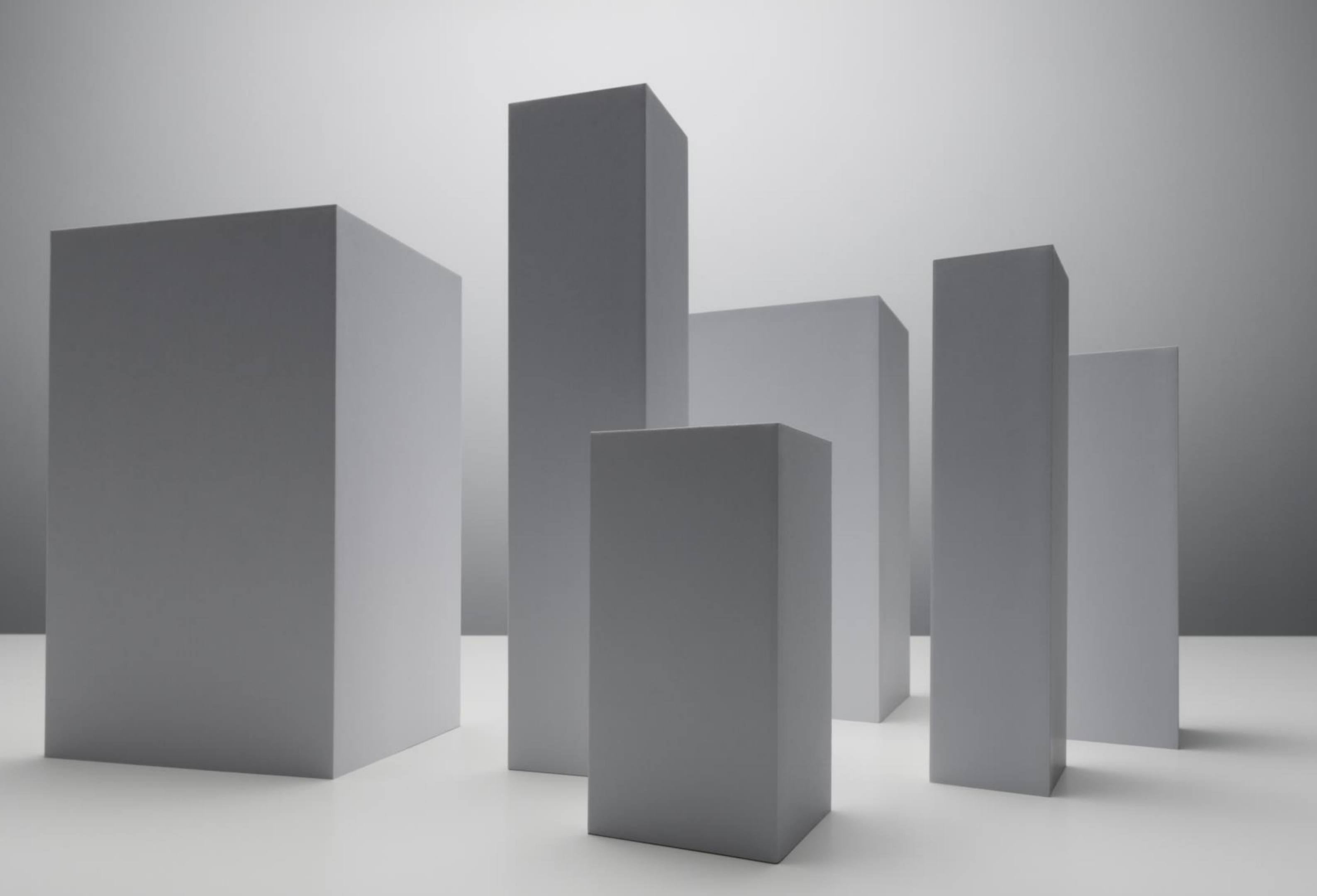
Barriers and Enablers to Energy Efficiency in Existing Buildings

Are Transaction Costs Making the Norwegian ESCO Market Fail?

Master Thesis
Anders Fagernæs
International Business and Politics
01.12.2016

Manuele Citi
47 pages
127 685 STUs



Barriers and Enablers to Energy Efficiency in Existing Buildings
- Are Transaction Costs Making the Norwegian ESCO Market Fail?

Print: CityPrint, Copenhagen

Foreword

A curiosity as to how the market for energy efficiency services is regulated has given direction to this study from the outset. However, the study has taken many twists and turns before ending up as a final thesis. Below is an account of the main turning points, as well as an explanation to why new paths have been laid out.

The first venture into energy efficiency was during fall 2013. I had just had signed a job with Geelmuyden Kiese, a Norwegian communications agency that I interned for over the summer, and was keen to collaborate with them on my master thesis. We decided to use the thesis as a potential pitch towards a company in the energy sector, a sector I was very interested in at the time. The potential client needed to be an international company, both due to the nature of my studies, but also because I was very interesting in the Brussels lobby at the time. We decided to go for Siemens, and I set up a meeting with the top management at the headquarters in Norway.

Siemens was keen to collaborate, and I started reading up on the unknown lands of EU energy politics and lobbying literature. I had no previous experience with any of the two, and realized that I needed to figure out on how politics in Brussels actually worked. During the spring of 2014, I used online courses and read up on friends' text books. I also read up on EU energy policies, with a special emphasis on energy efficiency.

I found a supervisor at CBS willing to take on the project, and applied for an internship at the Brussels Office, a Norwegian lobbying consultancy. After getting the internship approved by the study board, I went back to Siemens and presented them with my initial findings. An agreement was signed in September 2014, and soon after I left for Brussels. The full text of the agreement is provided in Appendix 4. Here is an excerpt of the research questions:

- How is energy efficiency regulated in the European Economic Area, Norway, and Sweden?
- What roles has Siemens AS and Siemens AG played in the development of energy efficiency regulation in the European Economic Area, Norway, and Sweden?
- How has Siemens' work to influence policy formation and implementation been organized?
- What effect have these roles and influence had on the regulatory governance (legislation and bureaucracy) of energy efficiency today, specifically in regards to Energy Performance Contracting?

While in Brussels, I read up on lobbying literature, and started to get a feel for the lobbying culture. I mapped all relevant actors, their lobbying initiatives and started looking into potential methods for answering the research questions. I had discussed automated text analysis with my supervisor before I left for Brussels, and wanted to do an analysis of Siemens' lobbying efforts towards the European Commission and the European Parliament. I contacted representatives from Siemens in Brussels, as was the deal with Siemens Norway. They were hard to reach, and provided cold German hospitality.

I soon realized that I had ventured in way above my head, and decided to go back to the beginning. I had never studied pure political science, however by this time I was looking deeply into three theoretical strands: Public interest theory, interest group theory and institutional theory. Institutional theory was the most promising avenue for enquiry, and transaction cost economics seemed to touch upon many of the problems identified in the initial scanning of the energy efficiency market.

Thus, instead of researching how businesses sought to affect legislation, I decided to flip the coin. By that time, I had understood that the market for energy efficiency services was not working at all in Norway. I therefore decided to figure out what was causing the market failure and how market interventions, both from the EU and Norway, was affecting the market for energy efficiency services in my home country. The condensed results of my efforts are presented in this master thesis.

Abstract

This study shows that transaction costs are making the Norwegian ESCO market fail. ESCO is an abbreviation for energy service company. ESCOs offer energy services to private and public enterprises. This study analyses the barriers and enablers of a market for energy efficiency services in existing buildings in Norway.

Available technologies can be installed in existing buildings to reduce energy consumption. Most investments in energy efficiency services are commercially profitable, and in some cases come at zero opportunity cost of capital. Still, the ESCO market in Norway has struggled to take foothold.

This study tests the hypothesis that transaction costs in ESCO projects are causing the market for energy efficiency services in existing buildings in Norway to fail. It uses transaction cost economics, a theory found within institutional economics, to analyze whether transaction costs on both the supply and the demand side is causing this failure. Transaction costs can be seen as all the hidden costs stemming from friction between buyers and sellers of highly specific assets.

Market failure suggest that society are producing a suboptimal level of energy efficiency services. If this is the case, Norway runs the risk of investing in a level of energy supply that is dimensioned for an inefficient level of energy consumption. Market interventions are analyzed to see whether they are capable of reducing transaction costs. Energy performance contracting, a project management tool developed through EU funding, is given special attention because it has attributes that are closely linked to transaction costs.

Table of contents

ABSTRACT **7**

TABLE OF CONTENTS **9**

TABLES AND FIGURES **11**

INTRODUCTION **12**

CHAPTER 1: BACKGROUND TO ENERGY EFFICIENCY **13**

THE CONCEPT OF ENERGY EFFICIENCY IN SUSTAINABLE ENERGY SYSTEMS 13
ENERGY EFFICIENCY WITHIN OECD-COUNTRIES 13
Decoupling of energy consumption and GDP *14*
Public benefits from energy savings *14*
THE MARKET FOR ENERGY EFFICIENCY IN BUILDINGS 15
MARKET FAILURES 17
ENERGY PERFORMANCE CONTRACTING 18

CHAPTER 2: LITERATURE REVIEW **19**

TRANSACTION COSTS IN ENERGY EFFICIENCY SERVICE PROJECTS 19
Ex ante transaction costs *20*
Ex post transaction costs *22*
REDUCING TRANSACTION COSTS THROUGH EPCS 22
TRANSACTION BOUNDARIES 26
SUMMARY 27

CHAPTER 3: THE THEORY OF TRANSACTION COST ECONOMICS **28**

TRANSACTION COSTS DEFINED 28
ASSUMPTIONS 29
Bounded rationality *29*
Opportunism and uncertainty *29*
Asset specificity *30*
TCE COMPARED TO NEOCLASSICAL MICROECONOMICS 31

CHAPTER 4: METHODOLOGY **34**

PURPOSE OF RESEARCH 34
RESEARCH DESIGN 34
OPERATIONALIZATION OF ANALYSIS 35

CHAPTER 5: THE NORWEGIAN ESCO MARKET **37**

THE ESCO MARKET UNTIL 2010 37
TRANSACTION COSTS IN NORWAY 38
The ESCO market between 2010 and 2013 ..... *40*
REGULATORY MARKET INTERVENTIONS 43
The legislative environment *43*
Market enabling institutions *50*
Assessment of energy efficiency policies aimed at buildings by the Office of the Auditor General of Norway *51*
A BOOMING NORWEGIAN ESCO MARKET 52

CONCLUSION **56**

BIBLIOGRAPHY **57**

APPENDIX 1: INTERVIEWS **61**

INTERVIEWEES 61

INTERVIEW GUIDE 61
APPENDIX 2: MEETING WITH THE LIAISON GROUP FOR EEA-MATTERS HOSTED BY THE OED 65
APPENDIX 3: DOCEAR MINDMAPS 72
APPENDIX 4: AGREEMENT ON MASTER THESIS COLLABORATION 73

Tables and figures

Figure 1.1: Trends in total energy intensity, gross domestic product and total energy consumption 1990-2010 (EU27)

Figure 1.2: Comparison of the potential for energy efficiency

Figure 1.3: Three levels of potential

Figure 2.1: Distribution of costs associated with ESCO projects

Figure 2.2: The value chain of an energy efficiency project and related risks

Figure 2.3: Historic structure of the energy services market

Table 2.1: The number of partners and the variety of contractors in a project with own investment vs. an ESCO project

Figure 2.4: Benefit, savings and operational costs during the lifespan of an EPC

Figure 2.5: Comparison of various financing forms of energy efficiency investments in terms of sharing risks

Figure 2.6: Boundary issues relating to transaction costs

Figure 2.7: Impact of transaction costs on carbon emissions reductions

Figure 3.1: Actual realizable potential in new and existing Norwegian buildings at different energy prices

Figure 3.2: Actual realizable potential distributed among barriers to energy efficiency in existing buildings

Figure 3.3: Barriers to ESCO projects in Norway

Figure 3.4: Key features of the Norwegian ESCO market in 2013

Figure 3.5: Relationship between the articles enabling legislation and institutions in the EED 2012

Figure 3.6: Policy intensity for energy efficiency measures in Norway

Figure 3.7 Approved EPC projects (Enova supported)

Figure 3.8 Distribution of EPC projects among third party facilitators

Introduction

The world has not been closer to a sustainable energy system since before the steam engine was invented. Investment into renewable energy has been booming, and the largest continents are racing to become independent of fossil fuel imports. Energy efficiency is a crucial part of sustainable energy systems. Yet, we tend to forget it among shiny Tesla's, blinking solar panels, and majestic windmills. The fact remains, however, that the cleanest and cheapest kilowatt ever produced, is the one never produced.

Although it has received little attention, energy consumption in industrialized countries have undergone a silent revolution in the last decades. Energy intensity, a measure of energy consumption and gross domestic products, has started to decrease. This means that energy consumption is decoupling from economic growth. Although there is reason to be optimistic about the developments, the change could take place a lot faster if the public became aware of the business opportunities in energy efficiency projects. One third of global energy consumption happens in buildings. In Norway, over two percent of the yearly energy consumption can be saved through investment in energy efficiency in existing commercial buildings.

This study will show that transaction costs caused severe market failure in the Norwegian ESCO market. It will do so by showing that a high degree of uncertainty, fueled by severe information asymmetries and a lack of trust, blocked demand for energy efficiency services.

Moreover, it will show the energy performance contracting is an effective tool for reducing transaction costs in the ESCO market. It will do so by showing how energy performance contracts reduce transaction costs on the demand side by providing a credible commitment that decreases financial uncertainty. Moreover, it will show how EPCs reduce transaction through third party facilitators who manage to instill trust and reduce information asymmetries in the relationship between the ESCO and the customer. Finally, it will show how EPC standardization reduces transaction costs on the supply side.

Chapter 1 provides a background to the concept of energy efficiency. Chapter 2 reviews the literature on transaction costs in energy efficiency projects. Chapter 3 lays out the theoretical foundation of transaction cost economics. Chapter 4 describes the method used in the case study, while chapter 5 provides a thorough case study of the Norwegian ESCO market.

The first section of chapter 5 looks at the development of the ESCO market until 2010. The second section takes a closer look at the transaction costs borne by both the supply and the demand side in 2011. The third section reverts to the ESCO market, and looks at the developments between 2010 and 2013. The fourth section provides an historical assessment of the legislative environment and market enabling institutions from both the EU down to Norway. Finally, the fifth section looks at the developments in the ESCO market between 2013 and 2016.

Chapter 1: Background to energy efficiency

Whenever the economic benefits are greater than the economic costs, a market should provide the good or service. If not, there is a market failure. Why the market for energy efficiency services is not booming, when the benefits seem so apparent, is therefore a puzzle.

Backlund and Eidenskog (2013) refer to the paradox that commercially profitable measures for energy efficiency are not implemented as the *energy efficiency gap*. The following sections will provide a background to the concept of energy efficiency in sustainable energy systems, explain the developments of energy efficiency within OECD-countries, survey the market for energy efficiency in buildings, and explain the concepts of market failures and energy performance contracting.

The concept of energy efficiency in sustainable energy systems

Europe is moving towards a more sustainable energy system. Mitchell and Woodman (2010, 574) defines a sustainable energy system as *"one where environmental impacts [are] minimized in both the short and long term, and where there is the potential for secure and acceptably priced energy"*. According to Mitchell and Woodman, the first step towards a sustainable energy system is to reduce or manage demand. Improving energy efficiency is therefore of top priority.

Energy efficiency is a measure of how energy is being used. At its simplest, energy efficiency is conservation of energy through reduced consumption. One way of doing that is by simply consuming less. However, our energy systems can also use the energy we produce smarter, for instance by adopting available technologies. Introducing a new technology or a more efficient process will reduce the amount of energy consumed, and at the same time keep the quality level of services constant.

In economics language, energy efficiency means that the utility from consuming one unit of energy stays constant, while the input to produce that unit of energy is reduced. Thus, if one kilowatt of energy input can produce a greater amount of output, and thus increase the utility, energy efficiency has been improved.

Lovins (1985) studied the potential of energy savings in the United States electricity market in the 1980s. Lovins argued that people are not really demanding electricity. Rather they are demanding the services that electricity provides, such as heating, ventilation, lighting, cold beer, hot food, etc. Following this reasoning, Lovins constructed a new term to describe energy savings as a commodity: negawatts. Negawatts are the saved electricity stemming from measures seeking to reduce the electricity needed for production of these services. Lovins worked under the assumption that the cleanest and cheapest kilowatt is the one never produced.

Energy efficiency within OECD-countries

The International Energy Agency (IEA, 2015), an autonomous organization working to ensure reliable, affordable and clean energy for its 29 OECD-member countries, published its third Energy Efficiency Market Report in 2015. The report takes a closer look at the end-use energy efficiency market, and the effects of energy efficiency investments over the last 25 years. According to the report, improvements in energy efficiency are a result of millions of investment decisions made by businesses, households and the public sector. Millions of transactions are therefore necessary to unlock the potential of energy efficiency in our energy systems.

Energy efficiency investments seek to either save money or increase profits. According to IEA (2015, 25), "efficiency investments reduce the amount of energy required to satisfy energy service demand, even as that demand grows and living standards increase.

Decoupling of energy consumption and GDP

The IEA report has two main findings. First, per capita energy consumption in IEA countries has dropped to levels not seen since 1980s. At the same time, income per capita has never been greater. Reduced energy consumption within the OECD countries made energy intensity fall by 2.3 per cent in 2014.

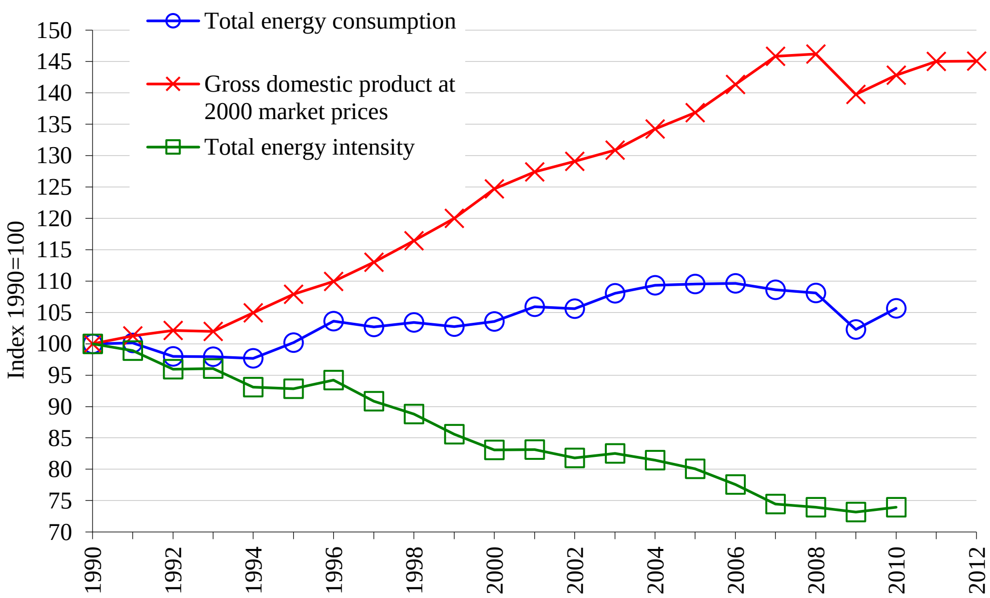
Energy intensity is an aggregate measure of energy efficiency, often used on a national level. It is calculated by measuring the percentage change in energy consumption per unit of GDP. A reduction in energy intensity is therefore the same as an improvement in energy productivity: Each unit of energy consumed is generating more units of GDP.

Since 2000, GDP per capita has increased by 13 per cent in OECD countries. At the same time, energy productivity increased by 24 per cent, and energy consumption was reduced by 9 per cent. IEA concludes that economic growth and energy consumption growth has been decoupled. These remarkable findings have not received much attention, neither by media nor by politicians.

Second, the IEA finds that energy efficiency investments over the last 25 years are the primary reason for the drop in energy consumption, responsible for two thirds of the reduced energy demand. This has contributed heavily to the steady decline in total final energy consumption within IEA countries over the last decade.

As seen in Figure 1.1, the European Union has had the same trajectory. Total energy consumption stabilized. At the same time, GDP increased. The result was a substantial reduction in total energy intensity in the period between 1990 and 2010. As we will see in the case study below, the EU has over the last two decades introduced a wide set of legislative and market stimulating measures to improve energy efficiency in buildings.

Figure 1.1: Trends in total energy intensity, gross domestic product and total energy consumption 1990-2010 (EU27)



(European Environment Agency, 2014)

Public benefits from energy savings

There is broad political consensus in the European Union to develop a sustainable energy system that secures clean and renewable energy. Reducing energy consumption will decrease Europe's import dependency and improve Europe’s security of energy supply. In this sense, energy efficiency serve as a foreign policy tool.

The IEA report also stress that returns on energy efficiency investments bring benefits to the wider society. The reduction in energy consumption has cut energy bills substantially. The IEA estimates that the cumulative savings in IEA countries have been USD 5.7 trillion since 1990. At the same time, consumers have received better energy services. In 2014, the IEA countries saved USD 550 billion from energy efficiency improvements. In comparison, the EU fuel import bill amounted to EUR 400 billion in 2014.

The savings have also led to a substantial reduction of IEA countries’ import dependency. At least 190 million tons oil equivalents (Mtoe) of primary energy imports were avoided in 2014, saving USD 80 billion in import bills. Moreover, 2 200 terawatt hours (TWh) of electricity have been saved since 1990, partly contributing to a flattening of electricity consumption in the same period. In comparison, the yearly electricity consumption in Norway is 234 TWh, including raw materials (SSB, 2016).

The IEA report concludes that the reduction in energy consumption has reduced import dependency in IEA countries. Reduced import dependency increases energy security and. Hence, measures to reduce energy intensity improves national security.

Moving towards a sustainable energy system is also an internal policy objective for the EU. New energy infrastructure construction has the potential to drive a new long-term investment cycle into the real economy of Europe. It is promising new jobs and economic growth for decades ahead. The EU focused for many years on increased renewable production capacity.

However, investments should not only stimulate the supply side of the market. Energy consumption must also be efficient. Energy efficiency services are an increasingly important tool for reaching energy savings targets set by the European Union. Forty percent of European energy is consumed within buildings, many of them without proper insulation. The savings potential, and thus business potential, is huge. Many low hanging fruits are commercially profitable with available technology. Nevertheless, various barriers bug the market and it has taken time for investments to pick up.

The market for energy efficiency in buildings

The IEA report estimates that the global market for energy efficiency investments in buildings was USD 90 billion in 2014. Energy efficiency investments are growing faster than overall growth of building construction. If current trends continue, the IEA projects the global market to grow by almost 40 per cent over the next five years, to USD 125 billion in 2020. With the buildings sector accounting for one-third of global energy consumption, there is a huge market potential for measures improving efficiency.

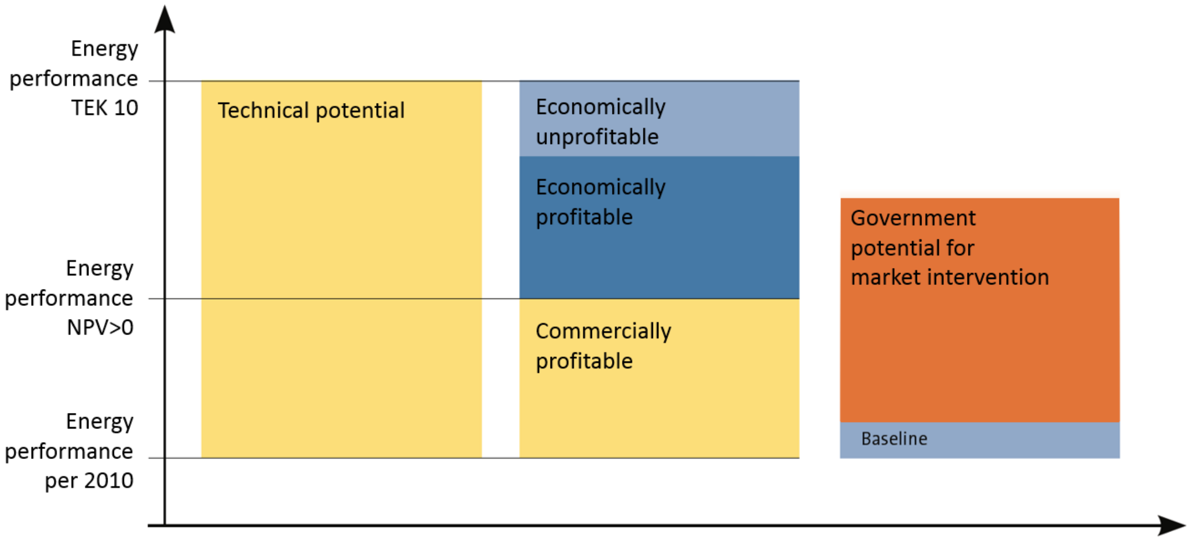
Energy price is one of the main factors influencing the demand of energy efficiency investments (Bertoldi et al, 2014). A steady rise in energy prices across Europe has improved the diffusion of energy efficiency across Europe. However, the untapped potential remains large, so also in Norway.

