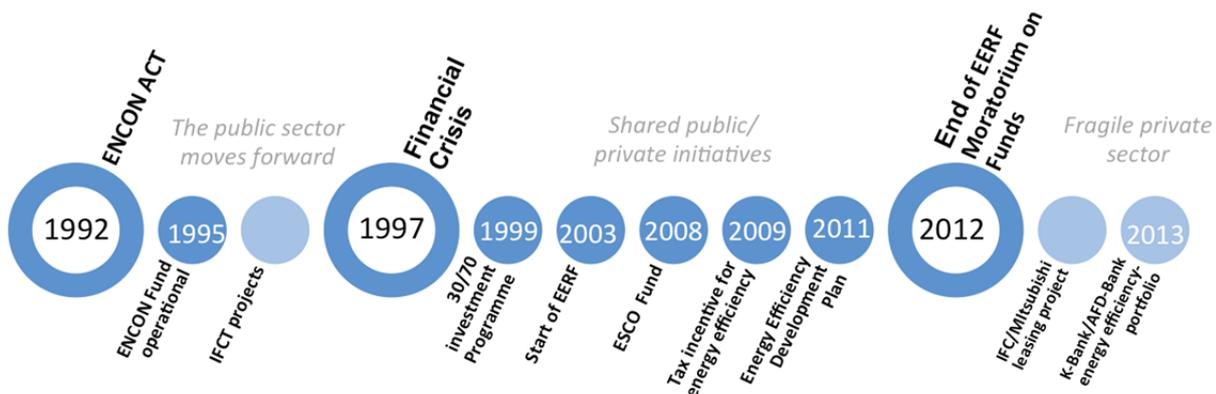


Figure 17: Overview of EEF relevant events in the Thailand case study (Abbreviations are defined in the main text)

Below, each phase is described in detail. For the overview of EEF mechanisms over time, secondary data was also used. However, the empirical data from interviews, workshops and World Cafes provided rich qualitative analysis. The interview data is indicated by using a code notation which indicates what sector the interviewee is from. For more detail see **Error! Reference source not found.** and Table 5 in Chapter III.

4.2.1 Period 1: 1992–1997: The public sector moves forward

This period was characterised by the dominance of the public sector by setting up EE regulations and a preliminary start to providing public sector EEF mechanisms.

In 1992, the passing of the Energy Conservation Promotion Act (the ENCON Act) created a demand for EEF initiatives. Most significantly, a program was established in 1992 requiring reporting and energy conservation measures in large, designated facilities. The ‘Designated Facilities Programme,’ was a compulsory program that required large commercial and industrial facilities (defined as facilities with electrical demand greater than 1,000 kW or annual energy use of more than 20 TJ/year of electrical energy equivalents) to start reporting on energy consumption and energy conservation initiatives (Chirarattananon, Chaiwiwatworakul, Hien, Rakkwamsuk & Kubaha, 2010). It also established a building energy code that was partially influenced by an ASEAN-led discussion on building codes during the late 1980s. The administering authority, the Department of Energy Development and Promotion (DEDP⁸) – then under the Ministry of Interior – focused mainly on technical capacity building measures, such as free and partially subsidised energy audits.⁹

The ENCON Act also established a mechanism for financing energy conservation programs and activities, namely the Energy Conservation Promotion Fund (ENCON Fund). The ENCON Fund was established in 1995 and was initially administered by the National Energy Policy Office, a permanent department under the supervision of the prime minister (Chirarattananon et al. 2010). Using the same mechanism as the already existing oil fund, the ENCON Fund is financed by a Thai Bath (THB)0.25 per litre tax on petroleum products (compressed natural gas and gas were excluded). The volume of the fund reaches up to THB 20 billion (US\$571330 million) with annual inflows of THB5 billion (US\$142836 million) to THB7 billion (US\$199971 million) each year (UNDP 2012).

⁸ DEDP was moved to the new Ministry of Energy in 2003 and renamed the Department of Alternative Energy Development and Efficiency (DEDE).

⁹ Full subsidies were provided from the ENCON Fund for “preliminary” audits, and partial subsidies were provided for “detailed” audits.

In 1991, a large EE demand-side management (DSM) programme was started. A DSM programme was initiated with utilities and the Electricity Governance Authority of Thailand (EGAT) as the implementing agencies (DuPont et al. 1991). The idea was that instead of financing new power plants, utilities could finance EE as a resource (DuPont et al. 1991). The programme promised to halve the cost of producing the estimated increase of electricity demand. (DuPont et al. 1991). EGAT generated US\$189 via an automatic tariff mechanism. US\$15.5 million were provided via GEF and the government of Australia, and the Overseas Economic Corporation Fund of Japan (OECF) provided a US\$25 million concessional loan.¹⁰ An evaluation in 1998 found that the programme had exceeded EGAT's target to save 4% of EGAT's total 1999 electricity capacity (Sing & Mulholland 2000). One challenge mentioned was that evaluation efforts took too long to adapt the programme according to the evaluation results. Another problem was the lack of pipeline preparation for projects. Also, the DSM programme was mainly administered by EGAT and this was a major constraint to reach particular customers, such as residential customers which are administered by the two utilities operational in Thailand (Sing & Mulholland 2000).

The interviewees provided some interesting insights into the administration of the ENCON Fund and the DSM programme with its feed-in tariff.

An international expert mentioned that initially the ENCON Fund was used mainly to finance energy audits and technical capacity-building measures (IC3). Only one programme could be identified that actually provided a 20% cost subsidy for chiller replacements. Many interviewees praised the Thai government for starting so early in providing grant finance for EE and RE projects.¹¹ They singled out the ENCON Fund as the main reason why Thailand had made so much progress toward its sustainable energy targets (G1; G6; F1; IC2). However, four interviewees made critical comments indicating that, due to the large annual funding, the quality of the energy conservation projects suffered (B1; IC3; IC1; A1). Also, some interviewees said the need to involve many external consultants (to design, implement and evaluate programs and projects) led to inadequate and ineffective monitoring of project achievements (A2; IC3; B3; IC7; G9).

¹⁰ The World Bank provided US\$9.5 million of technical assistance funding to the DSM effort through the Global Environment Facility (GEF), US\$ 6 million came from Australia and Japan's Overseas Economic Corporation Fund (OECF) pledged \$25 million of concessional loans for the DSM initiative. Subsequently, throughout most of the 1990s, the German government provided technical assistance to the Thai government through a series of in-house advisers in the Department of Energy Development and Promotion (DEDP)(Sing & Mulholland 2000).

¹¹ The Thai government understands energy conservation to encompass RE projects, as it reduces the amount of fossil fuel needed.

Two interviewees mentioned that the DSM programme resulted from a trip by relevant Thai government officials to the US and some further technical support via the Dutch government (IC3; F1). Further, it was mentioned that EGAT mainly implemented large-scale programmes with large companies (A1). For example, one programme focused on replacing 41W light bulbs with compact fluorescence lamps in large industries (G3). A government official mentioned that the residential sector was not affected, as EGAT had no arrangements for collaboration with the utilities (G3). The institutional set-up via a sub-committee which was cross-ministerial and involved academia was said to have worked effectively regarding programme administration (G3).

It seems extraordinary that at the end of the '90s, a special unit under the Industrial Finance Corporation of Thailand (IFCT) provided EEF for RE and EE loans. Interviewees pointed out that the IFCT, established a department which provided concessional loans for RE and EE projects (IC1; F3; IC2; IC6). The initiative was started with the financial assistance from the World Bank and the German and Japanese development banks, The Japanese development bank even arranged for a guarantee mechanism with the Thai Central Bank (IC6). Unfortunately, the interviewees and documents on the exact details were insufficient for an overall evaluation of the IFCT efforts for EEF.

4.2.2 Period 2: 1997–2012: Shared public and private sector initiatives

Period 2 was characterised by shared public and private sector efforts to support EEF initiatives. The start of this period coincided with the onset of the Asian financial crisis of 1997 and 1998. Public support included a stimulus of public sector funds provided to the banking sector, as well as incentive programs to support EE equipment and funding at the facilities level. Broadly speaking, the period ended in 2012 when the EERF was temporarily stopped.

Interviewees reported that this phase was dominated by programmes run under the ENCON Fund, as the ICFT was dissolved and the feed-in tariff for EGAT was cut. One IFCT employee reported that after the financial crisis, the IFCT was merged into the Thai Military Bank and the EEF efforts were discontinued (IC2). In 2001, it was reported that the financial mechanism for the DSM programme, which was administered by EGAT, was cut (G3). Thus, EGAT had to apply to the ENCON Fund for funding, which reduced the number of projects they implemented. Interviewees confirmed that once the tariff was dropped at the end of the '90s, EGAT lost its influence and interest in implementing DMS programmes (G3; IC1; IC4). Even though EGAT still administers

some DSM programmes, one EGAT employee noted that the move to a CSR department indicates the loss of importance within EGAT (G3).

International technical advisers, as well as influential finance individuals, lobbied for the establishment of EE incentive mechanisms. Interviewees mentioned several reasons why several public sector EEF mechanisms were started that aimed to enhance private sector EEF models during this phase: (1) the Thai government recognised audits alone would not lead to the implementation of EE measures and (2) an economic recession meant that incentive packages for the financial sector were politically acceptable (IC3; G2). A former IFCT employee mentioned that there was strong lobbying of relevant government officials from former IFCT staff, backed by some research funded from the German development cooperation to start new public sector EEF initiatives (G2; IC2). These were given as the main reasons why the Department of Alternative Energy Development and Energy Efficiency (DEDE) initiated two public sector EEF mechanisms (A1; IC3), both of which were funded via the ENCON Fund (IC3). These two mechanisms were:

- *The 30% Cost Subsidy Program for EE Standard Measures*
Initiated in the early 2000s, this programme was initially designed with support from a Danish agency. A grant was offered to an industry and building provider, originally for implementing nine identified 'standard measures' equal to 30% of the cost of the technology. The 30% subsidy expanded to also include more complicated projects with customised sets of EE measures (APEC 2005).
- *Energy Efficiency Revolving Fund (EERF)*
The EERF is a debt-financing mechanism that provides zero to low interest loans to banks for EE lending. Thai banks could on-lend the funds at a maximum of 4% interest. The initial amount of the EERF was THB 2 billion for a 10-year time frame (USD 50 million) (APEC 2005).

Interviewees added rich knowledge on the administration and effectiveness of the 30% Cost Subsidy Program for Standard Measures.¹² It was said that the 30% Cost Subsidy had a rapid approval process of about 30 days and catered mainly to small industries (IC3). This subsidy was mentioned in the Thailand case study as an important way to encourage private sector participation: An international organisation representative

¹² The EERF will be analysed in detail below in Section 1.3.

explained that ‘most of the Thai economy, they love subsidies [of] either 10% or 20%’ (IO6). A government official reported that the programme is still operating today, with the public sector share decreasing to 20% (G2). But one comment was made that 30% and now 20% is still not enough to incentivise SMEs to invest (ESP1).

Also, it was stated that with the establishment of the Ministry of Energy, the focus changed towards more privatisation and collaboration with ESCO companies. Three interviewees noted that by the mid-2000s governments began to focus more on the private sector. In particular, they focused on energy service companies (ESCOs) and this was linked to the establishment of the Ministry of Energy in 2003 (A1; G3; F1; IC3). This new direction was mentioned as the reason for the development of tax incentives and the ESCO Fund (F1).

- *Tax incentives*

Since 2006, tax incentives have included a combination of tax exemptions for EE and RE equipment, tax exemptions for corporate tax for ESCO companies and tax incentives for companies who invest in the EE or RE projects (IIP, 2015).

The interviewees mentioned that DEDE was the driving force behind the lobbying of the Board of Investment for tax incentives (C1; G5). But it was noted that tax incentives only work for companies who are large enough to have taxable incomes (G1).

- *ESCO Fund*

The ESCO Fund was started in 2008 and was temporarily stopped in 2014 in its third phase.¹³ This public sector EEF mechanism had the primary target of supporting EE projects for SMEs, including ESCOs, who would not normally be eligible for bank loans due to inadequate collateral.¹⁴

The interviewees noted that Thailand had become a middle-income country and that this shift caused problems concerning international support. Overseas development assistance (ODA) funding for technical assistance ceased towards the end of this period (I3; G2). From around 2005 onwards, many of the technical assistance efforts for EE, such as those provided by GIZ and Denmark’s development cooperation (DANIDA) (IC3; G1). This decrease in technical support, combined with the institutional shift from EGAT to the Ministry of Energy caused a lack of capacity.

¹³ It was restarted in April 2015.

¹⁴ Section 1.3 will provide a detailed analysis of this public EEF mechanism.

For example, it is believed to have affected the implementation and effective evaluation of the ENCON Fund (IC2; IC3). Further, up until the end of this research DEDE had not differentiated between EE and RE (G3).

4.2.3 Period 3: 2012–2014: Fragile private sector

In Period 3, direct support for EEF initiatives ceased and the private sector only had a couple of EEF initiatives still running. The start of this period was characterised by the temporary termination of the EERF, which marked a government shift away from public-private sector financing mechanisms towards support for direct incentives and ESCO market measures.

During this period the Thai public sector temporarily ceased to support financial institutions at the niche level. The government temporarily stopped the EERF in 2012 (A1).¹⁵ So the only support the Thai government provided to banks was via an ESCO-banking network, which was facilitated by the Federation of Thai Industries (FTI). But at the start of 2014 this was also stopped (F3; IC3; IC1). Interviewees from the banking sector clearly voiced the need for public sector de-risking mechanisms to support EE lending (B1:B2; B3). However, the public sector currently seems to be unable to provide such de-risking measures. Reasons given were procurement regulations, as well as the announcement in the beginning of 2014 of a limit to the creation of new funds (L1; IC7:G5).

One reason mentioned for stopping EEF support was the stronger focus of the Ministry of Energy on RE measures. One high government official stated: *'I understand that somehow the government at the moment seems to focus on renewable energy and not on energy efficiency [...] and even for the ENCON Fund you can see that there is more money spent on RE projects rather than EE projects'* (G9). It was pointed out that there now exist double subsidies for RE by the different programmes run under the ENCON Fund (G9; A5).

In the absence of Thai government support, development banks started to penetrate the market by offering soft loans to banks and ESCOs for EEF. It was reported that private sector branches of international development banks have started to show an interest (I3, G2). The ADB has provided funds for EE lending in the hotel chain sector; the International Finance Corporation (IFC) has funded a leasing programme with Mitsubishi, and the French Development Agency is working with a local bank to develop

¹⁵ It was restarted in July 2015 (The Nation 2015)

an EE portfolio in the building sector (F3; IO7; L2). Some interviewees mentioned problems with the disbursement of international soft loan funds due to unrealistic fee calculations and long administration processes (B3; L2). For example, AFD mentioned a negotiation period with a local bank of eight years (IO7). Transparency of data and buy-in from local bank's CEOs were mentioned as the main challenges (IO7).

Another source of support for EEF initiatives could come from climate finance. In 2014, Thailand's Nationally Appropriate Mitigation Action (NAMA) proposal for refrigeration and cooling was accepted (MitigationMomentum 2014). Further, The Ministry of Environment and Natural Resource presented a NAMA to further the ESCO market at the COP in Paris 2015.¹⁶ Thus, carbon finance might become another public EEF mechanism in the future.

The interviewees also noted that recent climate catastrophes, such as the extensive flooding of 2011, and international attention have changed the perception of climate change over the past ten years (ES1; IO6). *'Looking up into these drivers because the floods, the natural disasters, everything is coming from global warming. You need to take care of that'* (ES1). It was mentioned that the Green House Gas Organisation (TGO) has recently developed voluntary reduction schemes for Bangkok, and the Ministry of Energy and the Ministry of Environment and Natural Resources (MONRE) are starting to talk about possible projects (F4; IO1). However, the difficulty of EE certification, due to a complex monitoring system, was recognised from an academic who said it was *'quite difficult to obtain an EE certificate due to the difficulties of monitoring'* (A2).

4.2.4 Recent developments: The public sector steps in again

The current military government might provide a window of opportunity for EEF. The military organised a coup of the democratically elected government in May 2014 (BBC 2014). Technocrats replaced the ministers and a military government was put into place.

Interviewees mentioned that the military government might provide a window of opportunity for further EEF support involving financial institutions. A bank official noted that the military government seems to have tighter budgets and support cost-effective measures that leverage private sector investments (B1). Possible guarantee mechanisms might be possible as the Minister of Energy used to be at the Ministry of Finance (ES1). The overall ECON Fund programme was stopped and re-evaluated and

¹⁶ Bilateral discussion with Kuhn Amapawa, GIZ staff in Bangkok on 15.12.2015.

restarted in July 2015 (IC7).¹⁷ The two public sector EEF mechanisms were relaunched, namely the ESCO Fund and the Energy Efficiency Revolving Fund (EERF).

The ESCO Fund was relaunched in April 2015. The ENCON Fund provided THB200 million (US\$5.5 million) to the implementing agencies, namely to Energy for Environment Foundation and THB200 (US\$5.5 million) to the Energy Conservation Trust Fund. The lending conditions were THB50million as the maximum loan per project over a seven-year period.¹⁸

The ENCON Fund offered THB 1.5 billion (US\$42.5 million) capital for financial institutions that on-lend to manufacturers and service operators via the EERF programme.¹⁹ The specifics of the project didn't change. Eight banks participate and both RE and EE projects can apply. However, the terms specifically mention ESCOs as possible receivers of funds (TGP-EEDP 2016).

International organisations also promote EEF. In 2015, AFD signed a financial agreement with Kasikorn bank to launch the '*K-Green Building Program*'. The programme is to provide THB800 million (US\$23 million) with rates below the minimum lending rate and a repayment period of five years. The loan can be used for retrofits, lighting measures and more advanced technologies (Kasikorn Bank 2015b). Also, international organisations are facilitating discussions around energy efficiency resource standards (TGP-EEDP 2015b).

In summary, the overview on public sector EEF mechanisms in the Thailand case study over the last 20 years provided very useful insights concerning the dynamics of the development of the actors and institutions. In the gradual shift from government-focused initiatives to the private sector three interesting findings are noted: (1) no linear shift from public sector EEF mechanism to private sector EEF models occurred. (2) Public sector EEF mechanisms mainly focused on banks (3) The institutional shift, combined with limited technical assistance, caused a lack of capacity at the respective public sector institution.

¹⁷ The ENCON Fund announced THB4.93 billion for 14 renewable and EE projects. It includes relaunching the ESCO and the EERF (The Nation 2015):

¹⁸ Conversation with representative from the Energy Conservation centre for Thailand in August 2015.

¹⁹ Conversation with representative from the Energy Conservation centre for Thailand in August 2015.

The next section will provide a more detailed analysis of the two main financing mechanisms that claim to involve private sector financial institutions and de-risking measures, namely the EERF and the ESCO Fund.

4.3 In-depth analysis of the EERF and the ESCO Fund

This section goes into depth in analysing two public sector EEF mechanisms, namely the EERF and the ESCO Fund. These two mechanisms were chosen due to secondary literature being available and because they both claim to provide support to EEF. The programmes are assessed based on their objectives of incentivising financial institutions to provide EEF services. The SNM criteria, namely actors/networks, learning and visions/goals were used to structure the section and highlight current challenges.

4.3.1 Energy Efficiency Revolving Fund (EERF)

Thailand has received regional and international recognition for its long-term EERF programme (APEC 2005; Gruening et al. 2012; Venugopal 2012). Internationally, it is agreed that a revolving fund can be useful for incentivising banks to start EEF services (Kats et al. 2012; Selmet 2012). Therefore, the next section focuses on this mechanism implemented in Thailand.

4.3.1.1 General description

As indicated above, the interviewees mentioned that this programme was developed due to a combination of international support and efforts by Thai bankers. The German development cooperation had funded studies on EE barriers and access to finance was found to be one of the critical factors. One former IFCT banker initially introduced the idea of a low-interest loan fund to senior management at DEDE. Further, the World Bank provided technical advisers to design a revolving fund (G2; IO2).

The EERF was introduced in 2003 and ran continuously for almost ten years over seven phases. In its third phase, the EERF was opened to include not only EE but also RE projects. Also, the interest rate for banks was raised from 0% to 0.5% and remained there until the end of the programme (DEDE 2014).

A government official mentioned that initially, the EERF was only supposed to run for three years and educate the participating banks that would then take over by themselves. The first phase ran from 2003 to 2006, and three banks participated.

However, after the first phase other banks wanted to join the programme. So, the programme was extended (G1; F3).

The EERF has been praised as a success (Gruening et al. 2012; Venugopal 2012). By the end of the EERF in 2012, a total of US\$235 million in government funds had generated US\$264 million of co-investment by the private sector. All of the money was returned to the ENCON Fund and the average payback period was three years (IEA 2011). By the end of 2010, 335 EE projects and 112 RE projects had been implemented. As can be seen in Figure 18 the leverage ratio between government and private sector investment was estimated at 1:3 (Gruening et al. 2012).

In 2012, the programme was stopped. One interviewee pointed towards the participation of banks as one success factor: *'I think that we were successful for this program, because at this moment, I can say that all banks, they know, they understand about energy conservation projects'* (G2).

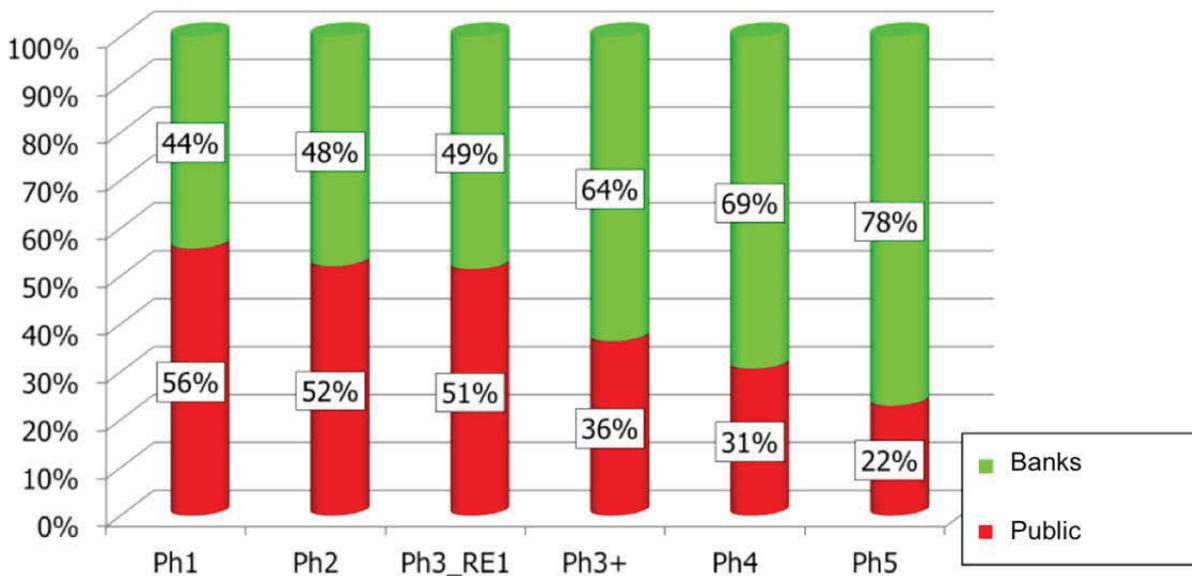


Figure 18: Investment from banks vs. public sector for the five phases of the EERF (DEDE, 2014)

However, the interviewees and some empirical data from DEDE demonstrate that from a sustainability point of view, the EERF has failed. The government temporarily stopped the EERF after its seventh implementation phase in 2012. An international consultant reported that by 2014, only two banks of the eleven original participants continued with EE lending (IC5). This was confirmed via a web page search across the Thai local banks (see Appendix IX). One of the banks that offered loans still had very strict underwriting criteria and could not provide finance to medium and large SMEs or ESCO companies (B3).

Also, if one only considers the EE projects and not the RE projects, the private investment leverage ratio is lower, at just 1:1.4 (DEDE 2014). Finally, the overall sum of the EERF of US\$453 million is inadequate, given the estimated costs to implement the Thai energy efficiency development plan were US\$2 billion (Sorrell, Mallett & Nye 2013).

Thus, the discussion below of the actors/networks, learning processes (knowledge) and shared vision (goals) will elaborate the challenges of the EERF.

4.3.1.2 Actors/networks: Large customers and disruptive international influence

Bank participation increased from three banks in the first phase to all 11 local Thai banks in the second to seventh phases (F3).

It was reported that the primary customers of the EERF were triple A rating, large companies, which might have been able to get similar or even better lending conditions with their own lending portfolios (IC2; ES1).

International agencies had an influence on the establishment of the programme. A consultant at that time reported that the initial design of this Fund was supported by a field trip to the US, technical assistance provided by DANIDA and also by the World Bank (IC3). However, after initial seed funding from the Global Environmental Facility (GEF), EPPO went ahead without additional GEF funding due to long administration processes (IC3).

DEDE was the implementing agency of the EERF but had to report to the ENCON Fund committee which was under the energy policy and planning office (EPPO). A slight rivalry between DEDE and EPPO was mentioned, which sometimes caused difficulties in communication (IC1; A1).

4.3.1.3 Learning: Limited capacity building of banks and too much praise

Banks were not incentivised by the EERF to develop own portfolios. It was mentioned that banks were merely used as extension officers and received free money. One bank representative reported that under the EERF banks merely acted as channelling mechanisms rather than project owners. DEDE was heavily involved in the project implementation of the EERF and thus banks, only facilitated access to the customers (B1). Banks forwarded all the proposals to DEDE, who made the assessments and gave their approval to the banks to provide the loans (B1). A government official stated that there was some general capacity building around the technicalities of projects, but not

specifically focusing on financing (G1; G3). International consultants remarked that the slight charge of 0.5% to the banks in the third phase of the EERF did not require the private sector to consider the real value of this niche financing market and optimise transaction costs (IC2; IC5). One international consultant pointed out that the EERF was an implementation project rather than a de-risking programme: *'The fund is not support much about the change of the risk perception of banks, it supports on how to boost up the activity'* (IC5).

Some of the reasons for this problem were the lack of involvement of an international partner as well as the slow evaluation process of the ENCON Fund. It was mentioned that the World Bank had provided a report which suggested increasing interest rates over the lifetime of the EERF. Interviewees suggested that after DEDE terminated the cooperation with the World Bank (GEF), the design of the EERF was in the hands of Thai government officials and lacked a business-orientated approach (IC3; F1). An academic and former member of the ECON Fund evaluation committee reported that the members of the committee were very conservative, and did not support new innovative approaches (G9; A5).

The decision to stop the EERF in 2012 seemed to be influenced by the positive evaluations of international organisations. Two government officials mentioned that they were often asked to present by international organisations. *'I don't remember how many foreign, how many places that I been to just to telling my experience in this revolving fund, this is another one could be on the record, very happy to do so'* (G1). *'Even World Bank they also consider, they also study on our financial scheme, even APEC they have they review'* (G2). All this attention was given as one of the reasons why the programme was stopped, as if it had been so successful surely it had achieved its goal of familiarising banks with EEF (G1; F3).

4.3.1.4 Shared vision/goals: Different lending portfolios and diversion of the programme to also cater to RE projects

An international consultant and a bank officer pointed out that most of the banks that participated in the EERF had usually different customers. Also, it was suggested that government support in general means immature markets. An international consultant explained that EEF mostly matched the characteristics of retail banks, which are used to small-scale lending (B1; IC7). However, only about five banks in the Thailand case study suited the EEF characteristics and could see EEF as a business opportunity. The bank officer also emphasised that as long as there is a lot of government support involved, banks still doubt the profit margins of this lending portfolio compared to other possible

offers: *'the financial support kind of spoils the market; it warns the market that the market has a characteristic of being immature'* (B3).

International consultants mentioned that opening of the EERF to RE projects decreased the number of EE projects, as RE projects are financially more attractive to financial institutions (IC2). Further, it was noted that the lobby groups of big RE companies raised the awareness of RE projects at the Thai government level (IC3).

Overall, the EERF can be considered a successful public sector programme as it led to real EE investments. However, efforts to establish EEF services in the banking sector have so far been unsuccessful. The main challenges identified were how to identify the banks that were active in certain market sectors and how to adjust the programme over time so it incentivised banks to create their own lending portfolios. It is also interesting to note that international organisations were again influential, sometimes in a disruptive way.

4.3.2 ESCO Fund

In response to criticism of the EERF, the Thai government started to develop the ESCO Fund, which aimed to reach SMEs and provide de-risking mechanisms for financial institutions (G2). This fund will be looked at in this section.

4.3.2.1 General description

In 2008, the ESCO Fund was established. Its primary objective was to serve small and medium enterprises. The ESCO Fund claimed to provide a diversity of financial products: (1) equity investments, (2) venture capital, (3) equipment leasing, (4) carbon market finance and (5) credit guarantee facilities. All financial offers applied to RE and EE projects. DEDE was the implementer and commissioned two implementing agencies, namely the Energy for Environment Foundation (EforE) and the Energy Conservation Foundation of Thailand (ECFT) to administer the funds (Center for Clean Air Policy 2013).

Interviewees explained that partly because of the criticism of the EERF that it only catered for large companies, and partly because of lobbying from international organisations, the government established the ESCO Fund in 2008 (F1; IC3).

As can be seen in Figure 19, the ESCO Fund ran over three phases from 2008 to 2014 with a public sector investment of THB895 million (US\$27.4 million). Overall project investment from the private sector was THB4939 million (US\$151.35 million). Thus it

had a leverage ratio of 1:5. However, the results of more detailed data analysis focusing on its actors and investment amounts for the first two phases suggest that the ESCO Fund did not achieve all its objectives (Energy Conservation Foundation of Thailand 2014; Sirikoon 2012).

It was found that the EE projects only used the leasing mechanisms (Energy Conservation Foundation of Thailand 2014). It was revealed that the ESCO Fund only applied a financial leasing model for the EE projects (F2; G6). The leasing terms under the ESCO Fund have a payback period of five years, with a maximum interest rate of 4% and a maximum investment amount of THB10 million (Institute for Industrial Productivity 2015).

Interviewees also noted that the guarantee mechanism was never implemented. Fund managers mentioned that the Thai Credit Corporation, which is part of the Ministry of Finance, would have to step in to provide such guarantees.

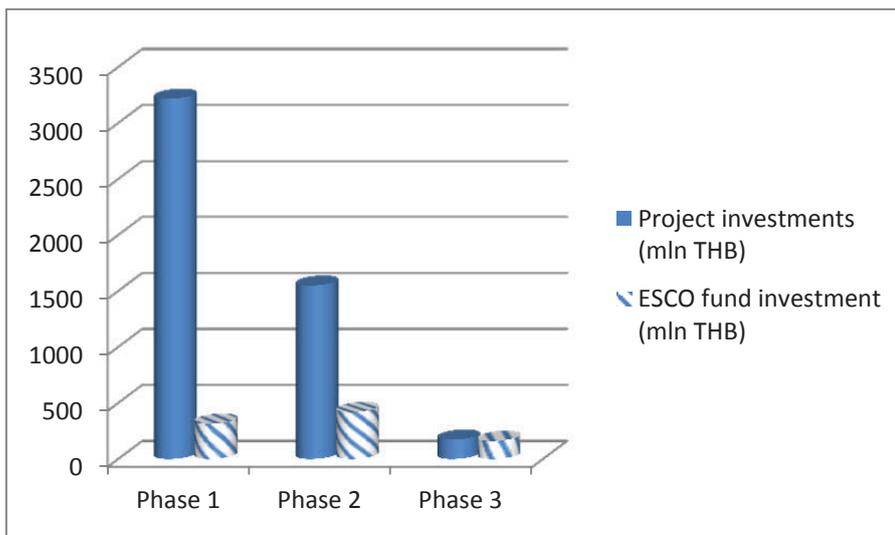


Figure 19: Project (THB million) vs. ESCO Fund investment (THB million) (DEDE 2014)

4.3.2.2 Actors/networks: Public sector is not engaging with more innovative energy efficiency finance initiatives

The ESCO Fund succeeded in providing finance to SMEs. However, as can be seen in Figure 20, in Phase 2 the number of large customers increased. For Phase 3 DEDE mandated that the focus should again be on SMEs (F2). About 30% of the ESCO Fund customers are in the building sector and around 70% are from industry (F2). Only a very limited proportion of direct customers were ESCO companies (Sirikoon 2012).

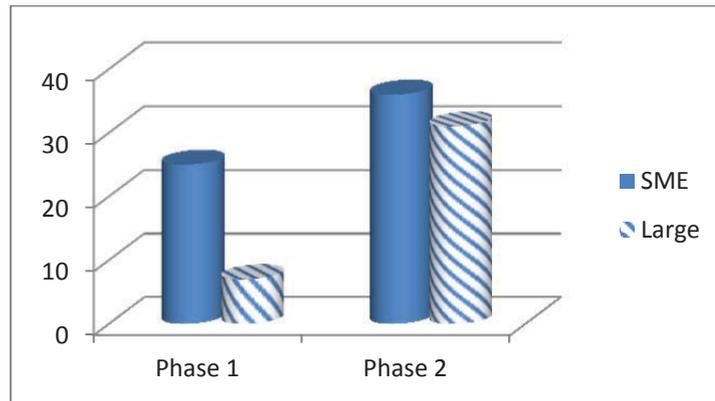


Figure 20: ESCO Fund SME and large customers for Phases I and II (Energy Conservation Foundation of Thailand 2014; Sirikoon 2012)

Several interviewees agreed that ECFT and EforE had different customer strategies. ECFT was reported to provide a variety of services to project facilitators, from leasing to advice. It was noted that EforE also implemented RE projects whereas ECFT focused on EE projects (A1). A facilitator mentioned that ECFT not only provided finance but also acted as a security or trusted facilitator to the customer (F2).

Some interviewees from banks mentioned that ESCOs play an essential part in the ESCO Fund. Some challenges were noted when collaborating with them due to the quality of current ESCOs. One facilitator mentioned that ESCOs were understood to be an essential part of an ESCO Fund because they provided energy audits or EPC contracts to the projects (F1). The fund managers would provide a recommendation to customers about how to engage with ESCOs, but did not directly cooperate with ESCOs themselves. To become an acknowledged ESCO company they had to implement an EPC contract and register with either FTI or the ESCO Association (F1). However, it was mentioned by another facilitator that divergent definitions of ESCOs in the FTI and the ESCO Association caused confusion and that unjust behaviours of ESCOs have been reported (F2). For example, it was reported that ESCOs guaranteed higher amounts than they had collateral for, or acted as technology providers rather than ESCO companies (F2). This lack of quality created mistrust of ESCOs on the part of the customers (F2). One of the reasons mentioned was the lack of capacity building under the ESCO Fund scheme. The next section will look into the learning processes that took place in this programme.

4.3.2.3 Learning: Limited financial mechanisms and RE implementation constrained the learning process

Leasing contracts provided suitable conditions to attract SME investment. However, due to tight financial management from fund managers and a lack of marketing, the participation of SMEs was still limited. As can be seen in Figure 20 SMEs were reached with the ESCO Fund. However, large companies still take up a large proportion of the overall ESCO Fund. Interviewees mentioned that the demand for the ESCO fund service was low, due to the lengthy application process and lack of awareness (ES3; IC4). Further, it was noted that information about finance programmes is limited to Bangkok or is only provided to selected customers by DEDE (World Café II; C3). Further, a leasing company mentioned that fund managers were afraid of non-performing loans and thus applied very strict financing criteria (L1).

Some data suggests that most of the investment went to RE projects, which also limits the learning on EE projects. In the first two phases of the ESCO Fund, according to EforE data 12 projects were RE projects and 40 were EE projects, but the value of the RE projects was THB 331 million compared to THB125 million (or 37% of overall investment) (Energy for Environment Foundation 2012). The ECFT data provided similar results: for Phase 1 and Phase 2, even though only 9 RE projects were implemented compared to 29 EE projects they took the bulk of the funding (US\$15 million compared to US\$8 million for EE projects) (Energy Conservation Foundation of Thailand 2014). This diluted the focus on EE implementation at the SME level. Some interviewees suggest that the leverage ratio for EE projects is much smaller than it is for RE projects. If the RE projects are ignored the leverage ratio for EE projects is small and thus does not encourage the private sector to invest (IC2; IC5).

4.3.2.4 Shared vision/goals: Confusion by pleasing international organisations

In English, the term “ESCO Fund” implies that the fund provided finance directly to ESCOs but this was misleading. During first World Café, local Thai participants noted that the literal translation of the Thai title of the ESCO Fund was a “fund to promote EE and RE projects” (Exit Workshop I). Therefore it was argued, it is not surprising that out of 53 EE projects administered by Energy for Environment Foundation only six were provided to ESCO companies (Energy for Environment Foundation 2012). Thus, the international consultants and participants noted that ESCO companies still lack a mechanism to support their lending ability (IC5; IC7).

Further, participants in the first World Café I mentioned that the Energy for Environment foundation and the Energy Conservation Foundation of Thailand are public sector organisations which focus more on small-scale customers who need development, rather than on viable economic projects. Interviewees reported that the fund managers at times focused more on development projects, rather than the development of more innovative financing mechanisms. For example, the Energy for Environment Foundation implemented small-scale RE projects in rural areas (ES1; L1; B1). Thus, the finance did not necessarily reach the medium to larger SMEs or ESCOs who are most in need for external EEF.

In summary, the evaluation of the ESCO Fund provided interesting insights. The programme successfully adopted leasing as its central finance mechanism to cater for EE investments. ESCOs did not receive finance via the programme. The ESCO Fund, at times, acted as a third party to enable them to receive funding.

Finally, overall learning experiences regarding more innovative EE financing mechanisms such as guarantees and ESCO- arranged funding was limited. The combination of RE and EE projects, and the lack of coordination with the Thai Credit Guarantee Corporation (TCG) and Ministry of Finance via the ESCO Fund, limited the learning experiences. In the next section, the main findings will be discussed.

4.4 Discussion

This section will synthesise the results of the above analysis. In particular, the lessons learned from the experiences of two public sector EEF mechanisms are elaborated. In addition, this section examines whether the international organisations were correct in their belief that using public sector funds to maximise private sector investments worked and whether placing EEF in the hands of the financial institutions was a successful strategy.

4.4.1 Findings from the I analysis of EEF mechanisms overtime

4.4.1.1 *Non-linear shift from the public to the private sector*

A non-linear process of moving from a grant-focused approach to more private sector participation in public sector EEF mechanisms can be observed in the Thailand case study. As can be noted from Figure 21 the general move from public to private sector funding occurred. However, it was not a linear process and was dependent on external and international input.

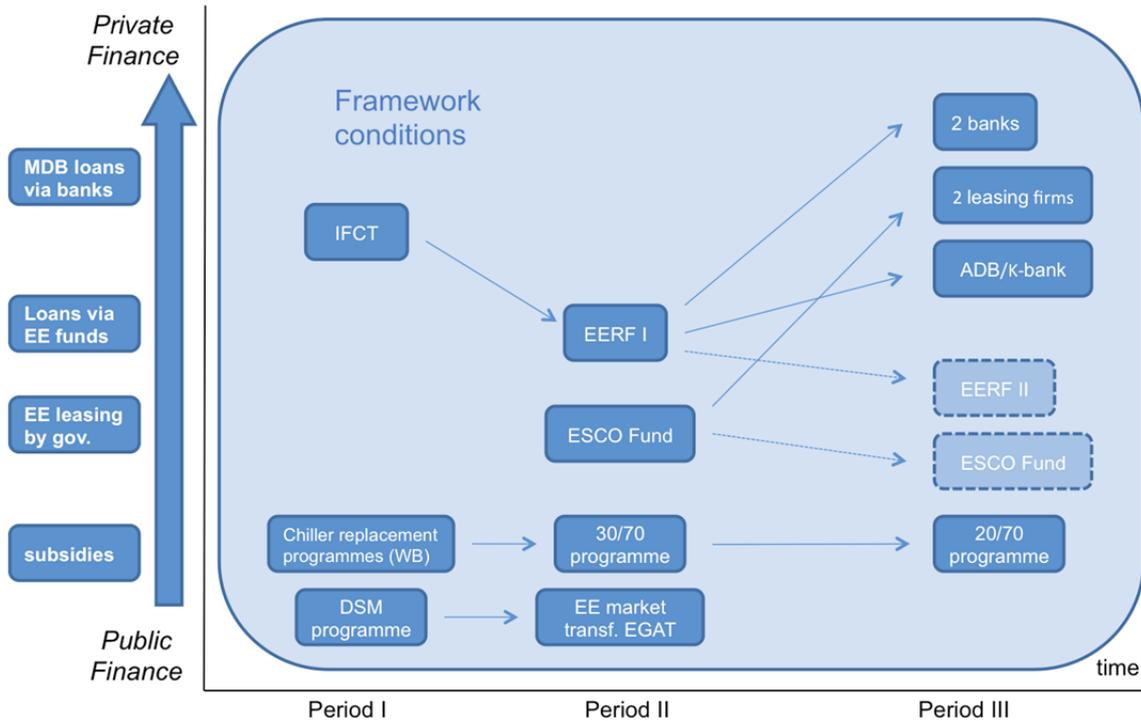


Figure 21: Public sector EEF mechanisms according to the stage of market development (adapted from Selmet, 2012)

The first period of the shift saw a proliferation of grant programmes, which were in one way or another supported by international organisations. For example, the chiller replacement programme was financed by the World Bank.

The early engagement of the IFCT seemed remarkable. From very early on, capacity building and experiments with de-risking guarantee mechanisms for EE took place. However, that the IFCT initiatives ceased to exist after the Asian financial crisis of 1997, confirms the non-linear characteristics of the process.

