Master Thesis Public Administration

Policy instruments to support the diffusion of near zero-energy housing in Overijssel

UNIVERSITEIT TWENTE.

In collaboration with

provincie Overijssel

Policy instruments to support the diffusion of near zero-energy housing in Overijssel

Research on the near zero-energy housing policy in multiple EU member states and the application of a decision-making technique on Overijssel

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Place & Date Enschede, October 29, 2014

Institute University of Twente
Faculty Management & Governance
Program Public Administration – Policy & Governance

Frontpage image source: EcoTerraInvest (2012)

Preface

In front of you lies my graduation paper, written in fulfilment of my master's degree in Public Administration at the University of Twente in Enschede. In this paper I assess possible policy instruments the province of Overijssel can use to promote energy efficient measures for private households within the province boundaries. In order to assess their options a comparative analysis of instruments used in a selection of EU countries is made and presented to a sample of involved stakeholders within the province of Overijssel to grasp the bottom up view on these instruments and their possible effect in the province of Overijssel. The paper therein gives clear recommendations to policy makers on which instruments / instrument mixes are deemed as effective based upon stakeholder opinions.

The execution of the project was made possible through the guidance of both my two supervisors from the University of Twente and my supervisor from the province of Overijssel. First of all then I would like to thank Joy Clancy, who took the role of first supervisor and guided me very well in initial design stage of the study and assisted in getting the British translations correct. Secondly I would like to thank my second supervisor Thomas Hoppe, who made sure the methodology used is at a master's level and assisted a lot in increasing the focus of the research. I also would like to thank Johan Dolstra and Freek Kranen of the province of Overijssel; Johan first for bringing this topic to my attention and helped guiding the province's part of this paper, Freek secondly for assisting in getting a sufficient sample for use in the survey. Finally I would like to thank my girlfriend Makien Verkroost for reviewing my work and helping me keep on track.

Enschede, October 29, 2014

Abstract

This research resolves around the question “Which (packages/mixes of) policy instruments from five selected Western European countries have proven to be effective in improving energy efficiency standards in private housing”. The research question is formed in collaboration with the province of Overijssel and assessed thee goals the province of Overijssel wants to meet with their energy efficiency policy mix: increasing energy efficiency for private households, strengthening the construction sector, and decreasing dependence on fossil fuels. The province saw interesting policy instruments being used in other EU countries and wanted to know whether those instruments would work in the province of Overijssel.

The research commences with identifying instruments used in the selected EU countries: Austria, Belgium, Germany, Sweden, and the United Kingdom. This identification process is guided by the policy instrument classifications by Jordan et al (2010) and assesses the effectivity of found instruments using perceived barriers to adoption of energy efficient improvements, efficiency, and stakeholder involvement. An instrument is then deemed effective when it provides the ability for stakeholders to participate in a bi-directional relationship and when it tries to diminish or overcome a barrier perceived by private house owners.

A total of seven instruments were selected based upon effectiveness criteria to use for a second part of this study in an application of these instruments to the province of Overijssel, which all have shown to have a positive impact on energy efficient improvements for private dwellings. The instruments are:

- Financial incentives
- BAFA on-site consultation
- -40% Club
- Green Deal
- Code for Sustainable homes
- Informational instruments
- Low-energy buildings in the building stock

Financial incentives are found to be able to overcome the financial barrier perceived by house owners as argued by Walls (2012. Financial incentives aim to make the initial purchase price barrier negligible by providing low-cost loans and subsidies for (part of) the purchasing price. The incentive can be paid in the form of loans, grants and/or allowances.

BAFA on-site consultation is directly aimed at overcoming multiple barriers perceived by house owners. It provides direct consultation in order to increase knowledge of house owners concerning the energy efficiency of their dwellings by providing detailed reports on the actual savings attainable by their dwelling, which also reduces uncertainty perceived by house owners.

Other informational instruments are directly aimed to reduce the lack of knowledge holding house owners back in purchasing energy efficient improvements for their dwellings. Informational instruments can range from free council to low-income households to the pre-emptive working of product labels and construction guidelines.

The minus 40-Percent Club is a special informational instrument, in that it serves an exemplary role for the whole of society, showing that it is possible to reduce a household's carbon emission by 40 %. The 100.000 households are followed over multiple years with extensive media coverage.

The Request project of the EU program 'Intelligent Energy Europe' aims with the low energy in the building stock project to the development of quality construction standards, enabling a speed-up of knowledge and the establishment of higher building standards.

The Code for sustainable homes then is trying to overcome not only the informational barrier, but also tries to reduce uncertainty and address the bounded rationality house owners perceive. The instruments functions by simplifying the building process and increasing awareness.

The Green Deal finally is an instrument targeted to negate the financial barrier entirely by enabling energy suppliers to improve dwellings and paying for them through the energy bill. It does so by first improving information available, second by reducing uncertainty about actual savings and thirdly by letting energy suppliers pay for the improvements in the form of a property-linked loan (not personal).

The instruments were used as input in the multi-criteria decision-making tool Analytical Hierarchy process. Via a survey companies and governments within the province of Overijssel were asked on their opinion of the feasibility of found policy instruments when applied to the province of Overijssel.

For all three goals, BAFA on-site consultation is prioritized the most. The problem with this instrument however is the required linkage to financial incentives for house owners. Results from this instrument's usage are concerned by interactions with financial measures. Informing citizens on their own energy use has been proven the most effective, making the instrument a good candidate for adoption. The second overall prioritized instrument is subsidy usage. In general, subsidies have been used for a long time and have proven their effectiveness.

An instrument which would best enable the province of Overijssel to pursue their stated goals then would be comprised of several instruments which work in tandem. First of all, on-site consultation should be used with contracted advisors to show house owners that their residence can be more energy efficient and that it can be beneficial to them by calculating and presenting projected costs and benefits. Second, financial incentives like the sustainability loan should complement this advice in order to increase the chances of adoption of the efficiency measures. Thirdly, people who are willing to make their house more energy efficient should be asked to be documenting their approach and the process of creating their energy efficient houses. These documentaries should then be promoted and advertised actively in order to reach the wider public; making certain that everyone knows what the costs and benefits really are.

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Chapter I - Introduction

There are two key issues related to energy that are exercising policy makers globally: energy prices (and in its extent energy security) and climate change. These issues can be simultaneously addressed through the promotion of energy efficiency. As the second largest consuming sector, energy efficiency measures in the residential sector can have a potential large impact on reducing climate change. Within the European Union, there is synchronisation of policies to addresses these issues and the Commission sees energy efficiency as one of the key mechanisms for addressing energy security and climate change. This policy synchronization has an impact in national legislation of the EU member states, and in the case of the Netherlands works down to municipal level government. To this end energy efficiency in the residential sector can be researched on the sub-national level.

This chapter will begin with a brief overview of existing research on the Dutch housing sector, following by the context of this research and the elaboration of the structure of this research paper.

1.1 Background

1.1.1 European Union level

In light of a few decades of developments concerning global warming, the European Union (EU) under the Kyoto protocol (UNFCCC, 2013a) and its later Doha amendment (UNFCCC, 2013b) has set energy target commitments: all member states have to comply with the following energy targets by the year 2020 (European Commission, 2013):

- Reduce the emission of greenhouse gases by 20%;
- Increase the use of renewable energy sources by 20%;
- Reduce overall energy consumption by 20%.

These targets are set at a supranational level, and due to the structure of the EU have mostly direct impact on national regulations and legislation, although this differs among member states). The energy consumption by its member states then is segmented by the following end uses in 2010 (Bertoldi et al., 2012):

- Transport	31.67 %	- Services	13.21 %
- Households	26.65 %	- Agriculture	2.17 %
- Industry	25.29 %	- Other	1.01 %

The housing sector then is the second largest energy user in the EU. Improving energy efficiency in this sector then are often considered as one of the most cost-effective ways of cutting carbon emissions (Ashford, 1999, p. 20).

1.1.2 Private housing sector

In the EU the housing market is segmented into two distinct submarkets: private households (owner occupied dwellings) and housing corporations. This distinction is made due to both demanding a different approach; housing corporations operate generally on a macro-level, investing in hundreds

of houses at once, while private house owners engage in micro-transactions, as they only invest in their own properties. The submarket of private households accounts for 71 % of the housing market in the EU on average, making this the most interesting submarket and potentially having the largest impact in reducing energy consumption in the residential sector (CECODHAS, 2012). In 2009, European households were also responsible for 68% of the total final energy use in buildings (Buildings Performance Institute Europe, 2011). In order to meet the energy targets of 2020, the EU has initiated a variety of directives in the residential sector in order to meet the 20-20-20 goals (EUFORES, 2009):

- Directive on energy performance of buildings (EPBD) (2002/91/EC)
- Directive on the promotion of co-generation (CHP-Directive) (2004/8/EC)
- Directive on eco-design requirements for energy using products (EuP-Directive) (2005/32/EC)
- Directive on energy end-use efficiency and energy services (ESD) (2006/32/EC)
- Directive for the taxation of energy products and electricity (2003/96/EC)
- Directive on energy efficiency requirements for boilers, refrigerators and ballasts for fluorescent lighting (2000/55/EC)
- Directives for labelling of electric ovens, air-conditioners, refrigerators and other appliances (2003/66/EC)
- Regulation of Energy Star labelling for office equipment (2006/1005/EC)

The directives can be broadly separated into two groups: directives to improve the energy performance of buildings (focus on more technical measures), and directives to reduce electricity use by households (focus on more behavioural measures). These directives are all obligatory for implementation by EU member states. The member states have outlined their energy reduction targets for the year 2020 based upon the EU directives and have implemented additional instruments in order to meet their targets (European Commission, 2008).

1.1.3 Member state level

All countries selected are Member States of the European Union. This means that all countries are subject to European laws and regulations. The European Union has agreed to the Kyoto Protocol and its later Doha amendment, which sets ambitious goals to be reached before 2020, the 20-20-20 goals (European Commission, 2008):

- A 20% reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20%;
- A 20% improvement in the EU's energy efficiency

In 2007 the EU rephrased and updated these goals, to achieve 20% reduction in both energy use and CO_2 emissions, and a 20% increase in both energy efficiency and a 20% share of renewable energy (Power & Zulauf, 2011). Each member state has incorporated these goals (at least to some extent) in their own national policies, and have added to some extent goals of their own, some more ambitious than others. In order to monitor progress of the member states, they are required to first of all create National Energy Efficiency Action Programmes (NEEAP), laying out their status quo and the coming plans, and after that produce National Communications (NC's) "in order to communicate their activities undertaken with a view to meeting commitments under the Convention" (Austrian

Federal Ministry of AFEW, 2010). These NC's consist of: greenhouse gas inventory information; measures to mitigate greenhouse gas emissions; measures to counteract adverse effects of climate change; measures to promote research and systematic observation; financial support for developing countries; initiatives to enhance the transfer of technology between Parties; and measures to foster education and public awareness with respect to climate change" (Austrian Federal Ministry of AFEW, 2010). In appendix A the selected countries are assessed on the basis of their national context and goals. The areas of interest are population, government structure, average temperature, Gross Domestic Product (GDP), Total Primary Energy Supply (TPES) and percentage house owners vs. house renters. The input for the countries background is provided by the Energy Efficiency Watch, an initiative of members of the European Parliament concerned with the energy efficiency of its member states (EUFORES, 2006). This initiative has produced country reports in which their energy efficiency action plans and policies are assessed for the year 2013.

1.1.4 Focussing in: Dutch Member state level

In the Netherlands EU measures have direct influence on legislation, and EU laws and directives are directly implemented. Efforts to gain these energy savings are led at national government level by multiple policy instruments such as the Energy Performance Certificate, covenants, economic and information tools (Murphy et al, 2012). However, as Murphy et al (2012) concluded in their study on policy instruments used to improve energy performance of existing private dwellings in the Netherlands, current instruments are poorly equipped to forge a long-term energy saving strategy for existing dwellings due to low integration of instruments implemented. Also, the objectives of instruments used are lost during implementation or are unsubstantiated (Murphy et al, 2012, p. 465). Current instruments used by the Dutch Government are combined into the “Energieakkoord”, which sets out the energy future of the Netherlands. In this document the Dutch governments has written its goal of a 100% sustainable energy supply in the year 2050 (Rijksoverheid, 2013). It is a covenant containing multiple goals and agreements which facilitate the sustainable energy supply. The most important goals of the covenant are (Sociaal-Economische Raad, 2013):

- A reduction of the final energy consumption with at least an average of 1.5 percent per year;
- 100 PetaJoule of energy saving on the final energy consumption in the Netherlands by 2020;
- An increase in the share of renewable energy sources to 14 percent in 2020;
- A further increase in this share to 16 percent by 2023;
- At least 15.000 full-time jobs, created in majority over the next few years.

For private house owners, these goals take the shape of several policy instruments to be used. The following is based upon the statements of foundation “Eigen Huis”, which has aligned all instruments mentioned in the energy covenant relevant to house owners (Eigen Huis, 2014). First of all, an indicative energy label will be handed out for houses which are not already labeled. Second, house owners should be better informed concerning energy efficiency measures, which is why an energy performance guarantee is given. This guarantee should be able to provide an ex-ante set required level of energy savings with normal use. In combination with these measures the financing possibilities are being broadened to include loans payable via the energy bill of households and a fund will be initiated containing 600 million euro for energy efficiency improvements for private households. The last measure mentioned in the energy covenant is a tax reduction on electricity when house owners are locally generating energy or in collaboration with other house owners.