There are close to four million buildings in Norway. The total energy consumption in buildings increased by 33 per cent in the period from 1990 to 2010 (Riksrevisjonen, 2015). Buildings are responsible for over one third of all Norwegian energy consumption (Boasson, 2015)

Abundant energy supply from hydropower and low energy prices over a long period has made energy efficiency a low priority in Norway. Enova, the Norwegian Energy Agency, conducted a potential- and barrier study for energy efficiency in existing commercial buildings in Norway in 2012 (Enova, 2012). The aim was to uncover the actual realizable potential for energy savings in the period leading up to 2020.

Enova divided the potential of energy efficiency into four types: technical potential, commercially profitable potential, economically profitable potential, and economically unprofitable potential. The different potentials are illustrated in figure 1.2, and explained below.

Figure 1.2: Comparison of the potential for energy efficiency



(Enova, 2012)

The government potential for market intervention is understood as the potential of governmental market intervention through policy measures and degree of ambition in the field of energy efficiency.

The baseline in figure 1.2 refers to the energy efficiency improvements that would result independently of government market intervention. The rehabilitation rate assumes that some rehabilitation of existing buildings will take place regardless of market factors. The energy efficiency baseline is estimated to be 2 per cent and the expected rehabilitation rate is set at 1.5 per cent.

Technical potential

In Norway, the technical potential of energy efficiency improvement in existing buildings is set by the building code, also known as TEK. The TEK standard sets minimum requirements for all new buildings, but also for refurbishment of existing buildings. If existing commercial buildings are upgraded to TEK-10 level, the total potential for energy savings was 18.5 TWh in 2012.

Commercially profitable potential

The economic potential is divided into two types: commercially profitable measures and economically profitable measures. The limit to investments in commercially profitable measures is given by a minimum requirement to profitability. As seen on the left hand side of figure 1.2, the net present value (NPV) of the energy efficiency investment decides whether the measure is commercially profitable or not.

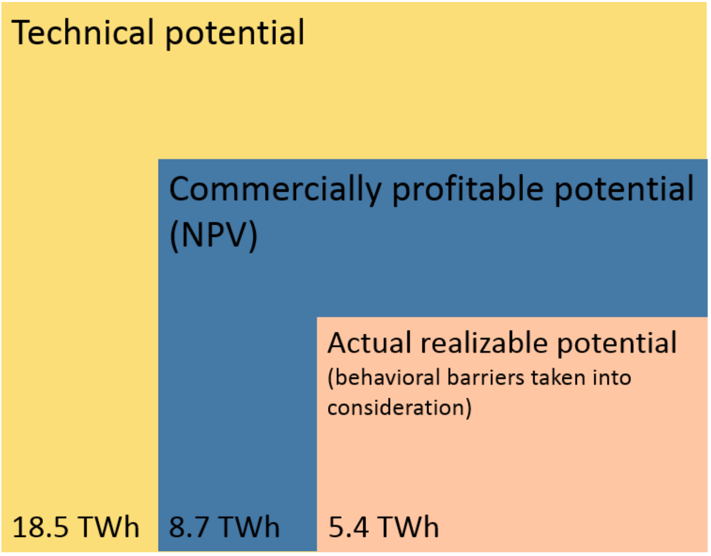
Enova does not fiscally support measures that are commercially profitable, as they assume that these measures will be invested in regardless of government intervention. Enova does invest in measures that are economically profitable and unprofitable. Economic profitability is limited by a requirement of policy measures to provide the public benefits that exceed the social costs. Hence, Enova only invest in the highest hanging fruits with a net present value below zero, but that provides an economic benefit to society.

Enova (2012) concludes that the commercially profitable potential in existing buildings in Norway is approximately 8.7 TWh at energy prices of NOK 0.8 kW. The analysis of the commercially profitable potential includes estimates of the energy savings, the cost of investment, the depreciation rate and the discount rate. Enova looks at the potential under various discount rates, allowing it to vary between 4 to 10 per cent. The commercially profitable potential is roughly 2 TWh greater at a discount rate of 4 per cent compared to a discount rate of 10 per cent, regardless of energy prices.

Actual realizable potential through governmental intervention

When controlling for behavioral barriers inhibiting energy efficiency investment, the potential drops to 5.4 TWh. Enova refers to this to as the actual realizable potential. The actual realizable potential should be targeted by governmental intervention. As seen above, Norway's total energy consumption was 234 TWh in 2014. By investing in the actual realizable potential, Norway could reduce national energy consumption by 2.3 per cent. The potentials are illustrated in figure 1.3 below.

Figure 1.3: Three levels of potential



Market failures

Studying the relationship between business and politics in modern capitalist economies, we look at the interaction between two social constructs; markets and regulation (Coen et. al., 2010). On the one side is the market for goods and services. On the other side is the authority to regulate the market transactions through a government apparatus.

In a modern economy, market failure is one of the key reasons behind governmental interventions. When interviewed in November 2014 on the need to regulate energy efficiency, Paul Hodson's, the Head of Unit Energy Efficiency and Intelligent Energy at DG Energy in the European Commission, immediate response was "market failures".

Regardless of the improvements in overall energy efficiency in IEA and EU countries, the potential for energy efficiency in buildings remain largely untapped. A market report published by the European Commission in 2014 (Bertoldi et al, 2014) concluded that although the markets for energy efficiency services in the European Union have improved, they were far from reaching their full potential.

In economics, market failures erupt when the allocation of goods or services is inefficient. Many investments in energy efficiency services are commercially profitable. According to Valentová (2010) transaction costs may outweigh the gains of energy efficiency improvements. Transactions costs can make a market fail. One of the greatest motivations behind this study then, is to figure out why investments into energy efficiency services remains so low when the business potential at the outset look so great.

Energy performance contracting

Energy performance contracting (EPC) is a concept that has received considerable attention within some EU regions but remain unknown in other regions. An important aspect of EPCs, which puts it apart from traditional contracting, is its results-driven nature (Lindseth, 2016). While traditional contracting invariable is price-driven, EPCs are constructed to ensure quality of performance. While a results-driven contract should be in the interest of the end-user, the foreignness of the concept has created uncertainty and has been a victim of severe information asymmetries.

In this paper, an ESCO is defined as a company that offers energy services and implements energy efficiency projects in buildings. Most ESCOs are profit-oriented private or public organizations, however non-profit arrangements are also observed (Bertoldi et al, 2014). Energy services include activities such as:

- Energy efficiency analysis, audits and management;
- Project design, implementation, maintenance and operation;
- Monitoring and evaluation of savings;
- Property/facility management;
- Provision of services and equipment (space heating/cooling, lighting, etc.);
- Advice and training.

ESCOs can also offer energy supply and equipment for production, for instance solar panels. This study focus on energy efficiency services only, and does not include services related to energy supply.

In the European Union's Energy Efficiency Directive from 2012, the European Commission (EC) defines an EPC as:

> *"[A]contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings."*

(EED, 2012/27/EU)

EPCs are usually binding long-term agreements of 5 to 15 years. EPCs can be constructed for one building or a pool of buildings. EPCs have two main characteristics: guaranteed savings and zero opportunity cost of capital (Bertoldi et al, 2014). A more detailed explanation of how EPCs work is given in the literature review below.

Chapter 2: Literature review

Transaction costs are very case specific. There are however three common traits in all of the reviewed literature: 1) market exchanges always involve some level of transaction costs; 2) transaction costs can be substantial; and 3) they affect the level of demand of energy efficiency services – independently of changes in energy prices. A common weakness found in the studies is the failure to apply a dynamic approach by looking at how transaction costs changes over time.

As we will see below, transaction costs erupt at various stages of an energy performance contract, and constitute as much as 40 per cent of the total project costs. The sources of transaction costs in EPC projects fit well with the theory of TCE: Assets are highly specific and trust can be severely limited due to a high degree of uncertainty in the contract model. Moreover, there are substantial information asymmetries between the ESCO and the customer. Nevertheless, EPC can provide a valuable tool for lowering transaction costs both before and after the transaction take place.

The literature review will cover the nature and scale of transaction costs in the market for energy efficiency services. Moreover, it will explain how transaction costs erupt in the different project stages of energy efficiency services, as well as an explanation of how EPCs reduce these transaction costs. Finally, boundaries will be defined between the actual market transaction, and the legislative interventions and market enabling institutions that may affect those transactions.

Transaction costs in energy efficiency service projects

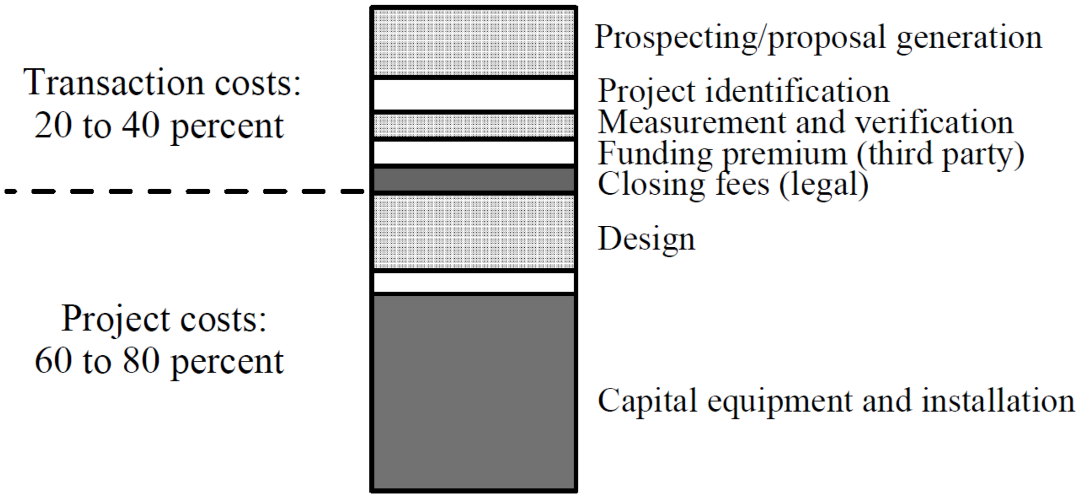
Assets in ESCO projects are extremely specific. The difficulties in agreeing on baselines and measurement and verification procedures lead to substantial transaction costs in energy efficiency projects. The size and performance of the technologies, as well as the potential high number of intermediaries in energy efficiency investments, are also variables affecting the scale of transaction costs.

Mundaca (2007) analyze transaction costs under different policy measures targeted at improved energy efficiency. Mundaca used secondary sources of information, such as estimation from key actors or consultancies, as well as interviews and surveys. More specifically, the study covered policies aimed at decreasing emissions from greenhouse gases (GHG), tradable certificates for energy savings, and energy efficiency audits.

In the studies reviewed by Mundaca, transactions costs were found to be on a scale between 5 and 36 per cent of total project costs, depending on the case. The main sources to transaction costs include search for information, negotiation and contract agreements with third parties, as well as measurement and verification activities.

Easton Consultants (1999) conducted an extensive quantitative and qualitative analysis of the ESCO market in Wisconsin and New York. The report found that transaction costs related to designing and implementing energy efficiency projects can be as much as 40 per cent, depending on the size and nature of the project. The cost distribution is illustrated by figure 2.1.

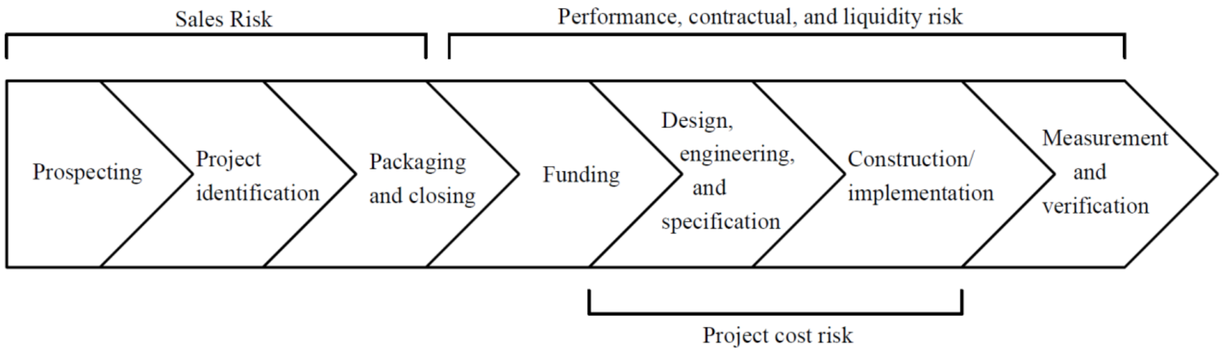
Figure 2.1: Distribution of costs associated with ESCO projects



(Easton Consultants, 1999)

Transactions costs arise in different stages of energy efficiency projects (Mundaca et al, 2013). The ESCO and the customers must agree on who should be responsible for the various project stages and the different tasks. Easton Consultants (1999) has constructed a value chain of seven stages for energy efficiency projects. The value chain is illustrated in Figure 2.2 below.

Figure 2.2: The value chain of an energy efficiency project and related risks



(Easton Consultants, 1999)

The stages can be divided into two: Ex ante transaction costs arise before the transaction takes place, while ex post transaction costs arise after the transaction is agreed upon. The various stages are explained in greater detail below.

Ex ante transaction costs

Prospecting

First, the ESCO must identify and make contact with prospective customers of energy efficiency projects. This is referred to as prospecting. In the reviewed studies, search for information and awareness of end-users played a critical role. Just finding customers willing to implement energy efficiency measures proved difficult. The lack of awareness among possible beneficiaries may hamper the positive impact from energy efficiency policies (Mundaca, 2007).

Project identification

Second, the scope of the project must be identified. Due to the specificity of the assets, the prospective customers' facilities and processes must be assessed in order to identify types of energy efficiency measures that will yield attractive returns. Project identification is done through a combination of energy audits and analysis of energy consumption history. The ESCO conducts a preliminary study of the clients building in order to define the potential for efficiency improvements.

Packaging and closing

Third, packing and closing of the agreement includes negotiations over the contractual terms. The deal must be able to attract capital to the project, and divide risks and responsibilities between the parties. The stream of savings must also be divided between the ESCO and the customer. Search for information, legal fees, development of a written proposal covering project identification, as well as evaluation and definition of measurement and verification measures are sources of transaction costs at this stage (Valentová, 2010).

Funding

Access to capital can be a market barrier. However, the public sector – an important sector for energy efficiency measures – is generally a trustworthy client for the banks as the risk on non-repayment is low (Valentová, 2010).

Excessively high discount rates due to a perceived uncertainty of EPCs, are thought to be major source adding to the efficiency gap (Valentová, 2010). Empirical studies estimate discount rates of energy efficiency measures to start around 20-25 per cent, but can reach as much as 50 per cent (Valentová, 2010).

Valentová (2010) offers a different view, arguing the energy efficiency investments actually should have lower than normal discount rates. The reason is the ability of using EPCs as a hedge against volatile energy prices as a hedge.

Design, engineering and specification

At this stage, the ESCO create the plans and finalizes the costs and equipment specifications for the energy efficiency measures being installed. Transaction costs were greater in projects where the target group had a passive role in the implementation of energy efficiency measures (Mundaca, 2007). This finding suggest that early involvement and understanding of the contract from the customer is important, especially at the stage of design, engineering and specification of the agreement.

Calculation methods for how energy savings should be measured, monitored, verified and shared between the ESCO and the customer must be decided. However, EPCs are hard to calculate and difficult for end-users to understand and compare. Information asymmetries are creating a knowledge gap between the ESCO and the firm. An ESCO with standardized calculation models can reduce transaction costs, and increase the level of trust substantially.

Construction and implementation

Energy efficient products and measures must be installed and implemented. These include, among others, energy management controls, heating, ventilation and air conditioning (HVAC), efficient lighting, peak load management, thermal insulation, and user motivation (Eu.ESCO, 2010).

In most cases the ESCO obtain and manage contractors that install and implement the energy efficiency measures. The ESCO supervises, inspect and commission their work. ESCOs operate in the same way as general contractors that manage a combination of their own internal resources and third party subcontractors.

Ex post transaction costs

Transaction costs arise from operating mechanisms that monitor, quantify and verify savings (Valentová, 2010). However, *ex post* transaction costs can also erupt from a lack of trust. Misunderstandings that take place *ex ante* may increase *ex post* trust between the parties (Backlund and Eidenskog, 2013). Such disagreements could be detrimental, particularly if enforcement of the contract would have to be tested by a judicial power.

Monitoring and verification

Operations start as soon the construction and implementation stage is finished. To make sure the guaranteed energy savings are actually delivered, the ESCO must have measurement and verification procedures in place. The procedures take account of changes to the climate, the building, and energy use over time. Whether the energy efficiency measures are performing as planned must be monitored and verified. This can either be done by the ESCO itself, or can be subcontracted to a third party firm.

Backlund and Eidenskog (2013) studied the relationship between ESCOs and private firms with potential to optimize energy use through energy efficiency services. Focusing on asymmetrical information, the authors found that the risk of opportunistic behavior between firms and ESCOs reduces trust in the EPC model. This in turn increases transaction costs substantially, due to the increased need for measurement and verification of contracts.

Through interviews with persons responsible for environmental issues, Backlund and Eidenskog (2013) investigated how private firms experience the consultation and collaboration stage. In all cases, the person responsible for environmental impact needed approval from a controller. Modeling energy savings for years into the future is complex. When every internal controller must develop his own case-specific calculation method to verify savings, transaction costs are much higher than if a standard measurement and verification procedure could be applied.

Knowledge gaps between the people responsible for environmental issues and controllers also led to internal power struggles. These knowledge gaps resulted in severe *ex post* disagreements erupting between the firms and ESCOs. The disagreements were mainly due to firms questioning the performance of the EPC in the operational phase. Specifically it was the objectivity of the measurement and verification models that were being questioned.

Mundaca et al (2013) identified a learning effect. Learning led to a reduction in transaction costs over time. Increased experience, development of standard contracts and competition in associated legal services were highlighted as important endogenous factors. This is consistent with McCann et al (2005), who note that transaction costs may decrease over time due to learning.

Reducing transaction costs through EPCs

Mundaca et al (2013) reviewed a broad range of literature on transaction costs of energy-efficiency technologies, such as planning, implementation and measurement and verification. The authors identified several strategies to limit the nature and reduce the scale of transaction costs. Standardized accounting systems, *ex ante* measurement and verification processes, streamlining of procedures, and standardized trading contracts, were among the most common strategies adopted.

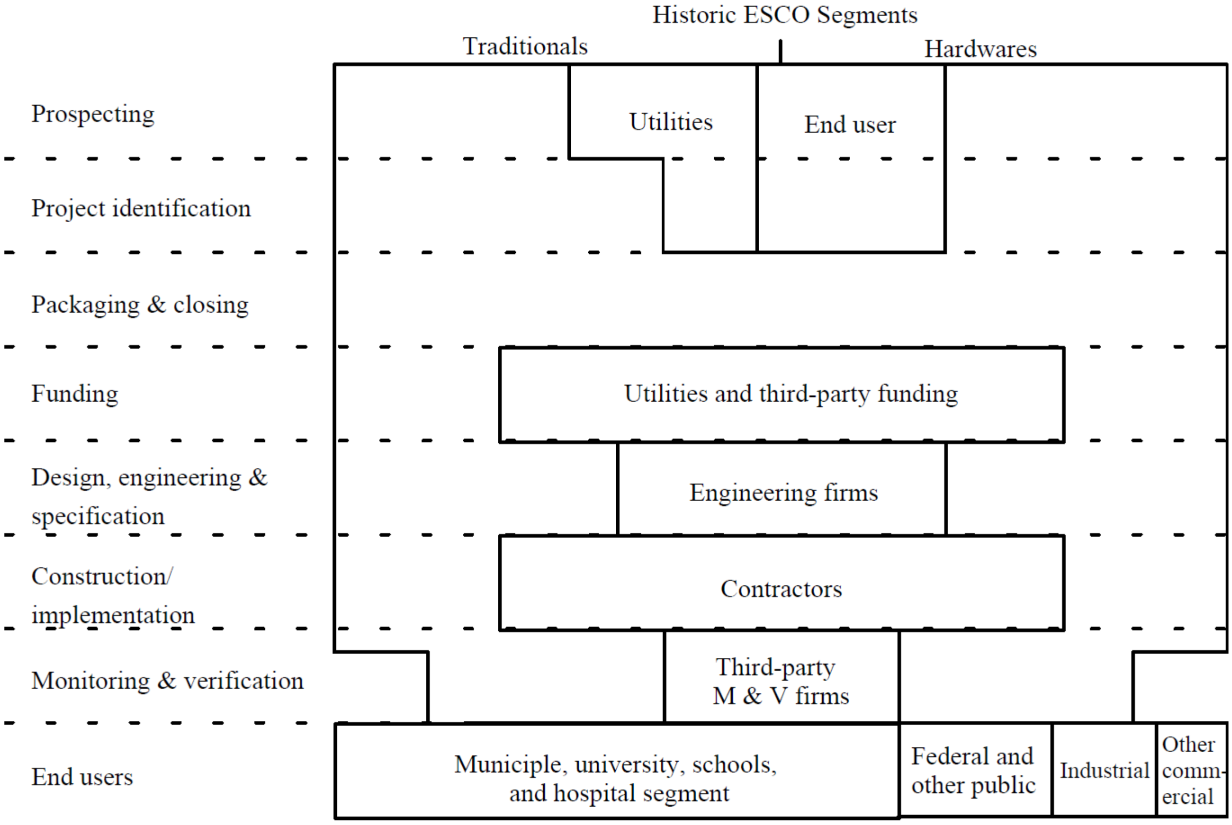
Backlund and Eidenskog (2013) conclude that EPCs help in overcoming market barriers stemming from information asymmetries. Backlund and Eidenskog (2013, 520) are also positive towards standardization of EPC contracts, which they think would *“help create market practices and overcome some of the trust issues that are related to the ESCO market being in an initial phase”.*

Below is an explanation of how EPCs reduce transaction costs through: 1) simpler contracting and inclusion of subcontractors; 2) increased trust through guaranteed savings; 3) cheap financing through zero opportunity cost of capital; and 4) risk sharing and partnerships.

Simpler contracting and inclusion of subcontractors

According to Bertoldi et al (2014), one of the key benefits of an ESCO is its ability to integrate the suppliers of various services as subcontractors. Figure 2.3 illustrates the historic structure of the energy services market in the US and the various parties involved in an energy efficiency project. As we can see, the structure is highly fragmented, with many actors providing services at the different stages of the project.

Figure 2.3: Historic structure of the energy services market



(Easton Consultants, 1999)

Backlund and Eidenskog (2013) argue that standardization of contracts and measurement and verification procedures will help end-users and finance to better understand EPC. This is in line with previous findings by Bertoldi et al (2006) when studying national market potential for energy efficiency services.

An illustration of how ESCOs integrate the subcontractors is provided in table 2.1. An ESCO creates a quicker and simpler contractor selection and tendering process. Moreover, it makes monitoring and verification easier and creates a feeling of partnership between the actors. ESCOs can therefore reduce the customers procurement related transaction costs substantially.

