Effectiveness of policy instruments in stimulating renewable energy production in the European Union

Room for improvement in the Netherlands

Bachelor Thesis

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Executive summary

One of the means included in the Europe 2020 strategy to achieve growth in the European Union (EU) is to stimulate the share of Renewable Energy Sources (RES). Studies indicate that the Netherlands lack ambitious and effective policy instruments for stimulating RES (Ecofys, 2011; Dinica & Arentsen, 2001; Agnolucci, 2007; Verbong, et al., 2008). The goal of this study is to construct a systematic overview of what empirical studies report on the degrees of effectiveness in operated policy instruments to support the production of green energy in the EU. This overview is supported by an analysis and evaluation of the collected data. Subsequently, recommendations are made for the case of the Netherlands and for policy makers in general. The study will contribute to an umbrella EU project; COMPLEX.

The role of public policies in promoting renewable energy sources is a significant one; studies have indicated that public policies are effective in deploying green energy. This finding justifies the importance of looking into the current literature that report on the effectiveness of policy instruments stimulating renewables and present the findings in one comprehensive research. Policy makers will be able to derive conclusions and recommendations based on the performed literature evaluation. Policy instruments for the production of RES are a means for achieving the Europe 2020 target, overcoming the negative externalities inherent to climate change and carbon emission and transiting to a low-carbon economy.

Findings of this paper show that the current empirical literature mainly focuses on the effectiveness of feed-in tariffs (FIT) and quota-based mechanisms (such as Renewable Portfolio Standards, Renewable Energy Certificates, Tradable Green Certificates), while governments have a wide array of different instruments at their disposal as denoted by the theory. Policy mixtures are not extensively examined. In addition, there is a lack of reliable and comprehensive data, and as a consequence the field of study mainly consists of case studies. This implies that there is a lack of profound quantitative analysis in this field of research.

The literature widely reports about various factors that influence the effectiveness of policy instruments. Certainty, legitimacy, risk mitigation, continuity, reliable commitment of the government, policy stability, and lobby pressures of existing industries have an impact on the effectiveness of policy instruments. Most studies indicate that the FIT is effective in stimulating green energy since the tariff successfully (not in all cases) reduces the influence of some of these variables. FIT's mitigate risk, provide certainty, give stability, enhance investment security, provide access parity, encourage faster and more widespread deployment of RES, and induce investments.

Moreover, various authors find out that the context (policy environment, oil price, electricity market, etc.) and the policy design are of a significant influence as well. Results show that the effectiveness of policy instruments varies in terms of different types of renewable energy sources

1. Introduction

When researching the implementation of EU Member-States' (MS) policy instruments stimulating the production of green energy, one can observe the array of potential policy instruments that may differ in their effectiveness and approach (Dinica 2003: 19). While some MS's excel in their pursuit of stimulating the production of RES, others lack ambition and fall behind. Keeping in mind the Contextual Interaction Theory (CIT) as introduced by Hans Bressers, there is no such thing as best practice for effective policy instruments. Circumstances (referred to as the context) shape the progress and influence the effectiveness of policy instruments. This study therefore strives to grasp the reported contextual matters in empirical studies that may influence the implementation progress and effectiveness of policy instruments promoting the production of green energy.

An extensive policy analysis of the Netherlands in the period 1974-2011 indicates that its policy instruments are hindered by policy instability, policy uncertainty, 'stop-and-go' policy implementation, lacking long-term support schemes, spatial planning issues, inability to provide a stable investment climate, exclusion of social, administrative and institutional aspects of technology diffusion, and the sole employment of voluntary targets[1](Dinica & Arentsen, 2001; Agnolucci, 2007; Verbong, et al., 2008).
Additionally, research of the EU Climate Policy Tracker project observes that the Netherlands nowadays falls behind in comparison with other Member-States (MS) with regard to policy instruments stimulating RES (Ecofys, 2011). Moreover, the Netherlands has a less ambitious target than the EU itself: 14% share of RES (Europe 2020 targets, 2013), compared to a 20% target.

An energy report issued by the Dutch ministry of Economic Affairs, Agriculture & Innovation in 2011 emphasizes the importance of energy efficiency. Thereby initiating policies primarily stimulating energy efficiency, while lacking incentives to promote the share of RES in energy supply. The Dutch cabinet is of the opinion that green energy is not workable (Ministerie Economische Zaken, Landbouw & Innovatie [EZ], 2011). Instead of expanding the budget utilized for energy policy, the Netherlands is cutting back on expenses drastically (Ecofys, 2011).

Given how the Dutch policies developed through time, and taking into account the status quo of the current employed policy instruments and ambitions, one can observe the path-dependency. The dependency on natural gas and imports, the perceived sole feasibility of wind energy and biomass technology diffusion, indistinctness of which group is responsible for stimulating green energy (what is the 'target group'), are some of the few contextual matters for the Netherlands that may have influenced the progress of the policies through time. Ineffective policies and the progression of these in the past may have contributed to the current sloppy status of the Dutch policies in stimulating the production of green

[1] An extensive analysis and evaluation of policy instruments stimulating green energy in the period 1974-2011 in the Netherlands can be found in the appendix.

energy and the low ambition held by the government. This adequately illustrates the significance of the CIT theory.

To put this into perspective, other MS's such as Germany do well in promoting the production of green energy. Germany initiated minimum fixed feed-in tariffs in 1991, and expanded this policy to a great extent (Büsgen & Dürrschmidt, 2009). Germany's Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG) is widely acknowledged for its achievements and effectiveness (Krewitt & Nitsch, 2003). The first version of the EEG, and its amended versions all set ambitious targets for the share of RES in Germany. The compensations stay fixed for a longer time period unlike the Netherlands' stop-and-go policy. No public budget is allocated since the act distributes the burden by obligating all energy suppliers to have the same share of RES in their production. Additionally, later versions of the EEG strive to stimulate a variety of RES technologies instead of focusing on efficiency. Many authors acknowledge the success of Germany[2].

The difference in policy instruments employed between the Netherlands and Germany illustrates how types of policy instruments differ from each other in their approach (e.g. voluntary-obligatory), thereby having an impact on their effectiveness. A theoretical framework constructed in this study will serve as a basis to analyze these different types of policy instruments. This research analyzes and evaluates what empirical studies report on the effectiveness policy instruments stimulating RES. On the basis of the evaluation, recommendations can be made specifically for the Netherlands and for policy makers in general. Current research fails to give an overview of what empirical studies report on the effectiveness of policy instruments employed in the EU. Previous research mostly employs research on one specific type of instrument, country, or a comparison. This study integrates the variety of policy instruments operated throughout the EU.

The varying effectiveness of employed policy instruments when comparing EU MS's raises a research question of a descriptive nature:

1. What degrees of effectiveness and types of policy instruments are reported in empirical studies into the operation of policy instruments to stimulate renewable energy production in Member-States of the European Union?

Since the effectiveness of policies cannot be explained by the sole utilization of the instrument at hand (or best practice), it is necessary to look into possible factors that influence the effectiveness of RES policy instruments as suggested by the CIT theory.

The inclusion of the component "Member-States of the European Union" refers to the parameter of this study; a focus on policy instruments employed in countries member of the European Union.

[2] Additional information regarding the German case can be found in the appendix

A classification and conceptualization of policy instruments will allow for a systematic differentiation between the policy instruments the literature provides us, therefore the inclusion of the concept of types in the research question will complement the research adequately.

Given the dissatisfactory path of the Dutch RES policies as mentioned above, researching what degrees of effectiveness policy instruments entail may provide lessons learned for the Netherlands. Thus, a sub question is formulated:

1A. To what extent can the observations made on basis of empirical studies in the EU provide recommendations for the current policy stimuli for renewable energy production operated in the Netherlands?

An in depth analysis of the Dutch policy status and research to studies into the implementation and effectiveness of RES policies will provide ground to make recommendations for the Netherlands.

This study is structured as follows; firstly a theoretical framework is constructed which serves as a basic reference point to systematically interpret the observed literature. This chapter also includes the conceptualizations of important concepts. Secondly, the methodology section will argue why a literature review, by means of a document analysis, will be an adequate research design to answer the research question and the supplementing sub questions. Thirdly, the empirical studies gathered will be analyzed and evaluated. Next, chapter 5 contains a conclusion based on the contents of the articles and a conclusion based on the status of the analyzed literature. The last chapter gives recommendations for policy makers in general and recommendations for the Netherlands. The reader will find an analysis of policy instruments that promote green energy employed in the Netherlands in the period 1974-2011 and the illustrative case of Germany in the appendix.

2. Concepts & Theoretical Framework

The effectiveness of policies is to some extent influenced by the context of the implementation process. The Contextual Interaction Theory (CIT) adequately embraces this notion and is therefore added to the theoretical framework (Bressers & Klok, 1988). This theory discusses the peculiarities of implementation processes. This section also contains the conceptualization of 'effectiveness'.

The theoretical framework is constructed at two levels. First, a discussion of types of generic policy instruments will provide an "umbrella typology", which is followed by a categorization of policy instruments specifically stimulating RES. This double-layered approach gives the opportunity to classify policy instruments in a systematic and profound manner. This will provide a clear typology when analyzing empirical studies.

Furthermore, the literature extensively argues for a variety of factors influencing the implementation and effectiveness of policy instruments promoting RES. Thus, one has to shed light on this field of research as well. These studies form a theoretical basis for empirical research into the effectiveness of policy instruments stimulating renewables. Therefore, the last section of the theoretical framework will address the axioms of this field of research.

2.1 Concepts

2.1.1 Implementation and effectiveness

Implementation, as defined in CIT theory, consists of "the process(es) that concern the application of relevant policy instruments, including the realization of projects to achieve physical changes" (Bressers 2004: 284).

According to the CIT theory, implementation processes are shaped by the context (or circumstances) under which they are employed. To understand the progress of implementation processes, one has to take into account the context of the employed instrument. Thus, the context of where or how a policy instrument is implemented influences the effectiveness of that instrument. CIT theory converts the context to the actions of the relevant actors by constructing three characteristics (motives, cognitions, resources). The dialectics between the actors is therefore central to the implementation process.

In this study, the concept effectiveness is defined in a broad manner since empirical studies into the implementation and effectiveness of policies may employ different conceptualizations of effectiveness. The definition of effectiveness operated is 'the degree or level of domestically produced green energy, fostered innovation, installed capacity, and achieved policy targets'. Thus, this definition should not be interpreted as a rigid, normative concept but as more as a continuum.

2.2 Theoretical Framework

2.2.1 Types of policy instruments

Howlett & Ramesh (1995: 80) defined policy instruments as "the actual means or devices which governments have at their disposal for implementing policies". Governments have the opportunity to select from a vast array of tools to implement a policy.
This section provides a categorization of policy instruments that governments have at hand. A clarification of relevant concepts is necessary since the research conducted is of a descriptive disposition.
Howlett & Ramesh (1995: 81) provide a renowned classification of policy instruments that "focus on the level of state presence in the provision of goods and services involved with the use of each instrument". The criterion of level of state presence allows for a voluntary-compulsory axis ranking the assorted instruments. Figure 1 provides the classification of instruments along the axis.

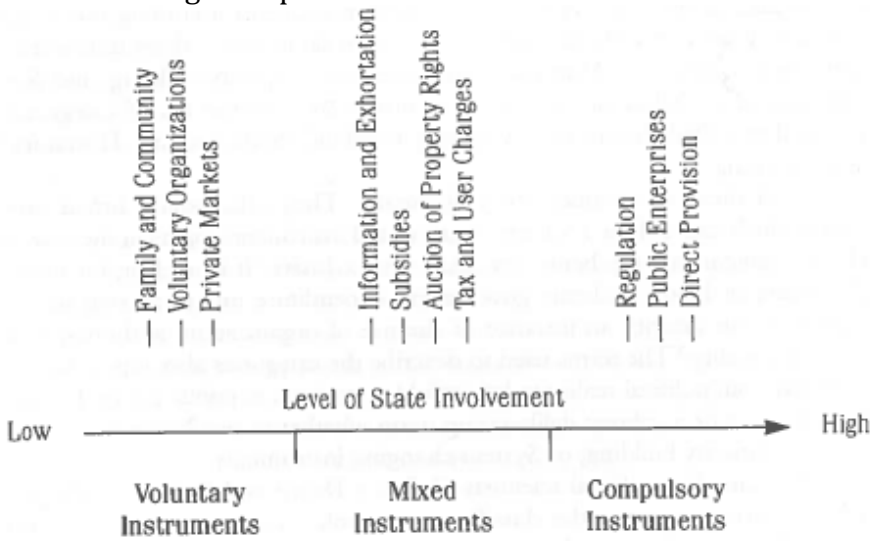

Figure 1.
A spectrum of Policy Instruments, constructed by Howlett & Ramesh (1995) in Studying Public Policy: Policy Cycles and Policy Subsystems.