1.1.5 Regional level[1]

"In many ways it is the local and regional actors who have the task of realizing the transition to an energy efficient and sustainable society. The planning and development of a regional strategic energy and climate program is therefore an important tool for the implementation of the national policy "(Swedish Parliament, 2011).

However, not all policy instruments can be effectively used on the Dutch regional level. Taxation for instance is excluded for the province; they can only levy provincial surcharges, which are part of the road tax and therefore only apply to owners of motor vehicles (Provinciewet, 1992). Other regulatory instruments (laws) are implemented nation-wide; provinces are obligated to carry out national policies.

1.1.6 Focussing in on the Dutch region of Overijssel

Overijssel provides a range of financial incentives for the purchase of energy saving investments like solar panels. These come in two forms: as a subsidy and as a loan. The subsidy is offering up to €1050 cash back for made energy efficient investments for both your own house and the neighbour's house. The sustainability loan offers up to €20.000 with an interest rate lower than market rates for usage for energy efficient investments. (Province of Overijssel, 2011). Next to these direct incentives for house owners the province is offering free 48 hours of marketing help for construction companies and has made agreements with housing corporations to make their housing supply more energy efficient (Provincie Overijssel, 2014). An experimental setup is also initiated in 6 municipalities to make 50 private households energy neutral; house owners can apply for this project and receive up to €8000 back on made efficiency investments (Provincie Overijssel, 2014). The province of Overijssel also engages in a variety of policy networks with among others energy suppliers and umbrella organizations in construction and project management in order to share knowledge and experience and collaborate on projects (Province of Overijssel, 2013). The collaboration in these policy networks could have the potential to reduce transaction costs for the province and assist in sharing information with market parties.

The policy instruments / mixes that are employed by the province of Overijssel, however practical and attractive they seem, are only sparsely used by private house owners in the Dutch province of Overijssel. There seems to be a "deadlock in supply and demand in the Dutch construction sector; a practical realization requires a transition in the status quo" according to Murphy et al (2012, p. 2). A shift from new-build to renovation will have potentially considerable effects on employment in the construction industry (Meijer et al, 2012). The province of Overijssel can see the market has the capability and potential to support a shift towards near-zero energy housing. Hanson & Laitner (2004) argue that efficiency investments have the potential to "both reduce energy costs and reduce needed investments in power generation" (p. 740), which makes promoting these investments interesting for both consumers (lower energy bill) as energy producers (less investment capital needed).

[1] The regional level is defined as the NUTS-1 region within a member state of the EU, see chapter 2.1.3 for more information

Therefore the province wants an instrument (or combination of instruments) to create the conditions for a competitive energy services market to deliver measures that will meet three goals linked to energy efficiency set by the province:

- Improved energy efficiency
- Make consumers less dependent on fossil fuels.
- Increase employment in the construction sector

Improving energy efficiency standards in privately owned dwellings is possible in at least two ways: either by increasing the efficiency of insulation/appliances etc (technical measures), or decreasing energy usage (behavioural measures). The problem then is, from a regional perspective, what policy instruments can be implemented to improve the energy efficiency standards in the residential private housing sector? This thesis will focus on a comparison of policy instruments in five selected EU countries that are used to improve the energy efficiency standards in private housing.

1.2 Previous research

Priemus (2005) argued that sustainable housing in the Netherlands is a badly defined concept due to the definition being extended to include social and ecological dimensions (Priemus, 2005, p. 6). Hoppe et al. (2013) argue that recent developments concerning energy efficiency in the Dutch residential sector had not been sufficient to attain the pre-set goals; "progress had not been substantial" (Hoppe et al., 2013, p. 14). This progress suffered from (Hoppe et al., 2013, p. 14):

- Too ambitious goals;
- The failure to (adequately) involve key target groups in policymaking processes;
- The predominance of 'soft' policy instruments and the lack of legislation;
- Innovation programmes which favour relatively un-innovative technologies and practices;
- Target group members' mistrust of the energy labels and energy performance standards
- Few incentives to encourage target group members to start radical innovative demonstration projects beyond the state-of-the-art of technology.

Research by Beerepoot (2007) indicates that a broad scale adoption of energy efficiency measures fails to occur in the existing Dutch residential sector. In his study on innovative energy systems (IES) in social housing Hoppe concludes that "little has been achieved in the Netherlands" concerning the implementation of innovative renewable energy and energy efficiency technologies (Hoppe T. , 2012, p. 799). This research will assess this apparent gap in adoption by analysing policy instruments used in a selection of EU member states[2] and do a case study on the application of these policy instruments in the Dutch province of Overijssel.

[2] See chapter 4.2.3

1.3 Motivation

This research will assess the feasibility of policy instruments to improve energy efficiency on the Dutch regional housing market, as local and regional governments have a "powerful planning role in terms of developing urban areas and authorizing building projects" (Han et al., 2011, p. 2). Also Hoppe (2012) argues that the adoption of innovative energy systems in existing housing in the Netherlands face many barriers, while ambitions were lowered in studied projects. Other EU countries seem to do a better job; it could therefore be beneficial to look across the border in order to identify (better) working policy instruments.

1.4 Research Objectives

The current state of the Dutch energy efficiency for private households market gives lead to this thesis' research goal. The first objective will be to create an overview of policy instruments used in five[3] EU member states. The second and main objective of this research will be the application of policy instruments found in five EU member states on the province of Overijssel and assess the effectiveness of those instruments according to local involved stakeholders.

1.5 Research Questions

In order to assess the problem stated, this research will address the following research question:

Which (packages/mixes of) policy instruments from five selected Western European countries have proven to be effective in improving energy efficiency standards in private housing?

This research question has a distinction into two phases. A first part will try to produce an overview of policy instruments from five selected EU member states. To this end the following sub question is given:

1. Which policy instruments or packages were used in five selected Western European countries between 2000 and 2013?

The second step is to assess the goal attainment and relative success of these instruments found. It can also prove valuable to assess what the success factor was in the instrument. The second sub question follows this line of thought:

2. To what extent were selected policy instruments (packages) effective in achieving the policy goals they were expected to achieve?

The first part of this research is finished after this sub question is answered. This will now form the input for the second part of this research, the application of the data found in the regional setting of the province of Overijssel. To this end a variety of stakeholders are asked to fill in a questionnaire in order to assess their opinions on the likelihood of successful implementation in Overijssel. This third

[3] See chapter 4.2.2

question then will provide a ranking of policy instruments and their probable success when implementing in Overijssel:

3. How are selected policy instruments prioritized by involved stakeholders for fulfilling the energy efficiency objectives for private housing in Overijssel using the analytical hierarchy process?

The final step then is to link this ranking to the theory used: Does the ranking match the effectiveness criteria used in the second sub question?

4. Which instruments are perceived best fitting for implementation by the province of Overijssel taking into account the effectiveness criteria used?

1.6 Chapter overview

In the second chapter the core concepts and the theoretical framework will be presented. The third chapter then will present the research objectives, questions used in this thesis and the relevance of the study. In chapter four an extensive explanation of the methodology used in this research project is covered. Results of the exploratory research in the first phase of this study will then be presented in chapter five, after which the sixth chapter will address results of the second phase of this study. The final chapter will provide answers to the main research questions, give recommendations (to policymakers) and discusses the limitations of the research.

Chapter II – Theories and Concepts used

In this thesis several concepts are used which are elaborated here. These concepts define the problem on a core level and will be elaborated in this chapter. As this thesis also focuses on a comparison of policy instruments usable on a regional level, but takes the information from multiple EU member states, the concept of regional government in these countries needs to be explored.

The theory implicated in this research focuses on policy instrument classification, goal attainment of policies, policy network types and stakeholder involvement. In the first part of the research an overview will be produced of policy instruments used in selected EU countries, which will be structured by instrument categories. Authors on policy instrument categorization are however not unanimous; most distinguish three or four categories, ranging to more than seven categories. In the second part of this thesis the application of found instruments on the province of Overijssel is applied, in which stakeholder participation is an important factor for achieving the goals set out by the province. Stakeholder participation then has the potential to enhance the use and success of policy instruments used.

2.1 Concepts used

2.1.1 Energy efficiency in the residential sector

Energy efficiency in the residential sector is according to Haas (1997) relatively easier to gain then for example in the industrial sector, as the residential sector is based on a large number of consumers with similar equipment and dwellings, which makes for a fairly homogeneous sample compared to for example manufacturing and service sectors (Haas, 1997) However, the vastness of the sample makes it also more difficult to change and monitor. An understanding of the components of change in household energy use makes it possible to separate factors that may increase with increased incomes or falling energy prices. However, it is impossible to link each of these factors of household energy use to the aggregate energy use; therefore it is more important to reflect on which aspects influence energy consumption by end use (Haas, 1997, p. 790). A common expression of energy efficiency follows the simple ratio (Patterson, 1996):

$$\frac{Usefull\ Energy\ output\ of\ a\ process}{Energy\ input\ in\ a\ process}$$

Energy efficiency then is defined as reducing the difference between the amount of energy going into dwellings and the effective energy consumption by heating and appliances. Energy efficiency then does not automatically reduce energy use. What has to be taken into account is a possible 'rebound effect'; occurring because improvements in energy efficiency could potentially increase use of the services, thereby possibly backfiring the policy and increasing energy use (UK Energy Research Centre, 2007).

2.1.2 Near-zero energy housing

Near-zero energy housing can be defined in multiple ways. The most encompassing term first, zero energy housing can be defined as "a net zero energy building where, as a result of the very high level

of energy efficiency of the building, the overall annual primary energy consumption is equal to or less than the energy production from renewable energy sources on site" (ECEEE, 2009). According to Hernandez & Kenny (2010), most definitions of near-zero energy housing refer only to “the energy that is used in the operation of the building, ignoring the aspects of energy use related to the construction and delivery of the building and its components” (Hernandez & Kenny, 2010, p. 815). Marszal et al. (2011) also recognize the complexity of the concept due to lack of agreement on the components and calculative methods used (Marszal, et al., 2011, p. 977). The near-zero energy definition however is always deducted from the superlative, meaning a near-zero energy building where, as a result of a high level of energy efficiency of the building, the overall annual primary energy consumption is near equal to the energy production from renewable sources on site. A second definition is set apart from this first one: “near–zero energy housing is when the primary power input in the house (whether conventional power of energy sources on site) equals the total energy consumption of the house. This second definition is used by the province of Overijssel. In this thesis the definition used by the province will most likely be too narrow as I will also consider energy efficient measures which will bring a dwelling to near-zero energy. The net zero energy definition then aims at a higher level than energy efficiency, by reducing energy spills to (near) zero. This thesis will therefore use the definition deduced from the superlative by the ECEEE (2009).

2.1.3 Regional governments in selected countries

As the administrative division among the countries differs, a selection for which level of governance must be made that enables a comparison among them. In this thesis the regional government will be chosen using the Nomenclature of Territorial Units for Statistics (NUTS) (Eurostat, 2012). In this the NUTS-1 level will be chosen for all countries except Austria, Netherlands and Sweden, as these three countries have no ‘real’ NUTS-1 level (NUTS-1 in these countries are comprised of groups of NUTS-2 regions). For the United Kingdom the NUTS-1 level is comprised of 12 statistical regions of England, Wales, Scotland and Northern Ireland. All regional governments chosen at the NUTS-1 level have relative autonomy on the energy efficiency policy field and can be compared with Dutch provinces. Below the regional governments are listed for the countries selected:

Austria: States (Länder)

Belgium: Regions

Germany: States (Bundesländer)

The Netherlands: Provinces

The United Kingdom: Statistical regions

Sweden: National areas (Riksområden)

2.2 Types of policy problems

A problem occurs when a factual situation is in discrepancy with a desired situation (Hommes et al, 2009). This implies that a problem always consists of normative and factual / empirical elements. Problems then should be recognized as subjective social constructs. Due to this subjectivity policy problems are defined by two dimensions, a consensus dimension and a knowledge dimension. In this study these two dimensions are shaped by stakeholder perceptions (consensus dimension) and the use of knowledge (knowledge dimension). (1) Well-structured problems exist where consensus is reached and a shared knowledge base exists (Hoppe, 2011). Moderately structured problems exist when (2) there is either a disagreement on the values and norms underlying the policy problem or (3)

there is disagreement on the knowledge base. (4) Unstructured or 'wicked' problems lastly exists where there is disagreement on both underlying values and norms and the knowledge base (Rittel & Webber, 1973).

Hoppe acknowledges however, that these four types are, however consistent with Weberian ideal types, not inherently dichotomous; hybrid types are also possible in practice (Hoppe, 2011, p. 75). Also, the problem classification can change over time; for example when new knowledge is being introduced, the amount of certainty can increase, structuring the problem in some degree (Hoppe, 2011). When consensus is reached the problem can also be more structured.

2.3 Stages of the policy process

The policy process can be divided in roughly eight stages according to Corkery et al (1995, p. 20). The stages distinguished in the policy making process are consecutively problem recognition, agenda setting, problem formulation, formulation of evaluating criteria, create alternatives, policy forming, policy implementation and policy evaluation (Corkery et al., 1995). Although Clay and Schaffer argue there is a notion of a "divided, dichotomous and linear sequence from policy to implementation" (Clay & Schaffer, 1986, p. 4), "the implementation of policy is a vital part of the policy making process, as "implementation always makes or changes policy to some degree" (Lindblom & Woodhouse, 1993, p. 11). Rein & Schön contribute to this theory by naming "the interactions of individuals, interest groups, social movements, and institutions through which problematic situations are converted to policy problems, agendas are set, decisions are made, and actions are taken." In equality of each other (Rein & Schön, 1993, p. 145). Also, Rein & Schön share the same notion for the first two stages of the policy process, named 'Naming' and 'Framing' of the problem (Rein & Schön, 1993, p. 153).