The second period of public sector support for EEF from 1997 to 2012 saw the greatest number of public-private sector EEF mechanisms that encouraged private sector engagement in EEF. They included the EERF, which promoted bank/government cooperation and which was claimed to be very successful. Private sector participation increased from three banks in 2003 to 11 banks in 2006. In addition, the ESCO Fund provided funds to smaller customers.

In the third phase, privatisation and market-opening policies led to a tightening of subsidies and the end of direct Thai government support for financial institutions. The 30/70 subsidy programme was tightened to 20/80, thus increasing the portion of investment made by the industry or building owner. When the EERF stopped temporarily in 2012, the Thai government ceased direct collaboration with financial institutions.

However, international development banks such as ADB and IFC provided support to financial institutions. With only two banks still active in EE lending, there is no evidence of a successful shift from the public sector to the private sector financial institutions.

Most recent developments indicate a shift back to publicly supported programmes. The ESCO Fund was re-established in April 2015 and the EERF was re-started when the ENCON Fund was relaunched in September 2015 (The Nation 2015).²⁰ The criteria for receiving EERF funding did not change (TGP-EEDP 2016). Thus, the pressure on the banks to establish EE portfolios was removed, and instead they are again encouraged to act as financial vehicles to administer the EERF funded projects. Further, the Thailand case study indicates that the evolution of EEF was not linear. The transition studies literature confirms the possibility of non-linearity in niche development by describing it as a non-linear process of developing, trialling, learning and developing (Geels & Raven 2006).

4.4.1.2 Importance of the shift of niche governance

The responsibility for implementing EE projects moved from EGAT to the Ministry of Energy due to the reduction in the financial tariff that EGAT received. The shift resulted in a decrease of EGAT's activities around DSM measures. This was named as one of the reasons why a proliferation of measures that were targeted at the financial institutions occurred (G4).

4.4.1.3 International influence

International cooperation and involvement in public sector EEF mechanisms was influential and also moved from technically focused grant support to concessional/private financing. The technical support that was provided by the World Bank to establish the EERF led to the decision that the EERF would be implemented solely by the Thai government (IC3). The idea for the ESCO Fund was sparked in an international conference that was attended by important energy officials (IC3). However, the influence of international organisations must not always be positive. As discussed above, the international attention that the EERF received was one of the reasons given by interviewees for why the EERF was temporarily stopped in 2012 (G2; IC3).

²⁰ Conversation with representative from the Energy Conservation centre for Thailand in August 2015.

4.4.1.4 Importance of unstable framework conditions

The findings of the analysis also indicate that the disruption of public sector programmes creates an uncertain environment for financial institutions to develop niche markets. During the interviews and exit workshops, banks complained about the long-term and inflexible EERF support that can also jeopardise private sector efforts.

4.4.2 Lessons learned from the evaluation of the EERF and the ESCO Fund

4.4.2.1 Dynamic support to move from grants to de-risking mechanisms

A closer look at the public sector EEF mechanisms indicates that the mechanisms need to be able to change overtime to increase private sector learning. Also, RE projects are financially more attractive to banks. Finally, current public sector EEF mechanisms are failing to provide finance to medium to large SMEs and ESCO companies.

Reflecting on the EERF it was found that de-risking mechanisms are still missing in the public sector EEF mechanism. Over half of the interviewees saw the need for public sector guarantee mechanisms as the next step to supporting EEF. Some interviewees stated that this problem is not only limited to the Thailand case study but that many governments in the region are reluctant to take any responsibility for risks, due to budgetary constraints on public sector spending (IC1; B1; IC5; IO7). Even, though the ESCO Fund promised to provide guarantee mechanisms, so far it has failed to do so. It was mentioned that the Ministry of Energy did not understand how to deal with unpredictability of spending within a guarantee fund. Also, necessary cross-coordination with the Ministry of Finance and the Thai Credit Guarantee Corporation were named as some of the reasons for this failure (F2; G6). Attempts by the Ministry of Energy to include guarantees for EE technologies by the Ministry of Finance for SMEs were unsuccessful (G6). Also, interviewees mentioned that the very slow increase of the interest rate of the EERF spoiled the private sector market and did not provide enough incentive for private sector banks to think about more innovative finance approaches (B1). The barriers to moving from grants to de-risking mechanisms have also been recognised in the global literature. To accelerate that shift the EU has implemented EU structural and investment funds that amount to €38 billion (IPEEC 2015).

4.4.2.2 Renewable energy is more attractive to financial institutions than energy efficiency

Public sector EEF mechanisms that combine RE and EE projects in one public sector EEF mechanism jeopardise the objective for banks to recognise EE as a market niche. RE projects will always be financially more attractive to financial institutions, due to their larger investment volumes and because they involve fewer technological challenges.

The evaluation of both public sector EEF mechanisms above found that the majority of government funds were spent on RE projects (Energy for Environment Foundation 2012). For example, in the ESCO Fund the public to private sector leverage ratio for EE projects implemented in the first phase by EFCT drops from 1:5 to 1:1.7 if the renewable energy (RE) projects are excluded.²¹ Also, after the EERF was temporarily stopped, more banks offered RE than EE lending portfolios (see Appendix IX). Of course, the general push for RE and feed-in-tariffs by the Thai government and industry lobby groups around the end of 2010 contributed to the preference of banks for RE investment projects (F1; G9). *'You will find out that that's only a part of the money spending, only on conservation. The bigger part [was] on renewable energy' (IC5)*. Thus, the lesson learned is that EE portfolios cannot compete with RE portfolios. Investments in EE are small, the benefits are less visible, and even though RE also has significant technological risks, the technologies in EE projects are more diverse. Therefore, public sector support for EEF and RE finance should be separated, or quotas should be included in the schemes to ensure that EE projects are implemented. Conservative behaviour from the public sector in the allocation of funds is another reason why the government has not yet reached medium to large SMEs such as ESCOs.

4.4.2.3 Current mechanisms do not reach SMEs and ESCOs

The Thailand case study revealed that public sector EEF mechanisms have mainly reached large industrial enterprises and the building sector. As demonstrated above, only the ESCO Fund has provided some finance directly to ESCOs and SMEs. However, most funds still went to large industrial companies and the building sector. Some of the reasons named for this were the conservative, risk-averse behaviour of government officials who did not want to have non-performing loans (L1). Another reason mentioned was that demand for the funds was low (IC7; A5). Therefore, RE projects or larger customers were the preferred options.

4.5 Conclusion

In summary, the analysis of public EEF mechanisms over time provided very useful insights concerning the dynamics of the development of the actors and institutions. Four significant findings are noted: (1) public sector EEF mechanisms focused mainly on banks (2) international organisations influenced the measures and processes (3)

²¹ ECFT data for the first two faces was provided by one of the interviewees.

institutional shifts, combined with limited technical assistance caused a lack of capacity at the public sector level and (4) there was no evidence of a significant shift from public sector EEF mechanism to private sector EEF models.

Overall, the detailed analysis of two public sector EEF mechanisms revealed that both mechanisms have been very successful in implementing EE projects over time: by 2010 about 334 EE projects had been established under the EERF and 125 projects had been established under the ESCO fund. However, they had limited success in transferring to financial institutions and service providers the knowledge needed for them to provide their own financing portfolios.

Concerning actors/networks, it was noted that international organisations played a significant role. Also, cross-ministerial coordination with the Ministry of Finance was missing. The establishment of both the EERF and the ESCO Fund were supported by international organisations, via reports and field trips. Further, the ESCO Fund could not implement guarantee mechanisms, as no cooperation between the Ministry of Energy and the Thai Credit Guarantee Corporation under the Ministry of Finance existed.

Interesting findings emerged regarding learning experiences, such as that monitoring and adjustments over time are key. In addition, RE might hinder EE implementation when finance for RE and EE are offered under the same mechanism. The analysis of the EERF found that measures need to be adapted over time to allow for learning processes within the financial institutions. Therefore, the ENCON Fund, having been praised for provide finance, is also limiting the monitoring, evaluation and adjustments of financial mechanisms. Further, the ESCO fund revealed that more investment went into RE projects, due to their larger investment volumes. This limits the lessons that can be learned for implementing EE projects.

It was found that as EEF is a transdisciplinary topic, there are several challenges when it comes to the question of creating shared visions. For example, the Ministry of Energy might not understand the banking sector and this may be why it offered the EERF to all eleven banks who volunteered for the role. The Ministry did not assess whether this type of business was compatible with each bank's current lending practices. Also, the two implementing organisations of the ESCO fund are focused on projects that benefit the underprivileged, rather than on best practice examples for the industrial and building sectors.

In both mechanisms evaluated in this thesis, international organisations caused conflict or confusion. For example, the long administrative processes required obtaining GEF

funding lead to the discontinuity of cooperation with the World Bank. This consequently caused the lack of the needed financial expertise for the implementation of the EERF. Due to the confusing translation into English of the title of the 'ESCO' fund, international organisations believed it was targeted towards ESCOs. The Thai government should not need to feel that they must disguise their current efforts. Rather, they should feel able to state publicly that their fund focuses on EE leasing for SME projects rather than ESCOs.

Also, overall international organisations had a powerful influence in shaping the measures and processes. Most of the public sector EEF mechanisms were somehow supported or pushed for by international organisations. So, in the context of an emerging economy, international organisations become important actors with particular interests and agendas. The institutional shift from EGAT to the Ministry of Energy, in parallel with Thailand moving from a developing to an emerging economy, caused lack of capacity to monitor and programme facilitation skills. It further encouraged a move towards private sector involvement.

The results showed that framework conditions are crucial for the success of EEF mechanisms. For example, the EERF was started due to the Asian financial crisis of 1997, as it opened up the opportunity for the public sector to cooperate with financial institutions such as banks. Further, due to political turmoil government programmes stopped and were restarted again, which means that an examination of these initiatives does not provide a long-term investment perspective for financial institutions.

Finally, the findings in the Thailand case study call into question the notion of public to private sector finance. Despite 12 years of public sector support for the EE lending sector, the public sector efforts have failed to sustainably shift finance for EE projects towards the private banking sector. The findings suggest a more complex relationship between long-term public and private sector support which is influenced by national framework conditions. Also, the shifts in EEF are non-linear and should be seen as part of an ongoing recursive process (Anadón 2012).

The next chapter will explore the impacts of the Thai public sector efforts on the private sector by providing a detailed niche analysis of the private EEF models.

5.1 Introduction

Having analysed how the Thai public sector has supported energy efficiency finance (EEF), it is now necessary to investigate the impact those actions had on the EEF activities of the Thai private financial sector.

Chapter IV demonstrated that to promote the implementation of energy efficiency (EE) projects the Thai government has mainly focused its support on the banking customers themselves. The Energy Efficiency Revolving Fund (EERF) was successful in leveraging THB9 billion (U\$257 million) in overall investments. However, it failed to transfer EEF to small and medium enterprise (SME) customers and ESCOs. The ESCO Fund, initiated to target SMEs by providing an array of financial support instruments, was a success in leveraging private sector funding. However, the programme only facilitated EE leasing between the implementing agencies and the customers. Also, both programmes invested more funds in renewable energy (RE) than in EE projects. Another interesting finding was that international organisations played a crucial role in the setting up of these public sector EEF mechanisms.

The analysis in Chapter IV also suggested that so far, the private sector has provided only limited financial services for EE initiatives. From the interviews and Exit Workshop I of Field Trip I, it became clear that banks are still reluctant to enter the niche market of EEF services. Some interviewees hinted that this reluctance could be caused by broader framework conditions, such as erratic government support. Other reasons mentioned were: (1) small investment amounts of EE projects, the need for collateral, and the quality of service providers and a lack of a market for EE.

Therefore, this chapter focuses on the niche of the private sector EEF models and explores the sub-research question:

'What private sector EEF models exist in the private market and how do they relate to public sector support in the Thailand case study?'

Literature that investigates the breadth of private sector EEF models, especially within the developing and emerging country context, is still limited. International organisations' evaluations of private sector EEF models are constrained to China, Brazil and India (Taylor et al. 2008). In Chapter II, a broader literature review of developed countries and case studies found a rich diversity of possible private sector EEF models, which are listed in Appendix II. Each one has a unique risk profile distribution that could be

amended by public sector support. This broad overview also indicated the importance of public sector programmes that create markets for EEF initiatives.

During the entry workshop of Field Trip II, where seven private sector EEF models were presented, three were found to occur in the Thailand case study: (1) EE-lending; (2) EE leasing and (3) ESCO-arranged finance. Guided by Strategic Niche Management framework for niche analysis, each of the models will be explored according to its actors and networks, learning processes, and whether the different stakeholders have a common vision and shared goals (Smith 2007). Even though the focus here is on the niche analysis, regime shifts or landscape events are mentioned if they had a direct impact on the offer of public EEF mechanisms. A more detailed regime and landscape analysis will be provided in Chapter VI. After the overview over time,

The results indicate that the Thai private sector EEF models are still fragile and not diverse. Despite over 10 years of public sector support to the private financial sector, private sector EEF models are limited to banks and to a very fragile group of ESCOs and leasing companies. SMEs and ESCOs are rarely reached by the EEF services. The main obstacles for banks are the fear of default payment, and the restrictive lending policies of banks.

These findings highlight the importance of the broader framework conditions, including the tight financial regulations and the lack of implementation of EE regulations to create sufficient demand for private sector EEF services.

5.2 The development of private sector EEF models over time

The development of the private EEF models has only started recently. For example, the EERF collaborated with banks, so they started their EEF lending through its support. Further, when it stopped in 2012 two banks started to provide their own EEF lending. The two Japanese companies that provide EE leasing services only started in 2014. Finally, ESCO-finance evolved entirely without public sector support and started around the end of 2010. Due to the short time frame of the private EEF models in Thailand, it was not possible to provide a detailed overview over time, as has been done for the public EEF mechanisms.

Thus, the next section will directly focus on the in-depth analysis of the identified private sector EEF models in Thailand.

5.3 In-depth analysis of existing private sector EEF models

From the overall list of different private sector EEF models, three were found to occur in the Thailand case study: (1) EE-lending (2) EE leasing and (3) ESCO-arranged finance. These will be analysed in detail below. First, an analysis of the international literature will highlight characteristics of each private sector EEF model. The analysis will then focus on the interviewees' responses and secondary data. The case study analysis focuses on the SNM criteria actors/networks, learning experiences and the shared visions among important stakeholders. The primary interview data can be recognised by the codes which indicate the sector in which each interviewee works. This was further elaborated in Table 4 and Table 5 of Chapter III: Research design.

5.3.1 Direct EE bank loans

Direct EE bank loans are the most prominent private sector EEF model discussed in the EEF literature. They are also the most prominent form of private sector EEF financing operational in the Thailand case study. Due to the long-term implementation of the EERF, EE lending should be well advanced within the banking sector in Thailand.

5.3.1.1 Overall literature review: Direct EE bank loan

EE loans are the most widely discussed EEF model (DeT'serclaes 2010; Kats et al. 2011; MacLean & Purcell 2014; Würtenberger 2012). In this model, financial institutions – usually banks – issue loans to consumers for EE projects. The loan size, interest rates and length of repayment depends on the assessment of the creditor and the risks in lending to them (Hainz & Kleimeier 2012). The customer receiving the loan owns the EE technology (Würtenberger 2012). Direct bank loans are usually easier to access and faster to transact than soft government loans or revolving funds (Würtenberger 2012). For the borrower, disadvantages include the fact that the bank will only lend to their existing customers and they have very strict lending criteria (Würtenberger 2012). Customers can have a 'debt-overhang problem', meaning that they have already utilised their core business lending to its capacity (Hainz & Kleimeier 2012, p. 293).

A number of strategies have proven to be useful: Project finance as a tool to minimise transaction costs for the financial institution, aggregating and streamlining projects with similar technologies and customers and opening up to new customers (Würtenberger 2012). Project finance has been applied to large-scale industrial and infrastructure projects in transport, energy and telecommunications, and is characterised by the repayment occurring through the projected cash flows of the project rather than the on-balance finance of the customers (Bouzguenda 2014; DeT'serclaes 2010). Normally, a

special entity is formed that could contain equity investors – ‘sponsors’ and lenders – a ‘syndicate’ of banks. However, due to the high transaction costs levied to ensure trustworthiness of all the parties and contracts, it has been reported that the minimum project size need is USD20 million which is much larger than most individual EE projects. It was found that adopting an integrated approach to RE and EE technologies within one loan package was useful to increase the project investment size (Würtenberger 2012).

The public sector can leverage public sector capital via risk mitigation tools. Examples of de-risking measures through regulation are: loan loss reserves and debt co-financing (Hainz & Kleimeier 2012; MacLean & Purcell 2014). A public sector funded loan loss reserve or guarantee provides the bank with loss protection in case a loan is not repaid. Further public sector debt co-financing can reduce the interest rates that the banks offer in emerging economies. Various models exist, ranging from senior to subordinated debt co-financing (MacLean & Purcell 2014). These measures are often implemented with the collaboration of development banks (Taylor et al. 2008). The government can also help reduce the vulnerability of a financial institution by providing benchmarking of EE across buildings and industries (MacLean & Purcell 2014). Another possibility to assist in EE lending is to assist as a neutral facilitator in the aggregation of EE projects to an investable loan size (MacLean & Purcell 2014).

Innovative Variation I: EE add-on loan

EE finance can be attached to normal corporate lending or residential home improvement loans, which makes it easier for lending customers (MacLean & Purcell 2014). The big advantage of this option is that EE finance is offered at the point of sale which can reduce transaction costs. However, it is often limited to certain technologies and existing customers of the financial institution that offers the loan (MacLean & Purcell 2014).

Innovative Variation II: Loan plus expert guarantee

Banks can collaborate with technology experts such as ESCOs or technology providers to cover the technical risks of a project (See Figure 22). A technology provider normally would provide a guarantee of its technology and an ESCO would provide a guarantee via guaranteed savings – energy performance contracts (GS - EPCs) (Hainz & Kleimeier 2012; MacLean 2012). In an GS – EPC the ESCO guarantees to the customer a certain amount of energy savings; any revenues that are generated beyond those energy savings are kept by the ESCO (Crossley & Wang 2013). The numbers of guarantees an ESCO or technology provider can provide depends on the collateral of the ESCO

company or technology provider. This can limit the number of projects a technology provider or an ESCO can undertake (Würtenberger 2012).

5.3.1.2 Overview of direct EE bank loans

Below, the experiences of EE lending in the Thailand case study are discussed with a focus on sustainable institutionalisation within the banking sector.

Actors/networks: Limited number of active banks and main customers not SMEs

Despite some marketing announcements, actual EE lending implementation during the research phase seemed limited to three banks: Kasikorn Bank, CIMB Thai and SME Bank.²² In January 2015, a web-based study found that out of the eleven participating banks of the EERF, five still advertised EE programmes via their websites (see Appendix IX). However, the interviews verified that only two of the five actually implemented EE lending projects: the Kasikorn Bank and CIMB Thai (IC5; IC2; ES1; IO4; IO6).

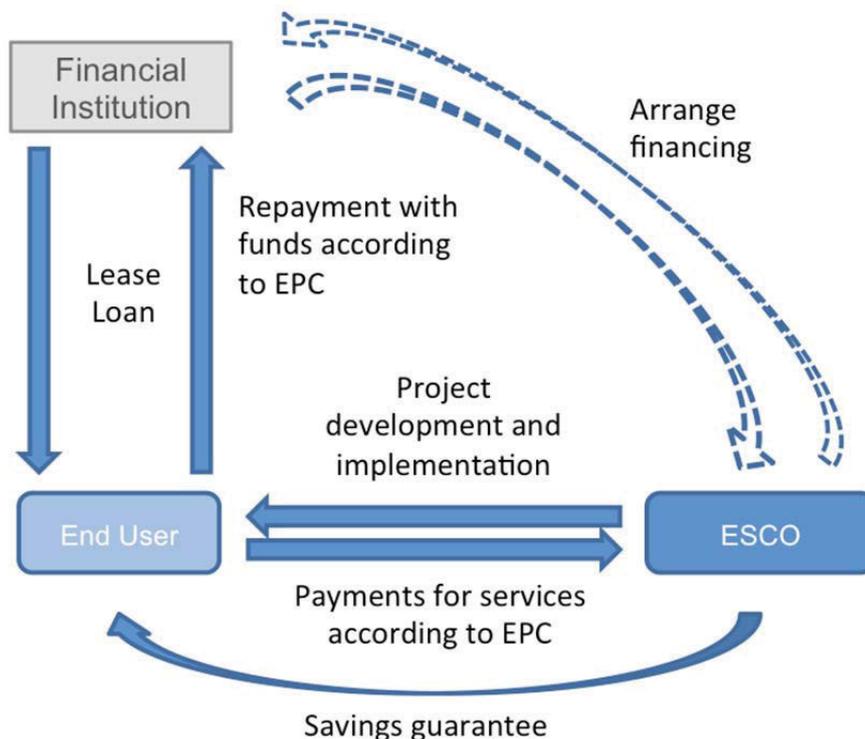


Figure 22: Guaranteed Savings Energy Performance Contract Model (adapted from Crossley & Wang (2013))

²² The end of the research period was 31 January 2015. The EERF fund restarted in 2016 with eight banks participating (TGP-EEDP 2016)

SME Bank also mentioned that during 2015 EE was an option for loans under an SME promotion loan scheme (B4). Table 8 provides a summary of the EE lending activities. Kasikorn Bank is the ‘champion’ of the Thai banks as it offers three different EE lending services. Since 2010, Kasikorn Bank has been involved with EE lending and participated in the EERF. Until the beginning of 2015, it offered the ‘K-Energy Saving Guarantee Program’, a loan that accepts an EPC contract as part of the collateral, if a trusted ESCO is supporting the loan application. The lending period is up to five years, with a 20% rate of return on the investment (Kasikorn Bank 2015a). In June 2015, Kasikorn Bank signed an agreement with AFD, who provided THB3 billion (US\$85million) in co-finance to the ‘Green Credit for Green Building Programme’ which runs over three years (Kasikorn Bank 2015b).

The interviewees mentioned additional EE measures implemented by Kasikorn bank and highlighted the importance of having one person as the driver for all the bank’s efforts. During the interviews, it was mentioned that Kasikorn Bank offers a top-up loan for schemes to increase the efficiency of lighting systems with a lending period of three years, as well as equipment leasing for proven technologies (B1; B3).

Table 8: In 2014 running private sector EEF model in the banking sector

Name	Type	Target group	Interviewee
Kasikorn Bank	Loan for EE and RE (4% interest rate)	Amount not exceed THB 50 million	B1; B3
	Commercial loan and commercial leasing combined with performance guarantee by ESCO	100% of project investment Backed up by AFD	B3
	Add-on (lightning)	Existing customer to top up on their credit line a loan for EE lighting	B1; B3
SME Bank	Productivity improvement Loan (possible guarantee)	SMEs	B4
CIMB-Thai	Loan for EE and RE (4% interest rate)	Amounts not exceed THB 50 million	B2

Also, international organisations and consultants agreed that one of the reasons Kasikorn Bank is so active is the work of one financial officer who drives the clean energy finance agenda (IO4; IC7; IO6). ‘*This person is why Kasikorn Bank is so active*’ (IC6).

CIMB Thai Bank offers a loan for EE projects, but its continuity is not guaranteed. According to a bank representative, by 2013 CIMB Thai had implemented about 50 projects in RE and EE (B2). After the EERF stopped in 2012, the CIMB Thai energy loan was created with a minimum lending rate of around 7.6% and a maximum investment of THB50 million per project. The payback period can be up to seven years (B2). Up until 2013 only eight customers had used the loan and the administering department only consisted of one bank officer (B2). Thus, without any further public sector assistance, at the end of the research period it looked unlikely that CIMB Thai would continue its EE lending service.

The SME Bank integrated EE features into its 'SME Productivity Improvement Loan'. A bank representative explained that this lending scheme started around 2012 and supported SMEs to finance necessary equipment upgrades to promote their economic output. Partially subsidised by the Ministry of Interior, the first phase provided a minimum lending rate of 3%. The loan accepted EE upgrades as one type of initiative it could be used for. Around 20% of the THB20 billion (103 million Euro) in the initial loan fund was allocated to energy conservation projects. To receive a loan, SMEs need to apply to the Ministry of Industry, receive a letter of support (for the technical aspects of their project) and apply with that letter to the SME Bank (B4). It was also mentioned that for this loan a guarantee could be provided by the Thai Credit Guarantee Corporation. If it has such a guarantee, collateral from the customer is not required (B4). In January 2015, the second phase was running with a total budget line of THB3 billion on the minimum retail rate. However, the bank officer interviewed for this study voiced reservations about whether further loans would be administered to EE projects, due to a recent push from the Ministry of Finance for loans to be made to small SMEs (B4).

One reason given for the limited number of private sector EE lending offers was the different customer focuses of the banks. Three interviewees commented on the different target groups of bank portfolios as an indicator of their level of interest in EE lending (B3; IO6; IO7). *'Some bank focus on the retail market, some banks focus on the big corporate, so it depends on the character of the bank if they are interested in energy efficiency lending'* (B3). Further, it was noted that state-owned banks such as the SME Bank are slower in their administration but also in their decision-making about whether to provide new credit lines: *'They are low if you compare the resource person, vision, many things. They cannot, really not compete. At 4 o'clock everybody shut down the computer and goes back home'* (IO6). Further, they seem to undergo staff rotations

much more frequently than commercial banks which make it difficult for them to build capacity for EE lending (IO4; IO5).

Another explanation given for the limited activity within the banking sector was the current lack of demand for external EEF: *'There are not enough EE projects'* (B2).

Medium to larger SMEs were identified as the target group for EE lending, but they were not targeted. Medium to large SMEs lack budgets for in-house investments (B3; B2). *'SME is very suitable for energy efficiency market for their lack of in house capital'* (B3). However, interviewees agreed that large building and industry enterprises such as the participants of the Designated Facilities Programme would not need special bank loans to initiate EE projects, as they already have access to credit under much better conditions (ESP1; B4; B2; B1). *'Big corporates do not need small money'* (B2). Medium to large SMEs seem to be uninterested and unaware of EE lending offers. International experts mentioned that currently, Thai SMES put a low priority on EE measures and thus are not willing to invest in them (IO6; IO4; B3): *'Thai SMEs, they are not ready to pay yet'* (IO4). The aim of achieving savings rather than investment and growth is difficult for them to comprehend: *'Customers need to start to understand the cash flow from energy savings rather than focus on the interest rates'* (B1). Further, an ESCO mentioned that SMEs have high return on investment requirements (>20%) that need to be met (ES2; C3; C2). Also, SMEs are not aware of EE lending offers. During the World Café II, most SMEs reported they were unaware of EE lending offers from the banks.

There are several obstacles to Thai SMEs borrowing from the banks that are currently active in lending for EE initiatives. For example, currently the SME Bank focuses on small SMEs, which might be too small to take out EEF loans (B4; IC6). Another problem mentioned by several interviewees was that Thai banks only provide special loans to their existing customers (IC5; ES1; ES3; IC6). ESCOs were named as a possibility to reach out and aggregate SME projects for the banking sector. However, lenders' technical advisers might not understand ESCO and it was reported that the relationships between ESCOs and banks were not always positive (B3; IC8).

Collaboration experiences between banks and ESCOs are mixed. Whereas during the first field trip in 2013, banks were still very enthusiastic about cooperation with ESCO companies, this was not so during the second field trip in 2014. One interviewee said that some ESCOs tried to cheat on their customers: *'ESCOs cheated a lot, and they do not care as if the client says no they will just go to the next one. Thai ESCO is not 100%. They trick each other because they still, there's still opportunity and many clients'* (B3).

The relationships between banks and the public sector are difficult. It was mentioned that Thai banks try to stay away from the government: *'There are the banks and there is the government ... there is a serious disconnect between the two. They don't necessarily like each other ... so what the government say and what the banks say are always two different things'* (IC3). The banks' communication with the public sector is another example of the challenges facing them. One international development bank pointed out that they had not received any information about the investments of a Thai banking partner: *'Have you seen the pipeline? We so far did not get that information. So, I do not think it is working'* (IO7). Some banks are worried that government programmes will compete with their offers of EEF services (Exit Seminar 2013). However, international organisations think that the government offer of THB50 million (US\$1.4 million) is too small to realistically compete with private financial institutions' offers (IO4; IO7). Also, it was explained that banks are reluctant to lend to semi-public customers such as schools and hospitals, due to possible protests by the public if there is a payment default and the banks have to take legal action against the customers (IC5).

Finally, some interviewees remarked that there are several important actors missing in the debate around EE lending. Two interviewees mentioned that the Thai Bankers' Association, as a body which disseminates information, could be useful (A5; B1). Also, some interviewees said the Ministry of Commerce could make an important contribution because of its potential to attract insurance companies (ES1). Further to this, interviewees said that the Ministry of Industry, due to its strong link to SMEs, should also become part of the network (B4).

Learning: Limited learning processes via the EERF – corporate financing dominates

The main capacity building tool for EE lending, namely the Energy Efficiency Revolving Fund (EERF) has so far had only limited success in transferring knowledge to banks. At least four interviewees mentioned that due to the management structure of the EERF, the banks did not learn anything about EE lending (IC5; IC8; B2; B1). *'The bank they didn't learn anything, didn't know how, didn't learn how to assess the risk'* (IC8). The banks were merely used as a vehicle to reach customers and the Department of Alternative Energy Development and Energy Efficiency (DEDE) provided the risk assessments and technology check (IC5). Monthly networking activities such as bank/ESCO meetings via the Federation of Thai Industries were seen as useful (B2).

Banks have started to build their capacities to provide EEF services, but technical capacity and institutionalisation are still limited and focused on corporate finance. The

banks' own efforts to build capacity in the new niche market are also still limited and several interviewees noted a lack of technical capacity (IO7; IC8; IC6; A3). One bank collaborates with Thai academics to keep up to date with the latest EE technologies (B2). Two banks carried out in-house trainings run by their own staff and one undertook training courses using external resources (B3; B2). So far, there have been no joint learning activities via the Bank Association (B2). Overall, a lack of experience seems to make bank managers conservative rather than innovative. *'They're not proactive they are reactive. That is not risk mitigation. So I think that the banks in Thailand are inexperienced in that and they are not willing to explore or go outside the box because of their experiences'* (IC8). One international investor voiced his frustrations about the lack of capacity among local Thai banks: *'They did not understand an equity model once introduced by international organisations. They did not understand what we were talking about'* (IC8). A problem of transparency was also noted: *'One bank did not comply with the minimum standards of FATF Financial Action Taskforce developed by the Organisation for Economic Cooperation and Development (OECD)'* (IO7).

The research found that only one bank demonstrated second order learning. One bank developed innovative lending approaches, such as expert guarantee and integrated approaches to EE and RE lending. Kasikorn bank has outsourced the technical risk by developing an EE lending tool, in which the customer can get a guarantee for their EE savings via a trusted ESCO or technology provider of the bank. After some difficult experiences with ESCOs, the bank officer reported that they introduced a strict list of criteria for which ESCOs could be approached by customers for expert guarantees (B3). So, the collaboration between the bank and the ESCO is seen as useful, the number of EE saving guarantees the ESCO can provide is limited by their collateral. As ESCOs in the Thailand case study are mostly small, this is becoming a problem (ESP1; ES1).

Another innovative approach mentioned might be to integrate EE and RE projects within one lending portfolio. Judging from the banks' comments, banks do not differentiate between EE and RE lending projects. *'We don't separate'* (B2). *'If we look at the solutions for green building, there are so many components that you can integrate: lighting, solar, chiller boiler'* (B3). So, banks are starting to advertise their lending portfolios as RE and EE together (IC5; B3; IC8). However, the dominance of RE projects might reduce the number of EE projects occurring in certain lending portfolios. The *'K-Energy Saving Guarantee Program'* was changed to the *'Kasikorn energy saving guarantee programme for solar rooftop instalments'* which indicates a focus on RE lending (Kasikorn Bank 2015a). An international consultant explained the higher

investment sums of RE projects, making them more attractive: *'Investment on one renewable power plant might one hundred million or two hundred million up to ten million, but to invest on even though replace the biggest equipment like the chiller in the buildings or boiler in the factories maybe three to five or ten million baht but you got to put the resource to do this type'* (IC6).

International interviewees pointed out that Thai banks are risk averse in their lending behaviour and currently only practise corporate financing (IO4). The slow process of establishing collaboration between an international development bank and a Thai commercial bank demonstrates the banks' risk-averse behaviour. For example, it took one Thai bank and an international development bank seven years to reach an agreement (Kasikorn Bank 2015b); IC5; IO7). Further, interviewees said that banks needed to engage in project finance so that customers are not judged solely based on the collateral they have to offer. *'The difference is that in corporate finance.... You look for the other activities and revenue from other activities itself. But in the case of project finance, it just concentrates on the project itself. It does not concern on the market or the customer'* (IC7).

Five interviewees mentioned that one of the main problems was that the banks had too strict underwriting criteria and only practiced corporate finance (IC8; IC5; IC6, IO7; A5). *'Their lending criteria are the same for EE lending as for a house loan'* (IO4). One interviewee commented that *'even though you can prove/ can prepare a good proposal, you might not get that because the bank might only look at the collateral itself. So, the energy efficiency financing in Thailand, it's not at the level that they will provide the project finance to the energy efficiency yet'* (IC6). One of the banks explained: *'We have to absorb all the credit risk. We have to be aware of the bad loan'* (B1). So, the collaboration with ADB will provide further insights into project finance and into reaching for new, targeted customers (IC5; ES3; IO6).

Recently, international capacity building efforts have picked up, but still show limited results. The interviews highlighted the high level of involvement of international organisations in EE lending. For example, Kasikorn Bank received funds from the United Kingdom (UK) for marketing materials. A German technical corporation (GIZ) and the American development organisation USAID provided training and ran a pilot project to experiment with a facilitator approach as an intermediate between banks and ESCOs (IO6). The United Nations Industrial Organisation (UNIDO) supports the Commerce International Merchant Bank (CIMB) Thai bank via a capacity building programme that provides finance to few industrial pilot projects (IO4). The AFD, as part of their newly

launched Green Credit for Green Building Programme, offers technical assistance to create pipelines for the lending programme (IO7). UNIDO and GIZ have supported the SME Bank with training courses and support to establish a new green lending line (IO4; IO6). The bank reported this support was very useful: *'We learn from the international institutions they come and tell us this, this, and this. My team learns from other sources, not the revolving fund'* (B3).

Shared vision/goals: EE lending is still CSR rather than recognised as a market niche Overall, banks still perceive EE lending as a corporate social responsibility (CSR) rather than a business opportunity. One bank pointed out: *'Energy efficiency projects are small, so public should push bank and government to work together ... it is a sustainability business activity'* (B1). Furthermore, an international organisation also talked about the larger good rather than the economic benefits: *'We have to leave something for our children behind. So, we have to educate the customers that the energy loan is providing future generations opportunities, even though it might not be as attractive yet'* (IO6). Five interviewees named the small investment size of EE projects as a hindrance (ESP1; IC5; IC6; IO4; IO7): *'So even though now they understand more on the energy efficiency project in terms of the volume itself might not so attractive for them'* (IC6). *'They still do not understand that EE will increase their competitiveness and thus eventually will increase their market share'* (ESP1). One interviewee suggested that the inactivity of the banks now might be their reaction to what they learned during the EERF. However, it was also noted by one interviewee that the Thai/Chinese banking culture does not care about the larger good: *'Forget about the environment, forget about climate change, conservation and this stuff ... how much does it save?'* (IC5).

Within one bank, it seems difficult to align visions and goals at the different levels. Within a bank, an engineer or financial officer will oversee corporate social responsibility or product development activities, but senior management needs to approve new credit lines. In the Thailand case study, interviewees reported they had difficulties in communicating to senior management. Also, a bank representative mentioned that the relationship managers who sell loans to clients must be trained in EE lending (B1). Further to this, the incentive structures within banks must take account of EE lending and should not just focus on investment size (B2).

Influence from the Ministry of Energy was seen as useful but other enabling framework conditions are also necessary. The Ministry of Energy has driven most of the public sector efforts for EEF. However, this Ministry does not know about the financial matters which hinder EE lending progress (IC7; G6). Most interviewees agreed that currently the

Central Bank of Thailand's underwriting regulations for bank loans are too strict (A5; B2; B1). *'Banks quite heavily regulated by the Central Bank so they cannot really go out of line too much'* (F4). Also, the recent push of the Thai government to focus on small SMEs hinders further EEF lending by the SME Bank (B4; IO6). It was reported that for the application of the guarantee mechanism provided via the Thai Credit Guarantee Corporation, the Ministry of Interior has to approve the technology upgrade analysis. However, so far, they have not shown an understanding of EE technologies (B4). Even though an interviewee questioned whether the Central Bank of Thailand had a significant influence on the banks, it is important to recognise the roles that the different ministries, besides Ministry of Energy, have in moving EE lending forward (L1).

Overall, private sector EE lending services are still in their initial stages and currently only two banks provide them. Even though the banking sector was supported via the EERF programme, it has failed to reduce the risk perception of banks when it comes to project finance, and to reach out to new customers. In particular, two important actors, namely the Central Bank of Thailand and the Ministry of Finance have so far been missing from the discussions. Furthermore, within banks it is difficult to convince high-level management of the business opportunities on offer, due to the small investment size and technological complexity of EE projects.

5.3.2 ESCO- arranged finance

ESCO-arranged finance has been internationally praised as a new mechanism to address the limited up-front finance that customers possess. Thailand has one of the best developed ESCO markets of the Southeast Asian region. Therefore, it is an interesting mechanism to explore.

5.3.2.1 International overview of ESCO-arranged finance – shared savings, EPC and energy supply contracts

In ESCO-arranged finance models, the ESCO becomes the financier of EE projects. The main advantage of these models is that the customer does not have to provide any upfront finance and can deal with the payments off their balance sheets. Two types of EEFMs exist under the ESCO-arranged finance model:

- shared savings energy performance contracts (SS – EPCs)
- energy supply contracts (ESCs).

As Figure 23 illustrates, under the shared savings EPC model the ESCO and the customer share the cost savings from implementing the EE measures at agreed percentages for a fixed number of years (Crossley & Wang 2013). These contracts are

thus longer than GS – EPCs (GIZ 2013). Monitoring and operation stay with the customer. Usually, shared saving contracts are restricted to large-scale public institutions such as universities, hospitals and leisure facilities (ADB 2015a; Würtenberger 2012). In Europe, the minimum yearly energy costs of the customer need to be around 100 000 Euro (US\$110 000) for this model to work (Würtenberger 2012).

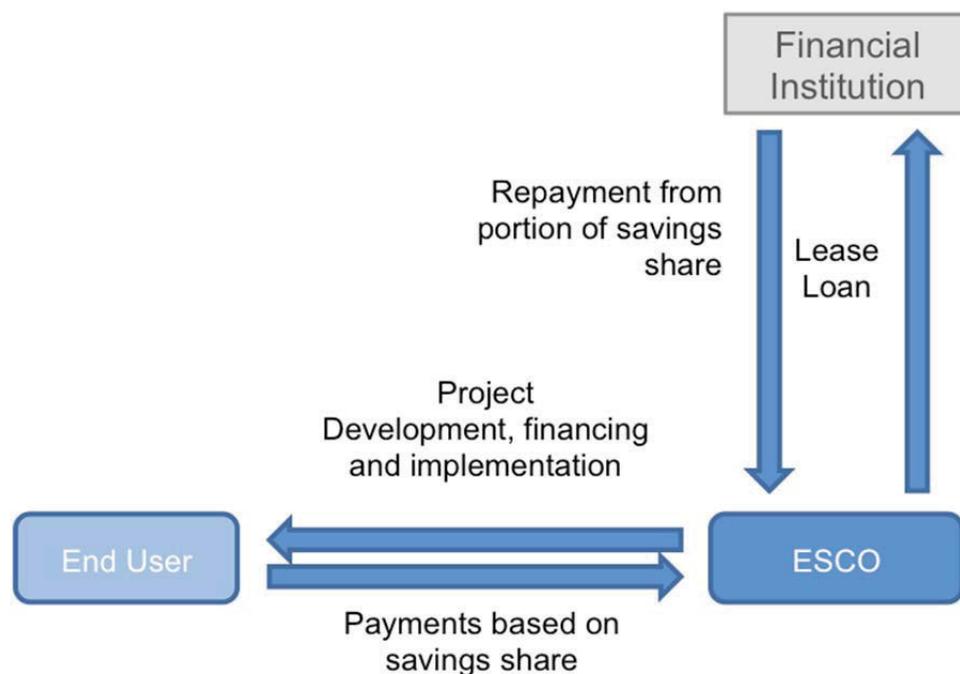


Figure 23: Shared Savings Energy Performance Contract Model (adapted from Crossley & Wang 2013)

The main advantage of SS–EPCs is that the customer does not have to account for the loan in their company’s balance sheet. This contract form also mitigates technology risks due to the EE performance contract. The need for projects to be large, the complexity of contracts, and the estimation and monitoring of energy savings over time are some of the disadvantages. The government could develop a programme for EE upgrades in the public building sector, where part of the funding could be provided to ESCO companies (Würtenberger 2012). But public buildings procurement regulations often need to be adapted before ESCO business can be financed over multiple years by the public sector (Würtenberger 2012).

In energy supply contracts (ESC), the ESCO provides specific EE services for an agreed fee. In this model, maintenance and operation is conducted by the ESCO and the customer pays the ESCO for electricity for a long period of time (10-15 years). The output is measured in verified megawatt hours provided to the customer by the ESCO, but does not involve a performance contract (MacLean & Purcell 2014; Würtenberger

2012). The government could support this model by facilitating access to finance to the ESCO, via revolving funds, bank guarantees or other mechanisms (Würtenberger 2012). Also, funds that pay for tonnes of coal equivalent saved at project completion have been set up, for example in China (MacLean & Purcell 2014).