In theory, all roads lead to Rome; in other words most instruments are to a certain extent 'substitutable' (Howlett & Ramesh 1995: 82). However, the task of the government is to select the (combination of) instrument(s) that is most appropriate for achieving the end objective, offering distributional equity. Cultural norms and institutional settings may influence the level of legitimacy experienced by the actors involved. Thus, policy instruments are influenced by the contextual factors. This notion is in line with the CIT school of thought.

The following section will discuss the classification constructed by Howlett & Ramesh (1995). This will give an answer to which policy instruments the literature distinguishes, and provide for a comprehensive categorization.

Voluntary instruments
Voluntary instruments are defined by the abstention of state involvement. Governments that decide to use these instruments are often convinced that the market or voluntary organizations resolve the public problem at hand. These instruments are especially suitable to implement economic and social policies (Howlett & Ramesh 1995: 83).

Family and Community
The government may appeal to the family and community in ways that will serve the desired policy goals. The government may decide to promote the involvement of relatives, friends, and so on directly, or indirectly by omitting a previously provided service and relying on the community cover for the loss. Benefits to this instrument are: the absence of costs and high political support. However, disadvantages are the possibility of inequity in distribution, since not all individuals have relatives of friends to rely upon. This policy instrument will not be appropriate for promoting green energy.

Voluntary Organizations
Voluntary organizations may provide services to those who are in need. They are non-profit and free of state coercion. Voluntary organizations are an equitable instrument since services that are provided are for those in need. However, possibility exists that these organizations rely on government funds, making them less efficient. Once more, this instrument appears to be inappropriate for promoting RES.

The Market
The voluntary interaction between supply and demand is expected to satisfy both. Society can benefit from this relationship since the good that is desired the most will most likely be provided at the lowest possible price.
If society gives value to a private good, it is ensure that resources are used for the production of that private good, insinuating efficiency and effectiveness. However, the market is an inequitable instrument. The energy market is a prime example: RES experience tremendous difficulties to compete with fossil fuels. Thus a purely market-based policy is most likely inappropriate for stimulating RES. This does not entail that it is not a useful tool in combination with other instruments. Thus, this voluntary instrument is mostly combined with more compulsory instruments, such as regulations.

Compulsory Instruments
This type of instrument directs the action of stakeholders. The state uses its coercive powers in these types of instruments. Thus, state involvement is high and stakeholder discretion is low.

Regulations
Howlett & Ramesh (1995: 87) define regulations as “prescriptions by the government, which must be complied with by the intended targets; failure to do so usually involves a penalty” (Howlett & Ramesh, 1995).

Regulations may be enforced by the police and judicial system, but the majority of regulations are administrative acts created for facilitating legislation and administered by the government (or independent government agency). These regulations may be in form of standards, permits, rules, legal orders and executive orders. Regulations may determine the quantity, quality, or price of a good. Economic regulations often strive to counter a perceived imbalance on the market. Benefit of regulations is the lack of necessity to adhere to the preferences of stakeholders (which is true in voluntary and mixed instruments). Regulations do not have to deal with the uncertainties of more voluntary instruments; moreover they are better controlled for. Regulations provide a suitable crisis management instrument since they are predictable. Additionally, subsidies and so on are more costly than regulations.
However disadvantages could be the inefficiency of the market, and distortion of voluntary and private activities. Moreover, regulations may provide market security for firms and therefore slow down innovation and reduce opportunities for experimentation. Additionally, the lack of flexibility of regulations presents another downfall.

Public Enterprise
This instrument goes one step beyond regulations. Public enterprises are more interfering because the government has high discretion considering its ownership. There is no clear definition of a public enterprise, Howlett and Ramesh (1995: 89) therefore provide three generalizations regarding the features of public enterprises:
Some degree of public ownership
Some degree of control by the government
Produce goods and services that are sold, unlike public goods
Advantage of this instrument is that the government can efficiently produce a good or services that is not produced by the private sector because of high capital investment or low/no profit. Yet again, the preferences of stakeholders are not important because the government is owner of the enterprise. Pitfall of public enterprises is their inability to go bankrupt, although they are inefficient. This inefficiency can be commissioned to the consumers when a public enterprise has a monopolistic position.

Direct Provision
The government may as well produce the good or service itself by using public resources. The same advantages and disadvantages count for this instrument as public enterprises.

Mixed Instruments
These instruments are a combination of characteristics of voluntary and compulsory instruments. Governments shape the decision-making process, but private actors make the final decision.

Information and Exhortation
Providing information to target groups in the hope changing their behavior is another instrument that is in the policy arsenal of governments. Exhortation is of a more persuasive nature. The government strives to change the target group's

preferences and actions. Advantage of exhortation is the relative inexpensiveness and the ability to abandon the program relatively easy. This instrument is likely to be ineffective when results are desired short-term.

Subsidy
This instrument is defined as all forms of financial transfers from governments to individuals, firms and organizations, or from individuals, firms, or organizations under government direction (Howlett & Ramesh 1995: 92). Purpose of a subsidy is to reward a desired activity. Subsidies influence the likeliness of firms or individuals to choose to perform the desired activity. Subsidies come in different shapes:

- Grants: "usually offered to producers, with the objective of making them provide more of a desired good or service than they would otherwise provide."
- Tax incentives: "remission of taxes in some form, contingent on some act."
- Vouchers: "papers offered by the government to consumers of a particular good or service, given by the to their preferred supplier, who then presents the voucher to the government for redemption." This subsidy supports consumers instead of producers (in the case of grants). It promotes competition.
- Loans: issued by the government, below the interest rate of the market.

Additionally, there are policy instruments that involve elements of subsidies but cannot be considered as subsidies as such.
Subsidies are flexible, easy to establish in case of consensus between what activity the government and the people desire, support innovation, experience political support.
Au contraire, subsidies are costly and resources for subsidies are difficult to establish. Subsidies have an indirect effect so the desired goals are often experienced on the long-term.

Auction of Property Rights
This instrument established a market where there is none. This market is characterized by a fixed quantity of transferable rights to consume a specified resource. This leads to a scarcity and creates a price mechanism. Subjects bid for the amount of the specified resource they desire. Advantages are the easiness of establishment and enabling subjects without alternatives the option to use the specified resource. Additionally, the government can change the quota's making it a flexible instrument. Disadvantage is wealth firms buying all rights and consequently hindering small firms. Another pitfall is the inequity of distribution since the rights are not distributed to the ones in need, but to the ones that are able to pay.

Taxes and User Charges
"A tax is a legally prescribed compulsory payment to government by a subject" (Howlett & Ramesh 1995: 96). Taxes can be used to stimulate desired behavior, or to deter undesirable behavior. Taxes may sanction undesired behavior

(negative incentive) while subsidies encourage desired behavior (positive incentive).
User charges are a type of tax to discourage undesired behavior. User charges are a combination of regulation and market instruments (Howlett & Ramesh 1995: 97), and are predominantly used to direct negative externalities. Benefits to taxes and user charges are the easiness of establishment. Additionally taxes and user charges provide a continuing reason for firms to reduce the undesired behavior, and promote innovation. Another advantage is the flexibility, since the rates can be easily adjusted. Moreover, the administrative burden is allocated to the firms in question, not to the government. Disadvantages are the costs of acquiring the information to set the taxes at the right level to prevent imbalances in resources. Another disadvantage is the ineffectiveness in the short-term and unpredictability because the path of dependence is determined by private decisions.

2.2.2 Types of policy instruments stimulating RES

Dinica (2003) constructed an overview of support instruments on the basis of a vast amount of literature. These groups of support instruments address the economic and financial barriers that hinder the distribution of RES. These are the groups identified by Dinica (2003: 20):

Subsidies
This instrument provides cash payments to the producer of the renewable energy project and directly decreases investment costs (investment subsidies). There are three ways of allocating subsidies to the subject: first-come first-served, competition-based allocation, selection by authorities (Dinica 2003: 20). Investment subsidies are crucial in the first stage of market introduction, since developing RES is capital-intensive. Subsidies can represent a ceiling of investment costs, or a percentage of the investment costs. Additionally, governments may decide to alter the amount of subsidy relative to the developer or project. When investments costs decrease, production subsidies are more appropriate because they stimulate efficiency.

Soft-loans
This instrument entails the equivalent of Howlett & Ramesh (1995). Governments may decide to pay a share of the interest rate that developers have to pay when financing a RES project. This is comparable to subsidies, but the amount of financial support is smaller. Once more, this instrument addresses the first phase in developing RES: overcoming financing difficulties when introducing the project to the market.
This instrument can be introduced voluntarily or via government bodies.

Instruments enabling bank financing
Instruments enabling bank financing comprise of three methods:
Governmental guarantees on project loans
Again, this instrument is useful in the market introduction phase when loan providers do not see profit in the RES project. To stimulate the provision of

loans, the government may decide to guarantee the loan provider a payback when the project fails to perform as predicted.
Project aggregation or bundling
This instrument lowers interest rates since smaller projects are all bundled in one large loan.
Third party financing
This method is a means of financing where an economic actor develops, finances, installs and operates a RES project (Dinica 2003: 22). When the financial requirements are fulfilled, the economic actor whom financed the project becomes the owner.

Fiscal instruments (direct/indirect incentives)
These instruments can directly or indirectly promote investments in renewable power plants (Dinica 2003: 22).
Direct fiscal incentives are known's as tax reimbursements, exemptions or rebates that improve the cost performance of RES plants. This practically works similar as a subsidy, but some taxes may exclude some type of economic actors.
Indirect fiscal instruments involve environmental taxes that strive to shape the incentive framework of producers/consumers of electricity to use RES, to save energy resources' consumption or to reduce electricity consumption (Dinica 2003: 23).
There are three types of environmental taxes: emission taxes, product taxes and consumer taxes.

Voluntary agreements for investments in renewable electricity plants
These agreements involve three basic forms: negotiated agreements (goals are discussed between the stakeholders), self-declarations of producers/consumers (goals are set unilaterally), programs created by government bodies (goals entail the desired goals of the government, subjects subscribe voluntarily) (Dinica 2003: 24).

Governmental requirement to invest in renewable electricity plants
This is a compulsory instrument; the government coerces energy producers to generate a percentage of electricity from RES. Tradable permission rights or certificates are not allowed in this system. In the literature this is also known as a Renewable Portfolio Standard (RPS). This instrument allows for more price competition between different types of RES.

Governmentally guaranteed purchase of renewable electricity
The name speaks for itself: the government guarantees investors in RES project to purchase renewable electricity. The government can obligate its agencies or electricity companies to buy renewable electricity.
There are four ways in which the government can settle this:
Price-focused support instruments: regulations settle at what price the electricity is purchased. There are no quota's in this instrument, but the amount of time this instrument is in force may vary (limited-unlimited)
Volume-focused support instruments: regulations settle the amount of RES output purchased. Once again, the time period may vary.

Mixed-guarantee support instruments: these instruments involve elements of both abovementioned approaches.
Weak-guarantee support instruments: the price is settled vaguely and in a broad manner, while the quota is unsettled, thus unlimited.
The distinction between feed-in tariffs and quota models made in studies cannot be easily confined in this categorization (e.g. Menanteau et al., 2003). Feed in tariffs may in some case solely reside in the price-focused instrument, but in other cases they are more characterized as mixed- or weak-guarantee support instruments (Dinica 2003: 25).

Programs for voluntary purchase of renewable electricity
These instruments have the central premises of an agreement between electricity companies or consumers to pay above-market prices for renewable electricity. There are three types of programs as constructed by Dinica (2003):
"Purchase of renewable electricity energy utilities/electricity companies based on a voluntary agreement with the government (or government bodies)"(Dinica 2003: 27)
"Purchase of renewable electricity by electricity companies/utilities based on a voluntary agreement with individual owners of RES plants" (Dinica 2003: 27)
"Voluntary purchase by consumers – households, commercial, or industrial users" (green pricing programs) (Dinica 2003: 27)

2.3 Factors influencing the implementation and effectiveness of policy instruments stimulating RES

This last section gives a brief overview of the field of research dedicated to the theoretical foundations of the variety of factors potentially influencing the implementation and effectiveness of policy instruments promoting RES. As will be discussed below, authors argue for various barriers and factors that have an impact on the deployment of RES and the policies implementing them. Despite their differences, consensus among the majority of authors is that stability and certainty influence the effectiveness of policy instruments.