Problem recognition is the first stage of the policy process. This stage resolves around the introduction of a policy problem, and how it manifests itself or is manifested by stakeholders. This is the nature of the policy issue; is it a chosen problem, has it arisen through 'normal' monitoring or has it come by means of a crisis. According to Grindle & Thomas (1991), the process of policy formulation tends to unfold differently depending on whether policy elites perceive they are dealing with a crisis situation or with orderly progress of a political agenda. As Rein & Schön argue, "In each case, the name given to the problematic situation selects different, at best overlapping, phenomena for attention and organizes them differently" (Rein & Schön, 1993, p. 154). The second stage is agenda setting; which opens the debate on the policy problem. When a policy problem gets in the agenda, only then will attention go to the debate and the policy process starts. However, politicians can choose to keeping attention from certain issues, effectively ensuring the policy process will not begin in order to suffocate them before they are spoken, or to keep them invisible (Corkery et al, 1995, p. 21). After a problem has been set on the agenda, the third stage commences, namely the problem formulation; what is the problem and when is the problem solved? An initial statement of the issue and of the objective will help to determine the nature of the information required and the actors and stakeholders who need to be brought into the process (Corkery et al, 1995, p. 22). After the problem has been formulated, the fourth stage commences: the formulation of evaluating criteria. The policy problem has to be solved, but when is the problem solved, and how can we measure this. There should be a general idea of a destination. It will almost certainly be modified

along the way because of new information or a new form of consensus, but it will help to determine the nature of the information required and the actors and stakeholders who need to be brought into the process (Corkery et al, 1995, p. 22). When the evaluation criteria are clear, the fifth stage begins. This is the time for the creation of alternatives. The debate is opened up to generate options that fulfil one, most or even all objectives created before. It would set out, for instance, who would gain and who would lose from each option. When this stage is completed, a choice must be made for an alternative; the policy is formed. This stage resolves around the actual decision-making process and therefore is the most important stage of the entire policy making process. Important factors in this stage are power relations and the values of stakeholders in order to make a decision. When the decision has been made, it is time for the implementation of the policy, stage six. As the implementation always "makes or changes policy to some degree" (Lindblom & Woodhouse, 1993, p. 11), this stage in the policy process defines the actual outcome of the policy. After implementation there is only one stage left; the final evaluation of the policy to compare the results with the predetermined goals. One should however not think of the policy process as a linear process; it is a much more muddy process and cylindrical in nature.

2.4 Stakeholders participation in the policy process

These stakeholders (project developers, energy consultants) can participate in the policy development process in a number of different ways, which can vary on (1) the stage of the policy process; (2) the type of policy problem at hand; and (3) the type of policy network. As Papadopoulos & Warin (2007) acknowledge: "Their decisions – when any are taken – can be binding or merely consultative, and they can emerge at different territorial levels or different stages of the policy cycle" (p. 448). Reed (2008) recognizes multiple typologies, as shown in Appendix C.

The concept of a hierarchy of participation, conceived of a 'ladder', has emerged within stakeholder theory. One of the former leading proponents of 'ladders' of stakeholder participation is Arnstein (1969, p. 8), who describes a total of 8 ranks on his ladder of participation. However, as Fung (2006, p. 67) notes, the ladder determined by Arnstein has become obsolete. Authors like Fung (2006, pp. 68-69), Health Canada (2000, p. 12) and Smith (2003, p. 36) argue there are 'only' five ways[4] stakeholders can be included in the policy making process, which also, like Arnstein (1969, p. 8), form a continuum based on the extent of involvement and role in decision making. These different processes are not separated by boundaries but naturally flow into each other, building on their predecessors. From low involvement to highest involvement, Smith (2003) distinguishes (1) information exchange, (2) consultation, (3) engagement / dialogue, (4) shared decisions and (5) shared jurisdiction. Culyer & Lomans (2006, p. 363) also acknowledge there are different levels which have an increasing level of participation, forming a continuum.

[4] (Fung uses six ways; Fung distinguishes Deliberate & Negotiate and Deploy Technique & Expertise while the other authors aggregate these)

Papadopoulos & Warin (2007, p. 445) also recognize different levels of participation which coincide with the levels mentioned by Smith (2003):

- According to Smith (2003), information exchange occurs when a decision has already been made, or there is need for acceptance of a proposal or decision before a decision may be made.
- Consultation occurs when policy decisions are still being shaped and discretion is required, and the purpose is primarily to listen and gather information.
- Engagement occurs when there is a need for a two-way exchange of information or when individuals and groups take an interest in the issue who will likely be affected by the outcome of the policy.
- Shared decisions are made when there is opportunity for shared agenda setting and open time frames for deliberation on issues, and when there is a decentralized open debate on the community level.
- Shared jurisdiction is used when policy makers recognize, respect and reflect community values in governance decisions, and there is room to make difficult allocation choices in a decentralized political context (Health Canada, 2000).

However, stakeholder participation can and should be included in different ways, according to the type of policy problem at hand and the type of policy network stakeholders are engaged in. In this thesis the application of a policy instrument is studied within a regional area, concerning a regional government. The instruments found are assessed based upon the stakeholder participation they allow, as participation is argued to increase the effectiveness of a policy (Reed, 2008).

However, policy makers ought not to rush into the highest form of participation; when speed is of interest for example; shared decision-making can slow the process down as far as to halt; decreasing participation effectiveness. When linking stakeholder participation to stages in the policy process of energy efficiency improving policy instruments, Reed argues that "participation should be considered right from the outset, from concept development and planning, through implementation, to monitoring and evaluation of outcomes" (Reed, 2008, p. 2423). Multiple authors argue that including stakeholders as early as possible in decision making can lead to better quality and durable decisions (Mazmanian and Nienaber, 1979; Stewart et al., 1984; Blahna and Yonts-Shepard, 1989; Gariepy, 1991; Beltson, 1995; Chess and Purcell, 1999; Reed et al., 2006).

2.5 Perceived barriers to adoption of energy efficiency improvements in private dwellings

Consumers perceive some barriers with regard to making energy efficiency purchases for their dwelling. Lorenzoni et al. (2007) found a 14 barriers or constraints that consumers perceive to engaging with climate change and energy efficiency more fully[5]. Schleich & Gruber (2008) found five categories of perceived barriers in the commerce and services sector, while Brown (2001) found only

[5] See appendix D

three barriers, but also identified five market imperfections[6]. Golove & Eto (1996) then identified six market barriers to energy efficiency purchases for consumers' dwellings, while Howarth & Andresson (1993) found at least four market barriers in the consumer appliance market[7]. Sunikka & Boon (2003) argue for three dimensions (costs, capacity and knowledge) for which eleven barriers are found. In general, consumers are argued to "lack full information regarding available energy-efficient technologies" (Howarth & Andersson, 1993, p. 263), while "energy efficiency is not a major concern for most consumers because energy costs are not high relative to the cost of many other goods and services" (Brown, 2001, p. 1202).

Most authors find the capital market to be a barrier for consumers. Also, most authors argue that a lack of information or knowledge can be a barrier on energy efficiency purchases. Uncertainty then can also act as a barrier, caused by stochastic future energy prices (Schleich & Gruber, 2008, p. 454) or uncertainty concerning benefits of improved energy efficiency (Howarth & Andersson, 1993, p. 265). Lastly, a bounded rationality has been argued by multiple authors by stating consumers are perceived to have a low priority of energy issues, and that climate change is a distant threat. Lorenzoni et al. (2007) have done a great deal of research in order to specify the barriers, but the resulting overview they use is due to this specification also not workable in this thesis. The studies by Howarth & Andersson (1993) and Schleich & Gruber (2008) show the most usability for this thesis, as both studies define these barriers quite extensively. Both studies also identify principal-agent problems as a barrier to energy efficiency purchases for residences. This barrier is however only perceived in the rental residential sector, and therefore falls outside of the scope of this research. The barriers most authors agree on and are used in this thesis then are:

- Financial barriers;
- Informational barriers;
- Uncertainty;
- Bounded rationality.

These barriers are distilled from the collection of barriers listed in Appendix D.

2.5.1 Financial barriers

The financial barrier mostly reflects the often large initial investment costs associated with energy efficiency purchases like solar panels and earth heat pumps. Although the benefits outweigh the costs on a long time period, this initial investment still makes consumers hesitant to purchase them. The long term benefits are not incentivizing enough to become attractive. Golove & Eto argue also that in practice, "potential borrowers, for example low-income individuals and small business owners, are frequently unable to borrow at any price as the result of their economic status or credit-worthiness" (Golove & Eto, 1996, p. 10).

2.5.2 Informational barriers

One of the key barriers identified is an informational or knowledge barrier. This barrier is based upon a lack of knowledge concerning the causes, consequences and potential solutions to their energy

[6] See appendix D
[7] See appendix D

efficiency problem. This includes a lack of experience, understanding and awareness and an overall lack of information (Lorenzoni et al., 2007, p/ 450). Most governments now use energy labels as a means for providing information, Howarth & Andersson argue however that "Empirical work has found that performance labelling has ambiguous effects on consumer decisions" (Howarth & Andersson, 1993, p. 263).

2.5.3 Uncertainty

Uncertainty is perceived as a barrier when trying to assess the returns from energy efficiency investments. Due to consumer's uncertainty about benefits of improved energy efficiency, rational consumers can act as if using high implicit discount rates for the purchase of energy efficient technologies (Howarth & Andersson, 1993, p. 265). This uncertainty can be the result of high costs associated with the gathering of precise estimates of energy prices and equipment performance.

2.5.4 Bounded rationality

As Golove & Eto argue, "individuals and firms are limited in their ability to use - store, retrieve, and analyze - information" (Golove & Eto, 1996, p. 20). They suffer from a 'bounded rationality': people are limited by their ability to process information and their finite amount of time available (Rubinstein, 1998). Schleich & Gruber argue that "when making decisions about investment priorities, firms are likely to focus on the core production process rather than on ways to save energy costs" (Schleich & Gruber, 2008, p. 453). Also, consumers still perceive energy efficiency improvements as something in the future; they perceive climate change as a distant threat and as such do not 'need' energy efficiency improvements (Lorenzoni, et al., 2007). Their bounded rationality does not allow them to incorporate future benefits into their current calculation and thoughts pattern, making them oblivious to potential long-term benefits.

2.6 Policy instrument classification

In Europe are various local governments engaged in energy efficiency policies for the residential sector. These instruments can be classified according to their manner of work and nature. Measures to improve private household energy efficiency can be named as a type of environmental policy, as the main goals of policies in this field are to reduce (carbon) emissions, (more) efficient energy usage and less dependence on fossil fuels. Environmental policy literature distinguishes between traditional regulatory instruments and 'newer' instruments or New Environmental Policy Instruments (NEPI's) (Knill & Lenschow, 2000; Jordan et al., 2003). Traditionally, instruments were mostly subject to a command-and-control strategy, but later use has been made of voluntary measures strategy (VM) and economic instruments (EI) (Bressers & Lulofs, 2004). Many authors use a narrow categorization of policy instruments, broadly known as 'the carrot, the stick and the sermon' (Bressers, 1994; Bemelmans-Videc et al, 1998) The carrot refers to economic incentives, more abstract 'rewarding' good behaviour, the stick is the abstract 'penalty' for bad behaviour and the sermon is the communicative instrument. Other authors like McDonnell & Elmore (1987), Stavins (2001) and Murphy et al. (2012) use approximately four categories: (1) charge systems, (2) tradable permits, (3) market friction reductions and (4) government subsidy reductions. In the broad sense these different categorizations match the threefold distinction used by Bressers (1994) and Bemelmans-Vedic et al (1998). As this threefold distinction is too narrow in my opinion, in this thesis the four distinct

categories as used by Jordan et al. (2010) are used: (1) regulatory instruments; (2) market-based instruments, (3) voluntary agreements; and (4) informational instruments. Jordan et al. (2010) classify these policy instruments according to how the ends and means of management are defined (Appendix B.1). In Appendix B.2 a matrix of different classifications of authors is included.

In practice, the European Commission has sanctioned the Energy Efficiency Watch (EEW) to assess the National Energy Efficiency Action Plans (NEEAPs) of the EU member states, in which the energy *efficient* plans of the member states are discussed under the EU Directive 2006/32/EC. The EEW identifies and categorize multiple policy instrument types in this assessment; the classification of the EEW is provided in figure 2.6-1.