5.3.2.2 ESCO-arranged finance

The yearly turnover of the Thai ESCO market is around US\$80million/year and thus it is one of the most developed ESCO markets of the region. The ESCO market has been operational for up to 10 years and has implemented over 300 projects (Saiphawan 2014). Between 2011 and 2013, 199 projects with a total investment of US\$61 million were implemented in the industry and 138 projects. Half of this money went to finance RE projects (Federation of Thai Industries 2014).

Interviewees provided some background information on this success. They reported that ESCOs became established and experienced their golden years during the public/private sector partnership phase of 1997 to 2012. After the Asian financial crisis in 1997, governments pushed for privatisation and provided many business incentives. It was noted that this was when Thai energy service providers endorsed the ESCO concept and expanded their business (IC4; F1). Also, international technology providers saw the opportunity in the Thai market (ES2). International organisations stressed that the ESCO market is very well developed compared to others in the region: *'Thailand is one of the countries in the region with an ESCO market – rather than Indonesia or Vietnam'* (IO7).

However, the research found that overall, ESCO market share in EE projects in the Thailand case study could be as low as 10-20% (see Figure 24). An international ESCO estimated that the success rate of its projects was as low as 10 % (ES2). *'We audit more than almost 100 sites but we win just only 10%'* (ES2.) Another international ESCO reported that they implemented four to six GS – EPC per year whereas they implemented about 20 projects just based on the technology (ES2). *'In the last year, I think we have around 4–6 projects on guaranteed savings and around 20 just as an energy service providers'* (ES2). In 2013, DEDE found that only 7% of industry and 3.5% of buildings, who fall under the criteria of the 'Designated Facilities Programme,' used the ESCO service (G6).

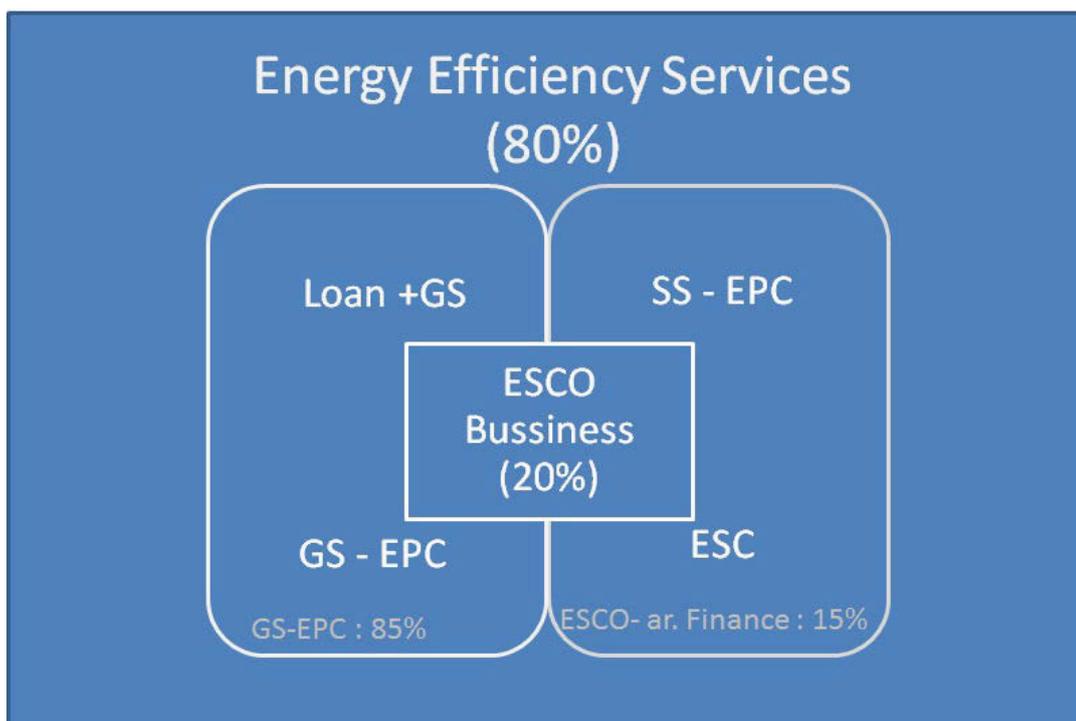


Figure 24: Proportion of ESCO-arranged finance in the whole Thai ESCO market

The analysis below will thus explore what challenges ESCO-arranged finance faces by focusing on actors, learning processes and shared vision.

Actors/networks: Confusion about what defines an energy service company

Confusion about what an ESCO is means that estimates of the numbers of firms currently in the Thai ESCO Market differ. The Federation of Thai industries (FTI) and the ESCO Association have different definitions and criteria for membership. According to the FTI there are 58 ESCOs, whereas the ESCO Association reports there are 28. The unclear definitions and registration of ESCOs via FTI and the ESCO Association create problems for the customers and create mistrust. From FTI's list, only 38 were 'active' (see Figure 25 below) and only 20 were ESCO companies. Eight were technology providers, seven were energy consultants and three were not identifiable (Federation of Thai Industries 2014).

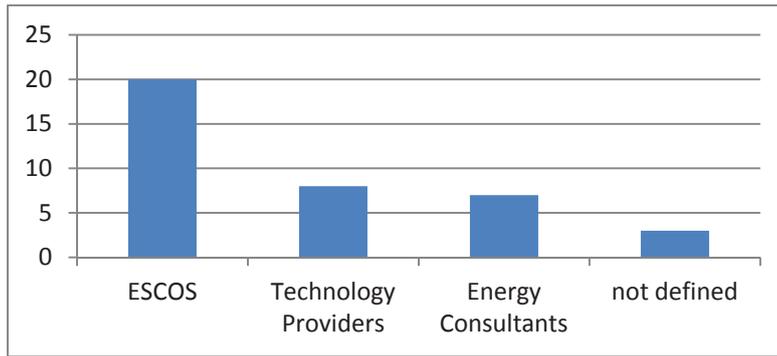


Figure 25: Composition of FTI's active ESCO stakeholders (FTI 2014)

Interviewees verified that currently there are around 20-40 Thai ESCO companies and five to ten international ESCOs active in Thailand (World Café I). The lack of collateral to finance and guarantee projects is one hindrance for ESCOs (IC5; ES1). Seeley (2014) reported that 67% of ESCOs can only provide guarantees to up to US\$1 million. One of the interviewees also noted: *'I checked around 20 companies' registration capital around THB10 -20 million (US\$280.000 – US\$570.000). Biggest around 50 million (US\$1.4 million) like Cofeley. That means it's difficult with the customer to make EPC with this kind of company too small'* (L2). The interviewees also confirmed the confusion on the ESCO definition: *"Most of the ESCOs here in Thailand, we go to the list, thirty or forty in the list in Thailand. Most of them are technology providers and not ESCOs"* (ES3).

Further, it was reported that international ESCOs, who might have the necessary finance, seemed to pull out of the Thai market, as they had difficulties finding appropriate customers (IC5; ES2; ES3). Excessively high expectations of chief executive officers (CEOs) were one problem noted by interviewees, and they are present in at least three international ESCOs (IC5; ES2; ES3). For example, one ESCO closed a division on building efficiency as their US headquarters wanted projects with a volume of US\$ 700,000 (ES1). Pressure on another international ESCO was noted: *'I can say from today's supervisors' meeting that in the next couple of years we have the vision to increase capacity five to six times. This is a must'* (ES3). Other international ESCOs focused on technology rather than on ESCO finance or service (ES2).

Technology providers offer EPC financing models and thus confuse customers. Several international experts mentioned that technology providers use EPC financing contracts to promote their technology (IO4; IC5; IC7). However, due to unclear communication and trying to optimise benefits, problems arise. *'Most companies see ESCOs as a supplier who wants to sell products'* (IO5).

ESCO Association

The ESCO Association was established in 2012 and provides capacity building services. It was reported that the ESCO Association mainly conducted training and is concerned with increasing the quality of the Thai ESCO market (ES2; IC3). So far, their support for international ESCO companies has been limited (World Café I). As indicated by Figure 24, the small Thai ESCO companies do not have the collateral to secure ESCO-arranged finance or guaranteed saving contracts which results in the small amount of 15% ESCO arranged finance of the overall 20% ESCO business.

ESCO and government

DEDE maintains a good relationship with ESCOs, but in the case of PEA, which has started to become a competitor, the relationship has been challenged. One ESCO mentioned that its close relationship with DEDE is beneficial: *'So because you have a close relationship with DEDE so you know about the announcement first'* (ES2). There were complaints that once the government started to act as an ESCO the competition became unfair *'Okay, so if PEA, ENCON, if EGAT wants to do, for example, ESCO business. How can we compete?'* (ES3).

Also, cross-institutional services from the Ministry of Commerce, Ministry of Finance and Ministry of Justice that are needed to create an enabling framework seem to be missing. The non-involvement of the Ministry of Commerce and the Ministry of Finance also are reasons for the lack of insurance and guarantees. *'Ministry of Commerce takes care of the insurance company, Ministry of Finance takes care of those physical things, and the Ministry of Energy is the one who releases the policy so that's kind of tri-parties that we need to involve'* (ES1). Further, ESCOs complained about the lengthy legal process in conflict situations (ES1).

ESCOs and customers

Customers of ESCO-arranged finance are large, industrial companies. According to an ESCO company, they are international customers or state-owned entities such as the Petroleum Authority of Thailand (PTT), or one of the two operational Thai utilities. About 70% of ESCO projects are implemented in the industrial sector and 30% in the building sector (ES2). It was reported that current Thai ESCO projects vary in size between THB2 million to THB20 million (US\$57.000 – US\$570.000). THB2 million (US\$57.000) monthly electricity consumption was named as the threshold which indicated whether a customer was big enough for ESCO engagement (ES2). However, it was mentioned that the most readily accessible firms have been serviced and that new customers need to be approached (ES1). Also, large and state-owned companies might not always need

finance and might have traditional views on energy conservation (ES2).

Small to medium sized companies were named as a huge potential customer cohort for ESCO-arranged finance. An ESCO stated that from its perspective, SMEs will become the main customers for external ESCO- arranged finance (ES1). International ESCOs are sceptical about SMEs as they use their money very selectively. *'It's very difficult because it depends on cultural of Thai people. They use their money carefully'* (ES2). Also, SMEs lack of information and understanding of the ESCO finance model and therefore are not interested (IO5). In addition, they might be very reluctant to have individuals or organisations assessing their financial practices and their technologies (ES3; World Café I). Food and beverage companies and hotels could be potential customers due to their inefficient energy use and long operating hours. *'International hotel chains are also interesting. They run 24/7'* (ES2).

Most interviewees agreed that ESCOs had a bad name at the moment in the Thai market. It was mentioned in several interviews that there are a lot of accusations against ESCO companies (IC5; IO4; ES1; B1). *'As they can lie to the customer about how much the saving will be generated so they can get more'* (IO4). Also, the confusion comes with the definition, as interviewees said a lot of the ESCOs were in fact technology providers (ES2). International experts said this caused mistrust between customers and ESCO companies (IO2; IC1; IC3).

Learning: Limited government support and collective learning

Facilitators and international experts affirmed that ESCOs benefitted from the capacity building measures of the public sector in the early '90s. Oil spikes in the '80s and government support for energy conservation in the late '80s/early '90s resulted in the establishment of energy service providers (F1; F3; IC4). Also, the international support was mentioned by interviewees. For example, GIZ and other organisations provided heavy support for the training of energy service providers (IC3). The industry became interested in saving energy, which also attracted some international technology providers. ESCOs reported it was due to the support of some of the service and international technology providers that they could establish themselves as Thai ESCOs (ES2; ES3).

Since 2005, the Thai government has actively supported the ESCO market via technical and financial assistance. Government officials noted that DEDE, under the Ministry of Energy, supports the Industrial Institute for Energy (IIE) under the FTI and the ESCO

Association to undertake ESCO capacity-building programmes (G5; G6). In 2006, the ESCO Fund was established (For more details see Chapter IV). Also, it was mentioned that around the same time, tax incentives for ESCO companies were introduced via the Board of Investment (G4). In 2010, a monthly bank ESCO network meeting was organised by FTI (ES1). Further, in the World Café I found that the Ministry of Industry also promotes ESCOs via an advanced technology implementation programme (World Café I). Also, an international expert mentioned that the ADB supported one international ESCO in Thailand to prepare project pipelines across the region (IC3).

An analysis of the first two phases of the ESCO Fund demonstrated that so far, almost no funding has gone directly to ESCO companies and their EE projects (Sirikoon 2012). One reason mentioned was that the fund managers were more interested in social, small-scale NGO-type projects than in business development (ES3). Also, in Exit Workshop II local experts explained that the fund was never intended to cater only to ESCOs. The original Thai name of this fund does not specify ESCOs and it was suggested that the English translation was chosen to satisfy the international community (IC5; Exit Workshop II).

Despite some positive results of the public sector support programmes, the ESCO market is still fragile and needs further support. The main ESCO business at the moment is via guaranteed savings-energy performance contracts. In this model, the ESCO company only provides a guarantee for EE savings at the time of the contract. Figure 26 shows that current 'shared savings (SS contract models) only make up about 10-15% of the overall ESCO EPC contracts (Saiphawan 2014). During the interviews, only one international ESCO could be identified that offers energy supply contracts which provide up-front finance (ES2). This is consistent with government research findings mentioned by a government official: *'90% of the total EPC projects are on the guarantee saving scheme where the customer building does the investment but only 10% are saving scheme'* (G6). One reason mentioned was that customers thought energy services were only consultant services, and did not involve finance (IC5). Also, no public sector programme that supported ESCOs had been implemented. ESCOs and consultants remarked that in other countries, the ESCO market is facilitated by the public building sector programs. *'Government need to demonstrate that EE projects are working'* (IC5).

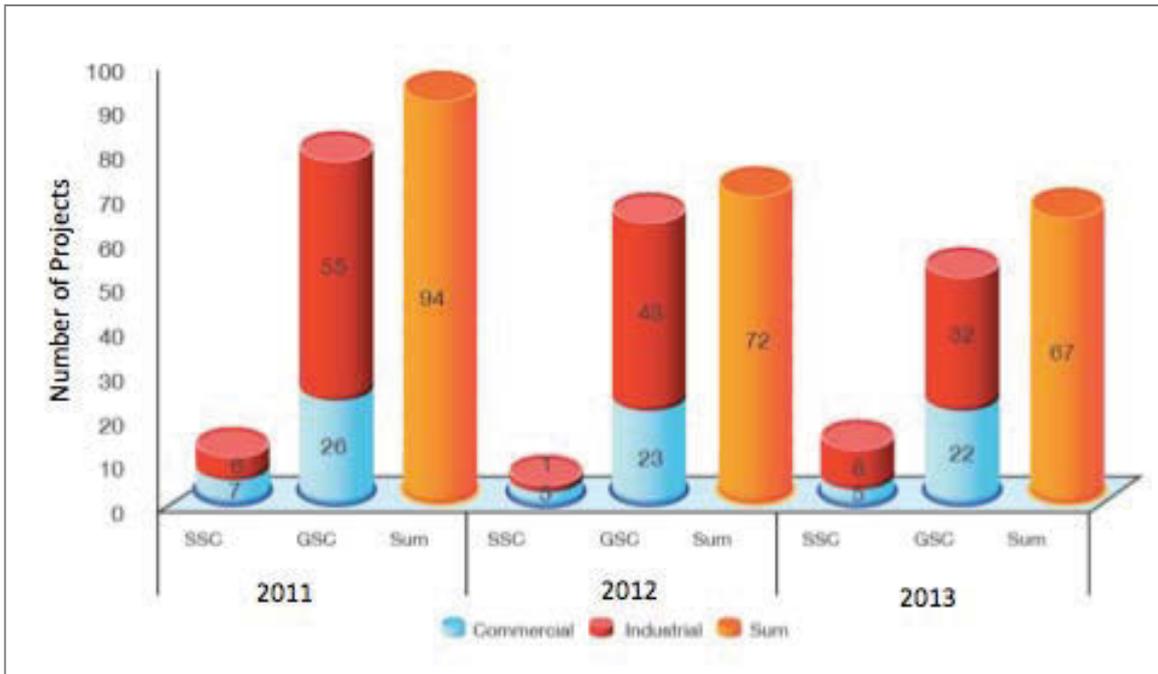


Figure 26: Shared saving contracts vs. guaranteed saving contracts from ESCO companies from 2011-2013 (Federation of Thai Industries 2014)

There have been some attempts to provide finance to ESCO companies via lending, leasing or public sector funds. One ESCO mentioned receiving finance from a bank and a leasing company (ES1; World Café I). However, one ESCO complained that banks often do not lend to the ESCOs, as they do not have enough collateral. This not only hinders ESCO finance but also guaranteed saving contracts (ES1).

Several challenges in the ESCO market were mentioned. For example, it was noted that many companies only joined the market to obtain public sector support: *'they grab the cheap money from the government but they lack in professionalism'* (IO7). Also, some interviewees mentioned that guaranteed savings projects are carried out using the most easily implemented technology options, such as LED lighting. Those projects are not attractive for ESCO-arranged finance as the investment required is too small (ES2). It was also mentioned that ESCOs do not understand how to make programmes look attractive for the financial institutions (World Café I). Furthermore, banks still overestimate the risks of EE lending and do not accept cash flow as collateral (IC5, ES1). They are very reluctant to finance companies that are not already their customers (World Café I). For ESCOs the costs and difficulties involved in explaining their projects to financial institutions was noted (ES1; ES3). *'Sometimes they understand but once the operation level understands, all the approval have to go to the senior executive board level in the bank, and you imagine that people in 50+, 60+ and thus it is difficult to explain to them'* (ES1). Another problem mentioned was that the banks put the interest

rates too high as they overestimate the risks (ES1). Also, banks do not accept equipment owned by the customer as collateral (ES3). International experts predicted that if banks would understand and accept cash flow as collateral, then ESCOs could get access to finance and implement more projects (IC5; ES1).

The lack of skills for appropriate monitoring and evaluation by ESCOs and customers is another problem. In 2014 only six professionals of the Thai ESCO companies were known to be certified by the International Performance Measurement and Verification Protocol (ES1; ES3; IC5; IO7). An example of a building owner's experience, reported by an ESCO further explains this situation: The shared savings model recommended by the ESCO was for a five-year repayment schedule. In Year 1 the repayments from the building owner were based on a ratio of ESCO to Building Owner of 70:30, and in Year 2 to Year 5 the ratio was 50:50. However, the payback period was no longer than 1.2 years. The building owner felt dissatisfied about this experience with the ESCO. Other interviewees also mentioned the problem of the ESCO underestimating the savings that would be achieved (ES1).

Regarding second order learning, limited progress has been made, as only one ESCO could be found that provides ESCO-arranged finance. One ESCO provides energy supply contracts. The main reason it gave for focusing on that business model was that it did not have to rely on the monitoring and verification of the customer (ES2). The ESCO adjusted its customer approach strategy from an engineering perspective to an economic one. The ESCO mentioned that it changed its rhetoric from focusing on EE savings to focusing on the rate of return on investment (ES2). *'If we can understand the customer's criteria, we can propose the saving and the investment to reach their criteria. And it's better for us to implement'* (ES2).

Shared vision/goals: Different perspectives on ESCO-arranged finance development *Energy Service Companies*

ESCOs are reluctant to engage in finance as they do not feel knowledgeable in this field, (ES2). ESCOs mentioned their limitations as financiers, for example they applied very strict underwriting criteria to clients (ES1; ES3). Only large companies met their criteria (ES3). Another obstacle to increase implementation of ESCO-arranged finance is that ESCOs do not have any insurance for technical/maintenance problems during the implementation phase (ES1). Further, ESCOs find it very hard to access loans from banks due to their lack of collateral (ES3). *'That's a big challenge for the ESCOs because most of the ESCOs emerge from the group of engineers, scientists, that don't have big capital. Their lifeline and cash line is very short'* (ES1).

Customers

Currently, the ESCO finance service is not reaching the actual target group, namely medium to large SMEs and the public sector. Current customers of ESCOs might not need external finance, and ESCOs cannot reach potential customers who do need external finance. One ESCO summarised the problem: *'Most customers do not want external finance because it's a big company and in our experience, we think that the customer don't want to use the external finance because I think it's a Thai culture. They can set up the budget if they interest in this project'* (ES2). On the other hand, SMEs are seen as likely customers as these stakeholders have limited funds but also lack in-house energy experts (ES2: ES3). However, the World Café II found that SMEs are reluctant to invest in non-core business and have difficult investment criteria. Several interviewees mentioned that customers think that ESCOs are too expensive (L2; ES3): *'I have heard many times that once the company contact with ESCO Company the ESCO will increase the costs of the EE project'* (L2). Another interviewee mentioned that customers say that ESCOs underestimate the savings (ES3). Also, they only allow for investments with repayment periods of fewer than five years (ES3). *'Many customers said oh! Five years contract. They don't want to implement because it's very long. Thai people would like to do very short projects'* (ES3). One international expert mentioned that SMEs are not used to paying for finance as they usually get subsidies for free (IO6).

The government is supporting ESCO companies, but it does not provide a market or direct finance to ESCOs. The Thai EE Development Plan includes an ESCO support programme. The Energy Efficiency Action Plan includes: (1) support for ESCO activities, namely to enlarge the public sector spending for ESCO support and (2) to develop ESCOs' personnel. The main implementing agency of these objectives is DEDE (Ministry of Energy 2011). As mentioned, the ESCO Fund has so far provided limited funds to ESCOs directly (For more detail go to Chapter IV).

Also in relation to public sector support, conflicts of interest were noted, especially if public agencies also become involved as ESCO investors. One interviewee provided a detailed description of a case in which the government hindered external ESCO involvement. The example was Bangkok's Suvarnabhumi Airport. The investors were the national petroleum company (PTT), EGAT and the municipal electricity authority (utility) and they implemented an absorption chiller that was fuelled by natural gas which was provided by the PTT. The external ESCO could have optimised the chiller's fuel consumption and saved money, but as the money paid goes to the petroleum company, the government did not want to follow the ESCO's recommendations. *'We already talk*

with PTT. I know we are losing money, but we're losing money in this pocket but in another pocket, we supply the gas. Okay, EGAT we lost in this pocket, but in another pocket, they got O&M service. So, it is difficult just to define. If the government themselves, they want to come in as another player. They should support not compete' (ES3).

In summary, the research demonstrated that the amount of ESCO-arranged finance is still very small and it is focused on large, industrial customers. The Thai ESCO market consists of many small Thai ESCOs, who lack collateral and access to finance. The focus of the public sector is on technical capacity development rather than access to finance. Customers still perceive ESCO support as expensive and due to quality issues, there is a lack of trust into ESCO services overall.

5.3.3 Energy efficiency leasing

EE leasing can play a critical role in assisting market functioning for investments that are too small to be attractive for banks, such as the SME market (International Finance Corporation 2013). Given the high percentage of SMEs in Thailand, this could be a very successful mechanism to provide finance to the target group of EE projects.

5.3.3.1 International experience with energy efficiency leasing

In this private sector EEF model, the customer, instead of buying EE technology, leases it from a financial institution. Usually, the financial institution remains the owner of the EE technology until the contract ends. The financial institution can be a leasing company or a technology provider. The customer pays a certain amount over a period of time. The main two types of leases are operational leases and financial leases. Under a financial lease the customer is responsible, for example, for financial accounting and administration obligations. An operational lease outsources those obligations to the financial institutions. At the end of an operational lease the asset goes to the financial institution. An operational lease is seen as an ad-hoc investment by the customer and does not have to be accounted for in their balance sheets (Würtenberger 2012). Depending on the local tax regulations for both models, tax claims can be made. EE leasing technologies need to be removable and cannot be integrated into a building as they might need to be removed if the lease is not paid for (ADB 2015a). For example, in Hungary a gas utility provided financial leases for homeowners to install new gas boilers and a range of building envelope improvements (Taylor et al. 2008)

The main advantages of EE leasing are that customers do not necessarily have to provide high upfront funds and that relatively small projects can be financed

(Würtenberger 2012). Also, investment sums as low as US\$50,000 can be covered via a leasing agreement (MacLean & Purcell 2014). That is also why ESCOs sometimes use this model to get access to finance for their EE projects (Würtenberger 2012). One of the main disadvantages of EE leasing is that the EE technology has to be removable (Würtenberger 2012). Also, the costs for leasing are higher than loans or self-financing (Würtenberger 2012). The government can support EE leasing by resolving regulatory barriers, such as licenses for international financial leasing companies, providing tax incentives and supporting banks to provide 'soft leases' similar to 'soft loans' (Würtenberger 2012).

5.3.3.2 Experience of energy efficiency leasing

The Thailand case study revealed that the private sector seems to have had very limited experience with EE leasing. Two leasing companies said they offered EE leasing activities. One of the companies had done so for two years and the other for five. One company started due to international collaboration with the International Finance Corporation (IFC), which provides a guarantee facility for EE leasing projects. The other company offered light emitting diode (LED) light leasing and some RE/EE measures such as solar water heating systems and rooftop solar (L1). Both leasing companies had Japanese mother companies with 20 and 35 years of experience working in Thailand (L1; L2). However, so far, the leasing companies had only undertaken five and two projects respectively. One mentioned a success rate of 5% for EE and RE leasing projects (L1).

Actors/networks: Foreign companies with restricted licenses

Leasing companies active in EE finance in Thailand originate from Japan, with some Thai banks starting to be interested. Both identified leasing companies in the case study have Japanese mother companies (L2). The financial officer of one of the leasing companies mentioned that in Japan, over 50% of EE activity is administered via leasing contracts (L2). Thus, the Thai leasing firm wants to transfer the knowledge of the leasing model from their experiences in Japan (F5). One bank mentioned during the interview that it intended offering leasing services for EE and RE projects (B3).

Government activities have supported capacity development but lack necessary cross-coordination. It was noted by facilitators that the ESCO Fund managers from EFCT and EforE have vast experience with EE leasing contracts. As previously reported, all EE projects of the ESCO fund were administered via EE leasing contracts (F2; F1). DEDE, which administers the ESCO Fund, does not seem to recognise the potential of EE leasing but rather wants to push for ESCO and bank collaboration. The Ministry of

Commerce provides financial licenses for institutions who want to operate in Thailand, but so far there seems to have been no guidance on EE leasing. One interviewee said this made the operation difficult (L1).

Currently, also for EE leasing, the main customers are large, well-established companies. Even though the ESCO Fund provides finance to SMEs, their lending criteria are rather strict (F2; L2). Medium-sized SMEs need a guarantee to get access to finance (L2). In addition, it was mentioned that so far, the experience of leasing companies in the Thailand case study was only related to car rental. Therefore, the EE leasing contracts are very carefully administered (L2). Moreover, collaboration with technology providers rather than ESCOs was seen as beneficial (L2). ESCOs are perceived as too expensive due to the extra costs of their service (L2).

Learning processes: the ESCO Fund

The ESCO Fund has provided an opportunity for customers to become familiar with EE leasing but has not involved leasing companies. An analysis of the first and second phases of the ESCO Fund found that EE leasing contracts were the basis of all 67 implemented EE projects (F2) (Energy for Environment Foundation 2012). An ESCO Fund facilitator mentioned that leasing companies were not involved, as the ESCO fund managers acted as the lessors (F2). However, the ESCO Fund was not seen as a competitor by the leasing firms as the 4% fee of the ESCO Fund is seen as high and the leasing firms said the ESCO Fund took a long time to approve loans (L2). *'The fee – 4% is high, there is a maximum amount of lending as well, and they take a long period for approval'* (L2).

Leasing companies learn from their mother companies, but a direct transfer is difficult. Both leasing companies mentioned that they had learned from the experiences of their Japanese mother companies. However, real knowledge transfer is difficult, as opportunities are limited (L1; L2). For example, one company wanted to set up an ESCO company but found the regulations for registration very difficult (L1).

The model used for EE leasing is financial leases, as this enables the clients to claim tax benefits. As the leasing officer explained, the client negotiates with the technology provider, buys the product and then sells it on the same day to the leasing company. The leasing company then leases the product back to the customer. This method means that the leasing company does not have to deal with the technology risk which stays with the technology provider (L2). International experts mentioned that leasing is appreciated by customers as they do not have to use their credit line and can invest off-balance

sheet (IC5). Lending periods range from three to five years (L1; L2). One of the leasing companies reported that it takes out insurance for RE technologies (L1).

Some companies see RE leasing and EE leasing as synonymous, which hinders efforts to increase EE technology leasing. Solar rooftop was named as an EE measure during the interviews (L1; B3). One leasing company offers LED lighting, photovoltaic solar, biomass and solar water heating systems for lease (L1). They emphasise that the leasing offer needs to expand beyond LED technology. *'LED is a very small amount, one million/two millions. Why we have to do the leasing?'* (L1) One leasing expert had a vision of larger, more complex EE technologies (L1).

An international organisation initiated a second-order learning process by offering a guarantee mechanism. Since 2011, an IFC guarantee for one EE leasing company has been in place. However, so far only five projects have been approved by this company, and none of them uses the IFC guarantee. The main reason given was the fact that they needed to focus on the collaboration on non-Japanese customers, which increased their financial check criteria (L2). *'Think the problem is the big change from Japanese customer to non-Japanese customer. That means from 20 years' experience that is a big change. Also, our criteria are still tough'* (L2). So far, the guarantee mechanism has been unsuccessful in decreasing the strict criteria for financial institutions and thus the schemes have not reached medium to larger SMEs that have difficulties getting access to finance from other sources (L2).

Shared vision: Lack of recognition by the Thai government

Leasing companies are very conservative but see good growth potential not only for EE but especially for RE leasing. Due to strict regulations from the Ministry of Finance, the international leasing companies focus first on their previous clients and make sure that there are no defaults in their financial services (L1). Both leasing companies expected the EE leasing market to grow, in parallel with increases in the energy prices (L1; L2). However, one of the leasing companies saw its EE leasing business as a 'feel good' business designed to encourage the customer to also buy other products, for example, RE finance (L1). *'See another point of view, you can make the customer feeling good, and if the customer feels good they might buy other products'* (L2). One leasing company stressed the high potential in RE projects (L1).

Customers like the idea of off-balance sheet investment but are unfamiliar with leasing equipment. One customer mentioned that the idea of only paying for the energy savings and not providing any up-front investment appealed to him (C2). Also, the leasing companies mentioned that the customers appreciated the tax reduction benefits of

leasing (L1). However, Thai companies mainly know about leasing within the automotive sector. Also, in general, they do not think that there will be an electricity price increase as it has been stable for a long time (L1; A5). *'Maybe customers in Thailand don't aware about that the electric bill will increase very soon' (L1).*

The Ministry of Energy does not recognise the learning experience for EE leasing by the ESCO Fund and cross collaboration with the Board of Investment is limited. As the ESCO Fund was supposed to not only implement leases but also offer six other financial mechanisms, government officials are reluctant to state that most of the finance was administered via EE leasing (G6; IC7; ESP1). The tax incentive offered by the Board of Investment is crucial for encouraging customers to buy into EE leasing. However, both leasing officers interviewed mentioned that the access needs to be improved and secured for a long period (L1; L2).

5.4 Discussion

This section discusses in detail the findings of the private EEF models in Thailand.

Analytical focus	Direct bank loans	ESCO- arranged finance	Leasing
Market/Price signals	Two banks implement EE lending. One bank provides add-on; expert guarantee and integrated EE and RE approach.	15% of ESCO market (which is 10-20% of overall EE market) involves ESCO-arranged finance; 2-3 ESCOs provide the service	Very limited activity. Two leasing companies, one active for 2 and one for 5 years. So far only 2-5 customers. One bank has announced their interest. In offering EE leasing service.
Actors/ Network formation	SMEs cannot access bank loans. Bank and ESCO relationship is tense. Banks are wary of government regulations. Bankers' Association and Ministry of Commerce are still not involved.	Customers: large and semi-public buildings ESCOs: reap 'low hanging fruit' Thai ESCOs have no collateral to obtain finance. DEDE: Most active agency supporting ESCO association and FTI: support organisations	Leasing companies: Japanese mother companies Government: Ministry of Energy and ESCO Fund managers. Ministry of Commerce still not involved.
Dominant design	Different lending practices. One is now foreign supported (K-green building loan)	85% of the businesses only use the ESCO service of guaranteed saving contracts. Only 15% of projects use ESCO as financier.	Financial leasing contracts. One has a guarantee mechanism, but does not use it.

Learning processes	Public sector support via EERF is a limited success. International technical support just starting. Banks still lack technical capacity.	Public sector support via capacity building. ESCO lack in quality and trust from customers. Still reap 'low hanging fruit'.	ESCO Fund provides customers with learning experience, but not ESCOs. Experience from Japanese mother companies cannot be transferred.
2nd order learning: Taking own initiative	One bank offers expert guarantee, integrated approach to EE and RE. But no project finance or guarantee measures	One ESCO initiated energy supply contract. Some are collaborating with banks. International ESCOs seem to have pulled out of the Thai market.	Guarantee offer from IFC is not taken up and has not yet persuaded leasing companies to liberalise their customer criteria.
Shared Vision and goals	Banks: perceive EEF as CSR rather than business opportunity Ministry of Energy: reluctant to cooperate with other important ministries ESCOs: Self-interested and lack in quality	Government: provides capacity building and sees high potential. ESCOs: different definitions of ESCOs confuse actors who actually are service providers, energy consultants and ESCOs	Government: relaunched ESCO fund which will provide more EE leasing; Pushes more for loan and ESCO finance Leasing companies: See the market grow; more on RE than EE. ESCO/technology providers: need to collaborate

provides an overview of the results for each EEF initiative, which are further discussed below.

5.4.1 Detailed discussion of each private EEF model

5.4.1.1 Direct EE bank loans – corporate social responsibility rather than business opportunity

The overall EE lending service is still limited. In the beginning of 2015, only two banks were actively implementing EE portfolios. Many banks perceive EE lending as an activity to support their corporate social responsibility (CSR) rather than as a business opportunity.

The absence of financial regulations and the focus on existing customers show that the banking sector is still a long way from successfully integrating EE lending into their businesses. Banks so far have not institutionalised EE lending, possibly because there is no guidance from the Central Bank of Thailand. To date, EE lending initiatives have been driven by the Ministry of Energy. Another key finding to note is that banks apply very strict underwriting criteria and thus currently only provide EE lending to existing customers. This makes access for ESCOs and other SME target groups difficult.

No clear pattern in EE bank lending activities can be recognised so far. The EE lending analysis indicates that only about four Thai banks advertise EE lending and only two implement it. Technical capacity and institutionalisation is still missing in the banking

sector, limiting the activities in EEF. The EE lending activities that have so far been initiated are included under the umbrella of corporate finance, and they focus mainly on existing customers rather than a specified target group. Recent attention from development banks might further help to raise awareness of the business opportunities of EE lending. Some innovative approaches such as expert guarantees, add-on loans and integrated RE and EE loans are emerging. However, project finance initiatives and the aggregation of projects have not yet been implemented.

Table 9: Private sector EEF business models in the Thailand case study according to SNM criteria

Analytical focus	Direct bank loans	ESCO- arranged finance	Leasing
<i>Market/Price signals</i>	Two banks implement EE lending. One bank provides add-on; expert guarantee and integrated EE and RE approach.	15% of ESCO market (which is 10-20% of overall EE market) involves ESCO-arranged finance; 2-3 ESCOs provide the service	Very limited activity. Two leasing companies, one active for 2 and one for 5 years. So far only 2-5 customers. One bank has announced their interest. In offering EE leasing service.
Actors/ Network formation	SMEs cannot access bank loans. Bank and ESCO relationship is tense. Banks are wary of government regulations. Bankers' Association and Ministry of Commerce are still not involved.	Customers: large and semi-public buildings ESCOs: reap 'low hanging fruit' Thai ESCOs have no collateral to obtain finance. DEDE: Most active agency supporting ESCO association and FTI: support organisations	Leasing companies: Japanese mother companies Government: Ministry of Energy and ESCO Fund managers. Ministry of Commerce still not involved.
Dominant design	Different lending practices. One is now foreign supported (K-green building loan)	85% of the businesses only use the ESCO service of guaranteed saving contracts. Only 15% of projects use ESCO as financier.	Financial leasing contracts. One has a guarantee mechanism, but does not use it.
Learning processes	Public sector support via EERF is a limited success. International technical support just starting. Banks still lack technical capacity.	Public sector support via capacity building. ESCO lack in quality and trust from customers. Still reap 'low hanging fruit'.	ESCO Fund provides customers with learning experience, but not ESCOs. Experience from Japanese mother companies cannot be transferred.
2nd order learning: Taking own initiative	One bank offers expert guarantee, integrated approach to EE and RE. But no project finance or guarantee measures	One ESCO initiated energy supply contract. Some are collaborating with banks. International ESCOs seem to have pulled out of the Thai	Guarantee offer from IFC is not taken up and has not yet persuaded leasing companies to liberalise their customer criteria.

		market.	
Shared Vision and goals	Banks: perceive EEF as CSR rather than business opportunity Ministry of Energy: reluctant to cooperate with other important ministries ESCOs: Self-interested and lack in quality	Government: provides capacity building and sees high potential. ESCOs: different definitions of ESCOs confuse actors who actually are service providers, energy consultants and ESCOs	Government: relaunched ESCO fund which will provide more EE leasing; Pushes more for loan and ESCO finance Leasing companies: See the market grow; more on RE than EE. ESCO/technology providers: need to collaborate

Some important actors and networks seem to be missing. SMEs, which might need external EEF, have so far had only limited access to banks' credit lines. The relationship between the government and ESCO companies is fractured due to past conflicts. Further, to loosen the very tight lending practices for EE projects, the Ministry of Energy will need to collaborate with the Ministry of Finance and the Central Bank of Thailand.

5.4.1.2 ESCO-arranged finance services – still a fraction of ESCO service

Compared to other energy services, ESCO-arranged finance is still at an early stage, due to the lack of quality assurance, access to finance and customers. International ESCOs engage in financing projects and target large customers with large amounts of collateral. As

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Actors/ Network formation	SMEs cannot access bank loans. Bank and ESCO relationship is tense. Banks are wary of government regulations. Bankers' Association and Ministry of Commerce are still not involved.	Customers: large and semi-public buildings ESCOs: reap 'low hanging fruit' Thai ESCOs have no collateral to obtain finance. DEDE: Most active agency supporting ESCO association and FTI: support organisations	Leasing companies: Japanese mother companies Government: Ministry of Energy and ESCO Fund managers. Ministry of Commerce still not involved.
Dominant design	Different lending practices. One is now foreign supported (K-	85% of the businesses only use the ESCO service of	Financial leasing contracts. One has a guarantee mechanism,

	green building loan)	guaranteed saving contracts. Only 15% of projects use ESCO as financier.	but does not use it.
Learning processes	Public sector support via EERF is a limited success. International technical support just starting. Banks still lack technical capacity.	Public sector support via capacity building. ESCO lack in quality and trust from customers. Still reap 'low hanging fruit'.	ESCO Fund provides customers with learning experience, but not ESCOs. Experience from Japanese mother companies cannot be transferred.
2nd order learning: Taking own initiative	One bank offers expert guarantee, integrated approach to EE and RE. But no project finance or guarantee measures	One ESCO initiated energy supply contract. Some are collaborating with banks. International ESCOs seem to have pulled out of the Thai market.	Guarantee offer from IFC is not taken up and has not yet persuaded leasing companies to liberalise their customer criteria.
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shows, no formal ESCO quality control exists in the Thailand, which has led to mistrust between ESCOs and customers but also between ESCOs and banks. The lack of trust results in limited finance opportunities for ESCOs, as financial institutions have no insurance when lending to these unknown service providers. In addition, the public building sector, which has boosted the ESCO market in other countries, cannot be accessed by the ESCOs in Thailand.

Overall, the market share of ESCO-arranged finance is still only a fraction of the overall ESCO business. The current ESCO market is around US\$80 million/year and over the last ten years around 300 projects have been implemented. However, only 15% of these were financed by ESCOs via shared-saving energy performance contracts (SS-EPCs) or energy supply contracts (ESCs). This is not surprising, as for example in China SS-EPCs or ESCs make up only about 9% of the overall EE market (Wang et al. 2013).

The actors and relationships within the ESCO market are diverse and limited by mistrust. Mistrust limits the current relationships between potential customers/financial institutions and ESCOs. Due to the lack of standardisation and sound practices within the ESCO market, some customers have felt cheated by ESCOs and technology providers.

Due to a lack of implementation, the learning process regarding ESCO-arranged finance has so far been limited. Governments' efforts so far have not provided access to finance for ESCOs. The analysis found that the ESCO Fund rarely directly supported ESCOs. Also, divergent definitions of what an ESCO business actually is by the facilitation bodies FTI and the ESCO Association confuse customers and lead to mistrust in the ESCO business.

No incentive or insurance mechanisms exist to reach customers who would need to obtain external finance via the ESCO market. Due to the lack of any de-risking measures ESCOs are currently mostly engaging with large industrial companies for ESCO finance. Also, large public buildings cannot be serviced, due to procurement regulations.

5.4.1.3 Energy efficiency leasing

This least developed private sector EEF model seems still in its infancy, due mainly to the failure by the Ministry of Energy to recognise its importance. Further, strict financial regulations that discourage new entrants from entering the market. As **Error! Reference source not found.** shows, the ESCO Fund does not collaborate with leasing companies. The International Finance Corporation (IFC) does offer a guarantee mechanism to one EE-leasing company. But due conservative leasing behaviour, the company is too cautious actually to take it up. The only positive public sector support for EE leasing at the time of this research was a tax exemption, which enables the investment to be tax deducted. Therefore, EE leasing is still fragile in Thailand.