Certainty, stability, clarity and commitment
Harmelink et al. (2008) and Reiche & Bechberger (2004) argue that a clearly stated government commitment is important to transforming to a RES market. The duration of the policy is also of significant importance; a long-term instrument in combination with certainty (e.g. fixed-price) encourages projects developers. Investment will stall if these conditions are not met. The notion of stability and certainty is shared with the majority of researchers in this field.

Haas et al. (2009) summarized the outcome of the third Forum of the European Network on Energy Research (ENER) (June 2002, Budapest). Several important conclusions were drawn on the basis of the proceedings. Long-term stability, accessibility to the electricity grid are crucial factors that policy instruments should address. This is also argued by Reiche & Bechberger (2004), in their influential paper determining conditions for successful RES deployment. Moreover, the existence of a best practice policy instrument is denied: nation-

and RES-specific policy packages are needed. Policy design is important and should be focused on stability and continuity.

Social acceptance and stakeholder involvement
Another strand of scholars emphasizes the significance of interests and ownership on the local level, this with regard to developing social acceptance. A particular study focuses on the local level of implementation of wind technology in light of a comparative case study (Breukers & Wolsink, 2007). The authors argue that stakeholder involvement (or: institutional capacity building) and equal treatment are key to policy effectiveness (hence: local ownership). Policy and decision-making processes should be open for all stakeholders.

An influential paper written by Wüstenhagen and his colleagues (2007) acknowledged the argument of social acceptance. They argue on the basis of a collection of best papers presented at a conference in Tramelan, Switzerland in February 2006, that social acceptance may be a hindering factor in achieving the government targets to increase the share of RES (for wind energy). This social acceptance is to be distinguished in three dimensions: socio-political acceptance, community acceptance, and market acceptance.
Socio-political acceptance is to be understood as societal acceptance on the broadest level; including policies and technologies. The public, key stakeholders and policy makers are relevant parties in this dimension. Community acceptance entails legitimacy, in a sense of procedural and distributional justice, and trust (of local community in actors outside the community). Community acceptance relates to local acceptance (siting decisions), where NIMBY debates take place. Social acceptance can also be interpreted as market acceptance (process of market adoption), stakeholders are consumers, investors and firms.

2.4 Concluding remarks

The typology provided for in the theoretical framework allows for a comprehensive paradigm to analyze the empirical studies into the operation of policy instruments to stimulate renewable energy production in the European Union. The theoretical framework indicates that there are different approaches in addressing the transition to a low-carbon economy. Moreover, the CIT theory suggests that the context at hand impacts the effectiveness and progress of these approaches (or instruments). Thus, this theoretical basis offers an analytical lens.
The last section gives a useful overview of what the literature reports on possible factors influencing the implementation and effectiveness of policy instruments stimulating RES. As we will see in the actual research, some of these factors appear in the empirical studies as well.

3. Research Methodology

3.1 Design

This study will employ a literature review to achieve the goal of the research. The research question implies the possibility to come up with a variety of degrees of effectiveness into the operation of policy instruments. As pointed out by Dinica (2003:19), there is a vast amount of implemented instruments, which causes difficulties in choosing the right analytical approach when comparing instruments with regard to effectiveness. Consequently, an evaluative literature review is appropriate for a thorough analysis and evaluation of implemented policy instruments and their effectiveness. If we, however, decide to go about inventing the wheel, or, analyzing the effectiveness for each individual instrument, the goal of the study would not be achieved. In this line, the resources necessary to accomplish such an approach would have to be of great magnitude. Therefore, evaluating secondary data, namely empirical studies, will provide a great amount of useful data. A basis for conclusions and recommendations will emerge from the literature reviewed.

3.2 Case selection & Sampling

Since the population of cases (empirical studies into the implementation and effectiveness of policy instruments stimulating green energy) is relatively small, randomized sampling will not be suitable. Thus this study will employ a purposive sampling method, sampling representative cases.

Empirical studies that report on degrees of effectiveness and types of policy instruments will be included in the research, thus subjectivity of the reviewer will be abolished. These criteria already offer a preliminary threshold for inclusion. Additionally, the employed methodology will be analyzed thoroughly. When necessary, authority, validity, currency, and objectivity will assess the quality of other secondary data.

In sum, the inclusion criteria are: empirical studies into the effectiveness of policy instruments, Dutch or English language, policies that are implemented in a EU Member-State, application of a profound research method, empirical studies dating between 1980-2013. Firstly, a selection for inclusion is made on the basis of the article's title. After this selection, an analysis of the abstract narrows downs the scope of the literature under review. Lastly, the conclusion and methodology will have to be examined as a final threshold for inclusion.

Search engines Google Scholar, Scopus and the search engine of Energy Policy are used to grasp the existing body of empirical studies into the effectiveness of policy instruments. The abovementioned inclusion criteria and the specific search terms described below are used to distillate the relevant academic literature.

For the search engine of Energy Policy, the terms “effectiveness, instruments” were used, 1000 results were scanned (the engine yielded little over 1000 articles).
For Scopus, the search terms “policy, instrument, renewable, green, effect effectiveness” were used, health sciences were excluded for search results. This enquiry only yielded 6 results, of which 6 were scanned.
For Google Scholar, two trails were used in light of exhaustiveness. The first effort used the terms: “quantitative, empirical, data, evidence, degrees, effectiveness, implementation, policy, instrument, stimulate, promote, increase, green, renewable, energy, sources, technology, innovation, diffusion, production, supply, European union, member states”. 771 results were scanned (the engine yielded 771 articles). For the second attempt, the search terms; “empirical, effectiveness, policy, instruments, green, renewable energy” were used. As a result, 1000 articles were scanned (the engine yielded over 15.000 articles). Some articles were included by means of the snowball-effect.

3.3 Data Collection

This study will employ a meta-evaluation, document analysis. Thus, existing data will be utilized. As mentioned above, empirical studies into the implementation and effectiveness of policy instruments stimulating green energy are viable units of analysis given the goal of this study.

3.4 Data Analysis

A classification of the specific policy instruments that stimulate RES will allow for inferences. If a study presents empirical results that indicate that feed-in tariffs are effective, then a concluding remark may be that subsidy-based policy instruments are suggested to be effective. Since there is no best practice policy instrument, the analysis will look into specific events or factors influencing the effectiveness of policy instruments. This approach allows for inferences, suggestions, and clarifications.

4. Empirical studies

This section will offer an overview of what the available literature reports on the effectiveness of policy instruments employed in the European Union. The section containing the theoretical framework provided a helpful indication of what types of instruments are used by the government for policy implementation. This will be necessary to make a profound analysis of the degrees of effectiveness of policy instruments reported in the available literature.

4.1 Empirical research

This paragraph discusses the literature that utilizes quantitative datasets to investigate the degrees of effectiveness of policy instruments promoting RES. As will be observed below, few authors performed such research.

The basic argument that public policies contribute to the wider use of RES is supported by an empirical research conducted by Marques & Fuinhas (2012). The study used a panel of 23 European countries (that are (in) directly committed to the supra-national authority of the EU) for the time span of 1990-2007 as a data set. The goal of the study is to provide empirical evidence for the argument that public policies are a major driver for the development of RES. Marques et al. (2012) control for other drivers that are suggested by the literature. The authors also categorized the different policies viable for stimulating green energy. This categorization enabled the authors to distillate which policies are suggested by the statistical data to be effective. As argued by the vast amount of theoretical literature, this research shows that subsidy policies (feed-in tariffs, grants, preferential loans, rebates, and third party financing) and policy processes (enhancement of existing policy, institutional creation, project-based programs, and strategic planning) have been effective in stimulating the use of RES. Other instruments with a quota-based backbone, R&D programs, tradable certificates, or instruments of a voluntary nature did not achieve the desired effect. Results of the study indicate the policy-driven logic RES deployment has been established upon, lacking a market-driven basis (Marques & Fuinhas, 2012). Additionally, the results confirmed that other factors might influence the deployment of RES. Instability of policies, lobbying in delaying RE development and energy dependence (on fossil fuels) may hamper the deployment of RES. It needs to be stressed that the importance of stability and continuity in policies promoting RES was indicated by the results. Illustrative to the notion of energy-dependency is the case of the Netherlands; a high dependency on fossil fuels causes a mobility barrier to transit to renewable sources. Jacobsson & Lauber (2006) confirm this in their study on the German diffusion of renewable energy.
Important to note here is that the research conducted Marques & Fuinhas (2012) is one of the few studies that give empirical evidence regarding public policies for renewables in the EU.

The research conducted by Dong (2012) is one of the few studies in the field of the effectiveness of policy instruments encouraging the production of RES that

employs a rigorous empirical test. Dong (2012) employs an econometric test with a panel data set consisting of 53 countries for the period 2005-2009 to investigate which policy instrument is more effective for encouraging wind capacity installment; FIT or RPS? The author controls for the following possible confounding variables: electricity consumption, oil dependency, GDP per capita, wind resources, CO2 intensity, and knowledge of other promotion policies that each country has (Dong, 2012).
The performed tests show that across countries, FIT creates at least 1800 MW more wind power capacity than RPS on average. Worth mentioning is that RPS performs better than no policy at all across countries, which can be related to the findings by Carley (2009) (discussed below). Since uncertainty of future revenue is inherent of RES projects, 'government's reliable commitment and support in the form of FIT is necessary and valuable to promote wind energy development' (Dong, 2012).
Furthermore, Dong (2012) observed that there are substantial variations in the design features of FIT and RPS across countries. This finding backs up the axioms argued by Wiser & Pickle (1998), and Haas et al. (2009).
As is stated in box 1 concerning Germany, and in the appendix concerning the Netherlands, findings of Dong confirm ('a positive correlation between net oil imports and wind capacity deployment' (Dong, 2012) that high oil dependence partially explains the variation in wind capacity development since energy security is an all-time matter on the agenda of countries with high oil dependence on foreign oil.
Interesting finding worth mentioning is that the countries that had adopted both FIT and RPS had the highest mean of total installed wind capacity.

Johnstone et al. (2010) examined the effect of environmental policies on technological innovation regarding renewable energy. While this research focuses on environmental policies, interesting conclusions concerning RES policies are drawn from their findings; public policy has a significant influence in determining patent applications. Johnstone et al. (2010) use a dataset of 25 countries over the period 1978-2003; in which 18 of these countries belong to the European Union. The use of patent account as an appropriate measure for technological innovation is not unambiguous. Advantage of patent counts as an operationalization of technological innovation is that the data is readily available and it focuses on outputs (various operationalizations focus on input; i.e. R&D expenses). However, it has to be mentioned that patent counts do not differentiate in their value (no commercial application of an innovation / an innovation that is highly profitable), variation in propensity to patent across countries, and differences in patent regimes across countries.
Other than the outcome that public policy significantly influences technological development in respect of RES, results also indicate that public expenditures on R&D have a positive and substantial effect on patent activity regarding wind and solar energy. Additionally, it appears that there is variation in the effects of policy instrument type on different types of renewable energy (Johnstone et al., 2010). Thus policy design matters, as argued by Wiser & Pickle (1998). Results show that feed-in tariffs have a positive and significant effect on solar energy (a high-cost technology), while this instrument does not encourage additional innovation for wind power, a more cost-competitive technology. On the contrary,

Renewable Energy Certificates (REC) have a positive and significant effect on wind energy, but not for solar energy.
What is important to note here with regard to this research is that the findings report on the effectiveness of policy instruments in respect of patent activity, and not share of produced renewable energy.