Table 2.1: The number of partners and the variety of contractors in a project with own investment vs. an ESCO project

	Own investment	ESCO project	
Preparation	Company A	ESCO	Subcontractor A
Implementation	Company B		Subcontractor B
Financing	Company C		Subcontractor C - Bank
Purchase of primary energy	Company D		Subcontractor D
Operation and management	Company E		Subcontractor E

(Bertoldi et al, 2014)

TCE predicts governance structures to be defined by the level of transaction costs. ESCOs adopting a hybrid contracting strategy with defined subcontractors reduce transaction costs arising from asset specificity. Integration of subcontractors absorbs all transaction costs on the ESCO side and end users' transaction costs are substantially reduced.

Increased trust through guaranteed savings

Crucially, the EPC specifically state that the projected energy and cost savings will be delivered and maintained over time. The EPC is constructed in way so that payments received by the ESCO for its services are directly linked to the achieved energy savings. In effect, the ESCO guarantee the building owner energy savings. The promise of guaranteed savings should have a major positive impact of the trust in EPC projects.

Cheap financing through zero opportunity cost of capital

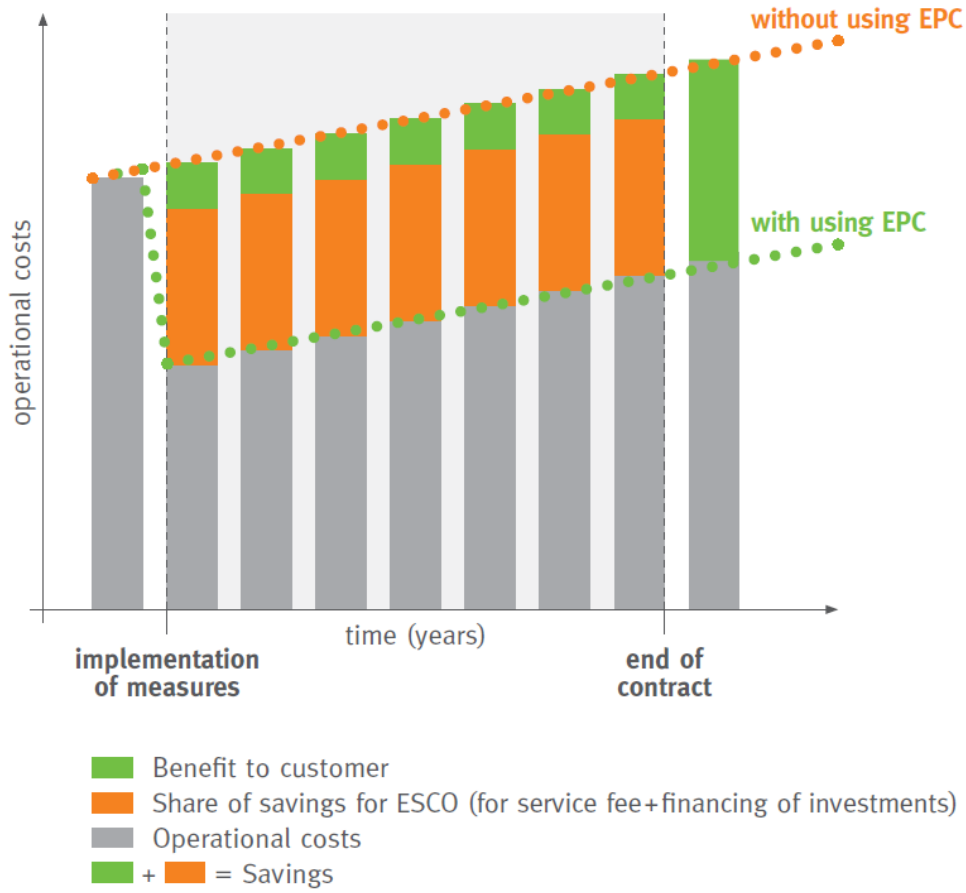
The savings guarantee allows the ESCOs to arrange financing of the projects. As the cost of investment is paid back from the energy saving over the duration of the contract, owners can make their buildings more efficient without having to bear any capital cost. EPC therefore promise to deliver guaranteed energy savings in buildings with zero opportunity cost of capital.

Financing of EPCs are tailored to the individual contract. There are three ways to finance the investment cost: By the client, by internal funds from the ESCO, or through third party debt financing (Bertoldi et al, 2006). Under the financing arrangement, either the ESCO borrow the money necessary for carrying out the project or the client borrows the money from a financial institution.

The loan is backed by the energy savings guarantee agreement with the ESCO. According to Bertoldi (2006), a major advantage of the financing arrangement is the isolation of the client from the financial risk related to the technical performance of the EPC. The risk removal also mean that the investment is not sitting on the customer's balance sheet.

Figure 2.4 illustrates the benefit to the customer, the share of savings for ESCO the service fee and financing of investment, as well as the operational costs during an EPC. The operational costs are reduced, and the customer reap immediate benefits after the measures are implemented. During the contract period both parties benefit, with a larger part of the savings paying for the service fee plus the financing of investments. After the investment has been paid down by energy savings, the customer reaps all savings to operational costs.

Figure 2.4: Benefit, savings and operational costs during the lifespan of an EPC



(EESI, 2012)

Risk sharing and partnerships increases trust

Easton Consultants (1999) found that high transaction costs reflected in ESCO pricing reflect the uncertainty of outcomes in all parts of the ESCO value chain.

As illustrated in figure 2.2, illustrating the value chain of an energy efficiency project, risks arise at various stages of an ESCO project. Before the contract is closed, the ESCO has no guarantee that there will be a deal. The ESCO therefore assume a sales risk. Moreover, as agreements are based on projected project costs, ESCOs take on the risk that actual costs will exceed estimated costs.

There is also a risk that projected energy savings will be lower than estimated. This constitutes a performance risk. Moreover, a risk that customer will back out of the contract or fail financially also exist. These contractual and liquidity risks will deny the ESCO the stream of energy savings needed for getting a return on the projects.

Figure 2.5: Comparison of various financing forms of energy efficiency investments in terms of sharing risks

	Investment risk	Operational risk	Credit risk	Inflation/exchange rate risk
own investment	Municipality	Municipality	Bank	Municipality
third party financing	ESCO	Municipality	ESCO	ESCO or municipality
leasing/rent	ESCO	Municipality	ESCO	ESCO
ESCO/EPC	ESCO	ESCO	ESCO	ESCO
forfeiting	ESCO	ESCO	Bank	Bank

(Bertoldi et al, 2014)

As seen in figure 2.5, the ESCO assumes the investment risk, the operational risk, the credit risk, as well as risk related to inflation and exchange rates. The ability of ESCOs to absorb the risks associated with energy efficiency services make them efficient tools in overcoming market barriers to energy efficiency. ESCOs minimize risks and cover associated costs in their pricing. Hence, EPCs lower transaction costs and through a credible commitment, in turn increasing the trust between the ESCO and the customer.

TCE assume trust to be an important variable in defining the nature and scale of transaction costs. Backlund and Eidenskog (2013) found that contract length had a positive effect on trust, in turn reducing transaction costs. As any misconduct would affect future earnings, the ESCO has less incentive to cheat. Long-term contracts, evolving into alliances and partnerships, should therefore be expected to succeed.

Mundaca et al (2013) finds support for Backlund and Eidenskog's (2013) claim that trust plays a significant factor in transaction costs analysis. This is also supported by Easton Consultants (1999, iii) noting that the most promising ECSO business models were the ones involving *"long-term customer relationships, combining energy efficiency projects with ongoing operations and maintenance services and equipment finance."* According to these findings, trust reduces transaction costs through the simplification of contract negotiations and reduction in search and administrative costs.

Easton Consultants (1999) conclude that important market barriers could be addressed through improvement of relationships between ESCOs and their customers. Proposed measures include customer education, ESCO certification, and support of new business models. Moreover, governments may assist in ESCO market creation by setting procurement rules and setting energy saving targets for their facilities.

Transaction boundaries

A major issue when applying TCE to transaction cost analysis is the accuracy of boundaries. Transaction costs are mostly used in studies of market transactions, however other exogenous variable are also affecting the nature and scale of transaction costs. As noted by McCann et al (2005), governments are also involved when property rights are defined and reallocated.

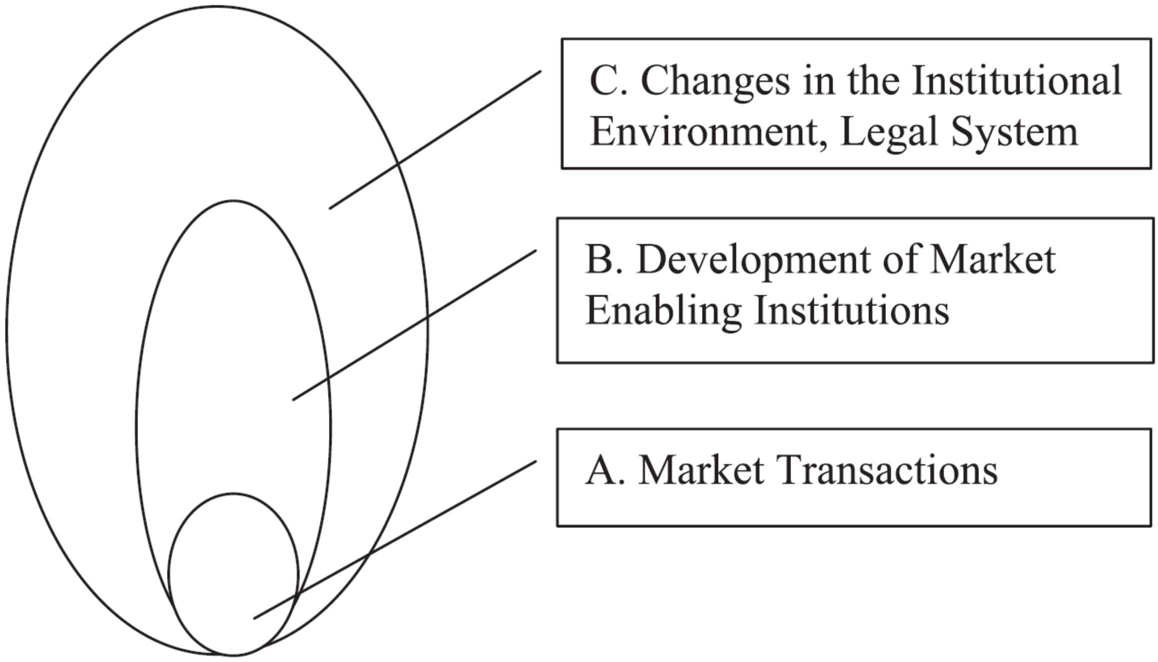
Public agencies implement, monitor and enforce market regulations that affect transaction costs. Transaction costs are also dependent on changes to the broader institutional development, such as the legal system. Williamson defines the institutional environment as:

> *"[T]he rules of the game that define the context within which economic activity takes place. The political, social and legal ground rules [that] establish the basis for production, exchange, and distribution."*
>
> (1993, 115)

Although Williamson (1981) was looking mostly at the internalization conundrum faced by firms, North (1984) also applied a transaction cost framework to studies of public policies.

In order to separate the study of the market transaction from the institutional environment this study applies McCann et al's (2005) understanding for the boundaries relating to transaction costs. Figure 2.6 below illustrates the different levels of analysis.

Figure 2.6: Boundary issues relating to transaction costs



(McCann et al, 2005)

Area A. covers the main unit of analysis is this study, namely the transaction. A full overview of how transactions in the market for energy efficiency services are carried out, and the costs linked to the transactions, is provided in the literature review in chapter 4. An assessment of changes in the institutional environment (area C.) and the development of market enabling institutions (area B.) is provided in the analysis of the Norwegian market for energy efficiency services in chapter 5.

Summary

The literature review has established that transactions costs can be substantial both on the supply and on the demand side, at various project stages. Moreover, proper implementation of EPCs can be expected to lower transaction costs substantially, particularly because it increases trust and lower information asymmetries between the transacting parties.

Chapter 3: The theory of transaction cost economics

Transaction cost economics is a theory within institutional economics. TCE is an interdisciplinary body of literature drawing on organization theory, economics and contract law (Williamson, 1981; 1993; 2010). Coase (1937) is heralded as the founder of the theory, with his groundbreaking research into why firms internalized certain functions, while outsourced others. A large literature following Coase (1937) and Williamson has validated the theory through various empirical studies.

Contrasting the static and rational models of neoclassical economics, TCE takes a dynamic and behavioral approach (Williamson, 2010). While neoclassicists focus on prices and output to analyze optimal choice under the assumption of perfect information, TCE assume actors boundedly rational.

The transaction cost framework looks at economic history and focus on how constraints change over time (North, 1984). TCE claims that industry structure and decision-making is heavily influenced by transaction costs, and believe that the purpose of economic organization is to economize on transaction costs (see McCann et al, 2005; Williamson, 1993).

From its beginning, transaction costs economists sought to understand why exchange relations broke down and whether costs related to the transaction could explain market failure (Coase, 1937; Williamson, 1981).

The following sections will define transaction costs within transaction costs economics, lay out the assumptions behind the theory, and compare it to neoclassical economics in order to theorize about the quantity of services produced in a market with transaction costs.

Transaction costs defined

A transaction takes place when a good or service is transferred from one entity to another (Williamson, 1981). Williamson (1993) likens transactions costs to friction in mechanical systems and define them as:

[T]he ex ante costs of drafting, negotiating, and safeguarding an agreement, and, more specifically, the ex post costs of maladaptation and adjustment that arise when contract execution is misaligned as a result of gaps, errors, omissions and unanticipated disturbances; the costs of running the economic system."

(1993, 56)

This paper adopts a definition by Matthews, who stated that transactions costs are:

> *"The costs of arranging a contract ex ante and monitoring and enforcing it ex post, as opposed to production costs."*

(1986, 906)

Williamson (1981, 552) defines transaction costs analysis as *"an examination of the comparative costs of planning, adapting, and monitoring task completion under alternative governance structures"*. A governance structure is the institutional set up deciding the level of formality of the transaction (Williamson, 1993). The main prediction from TCE is that governance structures with the best transaction cost economizing properties will replace governance structures with greater transaction costs (Williamson, 1981). The three most common governance structures are classical market, hybrid contracting and hierarchy.

First, the classical market is the arena where exchange happens, such as transaction in a grocery store. Second, hybrid contracting is a more formal integration between buyer and seller, and sets out a long-term relation. The contract makes sure that the parties preserve their autonomy and guarantees that the agreement will be kept. Third, a hierarchy means that transactions are taking place under unified ownership with administrative controls, for instance within a company.

As seen above, EPC provides a different type of governance structure compared to traditions energy efficiency agreements. EPC can be seen as a mix of hybrid contracting between the ESCO and the customer, and hierarchy between the ESCO and the subcontractors.

Assumptions

Transaction cost economics make some key assumptions about market and contracting behavior that provide important building blocks for the analysis. The assumptions below affect the degree transaction costs. However, as will be evident, it is impossible to separate the effect of one assumption from the other. The magnitude of one affect the other, and vice versa. The assumptions should therefore be seen as co-dependent variables.

Bounded rationality

TCE assumes that boundedly rational agents intend to be rational. However, the ability of human beings to formulate and solve complex problems is limited. While neoclassical theories assume that suppliers and buyers always will have perfect information about each other, the bounded rationality assumption within TCE means that information always will be imperfect (Forsgren, 2013). TCE on the other hand, assume a limit to the amount of information that can be received, stored, retrieved and otherwise processed by human beings.

Opportunism and uncertainty

Moreover, TCE assume human beings inherently self-interested. This self-interest will lead some individuals to cheat, mislead, deceive, and confuse the other party to an agreement. TCE assume that the constant presence of opportunistic behavior creates a constant threat of non-compliance within contractual arrangements.

The presence of non-compliance increases the risk of the investment. The increased risk leads to a greater discount rate. A greater discount rate decreases the net present value of the investment. Opportunism is therefore closely related to the degree of uncertainty between the transacting parties.

Uncertainty

The existence of uncertainty means that changes in the environment cannot be foreseen or controlled by the transacting parties (Forsgren, 2013). Dynamic markets are inherently unstable, creating a limit to the trustworthiness, stability, and predictability of any governance structure.

Uncertainty increases the risk, in turn increasing the discount rate. Increased uncertainty related to new technologies also create higher decision-making costs compared to standard technologies (Mundaca et al, 2013). Uncertainty is closely related to the degree of trust between the transacting parties.

Trust

Reduced trust between two transacting parties increases the perceived risk of non-compliance. Increased risk increases the discount rate, which decreases the net present value of the investment. Since it is assumed that all promises about future behavior potentially are open for renegotiation, any governance structure suffer from and inherent credible commitment problem.

A credible commitment involves a contractual promise that the counterpart will be compensated if the agreement is terminated or altered (Williamson, 1993). Information disclosure, auditing mechanisms and dispute settlement mechanisms are examples of measures that add assurance to the agreement (Williamson, 2010). However, these measures also increase the level of transaction costs as more work goes into preparations and negotiations.

A lack of enforcement mechanisms will make cheating easier. Strong enforcement mechanisms that levies costs on the non-compliant party, increases the credibility of the commitment. A contract helps by creating a bilateral dependency that increases the costs of non-compliance (Williamson, 2010).

Information asymmetry

Valentová (2010) refers to information asymmetry as a special case of imperfect information when two parties have access to different levels of information. Under the assumption of imperfect information, one can never fully trust the other party to a transaction.

Due to bounded rationality, there is always a cost involved when new knowledge has to be retrieved, stored and processed. Transaction costs are therefore dependent on the level of information asymmetry. Information asymmetry leads to information searching costs, as well as due diligence costs (Mundaca et al, 2013). The parties also have to collect information about the political, financial, technical and legal implications of the new investment.

Information asymmetries reduce the level of trust between the contracting parties. Leveling of information between actors can be done through information campaigns, knowledge transfer and competence building.

Asset specificity

Williamson (1993, 54) defines specific assets as *"a specialized investment that cannot be redeployed of alternative uses or by alternative users except as a loss of productive value"*. If the transacted asset is specialized to a degree that makes it difficult to sell on the market, the buyer and seller will operate in a bilateral exchange relation for a considerable period afterwards.

A feature of specific assets is that they give rise to bilateral dependency. The parties are locked into the agreement because a very specific asset has a much lower value among other market actors. TCE predicts that hybrid contracts and hierarchy will emerge as asset specificity increases (Williamson 1981; 1993; 2010). When the costs of transacting a specific asset reaches a certain level, organizations and firms will internalize the production of the good or service (Forsgren, 2013).

When asset specificity is great, the need for very specific contracts are necessary. The level of detailed needed for negotiations increases, and so does transaction costs. The transacting parties will construct an agreement that makes continuation beneficial. While transaction costs will increase in the negotiation phase, future transaction costs related to monitoring and enforcement of the contract may be severely reduced.

As noted by (Williamson, 1993), asset specific investments would never be made if they failed to promise future cost reductions or revenue increases. Moreover, as governance costs are considered greater when the asset specificity is high, efficient enforcement mechanisms are crucial.

Thin and thick markets

Markets can be either thick or thin (Williamson, 1981). Thick markets have a large amount of buyers and sellers, and have similar attributes to a market with perfect competition in neoclassical economics. Information is readily available, and the cost of transacting is negligible. Thin markets on the other hand, have few actors and are more similar to markets with monopolistic competition.

In thick markets, it is easy to obtain the necessary information about the product before you buy it. Shopping in a grocery store illustrate the concept of thick markets. When buying a pack of gum at the grocery store you know what you are paying for and what the prices are among competitors. Under these circumstances, neither the shop assistant nor the buyer have any interest in writing a lengthy contract before the transaction takes place. After the transaction is carried out, the buyer gets exactly what he expected: A pack of gum.

Thin markets tend to have more specific assets for sale. The more specific the asset, the harder it is to agree on price and quality of the asset before the transaction takes place. Information about the quality of the asset can be costly to obtain, and prices can be difficult to agree. The parties may spend considerable time and resources on negotiating a contract that specifies the terms and conditions of the transaction.

The building sector illustrates the concept of thin markets. Before construction can start, the builder and the contractors must have highly specified contracts in place. The asset is often a one-of-a-kind deliverable, and includes a highly complex process in which multiple technical solutions and human expertise must come together to deliver according to a project plan.

Building projects involve considerable monetary sums and a high degree of risk. There are many steps, and delays can be costly. As the assets are highly specific, detailed contracts are necessary before any transaction can take place.

TCE compared to neoclassical microeconomics

In neoclassical economics, rational economic actors are assumed to maximize their utility according to a budget constraint. If benefits exceed costs, a transaction takes place. Likewise, if the return on investment in energy efficiency measures is greater than the energy cost, the investment should take place. Energy efficiency will be demanded to the point where the marginal benefit of energy efficiency equals the marginal cost for energy. Consequently, neoclassical economics predict a decrease in energy prices to reduce demand for energy efficiency services.

If low energy prices reduce demand for energy efficiency services, increasing energy prices should lead to the use of more efficient technologies. From this, one could argue that low energy prices lead to the use of inefficient technologies (Valentová, 2010). At least, it is fair assume that low energy prices over a long period of time produce limited incentive to invest in energy efficiency measures.

However, energy costs are often only a small part among many other criteria for making an investment in energy efficiency projects. New Norwegian buildings are expected to last for fifty years. During a buildings full life cycle, operational costs amount to approximately 80 percent of the total costs. Although energy prices are low, rational actors should still invest in profitable energy efficiency measures because the accumulated savings are substantial.

Mundaca et al (2013) conducted a meta-analysis of transaction costs in energy efficiency, renewable energy and carbon market technologies. The study surveyed an emerging pool of empirical literature from new institutional economics, industrial organization, environmental economics and technology. Mundaca analyzed how measures reducing greenhouse gas emissions were affected by transaction costs.

The study adopted a simple microeconomic model to conceptualize the existence of transaction costs and the effect it has on market fundamentals, such as output (quantity), and decision-making variable, such as prices.

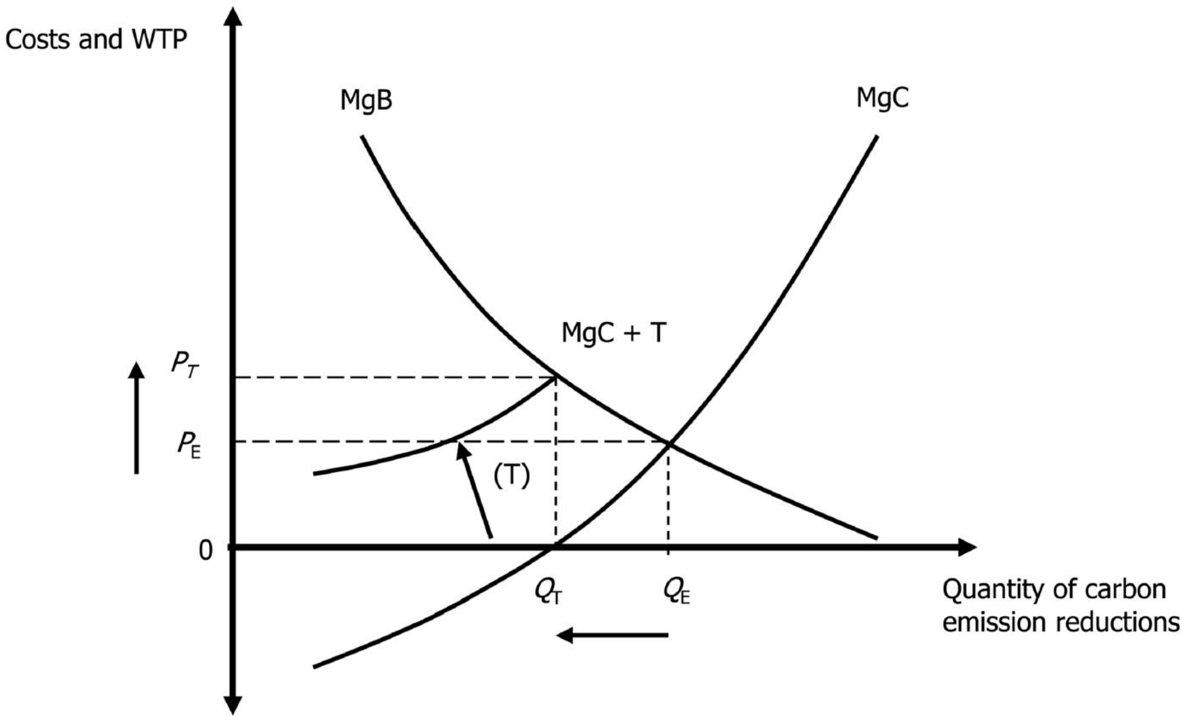
A microeconomic model makes predictions of how the two parties in a transaction – a seller and buyer – will optimize their behavior under the conditions of perfect competition. Perfect competition is an important neoclassical assumption. Under perfect competition, all market actors have perfect information and act as rational economic agents, optimizing their level of utility. Moreover, information asymmetries are non-existent.