EE leasing also has not yet penetrated the leasing markets. Only two leasing companies have implemented EE leasing projects and they have only implemented seven projects between them. Both companies have Japanese mother companies, and in Japan leasing is a major component of EE finance.

Governments' efforts are providing a good, albeit undirected, platform for learning experiences. The ESCO Fund provides a platform for learning about leasing contracts for customers but so far, these contracts have not involved leasing companies. The tax incentives offered by the Board of Investment (BOI) are crucial to make customers interested in EE leasing, but their continuity is not guaranteed.

The strict regulations of financial institutions and the lack of de-risking measures are hindering access to potential new customers for EE leasing. The fact that even though one company has access to a guarantee mechanism but does not use it illustrates how strong the fear of loan defaults is based on the Thailand case study.

5.4.2 Mutual challenges

From the interviewees comments, two mutual challenges were identified that cut across all EEF initiatives in Thailand.

5.4.2.1 Customer mismatches

So far, the largest potential target group for receiving external finance, namely medium to large SMEs, is not being reached by private sector EEF models. Banks mainly stick to their existing large clients that have large investments to make. ESCO-arranged finance is currently focused mainly on ESC, which necessitates large industrial plants to make the ESCO engagement worthwhile. Finally, leasing companies are still very restricted concerning EE technology offers and criteria for eligible customers, which in general only large companies can fulfil. Thus, a large group of potential SME customers cannot be reached by the current private sector EEF models.

5.4.2.2 Cross-ministerial/ institutional collaboration

For all three private sector EEF models, the need for cross-ministerial collaboration was noted as an important factor to expand EEF business.

For banks and leasing firms, it was noted that the Ministry of Commerce issues insurance licenses and thus could provide guidance in regards to the provision of financial and technical insurance for EEF. Also, the Ministry of Finance and the Central Bank of Thailand could provide guidance on green lending/leasing regulations. De-risking measures for SME finance, such as guarantees need to be co-designed by the Ministry of Energy, Ministry of Finance and Ministry of Industry. The Ministry of Industry has a strong focus on SMEs and currently issues support letters for business promotion loans. Also, the treasury department of the Ministry of Finance needs to change procurement regulations to be able to provide ESCO access to the public building sector. As discussed above, none of the private sector EEF models evaluated in the Thailand case study have penetrated financial institutions' practices. Direct EE Bank lending is mainly challenged by the lack of commitment from bank CEOs and the lack of guidance from the Ministry of Finance. The growth of ESCO-arranged finance is constrained by a lack of access to capital and a lack of trust on the part of potential customers. EE leasing needs recognition from the government. Overall, due to the risk-averse approach of the financial institutions, the largest group of potential customers, SMEs, cannot be reached. Also, due to a lack of cross-ministerial coordination, the demand for EEF services and de-risking measures are impeded.

5.5 Conclusions

In this chapter a niche analysis was conducted to explore the impacts that public sector EEF mechanisms have had on the private sector in regards to the financial services provided for EE.

The results demonstrated that private sector EEF models are still fragile and not diverse. Despite over 10 years of public sector support for the Thai private financial sector so far, the private sector EEF models are limited to banks and a very fragile group of ESCOs and leasing companies. This has resulted in SMEs and ESCOs not being reached by EEF services. Fear of defaults on payments and tight financial regulations seem the main hindrances for banks.

EE lending seems limited to only two active banks, and there is a lack of learning experiences and cross-ministerial guidance. The EERF has failed to build the capacities of banks to assess the risks of EEF and convince CEOs of its market potential. Furthermore, the Ministry of Finance/Central Bank of Thailand needs to provide appropriate guidance to the banking sector and develop de-risking mechanisms for further support.

ESCO-arranged finance is still very limited in the Thailand case study and the ESCO market is only estimated to be 15% of the overall EE market. The main challenge seems to be the quality of ESCO companies, who often pretend to be ESCOs but actually are technology providers or energy consultants. In addition, there is only one international ESCO company that implements ESCO arranged finance which limits the learning opportunities. Also, the government has so far not supported ESCOs by providing them with direct financial support.

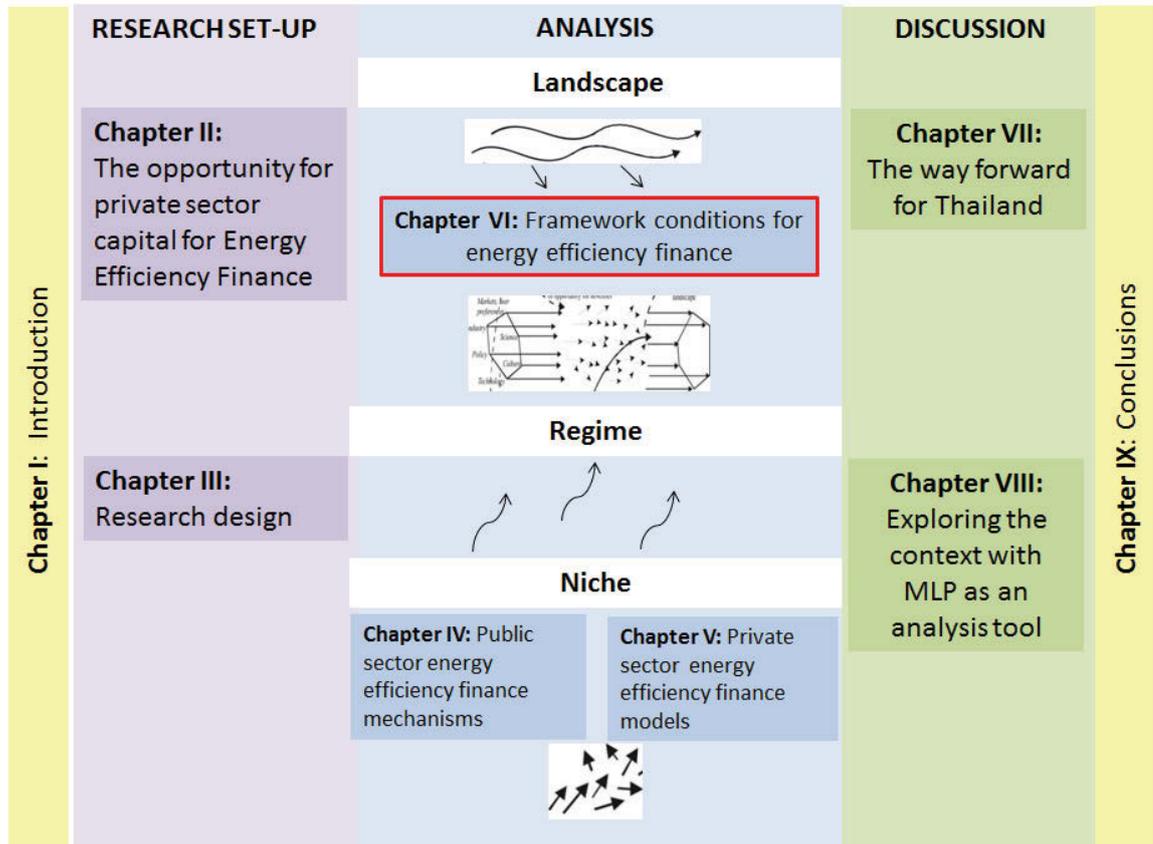
EE leasing is the least developed private sector EEF model in the Thailand case study. Only two leasing companies were identified which currently provide that service. One of the main challenges identified was the lack of public sector support via DEDE and international organisations. This results in a very conservative financial administration by leasing companies, and a focus on large, existing customers.

The difficulties of private sector EEF models highlight the complexity to leverage private sector EEF. Even for the win-win situation which EE offers, outcomes always depend on the local context, regulations and EE market potential.

Interestingly, all private sector EEF models faced challenges due to broader framework conditions. EE lending was clearly restricted by the tight lending regulations of the

Central Bank of Thailand. ESCO-arranged finance needs insurance and guarantee schemes which can only be implemented via the Ministry of Finance. EE leasing companies were highly dependent on a tax incentive provided by the Board of Investment and the provision of financial licenses from the Ministry of Commerce. Therefore, the next chapter will more closely examine the existing framework conditions in the Thailand case study and their impacts on the available EEF services.

Chapter VI: Framework conditions for energy efficiency finance



6.1 Introduction

This chapter focuses on the framework conditions (regime and landscape) in the Thailand case study and whether they impact on EEF service offers.

Chapter V revealed that despite over 10 years of public sector support to the Thai private financial sector, only a few private sector EEF models could be found. One reason was the non-conducive framework conditions.

The in-depth analysis of the public sector EEF mechanisms, indicated that public sector measures need to be adapted over time to enable private sector ownership. Also, RE measures might be more attractive to financial institutions and thus preferred over EE projects.

Looking at the private sector EEF models, it was seen that these are still limited and highly dependent on government support. Banks still lack the necessary appetite for risk and the capacity to develop more innovative project finance. ESCO-arranged finance is still very limited because of quality issues in the ESCO services and difficulties for ESCOs to access finance. Finally, EE leasing is very fragile, partly because it has not received any public sector support and the unavailability of a guarantee mechanism.

In particular, the analysis found that some circumstances are beyond the influence of the EEF initiative but are rather influenced by the framework conditions prevailing in the country. For example, banks are tightly regulated by the Central Bank of Thailand. ESCO-arranged finance is highly dependent on the procurement regulations of the public sector regarding agreements for public buildings to use ESCO services. Finally, EE leasing is currently only possible due to a tax incentive by the Board of Investment which could be changed at any time.

Drastic political events and the overall the political situation also affect the behaviour of financial institutions and customers who need external EEF. For example, it was shown that the EERF was established partly due to the 1997 Asian financial crisis.

As mentioned in 2.4. a comprehensive literature review from recent grey literature from Asian developing and emerging countries identified empirically which aspects in the framework conditions seem to be important for EEF and the results are displayed in Table 10.

Table 10: Conducive framework conditions for EEF, identified from the literature

	Factors that influence the enabling environments of EEF initiatives
Electricity sector	<ul style="list-style-type: none"> ▪ Available EE technology and capacity (international relations) (DeT'serclaes 2010) (1;2). ▪ Government regulations on EE (targets, standards and research) (DeT'serclaes 2010; Taylor 2012)(3). ▪ Geographical coverage of the electricity system (Verbong et al. 2010) (4). ▪ Institutional energy governance and the influence of international organisations (power relations) (Baker, Newell & Phillips 2014; Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Raven, Schot & Berkhout 2012; Sarkar & Singh 2010; Taylor et al. 2008) (5). ▪ High energy price creates a market demand for EEF (DeT'serclaes 2010) (6) ▪ Customer demand for EEF (efficiency status) (Limaye et al. 2012)
Finance sector	<ul style="list-style-type: none"> ▪ Capital is available(Wattana & Vaiyavuth, 2007) (4) ▪ Diversified banking sector, with experience in small-scale finance (Taylor et al. 2008) (1). ▪ On-lending regulations are supportive of EEF (3). ▪ Green energy legislation exists (Taylor 2012) (3). Capital available (Wattana, Sharma & Vaiyavuth 2008) (4). ▪ Institutions and international organisations' influence (Unger 1998) (5 & 7).
Political system/legal governance	<ul style="list-style-type: none"> ▪ Stable political systems make investment viable (DeT'serclaes 2010; Verbong et al. 2010); ▪ Sovereign risk in emerging economies can hinder investment (DeT'serclaes 2010) ▪ Contract enforcement needs to be strong to be able to outsource (Taylor et al. 2008). ▪ Influence of international organisations (Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Sarkar & Singh 2010)

The synthesis displayed in Table 10 indicate that the characteristics of Asian emerging economies demand a wider assessment approach than only to look at the electricity sector. These countries, with at times highly regulated financial and energy sectors, as well as political turmoils, need to include in-depth analysis of the financial sector and the political stability.

Regarding the electricity sector it is well known that the energy price, EE targets, efficiency condition and technological capacity will inform the demand of EEF (Limaye et al. 2012). Recent literature also suggests the prominent influence that International organisations have on the development of the electricity and finance regime needs to be acknowledged (Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Raven, Schot & Berkhout 2012; Sarkar & Singh 2010).

In Asian emerging economy context, financial markets are incomplete and/or heavily regulated. Therefore, it is argued that the state and topography of the financial markets needs to be assessed to understand what supporting mechanisms might be needed for EEF to flourish. Lack of liquidity, maturity and transparency in the financial sector will increase the financiers perceived risk assessment and might distort perception about EE investments (Polycarp, Brown & Fu-Bertaux 2013)

Political instability also affects energy efficiency finance in Asian emerging economies. The increased risk of investments in a political unstable environment has long been recognised, since they can influence investment decisions, whereas a political stable environment greatly minimises the risk for private investors (Irwin et al. 1997). International rating agencies give lower grades to investments in emerging economies due to the sovereign risk. Thus, technology markets need to be more mature than in developed markets to be attractive for foreign investors (DeT'serclaes 2010).

Based on these issues identified in the literature review, the research sub-question that this chapter addresses are: *'How have the framework conditions, specifically in the electricity and financial sectors in Thailand, influenced the outcome of EEF initiatives?'*

First a regime and landscape analysis, following the multi-level perspective framework is conducted. Multiple regimes are analysed, namely the electricity and financial sector regime. Each regime is characterised by seven components: (1) technology; (2) techno-scientific knowledge; (3) regulations and rules; (4) infrastructure; (5) industry structure; (6) markets and user patterns; and (7) cultural and symbolic meaning (Geels, 2005). The landscape is described as comprising the events/impacts that might destabilise the regime, but also includes 'deep structural relationships' of society, such as its political system (Baker, Newell & Phillips 2014, p.10). To acknowledge the slow changing regime dynamics the analysis in this thesis has been conducted over a 55-year timeline.

Then, the regime and landscape analysis is used to compare the empirically identified important framework conditions of Table 7 and Table 10 with the current situation in Thailand.

A key finding from this chapter is that for any process to design EEF incentive mechanisms needs to consider the state of the financial sector, the influence of international organisations and the political situation in a given country.

The analysis showed mixed results concerning the conduciveness of current EEF mechanisms and models compared to the framework conditions. Clear EE targets and

energy conservation projects since the 1990s have built up capacities and technologies in the EE service and in organisations providing advice on EE. However, the demand for EE within the industry and building sectors is still limited due to the subsidised energy price and low legislation enforcement. A tightly governed financial sector, which so far has not provided any guidance on green finance, could be a hindrance to the development of more innovative financing schemes. The political situation in Thailand caused continuous instability for the financial and electricity sector seems challenging, but recently there has been some indication that positive change is possible under the current regime.

6.2 Analysis of the Thai framework conditions over time

To more explicitly understand the dynamics of the framework conditions and landscape events, changes in the financial and electricity sectors over the last 55 years were analysed. As elaborated in 3.3.3. landscape events here also include the political system and international influence and important developments were noted.

Table 11 provides a comprehensive overview of the time periods, each with a brief description of the main events in the electricity, financial sector and the political situation. The sub-sections below describe each of the phases in detail. Secondary data were the main sources used to provide the overview, with interviewees filling in some qualitative detail.

6.2.1 1950–1972: Thailand’s industrialisation

Thailand’s industrialisation, facilitated by a central planning military government and the influence of the US and the World Bank, led to the privatisation of the finance sector and a centralisation of the previous rather diverse electricity market.

6.2.1.1 Political system/events

The military’s influence on the central bureaucracy marked this period. Calming the turbulent times of the 1940s a communist insurgency pushed for long-term, central planning measures (Unger 1998). The focus was on building up large industries that could compete internationally (Rock et al. 2009). The US lent heavily to the Thai government to create an ally in the Vietnam War (Greacen 2004).

Table 11: Overview of the transformation of the finance and electricity sector in Thailand from the perspective of time

Financial Sector	Period	Electricity Sector
<p>1962: Commercial Banking Act-</p> <p>1970s: 4 major banks</p> <p>100's small Chinese invest. firms</p> <p>Tight budgets in place. Thai-Chinese banks had good relations with the government.</p>	<p>1950-1978</p> <p>Thailand's <i>Industrialisation</i></p> <p>Milit. govt.</p>	<p>1960 Electricity demand increased 30x</p> <p>1967 and 1971: 46% of all foreign loans went to the energy sector.</p> <p>1968: EGAT established due to pressure from the World Bank</p> <p>Electricity tariff not cost-covering.</p>
<p>1978 –1981: Debt crisis</p> <p>IMF: Liberalisation Finance Ref.</p> <p>1985-1994: banks increased their assets by factor six (\$180 billion)</p> <p>90s: banks' relationship to govt. weakened.</p> <p>Political conflict between Ministry of Finance and Central Bank of Thailand caused weak oversight</p>	<p>1978-1996</p> <p><i>Foreign influence in Thailand</i></p> <p>'elitist democracy'/ military government</p>	<p>1978-1981: Oil shock</p> <p>IMF: Attempted start of the Electricity service industry (ESI) Reform</p> <p>End of '80s: International support for energy conservation.</p> <p>1992: ENCON ACT</p> <p>1995: ENCON Fund operationalised</p> <p>Electricity tariff not cost covering.</p>
<p>1997: Financial crisis</p> <p>International Monetary Fund provided US\$20 billion.</p> <p>Most banks were Thai owned</p> <p>2008: Financial Institution Business Act</p> <p>Central Bank of Thailand resumed governing power.</p> <p>Conservative, in-ward looking, Banks had a weak relationship with government.</p>	<p>1997-2015</p> <p>Thailand's Struggle for Stability</p> <p>Unstable political democracy- milit. govt.</p>	<p>IMF: Focus on privatisation of the energy sector</p> <p>2002: Ministry of Energy was established. EE issues shifted from EGAT to DEDE.</p> <p>2008: Energy Regulatory Commission was established</p> <p>2000-2006: Incomplete ESI reform that created an institutional 'mess'</p> <p>99.3% electrification</p> <p>Thailand is energy importing country.</p>

6.2.1.2 Financial sector –setting up

The institutionalisation of the financial sector in Thailand took place. In 1942, the Central Bank of Thailand, Bank of Thailand and the Industrial Finance Corporation of Thailand (IFCT) were established. In 1959, the Board of Investment was founded to provide investment incentives to the Industrial Investment Promotion Act. In the '50s the Thai

commercial banks began to dominate the sector and by the '70s they had concentrated into four major banks which had strong ties with the military government (Unger 1998).

6.2.1.3 Electricity sector: International lending and centralisation

International lending assisted the electricity sector to concentrate the institutional set-up and to match the rapidly increasing demand for electricity in the industry sector (Sadove & Byer, 1985). Due to rapid industrialisation in the early '60s, electricity demand increased 30-fold. The Thai government had to meet this electricity demand and borrowed foreign money to develop large-scale hydroelectric and lignite coal power plants (Greacen 2004; Wattana, Sharma & Vaiyavuth 2008). Due to pressure from the World Bank a central, autonomous power agency was established, namely the Electricity Generating Authority of Thailand (EGAT) (Chirarattananon 2011; Greacen 2004). EGAT is a power producer, a buyer of electricity, and a seller to the utilities, the Metropolitan Electrification Authority (MEA) and the Provincial Electrification Authority (PEA). It is also a transmission organiser (Dhiratayakinant 1991).

6.2.2 1973–1997: Financial liberalisation and the energy crisis

Financial assistance from the IMF and World Bank influenced the liberalisation of the financial markets. The oil shocks of 1973 and 1978 initiated new resource explorations and energy conservation efforts by the Thai government.

6.2.2.1 Political system/events

The democratisation process saw periods of stability alternating with periods of political turbulence. The student protests of 1973 started a surge for democracy, which resulted in the nation's first elected prime minister in 1989 (Wattana, Sharma & Vaiyavuth 2008). In the '90s military and populist governments alternated (Smith 2003). The sharp oil price increases in 1973 and 1978 caused the financial collapse of the public sector in 1979. Between 1978 and 1981, the price of imported oil tripled (Wattana, Sharma & Vaiyavuth 2008).

6.2.2.2 Financial sector – liberalisation reform

Following the financial collapse in 1979 the International Monetary Fund (IMF) guided a reform process. The reforms resulted in a liberalisation and internationalisation of the Thai financial market. Thus, the government lost the oversight over the financial transactions of the Thai banks. The IMF guided a reform process, which focused on increasing local savings, the liberalisation of lending activities that also allowed foreign investments (Unger 1998). The stabilisation of the economy and tight financial regulations, combined with good collaboration between banks and the government,

created another period of rapid economic growth from 1986 onwards (Unger 1998). Between 1985 and 1994 Thailand's six main banks had expanded their assets to over \$180 billion and they traded in Burma, Cambodia, Laos and Vietnam (Unger, 1998). The influx of more players into the Thai financial sector disrupted the previously close relationship between government and the banks (Medhi 1995; Unger 1998). In parallel, the political disputes between the Ministry of Finance and the Central Bank of Thailand in the 1990s caused further weak oversight of the banking sector (Unger 1998).

6.2.2.3 Electricity sector: System pressure, privatisation and the start of energy conservation

The IMF also guided the electricity sector towards the path of privatisation. Regulations to keep energy prices low, combined with further electrification expansion, brought utilities to a precarious financial situation at the end of the 1970s (Sadove & Byer 1985). The IMF demanded increases to energy prices and the privatisation of state-owned enterprises (Wattana, Sharma & Vaiyavuth 2008). The first step to reorganising the institutional landscape was to establish the National Energy Policy Office directly under the prime minister's office (Wattana, Sharma & Vaiyavuth 2008). Further the Petroleum Authority of Thailand (PTT) was established in 1987.

During a period of military government in 1992, the most progressive energy conservation legislation of the SEA region was passed. In 1992, the ENCON Act was enacted and in 1995 the ENCON Fund became operational (Chirarattananon 2011). International organisations, such as USAID, GIZ and development banks have been lobbying since the late '80s for energy conservation efforts. They conducted technical studies and co-financed new institutions, such as the Energy Conservation Centre of Thailand (Chirarattananon, 2011; Sadove & Byer, 1985). As already mentioned in Chapter IV the ENCON Act and the ENCON Fund put Thailand in the spotlight for progressive energy conservation policy in the region (see Section 4.2.1. for further information).

The interviewees provided interesting insights. For example, the term 'energy conservation' was assigned to capacity building from US agencies: *'the term conservation came around the 1980s at that time it was quite popular in the US. So somehow, we copy, copy paste from the US'* (A5). On the ENCON Act it was noted that one of the challenges which continues to this day comes from the fact that not one single authority was put in charge of monitoring the compliance with the ENCON Act (F1).

Although the ENCON Fund was praised by many interviewees, it was also criticised due to its lack of transparency and ineffective operation. Several interviewees mentioned the benefits of the ENCON Fund (B1; F4; G2; IC2) *'Thailand ENCON fund is actually very good, very beneficial to the campaign' (F2)*. However, the limited access to the fund and the administration of the Fund was criticised. In particular, the Energy Policy and Planning Office (EPPO) is a recipient of ENCON Fund finance but also part of the ENCON Fund committee (G3;(IC1): *'DEDE and EPPO are the recipient, but at the same time the EPPO as the secretary of the fund is the one who scrutinise and provide money, that is no good' (IC1)*. Further, a lack of appropriate monitoring and evaluation was mentioned: *'I think it is really a problem that we do not more monitoring and evaluation under the ENCON Fund project' (G9)*. One of the reasons named was the mandatory yearly turnover of large amount of finance, regardless of its outcome (A5; G9). Another reason mentioned was the long-term membership of the ENCON Fund evaluation committee, which would not encourage new, fresh ideas (A5). *'It is a sort of political economy thing. The members of the ENCON Fund. The committees who are sitting there they are the same group of people. They don't change (A5)'*.

6.2.3 1997–2014: Thailand's struggle for stability

The 1997 Asian financial crisis in Thailand and its implications marked this period. It changed the finance sector in Thailand completely, into a tightly governed, very conservative sector. Likewise, the financial crisis provided grounds for the IMF to re-enter Thailand which led to an imperfect privatisation of the electricity service sector.

6.2.3.1 Political system/events

The Asian Financial Crisis of 1997 had significant impacts on the financial sector in Thailand. In June 1997, officials led 16 finance companies to suspend their business, and another 42 finance companies were ordered by the Central Bank to suspend business (Unger, 1998). The IMF came to Thailand's rescue in 1997 and provided a \$20 billion loan (Smith 2003). Corrupted democratisation efforts caused an unstable political environment. Between 1991 and 2001, there were five changes of government which included military and democratically elected regimes (Smith 2003). The political instability continued up until the end of the data collection period, with the most recent military coup occurring in May 2014 (BBC 2014).

6.2.3.2 Financial sector: Tightly governed and conservative

The Asian financial crisis completely changed the finance sector in Thailand into a tightly governed sector. The Thai government resumed its governing powers by establishing several state banks. The Central Bank of Thailand started to tightly regulate the banking sector and the Financial Institution Business Act was passed (Bank of Thailand 2008). It, for example, limits foreign ownership of any financial institution to 15%. Also, it regulates the establishment of new financial institutions and it provides information on underwriting criteria for credit lending. Some special finance conditions exist for SME finance. For example, the Act specifies that the Thai Credit Guarantee Corporation can guarantee loans to SMEs (ADB 2014; Petchanet 2015; Sathapornnanon et al. 2015).

By 2014, commercial banks dominate the assets of the financial institutions with 50% and six state-owned financial institutions (ADB 2014). The 661 leasing companies only hold 3% of the assets share (Bank of Thailand n.d.). As can be seen in Figure 27, the bond and stock markets have developed slowly over the last three decades.

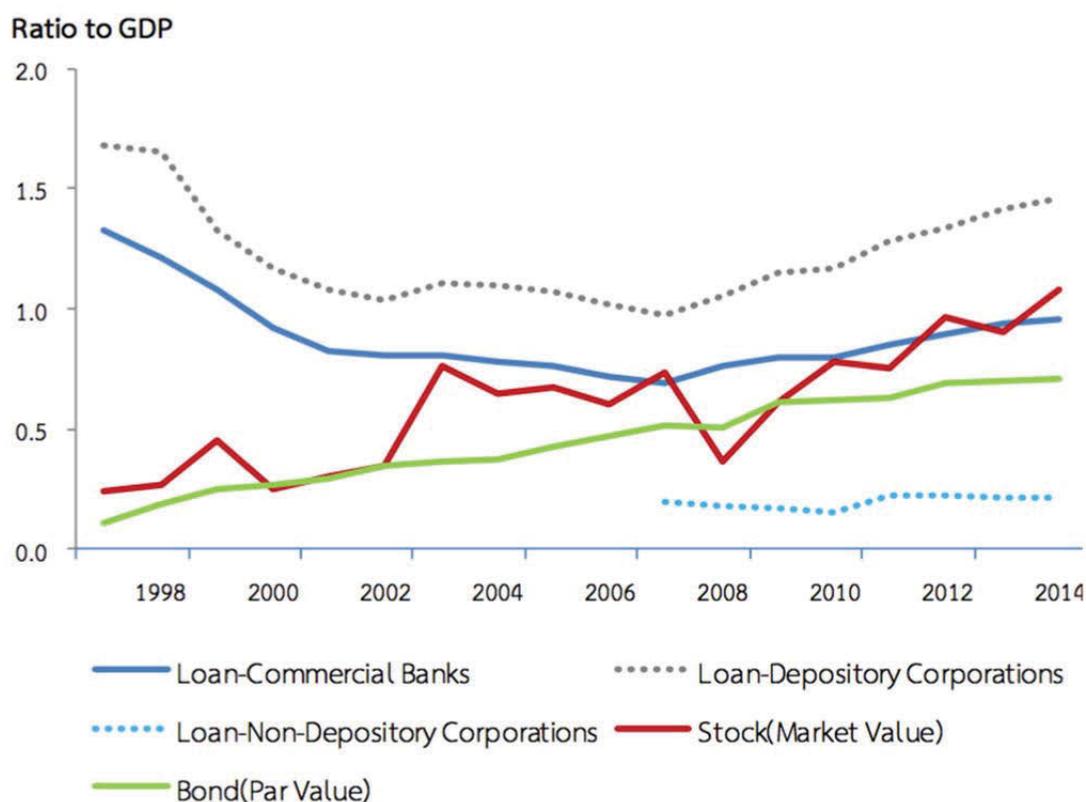


Figure 27: Comparison of loans, bonds and stocks (Bank of Thailand 2014)

Five interviewees mentioned that the bank regulations are very strict and that this strengthened the conservative, risk-averse attitude of banking institutions. Several academics mentioned that the strict lending regulations cause problems for providing

loans for more innovative, small-scale projects and establishing new financial institutions (A3, A2; L1). Also, it was mentioned that the Central Bank of Thailand monitors the compliance with the finance regulations of commercial banks on a yearly basis (A3). One interviewee mentioned: *'So there is no point for the bank not to follow the regulations of the Bank of Thailand. They don't want to get into a blacklist'* (A5). Also, it was mentioned that only a few banks were active in the small-scale retail lending business (A3; B3). Further, international organisations stressed that the conservative and hierarchical Thai/Chinese culture hinders innovative thinking (IO7; IO3). *'They are well educated, but they lack creative thinking [...] A lot of the bankers here because of the hierarchy thing they are scared to death to say yes or sign something'* (IC8). Also, the possibility that Thai bankers might be sceptical towards foreigners was mentioned: *'Thailand in many ways has a, I don't want to use the word prejudice ... but they are Thai first [...] if I don't understand something or I don't know something I am not going to ask a foreigner ... I am going to ask a Thai person'* (IC8). Some interviewees agreed: *'Definitely we do not call IMF as a donor [laughter]. They are agenda driving'* (A5). It was pointed out that after the financial crisis, international financial institutions could have a 50% share in Thai banks over a maximum of 10 years but then had to sell their shares (G9). Currently, international banks are mainly shareholders in large Thai banks (G9).

6.2.3.3 Electricity sector: Failed electricity service industry reform

The electricity sector is still monopolistic and centrally governed. The size of EGAT and political instability keep the electricity supply centralised. Even though efforts in gas production, which comprises the largest part of the electricity mix in Thailand, have increased, Thailand's electricity production it is still dependent on gas imports from neighbouring countries (IEA 2016).

The incomplete electricity service industry reform saw EGAT remain a state enterprise. The Ministry of Energy was created in 2002. National Energy Policy Office was integrated into the Ministry and became the Energy Planning and Policy Office (EPPO) and thus lost its political influence. In 2003, the cabinet revoked some of the privatisation plans, but still kept its commitment to privatise EGAT (Greacen 2004). In 2007 due to union protests and a military coup in 2007, all attempts to privatise EGAT were cancelled (Wattana, Sharma & Vaiyavuth 2008). As a small counterbalance to EGAT, the Energy Industry Act was passed in 2007 and the Power Development Fund and the Energy Regulatory Commission were established in 2008 (Wattana, Sharma &

Vaiyavuth 2008). As mentioned in Section 4.2.2, EGAT lost the financial source for its EE efforts (Koomsup & Sirasoontorn 2008).²³ While EGAT was able to continue its DSM programmes, it had to apply for annual funding for the ENCON Fund. Private electricity producers reduced EGAT's electricity production from 89% of total production in Thailand in 1995 to 49% in 2006. However, EGAT still owns about one-third of the electricity utilities. EGAT has assets of US\$10.8 billion and 32,000 employees, with another 33,000 working for MEA/PEA (Smith 2003). Wattana et al., (2007) argue that the privatisation effort failed due to different influences: international calls for privatisation, economic and financial crises, the processes of neoliberal democracy, and the vested interests of public-private actors (e.g. Petroleum Authority of Thailand (PTT) Public Company Limited).

The potential for EE implementation is still high in Thailand, especially within SMEs in the manufacturing sector and the commercial building sector. In 2011 Thailand imported 50.4% of its fossil fuels (in 2011 it was 50.4%). As illustrated in Figure 28, from 1990 to 2013, Thailand has seen continuous growth in total final energy and total electricity consumption. The manufacturing sector increased its consumption the most, followed by households and the service building sector. In 2013, the sectors which consumed the most electricity were the industrial sector and the services sector (buildings) at 41.75% and 34.94%, respectively (TGP-EEDP 2015a). In 2013, 97.2% of all enterprises in Thailand were classified as SMEs (ADB 2014). A study estimated that the EE investment potential in the industry and service sectors was around US\$410 million with a payback period of two to three years and in the commercial sector the EE investment potential was about US\$706 million, but with longer payback periods (three to six years) (ReEx Capital Asia 2011). In 2011, Thailand still used more than double the energy per unit of output as Germany (Berger 2011). Obstacles to implementing EE measures in the industry sector might include the diversity of company sizes, as well as the 24-hour operation of facilities.

²³ The mechanism, called the Ft, included some different cost elements, one of which was for DSM programs. The DSM component was a tiny share of the Ft.

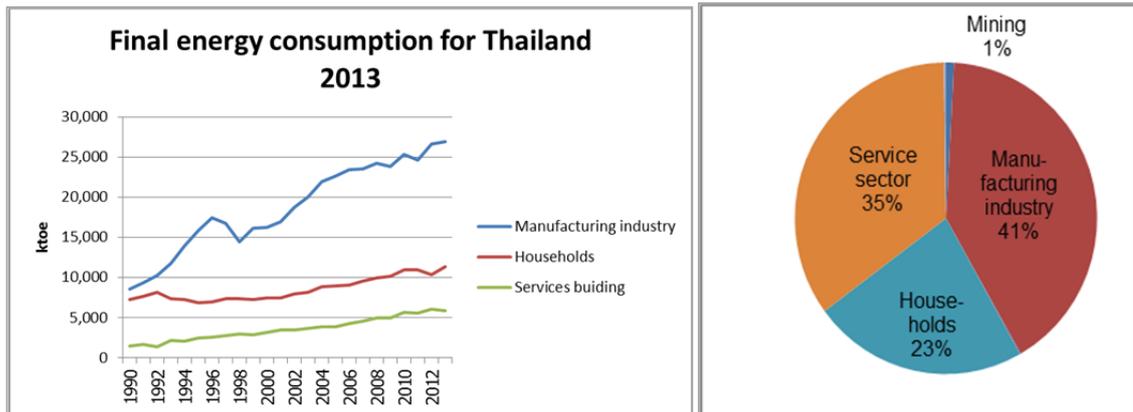


Figure 28: Energy consumption development in Thailand (Source: EPPO) and Electricity consumption in Thailand in 2013 (Source: DEDE)

Interviewees agreed that due to the incomplete reform and the transition of Thailand into an emerging economy caused a lack of capacity and enforcement of EE regulations. Thailand’s move from a developing to an emerging economy corresponded in a drop of technical assistance from international organisations. Several interviewees mentioned that the slowdown in EE projects was caused by the shift from the EGAT to the new and inexperienced Ministry of Energy and the lack of technical international support, (A5; IC1; IC3; A1; ESP1).’ *The whole environment has changed. They have lost and EGAT has been taken away some power. After establishment of Ministry of Energy and the Energy Regulatory Commission they are weakened. Both organisations have not built up their capacity; they do not have their strength*’ (A5). Also, half of the Thai interviewees mentioned that the lack of enforcement of EE regulations was caused by the institutional mess created through the incomplete reform of the ESI.

During the verification workshop of Field trip I, participants agreed that the institutional set-up of the EE policies is a ‘mess’. As can be seen in Figure 29, EGAT is not directly linked to the Ministry of Energy, whereas MEA and PEA remained under the Ministry of Interior. During Exit workshop of Field trip II it was explained that the spread of authority for EE across different Thai institutions hinders the enforcement of EE regulations. For example, the Energy Building Code of Thailand provides a mandatory building standard for new buildings. Licences for new buildings are issued by the Department of Public Works, under the Ministry of Interior (Surapong Chirarattananon, 2011). However, so far, the criteria in the building standards from Public Works department do not include

the energy building code requirements (A2; A5). Thus, the institutional set-up was announced to cause a ‘mess’ in regards to implementation of EE regulation.²⁴

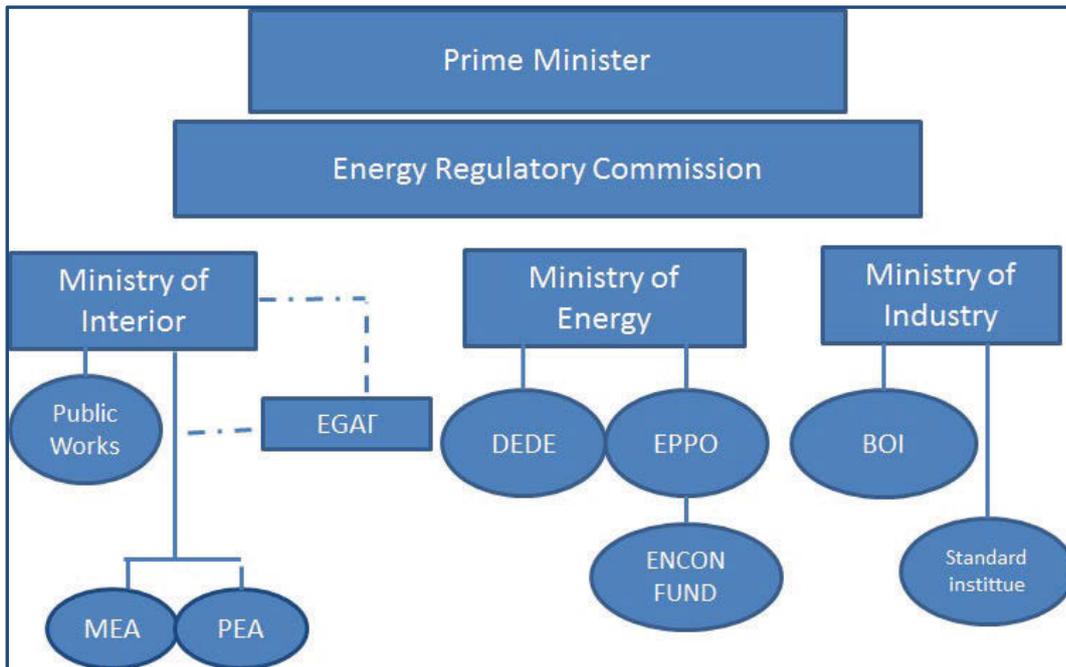


Figure 29: Spread of institutions involved in the governance of the electricity sector in Thailand (verified during Exit Workshop I)

6.2.4 New reforms in the energy sector due to the military government

The recent policy developments in Thailand provide hope for a new, fresh focus on EE and supporting legislation and incentives. Since May 2014, a military government has been in power (BBC 2014). In the beginning of 2015 the Energy Efficiency Development Plan (EEDP) was revised. The Thai government raised the energy intensity reduction target from 25% or 38,200 kiloton of oil equivalent (ktoe) or up to 30% or 56,142 ktoe by 2030 based on 2010 levels (Pichalai 2015). Also, as can be seen in Figure 30, for the first time EE is seen as one of the pillars of overall energy development (Kaewtathip 2015).

The interviewees reported that the military government stopped most of the previous government’s programmes, and undertook a comprehensive reform process. In particular, it was mentioned that all programmes under the ENCON Fund were stopped and evaluated (B4; G6; G9; ES3). *‘The ENCON Fund is now very closely monitored by*

²⁴ Comment by a professor at the exit seminar of my Field Trip I

the military' (ES3). Interviewees mentioned that the government will be promoting a tight administration of the national budget, a move which will benefit efforts to increase private sector investment (G6; IC7). Also, an official from the Ministry of Energy mentioned that they would like to separate RE and EE efforts (IC7).

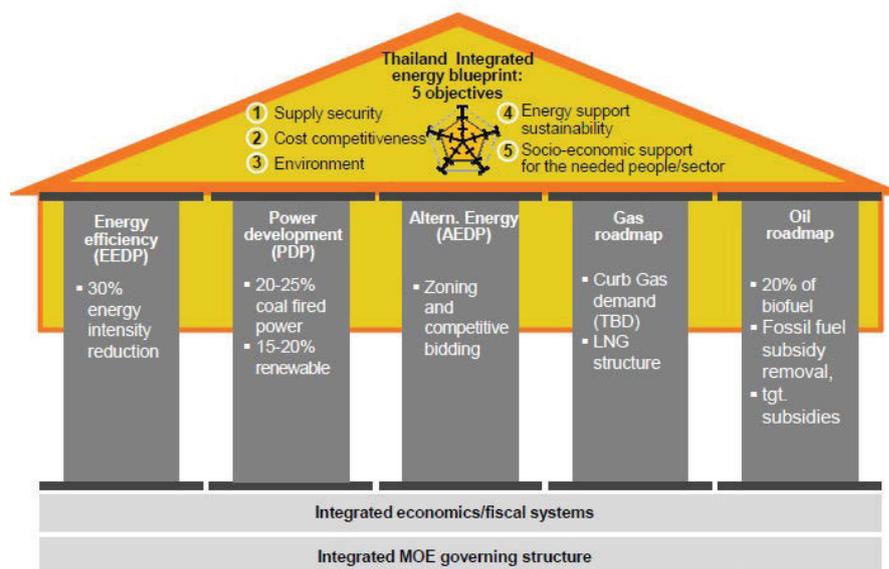


Figure 30: Summary of Thailand Integrated Energy Blueprint (Kaewtathip 2015)

6.2.5 Outcome of the I regime analysis overtime

The analysis over time indicated current challenges and efforts in the electricity sector. The early efforts in Thailand via the ENCON Act in 1992 and the ENCON Fund in 1995 provided clear EE targets and a conducive regulatory framework. However, also some of the challenges were found concerning its institutional set-up, lack of capacity, enforcement and problems with public sector funding.

The analysis over time indicated that the 1997 Asian financial crisis had a profound impact on the financial sector by causing it to become concentrated, heavily regulated and conservative which might hinder the emergence of innovative EEF mechanisms.