Jenner et al. (2013) performed an econometric study of feed-in tariffs in the EU and used panel data of 1992-2008. The goal of their study was to test the impact of feed-in tariffs on photovoltaic and wind power from 1992 to 2008 in 26 EU MS's. Their results indicated that the design of each policy (see also; Johnstone et al., 2010; Wiser & Pickle, 1998), combined with electricity price and production cost, (market context) are more important determinants of RES development than the sole enforcement of a policy instrument (Jenner et al., 2013). Thus, Jenner et al. (2013) confirm the importance of the context wherein a policy is implemented. Furthermore, while they find robust evidence that FIT policies have driven PV development; this is not the case for wind energy. The policy analysis uses a new indicator for the strength of FIT policies, which takes into account the heterogeneity of relevant instances (tariff rate, contract duration, electricity wholesale price, digression rate, electricity generation cost to develop a measure of the ROI for RES installations in each country-year). This new indicator therefore represents the diversity encountered in analyzing policy instruments and gives way to test for the impact of socioeconomic and political variables (along with policy variables). Jenner et al. (2013) learned to include these variables by referring to other empirical studies that neglected this all-embracing approach (Marques et al., 2010; Marques et al., 2011).

In another research, Söderholm & Klaassen (2007) sought to conduct a quantitative analysis of the main determinants of innovation and diffusion in the European wind power sector. The analysis is performed with a pooled annual time series data set for Denmark, Germany, Spain, and the UK in the period of 1986-2000. Results of the analysis show that the main driving force of diffusion of windmills is the reduction in investment costs, which is due to innovation efforts. As a consequence, changes in public expenses has no direct statistically significant effect, but an indirect effect via the reduction of investment costs. Moreover, coal price increase leads to an increased willingness to invest in new wind turbines (Söderholm & Klaassen, 2007), however when confounded with other power sources, similar outcomes are observed. This means that this outcome is not reliable.
In contrast to other studies, the outcomes show that 'an increase in the feed-in price leads, ceteris paribus, to the installment of more windmills, and this impact is statistically significant' (Söderholm & Klaassen, 2007). However, if feed-in subsidies increase, investors are less inclined to adhere to cost-saving measures (such as low-cost siting, etc.). Another finding is that windmills become less costly as a consequence of continuing diffusion and the subsequent learning-by-doing activities in existing plants, and public R&D support. This means that while diffusion encourages learning, the mechanisms to promote diffusion (feed-in tariffs) may reduce the learning aspect.

Zhang's study (2013) provides similar results as Held et al. (2006) (discussed below). However, Zhang investigates the relation between tariff setting and policy performance with regard to wind power capacity in 35 European countries between 1991-2010, using a dynamic panel data set. Zhang determines that the rate of the tariff does not necessarily lead to an increase in the levels of installed capacity of wind energy. Nevertheless, the duration of the FIT and the guarantee of grid access are significant determinants of policy effectiveness (Zhang, 2013). The author provides an interesting figure; 'A one-year extension of an original 5-year agreement on average increases wind investment by 6 percent annually, while providing an interconnection guarantee almost doubles wind investment in one year' (Zhang, 2013). The study controls for other possible confounding variables (policy design, electricity market conditions). Given the conclusion concerning the weak correlation between incentives and investment, Zhang argues that this might be the consequence of non-economic barriers. This argument was also made by Held et al. (2006) where France, although implementing high rates for FITs, administrative barriers hindered the development of wind energy.

Mulder (2008) states that the reason why there are few empirical studies into the effectiveness of policy instruments in practice (instruments for use of the government to encourage the private sector to provide a good or service which is not profitable, in a non-competitive market) is because of the poor quality and little availability of relevant data. Although the Mulder (2008) acknowledges this major limitation, he still pursues to investigate 'how a government may evaluate an investment incentive structure in a scarce data setting'. He uses IEA/OECD data of the EU (15) in the period 1985-2005 (for wind energy). The data does not make a distinction between ownership classes (public – private), which means that growth figures might be over exaggerated. Additionally, Mulder does not control for possible confounding variables. The author evaluates (an economic analysis) the attractiveness of the incentive schemes by applying four criteria: Tobin's Q, the Euler equation, an investment accelerator model, and the effective marginal tax rate (EMTR), and thereby using a structural investment model and a hypothetical investment in a 1 MW wind power plant (Mulder, 2008).
Results of his research indicate that the mixture of policy instruments becomes irrelevant when incentives are financially attractive (Mulder, 2008). However, analysis of countries individually seems to indicate that policy persistence, and a combination of both investment and production related measures have set off the largest investment levels in wind energy plants. Mulder (2008) also concludes that Germany, Denmark and Spain belong to the best performers regarding what policies worked best (Mulder provided different ways for how to measure effectiveness). These MS have used a mixture of feed-in tariffs, capital investment subsidies, and production subsidies. Mulder raises an interesting point regarding the latter; 'the feed-in tariff, generally considered to be the most effective instrument for encouraging wind power investment, has never been very high in Germany or Spain'. This notion is in coherence with what Held et al. (2006) argue, and enforces the statement of the importance of policy persistence.

Marques et al. (2011) defined a set of factors impacting policy instruments by using a quantile regression approach. Their data set consists of 24 European countries in a time span of 1990-2006. Apart from the goal of their study; determining drivers for the usage of RES in Europe (an end this thesis does not pursue), the authors suggested that if the goal of a policy is to deploy RES, the level of RES use should give indication for policies encouraging usage of RES. Thus, the status quo should be an indicator for the policy to be implemented. Haas et al. (2009) emphasize this as well. In the process of policy making (especially in the initial phase of market-introduction of a RES-technology) lobby pressures from established industries may hinder the development of RES (Marques et al., 2011) (also argued by Toke et al., 2008; and Marques et al., 2010).
Perhaps a remarkable finding of Marques et al. (2011) concerns energy dependency. The authors present that energy dependency is a potential effective driver for promoting RE, but only for low levels of RE use (such is the case in the Netherlands). Plus, the evidence suggests that when a country pursuits to reduce its energy dependency by means of the deployment of RE there is a high energy-import dependency. However, this is not the case if that country produces a significant amount of RE domestically.

Carley (2009) also performed an empirical assessment of public policies stimulating RES. While the data set used for this study constitutes of energy data of 48 American States from 1998 to 2006 (thus, according to the utilized inclusion criteria of this research deemed "not included"), the outcomes of this research do give insights in the effectiveness of policy instruments. The findings of this research reports that Renewable Portfolio Standards has an insignificant association with the share of RES. Or, states that have implemented RPS mechanisms do not have statistically higher rates of RES share deployment than states that do not employ such instrument. However, results also indicate that 'states that have operational RPS policies have significantly higher rates of total renewable energy deployment than states without RPS policies' (Carley, 2009). Thus, inference could be that RPS policies effectively promote total RE investment and deployment but do not effectively increase the percentage of RES generation in states' electricity portfolios.
Since the European Union set targets for RES in the Europe 2020 strategy and adopted the Directive on Electricity Production from Renewable Energy Sources in 2001 (a form of RPS), the outcome might be relevant for the EU.

4.2 Qualitative research

Some researchers took a different approach in analyzing policy instruments. This section offers an overview of what the literature reports regarding qualitative research from different angles.

Research conducted by Bürer & Wüstenhagen (2009) strives to asses the effectiveness of policies used for achieving the targets set by the government for the share of RES by surveying 60 investment professionals from venture capital and private equity funds (from both the U.S. and Europe). While this research does employ its own field research, relying solely on the stated preferences of

the investment professionals might not show high external validity; quantitative data regarding actual investments is not shoring up the qualitative interviews. Bürer & Wüstenhagen (2009) operationalized the effectiveness by observing the extent to which the policy at hand stimulated the professionals' interest to invest in RES technologies. Bürer and her colleague observed that within the realm of 'technology-push' instruments (instruments that increase the amount of technology supply), fund managers preferred government grants for demonstration plants the most. This policy is known to address the most precarious stage in the innovation chain (from R&D project to market); where successful prototypes need to be introduced to the market (Bürer & Wüstenhagen, 2009). Within the realm of market-pull technologies (instruments relevant to the pre-commercial of technology development to the commercial stage), fund managers preferred feed-in tariffs to other policies (including quota-based instruments).
The distinction between two phases in the evolution of a technological system like Bürer & Wüstenhagen (2009) provide, is also argued for in many other studies. These authors also acknowledge that some instruments are more effective in a specific phase (formative period – market formation) (Jacobsson et al., 2004; Johnson and Jacobsson, 2001, Bergek and Jacobsson, 2003).

Lüthi & Prässler (2011) employ their study from a developer's perspective, and strive to measure the impact of policy instruments on developers' decision making, and additionally make recommendations for how policy makers can increase the attractiveness of the policy instruments. Lüthi & Prässler (2011) confirm the findings of Jacobsson & Lauber (2006) and Marques & Fuinhas (2012). Their results show that developers (119 useful respondents, of the 1260 approached wind developers) highly value the mitigation of risk by the government. The authors measured this by means of a conjoint analysis. This analysis constructs the equivalent of a decision-making process to determine which factors are, as perceived by the developers, influential in the decision-making process. Also, developers find legal security and remuneration important factors for mitigating risk. Furthermore, a short duration of the administrative process and favorable grid access regulations are preferred as policy scenarios. Differences between large and small companies are observed as well: small companies prefer legal security; large companies find credit financing support mechanisms important. Lüthi & Prässler (2011) also detected that the most effective policy measures are strongly dependent on the current policy environment. This means that the extent of technological diffusion, the level of market development, and the status of legislation give indications of what policy measures may be the most effective. Sarasin (2009) observed this in practice. In the year 2007, Germany, Spain, and Greece all had implemented feed-in tariffs with a rate of around 45 ct/kWh for solar electricity generators, but the additional capacity installed in 2007 varied from 2MW in Greece to 505MW in Spain to 1,135 MW in Germany (Sarasin, 2009). As shown above, the response rate is fairly low, plus the usage of stated preferences instead of real behavior are limitations to this performed research.

In another study, Lüthi and Wüstenhagen (2012) investigated the influence of the most significant factors of solar energy policies on the decision of a project

developer to invest in a given country. This will contribute to the empirical measuring of the project developers' willingness to accept specific policy risk. This study is employed via the means of a stated preference survey among European solar project developers, with a data set of 1571 choice-decisions by 63 investors. This research gives implications about the price of policy risk for project developers. As previous research indicated as well (Lüthi & Prässler, 2011); the findings show the importance of the duration of the administrative process and political instability (non-economic barriers). This indicates that risk influences PV policy design. The developers perceived administrative process duration and rate of the feed-in tariff respectively as the most important factors in the choice to invest in PV projects. This research is conducted via similar means as Lüthi & Prässler (2011), which thusly shows similar limitations.

4.3 Case studies

This subsection offers an overview of the various case studies that report into the effectiveness of policy instruments stimulating RES. Several types of case studies are discussed.

Jacobsson & Bergek (2004) analyze the diffusion and development of technologies that generate RES in Germany, Sweden and the Netherlands. The authors detect obstacles for policy makers pursuing the transition to a renewable energy sector. There analysis is mainly based on secondary data. The analytical framework they erect embraces the processes were a new technology emerges, is improved and disseminated in society (or; a technological system). The authors analyze the technological system by looking into how a specific set of functions is served in the system. Innovation system literature reports the necessity of serving five functions in a technological system:
- 'Create new knowledge'
- 'The guidance of the direction of search among users and suppliers of technology'
- 'Supply of resources'
- 'Creation of positive external economies'
- 'Formation of markets'

As a next step, the authors illustrate what mechanisms (or factors) induce or block RES technologies.
The analysis points out that the Netherlands lacked a strong sense of legitimacy for RES. Building permits obstructed the diffusion of wind energy despite several market stimulating mechanisms. Actors at the implementation level were not involved and thusly neglected to permit the building of wind turbines. Moreover, throughout their analysis the authors mention the existence of uncertainty, unreliability, and a short duration in the policy instruments of the Netherlands and Sweden. Thus, powerful, predictable and persistent pricing policies are a necessity in the second phase (market formation) in order to successfully serve the function of the formation of a market. Furthermore Jacobsson & Bergek (2004) confirm that the type of policy instrument should differ per renewable energy source. They support this statement with the drawback of the German

EFL subsidy in 1991 which failed to support to stimulate demand for technologies that were more costly than wind power.