The TCE assumptions adopted above suggest that markets should not be analyzed through neoclassical models. Nonetheless, a basic supply and demand framework is informative when analyzing market failures.

Mundaca et al's (2013) microeconomic model is presented in figure 2.7 below. The marginal cost curve (*MgC*) shows the cost of reducing carbon emissions at different quantities. The model is included here to understand the effect transaction costs have on the optimal level of the diffusion of low-carbon technologies. The x-axis represent the quantity of carbon emissions reductions, while y-axis represent the monetary costs and willingness to pay (WTP). For the purposes of this paper, reductions in GHG emissions can be substituted by the quantity of energy efficiency services on the x-axis.

The marginal benefit curve (*MgB*) shows the level of utility, or return on investment, needed for a buyer to make a market exchange with a seller. It can be seen as the buyer's willingness to pay for another unit of energy efficiency service. The marginal cost curve constitutes the supply of energy efficiency services, while the marginal benefit curve constitutes demand.

Figure 2.7: Impact of transaction costs on carbon emissions reductions



(Mundaca et al, 2013)

In the absence of transaction costs (*T)*, the equilibrium level given by quantity Q_E at price P_E. However, if transactions costs are included on the supply side, the marginal cost curve (*MgC*) shifts upwards left, to the new supply curve (*MgC + T*). Hence, when transaction costs are included, the quantity of low-carbon technologies deployed is reduced to Q_T at increased price P_T.

Applying the model to energy efficiency, we can predict that when transaction costs are included, the first units of efficiency gains cannot be yielded at negative cost. In this model, transaction costs not only reduce the supply of energy services. Since energy efficiency services are commercially profitable at the outset, it also creates a market failure. As transaction costs are positive and equal to *(T)*, *MgC + T* will never intersect with the x-axis.

Mundaca et al (2013) find empirical evidence in support of the hypothesis that positive transaction costs impact energy efficiency investment negatively. The existence of transaction costs can therefore be expected to result in a socially suboptimal level of energy efficiency service investment. Transaction costs must therefore be considered when designing, implementing and assessing the market size of low carbon technologies. Ignoring transaction costs makes it likely that biases are included in policy design and instrument choice. However, as this neoclassical framework fails to include assumptions of uncertainty, bounded rationality and opportunism, it does not say anything about how these transaction costs arise.

The sources of transaction costs are central in the case study of the Norwegian market for energy efficiency services in existing buildings below. Before turning to the case study, the applied method will be described.

Chapter 4: Methodology

Purpose of research

The purpose of this study is to validate whether transaction costs are making the Norwegian market for energy efficiency services fail. Second, the study will assess what type of measures that have been the most effective for the diffusion of energy efficiency services in the case of Norway.

The central research questions of this study:

- Are transaction costs making the Norwegian market for energy efficiency services fail?
- If yes, what type of measures have been the most effective for reducing transaction costs in the market for energy efficiency services in Norway?

The analysis is supported by the following sub-questions:

- Why do economic actors fail to invest in energy efficiency services?
- How do transaction costs arise?
- Why do transaction costs arise?
- What is the effect of transaction costs on the optimal level of output of energy efficiency services?
- What effect does market interventions have on the level of transaction costs?
- How are transaction costs reduced?
- What role can energy performance contracting play in reducing transaction costs in energy efficiency service projects?

Research design

This study adopts a post positivist worldview (Creswell, 2009). The aim is to identify whether a cause (transaction costs) affects an outcome (market failure). In this sense, the study is deterministic. Moreover, knowledge is viewed as conjectural – absolute truth cannot be found. The case study will tests two hypotheses. The hypotheses will not be confirmed. Either they will be rejected, or they will fail to be rejected.

The hypothesis of the study:

- Hypothesis 1: Transaction costs are causing a failure in the market for energy efficiency services.
- Hypothesis 2: Energy performance contracting is an effective tool for removal of transaction costs in the market for energy efficiency services.

Energy efficiency measures are all small things, and the technology must be retrofitted into existing buildings. High asset specificity suggest high transaction costs. A sound theoretical grounding is essential in order to decide whether a cost can be deemed a transaction cost, and not just an ordinary operational cost. The study draws on institutional economics theory, specifically transaction cost economics, to test the two hypothesis. All costs associated with the assumptions found within transaction cost economics and stemming from transactions in energy efficiency service markets, both *ex ante* and *ex post*, is included in the term.

Operationalization of analysis

Transaction costs are hidden costs caused by friction between two parties that deal with each other. The sources to that friction are hard to identify, and hard to counteract. The study sets out to qualitatively observe and measure the magnitude of those hidden costs through a case study of the ESCO market in Norway.

Case study

The case study will present an objective reality through careful data collection and historical evidence building. The sources to transaction costs will be analyzed in order to identify whether they can be defined within the assumptions of transaction cost economics. Interventions by governments, businesses and customers to reduce transaction costs will also be analyzed, in order to identify whether they are working or not.

If markets are failing, society needs to know what it should do about it. A thorough assessment of market interventions is therefore made, along with an analysis of the impact those interventions have had on the market over time. The case study adopts a dynamic approach and the historic market development will be analyzed at a given yearly interval.

Primary sources

To delimit the study, test the hypothesis and seek information from primary sources through qualitative interviews of central personalities in Brussels and Norway will be conducted. The interviews will be semi-structured and follow the interview guide in Appendix 1. All interviewees will be asked whether they are comfortable standing forward with a full name or not.

Secondary sources

Access to project specific data is a major problem faced by researchers examining transaction costs (McCann, 2005). Private and public sector managers are understandably suspicious about the collection of information that may reflect unfavorably on them or their EPC projects. The case study will therefore be limited to a qualitative analysis of market reports, governmental reports, as well as legislative documents. As the ESCO market in Norway is expected to be relatively young, available presentations and information on web pages may also be included as secondary sources.

Reliability

The nature and scale of transaction costs differ according to context-specific endogenous determinants, and exogenous drivers. Methodological differences make comparisons and generalizations difficult. Methodologies differ both when it comes to the theoretical frameworks applied, as well as in the sources of information and quantitative models. As argued by Valentová (2010, 89): “the exact size of transaction costs still remain rather unclear, partly because there is no common method for evaluating them and including them in decision making.”

The case study will not seek to assess the exact level of transaction costs in the Norwegian market. Rather, the case study will develop an historical account of the developments, and analyze the findings through the transaction costs economics framework. Inferences will then be made as to whether transaction costs are causing of making the market for energy efficiency services fail, and subsequently whether EPC has had any part in reducing these transaction costs.

Validity

Transactions costs are interconnected and may reinforce each other (Valentova, 2010). This makes it very difficult to ascertain a causal relationship between specific transaction costs as the independent variables, and the market as the dependent variable. The hardship in separating the independent variables supports the use of a qualitative approach to the macro study of transaction costs.

Moreover, the market analysis should be careful before concluding any direct causal relationship. If a direct causal relationship cannot be established, transaction costs will be treated as co-dependent variables, which pooled together, has the potential of making the market fail. Testing the hypothesis will then become binary question: Either transaction costs are great enough to stop an investment decision, or it is not.

Chapter 5: The Norwegian ESCO market

This case study takes a close look at the historical developments in the Norwegian ESCO market. The analysis consists of five section. The first section looks at the development of the ESCO market until 2010. The second section takes a closer look at the transaction costs borne by both the supply and the demand side in 2011. The third section reverts to the ESCO market, and looks at the developments between 2010 and 2013. The fourth section provides an historical assessment of the legislative environment and market enabling institutions from both the EU down to Norway. Finally, the fifth section looks at the developments in the ESCO market between 2013 and 2016.

The ESCO market until 2010

The European Commission prepared a status report of the market for energy service companies in Europe in 2010 (Marino et al, 2010). The study includes an assessment of the Norwegian market for ESCO services. In 2005, ten companies defined themselves as ESCOs in Norway. By 2007, the number of ESCOs increased to between ten and fifteen. These companies had an estimated €30-40 million in turnover shared between them. In the period between 2005 and 2010, between two and three projects were being implemented each year (Bertoldi et al, 2014).

In 2009, the market had contracted. Only five to ten ESCOs were active, and the estimated turnover fell to €25 million (Marino et al, 2010). Energy efficiency services were supplied by subsidiaries of international companies as well as local manufacturers of building automation and control systems, facility management and engineering consultancies.

The majority of ESCO projects were done in public buildings. Although building refurbishment and modernization projects had a significant market value, only a small number of projects were implemented (Marino et al, 2010).

The majority of projects were implemented through traditional energy management agreements. EPC with guaranteed savings was also on offer, but only a small number used a shared savings model (Marino et al, 2010). Clients or ESCOs provided funding, either through internal funds or through bank loans.

Market barriers

While a lack of financing was identified as the main barrier for project development (Marino et al, 2010), public procurement rules were identified as a barrier to ESCO projects. Mistrust from building owners, and a lack of time and skills in energy efficiency measures, were found to lower the attractiveness of ESCO projects on the demand side.

Legislation and market enabling institutions

Through Enova, the Norwegian Energy Agency, the Norwegian state allocated €45 million to investments in energy efficiency improvements over a three-year period in 2008 (Boasson, 2013). Apart from this initiative, national energy authorities were found to give very low attention to EPC compared to other European countries (Marino et al, 2010).

Marino et al (2010) concluded that EU co-financed projects, such as the privately run European Energy Service Initiative (EESI) and Eurocontract, were the main drivers of the ESCO market. Eurocontract, short for European Platform for the Promotion of Energy Performance Contracting, is a project co-financed by the European Commission and the private industry (European Commission, 2016).

Summary

The market for energy efficiency services was shrinking in 2010. Marino et al (2010) concluded that under the given circumstances a large increase in energy prices would be necessary to increase the demand of ESCO projects in Norway.

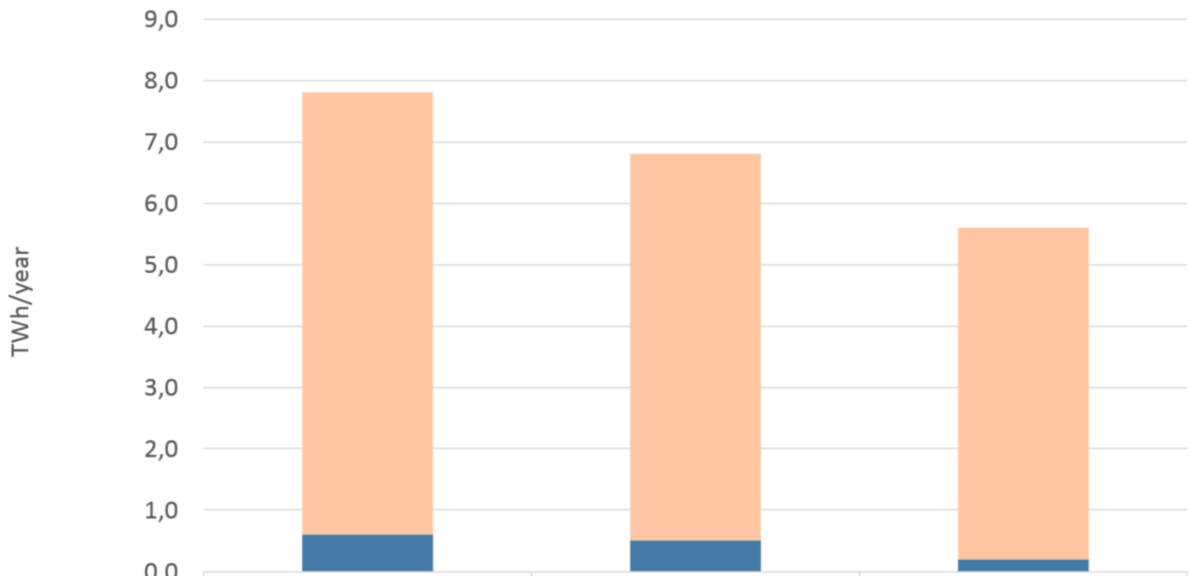
The authors were optimistic towards a new building certification scheme, and expected it to boost future Norwegian investment in energy efficiency improvements. The main recommendations included efforts to increase the knowledge and understanding of ESCO projects, as well as sharing of best practices.

Gottberg et al (2009) supported this conclusion. The authors conducted a survey and a workshop among Nordic ESCOs and public building owners in 2009. They found that buyers of energy efficiency services felt that the demands put on them were too high. A basic understanding of the contractual aspects of EPCs, as well as good project management skills, was needed for EPC to gain traction. Networks, training events, information, guidelines and best practice cases were highlighted as the most important tools for knowledge transfer to potential EPC buyers, especially smaller ones.

Transaction costs in Norway

A potential- and barrier study conducted by Multiconsult et al (2011) analyze the barriers inhibiting investment into the energy efficiency potential of existing commercial buildings in Norway. As seen in figure 3.1, behavioral barriers come at a cost to society of 5.4 TWh in unnecessary energy consumption.

Figure 3.1: Actual realizable potential in new and existing Norwegian buildings at different energy prices

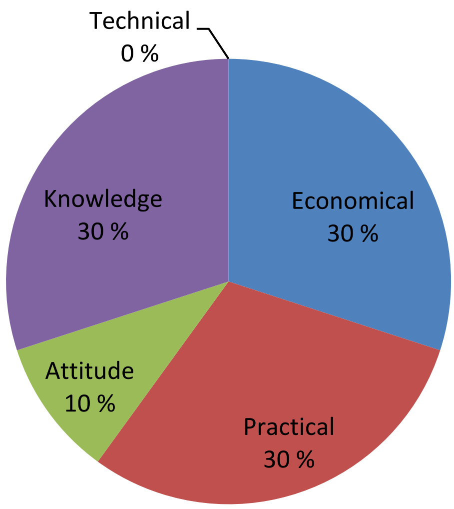


	Actual realizable potential (1.4 NOK/kWh)	Actual realizable potential (1.1 NOK/kWh)	Actual realizable potential (0.8 NOK/kWh)
Existing buildings	7,2	6,3	5,4
New buildings	0,6	0,5	0,2

(Multiconsult et al, 2011)

Multiconsult et al (2011) analyzed the actual realizable potential and distributed it among four different barriers: economical barriers; practical barriers; barriers from bad attitude; and knowledge barriers. Case studies were conducted and focus groups set up to verify the findings. Figure 3.2 below show how the actual realizable potential distributed among what Multiconsult et al refer to as behavioral barriers.

Figure 3.2: Actual realizable potential distributed among barriers to energy efficiency in existing buildings



(Multiconsult et al, 2011)

Economical barriers

Among the economic barriers, we find a rigid framework for public actors, lack of financing among public enterprises and high investment costs. Rigid systems were especially inhibiting public organizations, making it harder to highlight benefits and get approval of the commercial profitability of the projects.

Too high investment costs were among the first things to be mentioned by the focus groups. A lack of liquidity, and rigid internal systems to obtain funding, were among the main barriers.

Public enterprises spend fiscal transfers on other fields than energy efficiency. Multiconsult et al finds that public opportunism, such a prioritizing health care, hinders energy efficiency investment.

Practical barriers

Getting approval for energy efficiency measures within the organization was hard. Lack of incentives, interest and time used at implementation where found to inhibit energy efficiency measures.

Establishing new operations and implementing systems for compliance often demand changes to organization and routines. Multiconsult et al (2011) found that existing buildings have greater asset specificity than new builds, as installation of new equipment must be tailored to the specific building body, the construction, rooms, etc.

Secondly, Enova found that conflicting regulatory requirements were inhibiting energy efficiency measures. Conflicting regulatory requirements creates challenges when priorities must be made between other aspects of the building standard, such as for instance indoor air quality.

Attitude

Transformational processes takes time and is dependent on knowledge. Low consciousness and skepticism towards energy efficiency measures suggest a negative attitude among the focus groups (Multiconsult et al, 2011). As most Norwegian energy consumption in buildings is provided by clean and renewable hydropower, the focus group questioned the necessity of energy efficiency investments.

Feedback from focus groups also highlighted the need for a clearer direction and stronger attitude among politicians. Political signals would reduce uncertainty and make the future more predictable for future measures, investments and targets.

Nonetheless, Multiconsult et al found that the impact of attitude has been reduced due to the implementation of the energy certificate scheme and greater awareness of energy and environmental consideration in the news.

Knowledge barriers

A general lack of knowledge concerning benefits and profitability of energy efficiency investments, as well as a lack of competence in building operations, were identified as the main knowledge barriers. Technical building systems have become increasingly complex. The demand of competence among procurers has therefore increased substantially.

An example provided by Paul Hodson, Head of the Energy Efficiency Unit at DG Energy, is the lack of board attention to energy efficiency. When asked what market barriers are inhibiting the spread of energy efficiency the most, Hodson answered:

> *"In industry where things with a very short payback time are not done, the market failure is the lack of board attention. It is the suboptimal quantity of attention from senior management that is available within firms. Why else do you not do things which pays for themselves in 9 months?*

Summary

Economic barriers were found to be greatest in the beginning of projects. Moreover, practical barriers where greatest in the projecting phase, while lack of knowledge was the greatest barrier in the implementation phase. The attitude barrier affected the project at all stages.

Table 5.1: Actual realizable potential distributed among barriers to energy efficiency in existing buildings

Barriers	Impact	Energy price 0.8 NOK/kWh	Energy price 1.1 NOK/kWh	Energy price 1.4 NOK/kWh		Expected development 2010 - 2020
Economical	30%	1,600,000,000	1,900,000,000	210,000,000	kWh	Weak reduction
Practical	30%	1,600,000,000	1,900,000,000	210,000,000	kWh	Weak reduction
Attitude	10%	540,000,000	630,000,000	720,000,000	kWh	Reduction
Knowledge	30%	1,600,000,000	190,000,000	210,000,000	kWh	Weak reduction
Technical	0%	-	-	-	kWh	Unchanged
SUM	**100%**	**5,340,000,000**	**4,620,000,000**	**702,000,000**	**kWh**	

(Multiconsult et al. 2011)

Table 5.1 shows the distribution of the actual realizable potential. Multiconsult et al (2011) based their study on qualitative data; hence, the distribution is somewhat arbitrary. Nevertheless, it provides an indication of the magnitude of the various energy efficiency barriers.

The ESCO market between 2010 and 2013

The European Commission prepared a new ESCO market report for the EU in 2013 (Bertoldi et al, 2014). The Norwegian market was seen to have improved somewhat. The positive development was mainly driven by increased demand stemming from climate awareness in municipalities and active promotion carried out by the supply side. Nonetheless, the market remained immature and small in 2013, dominated by few major players.

Based on participation in tenders, Bertoldi et al (2014) identified five ESCOs dominating the market. The authors concluded that the market was *"in a kick-off phase, moving from pilot projects towards market based solutions"* (Bertoldi et al, 2014, 173).

Existing ESCOs were the key players in raising awareness and communicating the benefits of EPC to potential clients. Nonetheless, as seen in figure 3.3 the ESCO market development still experienced severe difficulties.

The market size was not estimated in 2013. However, the investment value of municipal projects revolved around €5 million. Five to eight projects were implemented each year in the period from 2010 to 2013. While publicly supported projects dominated in 2010, the municipalities' interest drove the market in 2013.

As of May 2013, 25 out of 428 municipalities had ventured into an EPC at least once. In these EPCs, the average savings potential have proven to be around 30 per cent (Bertoldi et al, 2014).

The most common financing of ESCO projects was through use of municipalities' own funds. In 2013 the banking sector was not yet ready to participate. The financial crisis made the reluctance even larger.

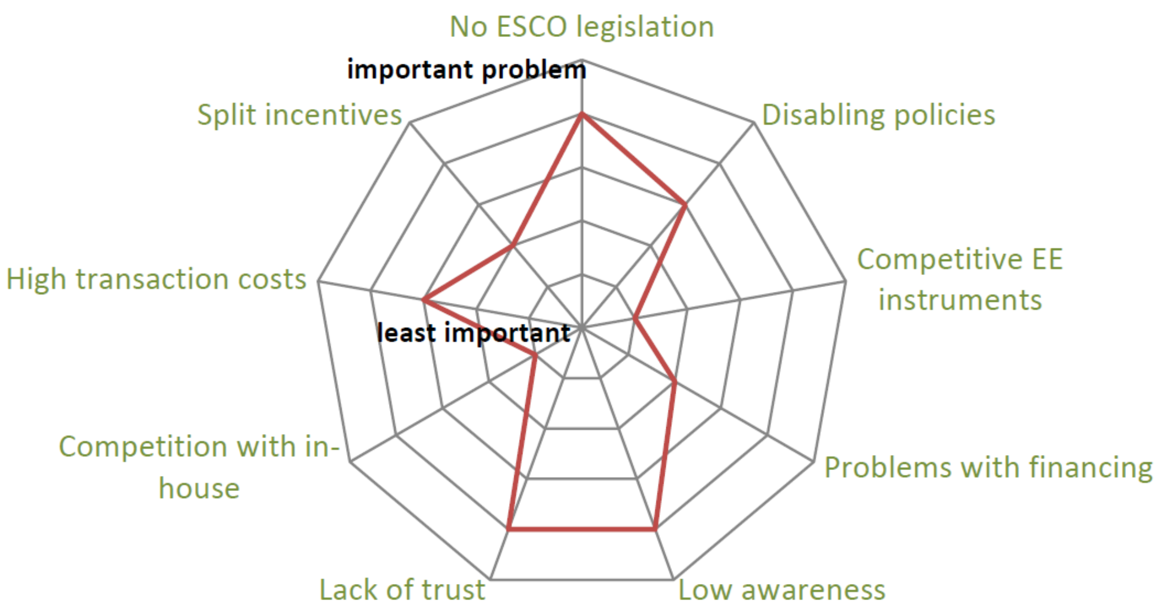
Market barriers

The consistently low energy prices over many years led to very limited profits from ESCO projects (Bertoldi et al, 2014). As seen in Figure 5.5, several other market barriers where identified.

Municipalities were found to lack knowledge about EPC. Moreover, the preparation process for EPC contracts was still complicated and expensive. The lack of capacity among potential end-users to prepare and participate in the project due to time and knowledge constraints heightened the insecurity and lowered the trust in the process and contract documents.

As illustrated by figure 2.3, low awareness, a lack of trust and missing ESCO legislation where highlighted as the most important barriers in 2013. Bertoldi et al (2014) applies a more narrow definition of transaction costs, but also treat them as an important barrier.