Finally, political instability in Thailand has caused problems for the electricity regime. Reforms of electricity services in Thailand have not yet been completed and any efforts to do so will face institutional challenges. The current reform process under the military government, however, might provide a new 'window of opportunity'.

In addition, the analysis over time revealed how much influence transnational/international organisations have had on the institutional and regulatory arrangements in the electricity and the financial sectors of Thailand. The World Bank provided loans early

on for large energy power systems. The IMF initiated a financial liberalisation reform process. Combined with a lack of governance this led to the financial crisis of 1997. The IMF, coming in after the financial crisis of 1997 forced a privatisation of the electricity sector, which was only partially successful. This reform caused institutional developments that make enforcement of EE legislation difficult up until today. Also, technical capacity building by bilateral organisations can have an impact. The World Bank for example decisively influenced the term ‘energy conservation’ that is still prominent in most EE legislation today and combines both EE and RE efforts under one term. Also, the lack of technical capacity can be noticed in the young Ministry of Energy. Some interviewees referred this back to international technical support efforts that stopped once Thailand moved from a developing to an emerging economy, which coincided with the shift from EGAT to the Ministry of Energy.

Next, we will use the results of the analysis over time to reflect on the framework conditions identified in the literature review that might influence EEF.

6.3 Are the framework conditions in the Thailand case study conducive to EEF?

In this section the interesting insights from the analysis over time will be compared to the conducive framework conditions identified in the literature. The results are summarised in Table 12 and discussed in more detail below.

Table 12: Comparison between the framework conditions identified in the literature and in the Thailand case study

Enabling Environment	Literature review	Thailand case study
Electricity regime	<ul style="list-style-type: none"> ▪ EE technology and capacity (DeT'serclaes 2010) (1&2). ▪ EE targets (DeT'serclaes 2010; Taylor 2012) (3). ▪ Institutional energy governance and influence of international organisations (5). (Baker, Newell & Phillips 2014; Taylor et al. 2008) ▪ High energy price (6). (DeT'serclaes 2010) ▪ Demand for EEF (Limaye et al. 2012) (6). 	<ul style="list-style-type: none"> ▪ Technology not voiced as a problem ▪ EE legislation in the 90s strong and now starts again. ▪ Messy institutional set-up ▪ Strong international influence in setting up the electricity and finance regimes ▪ Energy price stable and not high enough. Partially subsidised SMEs in manufacturing and building the main EE potential ▪ Large commercial buildings and industry existing customers ▪ 99.3% electrification

Finance regime	<ul style="list-style-type: none"> ▪ Capital is available (Wattana & Vaiyavuth, 2007) (4). ▪ Diversified banking sector, with experience on small-scale finance (Taylor et al. 2008) On lending are supportive of EE (IFC 2015) Green energy legislation (Taylor 2012) (5). 	<ul style="list-style-type: none"> ▪ Capital not available: closely governed and very tight and strict regulations. No outsiders allowed ▪ Financial regulations very tight and lending practices/underwriting criteria very strict ▪ Green finance legislation is non-existent ▪ International: liberalisation reform influenced the financial crisis.
Political system/external events (landscape)	<ul style="list-style-type: none"> ▪ Stable political systems are conducive to viability of investment (DeT'serclaes 2010; Verbong et al. 2010); ▪ Sovereign risk in emerging economies can hinder investment (DeT'serclaes 2010) ▪ Contract enforcement needs to be strong to be able to outsource (Taylor et al. 2008). ▪ Influence of international organisations (Djiby-Racine & Moll 2012; Hansen & Nygaard 2014; Sarkar & Singh 2010) 	<ul style="list-style-type: none"> ▪ Political turmoil – surge for democratic monarchy – privatisation ▪ Sovereign risk high ▪ Contract enforcement – the possibility to outsource EE services – mixed results.

6.3.1 Framework conditions in the electricity sector: Good targets, technology capacity, but low energy price and lack of capacity and enforcement of the regulators

The analysis over time above examined the early efforts of Thailand to move energy conservation forward but also outlined some of its challenges such as the institutional set-up, the lack of capacity, enforcement and problems with public sector funding. Further, due to low electricity prices the private sector still does not see the potential for EE. One academic summarised the current situation as not very progressive: *'We used to be very sophisticated compared to the neighbouring country but now we lag behind'* (A5).

6.3.1.1 Good technology and EE technical knowledge available in Thailand (dimension 1 and 2)

The need to have effective EE technology, and the need for competent service providers have been named as important factors for EE projects to happen (DeT'serclaes 2010).

Due to international technical capacity building, a good basis for EE technology and advisory services was provided. International organisations provided capacity building for EE audits and technologies from the late '90s. For example, the World Bank founded the Energy Conservation Centre of Thailand and supported a large demand-side management programme under EGAT. SIDA and GIZ provided technical capacity building to train energy audit service providers in the late '90s and early 2000s. Therefore, energy service providers and EE technologies are available in Thailand. But as also noted in Chapter V, some interviewees mentioned the lack of capacity of energy service companies (ESCOs) to provide holistic and not just technology-focused services.

6.3.1.2 EE regulation and targets exist but are not enforced (dimension 3)

The regulatory framework is crucial to progress in EE demand and technology, to encourage service providers to adapt their services. For example, in China the demand for EEF exists largely due to the strong and long-term energy conservation targets and government policies outlined in the 'Five-Year Plan from 2011 to 2015' (Taylor 2012). Long-term, implemented regulations, as well as implemented energy performance standards and building codes, enable firms to invest in new technologies and services (DeT'serclaes 2010; Djiby-Racine & Moll 2012; Rock et al. 2009). The outsourcing of energy services depends on whether contracts can be enforced (Taylor et al. 2008).

In Thailand, clear EE targets and energy conservation projects since the 1990s, via the ENCON Act and the Energy Efficiency Development Plan, have implemented strong EE reduction targets and put appropriate measures in place via the designated building and industry programmes.

Recent literature from emerging economies also stresses the importance of institutional set-up and the political system of the energy market. Moll (2012, p. 127) talks about the 'multilevel stakeholder governance' and (Smith & Raven 2012, p.1030) describe it as a 'global-local network' that contributes to the 'empowerment' of regimes to move them into the mainstream market. Gee and Mcmeekin, (2015) argue that the institutional set-up and the political context influenced the way biofuel support programmes developed in Brazil. The close relationship between large firms and the government were named as the main reason why sustainable technologies were adopted (Rock et al. 2009).

6.3.1.3 *Lack of governance and enforcement – ‘it is a mess’²⁵ (dimension 5- industry structure)*

As mentioned above, half of the Thai interviewees mentioned the lack of enforcement of EE building code and a lack of pressure to industries to implement EE measures. Many saw the main reason for this in the incomplete ESI reform described above. Also, interviewees said that most policies are voluntary (B1; A3): *‘I think the regulation or the law in Thailand is kind of voluntary basis, is not mandatory some country they already enforce the law, already, but in Thailand, Thailand very relax right now’* (B1). Problems about who is empowered to enforce regulations were also recognised in research in the Netherlands where the lack of necessary control reduced the demand for EEF (Voß et al. 2007). Policies can cause markets to develop, but they also need to be enforced.

Further, it was noted by the interviewees that while the ENCON Fund was a key measure to support the early EEF initiatives, it also became one of its challenges. The inability to monitor and shape the programmes more dynamically over time hindered real capacity building. The conservative, long-term membership of the ENCON Board was named as the primary reason.

6.3.1.4 *Market and user patterns (dimension 6)*

The efficiency potential in Thai industry and buildings is still high, but due to a governed energy price, lack of mandatory regulations and small share of overall electricity costs the demand is limited.

Governed energy price – mixed feelings about impact

The national energy price influences the economic aspects of EEF models and thus a high energy price provides a strong signal to the private sector that investments into energy conservation measures are profitable (DeT’serclaes 2010).

The electricity price in Thailand has been centrally governed and it is unclear if so far it has been high enough to cause private sector EE consideration. Interviewees were divided whether the electricity price was high enough to incentivise the private sector to implement energy conservation measures, even though it had been increased and fluctuated more over recent years. In the ’70s, electricity prices were kept low, and this continued well into the late ’80s (Chirarattananon 2011). A Liquefied Petroleum Gas (LPG) subsidy is still in place and some businesses have switched to this cheap fuel (F1). The MEA still provides finance to assist the rural, poorer customers of PEA via

²⁵ Comment by a professor at the exit seminar of my field trip I

cross-subsidisation (Koomsup & Sirasoontorn 2008). Therefore, interviewees and workshop participants agreed that so far, the energy price has not reflected the production costs. *'Thailand has high electricity price but still lower, compared to Cambodia, and the Philippines'* (IO5; B1). Some interviewees believe that businesses do not implement EE measures as energy costs have been stagnant for too long (B1; A5). However, three interviewees mentioned that costs have fluctuated and gone up over recent years. *'The energy price comes in play, once in a while, once previously was once every say 10-15 years but now is more, quite more often than that right? So every two to three years we have a significant spike or significant movements in the energy price'* (F4; B1; IC7; The Nation 2012; Shoane 2013; The Nation 2014).

Potential EEF customers

Thai SMEs in the commercial building and industry sectors have a lot of EE potential, but government regulations only partially target them. The designated industry and designated building programmes target high electricity consumers who might have access to finance but lack technical expertise. Most industry and commercial building enterprises are SMEs and are not targeted under these policies.

6.3.2 Framework conditions in the financial sector: banks dominant, start of diversification, heavily regulated, hierarchical/inward looking culture

As shown in the analysis over time, the 1997 Asian financial crisis had a profound impact on the financial sector, causing it to become concentrated, heavily regulated and conservative. This might hinder the emergence of innovative EEF mechanisms.

6.3.2.1 Typography (dimension 5: Industry structure)

Asian economies are characterised by incomplete financial markets, where not all financial instruments such as bonds and stocks are liberalised or available (Taylor 2012; Unger 1998). The financial sector is shaped by the national and international public sectors (Taylor et al. 2008). For example, in the case of the China Utility-Based Energy Efficiency Finance Programme (CHUEE) EEF programme in China, international organisations (World Bank, IFC and GEF) provided a loan guarantee scheme for local banks. GEF covered 50% of the first loss, up to around \$8.4 million. The project generated 42 times this amount in private sector investment (Selmet 2012). Therefore, in each case, the current state of the financial market and its actors needs to be identified.

Currently, Thai financial institutions are dominated by the commercial banking sector and the specialised funds. The 1997 Asian financial crisis caused a fundamental change in the composition of financial institutions, especially on international ownership and the number of firms involved. Most banks are Thai, with international shareholders operating in the background. Interviewees mentioned that access to capital is difficult as Thai commercial banks have different target customers compared to the customers most in need for external EEF. Besides loans from commercial banks, bonds and the stock market have also developed since the financial crisis in 1997. However, interviewees mentioned that it is hard to access these markets due to the very strict regulations by the Bank of Thailand. Since 2010, the private sector branches of development banks such as the ADB and the IFC have approached Thailand to become active in the sustainable energy field.

6.3.2.2 Regulations and rules of the financial sector (dimension 3)

The literature shows that financial regulations can both disable and enable EEF models in Asian emerging economies (DeT'serclaes 2010). Asian emerging economies are at times heavily regulated to support rapid economic growth (Taylor 2012). For example, in China the financial markets are nationalised and the government mandates interest rates and gives advice on risk assessments (Taylor 2012). But nationalised financial markets can also have their benefits for EEF. For example, China established a green finance policy which provides a guideline to banks to integrate green credits into their portfolios (Taylor 2012).

Because of the financial crisis in 1997, the Central Bank of Thailand resumed its control over financial institutions and governed them very tightly. No green credit policy exists. There are some promotion initiatives to provide SMEs with easier access to capital. For example, the Thai Credit Guarantee Corporation provides guarantees to commercial banks. So, the finance sector is heavily regulated and so far, does not include any environmental lending considerations.

6.3.3 Broader structural characteristics: Political turmoil and slow legal system (landscape)

The increased risk of investments in a politically unstable environment has long been recognised. Instability can influence investment decisions, whereas a politically stable environment greatly minimises risk for private sector investors (Irwin et al. 1997). For example, in India sudden policy changes to the ESCO market and the electricity system have discouraged foreign investors and technology providers from becoming active in EE (DeT'serclaes 2010; Patankar, Patwardhan & Verbong 2010). The effectiveness of

the judiciary, the risk of contract repudiation, the absence of corruption, and the risk of expropriation are all factors that influence creditors' rights (Esty & Megginson 2003; Taylor et al. 2008). For example, Taylor et al. (2008) showed that India and Brazil have the weakest institutions for contract enforcement and this makes outsourcing of EE expertise difficult.

The landscape and regime analysis over time has demonstrated that Thailand has experienced political turmoil for the last 30 years, and most energy conservation policy reforms have been introduced during periods of military government. As the analysis above shows, politics in Thailand involves balancing royal, military and bureaucracy. The incomplete democratisation processes in the Thailand case study have caused problems for the electricity sector. For example, the failure of the privatization of the electricity sector can be attributed to the political instability of the 2000s. Interviewees suggested that the current military government due to its 'technocratic' military/elite regime and non-political characteristics might provide a new opportunity for Thailand to advance energy conservation policies and an increase of private sector participation. The interviewed service providers believed the legal system to be working, but complained that at times legal processes were slow (ES3; ES1).

In summary, the analysis showed mixed results regarding the readiness of Thailand for EEF. Clear EE targets and energy conservation projects since the 1990s have built up capacities and technologies in the EE service and in organisations providing advice on EE. However, the demand for EE within the industry and building sectors is still limited due to the subsidised energy price and low EE legislation enforcement.

A tightly governed financial sector could be a hindrance to the development of more innovative financing schemes. After the traumatic experience of the financial crisis in 1997, the Thai government started to regulate the financial sector heavily. Capital is scarce, due to the very strict underwriting criteria for lending. Also, it is difficult to establish alternative financial institutions. So far there has been no regulation on green financing.

The broader context in Thailand seems challenging for EEF, but recently there has been some indication that positive change is possible.

6.4 Conclusion

This chapter reviewed the framework conditions in Thailand by elaborating how the electricity, the financial sectors and the political development in Thailand have developed over time.

The results of the literature review, focused on important framework conditions for EEF, indicated that the financial sector and overall governance are as important as electricity framework conditions. The international literature stresses that electricity frameworks are relevant to the creation of markets for EEF products. However, in an emerging country context the composition and condition of the financial sector also influences which EEF products can be developed. Governance aspects, such as legal systems and political stability, will also influence whether long-term demand and implementation of EEFs can be ensured.

The analysis of the electricity and financial sector regime over time in Thailand brought interesting insights. It revealed the strong role that international organisations play in setting up and developing the financial and electricity sector. It also showed that political stability can also provide windows of opportunity for sustainable pathways such as EE. The IMF initiated financial liberalisation and the ESI reform process. Liberalisation led to the financial crisis, which led to the closed, tightly governed financial sector of today. The ESI reform process is incomplete and causes challenging institutional framework conditions for electricity and energy conservation governance. The findings are consistent with findings from the literature which indicate that in developing and emerging countries, it is crucial to pay attention to what international organisations have done.

The results also confirm that in an emerging country context, regime instability does not always lead to penetration of sustainable initiatives. The analysis revealed that due to periods of political stability, brought by military governments, the most decisive energy conservation legislation and programmes were initiated. Stability is seen here as crucial. In the last 50 years in Thailand there have been periods of democracy interspersed with military or elitist regimes. It is interesting to note that major energy reforms, such as the ENCON Act and the establishment of important institutions such as the Ministry of Energy and the Energy Regulatory Commission of Thailand, have occurred under the military rule. Military governments in this context seem to have provided stability. This finding also confirms transitions literature from emerging countries which indicates that

too much instability, for example during the electricity service reform, can lead to imperfect outcomes (Verbong et al. 2010, p.279).

Finally, the question of whether the framework conditions in the Thailand case study are conducive to EEF was explored. It was found that the identified framework conditions were useful as a point of analysis.

The EE targets and the current investment potential of EE provide positive expectations towards EEF mechanisms. The high EE potential in the manufacturing industry and the commercial and public building sector indicate a possible demand for EEF products. Also, the early adoption of EE legislation, financial support and targets in 1992 indicates the early capacity building efforts of the government. For example, the EE building code was proposed as early as 1987.

However, the consistently low energy price and a lack of enforcement of legislation are currently preventing increased demand for EEF. Subsidies and the oil fund have kept the electricity price stable over the last two decades. The current imperfect institutional set-up hinders EE legislation enforcement. Also, legislation still provides limited guidance for SMEs, which seems the largest potential stakeholder to increase EE. Thus, the demand for EEF might be limited.

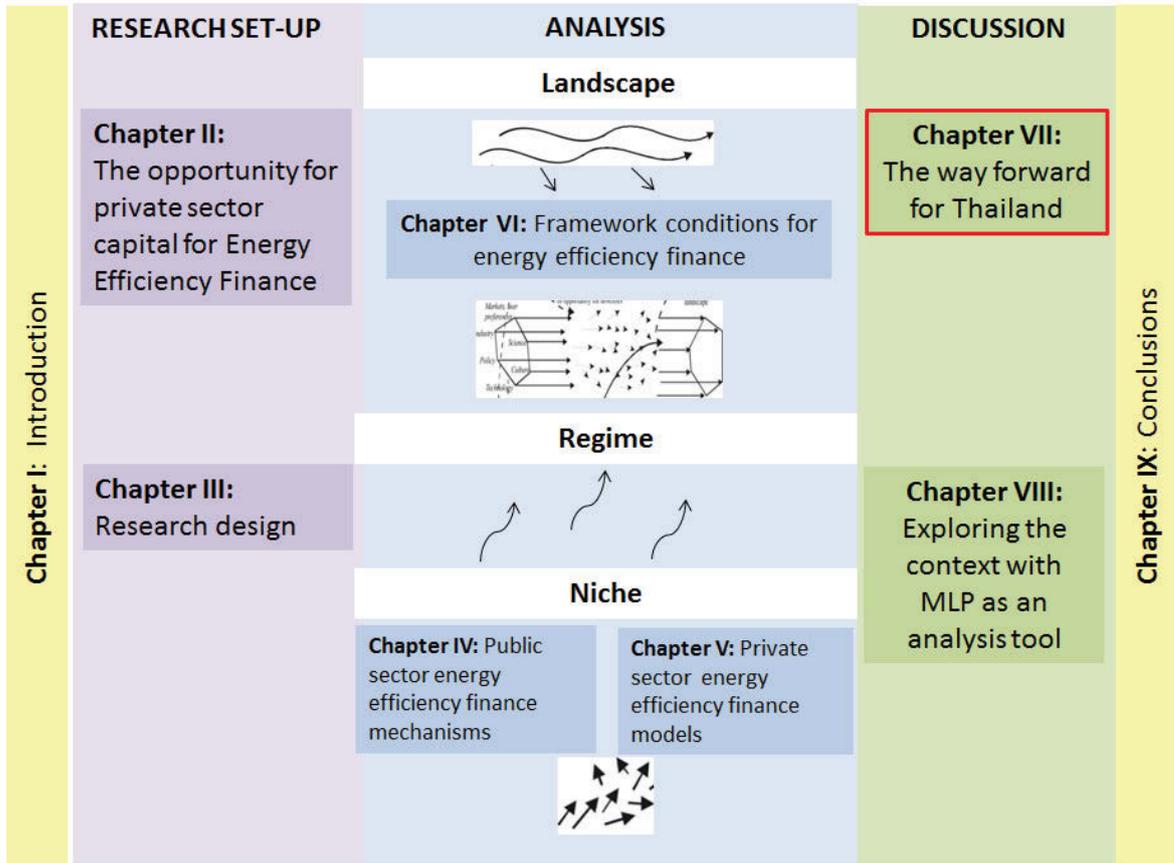
The analysis of the financial sector in Thailand revealed that there is a disconnect between financial governance and EEF. The financial sector is still developing. It is heavily regulated by the Ministry of Finance and it has a conservative and inward looking culture. Even though the financial sector is starting to diversify, the banking sector is still prominent. The banking sector is heavily regulated by the Central Bank of Thailand, because of the financial crisis of 1997. No green finance regulation exists and therefore capital is scarce. Also, the very strict underwriting criteria of lending and difficult regulations hinder the set-up of alternative financial institutions. Interviewees also mentioned that the rather apolitical, hierarchical and closed culture of the bank representatives restrict the development of new, innovative financing schemes such as EEF.

As a result of this analysis, a possible recommendation to policy makers in developing and emerging economies or development banks would be to pay particular attention to the status of the financial markets, international historical influences and the political systems of countries.

The usage of the seven dimensions suggested by the MLP framework was useful. While the regime analysis using the seven MLP dimensions over time was time consuming using this structure brought rich insights into the operation of the current EEF system. For example, the investigation into the existing EE regulations and the failure to enforce them revealed a possible lack of demand for EEF by the targeted group. As can be seen from Table x so it is interesting to see that the research could obtain any information on cultural and symbolic meaning.

Having looked at the EEF initiatives, and analysed the framework conditions, the next chapter will provide the way forward concerning public and private EEF mechanisms and models in Thailand.

Chapter VII: The way forward for Thailand



7.1 Introduction

This chapter draws on the findings of the previous three chapters, and provides suggestions about how the Thai public sector could support EEF further in Thailand.

Chapter IV and V indicated that the overall state of public and private EEF mechanisms and models can be described as still in the ‘development phase’. So EEF is still government driven, and government has so far been unsuccessful in obtaining sufficient additional private sector funding. In chapter IV and V it was found that EEF is still mainly driven by government initiatives. Private sector initiatives seem in need of further capacity building and public sector support. In transition studies terms, EEF is on a ‘reconfiguration path’, in that a diverse range of EEF initiatives compete with the existing practices of the electricity and finance sectors (Geels & Schot 2007). Overall, private EEF models are still fragile. EE lending needs greater institutionalisation and guidance from the Ministry of Finance. ESCO-arranged finance is lacking in terms of the quality of ESCOs and their access to finance. Lastly, EE leasing needs more government recognition and thus future support is unpredictable. Overall, there is a mismatch between the largest potential customer cohort for external EEF, namely SMEs, and EEF offers which cater mainly for large industry and buildings.

Chapter VI highlighted some of the positive developments and current challenges of the existing framework conditions in Thailand. The Thai government, supported by international organisations, has been building up capacities for EE and EE technology since the early '90s. There are also clear EE targets for the public sector. However, due to incomplete privatisation efforts, which were largely driven by international organisations, the institutional set-up in Thailand case study is in disarray. Therefore, enforcement of EE regulations such as building codes and standards is difficult. Further, the financial sector remains tightly governed due to the Asian financial crisis in 1997. In addition, the analysis in this study found that political turmoil has sometimes provided ‘windows of opportunity’ but can also hinder long-term policies or investment.

These findings on Thailand lead this chapter to consider the following and final research question:

‘How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?’

The Multi-Level Perspective (MLP) analytical framework has some limitations in providing concepts to analyse the way forward. Geels and Schot (2007) argue that a sustainability initiative is fully developed if (a) the design represents all of the learning processes associated with implementation (b) powerful actors are involved in the network; (c) price signals have improved the viability of projects and (d) the market share of the sustainable technology is between 5% and 20% of the original market. However, MLP does not provide any information on how the public sector can assist to accelerate and support the transition.

Preliminary empirical research and grey literature have suggested four specific mechanisms to enhance existing efforts to support EEF:

- introducing de-risking support measures (Limaye et al. 2012; Painuly et al. 2003; Taylor 2012);
- guidance from the central bank and the finance ministry (Limaye et al. 2012; Painuly et al. 2003) and
- seeking collaboration with international organisations/funds (Rock et al. 2009; Taylor 2012).
- market creation by assisting with project pipelines and communication (IPEEC 2015; Sarkar & Singh 2010; Taylor et al. 2008);

To identify possible next steps for EEF in the Thailand case study, two levels of analysis and synthesis are presented: (1) Suggestions from the interviewees on how to improve the situation will be summarised and (2) by comparing the suggestions with the findings from the broader framework analysis of Chapter VI and findings from exit workshops, three concrete options will be discussed: (a) development of a guarantee mechanism; (b) a standard offer programme and (c) a public sector buildings programme. International examples will strengthen the arguments made.

An interesting finding is that despite special attention to specific EEF initiatives, it is almost as important to create the demand for EEF initiatives via a public sector programme or enforcement of EE legislation. This also resonates with recently emerging literature on EEF support (IPEEC 2015).

7.1.1 Suggestions for additional public sector support for EEF

This section will present the ideas suggested by research participants about how the Thai government could further support EEF. The information is structured according to comments made on the specific EEF initiatives and necessary changes to the framework conditions. Finally, some recommendations that go beyond the existing EEF

initiatives are listed. For the representation of interviewees, the codes described in **Error! Reference source not found.** and Table 5 of Chapter III will be used.

7.1.1.1 Direct EE bank loans

Commercial loans are currently one of the main sources of finance for EEF: *'Most EE investments in Thailand are currently done via balance sheet financing or corporate loan' (IO6)*. So, this financing model becomes important and synthesised below are the perceptions of the interviewees concerning measures that would further support the supply of EE lending services.

Increase the investment size of EE projects

One of the main reasons banks are reluctant to provide EEF services is the small investment size of EE projects. Two suggestions were made to increase the project size: (1) combine RE and EE measures in one financial project and to (2) aggregate similar EE projects via ESCOs.

International consultants stressed the option of combining RE and EE measures in one financial project to increase the investment size. This approach was seen to be a win-win for RE and EE projects. RE technologies, which are usually costlier than EE technologies, are usually large enough to attract finance, but payback periods are usually too long. If they are combined with EE, which has short payback periods, both types of projects would benefit (IC5; IC8): *'If you blend it together you might get a payback period five years, which is much more acceptable' (IC5)*.

Another option to increase investment size would be to collaborate with ESCOs on specific EE projects where they could develop pipelines and aggregate the projects. International experts recommended the development of sector- or technology-specific project pipelines that could enable the aggregation of projects (IC5; IO6). Further, it was recognised that ESCOs and energy service providers could assist in aggregation, evaluate savings proposals for banks, and assist with bidding processes (B2; IC5): *'Existing customer that have a problem about the higher cost of energy consumption or fuel consumption and energy costs, we will talk to ESCO company to help them' (B2)*. Due to recent problems with ESCOs, international experts also suggested universities such as Chulalongkorn University, the Joint Graduate School of Energy and Environment, and the Asian Institute of Technology as possible sources of support.

Increase the capacity within the banking sector

Technical training programmes for banks were seen as essential for monitoring and educating CEOs about the opportunities provided by EEF (B1): *'I think to educate top*

manager, (executives, CEO) CEO, like CIMB I think, their executive' (IC2). Banks and international consultants suggested that regional training and the involvement of development banks might be more effective than training provided by the Thai government: *'Government also do a lot of capacity building but in the wrong way I think'* (B1). Regional training, especially peer-to-peer exchange, has been reported as very effective (IC8). Further, the involvement of development banks might help to raise awareness at the higher staff levels of banks (IC3). But, it was noted that the shift to EEF will not happen overnight: *'if you want to change the behaviour [...] it will take at least, one generation, 50-60 years meaning one generation'* (IO6).

Suggestions were made to focus public sector EEF mechanisms to incentivise project finance and reach new customers. Interviewees noted that banks need to engage in project finance so that customers do not have to be judged solely on the collateral they can offer. *'The difference is that when you look for corporate. You look for the other activities and revenue from other activities itself. But in the case of project finance, it just concentrates on the project itself. It does not concern on the market or the customer'* (IC7). Therefore, interviewees made the following suggestions: (1) provide ENCON Fund finance for targeted loans via the SME Bank to provide EE loans for SMEs and (2) ensure that finance from the Energy Efficiency Revolving Fund (EERF) focuses on project finance and new customers (A1; G3).

Improve the framework conditions for EEF

Develop a green lending policy

To promote project finance and change banking behaviour it was suggested that the Ministry of Energy collaborate with the Central Bank of Thailand and the Ministry of Finance to develop appropriate guidelines and policies (A5; IC8). Particularly due to the tight fiscal rules in Thailand, policies are crucial for guidance. Policies could guide the banks to develop internal guidelines or policies for a new business approach (IC8): *'Policy drives credit so you have to have the policy first and the policy is dictated by the Central Bank of Thailand'* (IC8). However, two interviewees raised concerns about whether policy alone will be sufficient, given the Thai culture and the current disconnect between banks and customers: *'The government side make a policy or the law but if there is a disconnect, they can't filter it to the bank. Then here lies your problem'* (L1; IC8).

7.1.1.2 ESCO-arranged finance

Thailand has an existing ESCO market, but it lacks creditability and finance. Interviewees suggested several options for government to provide further support. These are elaborated below.

ESCO accreditation body and standardisation (network/learning)

Several interviewees stressed the importance of government assistance for improving the reputation of ESCOs in the eyes of both the banks and the customers (B3; IC5): *'Government needs to assist to educate the market in regards to the cash flow' to both banks and customers' (B3).*

Suggestions were made for the institutionalised capacity building of ESCOs such as standardised contracts, bidding and monitoring procedures (IC5; B3; Exit Workshop II; World Café I): *'The role of government could be in forcing a level of accountability and standards with the ESCOs' (IC5).* To settle the confusion between the FTI and the ESCO Association's definitions of ESCOs, an accreditation body should be introduced (B3). An ESCO reported that there exists a process to some dialogue between FTI and the ESCO Association to align and tighten the criteria over time (ES1). Further, public sector facilitators, who assist customers with the ESCO engagement, could improve relationships between customers and ESCOs (World Café I; Exit Workshop II).

Guarantee mechanism to reduce financial and technical risks of ESCOs

To promote ESCO-arranged finance, it was suggested that a risk-reducing mechanism should be introduced. An interviewee and participants in the workshop called for the development of a guarantee mechanism to reduce the financial or the technical risks faced by the ESCO (World Café I): *'The technical risks cover the risk of EE machinery. The EPC contractor there is no risk covered there. So, if you can cover our technical risk, then the technical risk is managed' (ES1).* This necessitates collaboration between the Ministry of Energy, the Ministry of Finance and the Thai Credit Guarantee Corporation. Also, the ESCO fund could be used in case banks are hesitant to engage. *'If the banks continue not to see it as a business opportunity perhaps the ESCO Fund could serve as a guarantee mechanism' (IC7).*

Public sector programmes to increase the demand for ESCO-arranged finance

New financial mechanisms, in which standards and facilitation approaches could be tested, were mentioned as necessary. *'I would like to see a financial scheme for ESCOs in Thailand' (ES3).*

The interviewees and discussion during the World Café I focused on the creation of a new financial mechanism, namely a super ESCO model, which could provide investment and collaborate with small, specialised ESCOs (IC5; ES2). An ESCO company reported that one of the utilities had started to provide ESCO services and thus could become a super ESCO. However, if the utility did not collaborate with ESCOs, the EE service of the utility might be limited regarding technical knowledge. Further, it was noted that regulations need to be changed to upscale efforts to apply ESCO service in the public building sector (ES2).

The second option mentioned was the development of a public building programme. All the interviewed ESCO companies agreed that a public building programme would have a beneficial effect on the overall ESCO market (ES1; ES2; ES3; F1; IC4; IC6): *'Government needs to take the leader role; so far the government follows the private sector'* (ES3). A government official mentioned that the Ministry of Energy was thinking about such a programme: *'For providing financing in the public sector we want to use the ESCO concept for the public building sector'* (G6). However, interviewees cautioned about the high expectations such a public building programme could have in the ESCO Market. The overall market of government buildings is small, the transfer of EEF into the private sector is difficult and the necessary adjustment of government regulations might take a long time (IC5). Thus, a programme focused around the public building sector could be useful, but might have only a limited impact to the overall ESCO market.

7.1.1.3 Energy efficiency leasing

Private sector EE leasing is still minuscule in Thailand, but has a high growth potential if backed by the government. Interviewees felt EE leasing had great potential due to the option of funding small EE investments and doing it off the balance sheet (C1).

Support via the ESCO Fund (capacity)

Leasing companies and facilitators called for formal recognition of the ESCO Fund to provide capacity building for EE leasing and to work with private sector leasing companies (L1; L2). A facilitator highlighted how the ESCO Fund has already been a great platform for building capacity for EE leasing. However, leasing companies wanted to be involved to increase their learning experience (F1; L1). Involving private leasing companies would also increase the sustainability of the EEF initiative: *'The ESCO fund is public money. You don't know next year if it stays or not'* (L1).

Support via ESCOS or private sector equity firms (network)

Also, interviewees suggested a cooperation between ESCOs and financial institutions

such as leasing firms or equity investors. One interviewee mentioned that collaboration between ESCOs and leasing companies might help: *'ESCO doesn't have the fund but leasing company might have'* (IO2). Another interviewee mentioned that he approached a private sector equity company from Singapore, who specialises in hiring out EE equipment if they would also start operations in Thailand (IC5).

Sustainability of the tax incentive

All interviewees that knew something about EE leasing stressed that tax exemptions and further government support in licensing new EE leasing companies were crucial to sustain and develop the market (C1; F1; IC2; IC5; IO2; IO3; L1; L2). The tax incentive of BOI needs to be institutionalised, which requires the involvement of the Ministry of Finance (G4). The current interest on the part of development banks to get involved in EE leasing could raise the profile of EE leasing so that a dialogue between the government and the private sector might be possible (IO3). Further, a leasing firm mentioned problems in regards to receiving financial licences from the Ministry of Finance to start operating in the leasing business (L2). It was noted by an international expert with experience in the region that EE leasing markets in some Southeast Asian countries have vanished in a very short period of time when government incentives have been changed (IO2).

7.1.2 Recommendations beyond specific EEF initiatives

Below additional EEF initiatives that were mentioned by Interviewees will be discussed.

7.1.2.1 Suggestions for New EEF initiatives proposed by the interviewees

Guarantee mechanism

The policy development most frequently proposed by interviewees from the non-government sector was a guarantee mechanism. This measure would reduce the financial and technological risks for financial institutions (B2, ES1; G1; IC5; L2). Interviewees mentioned that a financial risk guarantee could address the problem of the limited collateral of SME customers (B2; G1; L2; IC5): *'SMEs, this group should be supported by the government. The way to support is related to the financial. So how to guarantee. So, the guarantee is the key thing'* (L2). Further, the current military government with its tight budget was named to be a possible supporter of a guarantee mechanism: *'The time is right, as now we set the restart button for a guarantee mechanism to be implemented'* (ES1). Five interviewees saw the Thai Credit Guarantee Corporation, due to its previous experience with the SME Bank, as an option to develop such a mechanism (A1; B2; ES3; IC7; IO3). Also, collaboration with the ESCO Fund was suggested, so that SMEs could apply for finance while receiving a guarantee from

the Thai Credit Guarantee Corporation (IC7; IO3). Finally, current international interest (e.g. from UNIDO) to support a guarantee mechanism might provide it with the necessary profile (A1; IO2; L2; IC7).

Some additional challenges mentioned were complexity, cross-ministerial coordination, slow collaboration with international organisations and risk-averse government and banking behaviour (I2; A1; IC1). An international financial expert mentioned that the development of a guarantee mechanism is highly complex (IO2; IO7): *'You have to set up rules for a guarantee fund you have to set up the governance for a guarantee fund you have to look at the underwriting criteria for a guarantee fund'* (IO7). Technical details can also be challenging. For example, an energy service provider mentioned one difficulty for technical guarantees would be EE projects in older buildings, due to the unknown history of construction and operation (ESP1). The development of a guarantee mechanism needs collaboration with the Ministry of Finance and also possibly the Ministry of Commerce as they are responsible for administering insurance businesses (G6; IO3). Even though dialogue between the Ministry of Energy and the Ministry of Finance has started, it has so far not resulted in concrete agreements (G6; IO3). Also, it was mentioned that international collaboration might take a long time (B3:IC5): *'Collaboration with the ADB is long and slow and complicated'* (B3). The AFD took from 2008 to 2015 to finalise a lending deal with Kasikorn Bank (IC5). Finally, governments might be reluctant to take responsibility for risk, as it is not possible to predict if the funds will be needed or not, which works against the yearly budget cycle of governments (A1; IC1; G2; G6). This was seen as a problem that applied not just to the Thailand case study but also to other Southeast Asian economies (I2).

Utility standard offer programme

The Thai government seems to be ready to take a new approach to energy conservation via targeting electricity utilities.

Government officials mentioned that there are ongoing discussions to develop Energy Efficiency Resource Standard (EERS)/Energy saving obligations and a standard offer programme (SOP) for utilities to reduce their energy consumption (G2; G3). EERS are energy saving targets that are imposed by government on energy providers and utilities (Crossley et al. 2012; DuPont 2014). A standard offer programme is a public financial incentive for buildings and industries to reduce their electricity consumption (DuPont 2014). The Thai EEDP that specifies the structure of energy conservation mentions the implementation of EERS and the SOP as an incentive to achieve them (Pichalai 2015). Compared to a demand-side management programme, EERS was said to provide more

energy savings and also realise them securely (A1). It was suggested this could also further promote on-bill financing, and collaboration between banks and the two Thai energy utilities (IC6). But legislation needs to be changed to allow utilities to bill customers for EE projects (IC5). However, interviewees seemed optimistic about whether the current government would make progress on its commitment to the Energy Efficiency Development Plan (EEDP): *'It depends on EPPO approving it ... 2013 not so likely but with new director in 2015 more likely'* (G3).

Carbon finance via a nationally appropriate mitigation action

Increased awareness about climate change might also lead to more financial incentives for EE measures using international climate funds. Recent climate catastrophes, such as the extensive flooding in North Thailand of 2011, and international attention have changed perceptions of climate change over the past ten years (ES1; IO6): *'Looking up into these drivers because the flood, the natural disaster, everything is coming from the global warming. You need to take care of that'* (ES1). The Thailand Green House Gas Organisation has recently developed voluntary reduction schemes for Bangkok. Also, the Ministry of Energy and the Ministry of Environment and Natural Resources (MONRE) are starting to talk about possible projects (F4; IO1). Especially considering current tight budgets, international climate funds were seen as potential funding sources (G6; IO1): *'Carbon Finance, NAMAs that I think that what was referred to and could also work for Thailand'* (IO1). However, the difficulty of EE monitoring was recognised (A2). In 2014, Thailand's NAMA proposal for refrigeration and cooling was accepted (MitigationMomentum 2014). Further, the Ministry of Environment and Natural Resource presented a NAMA to further ESCO market support at the COP in Paris 2015.²⁶ Thus, carbon finance might be used to develop some EEF initiatives in the future.

7.1.2.2 Measures that improve the framework conditions

Collaborate with Ministry of Finance and the Central Bank of Thailand

Interviewees agreed that the Ministry of Energy needs to seek collaboration with the Ministry of Finance. One government official from the Ministry of Energy mentioned: *'Last year I made an overview of EEF mechanism and found that somehow one has to involve the Minister of Finance'* (G6). The main areas of collaboration mentioned by interviewees were: (1) Assist with green lending policies and reduce financial regulations (IC8); (2) Develop guarantee mechanisms, especially for SMEs (A1; IO2); and (3) Institutionalise taxes and fiscal policies via the Board of Investment and the Ministry of

²⁶ Bilateral discussion with Kuhn Amapawa, GIZ staff in Bangkok on 15.12.2015.

Finance (A5; L1). For example, it was suggested that the existing guarantee mechanism be expanded under the Thai Credit Guarantee Corporation (TCG) (A5). One ESCO suggested introducing a credit policy such as the one used for agriculture under which 10% of a bank's lending must be directed into that sector (IC8).

The military government might provide a window of opportunity to seek a dialogue and collaboration between the Ministry of Energy, the Ministry of Finance and the Central Bank of Thailand. An ESCO company pointed out that the Minister of Energy in power in mid-2014/early 2015 used to be at the Ministry of Finance (ES1): *'Due to this new constellation we can work more close with the Ministry of Finance because they really know things in finance and they know how to utilise the financing things'* (A5). A government official further explained that under military rule, decisions could be taken quickly, as they do not have to vote or wait for other departments to approve or debate (G6).

Call for mandatory EE programmes

Finance experts pointed out the limitations of grant-based programmes (B1; B3; L1). A financier pointed out most EE policies are incentive schemes and voluntary actions that do not require mandatory implementation of EE (B3). For example, the programme for designated industries and building requires industries and buildings that consume more than 1MW per year to provide a yearly report on their energy consumption. However, there are no formal requirements in regards to EE improvements or implementation (C1). It was recognised that grant money can hinder stakeholder engagement: *'The government just gives; it's not sustainable because the company doesn't have ownership'* (F3).

Improve enforcement of EE policies

Interviewees further suggested it was necessary that the enforcement of the EE building code be streamlined to ensure demand for EEF services. Half of the Thai interviewees mentioned the lack of enforcement as a significant problem in the Thailand case study (B1; A2; A5; G2; IC2; IC5; IC7; IO2; IO3; A1; ESP1): *'Even if you have in the law that everyone has to do it, if they don't do it they have no penalty, no enforcement'* (A2): *'We have a long time the EE building code, but in the factory and building its still now not implemented'* (IC2). It was explained in Exit Workshop I that the Department of Public Works needs to be consulted, as it issues building certificates and does not acknowledge the EE building code. If standards were enforced, project developers could integrate them into their businesses. But an academic pointed out that this currently is not the case: *'You have been to SIAM Paragon, right? There is no EE or RE integrated*

into it. This sort of developers you should incentivise' (A5). Therefore, interviewees suggested that policies across relevant ministries should be streamlined to end the current state of ineffectiveness (A1; A5: IO2: IO3).