Lipp (2007) argues that a clearly stated government commitment is important to transforming to a RES market. The duration of the policy is also of significant importance; a long-term instrument in combination with certainty (e.g. fixed-price) encourages projects developers. Investment will stall if these conditions are not met. Additionally, akin to Jenner's et al. (2013) findings; how the policy is implemented, and how it interacts with other contextual factors and policies impact the effectiveness of policy instruments as well. Lipp (2007) employs a comparative case study. She selects Denmark, Germany and the UK since these countries have implemented different kinds of policy instruments, and possibly show resemblance in contextual factors since they are all highly industrialized nations (FIT / RPS). Lipp concludes that RPS mechanisms provide little certainty in terms of prices paid and contract duration, and that FIT's are both cost effective and meets the needs of the relevant energy sector.
Lund (2007), while focusing on both RE and energy efficient use (the latter not being relevant for this study), examined the effectiveness of policy instruments in creating energy impacts by analyzing 20 policy cases. Inevitably, the findings comprise of the energy impact regarding energy efficiency and RE. This statement should be taken into account when evaluating the findings of the research. Reason why this study is still included is that it provides relevant insights in what types of instruments are the most effective. Lund differentiates between two instruments; subsidies and catalytic measures ('actively utilize market forces to stimulate technology competitiveness and deployment'; e.g. niche management, procurement forms). Interesting finding that Lund states is the influence of the magnitude of the subsidy. The author argues that 'market impacts in the first category (subsidies) are very much dependent on the magnitude of financial support' (Lund, 2007), this finding is in contrast with the outcome of the research of Held et al. (2006) and Zhang (2013). Main conclusion is that subsidies have a higher degree of effectiveness (in terms of impact), when compared to catalytic measures. However, catalytic measures are more cost efficient. This can be explained by the focus of catalytic measures: on the market, end-users and stakeholder involvement. While catalytic measures work for both energy efficient sectors and RE production sectors, it is still not studied whether they are suitable for large-scale energy production.

Fouquet & Johansson (2008) compare FIT and TGC and discuss this with regard to the incentive of the EU to implement an EU-wide TGC scheme. Findings point out that investor risk is lower and innovation incentives are larger under a FIT. Also access parity and faster and more widespread dissemination of RES will occur under the operation of a FIT scheme. The authors consequently determine that an EU-wide TGC scheme is less effective than retaining FIT schemes. Additionally, as argued by various authors to be an influencing factor, the transition to an EU-level scheme may bring about lengthy legal processes that entail as a consequence uncertainty for investors. This uncertainty would in its turn lead to a slow-down in the development of RES. Several secondary datasets are used as evidence to compare the instruments.

Conclusions are also drawn regarding the TGC scheme. Fouquet & Johansson (2008) indicate that TGC markets entail uncertainty since the price level of the certificate is uncertain. As a consequence, investors are less likely inclined to invest in RES projects since the financial situation is unstable. As other authors have find out as well; TGC schemes favour the strongest and most dominant companies.

Held et al. (2006) used the results of EU projects for DG TREN as a basis for their paper. However, the section discussing the methodology does not mention what kind of data sets they have utilized. The authors solely exhibit the calculation method for the indicator of policy effectiveness, but define the concept effectiveness in a profound manner. Held et al. (2006) give an example for their effectiveness indicator concerning wind energy in the EU-25, based on wind on-shore electricity generation from 1998-2005. This indistinct feature in their methodology leaves doubts to whether this is an adequately performed quantitative research. However, the outcomes of this research are relevant with regard to the effectiveness of policy instruments.
Results indicate that the three MS that showed the highest effectiveness (measured by the effectiveness indicator) in the period 1998-2005; Denmark, Germany, and Spain implemented fixed feed-in tariffs. The fixed feature of this mechanism resulted in high investment security, and the presence of low administrative barriers encouraged strong and continuous growth in wind energy. The outcomes also suggest that a long-term and stable (or; 'credible'/ 'certain') policy environment is a key design-feature in enabling the development of RES markets. This argument is supported by the case of France; where high administrative barriers significantly hindered the development of wind energy despite the presence of a stable policy environment and fairly high feed-in tariffs (Held et al., 2006). Also, the level of the feed-in tariffs does not seem to be of significant influence since Germany and Spain did not employ a particularly high feed-in rate. General conclusion is that feed-in tariffs, that embrace low-policy risks, are effective at a relatively low producer profit. Quota-based TGC systems demonstrate low effectiveness but with the possibility of high profit margins. Furthermore, a well-designed (defined as dynamic, which entails a 'learning' aspect, and a 'technology-specific' structure) feed-in system ensures the fastest development of RES projects with the lowest cost for society. While this paper provides us with relevant results, key concepts such as 'administrative barriers' and their level, or 'substantial increase' (of RES capacity) are not operationalized or defined. Moreover, confounding variables are not discussed in the methodology (major change in system; Denmark resulted in lower effectiveness).
Mendonça et al. (2009) argue in the same direction: 'long-term, stable support schemes which allow a multiplicity of actors to invest in the sector will provide a secure basis for development of the industry in a decentralized way.'

Meyer et al. (2007) specify what types of uncertainty are the most dominant source of perceived uncertainty that influence entrepreneurial decision-making (= decision to engage in innovation activities). Additionally, the author's goals are to determine the interaction of perceived uncertainty and motivation with entrepreneurial action in different phases of biomass gasification projects.

Moreover, they strive to give indication of what critical factors influence the perceived uncertainty and motivation of the project developers.
Meyer et al. (2007) have conducted a research via an examination of seven innovation projects that pursue the development and implementation of biomass gasification in the Netherlands (the total population of initiated biomass gasification projects in the Netherlands). While this study reveals empirical results, the methodology finds its base in a case study with 16 interviews as the method for data-collection. By means of a dynamic analysis, Meyer et al. (2007) collected data on various project phases (start-up, implementation, exploitation). The results show that the most dominant uncertainty sources influencing the decision-making of project developers are technological, political and resource uncertainty. The perceived uncertainty is not rigid and may change over time as the dynamic analysis shows. This change in perceived uncertainty is influenced by factors in the internal (actor constitution, temporal duration of the project) and external (economic, institutional change, technological developments) environment of the project. The authors determine these factors on the basis of the interviews and secondary data. The latter statement reduces the scientific significance of this research. The researchers did not perform any quantitative analysis whatsoever; they solely analyzed 'empirical' cases and determined the factors on the basis of their qualitative findings. This research is however useful since it grasps the effect of uncertainty on the decision-making of project developers to some extent. The authors mention that the ambiguity and complexity in the Dutch emission regulation regarding the license of bio-energy plants may determine the perceived political uncertainty.

Wiser & Pickle (1998) argue that the effectiveness of policies is influenced by the neglect of policy makers in taking account of project development and financing processes when designing and implementing RES policies. In their review of five case studies, their findings suggest that policies lacking long-term stability or having negative secondary impacts on investment decisions will increase financing costs, and thereby negatively influencing the effectiveness of the program (Wiser & Pickle, 1998). Wiser & Pickle (1998) specify uncertainty in three ways; 'uncertainty in the eligibility of specific renewables projects to obtain program support', 'a lack of assurance that the policy will be maintained and will still exist when a project comes online, 'and uncertainty in the ability of the program finding mechanisms to provide a long-term predictable revenue stream'. This research has limited value for this research due to its design and U.S. orientated approach.

A research project funded by the German Federal Environment Agency (UBA) and the Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) gave more evidence for the influence of policy instability. The goal of the report was to evaluate the implemented policies for renewable energy in the EU. In this report, Ragwitz et al. (2006) evaluated the effectiveness of policy instruments in terms of different types of RES. The results show implications for wind on-shore electricity generation in 1997-2004. The Member-States that did not conduct a noticeable policy shift during this period showed the highest degree of effectiveness. Germany and Spain showed even higher effectiveness because of the long-term stability the feed-in tariffs provided for. Again low

administrative- and regulative barriers and high investment security supported the deployment of wind energy technologies adequately. The rate of the feed-in tariff is not to be considered a driver for investment regarding these two countries; the level of subsidy showed resemblance with other EU Member-States.
Since solid biomass is the least-cost type of RES, investments made for solid biomass projects are largely under policy instruments that are not technology – specific. Tax measures, quota obligations, and instruments that support the cheapest technologies are therefore the most suitable for this type of RES.
Outcomes regarding the effectiveness of policy instruments for PV energy showed that feed-in tariffs (accompanied by other instruments such as soft loans) are the most effective in supporting PV energy production. In conclusion, Ragwitz et al. (2006) confirm the effectiveness of feed-in tariffs in supporting RES, and show evidence of the importance of policy stability and the removal of administrative barriers (Ragwitz et al., 2006; Coenraads et al., 2006).

Butler and Neuhoff (2008) strived to explore the optimal design for policy instruments to support RES. The authors took the UK and Germany as cases to compare policy instruments that support RES. These two countries were chosen since the support scheme of Germany is characterized by a feed-in mechanism, and the support scheme of the UK is characterized by a tendering scheme. The authors use four indicators to assess the policy instruments: price of power generated, the installed capacity, and by means of a survey on project developers in the UK and Germany; the level of perceived competition and encountered barriers. Butler and Neuhoff (2008) adequately grasp the different approaches for measuring effectiveness. Moreover, by comparing two different support mechanisms, one can clearly observe the differences. However unlike other researchers, Butler and Neuhoff do not control for possible confounding variables (GDP per capita, resources, and so on).
The cost of the feed-in tariff is lower compared to the tendering scheme of the UK. Because of long-term guaranteed prices, the tariff reduces regulatory and market risks. With regard to the installed capacity; Germany exceeds the UK in both absolute capacity and capacity relative to the envisioned policy target. The survey indicated that the level of competition is stronger among turbine producers and constructors (since the greater part of the cost of wind projects involves procurement costs) under the feed-in tariff than the tendering scheme. The obstacle of obtaining planning permission was perceived by all project developers, but to a greater extent by the developers under the UK tendering scheme. Moreover, German developers perceived site selection as the major barrier for the development of RES.

Lüthi (2010) performed a study into factors determining the effectiveness of PV policies in the Mediterranean region (in addition to an analysis of installed capacities). She argues on the basis of her findings that there is a strong correlation between policy risk and market diffusion (PV diffusion is largely unrelated to factors determining level of return). In line with this, Mitchell et al. (2006) have argued that feed-in tariffs are more effective in increasing deployment of RES than quota-systems, since feed-in tariffs reduce the risk for RES generators more effectively. This indicates that installed PV capacity is

shaped by the consistency and stability of the support. The installed capacity does not per se increase proportionally to the level of return (Lüthi, 2010).

Moreover, the complexity and duration of administrative procedures is pointed out as a factor influencing the deployment of RES technologies as well (Lüthi, 2010; Ragwitz et al., 2006). Lüthi's analysis shows that above a certain level of return, risk-related factors are more prominent in investment decisions than return-related factors. While the aim of the study is to investigate the factors influencing the effectiveness of PV policies in the Mediterranean region, the restriction of Lüthi's sample limits the external validity for applying the results to the European Union as a whole. However, this limitation concerns this particular research, but does not influence the validity of Lüthi's research itself.

Wolsink (2007) confirms the role of social acceptance and focuses in his research on the influence of community acceptance on implementation of RES. He argues that local involvement, trust, and local site planning are important for the effectiveness of RES policies. Thus he strives to determine whether the tendency towards top-down planning directed at large-scale developments is an obstacle for successful implementation (of wind power). Wolsink employs a secondary and extended analysis of existing data collected amid 1986 and 2002 of comparative studies. This data comprises of large-scale structured surveys that provide adequate statistical analysis
Two limitations exist for Wolsink's research. Which is firstly the data collection method; he collected data from previous comparative studies, which means that the limitations inherent in those studies count for Wolsink as well. Moreover, Wolsink strives to draw conclusions on other RES as well, by means of analogical reasoning. This of course is not supported by data.

Toke et al. (2008) reason in the same line and put emphasis on planning regimes: positive and supportive planning regimes for wind power are necessities for successful wind power deployment programmes. This means that decisions on siting and planning should be taken at the level where actual implementation takes place. Additionally, Toke et al. (2008) argue that dominant ideological preferences in countries and their governments, plus the bargaining power of different sectors (i.e. energy) affect policy-making processes. The goal of the study is to investigate factors (identified as institutional variables) affecting wind power deployment. The authors utilize the same methodology as Wolsink (2007) namely; secondary data. What is interesting to point out, is that Toke et al. (2008) explicitly argue for why they employ an analytical method, instead of a quantitative assessment. Given the goal and analytical approach of the study, statistical generalization simply does not fit. Additionally, unlike other studies, the authors explore the resources variable as well, and conclude that this factor, obviously, is a potential determinant of the amount of wind energy likely to be deployed. Furthermore, Toke et al. (2008) discovered the essence of a consistent system of generous and reliable subsidies for wind power deployment.