Figure 3.3: Barriers to ESCO projects in Norway



(Bertoldi et al, 2014)

Legislation and market enabling institutions

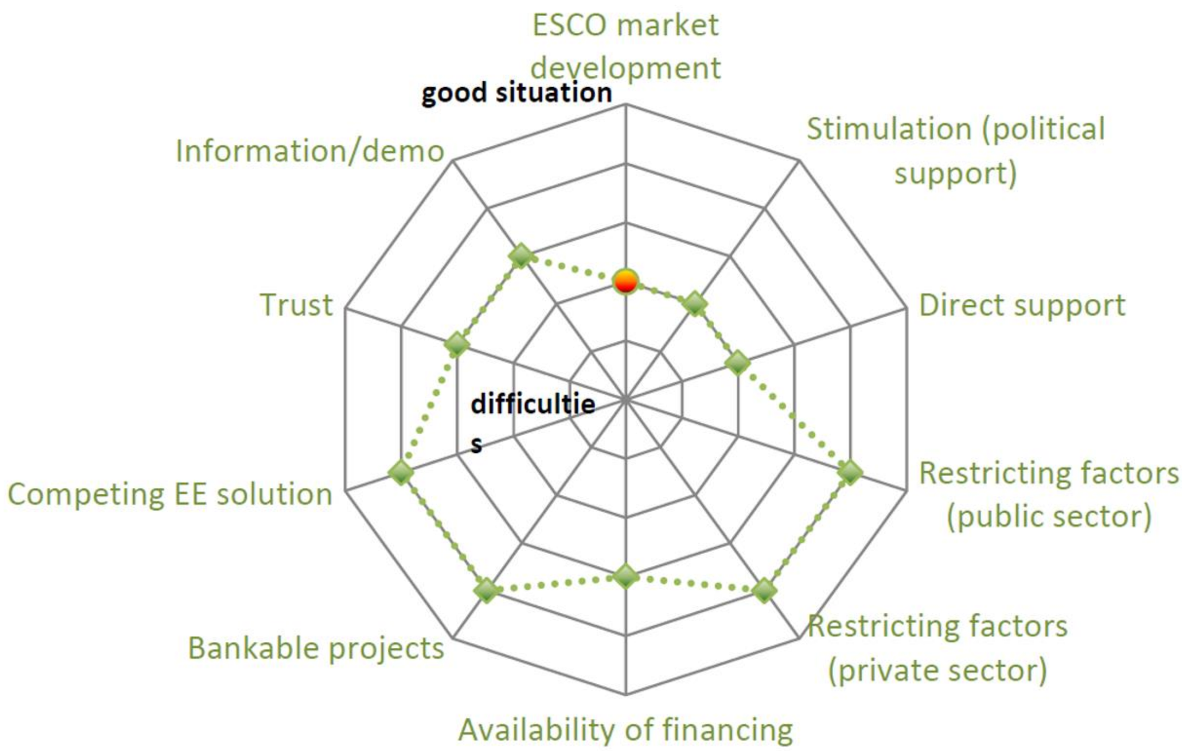
There was no Norwegian ESCO association in 2013, and ESCOs mainly promoted solutions on their own (Bertoldi et al, 2014). Enova had started making grants available for ESCO projects. However, except for sporadic independent activities from Enova, through seminars and trainings, proper market intervention remained negligible.

Climate plans developed by aware municipalities were found to be one of the key drivers of the market. Implementation of the Buildings Directive (EPBD, 2010/31/EU) was expected to further enhance municipalities interest in energy services. Nonetheless, the lack of direct regulation of the ESCO market was seen as one of the major market barriers. Insecurity about legislation and the regulatory framework, especially with regard to public procurement, remained one of the core barriers in 2013.

As seen in figure 3.4, both political support and direct support through market intervention was low. With the institutional environment in Norway neither hindering nor enabling the ESCO market, the influx of EPC standardization through various EU projects was seen as a key driver in 2013. The standard was expected to increase the trust of EPCs, making promotion by ESCOs easier. When trust in the EPC was secured, spreading information about the benefits of the ESCO model was hypothesized to be a key factor for boosting the market (Bertoldi et al, 2014).

Bertoldi et al (2014) had great expectations for an EPC standard that was in its final stages for adoption in 2013. An official EPC standard was expected "*to boost the knowledge about EPC, as well as to remove a number of barriers related to trust, public procurement and "outsourcing""* (Bertoldi et al, 2014, 174). The standard was based on findings from the Eurocontract and EESI projects, with inputs given from local stakeholders, the Enova, and the Norwegian Association of Local and Regional Authorities (KS).

Figure 3.4: Key features of the Norwegian ESCO market in 2013



(Bertoldi et al, 2014)

Summary

The market for ESCO projects had a positive development from 2010 to 2013, however growth remained slow. ESCO projects comprised mainly municipal buildings due to increased climate awareness with long-term and predictable climate targets in municipalities. The findings suggest that environmental leadership at the local administrative or political level has been important for ESCO projects to take foothold.

The findings point to transaction costs arising from complexities in the project process at both the market transactions level, the legislative level, and the political level. Some market enabling measures were in place, but these were spread out randomly with no overarching goal or purpose.

However, informational campaigns and standardization initiatives inspired by market logic from the EU showed ground for optimism in the ESCO market picking up somewhat. Nevertheless, the introduction of EPCs was still inhibited by a general lack of trust in the new contractual practice. Successful implementation of ESCO projects seemed dependent on climate targets set locally by the municipalities, and conviction in the EPC from the administrative level.

Regulatory market interventions

This section is divided into three parts: the legislative environment, market enabling institutions and an assessment of energy efficiency policies in Norway. The first two parts cover the both the EU and Norway, and the link between the two. The third part assess the impact of legislation and government run institutions on energy efficiency in buildings.

The legislative environment

The EU legislative framework

The EU has different modes of regulating behavior in its member states (Baldwin et al, 2012). The European Commission has stimulated the ESCO industry through legislation, information campaigns and financing programs since 1988 (Bertoldi et al, 2014).

The EEA agreement is governing the relationship between Norway and the EU, and if and how legislation relevant for the internal market should be transposed into Norwegian law. According to the European Economic Area (EEA) agreement, Norway must transpose all EEA-relevant regulations and directives into Norwegian law.

The following directives are relevant for energy efficiency services, and have been deemed EEA-relevant, and should therefore be transposed into Norwegian law:

- The 2002 energy performance of buildings directive
- The 2006 energy end-use directive
- The 2010 energy performance of buildings directive
- The 2012 energy efficiency directive

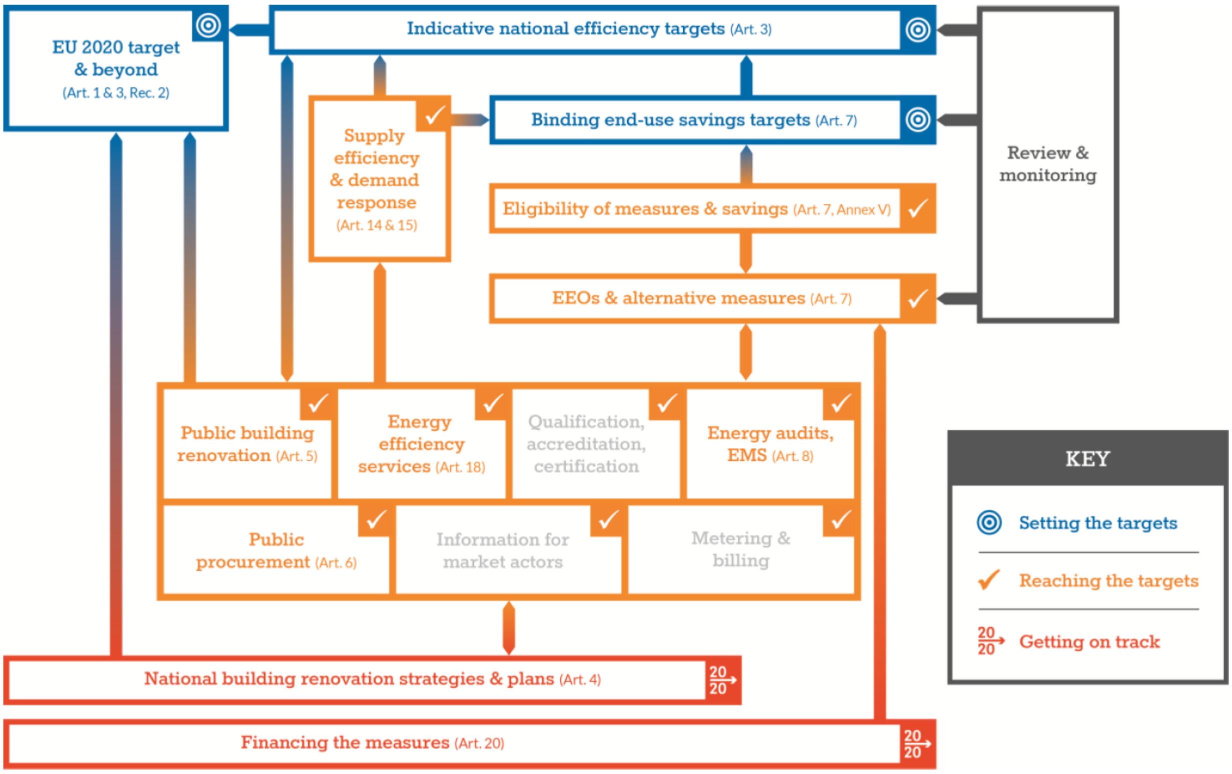
Within the directives, the EU has developed targets and indicators aimed at reducing energy consumption in buildings. The targets are put in place to nudge markets in the right direction, through implementation of common definitions, measurement methods, minimum requirements and other market tools aimed at reaching the targets.

The implementation into national law depends on transposition of legal texts and development of national action plans. The transposition should be completed within set deadlines, and results must be reported to the EU. Figure 3.5 illustrates how the field of energy efficiency has been developed within the EU regulatory framework.

The European Commission research, monitor and collect data on the transposition and market development. Many Member States are lagging behind in the implementation. So is the case of Norway.

One of the explanations behind the low transposition rate may be that the targets set by directives are non-binding. Although there are enforcement mechanisms penalizing failures to transpose the directives into national legislation, there is also a lot of flexibility for national governments as to how to implement the legislation.

Figure 3.5: Relationship between the articles enabling legislation and institutions in the EED 2012



(The Coalition for Energy Savings, 2013)

The 2002 energy performance of buildings directive

The main elements of the 2002 Energy performance of buildings are technological in nature, however the energy certificate scheme is a clear market measure (EPBD, 2002/91/EC).

Relevant articles include:

- Article 3 defines a joint method for calculating energy consumption in buildings.
- Article 4-6 defines how energy requirements for new buildings and buildings being renovated should be set nationally.
- Article 7 requires member states to introduce energy certificates for new and existing buildings, including recommended actions for improvement.
- Article 8 and 9 requires periodic inspection of boilers and air conditioners, and should lead to improvement or replacement of existing appliances.
- Article 10 specifies that independent experts, either public or private enterprise bodies, should check compliance with Article 8 and 9.

Most of the directive is aimed at the technical standards of the building envelope. However, the energy certification scheme is market measure. However, it is more an inspiration for Member States than it is a directive, as the flexibility in transposition is very large.

The 2010 energy performance of buildings directive

In 2010, the EU adopted a revision of the 2002 energy performance of buildings directive (EPBD). Apart from clarification and simplification of the existing provisions, the revised directive also substantially extended its scope (EPBD, 2010/31/EU). The 2010 EPDB has primarily a technology development steering character, but also include market logics.

Relevant articles include:

- Article 1 requires member states to apply minimum energy efficiency requirements to new buildings and building units, to existing buildings and building elements subject to major renovation, and to technical building systems whenever they are installed, replaces or upgraded.
- Article 2 sets out a cost optimal logic, and member states should seek to reach the "the energy performance level which lead to the lowest cost during the estimated economic lifecycle." Taking such longer term calculations into account make costly measures more economically viable.
- Article 5, commits the Commission to creating a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements. The goal is to create a benchmark so that the results can be assessed and compared.
- Article 6 instructs member states to implement minimum-standards for energy consumption in new buildings, as well as making sure that technical, environmental, and economic aspects of highly efficient alternatives have been considered and documented before building starts.
- Article 9 demands that by 2021 all new buildings are 'nearly zero-energy buildings', while all new publicly owned buildings should be 'nearly zero-energy buildings' by 2019. Furthermore, member states are required to draw up national plans for increasing the number of such 'nearly zero-energy buildings' and regularly report such plans to the Commission.
- Article 18 requires member states to ensure that independent control systems for energy certificates and reports on the inspection of heating and air-conditioning systems are established according to given guidelines. This ensures credibility of the measures. The certificates are obliged to be presented in building advertisements in commercial media, and the buildings frequently visited by the public must display the certificate in a prominent place. The market logic says that this information will affect the market value of buildings, as well as providing technical guidance on how to enhance the energy performance of their buildings (Boasson, 2013).

The 2012 EPBD lacks clear and binding commitments, and much agency is given to member states in the transposition phase (Boasson, 2013). As buildings and construction industries are highly country specific, this should be expected.

Nonetheless, Article 27 requires member states to lay down rules for penalties if there are any violations to the national provisions introduced as a result of the Directive, and enforce effective compliance of such sanctions.

Through Article 27 the Commission clearly instructs member states to implement strict enforcement of sanctions, and also include an enforcement mechanism through the European Court of Justice. On April 16th the Court of Justice, at the European Commissions (2014) request, applied a daily penalty of approximately €20,000 and €42,000 against Finland and Belgium respectively, for failure to transpose the 2010 EPBD (European Commission, 2014a).

The 2006 energy end-use directive

The 2006 Energy end-use efficiency and energy services Directive (EES, 2006/32/EC) focused heavily on the reduction of market barriers, increased availability of information, and the creation of incentives for ESCOs. The aim was to let market mechanisms take care of the transaction between the end-user and the ESCO.

Relevant articles include:

- Article 4 required member states to set indicative goals for energy saving by end-users according to set timelines.
- Article 11 stated that member states may choose mechanisms and frameworks for energy efficiency from a given set of options.
- Article 14 required member states to create Energy Efficiency Action Plans for best practice to be diffused, and to be reported to the Commission and updated every three years. Article 12 set out the responsibility of member states as information-gatherers.

The enhanced focus on the demand side did not result in unlocking the full potential of energy savings (Bertoldi et al, 2014). A revision focusing including both the demand and the supply side was therefore necessary, and is described in detail below.

The 2012 energy efficiency directive

The revised Energy Efficiency Directive in 2012 extended the market logic from the 2006 EES Directive (EED 2012/27/EU).

As seen in figure 3.5, the 2012 energy efficiency directive establishes a common EU framework for measures aimed at reaching the target of reducing energy consumption by 20 per cent by 2020. The EED contains a mix of market measures and technology development measures (Boasson, 2013).

Relevant articles include:

- Article 1 and 3 sets a legal definition and quantification of the EU energy efficiency target, and requires member states to set an indicative national target for energy efficiency in 2020. Nonetheless, these targets are subject to plenty of discretion and possibilities for exceptions for member states. As the targets are only indicative in nature, they remain non-binding upon member states.
- Article 4 requires member states to establish a long-term strategy for mobilizing investments into renovation of the national stock of residential and commercial buildings, and to update the strategy every third year. Article 5 encourage public authorities to lead by example.
- Article 7 requires all member states to establish mandatory energy efficiency schemes, securing that all distributors or retail energy sales companies achieve an energy saving equivalent to 1.5% of the annual energy sales to final customers in the period between 2014 and 2020. In addition, Article 7 opens up for members states to implement alternative mechanisms as long as the total energy saving is similar to the 1.5% required by the obligation scheme. Third, penalties for non-compliance have been introduced through Article 13.
- Articles 6, 8, 9, 10, 11, 17, 18 and 19 strengthen the reliance on market-mechanism from the 2006 EES Directive through removal of barriers and providing better information to the end-user.
- Article 18 “Energy services” is a dedicated provision for empowering the ESCO solution through measures increasing transparency and trust. Member states are required to (Bertoldi et al, 2014, 11):
    - Ensure access to clear information about EPC contracts;
    - Encourage the development of quality labels;
    - Develop and ensure access to a list of certified and qualified service providers;
    - Support the public sector to use ESCO services;
    - Remove regulatory and non-regulatory barriers;
    - Enable independent market intermediaries such as third party facilitators; and finally
    - Ensure that energy distributors, distribution system operators and retail energy sales companies refrain from blocking the market of energy services and do not abuse their dominant position.

- Article 24 strengthens the use of National Energy Efficiency Action Plans, and requires member states to report on expected and/or achieved energy savings, including those in the supply, transmission and distribution of energy as well as in energy end-use, in view of achieving the national EE targets.

The impact of EU legislation

According to Paul Hodson, Head of the Energy Efficiency Unit at DG Energy, the European Commission estimated in 2014 that the energy efficiency legislation put in place had contributed €30 billion to demand for energy efficiency. Another €24 billion would be added if the legislation was properly implemented by Member States.

Apart from article 18 in the 2012 energy efficiency directive, not many provisions can be directly linked to ESCOs or energy services. When being asked to describe how EPCs are regulated in the directives, Paul Hodson emphasized that the European Commission still holds an objective to build a market for energy efficiency.

However, in the case of developing EPC, the main work is no longer focused on regulatory work. Instead, the European Commission works with the finance sector and promotors of energy efficiency projects. The work includes information of the possibilities at hand and helping cities in putting together projects in a financeable form. The European Commission are also organizing yearly workshops where the status of the ESCO market is analysed and discussed.

According to Hodson, the building field cannot be understood as an EU competence. here is a wide array of building traditions in the EU. Building cultures has developed over hundreds of years, based on the resources available and the local climate conditions. This makes the building sector particularly hard to regulate on a supranational level. Hence, the Member States use the EU to set minimum efficiency standards of boilers, and clear labels on windows, in order to facilitate the transition of their building work. Common standards reduce the transaction costs of adopting more energy efficient technologies by providing easily understandable information to the consumers and the workers in the building sector.

Norwegian transposition of legislation from the EU

Norway implemented the 2002 energy performance of buildings directive (EPBD) in 2007 after the EFTA Surveillance Authority (ESA) filed a complaint for failure to transpose the directive into national legislation in 2006 (EØS-notatbasen, 2007; ESA, 2006). The European Free Trade Association (EFTA) is a body comprised of the member of the European Economic Area and representatives from the European Union. Its main function is to negotiate transposition and implementation of EU law into EEA member states.

Even after Norway had implemented the 2002 energy performance of buildings directive, warnings kept coming. After issuing several notifications, ESA sent a final warning in 2011, stating that the EBPD had not been correctly implemented (ESA, 2011). Norway had two months to comply with the directive. The incident indicates a substantial reluctance among Norwegian authorities to implement the certification scheme.

In Paul Hodson’s, Head of the Energy Efficiency Unit at DG Energy, experience, the failure of implementing energy efficiency regulations is not necessarily a function of the willingness of Member States to transpose the legislation. Rather, the field of energy efficiency is extremely micro and Member States must do an awful lot to implement the legislation. Energy efficiency are all small and diverse things, and getting it right within national legal regimes and within national institutional relationships is very complicated.

Moreover, Hodson does not see the targets for energy efficiency improvements are non-binding. In his view, the bottom-up voluntary targets specified by Member States are not the main driving force. Rather, the main driving force is Member States engaged in the difficult task of identifying and implementing a whole range of measures to improve energy efficiency.

The 2002 EPBD is currently the only legislation that has been implemented into Norwegian law. The energy end-use directive from 2006 was deemed EEA-relevant and has been sent out for consultations by the Ministry of Petroleum and Energy (OED) (EØS-notatbasen, 2013). A draft decision was sent from the EFTA Secretariat to the European Union External Action Service in April 2013.

However, the European Union had already published the 2012 energy efficiency directive in the Official Journal in November 2012. This started a new process, and the OED is now assessing the EEA relevance of a revision of a directive that is still being negotiated. In a meeting with the liaison group for EEA-matters hosted by the OED in December (see Appendix), the Director of Energy in OED noted that this situation illustrates the challenge with backlogged EU regulations in Norway.

The European Commission's pledge to update the energy efficiency once more is adding even more complexity to the situation. According to publicly available information, Norwegian bureaucrats in the OED is evaluating whether the directive can be deemed relevant for the EEA agreement (EØS-notatbasen, 2013b).

Legislation aimed at creating a market and lowering barriers for energy efficiency services is currently in a limbo. Norwegian bureaucrats are assessing the legal and economic implications of the 2012 EED with assistance from the Norwegian Ministry of Foreign Affairs. At the same time, bureaucrats in Brussels are writing a reply to Norway´s response to the 2006 EED, while other bureaucrats are preparing a draft text changing this exact legislation. It is fair to say that the uncertainty on the matter is substantial.

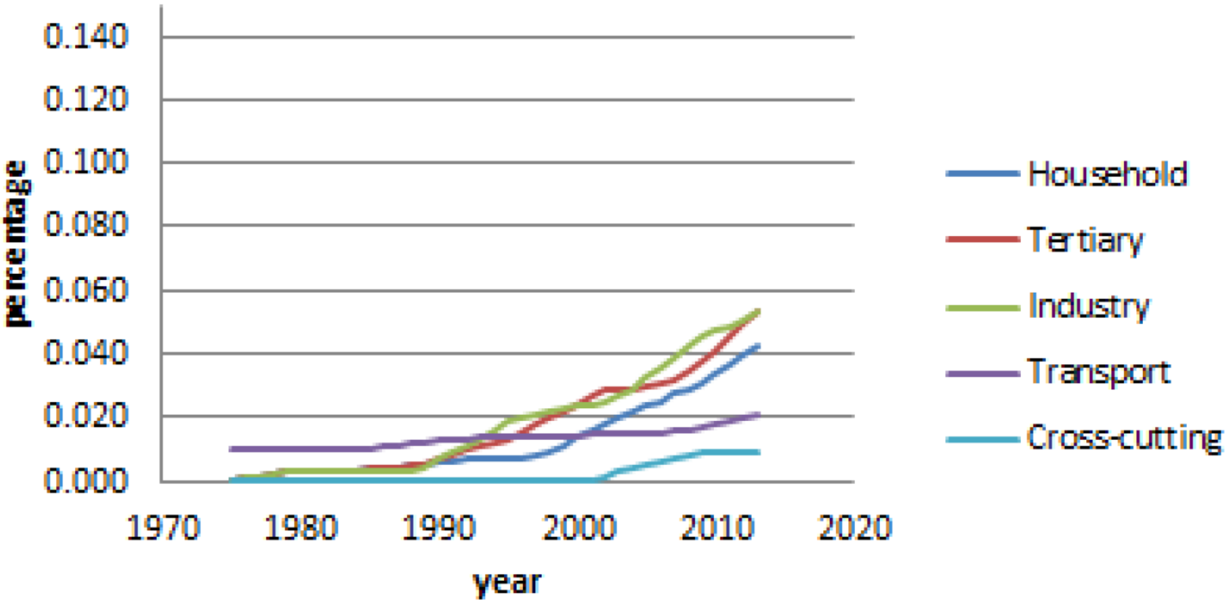
The implementation of the 2010 energy performance of buildings directive is less complex. The Norwegian government says on their web pages that although the matter has not been finally agreed upon, they are aiming to resolve the matter quickly. Although the negotiations are in their final stages, the Norwegian bureaucracy has delayed the process with over five years (Europalov, 2016).

The non-transparent transposition processes of legislation from the EU into Norwegian law take years. As the publicly available information is limited, and must be interpreted by professionals, market actors usually have no clue that the processes are even taking place.

The Norwegian legislative framework

Figure 3.6 illustrates the increasing quantity of energy efficiency policies across industries in Norway from 1970 to 2013. Despite its brief political history, the range of policy measures targeting buildings has become broader than any other area of Norwegian climate policy and has increased considerably since 2000. A specific target for buildings was introduced in 2012, stating that policy measures directed at buildings should reduce energy consumption by 15 TWh by 2020 (OED, 2012).

Figure 3.6: Policy intensity for energy efficiency measures in Norway



(Bertoldi et al, 2015)

The Norwegian Ministry of Petroleum and Energy's (OED) main task is to facilitate a coordination of an integrated energy policy. In a white paper published by the Norwegian Ministry of Petroleum and Energy in mid-April 2016, the Norwegian government proposed *"an ambitious and quantifiable national target for energy efficiency, with the goal of reducing the energy intensity (energy consumption/GDP) by 30 per cent by 2030."* (OED, 2016, 10). According to the white paper, the building codes and Enova are the main tools for improving energy efficiency in buildings.

The white paper makes no mention of a national action plan towards energy efficiency. Energy services are mentioned six times throughout the 230 page long document, either with reference to international reports or with reference to automat metering systems. Instead of discussing the potential for a market on energy services in buildings, the government notes that Norway may be reaching a limit in which increased regulatory pressure for energy efficiency in buildings may be counterproductive based on todays cost level and technologies.