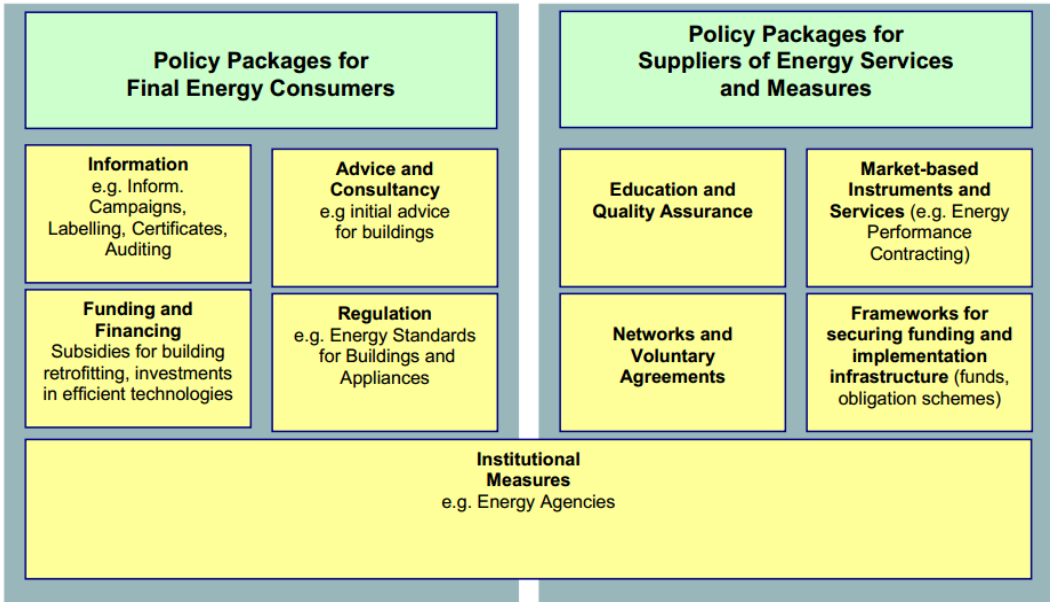

Figure 2.6-1: Basic and Improved Policy Packages and their Elements
Source: (EUFORES, 2009)

In this figure the classification by Jordan et al. (2005) can be distinguished. Jordan et al. (2005) however do not account for different instrument types for final energy consumers and for suppliers. In figure 2.6-2 the classification by Jordan et al. (2005) is laid on top of the framework used by the EEW.

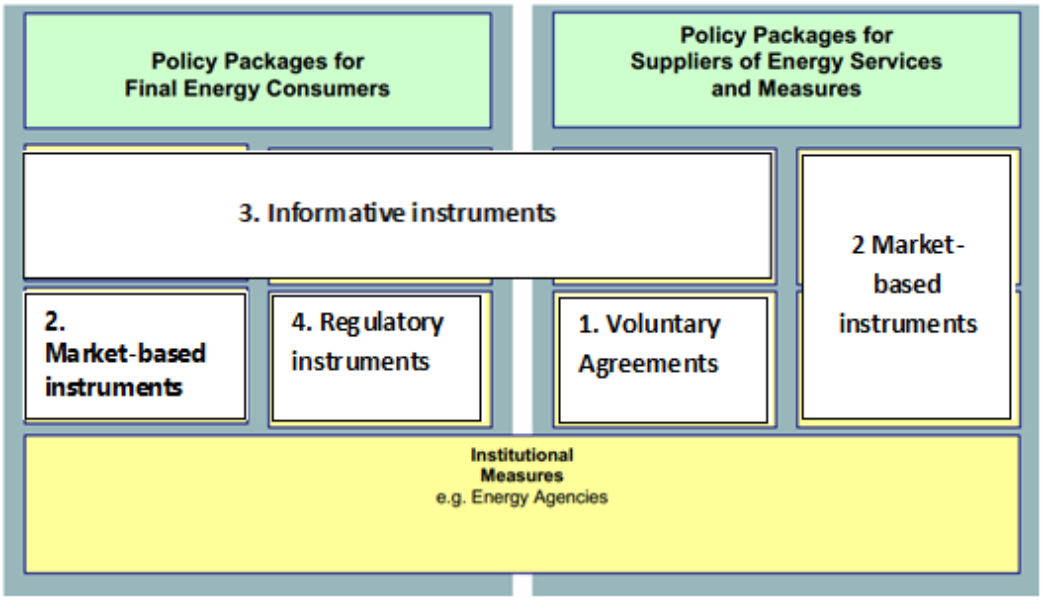

Figure 2.6-2: Jordan et al. (2003) classification applied to Eufores (2009) classifications

The bottom instrument category, institutional measures, tries to deliver an integrated package, dealing with both the final energy consumer side and the supplier side. However, due to the fact that only two EU member states mention these institutional measures in their own National Energy Efficiency Action Plan's (Denmark and the UK) (EUFORES, 2009, p. 69), these instruments will not be used as a separate category as such but as one of the four categories provided by Jordan et al (2003).

2.7 This research

This research will resolve around the fifth stage of the policy process: the creation of alternative instruments on the policy field of near energy-zero private housing. The problem has already been recognized and is on the policy agenda. Also, the problem has been formulated and evaluation criteria have been formed. This stage now resolves around the formulation of (sets of) alternative policy instruments which can be used to address the problem. Since the problem then can be defined as a moderately structured problem, stakeholder participation will likely be successful if stakeholders are included in the decision-making process extensively. As all barriers and issues resolve around the take-up of energy efficiency improvements rather than the development of these improvements, technical expertise is not deemed as a problem in this debate. Stakeholders should then likely be involved on the basis of creating consensus – i.e. engaging them in order to create a two-way flow of information, where it is more likely stakeholders will expand their own view and incorporate views from others – thus creating consensus. Lorenzoni et al. (2006) also argue that for a policy instrument to be deemed as successful it should (1) provide the ability for stakeholders to participate in a bi-directional relationship with all stakeholders involved and (2) engages perceived barrier by private house owners to not engage in energy efficiency purchases for their dwelling. Schleich & Gruber (2008) complement this by adding that "due to multiple types of barriers being significant, a mix of policies appears to be more appropriate than single policy instruments" (Schleich & Gruber, 2008, p. 461).

Chapter III - Methodology

In this chapter the methodology is presented which is used to answer the previous stated research questions. The methodology is divided into two distinct phases, where the second one builds upon the results of the first phase. This chapter will be structured accordingly, with first an elaboration of the first part of the research, followed by an elaboration of the second part.

3.1 Research outline

In order to assess the main question, the research is broken down into two distinct, consecutive phases. The first phase consists of exploratory research into policy instruments used in five selected EU member states, which will be discussed in chapter 3.2.2. The results of this exploratory research will then be used in the main phase as the input for a multi-criteria decision making technique on policy instrument ranking and selection. This technique will use a survey in order to collect data on the application of the policy instruments found in the exploratory phase. In this chapter these two parts are discussed separately.

3.2 Part 1: Cross-national study on policy instruments review in five EU MS

3.2.1 Research design

The first part of this research has an exploratory nature and can be defined as a cross-sectional study which will be constructed through means of extensive desk research. Desk research is also known as 'secondary research': "research using published sources, and/or the client's own internal sources, carried out prior to a research project" (Association of Qualitative Research, 2014). Through this desk research multiple cases are extensively studied in order to find suitable policy instruments.

3.2.2 Case selection

The units of observation and cases in this thesis are five selected EU member states. The units of analysis are policy instruments used by regional governments from these selected EU countries. A case study can be defined as an "in-depth study of a single unit" (Gerring, 2004, p. 341). There is no temporal variation, and spatial variation is within-unit (Gerring, 2004, p. 343). In order to select similar countries to the Netherlands, sample generalization will be on case-to-case transfer; making generalizations from one case to another (similar) case (Onwuegbuzie & Leech, 2007, p. 240). I will select countries based on criteria: policy availability (having an engaged policy field for energy efficiency improvements for private dwellings), climate, and economical strength. The first selection 'European countries' is chosen as these countries share jurisdiction to some extent in the form of European laws and agreements. Second, not all countries can be selected and most would not fit this research, as their context differs too much in terms of climate, economic strength and polity context (Lorenzoni & Pidgeon, 2006; TNS Opinion & Social, 2011; World Economic Forum, 2012). As the sample size should not be too large (difficult to extract thick, rich data and generally takes a long time to process) nor too small (difficult to achieve data saturation), I will select a total of 5 countries next to the Netherlands as this will enable a "comprehensive analysis without being overwhelming"

(Onwuegbuzie & Leech, 2007, p. 242). Countries selected should have a (most) similar climate[8], economically stable, and regional and local jurisdiction concerning energy efficiency policies for private house owners should be (most) similar. The countries selected based upon these criteria are Austria, Belgium, Germany, Sweden and the United Kingdom. The selected countries all have between 42% and 70% of owner-occupied dwellings of their total housing stock, as depicted in figure 3.2-1.

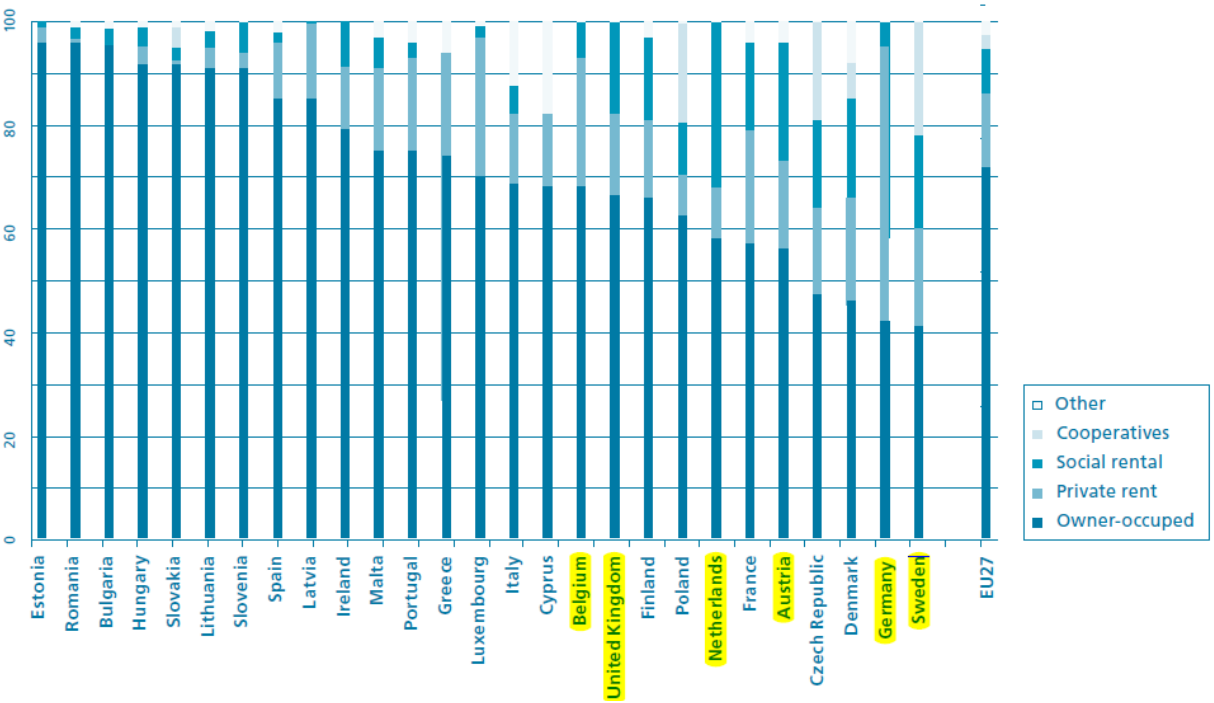

Figure 3.2-1: Tenure split in the 27 EU member states as a percentage of the total housing stock
Source: (CECODHAS, 2012, p. 10)

3.2.3 Data collection

The data needed for the cross-sectional analysis will be collected using two distinct sources: (1) policy white papers and evaluation reports (found in the MURE II database (www. muredatabase.org), the UNFCCC website (www.unfccc.int) and the website of the EU Commission (www.ec.europa.eu), and (2) additional correspondence with selected national experts (contact details found in policy white papers etc., government websites). Notably, the selected country's National Energy Efficiency Actions Plans (NEEAP's) are used as a source of instrument information.

3.2.4 Data analysis

In the selected countries some similar policies are found. Mostly generic these are subsidies for energy efficient measures (solar panels for example, building shell subsidies). These will therefore be clustered. Also, in some countries specific policies are found that cannot be clustered and need to be presented separately as they cannot be viewed the same as other policies due to being context-

[8] Countries with similar climates have likely a more similar need of for example insulation. Austria, with a minimum temperature below zero degrees Celsius, will likely have a larger need of insulation then for example Spain, where the minimum temperature is above zero degrees Celsius.

related or having very specific usages. In selected policies the EU measures are filtered out as they are already incorporated to some extent in all selected country's national policies[9].

The instruments that form the conclusion of the first sub question of this research (*Which policy instruments or packages were used in five selected Western European countries between 2000 and 2013?*) and consecutively will be used in the main phase of this research are chosen based upon a set of selection criteria. This set is based upon the criteria provided by the US Congress Office of Technology Assessment (1995)[10]. However, due to the policy instruments needing to be applied on a regional level of governance, the criteria are adapted and supplemented to some extent to better fit this thesis. The criteria on which policy instruments have to score are included in table 3.2-2 on the next page. An instrument scores positively (+) on a criterion when it not only provides information regarding the criterion, but also assesses the extent to which it complies with the indicator and fits the criterion. A neutral assessment (+/-) will be given when the indicator is only mentioned, but fits criterion, and a negative score (-) will be given when an indicator is not mentioned or does not fit the criterion. All criteria must be graded neutral or higher for the instrument to be included in the Overijssel assessment of policy instruments.

Criteria used in thesis	Indicator	Assessment
Furthers at least one of the goals set by the province	One of the goals is similar to the goals set by the province	+, +/-, -
Negative side effects	Does not have significant negative side effects	+, +/-, -
Goal attainment / Evaluation available	Has estimates on energy savings, information on ex-post evaluations	+, +/-, -
Control	Does the regional government hold any power of the instrument, also after implementation?	+, +/-, -
is applicable by a regional government	The province of Overijssel should have the power necessary to implement the instrument	+, +/-, -
Role of stakeholders	Announces the role of stakeholders (for example energy service providers)	+, +/-, -

Table 3.2-2: Criteria used for policy instrument comparison

The analysis for the effectiveness in terms of policy goal attainment of the policy instruments found builds upon the previous criteria, but extends to that as well. The relative effectiveness of policy instruments can be difficult to measure. One method entails using policy goals stated and measuring goal attainment as a measure for the success of the instrument. A second method will be used to try and measure the relative success of policy instruments found. This second method is based upon the idea that an instrument would logically try to (1) promote a certain action or (2) regulate actions. In this line of thought an instrument will try to diminish possible barriers that are perceived. The success of the instrument then is measured by the diminishing of a perceived barrier.