Increase electricity price

Broader discussions with interviewees stressed that an increase to electricity prices are another important strategy to increase the demand for EEF services. An international organisation representative said that the government should ensure that the incentive for EE investments is high enough in the private sector (IO5). The electricity price was mentioned by banks and during exit workshops: *'Once people are aware of the increased electricity price the demand comes automatically' (B3).*

7.1.3 Broader findings about the suggestions of the interviewees

The recommendations of interviewees and workshop participants regarding EEF were in many cases specific to particular initiatives, but they also provided broader overall recommendations.

For EE lending, interviewees suggested improving EE lending by trying to increase the size of EE projects by either integrating RE/EE projects or by aggregating similar projects via ESCOs. Further, to change bank officers' perceptions regional training programmes were suggested, as well as the continuation of financial incentive schemes. Finally, the development of a green lending policy was mentioned as the most effective way to change banks' lending practices and promote the financing of projects.

Recommendations to increase ESCO-arranged finance focused on improving the quality of ESCOs by improving standards and building trust between customers and ESCOs. It was interesting to find that interviewees called for further public building programmes that could provide finance and increase the demand for ESCO services.

Recommendations about EE leasing focused on support via the ESCO Fund and ESCO collaboration, as well as the long-term institutionalisation of tax incentives. Even though EE leasing seems the least developed form of EEF in the Thailand case study, its ability to cater to small projects makes it a promising private sector EEF model for the future.

Recommendations beyond existing EEF initiatives included three EEF mechanisms that could be developed: (1) guarantee mechanisms; (2) on-bill financing via a utility standard offer programme and (3) a carbon finance EEF initiative. Further, interviewees called for the improvement of broader framework conditions in the electricity and financial sectors.

Overall, it was insightful to recognise that some recommendations focused on the EEF initiatives themselves but others went beyond this by focusing on measures that would create more demand for EEF, such as a public building programme, a standard offer programme or the enforcement of EE legislation.

Recent discussions of an EEF task group stressed the importance of differentiating between policies that would increase the supply of EEF and those that would increase the demand for EEF (IPEEC 2015). A report which interviewed 30 national, regional and local commercial lenders confirmed that lack of demand is the primary reason why financial institutions do not provide special EE portfolios (Kolstad 2016). This resonates with the findings of the Thailand case study and indicates the importance of also focusing policy attention on creating demand for EEF overall.

Therefore, reflecting on the existing framework conditions and keeping in mind the call for demand-creating measures, the next section recommends three concrete steps that the Thai government could take.

7.2 Recommendations for the next steps for Thailand

Considering the current framework conditions (regime and landscape) as well as recommendations discussed in the exit seminars, the researcher recommends three main public support initiatives: (1) Develop a guarantee mechanism; (2) provide supply-side support for EEF initiatives and (3) introduce an EERS/SOP scheme and develop a broader programme for buildings in the public sector (create demand for EEF initiatives).

7.2.1 Develop a guarantee mechanism (direct support for EEF initiatives)

7.2.1.1 International overview

A guarantee mechanism has been recognised internationally to unlock local financial markets that might be currently unfamiliar with EE lending/leasing. A guarantee fund would provide a guarantee to financial institutions in cases of default payments. It would only be a temporary measure until the financial institutions gained more confidence in the market and its customers (Painuly et al. 2003). As can be seen in Figure 31, in a guarantee programme, the guarantee provider backs the invested capital and can be government or from the private sector. Thus, the guarantee provider does not necessarily have to make any real money transfer to investors; this would only be necessary if the promised return on investment did not occur. In return, the investor pays an upfront or ongoing fee (Venugopal 2012). The fee should match the difference

between the actual and perceived risks (SEF Alliance 2010). The provider of the guarantee acts as an insurer. This would reduce the lenders' risks and their transaction costs as they would not have to spend much time checking collateral for small-scale loans (e.g. to SMEs) (SEF Alliance 2010). As a mechanism, this arrangement follows a pro-market ideology rather than providing direct grant finance (SEF Alliance 2010).

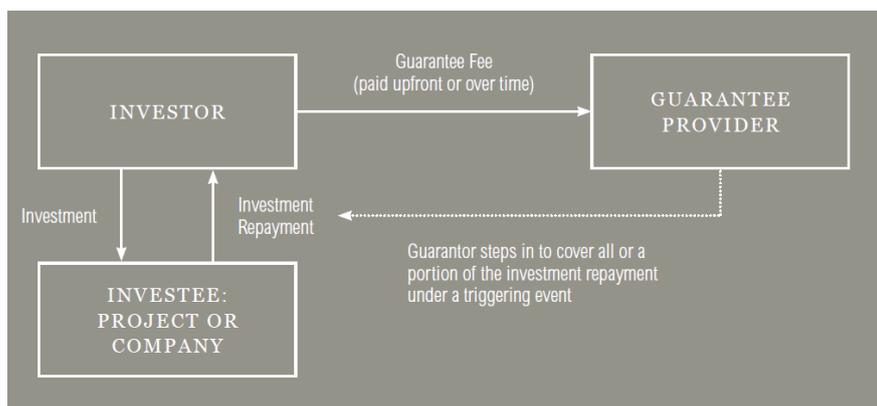


Figure 31: Mechanics of risk guarantee mechanism (Venugopal 2012, p.10)

Various forms of guarantee mechanisms exist:

- Partial risk guarantees – cover private sector lenders in cases when the public sector entity cannot pay (Venugopal 2012).
- Partial credit guarantee – cover private sector lenders against the risk of default of the loan up to a certain amount (e.g. 50–80% or less). The financial institution retains some risk to maintain good lending practice (Venugopal 2012).
- Minimum guarantee – protects a portion of the investment for the lifetime of the loan (Venugopal 2012).
- Back-end guarantee – covers the entire investment after a pre-specified timeframe (Venugopal 2012).
- Individual guarantee – the guarantor is involved in each individual project (SEF Alliance 2010).
- Portfolio guarantee – a guarantee is given for all loans that fall into a specified class of borrowers. Portfolio guarantees are used for RE/EE investments and SME loans (SEF Alliance 2010). The problem is that in this model the lender sometimes gives out loans to risky clients. However, second loss guarantees, which mean that the guarantor only pays after 5–6% of the loss is taken care of by the lender, or reduced guarantee fees, could be ways out of the problem (SEF Alliance 2010).

Alternatives to guarantees are loss reserve funds or insurance schemes (SEF Alliance 2010). Also, insurance products for ESCO projects can be developed. However, insurance schemes will also have to be incentivised to promote this new market niche (Painuly et al. 2003). In general, insurance schemes could follow a guarantee mechanism (SEF Alliance 2010).

Guarantee mechanisms have been proven to work in emerging country contexts for public–private sector EE projects (Venugopal 2012). China, Hungary, Lithuania and Bulgaria are just some of the countries that have developed guarantee mechanisms for EE measures (Venugopal 2012). Many of the arrangements in these countries were initiated or supported by international organisations (Shen et al. 2013; Venugopal 2012). It is interesting to note that the mechanisms often cater to ESCOs to overcome their difficulties in accessing finance. One lesson learned is that guarantee mechanisms depend on the domestic private sector capital markets (Venugopal 2012).

Guarantee examples

Bulgarian Energy Efficiency Fund (BEEF): This is a structure to promote EE savings in industries and households and it is an ESCO portfolio guarantee. The BEEF provides the ESCO with a 5% default guarantee and provides a financial buffer to cover for disruption in the flow of receivables. The BEEF signs a framework agreement with an ESCO for a certain pre-approved portfolio of projects.

The GEF/World Bank/NDRC's Phase II China Energy Conservation Project ESCO loan guarantee program. The GEF provided special guarantee reserve funds held by the Ministry of Finance that forwards it to the National Investment and Guarantee Company Ltd (I&G). It provides 90% guarantee cover to commercial banks that make loans to ESCOs for financing qualified EE projects. The Energy Management Company Association of China ensures the quality of ESCOs.

The International Finance Corporation's IFC/GEF Hungary Energy Efficiency Co-financing Program (HEECP). Finance is offered to ESCOs and end-users. The GEF provided grant funding to IFC. The program was implemented for EE financing in industrial cogeneration and hospitals and includes technology such as lighting, motors, controls, heating systems, industrial processes and co-generation. It also involves leasing companies.

The China Utility Energy Efficiency Programme (CHUEE) established a cooperation between the private sector branch of the World Bank, the IFC and the GEF to enrol into large loan guarantee schemes with local banks. The GEF covered 50% of the first loss,

up to around \$8.4 million. The project generated 42 times this amount in private sector investments (Selmet 2012).

7.2.1.2 Suggestion for a guarantee mechanism in Thailand

There have been some examples of guarantee schemes in the Thailand case study, including schemes related to EE lending and leasing. As mentioned in Chapter V, the IFC has provided a guarantee mechanism to a Japanese leasing company. However, it was mentioned that so far, the guarantee has not been used as the 2% charge is considered too high given the outreach to non-Japanese customers (L2).

The Thai Credit Guarantee Corporation (TCG), as a national body in Thailand, might be a suitable partner to promote an EE guarantee mechanism. The TCG is a specialised financial institute under the supervision of the Ministry of Finance. The TCG provides already a credit guarantee mechanism to SMEs and it is explained in Figure 32.

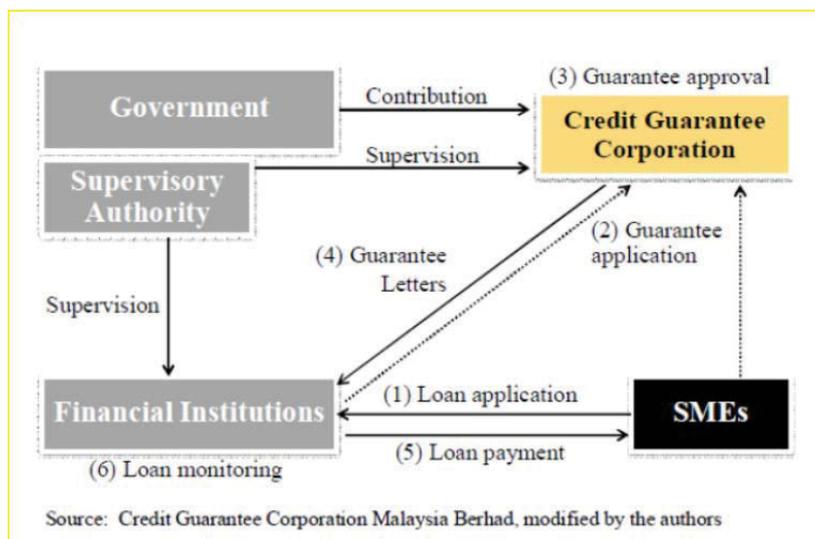


Figure 32: SME credit guarantee mechanism provided by the TCG (Warukul 2015)

Since 1992, the guarantee mechanism for SMEs has evolved from providing 100% loss coverage to a portfolio guarantee that currently provides 8.5–30% of the total loan and charges a 1.75% fee to the customer (Warukul 2015). The programme was highly successful in reducing the percentage of non-performing guarantees. In principle, this mechanism is available to any customer or financial institution. However, so far it has only been used by the SME Bank. The SME Bank under its Productivity Improvement Loan offered TCG’s guarantee. However, due to current guidance from the MOF that The SME bank should focus on small SMEs it is unlikely that this mechanism will further support EE lending (B4). During 2015, the Ministry of Energy approached the Thai

Credit Guarantee Corporation via a project which was facilitated by the German development corporation, to discuss the opportunity to provide a guarantee mechanism for ESCOs. Discussions are ongoing and an official NAMA proposal from The Ministry of Environment and Natural Resources includes such a mechanism.²⁷

In summary, the framework conditions in the Thailand case study seem to be very promising for developing a guarantee mechanism for EE finance. However, as mentioned by local experts the collaboration between the Ministry of Energy and the Ministry of Finance is needed. Research on governance in sustainable development that focuses on 'vertical and horizontal integration' of environmental policies could provide further information how to enhance cooperation (Lafferty & Hovden 2003). Decisions need to identify the target group (e.g. ESCOs or end-users) and what EE measures will be supported. The risk perception also needs to be assessed to develop a feasible guarantee mechanism that will be utilised. If financial institutions are reluctant to engage, the ESCO Fund could help and perhaps a pilot phase could be spearheaded by international organisations such as ADB or IFC, or via an NAMA supported by the Green Climate Fund.

7.2.2 Utility based Energy Efficiency Resource Standard Programme/Standard Offer Programme

Some experiences in the Thailand case study indicate that there could be further cooperation with utilities to reduce the electricity consumption. In 2014 a grant programme was implemented in which the PEA worked with the federal/municipalities, universities, schools and hospitals to implement EE measures. PEA has been running a programme called 'ESCO for Government Buildings'. The arrangement is that PEA signs a contract with a technology supplier and a contract with the customer and pays the supplier back via monthly payments. The supplier must come up with the finance. However, by the end of 2014 only three contracts had been signed with public hospitals and universities (G8). The main challenges were how the ESCO could receive the monthly energy savings that the government building generates as payments. Procurement regulations fall under the authority of the Budget Bureau and need to be changed (G8). To promote such a scheme EERS, under which the government provides a target to utilities so that they reduce energy consumption via their access to customers, could be a good approach. This is particularly the case as it is mentioned in

²⁷ Personal conversation with TGP-EEDP staff in July 2015.

the Energy Efficiency Development Plan that for retail consumers and SMEs a standard offer program (SOP) should be implemented (Pichalai 2015).

7.2.2.1 International experience of the Standard Offer Programme

A report from the Wuppertal Institute to policy makers in Thailand outlined different examples of SOPs from different countries. The price for EE savings, the duration of the investment scheme and an appropriate monitoring, reporting and verification (MRV) system need to be determined. The price can vary according to the different technologies applied, the source of energy, the customer group that implements the EE, over which time period the project needs to be implemented and the lifetime and persistence of energy demand in the future. For example, a higher price could be paid for savings that use more sophisticated technologies and lower prices could be paid for technologies that are well used (e.g. CFLs and appliances). This would avoid the problem that only easily achieved savings are obtained. Also, paying upfront for the overall lifetime savings could incentivise the implementation of saving measures. In regards to MRV, possibilities range from deemed savings (predetermined – easiest) to a complex individual measurement and verification process.

The international examples demonstrate that SOP is technology specific. For example, in Tunisia solar water heaters were subsidised whereas in Brazil efficient refrigerators were targeted. The overview shows that SOPs are diverse and can be customer (e.g. low-income household/industries) or technology specific (e.g. solar water heaters/refrigeration). Also, the source of funding can vary from a tax rebate to electricity tariffs to government grants.

7.2.2.2 Standard Offer Programme for Thailand

Given the experience within the Thailand case study, an SOP programme seems feasible. It was reported that in the early 2000s, the planning agency under the Ministry of Energy implemented a DSM bidding programme. It provided a call for energy saving potential in the industry and paid a certain amount for a minimum kWh saved. In theory, the DSM bidding ensures the most efficient outcome, as the cheapest bidder will be selected (A2). However, in practice, all bidders were awarded the subsidy and over the last seven years only about 10 projects have been implemented (A2). PEA implemented another programme in which it paid THB1/Kwh saved. Not much information was available about this programme (G7). Industries still have limited knowledge about how to reduce energy consumption of technologies, and SMEs might not apply for the subsidy due to high transaction costs (A2). Energy service providers from universities who can verify the savings have already entered the market (A2).

Suggestions were made that the Thai SOP could be more targeted towards particular technologies and could also target certain sectors (A2). Given the problem with reaching SMEs, it might be useful to develop an SOP targeted towards certain SMEs to enable aggregation. Communication will be crucial and it was suggested that the SOP should follow the path of the Thailand research fund with a yearly conference where new opportunities for research are announced (A2). Which monitoring, verification and reporting system to choose depends on the size of the projects and whether the transaction costs of verification outweigh the financial benefits of the measure.

On the institutional side, the administration of an SOP programme might fall to the Ministry of Energy, but given the utility connection it also might be well placed in EGAT. However, given the institutional shift to the Ministry of Energy regarding EE programme implementation outlined in Chapter VI, this appears unlikely.

7.2.3 Public building programme

7.2.3.1 International experience regarding public building programme

The public building sector, though small, still could serve as a significant example which demonstrates the implementation of EE projects to the private sector and the possibilities of opening a new market for ESCO business. Also, a public building sector programme would signal to the private sector that EE is a government priority (Goldman, Hopper & Osborn 2005). The public building sector faces the problem of how to provide up-front investment into EE refurbishments, as they are usually restricted to their budgets and cannot access loans (Hilke & Ryan 2012).. Performance contracting can facilitate EE investments in large, institutional and public sector customers (Goldman, Hopper & Osborn 2005). Regulations need to be changed to allow for energy saving service payments, also known as energy performance-based contracts (IEA 2011a).

International examples of programmes that focus on buildings in the public sector have supported the ESCO market. For example, it was found useful to develop facilitators, who mediate between government building owners and ESCO companies. They can assist in developing contract standards and facilitate a unified assessment and bidding approach for EE projects in the public building sector (Bullier & Milin 2013). Eighty-five per cent of the ESCO project demand in the US (mainly from hospitals and universities) up until 2008 originated from the public sector (Hilke & Ryan 2012). In the US, the ESCO businesses within public buildings were successful because the public buildings targeted were large, had EE potential and were run on tight public sector budgets. In Germany, the city of Berlin initiated an energy saving partnership program in 1995. In principle, the programme worked via partnerships between ESCOs and the public

sector, where the ESCO provided the financial backing and technical expertise. A facilitation body, called the Berlin Energy Agency (BEA) assisted. The programme achieved the retrofit of 750 public buildings and this model has been widely applied in other regions (Chmutina, Goodier & Berger 2012). Other financial mechanisms can also facilitate ESCO- arranged finance. Other finance schemes could be via credit lines or guarantee mechanisms (IEA 2011a) (SEF Alliance 2010). So this type of public sector support would also encourage ESCO-arranged finance (SEF Alliance 2010).

7.2.3.2 Public sector building programme in the Thailand case study

, Interviewees in the Thailand case study all agreed that a programme that focuses on buildings in the public sector would have a beneficial effect on the overall ESCO market (ES1; ES2; ES3; IC4; IC5; IC6): *'Government needs to take the leader role; so far the government follows the private sector'* (ES3). A government procurement law currently makes it very difficult to retrofit existing public buildings (IC4; IC5; G6; ESP1). However, in a recent military committee debate the issue was addressed by the Department of Alternative Energy Development and Energy Efficiency (DEDE). It was agreed to search for solutions to the legal problem (G9).

The Ministry of Energy confirmed their intention to develop a public building programme and use ESCOs as the implementers (G6). A wide range of opportunities within this market segment was mentioned, with some public buildings such as public hospitals, universities (total consumption) and water treatment facilities consuming large amounts of energy. Others, such as public schools and district offices, consume much less energy on an individual building basis. Here, the potential will depend on the ability to aggregate several buildings into projects (IC5; IC7). The current experience of one utility that started to provide ESCO services to universities and hospitals was mentioned as useful for understanding the necessary regulatory changes.

7.3 Conclusions

Reflecting on the interviewees' comments, this chapter outlined comments of the interviewees to overcome the barriers to EEF in Thailand. Further, by reflecting on the current framework conditions and political state, next steps in form of three specific initiatives were provided.

Interviewees suggested that EE lending should be further supported via aggregation measures and targeted capacity building. Regarding the framework conditions, the

development of green lending policy via the Ministry of Finance was suggested. ESCO-arranged finance needs quality related measures such as certification and standardisation measures, as well as the development of a technical guarantee mechanism and possibly the development of a super ESCO or a public building programme to increase further the demand for ESCO-arranged finance. EE leasing should be recognised by the Thai government, and one suggested way of achieving this was collaboration between the ESCO Fund and leasing companies. Concerning the framework conditions the long-term assurance of a tax incentive for leasing projects was seen as crucial.

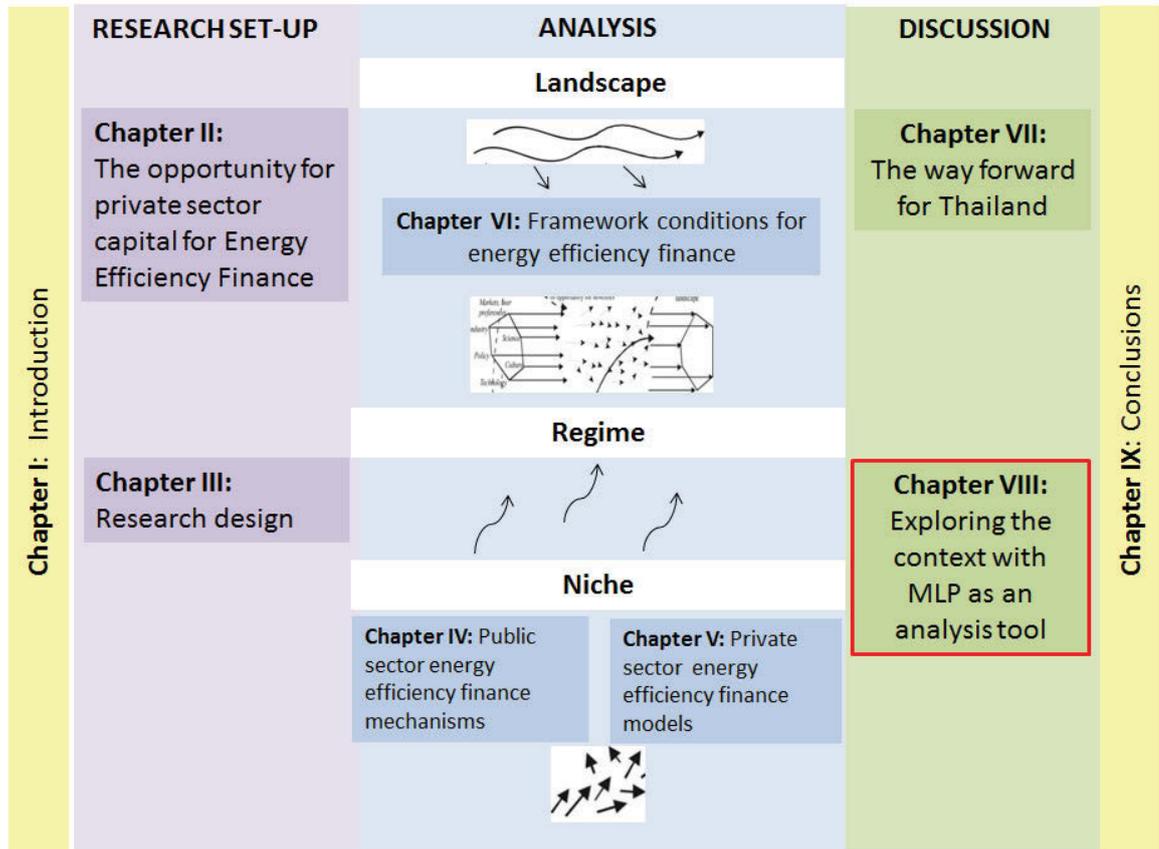
Reflecting on the current state of EEF initiatives and comments by the experts during exit seminars, three further EEF mechanisms were suggested: (1) a guarantee mechanism; (2) on-bill financing via a utility-based standard operation programme and (3) a carbon finance initiative. Further, the framework conditions of the electricity sector need to be improved. For example, the framework conditions could be improved by EE legislation enforcement, collaboration between the Ministry of Energy and Ministry of Finance, and increases to electricity prices to increase the overall demand for EEF initiatives.

Therefore, as a concrete next step the researcher recommended the development of a supply-side guarantee mechanism and two public programmes that would increase the demand for EEF services, namely a utility-based standard offer programme and a public building programme.

The findings are interesting for two reasons. First, they highlight the importance of enabling framework conditions in enabling EEF initiatives to thrive, and second, the findings indicate that besides focusing on EEF initiatives themselves, demand for them should be created.

The next section suggests an analytical tool to explore the context for EEF in an Asian developing and emerging economy.

Chapter VIII: Exploring the context with MLP as an analysis tool



8.1 Introduction

This chapter provides a discussion and suggestion about using transition studies, in particular the multi-level perspective (MLP) as an analytical tool to explore EEF options in other Asian developing and emerging economies.

As elaborated in Chapter III, transition studies emerged out of European research, and application of transition studies in developing and emerging economies context has only gathered momentum in the last decade (Berkhout et al. 2010). Researchers in developing and emerging economies have identified several challenges in using MLP:

- the limited amount of research that has focused on ‘radical social innovations’ analysis (Berkhout et al. 2010; Witkamp, Raven & Royakkers 2011)
- the analysis of two or more regime (Onsongo & Schot 2015)
- the constant instability of regimes (Verbong et al. 2010)
- the importance of the underlying culture and political set-up and the impact of political turmoil (Geels et al. 2015)
- limitations in the capacity of the framework to analyse relationships, interests and resource distribution within the MLP structure (Baker, Newell & Phillips 2014; Hansen & Nygaard 2013; Meadowcroft 2005; Stiglitz 1999, 2003).
- the influence of transnational/international development organisations on niches (Hansen & Nygaard 2013)

In light of these challenges, in this research MLP was used only as a heuristic tool (See Figure 33). The following adaptations were made:

- Identify EEF as a ‘radical social innovation’.
- Analyse two socio-technical regimes, namely the electricity and finance sectors.
- Pay attention to regime instability and its implications for EEF.
- Include analysis of the political system and culture at the landscape level.
- Be sensitive about the relationships and interests of relevant stakeholders during network analysis at the regime and niche levels.
- Pay attention to the influence of international organisations at all MLP levels.

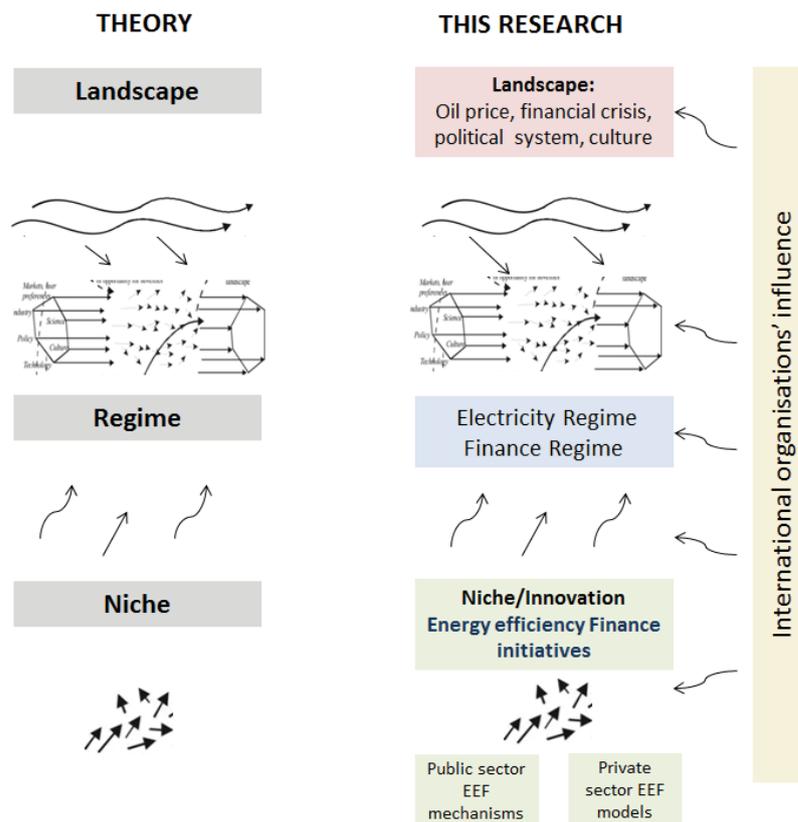


Figure 33: Multi-level perspective applied to this research (adapted from (Geels & Schot 2007))

The MLP/SNM analysis provided interesting results and could indicate the status of EEF and its challenges compared to the dominant practices. For example, the analysis identified that the Thai government has failed to provide appropriate de-risking/market creation measures that would allow financial institutions to develop specific services. Further, the regime and niche analysis found that lending practices and current customers are not conducive to new customers such as ESCOs and SMEs. Some limits were found regarding the forward planning. However, overall the analytical framework brought rich insights to a complex problem. Thus, MLP might be able to serve as an analytical tool for investigating the design of EEF initiatives in the future.

Besides recent national pressure on energy systems, also development banks have shown a significant interest in promoting EEF in Southeast Asia. However, the findings indicate the need for the international community to provide in-depth analysis of the context before providing finance for EEF initiatives. Therefore, an analytical tool that can provide rich insights in the context of an emerging country could be useful.

The core of this chapter will be to suggest MLP as a tool to investigate which EEF initiatives should be supported. Besides drawing from the experience of the Thailand

case study, for each level mainly Asian international examples will illustrate the broader implications of the tool.

Therefore, it also addresses the overall research question of: *'How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?'*

To design a complete analysis tool is beyond the scope of this thesis. In particular, empirical testing and analytical refinement would be necessary. However, based on the literature review and the Thailand case study, the components that could be relevant for the MLP analysis overall, and the conceptual issues that might be important at each level, are presented below. In particular, the integration of aspects of deep structural relationships and the influence of international organisations are integrated into the framework. It is recommended that further case study research be conducted to verify the usefulness of the tool.

8.2 Multi-Level Perspective -a tool to explore the context

The section below includes suggestions of how to investigate EEF, and what to consider at each level of the MLP analysis. The description of each level will involve two steps:

- theoretical background – MLP literature that relates to the approach
- in practice – guidance for practitioners based on the case study and literature review focused on Asian emerging economies.

8.2.1 Research approach

Important aspects of the MLP framework are: (1) identifying the scope; (2) conducting an analysis over time; (3) paying attention to international influences (4) noting the relationships and interests of the important stakeholders. These will be explained in detail below.

8.2.1.1 Identify the scope

The levels of MLP do not strictly conform to national geographies and thus need to be clearly defined in each case to provide the research focus.

Theoretical background

As illustrated in Figure 34, three levels of the socio-technical system are analysed: The protected space of innovation (*niche*), current prevailing practices (*regime*), and external

factors that might lead to the acceptance of innovations (*landscape*) (Van den Bergh et al. 2011). Initially, MLP was mainly used to examine long-term socio-technical transitions such as the transition in transport from the carriage to the car (Geels 2005). It is important to note that the levels of landscape, regime and niche will always depend on the perspective and experience of the interrogator and therefore might vary (Raven 2010).

In practice

As Figure 34 indicates, three different levels that can be identified to position the overall scope of a national EEF research:

- landscape: external events and the political system
- regime: the electricity sector, which includes the EE and financial sectors
- niche: EEF initiatives supported by the public or private sector.

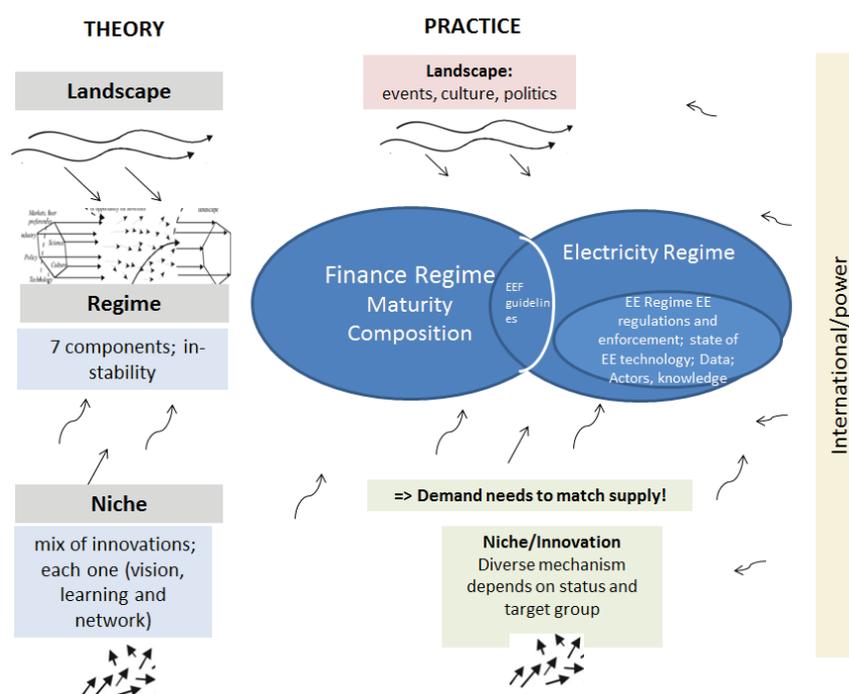


Figure 34: Suggested analysis tool to assess the context of EEF in an emerging economy (adapted from (Geels & Schot 2007))

Transition analysis from the perspective of time to gain a deep understanding of the institutional arrangements and the accompanying politics, especially in the relevant regimes, namely the electricity and the financial sectors, it is important to undertake an analysis over time.

Theoretical background

In MLP research, analysis over time is a key analytical tool to provide a deep understanding of the relationships between the different actors and institutions and their development over time. An analysis over time can highlight institutional developments and experiences to understand how to collaborate and with whom (Grin, Rotman & Schot 2010, p.284). Different time scales apply for the changes to be observed at different levels (Geels 2005). For regimes, the time scale is 50 years and for niches it is 10-20 years.

In practice

In undertaking the case study, the tool was found to be useful for analysing the transition over a period of time. For example, the analysis brought to the forefront the strong roles that the IMF and the World Bank played in pushing for a financial reform. This explained why Thai government officials were wary of the World Bank and their involvement in development projects. Further, the newly formed institutions did not receive a lot of technical capacity building from international organisations. This was because of a change in financial and technical support due to Thailand becoming a middle-upper income country. These findings are important for understanding the background of important institutions and their governance.

8.2.1.2 Consideration of international influence

The case study revealed that international development organisations are influential, not just at the niche level but at all MLP levels.

Theoretical background

Hansen (2013) found in Malaysia that international donor agencies are influential in shaping protective spaces at the niche level. Further, development studies have for a long time recognised how organisations such as the World Bank shape policies and institutional set-ups in developing countries (Bates 1988; Cammack 2002; Escobar 1995). Raven, Schot & Berkhout (2012) further recommended that transnational linkages be explored at all three MLP levels.

In practice

The case study found that international organisations were influential at all three levels. The IMF regulations contributed significantly to the 1997 Asian financial crisis (landscape level). At the regime level, the 1997 Asian financial crisis shaped the strict governance structure of the financial sector that exists today. At the niche level, it was observed that the technical assistance of several international organisations led to the

establishment and to the closure of the EERF. Further, the idea of the ESCO Fund was born at an international conference that was attended by important energy officials. It was interesting to note that due to Thailand changing from a developing to an upper-middle income country, the nature of the development support changed from technical to financial. Also, vested interests were noted. For example, the English translation 'ESCO Fund' did not accurately reflect the Thai name, but responded to the demand from international organisations that ESCOs should be supported.

8.2.1.3 Analysis of the interests of important stakeholders

As EEF initiatives need to be supported by the public sector, it is important to understand the relationships between different public and private sector institutions to evaluate which interventions will be viable, due to the existing relations and interests.

Theoretical background

The political economy lens identified interesting relationships between different actors at the regime and niche levels and confirmed that 'change has long been a political battleground' (Meadowcroft 2005, p.496). Political economists see that political and economic processes are intertwined and that interest groups can significantly shape the economic and political development in a country, especially in the energy sector (Baker, Newell & Phillips 2014; DFID 2009). Recent transitions research has focused on power relationships in transition studies, but so far has provided limited analytical tools to integrate it into the existing frameworks such as MLP (Avelino & Rotmans 2009; Geels 2014).

In practice

Rivalry between the Electricity Generating Authority of Thailand (EGAT) and the Ministry of Energy was noted. This rivalry led to a shift of authority to support EEF measures from EGAT to the Ministry of Energy. Further, at the regime level EGAT's staff resisted the privatisation process. Further, it was found that international organisations have a major influence on institutional set-ups. For example, after the 1997 Asian financial crisis the IMF attempted to force the government to privatise the electricity sector, but was only partially successful. The reform still caused institutional changes and shifts of authority. For example, the resulting establishment of the Petroleum Authority of Thailand (PTT) Public Company Limited continues to make the enforcement of EE legislation difficult. Therefore, it is important at all MLP levels to pay attention to the relationships and interests of significant stakeholders.

8.2.2 The use of MLP levels in EEF analysis

The use of the three different levels of MLP (landscape, regime and niche) proved to be effective for investigating the status and challenges of EEF in the Thailand case study. The three levels provided a useful framework for untangling the complex system of EEF.

The analysis at the landscape level, identified important drivers of EE change. In particular, the analysis of the political system was useful and identified windows of opportunity to advance EEF.

At the regime level, important adaptations to MLP were (1) to move away from the theory that regime instability always provides a window of opportunity for niche initiatives to transition to the regime and (2) the introduction of multiple regime analysis by focusing on the both the electricity and finance regimes.

Through the differentiation between the regime and the niche level a mismatch between the Ministry of Energy's focus on SMEs and the nature of actual EEF initiatives was revealed. Further, an examination of individual EEF initiatives at niche-level public and private sector initiatives provided some important facts – for example that RE projects are financially more attractive than EE projects.

The following subsections discuss each level of the MLP framework considering the findings of the Thailand case study. Each section begins with a short theoretical background, followed by the practicalities of using the level for EEF analysis. To indicate broader applicability, examples of other emerging economies have been provided.

8.2.2.1 *Landscape – external events and the political system*

Theoretical background

Traditionally, the landscape level has focused on external events or exogenous changes that impact on socio-technical systems and can lead to destabilisation and change (Geels 2005). External events can cause destabilisation and thus lead to change. However, as argued above, in an emerging country context it should not be assumed that disruptive external events will provide windows of opportunity. It was shown that in a very disruptive environment niches have difficulties to establish themselves at the regime level.

Recent MLP research has started to include in the landscape analysis the consideration of the 'deep structural relationships' within a society that impact on sustainable initiatives (Climate and Development Knowledge Network 2014; Geels et al. 2015). Geels et al. (2015, p.6) defines those relationships as 'static landscape' characteristics.

According to Geels et al. (2015) these could be cultural traditions, constitutional arrangements or policy styles. Deep societal structures inform which policy measures or niches might be easier to support or implement than others.

In practice

As demonstrated by the case study, external events and deep societal structures are important aspects of the analysis. As demonstrated by the case study and via the literature review, landscape events in the EEF context could be: (1) fluctuations in oil prices; (2) financial crises; (3) disasters; and (4) national, regional or international political pressures.

The case study demonstrated that by mapping important events, insights about the drivers for energy conservation (e.g. the 1973 and 1978 oil crises), reasons for contractions and tight governance in the financial sector may be recognised (also see Table 13).

In addition, the political system has a significant influence on EEF initiatives. For example, in 1992 the newly established technocratic government passed comprehensive energy conservation legislation which led to the Energy Conservation Fund. On the other hand, political instability in the Thailand case study in the early 2000s hindered comprehensive electricity market reform, due to constant changes of governments and policy direction. So, it proved useful to explore deep structural relationships. However, as was demonstrated with the current military government take-over, the landscape can change rapidly and thus should not be identified as ‘static’.

Table 13: Illustration of external events that could influence the policy support for EEF initiatives

Aspect and country	Description
Thailand	Disaster: flooding in 2011 in Bangkok increased concerns about climate change and therefore increased climate change mitigation activities
Thailand	International pressure: IMF involvement in the early '90s in the financial system and in the 2000s in the electricity system shaped the finance and electricity regime significantly.

Relevant ‘deep societal structures’, identified were: (1) stable political system (attract investors) (DeT’serclaus 2010; Verbong et al. 2010; Wattana, Sharma & Vaiyavuth

2008); (2) sovereign risk (high or low) (DeT'serclaes 2010); (3) contract enforcement – possibility to outsource (Taylor et al. 2008). An examination of the Thailand case study and the diversity of political systems in Southeast Asia (see Table 14) show that these important deep societal structures are anything but ‘static’.

Table 14: Illustration of the political systems in emerging countries that could influence the policy support for EEF initiatives

Aspect and country	Description
Thailand	Political turmoil, due to an incomplete democratisation, where corrupted governments are replaced by military regimes every other year. For example, as mentioned in Chapter VII, utility-based programmes might take a long time to establish as national legislation needs to be changed.
China	Communist system. Therefore, the enforcement of EE regulations is very strong (Taylor 2012).
India	Federalisation indicates that innovations will occur at the municipal and provincial levels. For example in 2005, in the city of Bangalore an EE lightning project was initiated and financed (Wang et al. 2013).

8.2.2.2 Multiple regime analysis of the finance and the electricity regimes

Theoretical background

Smith (2007) identifies seven concepts that are important for regime analysis:

- (1) technology
- (2) techno-scientific knowledge
- (3) regulations and rules
- (4) infrastructure
- (5) industry structure
- (6) markets and user patterns
- (7) cultural and symbolic meaning influencing the regimes pathway.

The focus of analysis in traditional MLP has mostly been on one regime and analysis of multiple regimes is not as common (Fam et al. 2014; Geels 2005; Onsongo & Schot 2015). For example, multiple-regime analysis has been used as a tool for examining multidisciplinary issues such as water management and the formal and informal financial services (Fam et al. 2014; Onsongo & Schot 2015). By considering more than one regime, the interactions and interdependencies between them can be analysed and understood. In this thesis two regimes were considered, the finance and the electricity sectors.

Finally, under the MLP framework the niche can only penetrate into the regime if ‘destabilisation of the regime creates windows of opportunity for niche innovations’ (Schot & Geels 2008; Smith 2007).

In practice

Analysis

While the regime analysis of the above-mentioned concepts was time consuming using this structure brought rich insights into the operation of the current EEF system. For example, the investigation into the existing EE regulations and the failure to enforce them revealed a possible lack of demand for EEF by the targeted group. In particular, the recognition of the interrelations between the finance and the electricity sectors was important. Further, the literature review of emerging economies identified conducive framework conditions for each regime. Table 15 identifies how these attributes link to the analytical concepts numbered above.