Building codes

Building codes have been in place in Norway since 1949 (OED, 2016). The Norwegian Ministry of Local Government and Modernization (KMD) is responsible for the building code, also known as TEK. Technology standards are the instrument for energy efficiency in Norway.

The National Office of Building Technology and Administration (DiBK) supervise the building code and is responsible for managing rules and regulations related to building and construction. A search for EPC on the DiBK website gives two hits: both lead to footnotes in two different reports written by Rambøll, a danish engineering consultancy (Rambøll, 2013).

The building code, also known as TEK, regulate energy requirements through the techniques and technologies that may be applied in building construction and renovation (Boasson, 2013). The requirement introduced in 2007 shall ensure that new and renovated buildings use 25 per cent less energy than required in the 1997 building code.

A new aspect in the 2007 building code was regulation of all features contributing to the total energy consumption of the building. Previous regulation had only regulated the thermal quality of individual construction components, such as floors, walls and roofs. The top priority of the building code is that the building shell shall have high thermal quality and high- density construction through insulation (Boasson, 2013). The building code is mad more stringent every five years, aiming to reach a passive house standard by 2020.

The energy efficiency standards in the building code also apply to renovation of buildings (OED, 2016) Nevertheless, it is only the exact parts being rehabilitated that must be upgraded. The reasoning provided by the government is that energy efficiency measures seldom are implemented on their own, but must be seen in context with other necessary improvement in order to reduce the costs of implementation.

With the building code as the most important tool for regulating the building, sector in Norway. However, in practice, the building code only applies to new buildings. The code has therefore substantial shortcomings when it comes to adapting existing buildings to new societal needs.

The energy certification scheme

The energy certification scheme is a market instrument operated by the Norwegian Energy Directorate (NVE). Certification is required for all large commercial buildings and buildings that are rented or sold. Experts must certify commercial buildings according to two scales: one for the energy quality and one for the heating solution. NVE is also responsible for supervision of the certification scheme and may implement sanctions in case of non-compliance (OED, 2016).

There is a clear market logic behind the certification scheme: Greater energy efficiency means lower operating costs. Hence, the market is given a price signal as to which building is better. Through the provision of transparent information, asymmetries between buyer and seller are reduced.

Market enabling institutions

EU legislation has not been identified as an important enabler of energy services in Norway, however the funding of various information and standardization projects have been key for the development of the ESCO market. The following sections look deeper into the impact of market enabling institutions in the EU and Norway.

Informational campaigns and funding from the EU

The European Union has implemented a wide range of informational campaigns and funding programs for energy efficiency. Efforts initiated by Eurocontract and the informational campaigns initiated by the Energy Efficiency Service Initiative (EESI) and Transparense project have been the most instruments important for the development of a market logic capable of introducing the ESCO reasoning in Norway.

Eurocontract produced documents and guides and proposed financing alternatives and quality standards for energy performance contracts (EESI, 2009). The EESI project built on the progress made by Eurocontract and made use of the standardization and tools for EPC and other energy services. The EESI organized local and regional capacity-building through national online help-desks, as well as hosting frequent training for local authorities, companies, consultancies (Bertoldi et al, 2014).

The Transparense project was initiated in 2013 and completed in 2015 (Transparense, 2015). It was co-funded by the Intelligent Energy Europe Programme and twenty private and public partners. Its main goal was to increase the transparency and trustworthiness of EPC. One of its main outputs was a Code of Conduct for the implementation of EPC contracts, with compliance serving as a guarantee of the quality of the EPC projects.

The European standard EN 15900:2010 was implemented in 2010 laying out best practice for the various stages of an EPC, such as energy audits, implementation, measurement and verification (Bertoldi, 2014). Most importantly energy efficiency services is defined as an agreed task designed to lead to an energy efficiency improvement. As long as energy efficiency services reduces consumption, the standard does not specify whether it is through substitution of technology, improvement of technology, better use of technology, or behavioural change.

Moreover, the procedures and instruments of the EPC standard were applied and advanced in concrete pilot projects. Country analysis, experience exchange, strategy concepts and bilateral dialogues with individual ESCOs on business plans and product development were also facilitated. One of the key learning experiences of the EESI projects was the importance of experienced third party facilitators (EESI, 2014). As concluded in the EESI report (2014, 10):

> *"A good EPC facilitator disposes of technical and economic expertise as well as a sound understanding of legal and financing issues. At the same time, a facilitator's most important role is communication and moderation.*
>
> *He or she has to explain well, listen to doubts, talk to stakeholders, and create confidence and mutual understanding. This is a key to making a project a win-win situation and a success. By supporting a project's initial set-up, by assessing, its feasibility, and by communicating the concept towards decision makers, the facilitator is crucial for putting the train on track. Many EPC projects which never reached the phase of implementation, have failed in this initial phase due to a lack of knowledge about and arguments in favour of EPC.*
>
> *Furthermore, facilitators guide their client through the procurement of the EPC-project, which requires sound knowledge of the process, the right handling of the tools, such as contract, baseline and tender documents, and the organisational requirements of EPC."*

Informational campaigns and funding in Norway

Enova, the Norwegian Energy Agency, has a mandate to intervene in energy markets through fiscal measures, as well as fiscal incentives aimed at development of energy- and climate technologies (OED, 2016). A key requirement for all investment support is that the measures should be cost-efficient: Enova shall receive as many kWh as possible out of the funding it grants. Grants are measured according to funding per energy result (NOK/kWh). Another important guiding principle is that no projects that are profitable at the outset will be supported (Boasson, 2013). This means that ESCO projects and EPC are defined outside of Enova's scope for economic interventions.

Enova was very active in the period between 2010 and 2013, especially within commercial buildings. The focus was targeted particularly towards pilot projects in passive buildings and low-energy buildings. An information and advice service was also set up to give free consultation for private individuals. The initiative received great response, but was terminated in 2013 because the market change it sought to create had been reached (OED, 2016).

With the termination of the support in energy efficiency in buildings and a mandate not supporting commercially profitable energy efficiency projects, major interventions into the market for EPC is unlikely. Whether Enova actually had reached the target is, however, questionable.

Assessment of energy efficiency policies aimed at buildings by the Office of the Auditor General of Norway

The Office of the Auditor General of Norway (Riksrevisjonen, 2015) conducted a study of governmental instruments for energy efficiency aiming to reduce energy consumption in buildings. Legislative and economic measures in the period between 2009 and 2015 were assessed, as well as potential sources for failure to reach the objectives.

The Auditor General assessed the most central instruments for energy efficiency in buildings: the building code, Enovas funding schemes, as well as informational campaigns. The main findings are horrifying.

First, the *legislative instruments* for energy efficiency are not having an effect on existing buildings. As the building code in practice only applies to new buildings, it will not have any noticeable effect until 2040. Energy efficiency in existing buildings will therefore be key to reduce energy consumption in buildings.

Second, the *economic instruments* for energy efficiency are only reducing energy consumption in buildings by a small amount. Enova's financial contribution to commercial buildings have had a limited effect. In the period between 2005 and 2014, Enova has contributed 2.2 billion NOK to energy efficiency in commercial buildings. According to Enova, this saved 3.3 TWh yearly, or 9.3 percent of total energy consumption in commercial buildings. However, the Auditor General estimate the total energy savings in the period to be much lower: 0.67 TWh per year, or 1.8 percent of total energy consumption. According to the Auditor General, the fact that Enova does not support commercially profitable projects may explain the limited effect of the measures.

Third, there is still a large need for information about energy efficiency and governmental coordination of the instruments. The Auditor General emphasize that energy efficiency to a large degree is a question of attitude and knowledge. Information to users and building owners is therefore important to obtain interest and affect investment decisions. Enova, the Norwegian Energy Directorate and the National Office of Building Technology and Administration (DiBK) are important state-run informational actors.

In the assessment, the Auditor General finds that Enova is the only actor that informs broadly about energy efficiency in buildings. The National Office of Building Technology and Administration (DiBK) limit their informational activities to guidance of the building code, with little emphasis on the energy rules. Moreover, there is a need for the Norwegian Energy Directorate to strengthen their informational work on the energy certification scheme.

The Auditor General point to the need of coordinating the instruments and information activities. No single public actor are gathering and presenting the information in a good way. It is therefore hard for an individual to understand how the instruments are working together. As mentioned by the Auditor General, the lack of coordination among governmental bodies is actually adding more confusion.

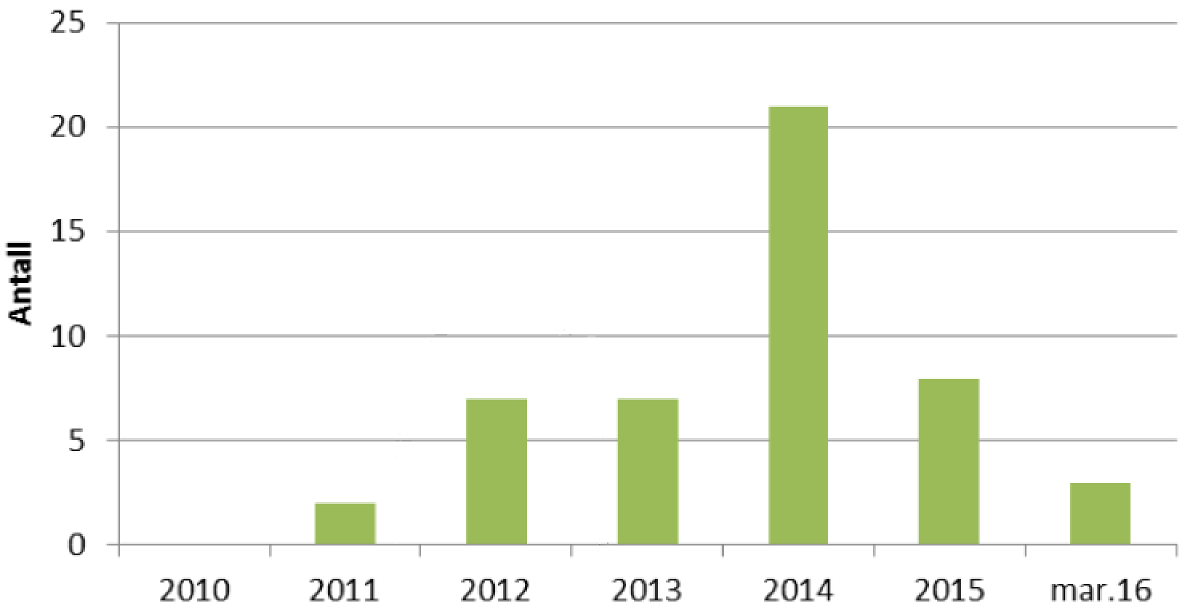
In conclusion, none of the legislative or market enabling institutions aimed at improving energy efficiency in Norwegian buildings are working. However, as we will see below, an initiative to spread EPC in Norwegian municipalities seems to have turned the market for energy efficiency services upside down over the last three years.

A booming Norwegian ESCO market

Until 2010, only two to three new EPC projects were being implemented each year. Between 2010 and 2013, the number had increased to five to eight. By the end of 2013, 32 tenders for municipal EPC projects had been published in total.

However, in 2014 the EPC market saw an incredible spike in demand. As seen in figure 3.7, 21 EPC projects were approved. In the same year, six new tenders were announced (Lindseth, 2015). In 2015, only eight new projects were approved. However, twelve new tenders for EPC projects were published.

Figure 3.7 Approved EPC projects (Enova supported)



(Moe, 2016)

With only five ESCOs bidding steadily for contracts, the market is now facing a shortage of supply (Lindseth, 2015). With only a limited amount of EPC personnel and experts, the ESCOs are not capable of taking on new projects. Municipalities are driving the demand, and a shortage on the supply side suddenly seems to be the main barrier for market growth.

Building owners in remote geographical areas are now complaining that the competition among suppliers is insufficient. ESCOs are reportedly cherry picking the most profitable projects, with the shortest travelling distances and highest potentials. The question is: What ignited this huge market boom?

Municipal ownership, EPC standardization and third party facilitation

Before 2010, projects were often initiated by ESCOs, which used their own implementation processes and traditional agreements (Gurigard, 2016). However, skepticism to private public partnerships were large in Norwegian municipalities. Many saw it as quite radical that a commercial company should make profits from energy efficiency services in public buildings, and they did not trust EPCs.

In 2010, the Norwegian Association of Local and Regional Authorities (KS) set in motion an initiative named "Green municipalities – Action and implementation". KS hired a private consultant, Kjell Gurigard, Together, they targeted public buildings, such as schools, offices and nursing homes were the main targets.

Gurigard had been working closely with the EESI2020 and Transparense projects for many years. He had gone through their training programmes, and become a professional third party facilitator for EPC. Now, KS needed help to make a Norwegian Standard for energy performance contracting. Gurigard travelled the country and held several EPC-courses and presentations for municipalities. The courses and presentations were conducted under the KS umbrella (Lindseth, 2015).

While the initiative previously had come from the ESCOs, the initiative was now put in the hands of the municipalities. This increased the trust in the EPC-model substantially (Gurigard, 2016). Many municipalities had local climate plans that set concrete targets also for energy efficiency in their existing building stock. This increased the interest in EPC as a tool to reach political goals.

By 2011, Gurigard acted as a third party facilitator for eight EPC processes. KS and Gurigard also started looking into creating a Norwegian Standard for EPC. In 2013, a working group consisting of representatives from energy authorities, market actors and legal representatives were assisting KS and Gurigard in developing a Norwegian Standard for EPC (Lindseth, 2015). The Norwegian energy agency, Enova, also starting showing interest EPC, and helped with market analysis and information material.

The official national standard (NS6430) was launched in April 2014, covering the entire process from analysis of the buildings, the implementation of measures, and regulation of the parties' relationship in the guarantee phase. The Norwegian standard was based on model documents and guidelines developed in former EU projects, and adapted to Norwegian circumstances.

The Norwegian EPC projects include improvement of the building envelope, energy management systems, automation, heating, ventilation, air conditioning and lighting. The standardized Norwegian EPC define how the measures are installed and operated. Third party facilitators assist in all necessary preparatory activities, prepare tender documents and lead the negotiations with the ESCOs. When a deal is struck, the facilitator prepare and set up final contracts, and may act as a mediator in the implementation phase if need be.

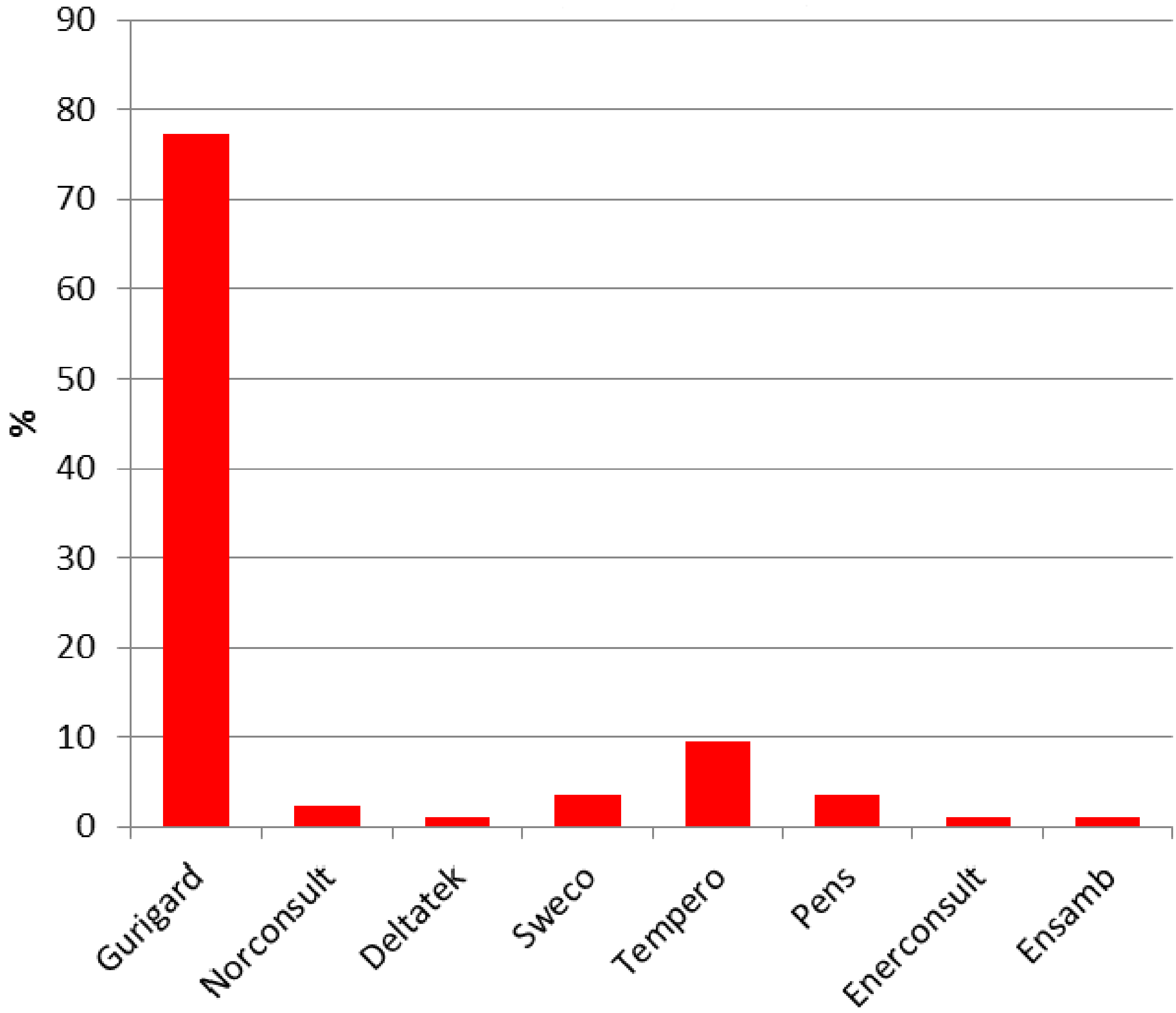
Experienced facilitators act as a control mechanism for the client, and secures a predictable process from start to end. When the measures, investments and resulting savings are agreed on, most of the risk for achieving the contracted savings is placed with the ESCO. The ESCO guarantee the savings throughout the lifetime of the investment, usually between 7 to 12 years in Norway (Lindseth, 2015).

Competence building and other informational activities

As seen in figure 3.8, Gurigard has been the most central facilitator by a large margin, and has also been referred to as "the man behind EPC in Norway", in one of the interviews. In July 2015, Gurigard had prepared 57 of 60 EPC projects on behalf of Norwegian municipalities. The lack of facilitators is starting to become a bottleneck (Lindseth, 2015). To mitigate this barrier, Enova is now organizing regular courses and training events for consultants looking to become EPC facilities.

Another actor who have seen the potential in EPC, is the state owned municipal bank, Kommunalbanken. Kommunalbanken issues green bonds in international capital markets and offer green loans to municipalities and counties (Prestvik, 2016). The interest rate is set 0.1 percent below NIBOR, the Norwegian Interbank Offered Rate. Financial institutions and ESCOs are not able to compete with these terms, hence all tendered project have obtained financing through Kommunalbanken. Although it decreases competition, the result is that all public EPC projects receive funding. Kommunalbanken is also actively promoting EPC, calling it the simplest case for Norwegian municipalities to start investing in when going green.

Figure 3.8 Distribution of EPC projects among third party facilitators



Recent reports from Enova show that EPC projects are much more efficient than traditional than traditional energy efficiency projects and that the municipalities are extremely satisfied with the results (Moe, 2016). EPC project cover larger pools of buildings, are more certain to be implemented, produce up to six times higher energy savings and are on average implemented 77 percent faster than traditional energy efficiency projects in Norwegian buildings.

In 2016, ESCOs reported that the time spent on making offers for EPC projects had been reduced from 100 to 15 after the standard was implemented (Gurigard, 2016). By this account, the EPC standard has managed to reduce transaction costs by as much as 85 percent, only in the initial phase.

Conclusion

Existing buildings in Norway had an actual realizable potential of 5.4 TWh of energy savings in 2012. This constitute 2.3 percent of the total Norwegian energy consumption in 2014. A substantial amount of those savings could be made through investments that are commercially profitable. Yet, the demand for energy efficiency services in the period up until 2013 were negligent. The following section discuss whether transaction costs made the market fail, and whether EPCs are effective in reducing transaction costs.

Transaction costs erupt at various stages of the projects and are highly case specific. Studies of concrete cases has shown that transaction costs on average constitute between 6 and 40 per cent of total project costs for ESCOs. Transactions costs borne by the supply side could therefore accumulate to a substantial amount. The practical transaction costs borne by the ESCOs are reflected in the price they charge customers. Hence, transaction costs leads to an inefficient price on energy efficiency services.

However, the ESCO projects on offer must remain commercially profitable. If not there would be no supply at all. Transaction costs borne by the supply side are therefore not likely to be great enough to make the market fail. However, based on neoclassical theory we can conclude that the quantity of energy efficiency services demanded is at a suboptimal level seen from a societal perspective.

The case study of the Norwegian ESCO market showed that transaction costs borne by the demand side also are substantial. But are they making markets fail? If we see the investment decision of whether or not an individual chooses to enter a transaction as a binary choice, we may be able to make some concrete inferences.

Investment decisions are based on risk and uncertainty. Uninformed buyers experience a high degree of uncertainty when investing in energy efficiency services. In the case of Norway the uncertainty was caused by significant lack of trust in both the ESCOs and the contract they were offering. The high asset specificity of the asset. More than anything, the lack of trust reflected a knowledge gap created by information asymmetries and very high asset specificity.

There are also clear indications suggesting that governmental attempts to intervene in the market has actually made things worse. Complex regulatory requirements, poor coordination of instruments and minimal amounts of information, may have added complexity to ESCO projects. Transaction costs stemming from poor regulation could be a promising avenue for further studies.

Based on the findings in Norwegian ESCO market, this study fails to reject the first hypothesis; that transaction costs made the market fail. However, there are signs showing that the tide is shifting. Reports from 2016 conclude that ESCOs now are having trouble coping with the demand for EPCs from Norwegian municipalities. Has the EPC-movement managed to overcome the transaction cost barriers in the ESCO market?

The attributes of the Norwegian EPC follows the best practice governance structure developed by market enabling institutions in the EU. Guaranteed savings create a credible commitment to commercial profitability, hence increasing trust. A third party facilitator levels the information asymmetries and close the knowledge gap between the ESCO and customer. The standardization of EPC contracts secures uniform measurement and verification processes, thus lowering *ex post* transaction costs as well. Moreover, standardization has that beautiful learning effect. Repeating the same processes, help ESCOs become more efficient in all phases of the project, again lowering transaction costs.

The Norwegian ESCO market boomed in same year as the standard EPC contract came into force. Reports now suggest that the supply side has become the bottleneck. Transaction cost economics predict that the governance structure with the best transaction cost economizing features will be chosen. This can by far be said to the be case with EPC in Norway. Based on these findings, this study fails to reject the second hypothesis, that energy performance contracting is an effective tool for removal of transaction costs in the market for energy efficiency services.

Bibliography

Backlund, Sandra, and Maria Eidenskog. "Energy Service Collaboration: It is a Question of Trust." Energy Efficiency 6.3 (2013): 511-21. Web.

Baldwin, Robert, Martin Cave, and Martin Lodge. Understanding Regulation: Theory, Strategy, and Practice. New York: Oxford UP, 2012. Print.

Baldwin, Robert, Martin Cave, and Martin Lodge. Understanding Regulation: Theory, Strategy, and Practice. 2nd ed. Oxford: Oxford UP, 2012. Print.

Bertoldi, Paolo, and Rocco Mosconi. JRC Science for Policy Report. Rep. European Commission, 2015. Web. <http://iet.jrc.ec.europa.eu/energyefficiency/system/tdf/jrc_report_jrc98236-pdf.pdf?file=1&type=node&id=9110>.

Bertoldi, Paolo, Benigna Boza-Kiss, Strahil Panev, and Nicola Labanca. ESCO Market Report 2013. Rep. N.p., 2014. Web. 4 Oct. 2015. <http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/jrc_89550_the_european_esco_market_report_2013_online.pdf>.