A second notion on policy instrument effectiveness comes in the form of stakeholder participation. It is argued that stakeholder participation can have a positive effect on the effectiveness of a policy instrument. Lorenzoni et al. (2006) claim that stakeholders should however be included in various

[9] Also, instruments not eligible for the province of Overijssel on the basis of the Overijssel context not applying and instruments for which the province not having the necessary authorizations / autonomy are filtered out.

[10] See Appendix E.

distinct ways according to the type of policy problem and the type of policy network stakeholders are engaged in. In this thesis then a participatory instrument can be deemed as successful once it should provide the ability for stakeholders to participate in a bi-directional relationship with not only the government (initiator and facilitator of the debate), but also with all other involved stakeholders.

The selected instruments and instrument clusters are analysed on multiple aspects in order to conduct a comprehensive analysis of the policy instrument effectiveness. The first indicator is availability of evaluation reports. A second in indicator is goal attainment, as this most often reflects policy instrument effectiveness. The third indicator used for policy effectiveness is stakeholder involvement, as this can have a positive impact on policy effectiveness (Lorenzoni et al., 2007). The last indicator used is barriers tackled; if an instrument can tackle a barrier perceived by consumers it can also be an effective instrument[11]. In summary, the following indicators are used to assess policy instrument effectiveness:

1. Goals stated / attained;
2. Available evaluations;
3. Overcome barriers.
4. Stakeholders involvement;

3.3 Part 2: Stakeholders' survey on perceived appropriateness of policy instruments

The main phase consists of the application of the policy instruments found in the exploratory research done in five EU member states. This phase resolves around the multi-criteria decision making technique 'Analytical Hierarchical Process' (Pohekar & Ramachandran, 2004).

3.3.1 Research design

The study will entail the usage of the exploratory research on policy instrument in selected EU member states[11] in the field of energy efficiency for private house owners as the input of the multi-criteria decision making technique Analytical Hierarchy Process (AHP). In the AHP a survey will be used to assist in identifying and weighing selection criteria for instruments (Saaty, 1980).

3.3.2 Sample / stakeholder selection

Han et al. (2011) argue local and regional governments play an important role in promoting and facilitating energy neutral housing developments; the authors also identify project developers and energy consultants as important stakeholders in the development process. Home owners can also be regarded as important stakeholders. However, home owners are not included in the development stage (UrbAct, 2012), making them unsuitable for this thesis which resolves around the development stage[12]. The respondents for the survey chosen are persons representing the following stakeholders: the Province of Overijssel, municipalities in Overijssel, energy suppliers, energy grid operators, project developers, construction companies, advisory companies in this sector and expert marketing companies for this sector.

[11] See Chapter 3.2.2
[12] See Chapter 2.7

A total 150 companies and governments are invited to the survey, divided in the following groups:

Energy suppliers	21	municipalities	25
Grid operators / Net suppliers	2	province	1
Project Developers	2	Marketing companies	2
Construction companies	64	Advisory companies	33

These companies are all invited digitally to partake in the survey. A two month period is established to collect the data.

3.3.3 Data collection

Data is collected through means of an online survey. As the format has some strict requirements, a special website was designed to format the questionnaire following the 'paper' example in Appendix F. The survey is accessible by everyone who received a link using a mailing list. The survey itself will consist of a selection of (1) open questions used to identify groups of stakeholders and (2) pair-wise comparisons.

Pair-wise comparisons will be formed in order to weigh instruments and goals with each other. Their usage helps in determining the relative importance of each alternative in terms of each criterion. Questions will be formed as follows:

> In order to achieve energy efficiency in private households, how important are the following two instruments in relation to each other?
>
> Instrument A
> Instrument B

Respondents choose their answer on a scale proposed by Saaty (1980). This scale is comprised of the following set of values:

{9, 8, 7, 6, 5, 4, 3, 2, 1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9}

This scale has been made fit to use for nine possible answers (Triantaphyllou & Mann, 1995):

1	9	Instrument A is a lot more important than instrument B
2	7	Instrument A is more important than instrument B
3	5	Instrument A is a bit more important than instrument B
4	3	Instrument A is slightly more important than instrument B
5	1	Instruments A and B are equally important
6	1/3	Instrument B is slightly more important than instrument A
7	1/5	Instrument B is a bit more important than instrument A
8	1/7	Instrument B is more important than instrument A
9	1/9	Instrument B is a lot more important than instrument A

The survey will be accompanied by a reference sheet, on which brief descriptions of policy instruments are found. Both the final survey as the reference sheet is included in Appendix F. The survey takes around 30 minutes, which matches the pre-test conducted on a sample of 10 respondents. In this pre-test the respondent's understanding of the questions and the ease of access were addressed. The questionnaire answers fit the desired framework for the AHP, and respondents

had room for suggestions / issues. These rooms were used most notably to assess textual issues in policy instrument clarifications and what the ' use' was of some questions of the survey. The question referred to asked respondents to rank their top three instruments; although it is not clear from the question how those results were used, as they already had answered the previous questions. The question however serves a checking function; to assess whether their AHP prioritizing ranking matches the straight-up question.

3.3.4 Data analysis (AHP)

The policy problem that lies at the heart of this thesis is moderately structured, lacking aligned stakeholder perceptions in order to adequately deal with the problem. The analytical hierarchy process (AHP) provides an effective means to deal with this complex decision for policy strategy: which of the found instruments can be used in the province of Overijssel? The AHP does this by analysing stakeholder's perceptions on the usage of found policy instruments in five EU member states within the province of Overijssel.

AHP structure

To this end AHP makes it possible to identify and weigh the selection criteria, analysing the data collected for the criteria and facilitate the decision-making process (Saaty, 1980). AHP has a mathematical basis and follows the following steps (Fu & Lin, 2009):

1. Describe the decision-making problem
2. Identify all criteria which affect the issues
3. Hierarchy Structure of the decision problem & relevant criteria
4. Establishing the paired matrices for comparison
5. Calculate eigenvectors.
6. Consistency test.

Describe the decision-making problem

The decision making problem at the heart of this thesis is the selection of a policy instrument / policy mix to use in the Province of Overijssel which will improve energy efficiency in the province of Overijssel.

Identify all criteria which affect the issues

As this research has been initiated by the province of Overijssel itself, they have provided the criteria for a successful policy instrument and how they relate to each other; the corresponding weights are calculated in the questionnaire:

1. Improvements of the energy efficiency standards of residential buildings;
2. Strengthens the construction sector;
3. Making consumers less dependent on fossil fuels.

Hierarchy structure of the decision problem & relevant criteria

In this research the hierarchical decision model is based upon three different levels which are described and elaborated in figure 3.3-1.

- Goal: Finding a 'best' policy instrument for the province of Overijssel
- Criteria: The three stated previously: energy efficiency, strengthening the construction sector and less dependability on fossil fuels.
- Alternatives: The policy instruments deemed suitable for implementation in Overijssel.

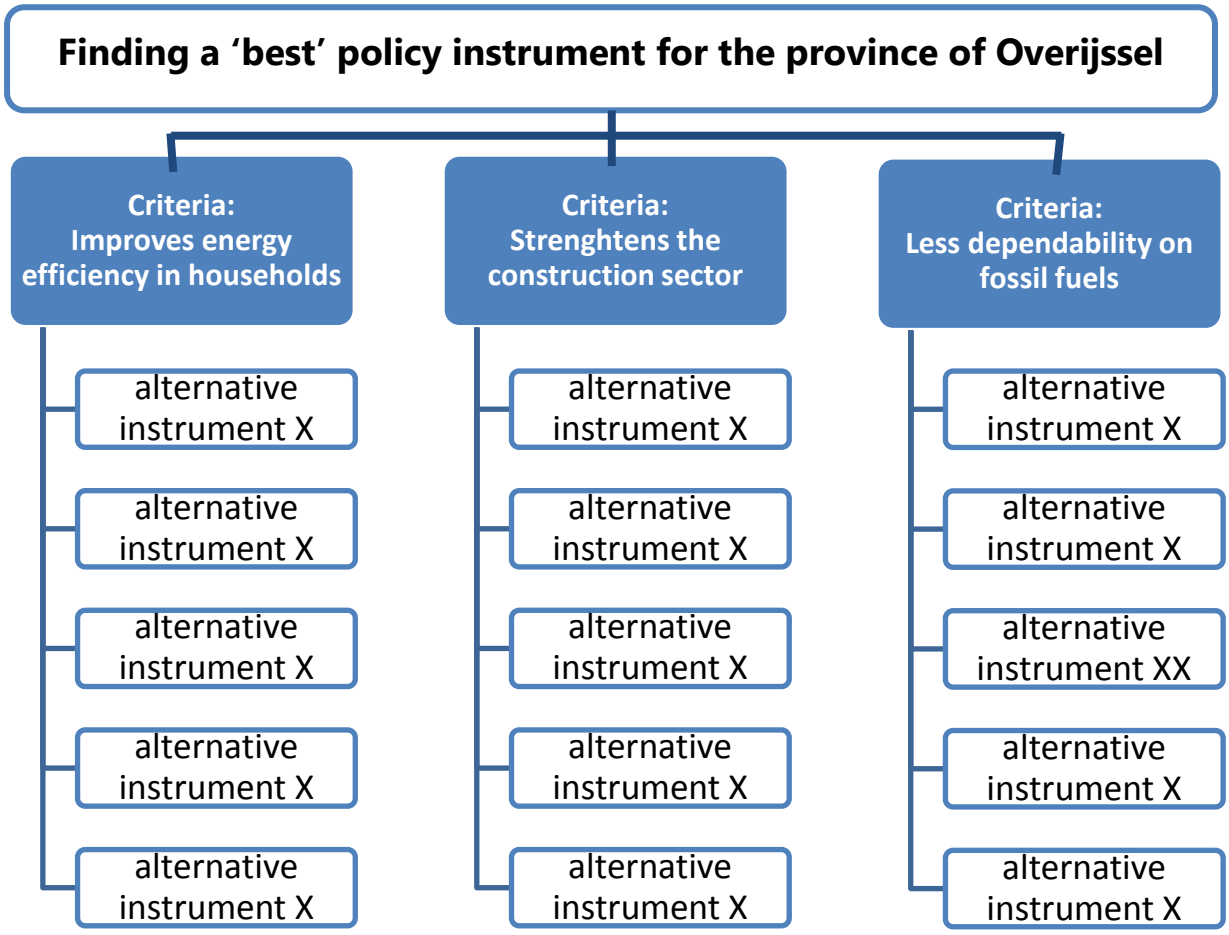

Figure 3.3-1: Overview of criteria and alternatives used in AHP

Establishing the paired matrices for comparison

The amount of questions asked differs per criteria. The amount of questions follows the following equation:

$$\text{amount of questions} = \frac{\text{n}\,(\text{n}-1)}{2}$$

For the main criteria there are:

$$\frac{3*(3-1)}{2} = 3\ pairwise\ comparisons$$

For the instruments there are:

$$\frac{7*(7-1)}{2} + \frac{6*(6-1)}{2} + \frac{6*(6-1)}{2} = 51\ pairwise\ comparisons$$

These pair wise comparisons will be used to create the paired matrices for comparison.

Calculate eigenvectors

The results of the survey will be computed into eigenvectors in order to compute the final vector containing the weight coefficients for all alternatives. The results in the final vector reflect the relative importance of policy instruments in relation to the goal stated at the top of the hierarchy. All respondent answers are aggregated into a geographic average, as each respondent's score is independent of all other respondent's scores. Following the structure of Pohekar & Ramachandran (2004), the eigenvectors follow the structure of matrix A, which contains the results of the pair-wise comparisons of element i with element j into the position a_{ji} as below (Pohekar & Ramachandran, 2004, p. 370):

$$A = \begin{bmatrix} a_{11} & a_{12} & . & a_{1n} \\ a_{21} & a_{21} & . & a_{2n} \\ a_{n1} & a_{n2} & . & a_{nn} \end{bmatrix}$$

This vector is then multiplied by the vector of the criteria used in order to receive the overall weighted coefficients for each alternative, taking into account the weighted goals. “This procedure is repeated upwards for each level until the top of the hierarchy is reached” (Pohekar & Ramachandran, 2004, p. 370).

Consistency test

The final step in AHP is to ensure whether “the calculation fit the condition of transitivity in priority” (Fu & Lin, 2009, p. 461). A consistency ratio (CR) is computed to “verify the credibility and reasonability of evaluation, and to check whether there is inconsistent causality or conflicts in subjective judgments (Fu & Lin, 2009, p. 461). According to Saaty (1980), the ratio is acceptable if it remains below 0.1. The following formula is used to calculate the consistency index (CI) and ratio (CR):

$$CI = \frac{\lambda_{max}-n}{n-1} \qquad CR = \frac{CI}{RI_n}$$

Saaty (1980) argues the following concerning the CR: *"The positive reciprocal matrix generated by valuation yields different consistency index (CI) values at each level. These CI values are called random indexes. The max λ is the maximized eigenvector of a pair-wise comparison matrix. The n is an attribute of the matrix, and n RI is a random index as shown in Table 3.3-2"* (Fu & Lin, 2009, p. 461).