Following up on the findings in Chapter VII, the EE regime analysis was important as the EE regulations and their enforceability will influence the demand for EEF. Recent international discussions point towards the importance of having rules and regulations that target the demand for EEF. Such regulations can be: EE industry and building standards, appliance standards, certified EE technology, company information or tax incentives. Even though not the focus of this thesis the interrelationships between demand-inducing policies for EEF and supply-inducing policies for EEF should be considered further (IPEEC 2015).

Table 15: Important aspects of the electricity and finance regimes for EEF with reference to which of the seven MLP concepts they belong to (in brackets).

Regime	Relevant aspects for the regime analysis
Electricity Regime	<ul style="list-style-type: none"> ▪ Available EE technology and capacity (international relations) (DeT'serclaes 2010) (1;2). ▪ Government regulations on EE (targets, standards and research) (DeT'serclaes 2010; Taylor 2012) (3). ▪ Geographical coverage of the electricity system (Verbong et al. 2010) (4). ▪ Institutional energy governance and the influence of international organisations (Baker, Newell & Phillips 2014; Taylor et al. 2008) (5). ▪ High energy prices (DeT'serclaes 2010) (6). ▪ Customer demand for EEF (efficiency status) (Limaye et al. 2012) (6).

Finance regime	<ul style="list-style-type: none"> ▪ Capital is available(Wattana & Vaiyavuth, 2007) (4) ▪ Diversified banking sector, with experience in small-scale finance (Taylor et al. 2008) (1). ▪ On-lending regulations are supportive of EEF (3). ▪ Green energy legislation exists (Taylor 2012) (3). Capital available (Wattana, Sharma & Vaiyavuth 2008) (4). ▪ Institutions and international organisations' influence (Unger 1998) (5) & (7).
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Multiple regimes

The Thailand case study and the literature review found the combined analysis of the electricity and finance regime very useful. The focus on the finance sector enabled an understanding of which EEF initiatives might be suitable, due to an understanding of the existing financial institutions and their governing structure. The inclusion of the finance sector revealed the tight regulation of banks via the Central Bank of Thailand which hinders efforts to expand EE lending. Further, a lack in guiding principles on clean energy finance from the Central Bank of Thailand was identified.

Regime stability

The Thailand case study confirms recent findings that in developing and emerging economies regimes are constantly unstable, mainly due to political turmoil. This instability is an obstacle to niches penetrating existing regimes. The political unrest of the 2000s in Thailand combined with the 1997 Asian financial crisis, made banks more conservative in their lending behavior. Also, it hindered any collaboration between the Ministry of Energy and the Ministry of Finance concerning de-risking measures. Thus, the instability of the regime did not result in opportunities to upscale private EEF but rather resulted in a trend to return to more government-driven support programmes. As political instability is a characteristic of many countries in Southeast Asia, this seems important. It is hoped that highlighting the impact of instability will spark discussion around the need to revisit MLP theories in a developing and emerging country context.

International influence

The Thailand case study and the emerging country literature review revealed evidence that international organisations also influence significantly the set-up of the electricity and finance regimes. This is important to note and monitor. As illustrated in Table 16 below, Mexico's and Thailand's electricity systems were shaped to a significant extent by loans and policy inputs from the World Bank (Jano-Ito & Crawford-Brown 2016).

Relationships and interests

Lastly, paying attention to the interests of stakeholders in the electricity system, and to

the relationships between them, is crucial to understanding the flexibility or willingness of institutions to improve the situation for EEF. The electricity sector is governed by economic and political interests (Climate and Development Knowledge Network 2014). The inability of the Ministry of Energy to cooperate with the Ministry of Finance is hampering the implementation of a guarantee mechanism. Further, EGAT, who has less and less stake in EE, might hinder EE resource standard measures or cooperation with local utilities.

Table 16 below shows how the analysis of the electricity and financial regimes in other emerging economies, with special focus on composition, international influence and relationships, can bring interesting insights for EEF.

Table 16: Illustration of relevant issues of the electricity and finance regimes in selected emerging countries

Country	Description
Thailand	<p>Finance sector: Tight regulation from the Ministry of Finance is an obstacle to the private sector developing EEF initiatives. Lack of guidance from the Ministry of Finance in regards to clean energy investments.</p> <p>Electricity sector: EGAT is a powerful player in the electricity system with a reduced incentive for EE at the moment. EE regulations are not enforced and thus cause a lack of demand for EEF from big industry and within the building sector. IMF initiated the Electricity Sector Reform. Reform is incomplete and this has led to unclear governance authority structures.</p>
Indonesia	<p>Finance sector: Only 51% of businesses have savings accounts. Guidelines on green investment practices do exist (Ketahanan, Pangan & Pangan 2015)</p>
India	<p>Electricity sector: Has an initiative that provides certified information on EE technologies that can be used by the finance sector to judge their lending (Yang 2006).</p> <p>Finance sector: In an industrial energy efficiency project it has proved difficult to convince the Indian Development Bank to process the necessary legislative measures to establish revolving funds (Limaye et al. 2012).</p>
Mexico	<p>Electricity sector: Mexico's electricity system has also been heavily influenced by international organisations. Loans from the World Bank caused a centralisation/nationalisation of the electricity system, which was only opened up through a privatisation reform in 2013 (Jano-Ito & Crawford-Brown 2016). So energy conservation legislation does exist for the industry (IDB 2011).</p>

8.2.2.3 *The niche level – recognising diversity and matching it to the demand for EEF*

Theoretical background:

Niches are understood to be the breeding spaces for new innovations usually in the form of new technologies (Kemp, Schot & Hoogma 1998). Recently, niches have also been identified as sources of ‘radical social innovation’ (Witkamp, Raven & Royakkers 2011).

The SNM criteria for niche analysis looks at the network and its actors, as well as learning processes (in particular secondary learning processes) and how they are governed by a shared vision. In addition, special attention should be paid to international development organisations as well as relationships and interests among niche actors.

Several niches are necessary to ensure optimisation over time. The theory describes that via a diversity of different dynamic approaches, learning and experimentation can occur between different actors of society to lead to sustainable transition outcomes.

In practice:

The niche is defined here as a social innovation, namely external EEF. EEF means external (not from customers capital alone) funds for EE projects for demand-side measures within the industry, building, residential and public sectors (Taylor 2012).

Analysis

The analysis of the niche with the categories actors/networks, learning and shared vision brought interesting insights. For example, the network focus revealed that for a guarantee mechanism under the ESCO fund to work, collaboration with the Thai Credit Guarantee Corporation is crucial. The focus on learning in the interviews revealed the lack of capacity building in the banking sector by DEDE during the operation of the Energy Efficiency Revolving Fund (EERF). The focus on second order learning identified that one bank actually did modify and provide an EE lending portfolio to its customers. The focus on vision, for example on ESCO arranged finance, showed there was a lack of public sector support. Currently the government does not provide ESCOs with finance or a market (e.g. via a public building programme).

EEF initiatives are diverse and cater to specific target groups

Examples demonstrate that EEF models are diverse and their nature depends on the primary target group, project sizes and political focus. As is outlined in Table 17, certain models serve certain markets. For example, on-bill financing, initiated by giving an energy conservation target to a utility will cater to the public and residential sectors. Loans and EE funds tend to serve the industry and commercial sectors. Further, not all

EEF models occur in one country. However, China seems to have a very broad diversity of EEF models and further research in their successes would be interesting. Equity funds are still very rare, with Indonesia and India being front-runners. India is currently developing the Venture Capital Fund for Energy Efficiency (VCFEE) and in Indonesia private equity fund for ESCOs has been used (Wang et al. 2013)

Table 17: Overview of possible EEF models, defined by the actors, customers and project size

EEF model	Actor	Customer	Project size	Countries	reference
Utility-based financing	Utilities	Public sector and residential	N/A	China	(Taylor 2012)
EE loans	Banks	Large commercial building and industry	US\$20 million	Thailand,	(International Energy Agency 2010b)
ESCO-arranged finance	Energy Service Companies	Public sector or large commercial/industry	US\$ 115.000 Thailand: 140.000 US\$ to 420.000 US\$.	India, China	ECN workshop in April 2015 (Limaye et al. 2012; Taylor 2012)
EE leasing	Leasing companies	SMEs, residential	US\$50.000 Thailand: US\$20.000	China, Thailand	(MacLean & Purcell 2014)
Guarantee / insurance	Government, insurance companies	SMEs, ESCOs	N/A	China	(Taylor 2012)
Secondary markets	Equity funds	Banks, ESCOs	US\$100-200 million	Indonesia	(MacLean & Purcell 2014)

Combination of RE and EE projects

An important feature of public sector support mechanisms is that there is a tendency to combine RE and EE projects, which causes problems. International examples confirm the findings in the Thailand case study that there is a tendency to combine RE and EE projects and that RE projects receive more attention. For example, in India the Indian Renewable Energy Development Agency Ltd. (IREDA) EEF Scheme in India was reported to only have been spent on RE projects, even though it was applicable for both (Limaye et al. 2012). Also, on financing policies for demand-side measures it is

interesting to see that RE was included into the priority sector lending guidelines of the Reserve Bank of India, but EE was not (Reserve Bank of India 2015).

International organisations

At the niche level it was observed that technical assistance of several international organisations led to the establishment and also to the closure of the EERF. The Thailand case study also found that international organisations were involved in EEF support, especially in the initial stages of this support in 2004 and 2008. Further, international organisations even influenced the name for a local EEF tool, namely the ESCO Fund. Further, it was interesting to note that due to Thailand moving from a developing to an upper-middle income country the nature of the development support changed from technical to financial. These findings were also reflected in other emerging countries, where it was found that all EEF initiatives in China, India, Mexico and Indonesia were initially supported by international organisations (Limaye et al. 2012; Taylor 2012). Between 1991 and 2010 the GEF spent US\$473 million on EE projects in developing and emerging economies (Yang 2013).

Relationships and interests

Paying attention to the relationships, interests and influence of international organisations are crucial in an emerging country context. In the Thailand case study, the EERF was only established due to a close relationship between a finance officer and leading officials at DEDE.

8.2.2.4 The way forward

The Thailand case study revealed that public sector initiatives should not focus only on increasing private sector investments, but should consider: (1) the framework conditions (2) what programmes exist and which target groups they serve, and (3) that public sector measures need to change over time.

Theoretical background

International organisations tend to believe that, with increased economic development, countries will shift from grant-funded programmes towards private sector-led initiatives. So, as you can see in Figure 35 the conceptual discourse suggests that grant support for EEF changes over time to concessional loans and public/private sector partnerships. Finally, with official development aid finance coming to an end, completely shifts to private sector-driven EEF initiatives (DeT'serclaes 2010; Sudo 2012).

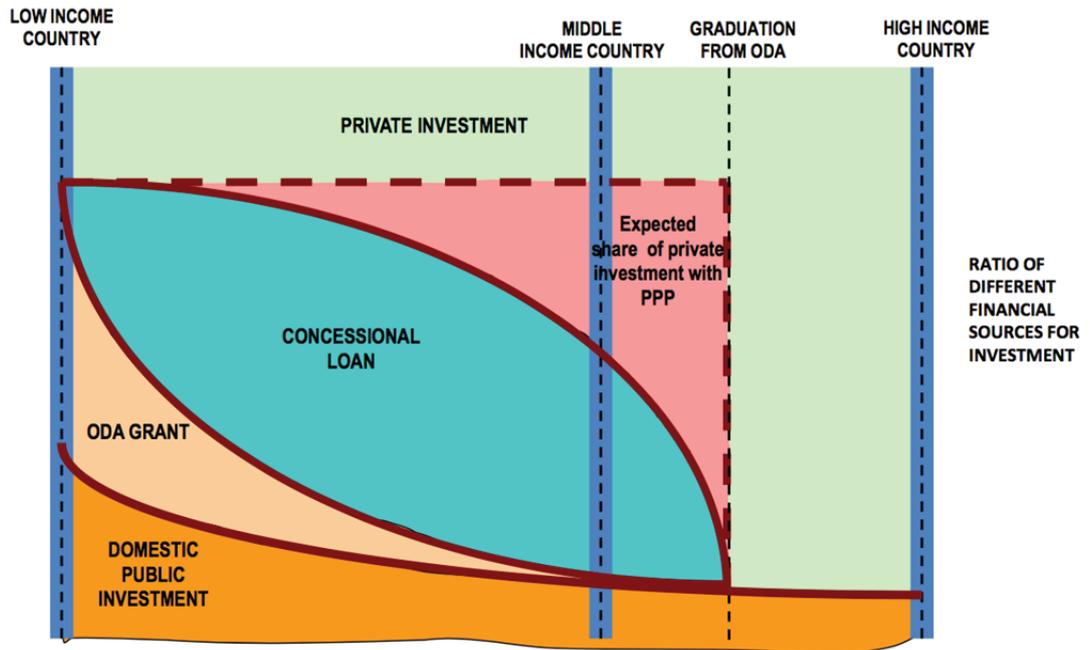


Figure 35: EEF from the public to the private sector (Sudo 2012)

MLP has limitations in regards to examining how the public sector could support EEF further. MLP is primarily an ex post evaluation tool which can, due to its research approach over periods of time, explore large-scale structural transitions (Smith, Voss & Grin 2010). So far, niche-regime analysis in the literature has not gone beyond identifying different transition pathways (Geels & Schot 2007). From these pathways, it could be shown in the Thailand case study that the development of EEF is on a 'reconfiguration pathway', which means that multiple innovations (here EEF initiatives) interplay and compete with old regime actors (Geels & Schot 2007; Verbong & Geels 2007). However, as discussed in Chapter VII guidance about how EEF could be supported further is still very limited (Anadón 2012; Geels 2011; Smith 2007). Other transition frameworks such as Strategic Niche Management (SNM) and Transition Management (TM) only provide limited knowledge on which measures could support EEF further. Transition researchers suggest that public sector support needs to decrease over time to ensure market penetration (Van der Loo & Loorbach 2012; Mourik & Raven 2006). Possible measures could be to develop: (1) a cap and trade system (2) align EE regulations and ensure enforcement and (3) push for market innovations via tax credits.

In practice

The Thailand case study indicated that the situation in emerging economies is complex and that private sector investment alone will not result in an increase of EEF over time. Recommendations from the interviewees focused on how to support the existing EEF

initiatives further. Responses focused on public programmes that could increase demand for external EEF via for example a public sector building or via a utility based programme. Thus, as can be seen in Figure 36, a suggestion is made that could lead to a more differentiated discussion of how the public sector can optimise EEF initiatives. Figure 36 indicates that depending on the maturity of the market, certain EEF initiatives might be more likely to succeed. Also, it indicates that the EEF initiatives must be accompanied with long-term public sector support, also via demand-creating regulations.

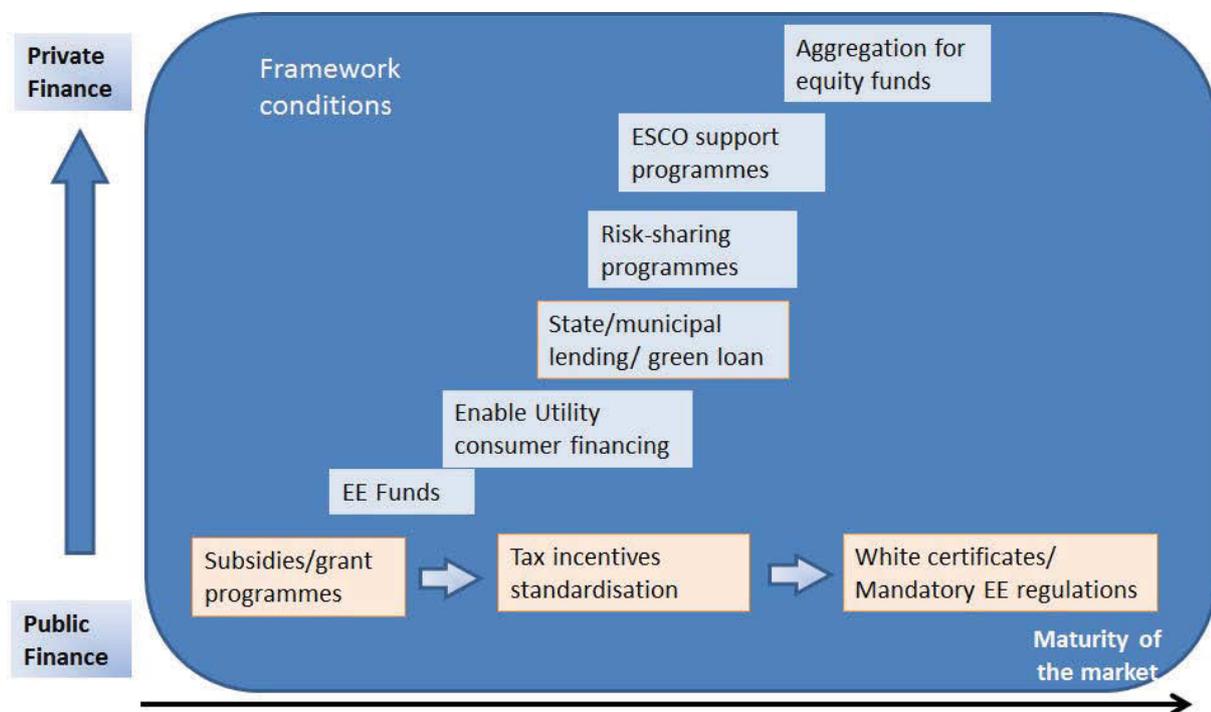


Figure 36: Possible EEF initiatives accompanied by an increase of private sector investment over time, given certain framework conditions

However, most important is the fact that any EEF initiatives chosen for public sector support need to fit into the framework conditions of the country in which they occur. Reflecting on international examples it seems to be that the target groups which might always be dependent on external support for EEF are SMEs and the residential building sector. The IDB in 2010 offered a special EE loan to the Mexican SME sector (IDB 2011). In India several EE funding programmes focused on the SME sector, as the SME sector contributes significantly to India's economy (Wang et al. 2013). In Germany, a

survey found that the primary barrier to EE implementation in SMEs was the lack of capital and high investment costs (Fleiter, Schleich & Ravivanpong 2012).

Regarding the specific EEF initiatives analysed, Figure 37 provides a more differentiated discussion of how the relationship between the public and the private sector works to increase private sector EEF investments/models. It explains that overtime support must shift from grant-based programmes to de-risking measures.

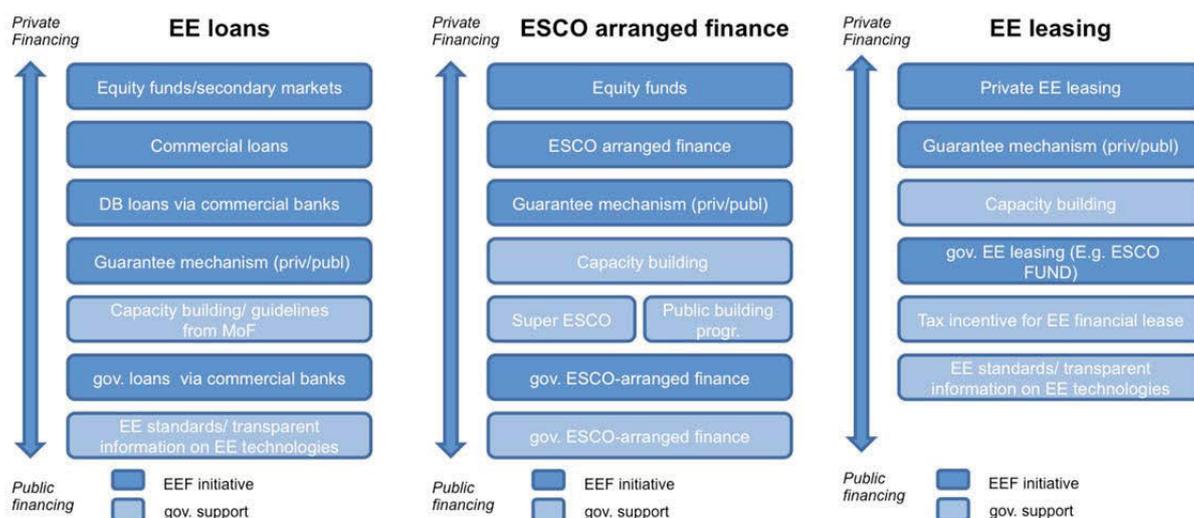


Figure 37: Transition from public sector to commercial financing for the three analysed EE initiatives EE lending, ESCO arranged finance and EE leasing (adapted from (Wang et al. 2013))

Regarding ‘way forward’ measures, the review of the international literature and the findings of the Thailand case study suggest that more market-orientated measures are necessary. They could include:

- long-term public sector support (Taylor et al. 2008)
- guidance from the central bank and finance ministries (Limaye et al. 2012; Painuly et al. 2003)
- de-risking support measures (Limaye et al. 2012; Painuly et al. 2003; Taylor 2012)
- collaboration with international organisations/funds (Rock et al. 2009; Taylor 2012)
- enhancing market demand by assisting with project pipelines and communication (Limaye & Limaye 2011; Sarkar & Singh 2010; Taylor et al. 2008).

Long-term public sector support is needed, not just for direct EEF services, but also to provide an enabling framework. Capacity building measures that bridge the sectoral divide between financial and energy experts are useful (Taylor et al. 2008). The messages communicated by energy experts need to be adapted to appeal to the financial sectors and customers. Instead, of energy savings, the focus should be on economic prosperity, health and to enhance energy security (Sarkar & Singh 2010). Accreditation bodies that are administered by the public sector for ESCOs and energy managers can provide quality checks and assure financial institutions that the business practices of the ESCOs are sound (Taylor et al. 2008).

De-risking measures are defined as measures that help investors and EE service providers to manage specific types of risks. These measures can be, for example, loan guarantees, insurance, and foreign exchange/liquidity facilities (Venugopal 2012). As an outcome of projects focused on EEF, guarantee facilities were established in Brazil and China. A savings insurance facility was recommended for India (Painuly 2009; Limaye et al. 2012). The most widely recommended policy measure proposed by the interviewees in the Thailand case study was a guarantee mechanism. Interviewees believed it would help address the problem of the lack of collateral among small SMEs and ESCOs.

Guidance from central banks was found to be useful for reaching out to the financial sector. In India, the reserve bank introduced special lending conditions for RE. If this could be done for EEF it would make the criteria for lending by financial institutions more liberal in regards to the necessary collateral and equity-depth ratio (Limaye et al. 2012). In the Thailand case study, it was also mentioned several times that the Ministry of Finance and the Central Bank of Thailand need to play a crucial role in further enabling EEF. Besides guidance on lending policy, these institutions could also develop a guarantee mechanism and coordinate physical regulations such as taxes.

International case studies found that collaboration with international organisations was recognised as a possible support mechanism in an emerging country context. Alignment of ongoing international projects in the country could optimise the outcomes (Limaye et al. 2012). In addition, international organisations could facilitate access to foreign funds such as the Green Climate Fund, the Nationally Appropriate Mitigation Action (NAMA) Facility or the Global Environment Facility (GEF) (Sarkar & Singh 2010). International organisations can also convince national bank CEOs to participate and assist in necessary in-house capacity building (Taylor et al. 2008). For example, in China, development banks exerted a beneficial influence by assisting in the development of green policies and increasing the communication between different stakeholders (Taylor

2012). However, as the findings of the Thailand case study indicate, care needs to be taken that foreign and international influence is directed to the appropriate target groups. Further, the degree of technical support will depend on the development status of the country.

Finally, demand creation support mechanisms are identified as crucial for enabling EEF services. Demand-creating measures could be enforceable standards and public sector programmes that specifically target one group (IPEEC 2015). For example, in India, the government focused its efforts on working together with large, industries to green their supply chains (Limaye et al. 2012). In Mexico, the IDB is assisting two ESCO companies to develop a warehouse line of projects worth US\$50 million, a volume that is interesting for financial institutions (IDB 2015).

8.3 Conclusions

The objective of this chapter was to reflect on how useful the analytical framework of MLP was for the analysis and how it can be adapted to fit into an emerging economy context to investigate the both the broader context and the 'social innovation' of EEF over time.

Most importantly it was noted that MLP is ideal for analysing the context via different analytical approaches: (1) three level analysis (2) analysis over a period of time (3) paying attention to international organisations' influence (new aspect) and (4) examining the relationships and interests of different stakeholders (new aspect).

MLP suggests analysis over a period of time, as it postulates that shifts at the regime level occur roughly over 50 years and at the niche level over 10 to 20 years. The analysis over time was found to be very useful for illuminating some of the institutional arrangements and the accompanying politics. At the niche level, it helped to highlight the disruptive government support for EEF initiatives due to the political turmoil.

The review of the literature revealed that transition scholars have focused excessively on internal struggles between national actors and so far have neglected the influence of international organisations at all MLP levels (Hansen & Nygaard 2014). In an emerging country context, paying attention to the influence of international organisations at each MLP level was found to be useful. The heavy influence of the World Bank could be identified and this explained the reluctance of government officials to collaborate with

development banks. Further, at the niche level development banks caused the EERF to be temporarily closed in 2012.

In transition studies the influence of the interests of organisations and the relationships of organisations with each other need to be further conceptualised. By paying attention to the relationships and interests of important stakeholders, interesting items were noted. These included the shift of support for EEF which moved from EGAT to the Ministry of Energy and the strong influence of local EGAT staff who opposed the privatisation process.

Also, this chapter discussed each MLP level: niche, regime and landscape, and what aspects will be important for EEF analysis in the future. At the landscape level, it is important, not just to pay attention to external events and the regime–niche relationship. It was important to reflect on ‘deep structural relationships’ such as the political systems and culture.

EEF regime analysis needs to focus on multiple regimes, namely electricity and e financial sector. Further, the relationships between different institutions and actors, especially the influence of international organisations, over time provide important information on their role in shaping the electricity or financial regimes. Also, the existing EE regulations, combined with the efficiency of potential customers, will define the demand for possible EEF mechanisms. Finally, it was recognised that in an emerging country context regime instability does not always mean an opportunity for the sustainable initiative to transition from the niche to the regime level.

At the niche level, EEF is defined as a social innovation which can be diverse. Besides adopting the niche analysis criteria of SNM, namely learning experiences relationships and interests of relevant stakeholders (including international organisations) and shared visions are crucial. Also, EEF niches are diverse in the nature of their relationships between public and private sector support, and they cater to different customers, due to the investment sizes and actors involved. For example, SMEs and the residential building sector might need more public sector support in the long term.

Concerning the way forward, the most important consideration is to focus not only on increasing private sector investment, but also on the framework conditions within the country, including political priorities. Only when this is done will it be possible to identify which groups to target EEF initiatives support. Also, the relationship between public and private sector support will change over time for each mechanism.

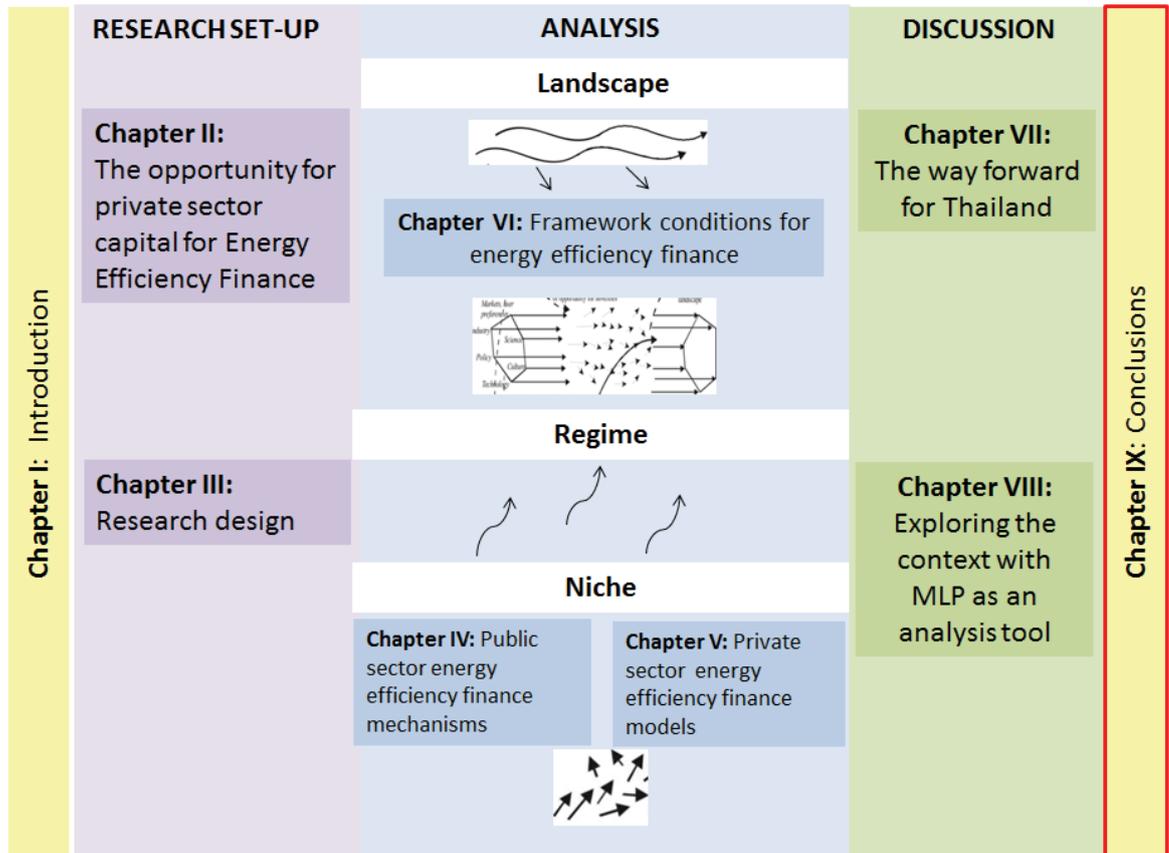
In countries with some experience of EEF initiatives, marketing and innovation strategies might be helpful. These strategies could include de-risking mechanisms, collaboration with finance ministries/ central banks and seeking international cooperation. Also, assistance to financial institutions to develop project pipelines and communication assistance. The offer of multiple EEF services is desirable. Also, long-term public sector support is needed, perhaps not in the form of direct EEF initiative support but in demand-creating measures such as enforcement of EE standards.

Future research should focus on further developing such a framework and integrating the following:

- a conceptual framework to integrate the analysis of relationships and interests into the MLP level structure
- the interrelationships between EEF initiatives and the policies that create demand for them.

Finally, the tool outlined above should be empirically tested in other Southeast Asian emerging countries to see whether it does in fact provide a more sensible approach to designing EEF initiatives than the current practices employed by national governments and international development banks.

Chapter IX: Conclusions



9.1 Introduction

This thesis has focused on the research question: *'How can the relationship between public and private sector support for energy efficiency finance be optimised in an Asian developing and emerging country context overtime?'* This chapter summarises the main findings of the research and its contribution to knowledge, and discusses the academic and policy implications.

The first section elaborates on the call from the international community that public sector support needs to work towards a 100% private sector uptake of EEF. The findings in Thailand do not confirm this statement, but rather point towards the importance to analyse the framework conditions to design dynamic public EEF support mechanisms.

The second session focuses on the findings that indicate how to optimise the public and private relationship for EEF mechanisms in Thailand. This is summarised from the analysis of the public EEF mechanisms, the private EEF models, the framework conditions analysis and next steps for Thailand.

In regards to public support mechanisms it was found that: (1) Mechanisms need to be dynamic and focus on private sector capacity building (2) It is better to deal with EE and RE in separate financing initiatives; (3) Most potential customers such as medium to large SMEs and ESCOs were not reached.

The focus of three private sector initiatives, namely EE-lending, ESCO-arranged finance and EE leasing concluded that Thai private sector EEF models are still fragile and not diverse. Despite over 10 years of public sector support to the private financial sector, private sector EEF models. Conservative behaviour of banks, no collateral of ESCOs and lack of recognition of the Thai government were named as some of the reasons for the models not to flourish.

Focusing on the framework conditions (regime/landscape analysis) the argument of recent grey literature was strengthened that framework conditions have an important role to play. Attention needs to be paid to the financial sector, the influence of international organisations and the political situation. For example, the conservative behaviour of banks in the end of 1990s was caused by the financial crisis. Due to tight regulations banks are unwilling to administer project finance. Also, the importance to recognise the political situation in a country is crucial to understand which reforms or mechanisms might be able to be implemented.

As next steps in Thailand de-risking mechanism and creating demand, especially in the SME sector was suggested.

Finally, a suggestion was made to use MLP as an analysis tool in other Asian emerging country context. Especially the approach to survey a sustainability niche overtime and at different levels was useful. Some of the challenges mentioned were to analyse possible intervention options and that instable regimes do not always have to present a window of opportunity.

Section four recommends areas for future research, given the limitations of the present study. Finally, section five highlights policy implications of the research.

9.2 Challenging the current discourse

The main finding from this research is that EEF in an emerging country context will never be transitioned 100% to the private sector, even though maximising private sector investment is one of the objectives. It will always be reliant on long-term consistent support from the public sector. Rather it is important to design public sector interventions according to the specific context in a country and the government's priorities.

The call from the international community to increase private sector investments for sustainable development has most recently emerged again in climate finance discussions (International Development Finance Club 2013; IPEEC 2015). Therefore the international discussions concerning EEF is about how EEF initiatives can be shifted from public EEF mechanisms towards privately driven project development and commercial finance. The shortage of public sector funds in developing and emerging economies, as well as the high business potential of EE are the main reasons for this emphasis (Selmet 2012; Sudo 2012; Wang et al. 2013). Most literature from development banks experts focuses on how large-scale investments can be supported by public sector funds (Limaye et al. 2012; Taylor 2012; Wang et al. 2013).

The thesis found that despite the long-term commitment of the Thai government towards EEF initiatives, private sector EEF initiatives are limited. In the beginning of 2015, only two banks had developed and offered loans to EE projects via their existing customers. ESCO-arranged finance was only administered by one international ESCO and EE leasing for the private sector has only reached seven projects. This indicates that

broader framework conditions, such as the lack of guidance from the Central Bank of Thailand, and the inability to create demand via EE legislation, seem to hinder the uptake. The Thailand case study also confirmed that the public sector has a crucial role to play in establishing programmes and policies that create a market for specific EEF initiatives.

Most importantly the research found that broader analysis of the framework conditions that are relevant for EEF are necessary to be able to sensibly design EEF support.

The Thailand case study highlighted that EEF initiatives cater to different target groups, which makes stakeholder analysis very important. For example in Thailand, some of the public sector efforts did not cater to the actual stakeholders in need for EEF, namely SMEs and ESCOs.

Further, an understanding of the interest and activities of international development organisations are also important. For example, all EEF initiatives in Thailand had some kind of influence from international organisations. For example, technical assistance from the World Bank and GIZ provided initial designed ideas for the EERF. EEF mechanisms were even named according to international organisations' liking to ensure their support.

Finally, it was found through the analysis that in an emerging economy financial markets and political systems might not be stable. The political turmoil in Thailand led to an imperfect privatisation of the electricity market which up until today has implications for coordination and enforcement of EE regulations. In Indonesia, only 51% of businesses have a bank account which limits impact of bank-led EEF services. Political systems also influence EEF, as for example in a decentralised system like India decentralised or city-wide support efforts for EEF might be more suitable than national initiatives.

Therefore, the analyses of the current and development of relevant framework conditions in the past are crucial to design sensible, successful policy interventions for EEF. In particular, this includes the relationships and actions of the involved stakeholders, especially of the international development organisations.

Using the Thailand case study, it was demonstrated that achieving an optimal relationship between public and private sector support for EEF is complex. Rather than private sector optimisation, the objective should be to analyse the context and identify which target groups need EEF initiatives. Then it can be decided what the public-private involvement needs to be to provide suitable EEF services to that target group. The

public sector needs an assessment tool which provides information about the status quo. Thus, this research suggests that the relationship between public and private sector support for EEF is complex, and depends on the context in the emerging country.

9.3 Optimising energy efficiency finance in emerging economies

Through the case study of Thailand, this thesis provides an in-depth analysis of the development of EEF initiatives over time. It illustrates the public and private sector relationship in regards to EEF and how it could be optimised to achieve the availability of EEF within the country. This was done by: (1) analysing public sector efforts to support EEF, (2) reflecting on the private sector EEF models that had been developed and (3) looking beyond the niche and seeing which framework conditions played a major role in influencing the outcome of EEF initiatives.

9.3.1 Public sector support needs to shift overtime to de-risking measures

The focus on the public EEF mechanisms (*Sub-question 1*), indicated the importance of both external events and internal champions for developing and driving EEF initiatives. This focus also revealed the challenges associated with developing de-risking measures and the importance of broader framework conditions such as financial guidance from the Central Bank of Thailand and the enforcement of existing EE legislation.

The Thai government developed two prominent public EEF mechanisms, namely the Energy Efficiency Revolving Fund (EERF) (since 2003) and the ESCO Fund (since 2006). These initiatives were responses to the Asian financial crisis and ignited by lobbying from Thai financial experts and international organisations. These EEF mechanisms were very successful in providing EEF to customers and implementing EE projects within the large industry and building sectors. However, these programmes were temporarily stopped between 2014 and 2015 due to the perceived success and military government intervention. All government officials mentioned that at international conferences and in reports the EERF was always praised to be best practice examples and therefore had achieved its goal. However, the analysis showed that the program had not been successful in incentivising banks and ESCOs to develop sustainable EE lending/financing portfolios. Key lessons learned were that governments need to move from grants to de-risking measures, and that extensive capacity building with the respective financial institutions is necessary. Further, a combination of EE and renewable energy (RE) projects within one mechanism leads to a bias towards RE projects, due to their investment size and relatively established technology options.

9.3.2 Private sector niches are reliant on cross-ministerial public sector support

The results of the private sector EEF models analysis (*Sub-question 2*) found that they are still very limited. They were dependent on dynamic public/international development sector support and also, the framework conditions had a high impact on their outcomes. It was found that currently, all the private sector EEF models are limited to a few financial institutions. Also, the public sector focused mostly on EE lending. At the beginning of 2015, only two banks still offered EE lending; only one ESCO provided ESCO-arranged finance, and only two leasing companies had implemented EE leasing projects. EE lending offers were limited by the strict underwriting criteria for existing customers and a limited response to the offers. Due to the re-launch of the EERF and support from the French development agency (AFD), further capacity building will hopefully overcome some of the barriers. ESCO-arranged finance was limited due to a lack of access to finance. Also, the ESCO fund, despite its name, has so far provided only a very limited amount of finance to ESCOs. Only one ESCO company could be found that provided ESCO arranged finance, starting at THB 2 Mio (US\$57.000) annual electricity consumption. Leasing projects, which have only just started in Thailand, have so far not received any Thai government support and lack de-risking mechanisms that would allow them to reach out to new customers and grow their portfolios. For all private sector EEF models, the importance of the framework conditions were noted, such as the composition of the financial sector, and enabling regulations such as enforced EE building standards or tax incentives.

9.3.3 Framework conditions/ multiple regimes – financial sector and ‘deep structural relationships’ as important as the electricity sector

Exploring the framework conditions and how they influenced EEF initiatives (*Sub-question 3*), highlighted that besides the obvious influence of the electricity sector, the financial sector as well as ‘*deep structural relationships*’ are relevant for EEF (Climate and Development Knowledge Network 2014, p.794).

9.3.3.1 Electricity sector

It was confirmed that EE legislation is crucial for creating the demand for EEF initiatives. For example, the lack of demand for the ESCO fund was partially because the national legislation focuses on large industry and buildings, rather than SMEs, which is actually the target group for the ESCO fund.

Other important aspects noted were:

- Technical capacity: Due to the long-term technical capacity-building since the 1990s, Thailand has qualified experts and technologies available. However, quality issues such as confusion about what an ESCO is, unsound ESCO practices and monitoring problems, currently hinder the ESCO market.
- Institutional set-up which links to enforceability of policies: The Thailand case study demonstrated that the cross-ministerial administration of the EE building code and the difficulties of coordination caused a lack of enforcement and this limited the demand for external EEF.
- Electricity price: Interviewees noted the importance of the electricity price in making a business case for EE. However, the comments were mixed regarding whether Thailand's electricity price was already high enough or not.

9.3.3.2 Financial sector – topography and governance

It was found that the composition of the financial sector and its governance had a significant impact on EEF. For example, the prominence of EE lending was influenced negatively by the high percentage of capital assets in the banking sector. Also, the lack of involvement of the Ministry of Finance and the Central Bank of Thailand to provide guidance for EE finance has resulted in the very strict underwriting criteria of the financial institutions today. Further, to establish de-risking measures for EEF need to involve the Ministry of Finance or sub-departments, as they have the mandate and expertise to design such instruments.

9.3.3.3 Deep structural relationships and external events – international influences

The results confirmed that the deep structural relationships and events that are beyond the direct influence of EEF initiatives are important. In particular, the strong influence of international organisations in an emerging country context needs to be considered as well as the political system of a country. International organisations have shaped the electricity and financial sectors in Thailand and have been highly influential in the initial technical support for EEF. The political turmoil during the Electricity Service Industry Reform process in Thailand caused the problematic institutional set-up of the electricity sector today. Also, it was noted that the start of EEF initiatives was caused by the financial crisis, political turmoil and international lobbying, indicating the importance of disruptive events in providing opportunities for new innovations to rise.

9.3.4 Suggested next steps for Thailand – de-risking mechanism and creating demand

The final focus of analysis was on how to optimise EEF in Thailand by looking into existing initiatives and by thinking about what other efforts could be started to provide an even richer diversity of EEF options (*Sub-question 4*).

The diversity of EEF initiatives differentiated by the project size and customers, explains the specific suggestions that interviewees made. Relevant to all EEF initiatives was the finding that currently, EEF initiatives do not cater for medium to large SMEs, who comprise the largest group of candidates for external finance.