Bertoldi, Paolo, Silvia Rezessy, and Edward Vine. "Energy Service Companies in European Countries: Current Status and a Strategy to Foster Their Development." Energy Policy 34.14 (2006): 1818-832. Print.

Boasson, Elin Lerum. National Climate Policy: A Multi-Field Approach. New York: Routledge, 2015. Print.

The Coalition for Energy Savings. Guidebook for Strong Implmentation. Rep. N.p., May 2013. Web. <http://eedguidebook.energycoalition.eu/images/PDF/EED.pdf>.

Coase, R. H. "The Nature of the Firm." Economica 4.16 (1937): 386. Web.

Coen, David, Wyn Grant, and Graham K. Wilson. "Political Science: Perspectives on Business and Government." The Oxford Handbook of Business and Government. Ed. David Coen, Wyn Grant, and Graham K. Wilson. Oxford: Oxford UP, 2010. 9-34. Print.

Creswell, John W. Research Design: Qualitative, Quantitative, and Mixed Method Approaches. Thousand Oaks, CA: Sage Publications, 2003. Print.

Culpepper, Pepper D. "Capitalism, Institutions, and Power in the Study of Business." Oxford Handbook of Historical Institutionalism. Ed. Orfeo Fioretos, Tulia G. Falleti, and Adam Sheingate. Oxford and New York: Oxford UP, Forthcoming 2015. N. pag. Sept. 2014. Web. 19 Jan. 2015. <http://www.pepperculpepper.net/images/stories/business_in_hi_v3_final.pdf>.

Easton Consultants. Energy Service Companies - A Market Report Study. Rep. N.p., Apr. 1999. Web. 5 June 2015. <https://library.cee1.org/sites/default/files/library/1034/176.pdf>.

Energy Performance Contracting – Results of the European Project EESI 2020. Rep. N.p., 2012. Web. 13 Aug. 2015. <http://eesi2020.eu/wp-content/uploads/2016/03/EESI2020_brochure_EN_final.pdf>.

Enova. Potensial- Og Barrierestudie Energieffektivisering I Norske Bygg. Rep. N.p., 2012. Web. <https://www.enova.no/upload_images/A319D657AFC34028B18D5C74BA4F0094.pdf>.

ESA. "Energy: Norway in Breach of the Directive on the Energy Performance of Buildings." EFTA Surveillance Authority. N.p., 18 July 2011. Web. 01 Feb. 2016. <http://www.eftasurv.int/press--publications/press-releases/internal-market/nr/1501>.

ESA. "PR(06)45: Liechtenstein and Norway Fail to Implement Rules on Energy Performance of Buildings." EFTA Surveillance Authority. N.p., 7 Nov. 2006. Web. 01 Feb. 2016. <http://www.eftasurv.int/press--publications/press-releases/internal-market/nr/490>.

EØS-notatbasen. "Bygningsdirektivet." Regjeringen.no. N.p., 2007. Web. 4 Feb. 2016. <https://www.regjeringen.no/no/sub/eos-notatbasen/notatene/2005/nov/bygningsdirektivet/id2430395/>.

EØS-notatbasen. "Energieffektiviseringsdirektivet." Regjeringen.no. N.p., 26 Oct. 2013b. Web. 04 Feb. 2016. <https://www.regjeringen.no/no/sub/eos-notatbasen/notatene/2011/sep/energieffektiviseringsdirektivet/id2433307/>.

EØS-notatbasen. "Energitjenestedirektivet." Regjeringen.no. N.p., 20 May 2013a. Web. 4 Feb. 2016. <https://www.regjeringen.no/no/sub/eos-notatbasen/notatene/2005/nov/energitjenestedirektivet/id2433111/>.

Eu.ESCO. Energy Contracting: Successful Energy Services Business Models. N.p.: Eu.ESCO, n.d. Www.eu-esco.org. European Association of Energy Service Companies, Oct. 2010. Web. 20 Jan. 2015. <http://www.eu-esco.org/fileadmin/euesco_daten/pdfs/101006_euesco_ContractingFlyer_A4_final_low.pdf>.

Europalov. Bygningsenergidirektivet (fra 9.7.2012): Energieffektivitet Av Bygninger | Europalov. N.p., 29 July 2016. Web. 06 Aug. 2016. <http://europalov.no/rettsakt/bygningsenergidirektivet-fra-972012-energieffektivitet-av-bygninger/id-1941>.

European Commission. Energy Efficiency in Buildings: Commission Refers Belgium and Finland to Court for failing to Fully Transpose EU Rules. Press Releases Database. 16 Apr. 2014a. Web. 13 May 2014. <http://europa.eu/rapid/press-release_IP-14-447_en.htm>.

European Commission. "Eurocontract - European Platform for the Promotion of Energy Performance Contracting - Intelligent Energy Europe - European Commission." Intelligent Energy Europe. N.p., n.d. Web. 01 Dec. 2016. <https://ec.europa.eu/energy/intelligent/projects/en/projects/eurocontract>.

European Energy Service Initiative (EESI). "EUROCONTRACT." European Energy Service Initiative: Eurocontract Toolbox. N.p., 2009. Web. 01 May 2015. <http://www.european-energy-service-initiative.net/francais/eu/toolbox/eurocontract-toolbox.html>.

European Energy Service Initiative (EESI). Facilitators Guideline for Energy Performance Contracting. Rep. N.p., Sept. 2014. Web. <http://eesi2020.eu/wp-content/uploads/2014/11/EESI2020_EPC_Facilitators_Guideline.pdf>.

European Environment Agency. "Trends in Total Energy Intensity, Gross Domestic Product and Total Energy Consumption, EU-27." European Data. Web. 19 May 2014. <http://www.eea.europa.eu/data-and-maps/figures/trends-in-total-energy-intensity-4>.

Forsgren, Mats. Theories of the Multinational Firm: A Multidimensional Creature in the Global Economy. N.p.: n.p., 2013. Print.

Forsgren, Mats. Theories of the Multinational Firm: A Multidimensional Creature in the Global Economy. 2nd ed. Cheltenham, Glos, UK: Edward Elgar, 2013. Print.

Gottberg, Annika, Jenny Gode, and Ulrik Axelsson. Acceleration Energy Efficiency Improvement in the Public Sector, Using Energy Performance Contracting - A Workshop on Nordic Experiences and Needs for Improvements. Rep. N.p., Aug. 2009. Web. <http://www.ivl.se/download/18.343dc99d14e8bb0f58b7590/1445517409462/B1866.pdf>.

Gurigard, Kjell. Erfaringar Med Eksisterende EPC-malar. Rep. N.p., 18 Apr. 2016. Web. <https://www.enova.no/download.aspx?OBJECT_ID=/upload_images/FCCE50978192441E80F7F15E57BA6891.pdf>.

Hantke-Domas, Michael. "The Public Interest Theory of Regulation: Non-Existence or Misinterpretation?" European Journal of Law and Economics 15 (2003): 165-94. Print.

International Energy Agency (IEA). Energy Efficiency Market Report - Market Trends and Medium-Term Prospects. Rep. N.p.: n.p., 2015. Web.

Le Gentil, Stéphane. "Energy Performance Contracting for Public Buildings: The Key to Cost-effective Energy Efficiency in Europe." Interview. EU-ESCO. European Association of Energy Service Companies, 30 Oct. 2010. Web. 20 Jan. 2015.

Lindseth, Liv Randi. EPC in the Nordic Countries. Rep. Norden, 2015. Web. <http://norden.diva-portal.org/smash/get/diva2:900555/FULLTEXT02.pdf>.

Lovins, Armory B. "Saving Gigabucks with Negawatts (1985)." Fortnightly. N.p., 21 Mar. 1985. Web. 19 Apr. 2016.

Marino, Angelica, Paolo Bertoldi, and Silvia Rezessy. Energy Service Companies Market in Europe - Status Report 2010. Rep. N.p., 2010. Web. <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC59863/jrc59863%20real%20final%20esco%20report%202010.pdf>.

Matthews, R. C. O. "The Economics of Institutions and the Sources of Growth." The Economic Journal 96.384 (1986): 903. Web.

Mccann, Laura, Bonnie Colby, K. William Easter, Alexander Kasterine, and K.v. Kuperan. "Transaction Cost Measurement for Evaluating Environmental Policies." Ecological Economics 52.4 (2005): 527-42. Web.

Mitchell, Catherine, and Bridget Woodman. "Regulation and Sustainable Energy Systems." The Oxford Handbook of Regulation. By Robert Baldwin, Martin Cave, and Martin Lodge. Oxford: Oxford UP, 2010. 573-90. Print.

Moe, Øyvind. Erfaringer Fra EPC Kommuner. Rep. Enova, 18 Apr. 2016. Web. <https://www.enova.no/download.aspx?OBJECT_ID=/upload_images/3F807E49C2F34CF1BB95D140D7279036.pdf>.

Multiconsult, Analyse, and Strategi AS. Potensial- Og Barrierestudie - Energieffektivisering I Norske Yrkesbygg. Rep. N.p., 28 Sept. 2011. Web. <https://www.enova.no/upload_images/9F05167A14754E189F3A9591B5D7F648.pdf>.

Mundaca, Luis. "Transaction Costs of Tradable White Certificate Schemes: The Energy Efficiency Commitment as Case Study." Energy Policy 35.8 (2007): 4340-354. Web.

North, Douglass C. "Transaction Costs, Institutions, and Economic History." Zeitschrift Für Die Gesamte Staatswissenschaft / Journal of Institutional and Theoretical Economics Bd. 140.H. 1., The New Institutional Economics: A Symposium (1984): 7-17. JSTOR. Web. 01 Dec. 2016.

Olje- og energidepartementet (OED) (2012b) Regjeringens mål for energieffektivisering i bygg. Press release, 23.11.2012. Oslo: Ministry of Petroleum and Energy (OED)

Olje- Og Energidepartementet (OED). Stortingsmelding Om Energipolitikken: Kraft Til Endring. Rep. N.p., 15 Apr. 2016. Web. <https://www.regjeringen.no/no/aktuelt/stortingsmelding-om-energipolitikken-kraft-til-endring/id2484248/>.

Posner, Richard A. "Theories of Economic Regulation." The Bell Journal of Economics and Management Science Autumn 5.2 (1974): 335-58. Print.

Prestvik, Lars Strøm. Kommunalbankens Grønne Låneprogram: Attraktiv Finansiering for Kommunale Energiprosjekter. Rep. Kommunalbanken, Jan. 2016. Web. 5 May 2016. <http://www.kommunalbanken.no/media/190421/groenn-rente-enovakonferansen-januar-2016.pdf>.

Rambøll, and Link Arkitektur. Utredning Nesten Nullenergibygg for Norge. Rep. N.p., Jan. 2013. Web. <https://dibk.no/globalassets/energi/nesten_nullenergibygg_for_norge_ramboll_og_link.pdf>.

Riksrevisjonen. Riksrevisjonens Undersøkelse Av Myndighetenes Arbeid Med Energieffektivitet I Bygg. Rep. N.p., 24 Nov. 2015. Web. 18 Mar. 2016. <https://www.riksrevisjonen.no/rapporter/Documents/2015-2016/EnergieffektivitetBygg.pdf>.

Statistisk Sentralbyrå (SSB). Energiregnskap Og Energibalanse, 2014, Foreløpige Tall. N.p., 6 May 2016. Web. 4 Sept. 2015. <https://www.ssb.no/energi-og-industri/statistikker/energiregn/aar-forelopige/2015-05-06>.

Stigler, Geroge J. "The Theory of Economic Regulation." The Bell Journal of Economics and Management Science, Spring 2.1 (1971): 3-21. Print.

T, Luis Mundaca, Mathilde Mansoz, Lena Neij, and Govinda R. Timilsina. "Transaction Costs Analysis of Low-carbon Technologies." Climate Policy 13.4 (2013): 490-513. Web.

The European Parliament, and The Council. "Directive 2002/91/EC on the Energy Performance of Buildings." *Official Journal* (2002). *EUR-Lex*. Web. 14 May 2014. <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32002L0091>.

The European Parliament, and The Council. "Directive 2006/32/EC on Energy End-use Efficiency and Energy Services." *Official Journal* (2006). *EUR-Lex*. Web. 18 May 2014. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0032>.

The European Parliament, and The Council. "Directive 2010/31/EU on the Energy Performance of Buildings." *Official Journal* (2010). *EUR-Lex*. Web. 18 May 2014. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:EN:PDF>.

The European Parliament, and The Council. "Directive 2012/27/EU on Energy Efficiency." *Official Journal* (2012). *EUR-Lex*. Web. 18 May 2014. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:EN:PDF>.

Transparense. Transparense.eu. N.p., 2015. Web. 4 May 2015. <http://www.transparense.eu/eu/home/welcome-to-transparense-project>.

Valentová, M. "Barriers to Energy Efficiency – Focus on Transaction Costs." Acta Polytechnica 50.4 (2010): 87-93. Print.

Williamson, Oliver E. "The Economics of Organization: The Transaction Cost Approach." American Journal of Sociology 87.3 (1981): 548-77. Web.

Williamson, Oliver E. "Transaction Cost Economics and Organization Theory." Industrial and Corporate Change 2.1 (1993): 107-56. Web.

Williamson, Oliver E. "Transaction Cost Economics: The Natural Progression." American Economic Review 100.3 (2010): 673-90. Print.

Appendix 1: Interviews

Interviewees

Name	Position	Information about the interview
Paul Hodson	Head of Unit Energy Efficiency and Intelligent Energy at DG Energy in the European Commission.	The interview was carried out on November 26th, 2014, in Mr. Hodson's office at the European Commission, and lasted for 35 minutes. The full interview is provided on attached memory stick.
Frederick Federley	Swedish Member of the European Parliament	The interview was carried out on December 10th 2014, at Mr. Federley's office at the European Parliament, and lasted for 20 minutes.
Tore Strandskog	Director for industrial policies	The interview was carried out on January 17th 2015, in Mr. Strandskogs offices at Majorstuen, Oslo, and lasted for 1 hour and 5 minutes.

Full audio transcripts are provided on attached memory stick.

Interview guide

Briefing:

1. I am here to interview you about regulation of energy efficiency in the EU. My master thesis is looking closer at Energy Performance Contracting, with a specific focus on the EPBDs from 2002 and 2010 and the 2006 Energy End-use and Energy Services Directive, as well as the 2012 EED.
2. The purpose of the thesis is to look at the interplay between business and politics in the development of energy efficiency policies in two different states, Norway and Sweden, and to look closer at the impact EU has had on these policies.
3. Use of tape recorder all right?
4. Any questions?

Public interest theory - Protection and benefit of the public at large - Correction of inefficient or inequitable market practices → market failure	Why do we need energy efficiency? Why is energy efficiency regulated? Who benefits most from improved energy efficiency?

	How would you describe the design of energy performance of buildings regulation? How would you describe regulation of EPCs in the abovementioned directives? Have you discovered any challenges in the transposition and implementation phase of the directives? Most common? Poor implementation, not function of lack of willingness, just because difficult.
Interest group theory - Capture of regulation by businesses - Regulation supplied in response to demands of interest groups struggling among themselves to maximize incomes of members - Economic regulation serves the interests of politically effective groups	Who demands regulation of energy efficiency? Who supplies regulation of energy efficiency? Are the EPBDs, Energy End-Use Efficiency and Energy Services, and Energy Efficiency Directive designed to create/improve market conditions for EPC? Did you experience any organized attempt on influencing the directives? If yes, how was it organized? And what were their messages?

	In your view, does the directives reflect the views of some interest groups better than others? If yes, which ones?
Institutional theory - Transactions costs - Costs of exchange - Role of government in costs of exchange, especially with third party enforcement - Information asymmetry - Credible commitment	What market barriers do think are inhibiting the spread of EE the most? How would you assess the transaction costs related to Energy Performance Contracting? Do you think third party enforcement is necessary for it to be a market for EPC? Do you see it as a problem for the credible commitment of the whole energy efficiency regulation that the target both for 2020 and 2030 is non-binding upon member states? Are there other features of EE regulation on the EU level that impedes the credible commitment of sustained regulation, in turn making the investment environment unpredictable?
Multi-field framework - Institutional logics - Professional logics • Market measures • Technological development • Minimization of social cost	How much authority would you say that the EE directives have upon member states? Do you deem government of the EE to be predictable? Which professional logic do you feel best represent the DG Energy Efficiency?

Debriefing

a. Anything else to add?

b. Experience of the interview?

c. Main points interviewer learned from interview

Appendix 2: Meeting with the liaison group for EEA-matters hosted by the OED

EU-EØS Kontaktutvalget, 7.12.2015, Akersgata 59, 0180 Oslo

Sammendrag

- Avdelingsdirektør og leder OEDs spesialutvalg for EØS-saker innenfor energi, Johan Vetlesen, var ikke klar over at Paal og Brusselkontoret er blitt en del av GK. Det er han nå.
- Til stede
    - Mest aktive: Norsk Olje og Gass, Statoil, Norwea, Statnett
    - Andre: EnergiNorge, KS Bedrift, Hydro, NHO, Bellona +++
    - Konsulentselskap: Lund & Co for (fikk ikke med meg hvem de representerte), Geelmuyden Kiese for Geelmuyden Kiese
- Overordnet inntrykk
    - Fokus på at resten av energi, klima og miljø lovgivningen vil kastes opp i lufta i 2016. Energiråden gjorde det klart at dersom man vil påvirke så er tiden for det nå.
    - Det knytter seg også stor spenning til hvordan den helhetlige Governance-strukturen for de 5 dimensjonene av Energy Union vil se ut, og hvordan Norge skal forholde seg til dette. Inntrykket er at det vil vanskeliggjøre EØS-samarbeidet iom at styringsmekanismene ikke lenger vil være eksplisitt omtalt i de enkelte direktivene, men heller være definert i et eget Goverance-system.
    - Blant de tydeligste signalene er det at vi nærmer oss en løsning på Norges tilknytning til ACER. Dette er det siste hinderet for implementering av 3. energimarkedspakke, så vi kan nok forvente at denne slår inn ila 2016. Kommisjonen har gjort det klart at EU ønsker å være konsekvent i byrå-tilknytningene på ulike områder. Det vil nok bety at Norge vil kobles på ACER etter samme modell som Finanstilsynet er underlagt EBA.
    - OED er også meget fornøyd med samtalene de har hatt, og vil ha, med Nederland før de overtar presidentskapet for EU. OED ser på Nederland som pragmatiske og samarbeidsvillige. Det kan være en indikasjon på at OED ønsker å gjennomføre så mye som mulig innenfor første halvdel av 2016.

Innledning Johan Vetlesen

Overordnet

- Energiinfrastrukturforordningen
- Tredje energimarkedspakke – Jobbet mye med
    - Et utestående spm: Hvordan håndtere ACER
    - REMIT også på lista
- OED deltar i Komitologi

Pre-pipeline saker

- Revisjon av SOS forordning gass (1Q 2016
- Revisjon av beslutning om IGA – bilaterale handelsavtaler (Norge vurdert som tredjeland i avtaler) (1Q
- Revisjon av energi-energieffektiviseringdirektivet (3Q
    - Illustrerer utfordring med back-log
- Revisjon av EPBD 2 direktivet (3Q

- Ny lovgivning el-markedsdesign (4Q
- Revisjon av elforsyningsdirektivet – 2005 (4Q
- Revisjon av fornybardirektivet 2 (4Q
    - Ikke nasjonale mål men innrapportering av planer
    - Konsultasjon i gang
    - Planlegger høringsuttalelse?
        - Heldigvis ikke frist for februar - utgangspunktet
- Ny lovgivning om strømlinjeforming av planer og rapportering (4Q
    - Governance – Rådet har planer
    - Hvor mye blir liggende i de enkelte direktivene?

Pipeline

- Forordninger under ecodesign
    - Kommisjonen, ENTSO, ACER, komitologi
    - Triologi, Parlamentet har kommet sent inn
- Nettverkskoder

EU-adopted

- Bygningsdirektiv 2 (2010)
    - Relativt nær å sende tekst til EEAS
- Energieffektiviseringsdirektivet (2012)
    - Ikke diskutert skikkelig i EFTA enda om hvordan det skal bringes inn i EØS
- Template for nasjonale energieffektiviseringsplaner (2013
- Energiinfrastrukturforordninger (2013
    - Knyttet opp til 3. pakke
    - Fått inn forskningsprosjekter
    - Struktur for PCIs
- CACM Network code (Capacity Allocation and Congestion Management
    - Ulike type formasjoner som man må sikre seg deltagelse I

Fase 4

- Tredje energimarkedspakke
    - Kan ikke si mye, men vil løses snart
    - Løsning tett opp til Finanstilsynet
    - Ønsker system som likner på tvers av byråer
    - Ikke en enhetlig aktør
- Ecodesign og energimerkeforordninger
    - Foregår studier som kan ende opp i revisjon
    - Større varmtvannsbeholdere kan få en behandling som er rett og rimelig, og ikke må fases ut

Gaute Egilsen – Energiråd Brussel

Hvordan han ser det på høyt aggregeringsnivå

- Det er så mange kriser, at det knaker i grunnvollene i EU
    - Schengen har brutt sammen – Russland, Hellas, migrasjon, sikkerhet (Paris), Brexit
- Samtidig åpenbart at ingen land klarer å løse alene. Flere spørsmål enn svar
- Påvirker åpenbart andre saker på EUs agenda – Hvilken grad smitteeffekt, påvirker andre?
- Sefkovic sier at krisene betyr at toppledelsen holder på med krisehåndtering
    - Fremdrift går ned på neste nivå
    - Ordentlig trykk i Energiunionen fortsatt

1 år siden – Begynte å bli klart hva Kommisjonen tenkte

- Klima vs sikkerhet
- Strategidokument – 5 dimensjoner (energi og klima bredt: transport, konkurranse, forbruker, statstøtte)
- Våren – konsolidering
  - Imponerende å gå fra situasjon uavklart
  - 1 mnd – Ja vi er enige i Rådet i mars – sånn gjør vi det
  - Skyldes Sefkovic – Styrker: gjør mye sonderinger, hvor går smertegrensen. Strategi skrevet på en slik måte at det er vanskelig å være uenig.
- Var ikke konkret innhold mtp initativer. Der kommer fightene til å komme.
  - Se konturene av at MS vil fokusere på nasjonal interesser – kompromiss
- Retningen er staket ut – støtte på høyt politisk nivå – hevet listen enn hva vi kan være imot
  - Energiunionen mer enn gamle initativer pakket inn på nytt.

Sommerpakken

- Forslag dekker hele tidspekteret – 43 konkrete tiltak
- Hvordan skal kvotesystemet se ut? Karbonlekkasje – hvem skal stå på listen?
  - Sak til vurdering i institusjonene. Kvotepliktig sektor
  - Det som gjelder ikke-kvotepliktig sektor ikke på bordet enda.
- Markedsdesign

Høsten 2015

- Forskningssatsning – SET planen

November

- Statusrapport – pakke. Listen over elementer i den pakken – mange sider. Smått og stort pakket sammen.
- Hva har man fått til under 5 dimensjoner. Hva har skjedd? Fått til mye.
- Litt nytt: Eksplisitt tilbakemelding. Skryt til de som gjør det bra. Dårlige land rapporteres. Mer name-shame kontur. Et av virkemidlene Kommisjonen har.
- Hva kommer fremover?
  - 2016 blir et hektisk år. Hele rammeverket for energi-sektoren + klima hevet opp i luften.
  - ETS + energimarked på bordet nå. Resten kommer i 2016.
- 3 pakker
  - 1 februar: energisikkerhets/gasspakke
  - Sommer: Ikke-kvotepliktig sektor
    - Innsatsfordelingsdirektiv: Nasjonale mål
    - Transport
  - Høstpakken/vinterpakke del 2?

Til alle om er opptatt av energi – alt er oppe i luften. Spennende periode.