N	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R.I.	0	0.58	0.90	1.12	1.25	1.32	1.41	1.45	1.49	1.54	1.48	1.56	1.57	1.59

Figure 3.3-2: Random index.
Source: Fu & Lin (2009), p. 461.

3.3.5 Validity & reliability

The data collected in the survey will be mostly quantitative, therefore I will use the computer program SPSS[13] to analyse the data. Some pitfalls are to be avoided or accounted for which are described by Shadish et al. (2002) in their definitions of types of validity. They argue there are four different validities: statistical conclusion validity, construct validity, internal validity and external validity.

Construct validity resolves around the degree in which the used operationalization represents the used concepts and theory (Shadish et al., 2002). In short: "Is what is being measured what is meant to be measured?" This research will use a great amount of data that will be specified for the case of Overijssel, biggest threat to validity will be a mono-operation bias: the operationalization process cannot be executed continuously in the same way. There then will be a selection bias, as the sample is produced from a list of companies affiliated with the province of Overijssel, and is provided by the province. This however does not inherently poses a threat to the results of this research as these companies are not inherently 'loyal' to the province, but are key players in this market and especially their opinion will prove valuable to this research.

External validity of research resolves around the generalizability of the found causal relation and the overall generalizability of this research. This research will be severely limited in external validity due to the small size of the sample used and the usage of only stakeholders who are based in the same region. However, all respondents are representatives of their domain of expertise, making their opinions invaluable to this research, and offer some form of validity to this research.

Reliability finally links to the degree in which you will consistently get the same results when repeating the steps in the research. First, due to the subjective nature of the questionnaire input (stakeholder opinions) the reliability of this study is likely not too high. The opinion of stakeholders is subject to a great amount of factors, most notably available knowledge. The survey offered additional information on questions asked and the instruments in them, but it is not known to what extent stakeholders fully understood the questions asked, nor their understanding of the instruments given in the questionnaire. Second, as this research follows a case study design in which the time dimension is ignored and all measurements reflect a single moment in time, it can be assumed that a repetition of this research at a later date will have different results. The reliability of the method used (ahp) however is very high, as it is a mathematical process which, given exactly the same input, will always generate the same results.

[13] SPSS version 20

Chapter IV – Results of the exploratory international study on policy instruments

The policy instruments will be classified using the theory provided by Jordan et al. (2010). To structure this chapter a first division will be made on the countries the instruments are used in. Within the countries the instruments will be structured using the categories of Jordan et al. (2010). After all instruments have been discussed, an overview will be presented of all policy instruments that have been reviewed. In this chapter all instruments have been gathered into collection tables divided by country. All instrument backgrounds are included in Appendix G for reference.

4.1 Policy Instrument overview

The following instruments were found using the selected countries National Energy Efficiency Action Plans. The instruments are fully explained in appendix G. In this section the instruments are gathered in an overview table per country with a short description. These tables form the basis of the conclusion of the first sub question of this research, which will be answered in the next section.

4.1.1 Austria

In Austria there are currently multiple policy instruments used by regional governments to promote energy efficiency measures for private dwellings. According to the Energy Efficiency Watch (EEW), Austria implemented a very comprehensive policy package in the buildings sector (Energy Efficiency Watch, 2013a, p. 2). When discussing Austria's 2nd NEEAP, EEW argue that "the policy package combines almost all relevant elements, from legal minimum standards and other regulations to widely available financing and economic incentives to energy performance certificates" (Energy Efficiency Watch, 2013a, p. 2). In table 5.1 on the next page the instruments found in Austria are gathered (Based on the second national energy efficiency action plan).

Instrument	Policy classification	Role of regional government	Target group (as mentioned in the NEEAP's)
Energy taxes	Regulatory	-	All final energy consumers
tightening construction law requirements	Regulatory	Responsible body & monitoring	Buildings
subsidy for efficient heating systems	Market-based	Responsible body & monitoring	Private households
subsidy for the building shell	Market-based	Responsible body & monitoring	Private households
national recovery plan / renovation voucher	Market-based	monitoring	Private households, companies
statutory provisions to promote district heating	Market-based	Responsible body & monitoring	District heat consumers
smart metering	Informative	implementing	Households
energy advice for households	Informative	Responsible body & monitoring	Private households
Research and development	Informative	Responsible body & monitoring	All final energy consumers
Education, training and information/Raising awareness	Informative	Responsible body & monitoring	Citizens, craftspeople, enterprises, public budgets
Energy labelling	Informative	Responsible body & monitoring	All end users

Table 4.1-1: Policy instruments used in Austria

[1] Kraft-Wärme-Kopplung (combined heat and power)
[2] Wärme- und Kälteleitungsausbaugesetz (Heating and Cooling Grid Expansion Act)

4.1.2 Belgium

In Belgium there are currently multiple policy instruments used on a regional level to promote energy efficiency for private dwellings. According to the Energy Efficiency Watch (EEW), Belgium implemented a balanced policy package comprising of regulatory instruments, market-based instruments and informational instruments (Energy Efficiency Watch, 2013b). The EEW argues the 2nd Belgium NEEAP does not set ambitious goals and it is missing a roadmap for "revision and tightening of the minimum energy performance standards" (Energy Efficiency Watch, 2013b, p. 2). In table 5.2 below an overview of instruments found in the 2nd NEEAP, the MURE II Database and in the 5th NC is given, which will be discussed separately.

Instrument	Policy classification	Role of regional government	Target group (as mentioned in the NEEAP's)
Strengthening Minimum Energy Efficiency Standards for appliances	Regulatory	-	All final energy consumers
Introduce a minimum energy performance threshold	Regulatory	Responsible body & monitoring	Housing Corporations, house rental organizations
Tax deduction	Regulatory	-	End users
Thermal regulation for buildings	Regulatory	Responsible body & monitoring	House owners,
Act structurally on the supply side	Voluntary agreements	Responsible body & monitoring	Private households, companies
Insulation and energy performance regulations for buildings	Regulatory	Responsible body & monitoring	District heat consumers
Green Certificates for renewable electricity and high yield cogeneration	Regulatory	Responsible body & monitoring	Households
Grant energy subsidies	Market-based	Responsible body & monitoring	All final energy consumers
Energy Fund and other horizontal funding	Market-based	Responsible body & monitoring	All final energy consumers
Develop sustainable neighbourhoods	Informative	Responsible body & monitoring	Citizens, craftspeople, enterprises, public budgets

Table 4.2-1: Policy instruments used in Belgium

4.1.3 Germany

In Germany there are currently multiple instruments active on a regional level to promote energy neutral and energy efficient housing. According to the Energy Efficiency Watch (EEW), Germany implemented numerous policies aiming to improve the energy efficiency of residential buildings (Energy Efficiency Watch, 2013c). The EEW argues the 2nd German NEEAP does not mention market-based instruments for household appliances and that the building sector should "improve education & training to ensure that energy performance standards are attained" (Energy Efficiency Watch, 2013c, p. 2). Most financial incentives are directed and initiated through the federal bank the 'Kreditanstalt für Wiederaufbau' (KfW) and are therefore not included in this overview. In table 5.3 on the next page an overview of instruments found in the 2nd NEEAP, the MURE II Database and in the 5th NC is given, which will be discussed separately. All discussed instruments are initiated by the national government and must be carried out by all federal (member state) governments.

Instrument	Policy classification	Role of regional government	Target group
Energy Saving Ordinance (residential buildings)	Regulatory	Responsible body & monitoring	Residential buildings
Energy certificate	Regulatory	Responsible body & monitoring	(Residential)
Law on the promotion of renewable energies in the heating sector	Regulatory	Responsible body & monitoring	Residential buildings
Heating Costs Ordinance	Regulatory	Responsible body & monitoring	Building owners
Energy-using Products Act (EBPG): measures for electrical appliances in private households	Regulatory	Responsible body & monitoring	Building owners
Ecological Tax Reform	Regulatory	-	End users
Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP)	Market-based	-	Building owners
Federal states' activities in the buildings sector	Market-based	Responsible body & monitoring	Building owners
E-Energy – ICT-based energy systems	Informative	-	Energy users
Energy saving guidelines	Informative	Part responsible, part	Private households
Energy Efficiency Initiative	Informative	-	Private households
"future of housing" campaign	Informative	-	owners, tenants
Energy Consumption Labelling Ordinance	Informative	Responsible body & monitoring	Domestic appliances
Energy counselling in consumer advice centres	Informative	-	Consumers
Energy check-up for low-income households	Informative	-	Private households
Minus 40 Per Cent Club for private households	Informative	Responsible body & monitoring	Private households
Buy Smart project	Informative	-	private consumers
BAFA On-site Consultation	Informative	-	Consumers
Low-energy building in the building stock	Informative	-	Residential buildings

Table 4.3-1: Policy instruments used in Germany

4.1.4 United Kingdom

In the United Kingdom (UK) there are currently a variety of instruments active on a regional level[14] to promote energy neutral and energy efficient housing. These include regulations, standards and financial incentives. According to the Energy Efficiency Watch (EEW), the UK has a great potential for additional savings in the housing stock (Energy Efficiency Watch, 2013d). The EEW argues however that the rate of progress over the last three years can be deemed as medium or even low (Energy Efficiency Watch, 2013d, p. 2). The EEW discusses improvements on the 'Green Deal', as experts are uncertain of its impacts and perceive it as a risk, although it is expected to become the key financing instrument for the housing sector (Energy Efficiency Watch, 2013d, p. 2). The instruments used in the UK housing sector are shown in table 5.4 below.

[14] See Chapter 2.1.3

Instrument	Policy classification	Role of regional government	Target group
The Green Deal	Market-based	Initiator, Monitoring	Building owners
Building Regulations	Regulatory	Monitoring	Building owners
Supplier obligations	Regulatory	Monitoring	Suppliers
Products policy (appliances)	Regulatory	-	Suppliers
In home displays / Smart meters	Informative	Monitoring	Building owners
Renewable Heat Incentive	Market-based	Responsible body, Monitoring	Building owners
Warm Front Scheme to address fuel poverty	Market-based	Responsible body, Monitoring	Building owners
Feed-in-tariff	Market-based	-	Energy generators
Code for Sustainable Homes	Voluntary agreement	Monitoring, facilitating	Building owners,
EU performance of buildings directive	Regulatory	-	constructors
Energy Savings Trust advice	Informative	-	Building owners
Product standards and labelling	Regulatory	-	Consumers

Table 4.4-1: Policy instruments used in the United Kingdom

4.1.5 Sweden

In Sweden there are currently a variety of instruments active on a regional level to promote energy neutral and energy efficient housing. According to the Energy Efficiency Watch (EEW), Sweden offers several informational instruments together with economic incentives (Energy Efficiency Watch, 2013e). A promising measure is "the establishment of procurement groups that address property owners as well as tenants to develop options for improving energy efficiency" (Energy Efficiency Watch, 2013e, p. 2). The instruments used in the Swedish housing sector are shown in table 5.5 below.

Instrument	Policy classification	Role of regional government	Target group
Planning and construction legislation and energy requirements in building regulations	Regulation	-	Building owners
Energy certification	Regulation	-	Buildings
Repairs, maintenance or conversion and extension work (ROT) tax reduction	Market-based	Responsible, monitoring	Private households
Grants & Tax deductions for: Windows and bio fuels, Conversion to sources of renewable energy, Solar cells, Solar	Market-based	Responsible, monitoring	Private households
Technology procurement	Informative	-	Residential property owners
The Delegation for Sustainable Cities	Informative	-	Municipalities
Low-Energy Buildings Programme	Informative	Responsible, monitoring	Project developers, municipalities
Energy services	Informative	Responsible, monitoring	Energy suppliers
Become Energy-Smart – Renovate Energy-Smart	Informative	Responsible, monitoring	Private households
The energiaktiv.se web portal	Informative	-	Building owners
The Construction/Living Dialogue	Voluntary agreement	-	Construction / property sector
CERBOF – the Centre for Energy and Resource Efficiency in the Built Environment	Informative	-	Construction sector
Energy IT and Design	Informative	-	Individuals
Taxation of energy	Regulation	-	Energy users

Instrument	Policy classification	Role of regional government	Target group
The Environmental Code	Market-based	-	Everyone
Municipal energy and climate advice services	Market-based	Monitoring	End users
Regional climate and energy strategies	Informative	Responsible, monitoring	End users
Ecodesign and energy labelling	Informative	-	Energy users
ELAN – the Programme for day-to-day electricity use	Informative	-	Energy companies,
The Co-ordinated Urban Development Programme	Informative	-	Project developers,
The Sustainable Municipalities programme	Informative	Monitoring	Municipalities
The Fjärrsyn [District Vision] Programme	Informative	Responsible, monitoring	District heating companies

Table 4.5-1: Policy instruments used in Sweden

4.2 Eligible instruments for survey - conclusion on sub question 1

After applying the criteria on each instrument, more than half of found instruments have proved to not be eligible to use in this thesis. Second, the instruments can be clustered by similar criteria: purpose, working, financing method, category, etc. For example, all awarded grants, whatever their name, are still grants (if no extraordinary criteria are given for application etc). Tax reductions are often also associated with grants use. However, as these have a different mechanic and usability, they are not clustered together with grants.

The reference tables for each individual instrument are included in Appendix G. Table 5.6 on the next page shows all instruments and clustered instruments that are deemed fitting to use from here onwards, after which they are shortly discussed. This table forms the conclusion to the first sub question of this research:

Which policy instruments or packages were used in five selected Western European countries between 2000 and 2013?