Also, Lipp (2007) argues that the inclusion of different stakeholders benefits the deployment of RES technology. This means that the interests of the public actors, as well as private actors should be included. Mendonça (2009) and his colleagues

acknowledge the importance of local acceptance, and long-term stable support schemes as well.

Boomsma et al. (2012) investigate investment behavior under feed-in tariffs and renewable energy certificate trading. The authors take account of uncertainty under each support scheme and uncertainty related to a change of support scheme. Boomsma et al. (2012) examine investment behavior of private investors for wind energy in Nordic countries. The findings show that the FIT stimulates earlier investment. When investment has been carried out, REC trading encourages the development of larger projects.

In contrast to this observation, Jacobsson et al. (2009) point out various negative experiences with the implementation of REC (or as Jacobsson and his collagues classify as; Tradable Green Certificates). The authors make effort to convince the Commission that a harmonized TGC-scheme is right approach for RES development in Europe. The authors thusly suggest that policy makers should look into MS's experiences with TGC's and raise Sweden, Flanders and the UK as prime examples. It is found out that TGC's; favour dominant companies, stimulate investment in mature technologies and that the domestic demand fails to encourage the development of less mature technologies, and that this scheme is inclined to locate high levels of excess profits to dominant actors and mature technologies (also observed by Verbruggen (2009).

Bergek & Jacobsson (2003) compared the Netherlands, Sweden an Germany to explore the processes behind the performance of these countries to stimulate wind turbines industry. The authors observed that Germany is the most successful country and want to explain the success of the German industry. Bergek & Jacobsson (2003) base their research on a large amount of interviews and secondary data. The authors conduct an analytical framework to investigate what factors induced certain functions of the selected technological systems, and what mechanisms blocked the emergence of the innovation system. Bergek and her colleague formulate various policy implications on the basis of their comparative case study. First, R&D expenditure in absolute numbers has no significant impact, it is rather how these funds are spend and how they can generate more resources. Second, Bergek & Jacobsson (2003) make a statement concerning the creation of knowledge and thereby the direction of search (regarding technological choice). In case of technological uncertainty, diversity of technologies is important. One cannot determine which technology will be successful, so all options will have to be left open. As other authors have argued as well; legitimacy is important for firms to enter the industry. Institutional changes or administrative barriers can be made or eradicated difficult without legitimacy. Once again, Bergek & Jacobsson (2003) also conclude that the creation of 'powerful, predictable and persistent economic incentives' is associated with the establishment of variety (in technology). Moreover, non-economic barriers can hinder economic incentives such as subsidies to the extent that they have limited effect.

Menanteau et al. (2003) compare feed-in mechanisms with bidding systems and draw remarkable conclusions. However, this article needs to be placed in a

certain context. This highly cited article is well known in the field of policy analysis of RES instruments. Despite its pivotal position, the research itself is shows flaws. The authors argue for several factors influencing the operation of policy instruments, but argue this on the basis of data set providing the differences between countries (Germany, Spain, Denmark, UK, Ireland, France) in two points of time regarding wind energy capacity. As a result, their arguments such as: 'the considerably lower purchase prices obtained through bidding systems under the pressure of competition limit the margins with respect to risk and thus result in much more limited installed capacities' (Menanteau et al., 2003), are possible effects of policy instruments, but not tested rigorously. Hence, the results regarding factors influencing RES effectiveness are loosely connected to the empirical data, the authors do not control for confounding variables.

5. Conclusions

This chapter is divided in two subsections. The first subparagraph will give the conclusion made on basis of what the empirical studies report on the effectiveness of policy instruments stimulating RES. The second subsection will offer an evaluation of the analyzed literature.

5.1 Conclusion based on the articles

Policies
Several conclusions can be made on the basis of the performed literature review. Firstly, a step that the majority of the authors miss out on is to provide evidence whether public policies actually help to develop RES. Marquis & Fuinhas (2012) and Johnstone et al. (2010) do take this step and determine that public policies support the wider use of RES.

As outlined in the theoretical framework, there are a lot of policy instruments that governments have at their disposal to stimulate green energy. However, solely feed-in tariffs and RPS (quotas/renewable certificates) comprise the majority of the literature into the effectiveness of policy instruments. The authors mostly assume the perspective of price-based versus quota-based models of support. In general, outcomes of these studies into the comparison of these instruments conclude that FITs are effective (Marques & Fuinhas, 2012; Jenner et al., 2013; Söderholm & Klaassen, 2007; Held et al., 2006; Ragwitz et al., 2006; Butler & Neuhoff, 2008; Lüthi, 2010), or more effective than RPS (Dong, 2012; Lipp, 2007; Lund, 2007; Menanteau et al., 2003; Mitchell et al., 2006; Fouquet & Johansson, 2008) in promoting RES. Carley (2009) argues that RPS are not effective in promoting RES, but are better than operating no policy at all. Also, RPS provide for little certainty (Lipp, 2007). It seems as though mixed intstruments (as defined by Howlett & Ramesh (1995) are more effective than voluntary instruments (i.e. the Netherlands). In general it can thus be said that subsidy-based instruments are by the current literature observed to be effective instruments in promoting RES. In addition, compulsory instruments (regulations) or in RES policy terms 'quota-based mechanisms' are observed by the literature as relatively ineffective.

Jacobsson et al. (2009) observe that TGC's favour dominant companies, stimulate investment in mature technologies and that the domestic demand fails to encourage the development of less mature technologies, and that this scheme is inclined to locate high levels of excess profits to dominant actors and mature technologies (which is also observed by Verbruggen (2009) and Fouquet & Johansson, (2008).

Factors influencing policy effectiveness
The literature has derived numerous factors that influence the effectiveness of policy instruments. Many authors conclude that certainty, risk mitigation, stability, continuity, reliable commitment of the government, legitimacy, policy stability, and lobby pressures of existing industries influence

the effectiveness of the policy instruments (Marques & Fuinhas, 2012; Dong, 2012; Zhang, 2013; Mulder, 2008; Marques et al., 2011; Lüthi & Prässler, 2011; Lüthi & Wüstenhagen, 2012; Lipp, 2007; Held et al., 2006; Meyer et al., 2007; Wiser & Pickle, 1998; Ragwitz et al., 2006; Butler & Neuhoff, 2008; Lüthi, 2010; Mendonça et al., 2009; Bergek & Jacobsson, 2003; Jacobsson & Bergek, 2004). Reason why most authors argue that the FIT is effective, or more effective than RPS in stimulating RES is that the FIT reduces the influence of these unwelcome factors. FIT's reduce risk, provide certainty, give stability, enhance investment security, provide access parity, faster and more widespread deployment of RES and induce investments.

Regarding TGC mechanisms, Fouquet & Johansson (2008) indicate that TGC markets entail uncertainty since the price level of the certificate is uncertain. As a consequence, investors are less likely inclined to invest in RES projects.

Policy design

Close to this is the share of authors who argue that policy design matters (Dong, 2012; Johnstone et al., 2010; Jenner et al., 2013; Wiser & Pickle, 1998; Held et al., 2006; Jacobsson & Bergek, 2004). Findings show that FITs are effective in encouraging the development of PV power (high-cost technology), but do not lead to additional installed capacity of wind energy (cost-competitive) (Johnstone et al., 2010; Jenner et al., 2013). It is suggested that policy makers should take into account project development and financing processes (Wiser & Pickle, 1998).

Söderholm & Klaassen (2007) argue that feed in tariffs yield a double-edged sword; on the one hand an increase in the level of FITs leads to additional wind energy installments, and on the other hand, this high rate causes investors to be less inclined to adhere to cost-saving measures; thus it might induce a reduction in learning.

In line with this, is the discussion based on the rate of the tariff. Authors do not reach a consensus on whether the level of the FIT matters (Söderholm & Klaassen, 2007; Lund, 2007; Lüthi & Wüstenhagen, 2012), or not (Zhang, 2013; Mulder, 2008; Held et al., 2006; Ragwitz et al., 2006). Furthermore, a research by Bürer & Wüstenhagen (2009) suggests that the timing and policy type are relevant; specific policies are effective in different stages of the innovation process.

Lüthi & Prässler (2010) find out that there is a difference among the preferences of small and large companies; small companies prefer legal security while large companies have the preference of credit financing support mechanisms.

Boomsma et al. (2012) determine that the FIT stimulates earlier investment. When investment has been carried out, REC trading encourages the development of larger projects.

Mulder (2008) takes a birds-eye view and argues that the mixture of policy instruments does not matter, but the financial attractiveness is key in the attractiveness of incentives. However, Lüthi (2010) argues that risk-related

factors become more important in investment decisions than return-related factors above a certain level of return. Still, some authors argue that R&D expenditures directly or indirectly influence the development of RES (Johnstone et al., 2010; Söderholm & Klaassen, 2007). Bergek & Jacobsson (2003) find out that R&D expenditure in absolute numbers has no significant impact, it is rather how these funds are spend and how they can generate more resources. Moreover, the stimulation of a variety of RES technologies is important in case of technological uncertainty.

Jacobsson et al. (2009) found out that TGC's favour dominant companies, stimulate investment in mature technologies and that the domestic demand fails to encourage the development of less mature technologies, and that this scheme is inclined to locate high levels of excess profits to dominant actors and mature technologies (also observed by Verbruggen (2009).

Context
Moreover researchers seem to agree that the context is important in determining the effectiveness of policy instruments. This strand of outcomes therefore gives implications on the importance of the CIT theory. The policy environment, investment security, the status quo of the technological development, energy dependency, the complexity or duration of administrative procedures, planning permissions, site selection, grid access, ideological preferences of the government, and other non-economic barriers shape the operation of the policy instruments. (Marquis & Fuinhas, 2012; Jenner et al., 2013; Zhang, 2013; Marques et al., 2011; Lüthi & Prässler, 2011; Lüthi & Wüstenhagen, 2012; Lipp, 2007; Held et al., 2006; Ragwitz et al., 2006; Butler & Neuhoff, 2008; Lüthi, 2010; Toke et al., 2008; Jacobsson & Bergek, 2004; Bergek & Jacobsson, 2003).

Another strand of authors argues that social acceptance, local site planning and local involvement of stakeholders (at the implementation level) are key factors in shaping the development of RES (Wolsink, 2007; Toke et al., 2008; Lipp; 2007; Jacobsson & Bergek, 2004).

Different perspectives
Some authors apply different perspectives (fund managers or developers) instead of analyzing policies from the top-down approach and conclude that risk mitigation (legal security and remuneration are factors for mitigating risk), grid access, short administrative processes, dependency of effectiveness of policy instruments on the policy environment, political instability and level of support influence the decision made by actors to develop or fund RES projects.

5.2 Evaluation

During the process of searching empirical studies into the effectiveness of policy instrument promoting renewables, it became apparent that this particular research field finds a lack of representation. The vast amount of search results that were yielded with use of specific key words and subsequently analyzed only included a handful of profound empirical studies. What probably strikes the ability to conduct quantitative research on this matter the most is the absence of

comprehensive data. Various authors acknowledge the lack of data and predominantly use a variety of information sources to conduct their research (that may vary in quality). As a consequence of this lacking, profound quantitative analysis and rigorous tests are performed in scarcity. As a consequence, the literature mainly exists of case studies (or comparisons), which have limited reliability and external validity.

As contemplated by the Contextual Interaction Theory, context matters. But whether the context is more of an influence than the policy instrument itself is not clear. While some authors control for possible confounding variables and acknowledge the importance of the context and policy environment, others ignore these potential factors of influence and attribute the degrees of effectiveness solely to the policy instrument at hand. It needs to be stressed that it causes difficulties when one tries to isolate the effect of a policy instrument. It needs to be stressed that the literature only controls for a limited amount of context variables. Perhaps the economic crisis of 2008 made consumers or firms more likely to adopt RES projects to increase their own energy security.

Regarding the statement above - the importance of context and confounding variables - it is difficult to assess the effectiveness of a policy mechanism based on the available data. Information about i.e. installed capacity is not likely to meet the demands of a comprehensive data source that will suit empirical research. To illustrate this, imagine that two MS use FITs as the dominant policy mechanism to stimulate renewables and one of these MS comes out as the top player in the development of green energy, one simply has to recognize that other factors are involved. Thus, the best practice school of thought cannot be applied to this particular issue. Still, various authors seem to imply the 'superiority' of feed-in tariffs.