- Kritisk fase – alt som legges frem av forslag – jobber med det nå. Lobbe i Kommisjonen før de legger frem. Påvirker premissene før det legges frem. Bør gå inn og påvirke nå.
- Departement – komparativt fortrinn i ekspertgruppene. Relevant kompetanse og erfaring. Interessant periode.
- Ila 2016 – levere på 90% av forslagene. Juncker ikke gjenvalg.

Nevne en annen sak som henger sammen med 2030 målene

- Bindende fornybarmål på EU-nivå. Hva er det? Overskrift: Energy Union Governance (styringssystem for å nå 2030 målene).

- Hva skal være mekanismene dersom man ikke når EU-målene? Noen vil ta det nå. Andre mener det kan utsettes. Diskusjon. Jobbet med rådskonklusjoner. Landet kompromiss i Governance.
    - Hovedelement – Planer og rapportering
        - Hvert enkelt land skal lage planer for 5 dimensjoner
        - Referansebaner – nasjonale fremskrivinger. Liste tiltak og nasjonal politikk.
        - En masterplan. MS enige om at dette skal være klart 2019. Rapportering annet hvert år.
        - Kommer kanskje eget lovreglement. Kommer i slutten av neste år.
- Slik det er nå ligger dette i de ulike direktivene.
    - Ser for seg å kutte bort fra enkelt rettsakt. Se ting i sammenheng.
    - Utfordrende for Norge: Har ikke samme tre målene i vår struktur.

Alle ting som hender nå relevant for Norge

- Regionalt samarbeid tillegges mye vekt. Raskere å få ønsket utvikling. Lettere å få god dialog. Lettere fra norsk perspektiv.

Spørsmål

- Oppfølging til masterplanen (Ref Timmermans og Governance/Better Regulation)?
    - Tenker så det knaker i OED. Brainstormingnivå. Vet ikke hvor mye. Indre marked, infrastruktur, forskning. Vet ikke hvordan det kommer til å se ut.
    - Involvering fra bransje?
        - Gjøre jobb på hjemmebane. Hva er vår retning.
        - Er ikke dumt å møte vise-presidenten nå.
        - Dette er en referansegruppe +
- Regionalt samarbeid?
    - Umodent. Mulighet for oss. Nordiske samarbeidet trekkes frem som modell. Hvor viktig blir nordiske modellen fremover? Komme med noen gode ideer der
- Tredjeland
    - Energy union does not stop at EU borders. Ingenting konkret om tredjeland. Men Norge fortsatt interessant. Vi er ikke ute, på ingen måte.
- Ledelse
    - Canete og Sefkovic – Politiske plan veldig likt. Fronting utad bruker de mye tid på.
- Parlamentet
    - Ønsker også å være premissleverandør. Sefkovic ansvaret for Parlamenetet – mye kontakt. EP laget egen rapport. Parlamentet tar tid. Kommer med formelle ting ganske sent.
    - Helt klart med. Opptatt av beslutningstakere. Ønsker å finne ut av hvor grensene går i forkant.
- Alle baller opp i lufta – ulike konfliktnivåer. Hvordan posisjonerer vår region seg? GB, DK,
    - Klimasiden: Green Growth Group – alle land du nevner + Norge. Stor strekk i laget. UK og Tyskland motpoler. Blir sprik i laget når det skal operasjonaliseres.
    - TSOene, nordisk ministerråd. BEMIP, Pentalateralt forum. Ulik grad av Kommisjonsevaluering. Heller drevet underfra og opp.
    - Bør Kommisjonen inviteres til Nordisk samarbeid? Spørsmål som kommer opp?
- Før helgen, Georgia – Kommisjonen tok opp Energy Union

Høringsrunde

Statnett

- Det viktigste er at nettkodene blir satt ut i livet
- 3. pakke, har alle virkemidlene
- Noen spilt inn på missing regulation
    - Trenger et nytt direktiv på sikkerhetssiden
    - Lage indre energimarked – må ha regional security of supply
        - Spesielt scarcity
        - Kapasitetsmekanismer
    - Missing regulation på sluttbrukermarkedet – Hvordan
    - Rolle – DSO vs TSO.
- Hvordan skal ACER styre TSOene og ENTSO-E
    - Kan komme ny governance her.
    - Regioner: Endelig.

Statoil

- Ukraina får 70% av gass non-russland
- Styringssystemene er viktig fremover.
- Hva kommer Statoil til å legge vekt på?
    - Forsyningsforordning
    - Varme og kjøle
- Er ikke gitt at Energiunionen er medisin for Europa i det hele tatt
    - Må få bukt med fragmentering og amputering
    - Konsernsjef – Ja det er vanskelig. Men det går den riktige veien.
- Kommentar fra OED
    - Nederlandsk formannskap – Tenker pragmatisk og steg-for-steg
    - Ikke uvanlig at OED møter neste formannskapet før de går inn.

Norsk olje og gass

- Støtter indre energimarked – øker etterspørselen etter gass
- Svært negativ til Hydro carbon-BREF
    - Skepsis deles av flere EU-land, interesseorganisasjoner, herunder norsk LO
    - Hindre forordning knyttet til Offshore Satefy – oppfordrer OED til å jobbe mot
- Fellesinnkjøpspolitikk?
    - Leveranseavtaler for naturgass må foregå basert på kommersielle vilkår melllom uavhengige parter.
    - Kommentar OED: Det du sier om kommersielle vilkår er ikke gæærnt det.
- Statnett
    - Hva betyr reelt sett en strategisk samarbeidsavtale/energpolitisk partnerskap
    - Kommentar fra Energiråden
        - Fine ord. Innebærer at vi gjør mer av det vi allerede gjør med kontakter på politikersiden. Systematisk kontakt på ulike nivåer gjennom året. Bilaterale kontakter, uformelt. Regulær kontakt embetsnivå. Konferanse. EFTA/EØS.
        - EU fremhever Norge som strategisk partner. Kommunisere vilje til å fortsette samarbeidet.
        - Frokost for NV8 – nordisk møte i forkant av energiministermøtene
- BREF
    - Workshop – Hva er det materielle er usikkert.
    - Kommentar fra Energiråden
        - Møte i teknisk arbeidsgruppe gjennomført. Kommisjonen sammen med ekstern konsulent presenterer scope for hvordan drive videre. Møtet ble om hva er

fornuftig å gjøre? Møtet endte med time-out. Bestilte innspill: hva er galt? Hva trenger mer retningslinjer. Frist. Innspill. Tygges. Nytt møte.

EnergiNorge

- 2030-målene kjerne. Observerer tendens flyttet fra klima til forsyningsikkerhet. Flyttes til priser og reguleringsnivå. Annerledes situasjon i Norge.
- Viljen og lysten til å ta i bruk virkemidler for forsyningssikkerhet tar ikke innover seg kost-nytte.
- Tre diskusjoner
  - 1. Kapasitetsmarkeder. På vei inn. Ønsker ikke velkommen. Utvikling i Tyskland mer positiv. Finne grep som ikke er så inngripene i markedet.
  - 2. Kvotesystemet – ETS. Stadig vekk troverdighetsproblem rundt. Viktigste å holde på.
  - 3. Utfasing av mest skadelige støttemekanismer på vei ut. Bort fra feed-in i Tyskland og UK bra.
    - Hvordan markedet blir klart for RES?
- Prioriteringer
  - 1. Markedsdesign
  - 2. Støttesystemer – bør
  - 3. Energieffektiviet – Hvordan måle energibærer
  - 4. Ikke-kvotepliktig sektor – Viktig. Handler om elektrifiseringsmålet i EU.
  - 5. Governance – Dette blir en viktig arena for å diskutere markedsdesign. Viktig at vi strategisk prioriterer.
    - Energimeldingen er et godt sted å se på det. På en måte en nasjonal plan.
  - OED – tatt ut fra listen over hva som kommer. Helt enig.

NORWEA

- Governance veldig viktig. Regional collaboration – Trenger mer politikk, infrastruktur og marked.
  - Kapasitetsmekanismer godt område for å skape åpenhet.
  - Legges frem til streng tolkning. Rådskonklusjonene – constructive dialogue between Commission and Member States.
    - Viktig at Norge får være med. Her kan det være at vi har en interesse
    - Sikre deltagelse på offisielle arenaer.
  - Planer
    - Mal ventet på nyåret. Svært viktig prosess.
    - Investeringssikkerhet – Stake ut en retning. Styringssignaler til TSO, retningsgivende dokument – ala energimeldingen.
    - Prosessen starter automatisk i MS.
    - Hva kan norges bidrag være?
  - Klassikeren like konkurransevilkår
    - Fare for etterslep – deltagelse for
  - Viktig å prioritere fornybarenergidirektiv 3.
  - OED kommentarer
    - Alle fem veldig interessant.

KS Bedrift

- Mindre og mellomstore selskap. Melder inn syn til paraply.
- Energiunionen
  - Hvordan utvikler insentiver for investering i fornybart?

    - Påvirke pris
    - Støtter EnergiNorge – viktig at vi er tidlig ute. Tilpasse til norsk situasjon.
    - Må kaste oss på ny teknologiutvikling.
    - Grønne sertifikater: Bør det utvikles i annen retning?
        - I hvilken grad er regionale auksjoner noe vi må forholde oss til?
    - Avfallssektor og sjøtransport
        - Bedre ressursutnyttelse. Kan få til en ny industri i Norge.

Norsk Hydro

- Må ha langsiktighet
- Mangler konkurransedyktighet. Bekymret for kostnader. 80% fornybar for høyt.

Bellona

- Fra EØS-standpunkt
    - Bør prioritere eksisterende direktiv. Energieffektiviseringsdirektiv, bygningsenergidirektiv.
    - Nasjonale mål og handlingsplan – Ukomplisert og lite sensasjonelt å være ambisiøse her.
    - Energimelding kommer etter hvert.

Kristoffer Sahl – NHO

- Veldig viktig prioritering – Naturgass vil være og bør være viktig. Etterspørselusikkerhet. Må ryddes av veien dersom nye investeringer skal komme. Fornøyd med at myndighetene har det høyt på dagsorden.
- Jobbe med å fase ut støtteordninger i MS – ETS skal satses på.
- Karbonlekkasje viktig.
- Ønsker Pan-europeisk elektrisitetsmarked
- Energimerkeforordningen
    - Elektriske produkter diskrimineres. Primærenergimarkeder.
    - OED jobber hardt med DK og Finland.

Er det noen sammenheng mellom klimamål/ETS og ny fornybarproduksjon

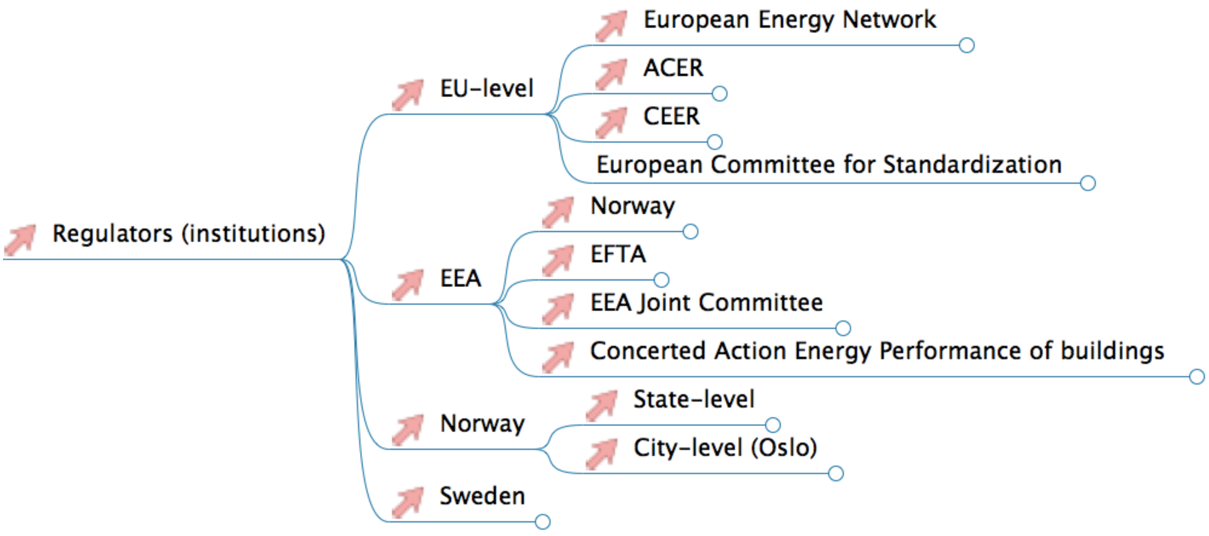
- Statoil: Rapport med sommerpakken – svart på hvitt at det bringer ikke frem fornybar energiproduksjon.
- EnergiNorge: Ikke forurenser som har betalt, men skattebetaler
    - Per Sanderud – Energidagene
        - Kutter 6-7000 tonn i transport. Får opp klimamålene.
- Statoil
    - LOCC – kan legge på hvilken karbonpris du vil. Fornybar konkurransedyktig på alle måter.

OED avsluttende

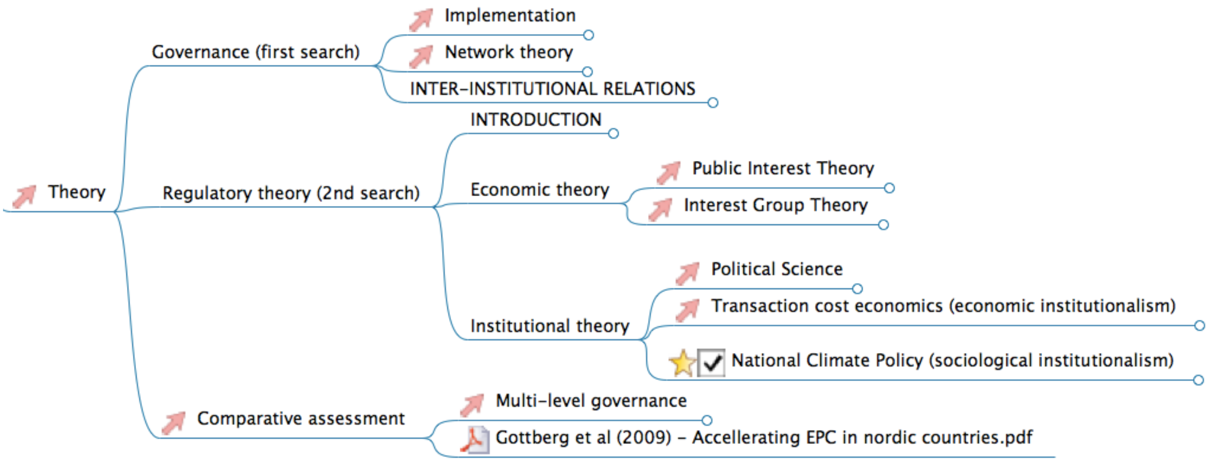
- Norsk olje og gass konferanse blir utsatt til 5. februar.

Appendix 3: Docear mindmaps

Mindmap for regulators

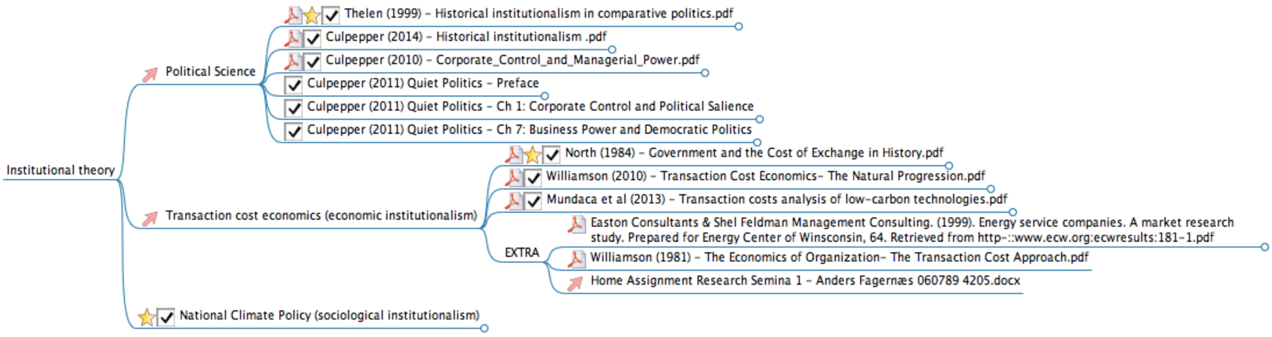


Mindmap for theories in first and second search



Mindmap for public interest and interest group theory

Mindmap for institutional theory



Appendix 4: Agreement on master thesis collaboration

Agreement between Siemens AS and Anders Fagernæs regarding Master Thesis collaboration

1. General

1.1 This Agreement sets out the terms and conditions of the collaboration between Siemens AS and Anders Fagernæs in writing Anders Fagernæs' Master Thesis at Copenhagen Business School (CBS).

1.2 Anders Fagernæs, student of International Business and Politics (IBP) at CBS, will function as the researcher and writer of the "Project" and coordinator of the collaboration, and is responsible for delivering the final Project in the form of a Master Thesis to Siemens AS upon completion of this Agreement.

1.3 Director of Communications and Sustainability, Gry Rohde Nordhus, will function as the contact person from Siemens AS and will be responsible for coordinating the availability to Siemens AS' and Siemens AGs confidential "Information", including Information from any interest group or lobby coalition that Siemens AS and Siemens AG is part of in Europe.

1.4 Manuele Citi, Assistant Professor at the Department of Business and Politics at CBS, will function as the academic supervisor of the Project, and will be responsible for monitoring that the Project falls within the scope of Paragraph 34. "Competency Profile" and Paragraph 36. "Master's Thesis", described in the CBS Study Board's "Programme regulations for MSc in International Business and Politics".

1.5 Lars Nermoen, Senior Advisor at Geelmuyden Kiese, will function as an external advisor to the Project. Geelmuyden Kiese, the future employer of Anders Fagernæs, will also, at their discretion, cover Anders Fagernæs' travelling and other expenses directly linked to the completion of the Project.

1.6 The nature of the Project, written specifically for the purposes of Siemens AS, and subject to the attached "Agreement on confidentiality and rights", is described in greater detail in the Research Design under Clause 2.

1.7 The collaboration will begin upon signing this Agreement, and will terminate when the final Project has been delivered to Siemens AS, at the latest by the end of June 2015.

1.8 In relation to the specific Project described under Clause 2, the parties agree that no remuneration will be paid from Siemens AS during or after the completion of this Agreement, neither to Anders Fagernæs, CBS, nor to Geelmuyden Kiese.

2. Proposed research design for the Project "Siemens AS and Regulation of Energy Efficiency in a European Context"

2.1 Research questions

2.1.1 How is energy efficiency regulated in the European Economic Area, Norway, and Sweden?

2.1.2 What roles has Siemens AS and Siemens AG played in the development of energy efficiency regulation in the European Economic Area, Norway, and Sweden?

2.1.3 How has Siemens' work to influence policy formation and implementation been organized?

2.1.4 What effect have these roles and influence had on the regulatory governance (legislation and bureaucracy) of energy efficiency today, specifically in regards to Energy Performance Contracting?

2.2. Specification and limitation of scope

2.2.1 The context will be limited to Europe in geographical space, the European Economic Area in political jurisdiction, and the 1990's to the present in temporal scope. Moreover, specific attention will be put on the 2002 and 2010 Energy Performance of Buildings Directives, the 2006 Energy End-use efficiency and Energy Services Directive, and the 2012 Energy Efficiency Directive, and any other energy efficiency legislation arising from the European Economic Area that the parties to this Agreement may deem relevant, specifically relating to the political jurisdictions of Norway and Sweden.

The role of government ministries and government agencies, and their vertical (multi-level inter-governmental) and horizontal (intra-governmental) interactions, along with their interaction with the energy efficiency legislation, will be central in the analysis. Specifically, the *competence distribution* – whether regulation is decentralized to national or sub-national authority, or subject to centralized EU governance – and the *steering method* – whether it is technological development or market approaches that underpin the logics of regulation – will be researched. This research will be seen in light of issue-specific factors for the regulatory governance of energy efficiency, and analyzed from Siemens AS' interests in regulatory design, with Energy Performance Contracting taking a central role.

2.2.2 Siemens AS, in its position as an Energy Service Company delivering Energy Performance Contracts, will be at the center of the analysis. Its role in the development and implementation of energy efficiency regulation in Norway will be analyzed. The scope of this analysis may extend to Siemens AG's role in the development of EU energy efficiency regulation and Siemens Sweden's role in the development of Swedish energy efficiency regulation, if the conducted research deems this beneficial for the Project.

In terms of political processes, the following themes have been identified as relevant: 1) issue emergence/agenda setting (framing of debates by politicians and industry); 2) policy formation (supranational preparation and negotiation of legislation); 3) policy transposition and implementation (national and sub-national preparation and negotiation of legislation). The analysis of Siemens' organization of its influence efforts – along with the influence work conducted by central interest groups and lobby coalitions that Siemens is affiliated with – on the design of legislation and bureaucracy, will be informed by these separate but interdependent processes. In case of further limitation, the transposition and implementation phase will be the one taking center stage, as this is the most relevant for Siemens AS. However, in this regard, the exact focus of the Project will depend on availability of data and methodological tools for measuring the effect of Siemens' roles and influence on regulatory governance of energy efficiency.

2.3 In terms of methodology, the Project will adopt a mixed methods approach, relying on both qualitative and quantitative research methods. The qualitative part is likely to be influenced by theories of regulation found within Political Science (Liberal Intergovernmentalism and Multi-Level Governance), Economics (Transaction Cost Economics and New Institutional Economics), and possibly also Sociology (New Institutionalism). Moreover, the majority of primary data is planned to be collected through personal interviews of relevant actors and any primary data the researcher may get access to from Siemens and the interest groups and lobby coalitions Siemens participates in. In terms of the quantitative approach, the researcher has an ambition to apply an innovation within political science known as Quantitative Text Analysis, as it holds the promise of quantitatively analyzing influence on legislation.

2.4 Any refocusing or rebalancing of the research question found necessary by the researcher and writer will be under the sole authority of the researcher and writer in collaboration with the academic supervisor. However, Siemens AS will be consulted before any such changes will be made.

3. Access to and administration of information and rights

3.1 The extent of Information Siemens AS makes available, as well as access to any relevant interest group or lobby coalition, is put solely under the discretion of Siemens AS. However, for the purposes of the quality and depth of the Project, Anders Fagernæs will be given access to confidential information in order to carry out any necessary research, specifically in terms of interviews of Siemens employees.

3.2 The parties agree that confidential Information can be incorporated in the written paper that Anders Fagernæs submits to CBS for assessment, subject to the attached Agreement on confidentiality and rights.

3.3 It is imperative to this agreement that Geelmuyden Kiese will not in any way use the confidential Information obtained from Siemens in this Project in any other project with another client, and that Geelmuyden Kiese do not communicate or pass on any confidential Information obtained from Siemens to any third party not part of this Agreement.

3.4 In order to assure that the researcher is able to conduct interviews with third parties that may have access to confidential or sensitive information, the parties agree that interviewees may reserve the right to have their personality kept anonymous in the final Project.

3.5 Apart from the copy of the Project delivered to Siemens AS upon completion of this Agreement, one copy of the Project will be given to: CBS; the academic supervisor from CBS; the external examiner from CBS; and the external advisor from Geelmuyden Kiese. Fellow students or others are not allowed to receive copies, unless agreed upon between the parties to this Agreement.

4. Communication of results

4.1 Any publication of the final Project, either in its original form in a journal article or in a newspaper article, will be decided and agreed upon by both parties at the time when such questions arise.

4.2 In addition to the written copy of the Project, Siemens AS will get an oral presentation of the results.

5. Signatures

We indicate by our signatures that we accept the terms and conditions of this Agreement from page 1 to 3,

Anders Fagernæs .... Date 23/9 - 2014

Anders Fagernæs
Student of IPB, CBS

.... Date 23/9 - 2014

Gry Rohde Nordhus
Director of Communications and Sustainability, Siemens AS

Manuele Citi .... Date 29/09/2014

Manuele Citi
Assistant Professor at CBS

Assistant Professor at CBS

Lars Nermoen

Date 23/9 - 2014

Lars Nermoen
Senior Advisor, Geelmuyden Kiese