Instrument	Category	Main Goal	Short description
Financial incentives: - for efficient heating systems, building shell - Renewable Heat Incentive - Warm Front Scheme - Market Incentive Programme for Promotion of the Use of Renewable Energies	Market-based	All goals	Subsidies aim to make the initial purchase price barrier negligible by providing low-cost loans and subsidies for (part of) the purchasing price. The subsidy can be paid in the form of loans, grants and/or allowances. The objective of subsidy programmes is to boost the sale of renewable energy Technologies by means of investment incentives and to improve their efficiency. Subsidies can aim at all energy efficient measures or be specific like the renewable heat incentive, building shell subsidies.
BAFA On-site Consultation	Informational	Energy Efficiency, less dependability on fossil fuels	Advice can be an important factor in tackling the barrier that a lack of information can represent to taking action on energy efficiency. DECC, the Scottish Government and Welsh Government provide grant funding to the Energy Saving Trust (EST) to support its provision of free, impartial, expert energy efficiency advice to consumers.
Information schemes: - "future of housing" campaign - Energy Efficiency Initiative - Energy check-up for low-income households - Energy counselling in consumer advice centres - Energy labelling - Energy saving guidelines	Informational	All goals	Informational instruments can be implemented in various ways. Among other instruments are council, guidelines, labelling and energy checkups
Minus 40 Per Cent Club for private households	Informational	All goals	92,000 households have been recruited for the Online Energy Saving Account (ESA) of the Minus 40 Per Cent Club. The software calculated the CO2 figures for the heating energy and electricity consumption figures read off and recorded how the minus 40 per cent target (1990-2020) was achieved and exceeded.

Instrument	Category	Main Goal	Short description
Low-energy building in the building stock	Informational	Energy Efficiency, Construction labour market increases	The aim is to speed up transfer of knowledge about construction of low-energy buildings, to establish exacting energy-efficient redevelopment standards on the market, and to advertise, develop and launch on the market innovative technologies related to energy-efficient building redevelopment. The aim is to encourage imitation by means of transferable, economically viable redevelopment recommendations and examples. The residential property construction companies carry out their restructuring measures themselves.
Code for Sustainable Homes	Voluntary agreements	All goals	The national voluntary standard for the design and construction of new homes became operational in 2007. It covers standards for energy, water and waste management.
The Green Deal	Market-based	All goals	The Green Deal is a market framework which will enable private firms in Great Britain to offer consumers energy efficiency improvements to their homes, community spaces or businesses at no upfront cost with repayments recouped through a charge made in instalments on their energy bill. A key element of Green Deal finance is that only packages of measures that pay for themselves over the lifetime of the Green Deal will qualify. It will allow householders and businesses to enjoy the benefits of efficiency measures and the energy bill savings they can bring, without the need for up-front finance. If they move to a different property, the charge will not move with them, meaning those in the property will pay from the savings they make.

Table 4.6-1: Policy instruments eligible in this thesis

Seven distinct policy instruments / packages have been found in the selected EU countries that fit the criteria used in this thesis. They span three out of four classifications by Jordan, Wurzel & Zito, and can be used to further at least one goal set by the province of Overijssel. The only category missing are regulatory instruments, due to the fact these are in the Netherlands mostly, if not all, organized on a national level, leaving no or little room for policy on a regional or local level.

This then is also the answer to the first sub question "Which policy instruments or packages were used in five selected Western European countries between 2000 and 2013?" In summary, the following instruments are found:

1. Financial incentives
2. BAFA on-site consultation
3. Information Schemes
4. Minus 40 Percent Club
5. Low-Energy Building in the building stock
6. Code for Sustainable Homes
7. The Green Deal

4.3 Policy instrument effectiveness

The next step is to identify the goal attainment or effectiveness of found policy instruments, and answer the second sub question:

"To what extent were found policy instruments (packages) effective in achieving the policy goals they were expected to achieve?"

All instruments found in the previous section are assessed based upon four points:

- Goal statement / attainment
- Evaluations
- Barriers overcome
- Stakeholder involvement

Each instrument will be discussed separately, answering the research question individually.

4.3.1 Financial incentives

The use of financial incentives can assist in improving energy efficiency in households. Multiple authors (Howarth & Andersson, 1993; Golove & Eto, 1996; Brown, 2001) have perceived the lack of access to financing associated with energy efficient measures like the use of solar panels or (more) insulation as a barrier for house owners. Financial incentives aim to make this initial purchase price barrier negligible by providing low-cost loans and subsidies for (part of) the purchasing price. The incentive can be paid in the form of loans, grants and/or allowances.

Evaluation

Research by Margeret Walls (2012) indicates that the use of subsidies is preferable over the use of loans when it comes to the purchase of appliances (Walls, 2012, p. 13). Policies based upon loans then have only marginal impact (0.8 % difference with the baseline over 2011 to 2035), while subsidies have a 4.2 % impact over this time period. The policies then work in reducing residential energy use.

Goals stated / attainment

The goal of a financial incentive is to make the choice to purchase energy efficient equipment for consumers and house owners an easier one by taking away the financial barrier perceived. Walls (2012) found that "a subsidy that reduces up-front costs by 50 percent would cause a substantial shift in purchases toward high-efficiency options: over the 2011–2035 forecast period, approximately half of all heating and cooling equipment purchases are predicted to be high-efficiency versus only about 20 percent in the baseline case" (Walls, 2012, p. 27).

Barriers tackled

Financial incentives are the primary tool used to engage perceived financial barriers. They are mostly directed at the core problem of the financial problem: the up-front investment costs.

Stakeholder involvement

This instrument is not directly affiliated with stakeholders. Indirectly financial incentives can involve be (national) banks as stakeholders to, for example, supply loans.

4.3.2 BAFA on-site consultation

In Germany, the Federal Office of Economics and Export Control (BAFA) is offering free on-site consultation by accredited energy advisors to house owners concerning energy efficient and energy saving measures like structural thermal insulation, heat generation and heat distribution and the use of renewable energies. This free on-site advice diminishes another barrier perceived by citizens - too little information regarding actual savings and benefits of energy efficient measures - by giving free advice to these customers regarding their personal situation and savings they can make. This measure dates back to 1991 for the first part of the program, after which the second (current) part of the program began in 1998 (MURE, 2011).

Evaluation

A policy evaluation is available for this instrument. The latest impact evaluation was published in Germany's second NEEAP. The instrument usage has grown over the last years, from 1034 advices in 1998 to 22000 in 2006 and 15800 in 2007. A survey conducted by BAFA rated advice implementation on around 64%. However, the instrument is directly intertwined with other (financial) measures. The evaluation clearly states that Kleemann and Hansen (2005) "assume that 62 % of the savings calculated above are concerned by interactions with financial measure, but these saving cannot be unequivocally assigned to the financial measures or the advice programme" (MURE, 2011, p. 2).

Goals stated / attainment

Prospected energy savings in the period 1998 - 2016 are 2.3 PetaJoule (PJ). The early action period (1995-2007) is prospected to result in 0.5 PJ, after which the following period (2008-2016) will deliver 1.8 PJ energy savings. In contrast, Germany’s energy use in 2007 was around 13.8 PJ (OECD / IEA, 2007). Delmas et al. (2013) have found that “energy audits and consultation, when individuals are informed about their own energy use and given advice on how to lower their consumption, were the most effective” (European Commission, 2013).

Barriers tackled

As an informational instrument, this directly aims to tackle the informational barrier consumers perceive. House owners gain a detailed on-site consultancy report concerning their personalized possibilities, assessed by an engineer or energy building consultant (MURE, 2011).

Stakeholder involvement

This instrument also makes active use of stakeholders involved, most notably accredited energy advisors.

4.3.3 Information Schemes

Informational instruments come in a wide variety: from council for low-income households to product labelling, energy check-ups and guidelines for construction. These tender aids are being offered for free download on a new internet site, which also contains information on green procurement, labels, and a good practice database, and often times also in folders acquirable at municipality offices.

Evaluation

An assessment of Swedish information campaigns by Henryson et al. (2000) shows that it is possible to influence households' energy efficiency awareness through the use of information. The authors found that households perceive some informational barriers, of which the highest rated, are:

- Lack of knowledge on how to save efficiently;
- Lack of feedback in order to be able to control the effects of the measures taken;
- Lack of possibility to compare oneself with a reference object ('equivalent household').

The report however also states that these instruments can cause negative effects. Such effects include:

- Rebound effect; Increased energy use as a reaction towards lower electricity expenses.
- Snap-back effect; Buy more appliances as a reaction to saved money through lower expenses.
- Free rider effect. Some participants would have become more energy efficient anyway, making it uneconomical to place resources on this particular group (Henryson et al., 2000, p. 179).,

Goals stated / attainment

The goal attainment of information schemes varies, but they all aim at removing a barrier perceived by consumers and using this information to change their behaviour concerning energy efficiency.

Barriers tackled

Most instruments in this category try to increase awareness among house owners on the choices they make and the products they use - thereby instituting a behavioural change towards a more environmental, sustainable perspective. These instruments assess not only the perceived informational barrier, but also addresses uncertainty and the bounded rationality consumers can perceive.

Stakeholder involvement

Many stakeholders can be involved with informational schemes. Most common are independent energy advisors, consulting / marketing companies, press, architects and engineers, but the media also plays an important role.

4.3.4 Minus 40-Percent Club

In the minus 40 percent club households are recruited to 'race' towards low energy consumption of at least 40 % reduction in emissions of their household. Households are challenged to reduce their carbon emissions for heating energy and energy consumption. The households are followed over a period of multiple years and serve an exemplary role towards the rest of society. They achieve the energy efficiency and lower emissions using available resources like grants, tax reductions and information centres. Also, the initiator (regional government) tries to create an interactive arena on which also energy utilities and media companies form a partnership to increase the effectiveness of the exemplary households.

Evaluation

No evaluation has taken place yet, but a year after initiation (2008), already 10.000 households committed to the project.

Goals stated / attainment

The goal attained here is simple: let society know that an emission cut of 40 % is 'easily' achievable before 2020 by recruiting 100.000 households. The attainment is so far rather high with 10.000 households committed.

Barriers tackled

This instrument tries to provide an exemplary role for society to follow. The households committed are followed over years and show that it is possible with very few costs for house owners to reduce energy use, improve energy efficiency and reduce their carbon footprint. In this it seeks to diminish the perceived informational barrier.

Stakeholder involvement

Many stakeholders are involved with this instrument, most particular the 100.000 households which are actively engaged in decreasing their energy use and CO_2 emissions. Second, media have been actively engaged in order to promote the project and its successes. Thirdly, every household who commits to the project are guided by a certified energy advisor. Other stakeholders involved are energy suppliers (installing smart meters into houses).

4.3.5 Low-Energy Building in the building stock

This instrument is used in multiple EU countries under the Request Project, funded by the European program "Intelligent Energy Europe" (Request, 2014). The project focuses in Germany on the development of quality standards, aiming at specialist designers, architects and construction project sponsors. The instrument tries to (1) speed up the transfer of knowledge about construction of low-energy buildings and (2) to establish exacting energy-efficient redevelopment standards on the market. This instrument therefore resolves on the interaction between important stakeholders in the construction sector in order to improve standards and increase knowledge generation.

Evaluation

Evaluation by DENA has shown that "the instruments for quality assurance at the building site are an important step forward to a structured way of improving quality of renovated buildings; The proposal for a quality seal will be developed further to make good quality visible; Current talks with KfW Bankengruppe about linking these new instruments with governmental funding" (DENA, 2012, p. 1). The evaluation also states that one of the main barriers found was the "time and money problem" (Request, 2012, p. 74).

Goals stated / attainment

The goal of the project is to "increase the uptake of low carbon renovation measures in residential properties across Europe for all ownership tenures" (Request, 2014). The output stated in the factsheet released by the German Energy Agency (DENA) concerns "increasing awareness and knowledge of quality assurance in the renovation process by craftsmen and energy experts" (DENA, 2012, p. 1).

Barriers tackled

The project itself states in its goal statement that its focus lies on "addressing one of the key barriers to action for property owners, namely easy access to a reliable quality installer or, in the case of major renovation, a range of professionals, referred to for the purpose of this project as the supply chain" (Request, 2014). The instrument then addresses both the financial barrier and the informational barrier.

Stakeholder involvement

The pilot project in Germany involved a total of 24 companies[15] engaged with 27 refurbishment projects[16] in the regions of Leipzig and Munster (Request, 2012, p. 57).

[15] 5 craft businesses, 5 energy consultants, 5 consulting engineers, 3 architects, 1 construction company

[16] 11 single family houses, 14 multi-family houses, 2 non-residential buildings

4.3.6 Code for Sustainable Homes

The Code for Sustainable Homes in England, Wales and Northern Ireland provides a single voluntary national standard to guide industry in the design and construction of sustainable new homes. The Code measures the sustainability of a new home against nine categories of sustainable design, rating the 'whole home' as a complete package – including energy/carbon. Each category contains “credits” which developers can gain by building to those standards and the Code uses a one to six star rating system to communicate the overall sustainability performance of a new home against these nine categories, with 6 being the highest rating.

Evaluation

As the Code for sustainable homes does not have a direct measurable target but an 'increase awareness' goal, the evaluation of this instrument entails 'the more the better'. Over the period April 2007 - December 2013, a total of 159.677 dwellings have received a three star rating at the design stage and 51.305 dwellings a four star rating at the design stage, while a total of 114.621 dwellings received a three star rating at post-construction stage and 26.269 dwellings received a four star rating at post-construction stage (Department for Communities and Local Government, 2014, p. 2).