Another observation regarding the analysis of the articles is that the majority of the studies focuses on either the effectiveness of feed-in tariffs, or compares the latter with Renewable Portfolio Standards. As stated in the theoretical framework, policy instruments stimulating RES come in various forms. While it is true that FITs and RPS belong to the most popular instruments, other policies (in the articles mostly defined as 'policy mixtures') are not placed under investigation. Consequently, policies that are not examined may interfere with the outcomes of the research.
Also, the analyzed literature predominantly compares FITs with other mechanisms. To gain more insights in how the effectiveness of policy instruments are influenced, an option could be to compare MS that have implemented FITs, and determine what factors are of significant influence.

Another relevant finding is that the greater part of the analyzed articles examine the effectiveness of policy instruments in the light of either wind energy or, increasingly, solar power. This is obviously a sound approach, since these RES are relatively well developed (in terms of innovation, effectiveness and market introduction) and socially accepted (the majority of the authors acknowledge this). However, this does not mean that the focus should tilt to solely using or developing these RES, instead of including other renewable energy sources.

It is clear that several issues characterize the empirical studies that report on the degrees of effectiveness of policy instruments promoting RES. But why are the outcomes of these studies important?
As mentioned by the Marques & Fuinhas (2012) and Johnstone et al. (2012), public policies (directly or indirectly) influence the development of renewable energy. This finding gives reason enough as to why it is important that empirical studies examine the degrees of effectiveness of policy instruments. Moreover, since the government can take different approaches in tackling public issues (voluntary, regulatory, mixture), data concerning the effectiveness of these approaches will be of crucial importance. As the literature concurs, uncertainty and risk differ in magnitude under varying policies (FIT-RPS). Thus, determining the policy instruments that is the least affected by such factors should be the one that is the most effective in achieving its target.

6. Recommendations

This chapter will give recommendations on the basis of the analyzed and evaluated literature. This chapter is divided in two subsections; firstly; recommendations are made for future research into the effectiveness of policy instruments, second; recommendations are made for the Dutch case.

6.1 Recommendations for future research

On the basis of the evaluation in chapter 7, several directions can be mentioned for future research.
First of all, future studies should grasp the entirety of policy instruments implemented in MS's. While some instruments may form the backbone of a country's policy approach, several additional supporting instruments may significantly impact the effectiveness of the dominant policy instrument. A broader view will hopefully abolish the feed-in tariff versus quota obligations/renewable portfolio standards perspective extensively applied in the current literature. This mixture of policies, obviously, corresponds with the environment.

As the majority of the studies recognized, several factors may influence the effectiveness of policy instruments. Thus, future research should not only strive to account for these variables but, in respect of the CIT theory, also determine whether policies are the strongest influence in developing RES, or that other factors are more relevant.

As stated by Bergek & Jacobsson (2003), governments cannot determine which energy source will be the most effective and thus diversity of technologies is important. This denotes that future studies should look into other less popular renewable energy sources as well.
A general issue for all researchers in the field of policy analysis regarding RES is that there is a lack of data. Setting up an organization that collects and measures the increase in domestically produced green energy, fostered innovation, installed capacity, and achieved targets.

6.2 Recommendations for the Netherlands

The policy analysis of the Netherlands (located in the appendix) gives insight into the peculiarities of the Dutch policy instruments. The Dutch stop-and-go policies gave project developers little certainty and stability. Thus policies left little room for long-term reliability. During the 90's and the beginning of the 21st century, policies shifted from a consumer-focused approach towards a producer-focused approach. While the demand rose to 1.4 million customers, the supply-side could not meet the demand. This indicates that demand-orientated policies are in principle not effective in promoting the development of RES. Moreover, the Dutch government failed to lower administrative- barriers, and –bottlenecks, and the complexity of the procedures left private actors unable to fully benefit from the provided support. Moreover, innovation is not stimulated due to the

cap on subsidies. As a consequence of this cap, the annual budget is in the majority of the cases not sufficient for the applications of higher subsidies for costly projects.
The Netherlands would benefit from a shift of focus of their policy instruments. It seems as though the Dutch government focuses on four policy targets; increasing innovation, increasing efficiency, reducing CO2 emissions via nuclear energy, CCS and ETS, strengthening the energy infrastructure and grid access. Renewable energy has a small role in this matter.

In the Energy report of 2011; the Dutch Ministry of Economic Affairs aims at increasing the R&D expenditure to make RES more competitive and profitable. Only a small part in the literature argues for the increased expenditure on R&D, and additionally the validity of these findings is highly arguable. It is more important how these funds are spent.
Energy efficiency is addressed via the "Green Deal" and asks for the involvement of both the government and society. This instrument involves societal aspects, previously omitted by the Dutch government.
Also, The Netherlands put emphasis on the importance of the European Emission Trading Scheme in reducing CO2 emission, plus the utility of nuclear power plants. These nuclear plants are partly used as a means to reduce the dependence on energy imports.
Regarding issues of site planning: instead of integrating local actors and interests, the Dutch government determines viable sites via a top-down approach.

Various recommendations van be made on the basis of the Dutch' approach to increasing the production of renewables.
Firstly the government should direct public expenses to policy instruments of different designs, instead of predominantly focusing on R&D expenditure. These policy instruments should differentiate between the various types of renewable energy technologies (e.g. FITs do not lead to additional installed capacity for wind). Most importantly, the different types of renewable energy are not at the same level regarding their development. Thus, the Dutch government should apply more technology-push centered policies for the one RES, while implementing more market-pull focused policies for the other. In the current approach, the government solely focuses on technology push instruments, trying to boost innovation. The ministry foresees that companies will profit by selling patents. However, this approach excludes actors willing to produce green energy and ignores the need of technological diffusion of RES in society and not only in the energy market.

Second, policy instruments should extend over longer periods of time and as a consequence increase the policy certainty and reliability. In other words, for example a FIT should guarantee a specific rate over a certain time period. This rate should be determined with care since a rate that is too high disturbs the learning processes of investors. However, implementing a feed in-tariff is not sufficient. Administrative barriers should be reduced since they might hamper the effectiveness of the FIT. In light of this, investment climate should be made stable to attract project developers and increase financial attractiveness.

Thirdly, as indicated by the literature; local involvement is important to the deployment of RES. Thus, instead of site planning on the national level, the government should include the interests of local stakeholders and take decision-making procedures to the implementation level.

Fourth, the Dutch ministry seeks to achieve its goals in concurrence with the grey energy sector. However, as indicated by various articles, the lobbying pressure of these actors can obstruct RES development. Thus, the Dutch government should reduce its dependence on this archaic energy regime.

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8. Appendix

8.1 The Netherlands: an in-depth policy analysis and evaluation of the period 1974-2011

8.1.1 Analysis

1974-1989
The Netherlands has a long history with policy instruments that support renewable energy sources. Dutch policies stimulating RES not only differed in type (feed-in tariffs, quotas), but also in their focus (demand, supply) (Agnolucci, 2007).

The energy crisis of 1973 led to a paradigm shift among the Dutch policy makers. Energy differentiation was acknowledged to be an important aspect in energy security. Consequently, the Dutch government affirmed the potential role of renewable energies. However, in the 1974 White Paper, consensus was that RES would not provide a significant market share in energy production between 1975 and 1985 (Ministerie van Economische Zaken [EZ], 1974). The Dutch government was convinced that wind turbine technology would be the first viable RES, and consequently developed supportive programs for the development of wind turbine technology (EZ, 1974, Dinica & Arentsen, 2001).

The Electricity Act 1989 initiated the Dutch incentive to liberalize the energy market. The act gave guaranteed demand for de-centralized producers of electricity. This was of great advantage for renewable generators. Additionally, price floors would ensure an adequate remuneration, but in practice this was not quite the case (Dinica & Arentsen, 2001). The Electricity Act in 1998 put even more restrictions on the remuneration received by de-central generators. This price floor was calculated on the basis of average avoided costs, and in the end formulas to calculate the price were negotiated by the distributors and private producers. The government did not have any jurisdiction in this matter. These two reasons contributed to a weak guaranteed demand for RES.

1990-2001
The 1974 White Paper was followed up in 1990 by a new policy initiative, namely; the introduction of the first national environmental program (Nota Energiebesparing) in the Netherlands. This program stressed the importance of sustainability and strived to achieve this via energy savings and RES. Pivotal in this program was the stakeholder approach; the government identified sectors that would receive different obligations regarding sustainable energy. Different kinds of policy instruments were used in this program: Information and subsidies (mixed instruments), regulations (compulsory instrument), priming the role of utility companies (distribution sector) and cooperating with administrative authorities (mixed instrument), stimulation of Research & Development.

Energy distribution companies took initiative in correspondence with the national government to set up a voluntary program, known as the Environmental Action Plan (Milieu Actie Plan (MAP))(EZ, 1990). The Dutch government stated the pivotal role of the distribution sector. According to the program, the distribution sector is more close to the energy consumer than the national government and therefore the relationship of supply and demand (utility company – consumer) is suitable to be utilized for stimulating energy savings. Thus, the Dutch government uses a market based approach but with ties to the government (mixed instrument).

The energy distribution sector, represented by EnergieNed replaced the former MAP by MAP-II. Two approaches were conducted in decreasing the CO2 emissions: addressing consumption by limiting the demand for energy (consumers), and enabling the production of RES that addresses the supply side (producers). Measures that were perceived to have a high cost-effectiveness were prevalent (Energieonderzoek Centrum Nederland [ECN], 1994). The MAP-II scheme set more ambitious targets for decreasing CO2-emissions: from 4.6 million tons of CO2 emission to 11 million tons, and was more effective than the first MAP scheme (ECN, 1994)

The consensus formulated in MAP-II addressed the period of 1991-2000 and acknowledged the pivotal role of RES, and provided a framework for later RES policies. The MAP-II focused on three groups: households, firms and the government, and the energy distribution sector. Goal of this scheme was to decrease the CO2-emission. Stakeholder organization EnergieNed supported public authorities in enforcing MAP by stressing energy efficiency, stimulating energy-saving technology and producing RES.

RES were promoted by the MAP levy as well as the governmental support out of public resources (Dinica & Arentsen, 2001). The increase in consumer tariffs (MAP levy) supported the investment in RES projects. Funds collected from this scheme were returned to distributors and generators applying for production or investment subsidies. However, the MAP levy favored energy distributors above energy generators, and specific types of technologies (wind turbines and co-generation plants (Dinica & Arentsen, 2001). The MAP-II scheme did help RES through the first phase of market implementation; demonstration and introduction.

The follow up paper in 1994 took the same stakeholder approach as the Nota Energiebesparing in 1990. Once again, the Dutch government acknowledged the important role of intermediate organizations in linking supply and demand (utility companies). Public authorities assumed a role of regulation and stimulation (EZ, 1993). The strategy conducted by the Dutch authorities to ensure society with “clean, affordable and reliable energy till 2000” was of a voluntary nature. Incentive was to eradicate institutional restrictions to the energy market and making the market self regulatory (EZ, 1993). Moreover, exhortation and subsidies (fiscal incentives, reward incentives, tariffs) were again placed in the arsenal of policy instruments. Additionally, Research & Development received attention in stimulating innovation.

Stimulating RES in MAP-II was primarily done by the means of subsidies and feed-in tariffs (ECN, 1994). The share of RES was set for 2.8% by the end of 2000. But, MAP-II and the White Paper of 1994 stressed energy efficiency and savings, postponing the potential role of RES after 2000.

The Dutch government published the third White Paper in 1996, setting targets for energy efficiency and RES specifically (RES in an implementation program published in 1997 by EZ). In the period of 1995-2020, 10% of the total energy consumption in The Netherlands would have to be from RES. The government did not exclude import as a means for supply. As a consequence, import of green energy increased dramatically, pointing out the importance of terminology (Reijnders, 2002).

Incentives to intensify market-introduction for RES clashed with the intentions to liberalize the energy market (EZ, 1996). Previous instruments to stimulate RES were focused on utility companies selling a minimum target of RES to contracted consumers. However, since consumers now receive the opportunity to switch energy supplier, this instrument would not be effective anymore. Consequently, fiscal incentives would be the best option (EZ, 1996).