Specifically EE lending needs specific technical support to possibly aggregate SME projects and builds the capacity of the banking sector. Collaboration with the Ministry of Finance and Central Bank of Thailand is seen as crucial to provide necessary guidance to the banking sector and possibly facilitate a guarantee mechanism.

ESCO-arranged finance can be supported by ensuring the quality of local Thai ESCOs via certification bodies, facilitators and by the standardisation of contracts and procedures. Also, finance could be provided via a publicly supported Super-ESCO which could finance and collaborate with small technical ESCOs. A guarantee mechanism could overcome the access to finance problem.

EE leasing initiatives, which mostly would cater to SMEs, can be supported by the public sector formally recognising the EEF initiative. Also, possibly a collaboration between private sector financial leasing firms and the ESCO Fund could be created. Further, tax exemptions are crucial for this model to work and should be made permanent.

Given the current political set-up, framework conditions and recommendations by the exit seminars the researcher suggests three concrete next steps: (1) a guarantee mechanism; (2) on-bill financing via a utility-based standard operation programme and (3) a carbon finance initiative. One suggestion is to establish a guarantee mechanism. Further, to create the demand for external EEF services, a public building programme that targets ESCO-arranged finance and a standard offer programme via utilities that can cater to SMEs should be initiated by the Thai public sector. Government officials stated that due to the current political situation, the collaboration between the Ministry of Energy and the Ministry of Finance to develop a guarantee mechanism for ESCOs and SMEs under the existing Thai Credit Guarantee Corporation could occur. Also, international experts and ESCOs have called for a public building programme. As inter-ministerial discussions have started to work on the procurement regulations, this option

could become a reality soon. Also, a standard offer programme, which is a financial incentive for industries and buildings could be facilitated via electricity utilities and create a new market for EEF (e.g. the residential sector) and also take advantage of the rather centralised administration of the electricity market in Thailand.

9.4 Multi-level perspective – an useful analysis tool to explore the context

Finally, the thesis reflected on the use of the analytical Multi-Level Perspective (MLP) tool. Most transition studies still focus on European countries, but over the last decade publications that focus on developing and emerging economies have rapidly increased (Berkhout et al. 2010; Hansen & Nygaard 2013; Onsongo & Schot 2015; Verbong et al. 2010).

The application of MLP to an emerging country context brought interesting insights via:

- 1) analysing different levels
- 2) analyse transitions over periods of time with particular attention to the involvement of international organisations
- 3) paying particular attention to international influences at all MLP levels
- 4) Accounting for the political system and cultural context.

Challenges were identified in regards to understanding (1) the dynamics between the niche and the regime and (2) the MLP theory of 'regime stability' in an emerging economy with constant political turmoil.

9.4.1 Analysis of different levels

The differentiation between the niche, regime and landscape levels enabled an investigation, not just of EEF initiatives, but also of the enabling framework conditions and events that might support or hinder them. In particular, the differentiation between the niche and the regime highlighted the obstacles due to the current situation in the electricity and financial sectors that will hinder the success of EEF initiatives.

9.4.2 Analysis of EEF over time – crucial in a vast changing emerging context with international influence

The analysis of EEF over time enabled an understanding of the complex relationships between important stakeholders and institutional challenges. For example, the overview of Thailand over the last fifty years revealed the strong influence of international

organisations. The International Monetary Fund's (IMF) regulations contributed significantly to the financial crisis of 1997 (at the landscape level), which shaped the strict governance structure of the financial sector at the regime level up until today. This provided an understanding of why some government officials were not very open to further World Bank or IMF support. However, so far MLP has not provided specific analytical tools to highlight the political and economic interests. Some attempts have been made and further research would be very useful in this regard (Baker, Newell & Phillips 2014; Newell 2013; Geels 2011; Avelino & Rotmans 2009).

9.4.3 International influences

International cooperation and involvement could be observed at all MLP levels.

The analysis at the landscape/regime level revealed the strong role that international organisations played in inducing landscape events, such as the financial crisis. International organisations influenced the setting up and development of the financial and electricity sector of Thailand. The IMF initiated financial liberalisation and the ESI reform process. Liberalisation led to the financial crisis, which led to the closed, tightly governed financial sector of today. The ESI reform process is incomplete and causes challenging institutional framework conditions for electricity and energy conservation governance.

At the niche level it was noted that, specifically for the public sector EEF mechanisms, the influence of international organisations was influential and also moved from technically focused grant support to mechanisms supporting privatisation. However, the influence of international organisations must not always be positive. As discussed in chapter IV, the international attention that the EERF received was one of the reasons given by interviewees for why the EERF was temporarily stopped in 2012, even though banks had not yet integrated it into their portfolios. Private sector initiatives were also supported by international organisations such as development banks and foreign mother companies.

Thus, this research confirms Hansen & Nygaard (2013) and Raven, Schot & Berkhout (2012) notion that the influence of transnational organisations needs to be included in the MLP framework and should also not be seen as only influencing the landscape level.

9.4.4 Accounting for the political system and cultural context

Recent MLP research has started to include in the landscape analysis the consideration of the 'deep structural relationships' within a society that impact on sustainable

initiatives but cannot be changed or influenced (Climate and Development Knowledge Network 2014; Geels et al. 2015). Geels et al. (2015, p.6) defines those relationships as 'static landscape' characteristics. According to Geels et al. (2015) these could be cultural traditions, constitutional arrangements or policy styles.

The case study demonstrated that the political system has a significant influence on EEF initiatives. For example, in 1992 the newly established technocratic government passed comprehensive energy conservation legislation which led to the Energy Conservation Fund, which became operational in 1995. On the other hand, political instability in the Thailand case study in the early 2000s hindered comprehensive electricity market reform, due to constant changes of governments and policy direction. So it proved useful to explore deep structural relationships. However, as was demonstrated with the current military government take-over, the landscape can change rapidly and thus should not be identified as 'static'.

9.4.5 Challenges of the MLP framework

The research in this thesis also revealed limitations of the MLP framework to provide analytical concepts to understand how niches penetrate into the dominant regimes. Except for the identification of transition pathways, MLP literature has so far been limited to research analysing which measures might further encourage mainstreaming of sustainability initiatives (Anadón 2012; Geels 2011; Smith 2007). So in the Thailand case study the researcher was able to identify the transition pathway as a 'reconfiguration pathway', which means that multiple innovations (in this case EEF initiatives) interplay and compete with old regime actors and will slowly change the electricity and finance system over time (Geels & Schot 2007; Verbong & Geels 2010). However, from this research no guidance could be obtained about how to further advance EEF. A broader literature search on transition studies identified some further guidance by other frameworks. For example, some research calls for market innovations such as tax credits, guarantees and venture capital availability (Van der Loo & Loorbach 2012). Therefore, the researcher recommends further research which combines the two frameworks (Markard & Truffer 2008).

Also, the findings in the Thailand case study challenge the MLP theory of 'regime instability'. Under the MLP framework the sustainable niche under development can only penetrate into the regime if 'destabilisation of the regime creates windows of opportunity for niche innovations' (Schot & Geels 2008; Smith 2007). However, the Thailand case study confirms recent findings that in emerging economies, regimes can be constantly unstable, which does not allow initiatives to mature further. The political unrest of the

2000s in Thailand combined with the financial crisis in 1997, made banks more conservative in their lending behavior. Also, it made any collaboration between the Ministry of Energy and the Ministry of Finance on de-risking measures impossible. Thus, the instability of the regime resulted, not in a 'window of opportunity' but in limitations to EEF. This finding contributes to the arising discussions about how to adapt transition theory to match the context in developing and emerging economies.

In conclusion, the MLP framework has enabled an interesting analysis in the Thailand case with encouraging results. Therefore, keeping some of the outlined challenges and limitations in mind, at the end of this thesis a suggestion is made about how to use the MLP structure to highlight important analytical considerations for investigating EEF in an emerging economy context.

9.5 Opportunities for future research

In addition to the theoretical and empirical contributions of this thesis, it highlights possible future research on EEF in emerging economies that were not covered in this thesis.

First, even though the thesis provides valid empirical evidence of the complexity of EEF in an emerging country context, its conclusions cannot be generalised to other Southeast Asian emerging economies. Further, one of the main findings stresses the importance of the specific context of a country defined by the political system, the financial and electricity sectors.

That is why it is suggested that further research be conducted to develop an analytical tool that enables the exploration of EEF in any emerging country context. The suggested tool would use MLP to analyse the development in the past and the current situation in order to investigate which EEF initiatives might be worth supporting. Rather than focusing on the management of any EEF initiative, it would focus on the analysis of the current context. Therefore, it is envisaged that this tool would contribute to existing efforts to optimise EEF by providing a more nuanced and accurate knowledge base for designing sensible supporting policies. For each level, important features were identified. However, the development of a comprehensive tool was beyond the scope of this thesis. More empirical testing and analytical refinement would be necessary. Further, the integration of specific analysis frameworks to illuminate the relationships and interests would be useful.

The international overview found that China has a vast diversity of EEF models and also has been the focus of international collaboration for a long time. Thus, China could be an interesting case study or comparison for testing the model in depth (Crossley & Wang 2013; Taylor 2012).

9.6 Policy implications

Having focused on a current and complex problem in an emerging country context, this research furthers the national and international policy discussions around how to support EEF.

9.6.1 Policy makers in emerging economies

This thesis provides insights on how to optimise the provision of EEF in an emerging country context. This is useful for Asian policy makers as pressures in Asian emerging economies are increasing, due to continuous rapid development and increases in the frequency and intensity of disasters.

The evaluation of public and private sector EEF initiatives in the Thailand case study highlighted four interesting lessons learned:

- 1) Public and private sector involvement needs to be optimised according to the framework conditions and the political focus.
- 2) EE de-risking measures such as guarantees are important.
- 3) EE and RE investments have different characteristics and thus need to be handled via separate mechanisms.
- 4) International organisations influence the support of new financing approaches and mechanisms in a developing/emerging country context.

9.6.1.1 *Framework conditions as a guide on the need for public and private sector support for EEF*

EEF initiatives will involve a constant balance between public sector support on the one hand and the private sector offers on the other. Besides kick-starting public EEF mechanisms the public sector needs to provide continuous support for enabling framework conditions and specific incentives on EEF offers. The state of the financial sector, technology providers and the political system should inform the choice of which EEF initiatives to support. Also, in addition to the set-up of the financial mechanism, raising the awareness of the target group and implementing mandatory, enforceable policies are crucial.

9.6.1.2 De-risking measures

Public EEF mechanisms need to move from being grant based measures to de-risking mechanisms. This might be challenging for governments, as the disbursement of funds is somewhat unpredictable. International development banks might be able to support them.

9.6.1.3 Renewable energy and energy efficiency mechanisms

If a mechanism combines EE and RE projects as eligible for funding, the RE projects will always reap the majority of the investments. For project developers as well as financiers, RE projects are financially more attractive because in RE projects technologies are limited, assets are visible and the investment amounts are larger. EE projects involve diverse technologies, electricity savings are invisible and the investment amounts are small. Quotas or separate EEF mechanisms could avoid that problem.

9.6.1.4 Account for the influence of international development organisations

International development organisations can provide useful support for technical capacity building or by providing assistance with guarantee mechanisms, but sometimes they can also confuse the process. Thus, this research strengthens Raven, Schot & Berkhout (2012) that transnational influences need to be considered also at the niche level. Local policy makers should assess and coordinate the influence of these organisations to align their activities with the political priorities.

9.6.2 International donor community

Recent discussions in the international community highlight their interest but also their limitations in providing intervention mechanisms to effectively promote EEF. Thus, this thesis calls on the international community to consider the following findings:

- the need for de-risking measures;
- the diversity of EEF mechanisms which can also be dependent on public sector programmes or which can be focused on SMEs (e.g. EE leasing);
- the need to recognise the delicate relationship between public and private sector efforts depending on national framework conditions and the political priorities.

The Thailand case study and other emerging economies demonstrate that sometimes it is not external funds, but rather assistance to design guarantee mechanisms and other de-risking tools, which would be beneficial contributions from international organisations.

EEF initiatives are diverse, due to the presence of different actors, customers and risk profiles. The international overview presented in Table 3 demonstrated that besides bank-related mechanisms, EE- leasing or public sector programme-specific mechanisms are also possible.

Most importantly, the international community needs to move away from its dominant discourse of increasing private sector investment and acknowledging the complexity of EEF. This research has shown that national framework conditions are crucial for identifying useful EEF initiatives. Joint efforts can be made, not only to focus on investments but also to fund and support in-depth country analysis before those investments are made.

9.6.3 Importance of assessment frameworks that catch the complexity

The main message of this thesis is that context matters in the design of EEF initiatives. However, besides listing possible things to consider, no comprehensive assessment tool exists that could adequately assess the status quo in an emerging country to inform the sensible design of EEF initiatives. Thus, this thesis provides some rationale for the development of such a tool, possibly using the MLP framework.

In developing and emerging countries, long-lasting and successful EEF initiatives will not be possible until national and international interventions are based on thorough analysis.

9.7 Conclusion

As has been demonstrated in this thesis, EEF is an important prerequisite for realising EE potential in emerging economies. So far, knowledge about how to design public sector mechanisms that can optimise EEF in emerging economies is limited.

International organisations have advocated for the provision of EEF to change overtime to a scenario where private sector capital is predominant, specifically from the banking sector. However, this discourse obscures the reality that in emerging economies the situation is complex and changing at a rapid rate.

The in-depth case study of Thailand revealed that even after over 10 years of public sector support, private sector EEF initiatives are still limited. Therefore, the public sector's role in supporting EEF initiatives needs to be long-term and be able to change overtime. The analysis also found that the framework conditions are crucial for

identifying which EEF initiatives might be suitable. Finally, it is not just the design of the EEF initiatives that will be important: it is also necessary to create measures, such as EE legislation or larger public sector programmes that create a demand for those services.

It was found that an analytical tool for an emerging country would be helpful for designing sensible policy interventions to support EEF initiatives in the future. The analysis of the framework conditions over time, in-depth analysis of the situation of the electricity and finance sectors, as well as international influences and the political system will be important components of any such analysis.

Through an improved assessment approach for policy makers it will be possible to design or support the appropriate EEF initiatives which will encourage the optimal combination of public and private sector finance. This will contribute to the realisation of EE potential in Asia and the Pacific and thus support sustainable development in this region.

Appendix I: Energy efficiency barriers identified from the literature

Barrier	Micro -level	Macro-level: Lack of Political/supporting mechanisms
Imperfect information	Most energy efficiency technologies are sector and process specific. Especially in a developing/emerging country context, it is very hard to get the necessary information on readily available technologies. Also, culturally acceptable and directed information on the EE technology on the level and pattern of energy consumption and how it compares with benchmarks and the energy consumption of retrofitted buildings is often missing (Ghosh 2001; Sorrell, Mallett & Nye 2013; UNEP 2011).	<ul style="list-style-type: none"> ▪ Lack of information and support on readily available technologies and services (e.g. labels, information etc.) (UNEP 2006; UNIDO 2011) ▪ In developing/emerging countries, readily available EE technologies are limited (Anbumozhi 2009; Huovila et al. 2007; UNIDO 2011).
Risk	Decision-makers in the industry, building and local financial sector might assign high risks (short payback periods) to energy efficient technology due to the limited research and experience with its energy savings. (IEA 2012; Sorrell, Mallett & Nye 2013; Ward 2010);	<ul style="list-style-type: none"> ▪ Lack of financing instruments in the market increase the risk perception and thus the interest rates (Sarkar & Singh 2010) ▪ Lack of readily available EE technology (UNEP 2006; UNIDO 2011) ▪ Insecure power systems (UNIDO 2011) ▪ Lack of political commitment (Anbumozhi 2009; UNEP 2006)
Split incentives	Split incentives means that the benefits of the energy savings will not be earned by the same individual who makes the EE investment. Operational structures, cost administration, outsourcing of services and a division between investors and beneficiaries might all cause a disincentive to invest in EE (Masselink 2007; Punte et al. 2005; Worrell 2011).	Split incentives are mainly relevant within an enterprise. No macro-economic influences could be identified. (Hasanbeigi, Menke & Du Pont 2009)
Hidden costs	It has been suggested that hidden- or transaction costs cause the energy efficiency gap as they represent the multitude of costs that might be ignored in cost-benefit analysis (Selmet 2012): Maintenance costs, disruption of production during EE technology installation, staff training and costs to find the information on EE technologies are the main hidden costs mentioned. Also it was noted that this barrier is especially problematic for SMEs (Anbumozhi 2009; Hasanbeigi, Menke & Du Pont 2009; Sorrell, Mallett & Nye 2013; UNIDO 2011; Worrell et al. 2003);	<ul style="list-style-type: none"> ▪ Lack of information and support on readily available technologies and services (e.g. labels, information etc.) (UNEP 2006; UNIDO 2011) ▪ Small and medium enterprises are abundant in Asia. Their capacities are even more limited in time and skills to find appropriate information (Anbumozhi 2009; UNIDO 2011);
Bounded rationality	Optimised cost-benefit analysis sometimes also does not happen due to limitations of culture, peoples' capacity, core activities and time. This is referred to in the literature as ' bounded rationality '(Anbumozhi 2009; Ghosh 2001; Kumar 2005; Punte et al. 2005; Taylor et al. 2008; UNIDO 2011).	<ul style="list-style-type: none"> ▪ Level of education of the working force (Sorrell, Mallett & Nye 2013).
Access to capital	Even though the EE measures will refinance themselves rather quick due to saved energy consumption, the initial capital costs might be very high and thus access to up-front finance has been recognised as important, Especially in developing/emerging markets where capital is limited (Huovila et al. 2007; Sorrell, Mallett & Nye 2013; Taylor et al. 2008; UNEP 2011);	<ul style="list-style-type: none"> ▪ <u>Energy price undervalued</u> due to missing integration of externalities and energy subsidies (APEC 2012; IEA 2012; UNIDO 2011; World Bank 2011); ▪ SMEs have little credit worthiness (Taylor et al. 2008). ▪ Lack of political commitment (Anbumozhi 2009; UNEP 2006); ▪ Weak legal and contracting arrangements (Sarkar & Singh 2010; Taylor et al. 2008; The World Bank 2013);
Rebound effect	Another behavioural related aspect which might hinder a real reduction in energy consumption is the rebound effect . The energy consumption behaviour might change due to the awareness of energy savings achieved and actually cause an increase of the previous energy consumption levels Ayres 2010 in (UNIDO 2011).	

Appendix II: Energy efficiency finance approaches

Market segment	Customer/ Size						Actors and roles	Project Risk Profile	Market enabling action
	L	SME							
	C	I	C	I	P	R			
Energy efficiency business models based on new financing schemes									
1. Direct Bank Loan 5-7 years	X	X					Banks: lender Customer	Operational and financial risk: Bank	Revolving funds Soft loans Loans with guarantee; direct investment subsidies
1a. Add-on loans < 3 years	X	X					Bank customer	Operational and financial risk: Bank	
1b. Direct loan+ Expert guarantee (e.g. GS EPCs)	X	X					ESCO: techn. exp. Bank: lender Customer:	Performance risk: ESCO financial risk: Bank	- Facilitation - ESCO fund for guarantees
2. Leasing < 3 years			X	X			Financial institution technology provider Customer	Operational risk: Customer Financial risk: Leaser Technical risk: Customer/ techn.prov.	-tax initiatives - subsidised 'leasing' loans
3. Property Assessed Clean Energy (PACE)					X	X	Munic. Gov.	Operational risk: Customer Financial risk: Munic. Gov.	Adjust property tax bill that it can be increased to pay back loan overtime
4.State/municipal loan/green bond	X	X	X	X		X	Munic: fund local FI: lender	Operational risk: Customer Financial risk: city/bank	-secondary market funds supported via gov. endorsement
5. On-bill financing	X	X	X	X		X	Utility: Bill Third party: tech adv.	Technical risk: utility/customer Operational risk: customer Financial risk: customer and utilities, Third party financial institutions or bond holders	-leverage funds -Loan guarantees -Saving Energy obligations -Change of procurement reg.

	Customer/ Size						Actors and roles	Project Risk Profile	Market enabling action
Market segment	L	SME							
	C	I	C	I	P	R			
6. Private sector Investor	X	X			X		Special project entity, customers, financial intuitions	Operational risk: Special Purpose Entity (SPE) Technical risk: ESCO/tech. prov. Financial: Lender	-guarantees or funds that buy down risk for secondary money market - unsecured consumer loan.
ESCO arranged Finance									
7. ESCO – Shared SS EPCs > 10 years	X	X			X		Financial institution customer ESCO	Operational and Financial risk: ESCO	Revolving Funds Public building programme monitoring standards standarised contracts
8. Energy supply Contracts(15-20 years)	X	X					Financial Institution Customer ESCO	Operational and maintenance risk: ESCO Financial risk: ESCO	
9. Energy Saving Purchase agreements	X	X			X		ESCO utility	Financial risk: Utility Maintenance risk: Utility ESCO: operational risk	Standard offer programme
10. Transform Markets							Government customers Technology providers	Operational risk: Technology provider Financial risk: Customer Maintenance: Customer/Technology provider	Label standards Forced market transformations Education campaigns Audits Consumption disclosure requirements
11. Certified green building label		X		X	X	X	Property developer/architect ; Customer certification body	Customer: Financial risk Project developer: maintenance risk Technical risk: certifier	-implement policies to avoid split incentives programme - policies that mandates 'green' certification - Awareness campaigns - Applying them to public

	Customer/ Size						Actors and roles	Project Risk Profile	Market enabling action
Market segment	L	SME							
	C	I	C	I	P	R			
								buildings	
12. Preferential Terms for Green / EE Buildings						X	Customer (property owners) Governments Technology providers	Financial risk: Customer Technical risks: Technology provider Operational/Maintenance: Customer	- regulation which allows for rent increases -Research about potential rent increases - Database of cost increases by building types
13. Carbon Finance	X	X				X	Government Customers Technology providers	N/A (depends on the type of carbon finance)	Emission trading schemes
Sources: (ADB 2015a; Kats et al. 2012; MacLean & Purcell 2014; Würtenberger 2012)									

Appendix III: Semi-structured interview – schedule (Field Trip I)

Objective:

To obtain insights into the dominant finance regime, the public sector initiatives to incentivise for EEF, the current position of EE investment and existing challenges.

Themes to be looked into:

Three factors have been identified as influencing the deployment of an innovation (here EEF) into mainstream market practice: learning, networking and the existence of a shared vision.

If the dominant regime is to be analysed the institutions, networks and technical infrastructure will need to be addressed.

In addition information will be gathered on the existing EEF mechanisms as well as an indication of the enablers and barriers.

Below, the themes are described with some preliminary questions. Instead of going from one question to the next, a mix of 5-8 questions will be chosen, depending on the expertise of the interviewee. In bold are some questions highlighted which seem very important.

Experience (Introduction):

Objective/purpose:

Make the interviewee feel comfortable and create a rapport between the researcher and the interviewee.

- What has been your role in your current position in relation to the EE activities?
- What drives you to work in this area ... what has been for you a key experience/motivator to work in this field in the Asia region and specifically in Thailand?

General understanding of EEF:

Objective/Purpose:

To understand how EEF is defined and described within the country. Information should be gathered on the definition of EEF and varieties and its development in the past.

- What do you understand under EEF?
- What public sector finance programmes for EE do you know of (ESCO support; funds; market transformation; utility programmes? Possibly facilitated by the public sector or international organisations?
- Could you provide a rough timeline of how EEF policies in Thailand have developed over time?

Networks

Objective: To observe in how far a new actor network with complementary resources

has been created around EEF next to the dominant energy financing one.

- Who do you think is important to consider for the financing sector in Thailand?
- Who would be particularly interested in EEF policies?
- What academic institutions exist that might also provide knowledge on energy efficiency finance?
- What resources have been pledged for building up such a network?
- **How is the communication between ministries, academia and the private sector concerning EEF? Why do you think that is so?**
- What changes have you observed over the last 10 years? How did they come about?
- Do you think international organisations could influence the developments for the positive or the negative?

Learning/capacity development

Objective: Observe in how far Pilot projects and capacity building have led the innovation to interact with the regime and established sustainable learning curves and capacity development in the financing sector.

- What does learning and capacity building mean to you?
- What learning/ capacity building exercises in regards to EEF are you aware of?
- Which stakeholders were involved in these developments (from the private sector, government or international organisations)?

Voicing and shaping of expectations

Objective: To further the understanding in how far the expectations and visions of the different actors in EEF have been aligned to guide the direction for the innovation.

- Why do you think EE measures are important to Thailand?
- Are you aware of a document that actually describes the targets for energy efficiency finance in Thailand (from the private, government side)?
- What in your opinion would be necessary to achieve shared vision/goals in this area?
- What would be the steps to move forward?

Barriers and challenges

Objective: To identify the barriers and challenges that EEF faces as a new mechanism within the existing energy finance regime.

- How important do you think EEF is in the overall investment market?
- How does the current energy financing sector operate in Thailand?
- What are the main risks to energy investors in Thailand?
- What barriers do you think are there for EEF not to be applied more widely in the Thai finance sector?

Status of energy efficiency finance in Thailand

Objective: Receive a preliminary indication of the position of the sustainable mechanism of EEF in Thailand.

- In your opinion do you think EEF is already a commercial option to project developers or where is its current position? (Demand from the customer,

institutional change, changes in price and performance). What public sector efforts could assist to mainstream EEF further?

- Do you think nationally appropriate mitigation actions (NAMAs) could play any role in this?

Conclusion:

Objective: Enable a closure to the interview discussions and provide the interviewee to voice final concerns or reflect on the overall interview process.

- Of all the challenges discusses which one is to you the most important challenge?
- Do you feel some relevant information in regarding to the topic of EEF is missing that you would like to be raised?

Would you be available for follow up questions during my 2nd field visit in mid-2014 or if I would like to verify some information gathered during this interview?

Appendix IV: Interview schedule for the financial sector (Field trip I)

Objective:

Identify the **current prevailing practices of the financial sector**, its regulations, networks and invested capital and provide an in-depth overview of the financial institutions related to EEF (Bond financing, loan guarantee companies, financial leasing companies, some investment or trust companies, or even some financially well-positioned ESCOs).

Interviewees

8-10 key financial experts (banks, academia, large ESCO...) will be interviewed. Out of those interviewees also the focus group discussant will be identified. The interviewees should be broadly from:

- Financial institutions (trust companies, insurance companies, bond institutions and large ESCOS),
- Financial facilitators (associations, consultants)
- Government (Central Bank of Thailand)
- Academia (universities)
- International organisations (development banks, bilateral organisations, UN organisations)

The snowball system will assist to make a selection. Informants will be chosen from the first field trip.

Themes to be looked into:

As this focuses mainly on the dominant regime the criteria, institutions, networks and invested capital will be addressed.

Institutions:

- regulations (government and sector policies)
- cultural (Thai, Buddhist etc.)
- market and user patterns

Networks (organisational capital):

- current networks
- relationships and interests/agency

Invested Capital:

- current infrastructure investment portfolio
- existing departments.

DRAFT INTERVIEW SCHEDULE:

Experience/Introduction:

- What has been your role during your time in xxx?
- What drives you to work in this area...what has been for you a key experience/motivator to work in this field in the Asia region and specifically in Thailand?
- What do you understand under EEF and where does your experience come from (e.g. EERF or other schemes)?

EEF

General-institutions

- What are the decisive policies and regulations concerning the financial sector and in your opinion does it provide an enabling or disabling environment for EEF?
- Are there any EEF specific guidelines from your organisation, government or association?
- Do you consider any transnational guidelines or debates on EEF?

Networks

- With which stakeholders do you engage with on EEF in Thailand? (financial institutions, facilitator and government)
- What communication channels do you normally use for portfolio development ---- Is that how you relate to the EEF relevant stakeholders? Why and why not?
- What changes have you observed over the last 10 years? How did the financial crisis in 1997 impact this? How did they come about?
- Do you think that international organisations have any influence? If in what way?

Invested Capital/organisational capital EEF/niche

- How important do you think EEF is in the overall investment market?
- Why does your institution engage in EEF?
- How is EEF institutionalised in your organisation?
- What are the main risks to energy investors in Thailand?

Others

- In your opinion do you think EEF is already a commercial option to project developers or where is its current position?
- In your experience what do you see as the main barrier to EEF?
- What **public sector efforts** could assist to mainstream EEF further?
- What might be the role of transnational organisations?

- Which other stakeholder would you recommend to provide further information on this topic?

Appendix V: Draft interview schedule for ESCOs

Interviewees

4-6 EE expert ESCOs will be interviewed. The interviewees will be recommended by GIZ EE programme that conducted an ESCO evaluation in June 2014.

Themes to be looked into: As this focuses mainly on furthering the understanding of the EEF customers, challenges and support mechanism of the public sector, the following topics will be addressed:

Experience/Introduction:

- What has been your role during your time in xxx?
- What drives you to work in this area...what has been for you a key experience/motivator to work in this field in the Asia region and specifically in Thailand?
- What do you understand under EEF and where does your experience come from (e.g. EERF or other schemes)?
- How long has your ESCO been in operation in Thailand?
- What have been the main barriers or challenges to your operation?
- What is your current turnover of projects /year?
- **Which are your main customers for EEF in Thailand and why?**
- **Where do you see further potential for EE reductions?**

Barrier – EEF

General – institutions

- What are the decisive policies and regulations concerning your business? the
- Do you consider any transnational guidelines or debates on EEF?
- Do you think that the public sector support coincides with the highest potential in regards to EE reductions?

Networks

- How do you find your customers?
- Are you a member of the ESCO association or have received any public sector support?
- Do you think that international organisations/ESCOS have any influence? If in what way?

Others

- In your opinion do you think EEF is already a commercial option to project developers or where is its currently position?
- What **public efforts** could assist to mainstream EEF further?
- What might be the role of transnational organisations?

- Which other stakeholder would you recommend to provide further information on this topic?

Objective:

To understand how the consumers perceive the supply for EEF in Thailand, what their experiences are so far and what they actually need from EEF that would assist them to overcome the barrier. Also it will be verified that EEF is a barrier for them to implement EE in their businesses.

Interviewees

2–3 EEF end-users for previously identified EEF portfolio streams. Probably they will come from large, middle income industries or buildings in commercial or residential sector. They will be identified by consulting with JGSEE and GIZ staff once the EEF portfolio streams have been identified.

Themes to be looked into: As this focuses mainly on furthering the understanding of the EEF customers, challenges and support mechanism of the public sector, the following topics will be addressed:

Experience/Introduction:

- Which product is your company producing?
- What has been your role during your time in xxx?
- What drives you to work in this area...what has been for you a key experience/motivator to work in this field in the Asia region and specifically in the Thailand case study?
- How long has your business been in operation in Thailand?
- Since when did you start thinking about EE improvements in your business? How was it started?
- What were the EE measures implemented and how was it done? What were the main barriers for you to implement EE measures?
- How did you overcome them?
- Do you see further EE reduction potential and how could it be implemented?

Barrier – EEF**General institutions**

- What do you understand under EEF and where does your experience come from (e.g. EERF or other schemes)?
- How are investment decisions made in your company concerning internal equipment or infrastructure?
- Are their guiding documents that you follow?
- About the EEF programme, were there clear instructions about the different roles and the process of the lending?

Networks

- How do you find out about the EEF programmes?
- Are you a member of an association and do they provide information about innovation in your sector or government programmes?

- Do you have any influence coming from international organisations?
- How was your cooperation with the government or bank for the EEF lending?

Invested capital:

- How important do you think EE and EEF is in your organisation?
- Will it change in the future?

Others

- In your opinion do you think EEF is already a commercial option to the private sector or where is its currently position?
- How do you think does the government still need to support in the future?
- What might be the role of transnational organisations?

- Which other stakeholder would you recommend to provide further information on this topic?

Appendix VI: Draft interview schedule for EEF customers

Objective:

To understand how the consumers perceive the supply for EEF in Thailand, what their experiences are so far and what they actually need in regards to EEF that would assist them to overcome the barrier. Also it will be verified that EEF is a barrier for them to implement EE in their businesses.

Interviewees

2–3 EEF end-users for previously identified EEF portfolio streams. Probably they will come from large, middle income industries or buildings in commercial or residential sector. They will be identified by consulting with JGSEE and GIZ staff once the EEF portfolio streams have been identified.

Themes to be looked into: As this focuses mainly on furthering the understanding of the EEF customers, challenges and support mechanism of the public sector, the following topics will be addressed:

Experience/Introduction:

- Which product is your company producing?
- What has been your role during your time in xxx?
- What drives you to work in this area...what has been for you a key experience/motivator to work in this field in the Asia region and specifically in the Thailand case study?
- How long has your business been in operation in Thailand?
- Since when did you start thinking about EE improvements in your business? How was it started?
- What were the EE measures implemented and how was it done? What were the main barriers for you to implement EE measures?
- How did you overcome them?
- Do you see further EE reduction potential and how could it be implemented?

Barrier – EEF

General institutions

- What do you understand under EEF and where does your experience come from (e.g. EERF or other schemes)?
- How are investment decisions made in your company concerning internal equipment or infrastructure?
- Are their guiding documents that you follow?

- About the EEF programme, were there clear instructions about the different roles and the process of the lending?

Networks

- How do you find out about the EEF programmes?
- Are you a member of an association and do they provide information about innovation in your sector or government programmes?
- Do you have any influence coming from international organisations?
- How was your cooperation with the government or bank for the EEF lending?

Invested capital:

- How important do you think EE and EEF is in your organisation?
- Will it change in the future?

Others

- In your opinion do you think EEF is already a commercial option to the private sector or where is its currently position?
- How do you think does the government still need to support in the future?
- What might be the role of transnational organisations?
- Which other stakeholder would you recommend to provide further information on this topic?

Appendix VII: Terms of reference for a seminar: ‘Explore ESCO business in China and what the EEF initiatives are in Thailand’

Objective:

- Provide an interesting seminar for ESCOs and energy service companies
- Enable sharing of experiences and opinions among participants
- Conduct some PhD research to verify preliminary results on existing EEF models and their challenges

Participants: (up to 20 participants)

ESCO companies, energy service companies, (government)

Outcome:

- Increased knowledge about ESCO business elsewhere (here: China)
- Increase the knowledge of ESCOs and energy service companies about financing opportunities in Thailand
- Increased understanding of the needs for EEF
- Identify some barriers and challenges of EEF
- Opportunities for public sector support highlighted

Please find also on page 2 the proposed agenda.

Language: English

Date: 28th of November, 9.00-13.30 am

Location:

Nexant office

Facilitation and finance:

Verena Streitferdt can provide technical input to the presentation, facilitation (limited if in Thai), provision of two Thai research assistants and overall coordination tasks.

Funding for the venue and lunch needs to be provided by the partner (e.g. KMUTT or NEXANT?)

Proposed agenda

08.30 – 09.00	<i>Registration</i>	
09.00 – 09.30	Welcome & Opening Address	<ul style="list-style-type: none"> • Nexant • KMUTT
09.30 – 10.00	ESCOs as a delivery mechanism for DSM in China	<ul style="list-style-type: none"> • Dr. David Crossley
<i>Coffee Break</i>		
10.15 – 10.30	Thailand experience with Energy Efficiency Finance	<ul style="list-style-type: none"> • Verena
10.30 – 10.45	Explaining world-café set up and the overall research	<ul style="list-style-type: none"> • Verena / Chris
10.45 – 11.30	<p>World café</p> <p>Table 1: Challenges and Barriers of Energy Performance Contracting?</p> <p>Table 2: Existing Public sector support and possible public sector support needed in the future for Energy Efficiency Financing (EPC)?</p>	<ul style="list-style-type: none"> • Facilitators (Thai/English) - Chris Seeley - Krib (research ass.) - Phapada (research ass.)
11.30 – 12.00	Presentation of the findings and open plenary discussions	<ul style="list-style-type: none"> • facilitators • moderator
12.00 – 12.15	Wrap up	<ul style="list-style-type: none"> • Nexant/KMUTT
<i>Joined Lunch</i>		

**Appendix VIII: Agenda for the EU-Switch Asia Seminar on EEF
held at the Eastin Hotel, 15 December 2014 from 13.00 to
17.00**

13.00 – 13.30	<i>Registration</i>	
13.30 – 13.45	Welcome remarks	Ms. Milou Beereboot ผู้อำนวยการโครงการ TGP-EEDP, GIZ
13.45 – 14.00	Research on International and national experienc with energy efficnecy finance กรณีศึกษาโมเดลเครื่องมือและบริการทางการเงินในด้านการอนุรักษ์พลังงานและสิ่งแวดล้อมในต่างประเทศ	Ms.Verena Streitferdt
14.00 – 14.15	ESCO finance in Thailand เครื่องมือและบริการทางการเงินในด้านการอนุรักษ์พลังงานและสิ่งแวดล้อมในประเทศไทย	Khun Arthit (ESCO Association)
14.15 – 14.30	Q and A	Moderator
14.30 – 14.45	Explanation of the method Knowledge cafe.	Ms.Verena Streitferdt and moderator?
14.45 – 15.00	<i>Coffee break (perhaps while building the groups. Watch timing)</i>	
15.00 – 16.00	Discussion in café tables 1 table: current existent financing models 2 table: challenges and barriers of each experienced mechanism 3 tables: What could public sector support? In the end of each discussion weighting.	3-6 tables with a host at each table. Documentation crucial!
16.00 – 16.15	Plenary feedback of the weighted points	วิทยากรแต่ละกลุ่ม
16.15 – 16.30	Presentation of TGP-EEDP on Thai facilitation offer (in partnership with Kasikorn bank).	
16.00 – 16.45	<i>Closing</i>	
		Green Auto Parts, GIZ

Appendix IX: Web-based Thai bank analysis

Krungthai	Commercial loan	1) Use of loan as expenses in construction/renovation of factory, premises/building, site and/or manufacturing/alteration/installation of machinery and equipment including materials used in energy saving or alternative/ renewable energy. 2) Support and promotion of energy saving and conservation through use of renewable/ alternative energy or operation for econo 3) Implementation of new or alternative energy projects such as power/ electricity generating to be used in business establishments and/or for sale to the Electricity Generating Authority of Thailand (EGAT)	T/L limit to be considered and approved as deemed necessary and appropriate.	http://www.ktb.co.th/ktb/en/product-detail.aspx?product=10XVRvwlwtoPhhoQ3YG0g%3d%3d&type=c
	with MLR per annum For T/L : MLR – 1.0% during the first two years (i.e. year 1&2) and MLR from third year onward For W/C : Not lower than MOR	Loan for investment and/or working capital in project/scheme to bring about energy saving, use of alternative or renewable energy and clean energy both in case of production for own use or production for sale, pollution elimination/reduction to conserve the environment including expenses on improvement or renovation of business establishment site, building construction and related machinery and equipment.	Term loan (T/L) and working capital (W/C). Credit limit/line is considered and approved as deemed necessary and appropriate.	http://www.ktb.co.th/ktb/en/product-detail.aspx?product=0DYsr%2foFU%2f2eeyNXLnUIDg
Bank	One million baht or more, loan term is ss per Bangkok Bank's conditions, interest rate is MLR or lower per annum as prescribed by	1) High credit line 2) Special low interest rate may be as low as MLR or lower per annum 3) Waived management fee	To be eligible for the Bualuang Green Loan your investment must fit one of the following criteria: 1) Investment in energy-saving projects and activities 2) Development of alternative/renewable energy 3) Support green label products 4) Support waste management (turning waste into energy) 5) Development and production of bio-products (replacing chemical products)	http://www.bangkokbank.com/BangkokBank/BusinessBanking/SMEs/LoansForSMEs/BualuangSMELoans/Pages/BualuangGreenLoan1.aspx

Bank	Type	Key Features	Terms and Conditions	Note
Kasikorn	Loans for energy conservation and/or promotion of alternative energy resources.	A long-term loan with a special fixed interest rate of 4.0%.	<p>1) This is a credit facility for investment in energy saving or alternative energy projects in compliance with government initiatives.</p> <p>2) Amount extended not to exceed THB50 million per project, and have a term of not over than 7 years and a grace period of less than 12 months.</p> <p>3) Not available for already-established projects, paid expenses, or refinancing.</p>	http://www.kasikornbank.com/EN/Corporate/Credit/TermLoan/Pages/EnergySavingsLoan
	Commercial loans and commercial leasing	<p>1) Credit limit : 100 percent of project investment (inclusive of ESCO service and consultation fees)</p> <p>2) Energy-saving performance guaranteed by ESCO assures customers of loan repayment ability without affecting business cashflow.</p> <p>3) Energy cost savings ensure enhanced financial status and competitiveness over the long term.</p> <p>4) Energy efficiency projects can be integrated into Corporate Social Responsibility (CSR) activities</p>	<p>1) Annual sales turnover of 50 million Baht or more.</p> <p>2) Energy efficiency project with performance guaranteed by ESCO.</p> <p>3) To be eligible, an ESCO must pass the ESCO Selection Criteria established by the Bank.</p> <p>4) To be eligible for 100% project financing, the project and customer must meet qualifications established by the Bank.</p>	http://www.kasikornbank.com/EN/Corporate/Credit/SpecialProduct/Pages/K-Energy%20Leasing
TMB Bank	Long-term loan	Loan: 4% per year and payment period of not being more than 5 years	<p>Building owners</p> <p>1. Buildings and/or controlling factories that use electricity meters of up from 1000 KW or have transformers altogether installed of over 1.175 KVA, or consume nonrenewable energy in a total amount of more than 20 mega-joule per year</p> <p>2. Buildings and/or factories outside the controlling scope or energy service companies (ESCO)</p>	https://www.tmbbank.com/business/sme/loan-financing/credit-domestic/blue-planet/machine-fund-en.php

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