Policy instruments effectuated to achieve the targets were set up in an action plan (EZ, 1996; EZ, 1997):

Market Penetration

- Tax exemptions for generating or importing firms of green energy, or production subsidy (Regulerende Energiebelasting; REB*, **). Zero rate in 1998 for RE that are passed on to consumers under the heading of a green electricity contract.
- Tax increase for electricity and gas (REB)
- Green electricity products for voluntary purchase: schemes made by distributor companies for consumers who are willing to pay extra for RES. Funds are used for subsidies for investment or production by distributor or generator companies that did not receive a MAP levy (consumers do not have to pay for the MAP-levy on top of this tariff) (Dinica & Arentsen, 2001).
- Tax exemptions on interest received by investing in funds for green energy (green funds)
- VAMIL (or; accelerated depreciation): scheme where investors may choose when they benefit from the support: it increases the firm's profits in the first phases of the RES project, and reduces it later.
- Investment costs subtraction for green energy technologies

- Initiative of distribution firms to increase the application of RES among consumers
- Initiatives of distribution sector in MAP-II scheme: Green label trading system: provided for 1500 GWh generated by RES in the years 1998-2000. This was a voluntary scheme initiated by the energy sector (Dinica & Arentsen, 2001)

Technology Push

- Increase of budget for R&D, coordinate R&D among the various organizations involved to make sure all go the same direction (direct financial incentive)
- Targeting the uncertain first phase of new technologies by providing market introduction and demonstration projects out of public resources

(*The REB tax scheme was effective in two ways: it encouraged the demand for green energy by increasing the price level of fossil fuels. Consumers will subscribe for voluntary green electricity schemes. Plus, RES generators receive subsidy and are encouraged to invest in new green projects. Additionally, because of the rising level of the REB tax, and the conditions of green electricity schemes, some distributors were able to offer green energy at the same price of conventional energy (Dinica & Arentsen, 2001))

(**REB is later on replaced by MEP)

EZ included amendments for the Electricity Act in 1998 that would enter into force in 2001. The Electricity Act 1998 contributed to the incentive of the Dutch government to liberalize the energy market. The government increasingly alters its role as actor (as owner of energy companies) and regulator, to solely regulative tasks (EZ, 1999). The government switches from public enterprises instruments to more voluntary and mixed instruments.

Among others, one of the clauses included was the minimum amount of electricity generated by green energy. To prove that the share of green energy is achieved, consumers or distributors must be able to present green certificates. The green certificate proves that the electricity producer transported a certain amount of green energy to a distributor or consumer in a specific time period. These green certificates are tradable, this is known as the Tradable Certificate System (EZ, 1997). However, obligating a guaranteed share of green energy addresses the demand side, and does not resolve issues concerning the supply side (location-, permits-, and investment issues) (EZ, 1999). Therefore, the green certificate system along with the stimulation of both supply and demand would be a viable solution according to the Dutch authorities (EZ, 1999). An obligated share of green energy would have to be allocated to the supply side in order to be effective. However, this instrument rather establishes a separate green market, than integrating RES in one market (Fraser et al., 1998).

2002-2011

An evaluation report published by EZ in 2002 observed an increase in demand for green energy, but the inability of the supply side to meet this demand. Spatial planning and investment climate are the two factors that hinder the supply of green energy (EZ, 2002). The Netherlands' is not able to achieve the targets set for RES by domestic supply. Therefore, another means to realize the target is the import of green energy. This notion cannot be ignored; the Netherlands relied on supply outside the realm of its domestic capabilities. Thus, after 2003 policies

were more focused in supporting the supply-side. Moreover, the energy report stated that there was a lack of investment climate stability.

The Netherlands took a new approach to transfer to a low-carbon economy; transition management (EZ, 2002; EZ, 2004). It included a long-term policy; based on energy research funded by public resources, the inclusion of all relevant target groups in resolving barriers and formulating common goals. This transition approach was not effective as observed by Kern & Smith (2008). This is because actors in the incumbent energy regime are dominant and hinder system innovation and structural change. Therefore, technology-push received most attention, neglecting other learning processes important for transition management and implementation (Verbong et al., 2008; Kern & Smith, 2008). Additionally, the narrow social network involved in the policy process contributed to the technology push approach (large firms, knowledge institutes, stakeholder organizations) (Verbong et al., 2008).

In 2003, the Dutch government implemented a subsidy scheme for domestic producers, MEP ((Mileukwaliteit van de Elektriciteitsproductie). Foreign RES producers could not be excluded from the REB-exemption because of EU regulation. Therefore, the MEP was introduced to stop the loss of subsidy to foreign producers (because of the relative high share of green energy imports) (EZ, 2005). The cost-efficiency and cost-effectiveness were the drivers for the Dutch government to revise the REB-exemption. MEP was a flexible tariff determining the amount of subsidy allocated relative to the development and scale benefits of the technology in concern. The MEP differentiated between technologies (such as solar-, and windpower) for RES. Main objectives were to reduce investment risk and to improve the cost-effectiveness of RES (Rooijen & Wees, 2006).

Research commissioned by the Tweede Kamer observed that the MEP-subsidy scheme was too costly as well (Algemene Rekenkamer [AR], 2007). The scheme was abolished in 2006 and superseded by a new policy instrument. In pursuit of more ambitious targets (20% RES in 2020, (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer [VROM], 2007)) for reducing CO2 emissions, the Dutch government replaced MEP by a new scheme; Stimulering Duurzame Energie (SDE) in 2008. Differences between the two schemes were that SDE was to be financed completely by direct government support, and projects were selected through tendering (International Energy Agency [IEA], 2012). Additionally, the sum of subsidy is dependent on the prices of fossil fuels. Under the SDE, producers enjoy a fixed price per kWh. Consequently, when the electricity price exceeds the feed-in tariff price, no subsidy is rewarded to the producers; a flexible feed-in tariff (IEA, 2012).

The SDE was later on superseded by SDE+ in 2011. This policy scheme benefits the cheapest technologies producing RES. Cheap technologies can apply for subsidy in the first place, costly technologies may apply for higher subsidies, but are only granted these subsidies if the annual budget meets their demand (IEA, 2012).

8.1.2 Evaluation

In conclusion the policy approach of the Netherlands in the 90's and beginning of the 21st century is primarily based on market stimulation, regulation and voluntary agreements (EZ, 2002). The early 90's was characterized by voluntary agreements of the government with the energy distribution sector, setting goals for green energy sales.

Wind energy cost recovery incentives were initiated throughout the 90's, while bio-mass and solar PV technologies were only supported in the beginning of the 90's (Dinica & Arentsen, 2001). Additionally, wind energy mostly received support for demonstration projects, while solar PV and biomass received support for demonstration and market introduction projects.

Subsidies till 1996 supported market introduction and financed 25-35% of the total project costs of the RES. After 1996, subsidies were mostly allocated to demonstration projects that financed 25 – 40% of the investment. Production subsidies were cut short (Dinica & Arentsen, 2001).

Distributors had the highest market share as investors of RES because they allocated the financial resources in the Electricity Act and the MAP levies. Although private and utility generators had equal access to the fiscal and financial support schemes, private actors enjoyed them to a lesser extent because the incentives were in principle too complex for correct and timely application (Dinica & Arentsen, 2001). Actors involved were not sure were the responsibility in RES promotion lay; in the consumer or producer? Revenue was difficult to calculate, and burden sharing was not clear (Dinica & Arentsen, 2001; Rooijen & Wees, 2006).

Although the target for the Dutch government was the supply side between 1996-2001 in reducing administrative bottlenecks (spatial planning) and providing a stable investment climate, policies were mainly directed at the consumer. The policies were flexible, but mostly ineffective (Rooijen & Wees, 2006; Agnolucci, 2007).

From 1996, the focus was on demand with the introduction of the REB tax. This did not lead to new green energy projects but to increased imports (Dinica & Arentsen, 2001; Rooijen & Wees, 2006). From 2003 on, the focus shifted to the production side with newly implemented, regulated feed-in tariffs.

Green electricity schemes did not initiate investment in new technologies or expansion of the installation of green technologies (Dinica & Arentsen, 2001). Subsidies were not reliable in the long-term; varying extent and different criteria applied from time to time. Additionally, policies focused too much on fiscal and financial instruments instead of social, administrative and institutional aspects of new technology diffusion. These factors are pivotal for transition management (Kern & Smith, 2008). Also, the focus on new technology diffusion in energy market prevailed, instead of diffusion in society (Dinica & Arentsen, 2001).

Throughout the policy history of the Netherlands, targets set by the government, or targets set voluntarily by the energy sector were not achieved. Plus the targets were always of a voluntary nature (Rooijen & Wees, 2006). Additionally, stable and long-term policies were absent (Dinica & Arentsen, 2001; Agnolucci, 2007; Verbong, et al., 2008). The only stable policy was REB. Lastly, the transition of market diffusion subsidies to demonstration projects subsidies was too rapid.

8.2 The case of Germany

Germany did not own any large oil corporations or resources, it was dependent on domestic coal and later on nuclear energy. The rise of various movements combating nuclear energy and the externalities of coal, along with the Chernobyl crisis provided drivers for transforming the energy system (Jacobsson & Lauber, 2005). Germany's policy process is characterized by the introduction of R&D programs that are flexible in funding and large enough to fund the majority of project that are applied for. This developed a strong knowledge base, with an experimental- instead of a commercialized-logic. Government initiated demonstration programs protected this knowledge base and made knowledge applicable. The enforcement of a Feed-in law (StrEG) in Germany gave guaranteed payment, and compensation for RES above the level of avoided costs. Additionally, the feed-in law required utility companies to connect generators of green electricity to the grid, and buy the electricity at a rate of (which for wind and solar cells amounted to) 90% of the average tariff for final customers (Jacobsson & Lauber, 2006).
This policy context accounted for a market expansion from 20 MW in 1989 to almost 490 MW in 1995 (Jacobsson & Lauber, 2005). The potential decrease of the feed-in rates in light of political efforts and liberalization led to insecurity for investors and a market stand still for wind energy from 1996 to 1998 (the amendments particularly addressed wind energy). When it became evident that the feed-in rates would remain the same, uncertainty was taken away and was replaced by market expansion.
The reform of the feed-in law in the late 90's guaranteed the tariff-scheme's rates for investors for 20 years, leading again to a significant market expansion. The legitimacy of new technologies and the vision of their role in the future are prerequisites and the results of the process of their diffusion, as observed in Germany (Jacobsson & Lauber, 2006).
Wüstenhagen and Bilharz (2006) analyzed the German diffusion of renewable technologies as well and acknowledged the effectiveness of its feed-in tariff. They observed that between 1990 and 2002, about 13,0000MW of installed capacity have been established in Germany, which is mostly accounted for by the feed-in system. , Germany increased their power generation from renewables to a greater extent in comparison with the EU average; between 1991-2000: power generation from RES grew from 15 to 37 TWh in Germany (141,5%) compared to the increase from 269 to 337 TWh (25,1%) in the EU. Also, the share of RES had doubled in Germany (2.8% to 6.3%), while in the EU it only grew by 12.6% (12.7% to 14.3%). Wüstenhagen et al. (2006) assessed the impact of green power market with regard to public policies. Results showed that public policies have a strong positive impact on new capacity compared to helping the green power market expansion. (13,000MW new wind capacity between 1991 – 2003

as a result of public policy, compared to 127MW new capacity as a result of green power marketing between 1999-2003. The increase of PV capacity with about 200 MW between 1999-2002 also illustrates this difference in success). Wustenhagen et al., (2006) conclude with several factors on the basis of the German case that facilitate a successful policy process. These factors are: a strong central government open and a political culture that is open for government intervention, a large amount of interest groups that favor RES, and politicians with the expertise of RES.

Frondel et al. (2010) take another stance in the effectiveness of Germany's support system. The authors argue that the implemented FIT did not exploit market incentives that are necessary for the introduction of renewable energy in the energy sector. Furthermore, the authors state that this FIT does not give a long-term perspective in respect of stimulating the economy or increasing energy security whatsoever. Frondel et al. (2010) employ a case study and dive into data on energy production and feed in tariff rates. The authors conclude that the FIT does not result in a positive impact regarding energy security and technological innovation. However, their arguments are more based on rhetoric than on solid data. In addition, the authors argue that public expenditure on R&D does provide an effective means to stimulate renewables, an ambiguous statement as found in the analyzed literature.