Goals stated / attainment

The goal of the Code is not to be mandatory, but to promote higher standards of sustainable design above the current minimum standards and to reduce carbon emissions. The reason behind this is that there are no clear national standards set and the standards available "are complex, sometimes overlapping or even contradict parts of the building regulations" (Department for Communities and Local Government, 2013, p. 3). The intended effect then is to make more housing projects economically viable due to the more consistent set of standards available (Department for Communities and Local Government, 2013, p. 3): reducing the amount of ‘red tape’.

Barriers tackled

The main goals of the instrument is raise awareness and simplify the building process by creating a voluntary standard - in this it tries to tackle the informational barrier of complex housing standards in the UK. The sheer amount of homes already improved proves that the instrument is effective in reaching its goals.

Stakeholder involvement

The main involved stakeholder is the Building Research Establishment Global's EcoHomes scheme. They act as the advisors during the design and post-construction process.

4.3.7 The Green Deal

The Green Deal is a market framework which will enable private firms in Great Britain to offer consumers energy efficiency improvements to their homes, community spaces or businesses at no upfront cost with repayments recouped through a charge made in instalments on their energy bill. A key element of Green Deal finance is that only packages of measures that pay for themselves over the lifetime of the Green Deal will qualify. It will allow householders and businesses to enjoy the benefits of efficiency measures and the energy bill savings they can bring, without the need for up-front finance. If they move to a different property, the charge will not move with them, meaning those in the property will pay from the savings they make.

Evaluation

In January 2014 a total of 76.648 households had done a Green Deal assessment (DECC, 2014b, p. 9). Of these, between 58.000 and 64.000 households had installed at least one measure proposed. Awareness is raised by direct marketing; the advice given is 'generally welcomed' (DECC, 2014b, p. 9).

Goals stated / attainment

The goal of the Green Deal is to "overcome access to capital, mismatched incentive problems and provide a trustworthy framework of advice, assurance and accreditation for the energy efficiency supply chain" (DECC, 2012b).

Barriers tackled

The Green Deal tries to assess both the financial barrier as the informational barrier. DECC argues that ' Many households and some organisations cannot access conventional finance markets to fund energy efficiency improvements, while other households and organisations may face high costs of capital that do not reflect the particular nature of energy efficiency investments i.e. a reliable stream of bill savings" (DECC, 2012b, p. 15). Also, there appears to be a "lack of trusted information for consumers (including businesses) who do not have easy access to, or a full understanding of, information on energy efficiency measures available to them (DECC, 2012b, p. 15).

Stakeholder involvement

Multiple stakeholders are involved in the Green Deal, as it is offered by the private sector to enable home owners to implement energy efficiency improvements. In this the private sector delivers a Green Deal assessor, provider and installer. The government has initiated the 'Green Deal Oversight & Registration Body' which facilitates the instrument and monitors its usage and progress (DECC, 2014a).

4.4 Conclusion - answer to sub question 2

The instruments found all have shown to have a positive impact on energy efficient improvements for private dwellings. An instrument is then deemed effective when it:

- Provides the ability for stakeholders to participate in a bi-directional relationship;
- Tries to diminish or overcome a barrier perceived by private house owners[17].

Financial incentives are found to be able to overcome the financial barrier perceived by house owners as argued by Walls (2012. In Germany the KfW Bankgruppe (a private bank) is engaged in supplying loans for energy efficient improvements, but no other stakeholders are directly involved. Contractors and suppliers can be indirectly involved in the actual execution of energy efficient improvements.

BAFA on-site consultation is directly aimed at overcoming multiple barriers perceived by house owners. It provides direct consultation in order to increase knowledge of house owners concerning the energy efficiency of their dwellings by providing detailed reports on the actual savings attainable by their dwelling, which also reduces uncertainty perceived by house owners. Many stakeholders are also involved in the usage of this policy instrument, of which most are independent energy advisors, and indirectly the contractors, architects and suppliers.

Other informational instruments are directly aimed to reduce the lack of knowledge holding house owners back in purchasing energy efficient improvements for their dwellings. Informational instruments can range from free council to low-income households to the pre-emptive working of product labels and construction guidelines. All kinds of stakeholders can be involved in informational schemes, ranging from marketers to architects to energy advisors.

The minus 40-Percent Club is a special informational instrument, in that it serves an exemplary role for the whole of society, showing that it is possible to reduce a household's carbon emission by 40 %. The 100.000 households are followed over multiple years with extensive media coverage, including many stakeholders in the process of improving the associated households.

The Request project of the EU program 'Intelligent Energy Europe' aims with the low energy in the building stock project to the development of quality construction standards, enabling a speed-up of knowledge and the establishment of higher building standards. It addresses a financial barrier by aligning professionals and consumers, and the informational barrier by raising the quality standards for buildings. The stakeholders involved in the project range from energy consultants to architects to construction companies.

The Code for sustainable homes then is trying to overcome not only the informational barrier, but also tries to reduce uncertainty and address the bounded rationality house owners perceive. The instruments functions by simplifying the building process and increasing awareness. The instrument employs the Building Research Establishment Global's EcoHomes as advisory stakeholders.

The Green Deal finally is an instrument targeted to negate the financial barrier entirely by enabling energy suppliers to improve dwellings and paying for them through the energy bill. It does so by first

[17] See Chapter 2.5

improving information available and diminishing this barrier, second by reducing uncertainty about actual savings and thirdly by letting energy suppliers pay for the improvements in the form of a property-linked loan (not personal). As this instrument is offered by the private sector multiple stakeholders are involved, most certified and associated as Green Deal assessors, providers and installers.

When comparing these instruments, all assess at least one perceived barrier and enable house owners to improve the energy efficiency of their dwelling. The instruments all show a degree of goal attainment based upon the increasing use of the instrument. The instrument can also be linked to the goals previously set for this research:

1. Improved energy efficiency
2. Make consumers less dependent on fossil fuels.
3. Increase employment in the construction sector

A total of seven instruments have been found which are eligible to be included in the main phase of this research. These seven instruments are therefore clustered on the goals they can try to attain. As an instrument can aim for multiple goals, they are not solely included for a single goal. The result of the linkage to the goals set in the main phase is depicted in figure 4.7-1 on the next page. All instruments are weighted to each other in relation to the three goals stated.

Best perceived fitting instrument for usage by the Province of Overijssel to increase energy efficiency by private households

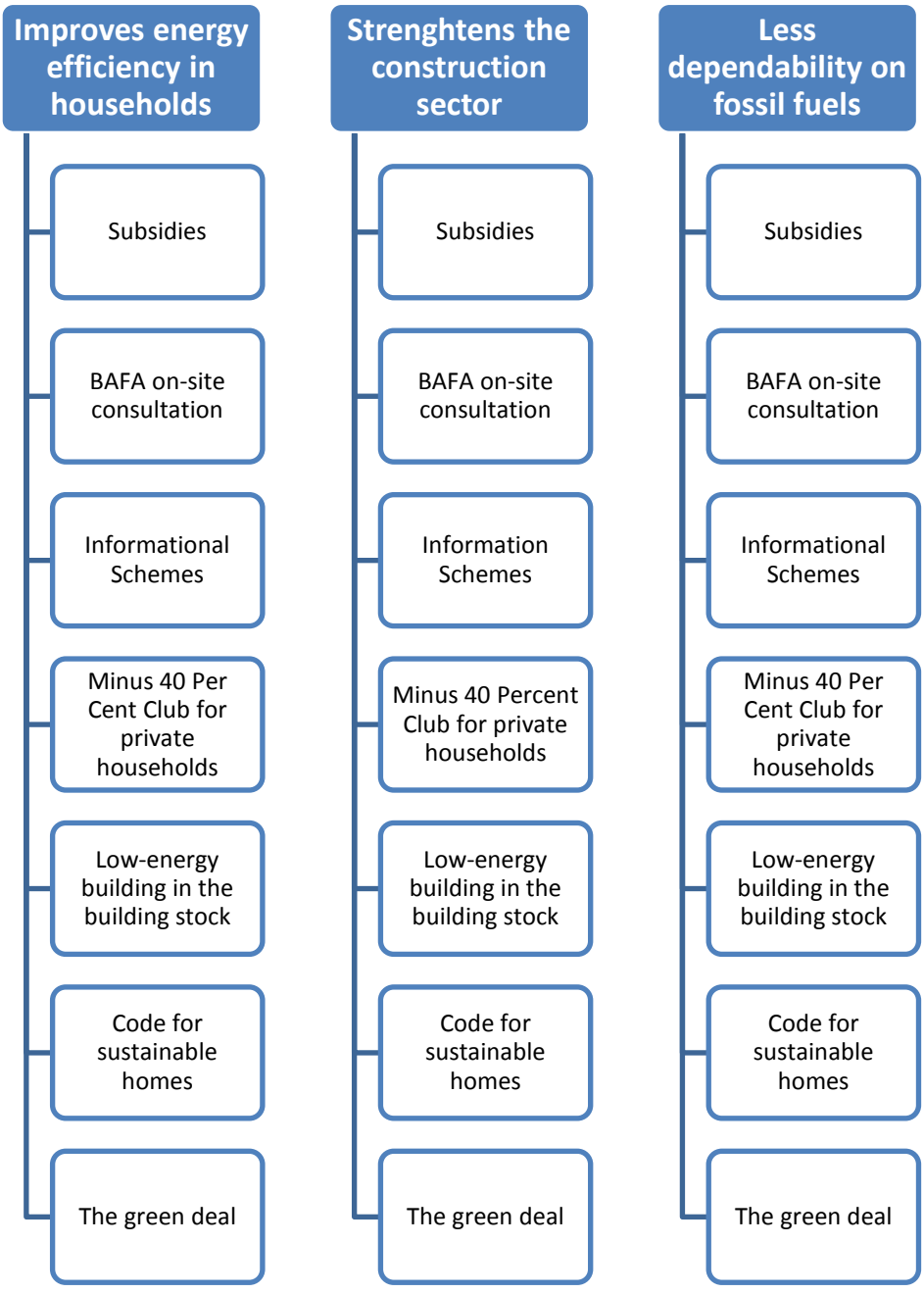

Figure 4.7-1: Eligible instruments to use in the main phase

Chapter V – Results from the AHP

5.1 Most preferred instrument overall - answer to sub question 3

5.1.1 Survey statistics

The survey used has been filled in by a total of 43 respondents. Of the sample all respondents are valid, as they questionnaire could only be completed if all questions were answered needed for the analysis. There were no "I do not know" options available so every answer counts. The results of the survey questions are scaled variables from 1 to 9, leading to a total of 63 variables used in the AHP. All pair-wise comparisons answered have been recoded into above scale to fit AHP requirements. The results are recoded as follows (Triantaphyllou & Mann, 1995):

1	2	3	4	5	6	7	8	9
9	7	5	3	1	1/3	1/5	1/7	1/9

5.1.2 Overall results

Based on the scaled results squared matrices were created, which were then used to form eigenvectors. These eigenvectors show the relative weight of all alternatives entered. The eigenvectors were finally checked for consistency using the consistency ratio. The eigenvector for most important goal shows a consistency ratio of 0.0572. As the ratio is significant if below 0.1 (Saaty, 1980), this measure is significant. The resulting ratios can therefore be used to form a conclusion. Energy efficiency is the most prioritized goal according to the sample as shown in Table 5.1-1.

	Energy efficiency	Construction sector	Fossil fuel dependency	$\sum$[18]	Ratio	Consistency measure
Energy efficiency	0.461173	0.459954	0.458746	1.38	0.7306	3.0638
Construction sector	0.220285	0.221968	0.221122	0.66	0.0810	3.0670
Fossil fuel dependency	0.318542	0.318078	0.320132	0.96	0.1884	3.0684
					CI[19] =	0.0332
					RI[20] =	0.58
					CR[21] =	0.0572

Table 5.1-1: Overall goal ratio

[18] Row sum
[19] Consistency index
[20] Random index
[21] Consistency ratio

Overall the instruments are ranked accordingly using the same method. The overall instruments do not need the consistency ratio, as the ratio is the result of combining all instruments over all goals, which are checked for consistency. Overall pairwise comparisons for each alternative have yielded stakeholder preference weights as reported in Table 5.1-2.

Instruments	Ratio
BAFA on-site consultation	0.3607
Subsidies	0.1598
-40% Club	0.1335
Informational Schemes	0.1142
The Green Deal	0.1005
Low-Energy Building in the building stock	0.0865
Code for Sustainable Homes	0.0448

Table 5.1-2: Overall best instrument ratio

Visible in the table is that the instrument 'BAFA on-site consultation' clearly rises above all other option when discussing their relative effectiveness to fulfil the set goals. Subsidies are argued to be the second best option to use, whilst the -40% club comes third. The instruments are also weighted according to a singular goal. The results of these separate goals are depicted in tables 5.1-3 through 5.1-5. All three goal tables are valid as the consistency ratios are below 0.1.

Goal 1: Energy efficiency:

	Ratio	Consistency measure
BAFA on-site consultation	0.3883	7.7495
Subsidies	0.1478	7.7074
Informational Schemes	0.1299	7.7583
-40% Club	0.1171	7.7728
Low-Energy Building in the building stock	0.0899	7.7474
The Green Deal	0.0845	7.7358
Code for Sustainable Homes	0.0425	7.7722
	CI =	0.1248
	RI =	1.32
	CR =	0.0946

Table 5.1-3: Instrument ratio for the goal Energy Efficiency

Goal 2: Strengthen the construction sector:

	Ratio	Consistency measure
Subsidies	0.2783	7.1432
BAFA on-site consultation	0.2679	7.1207
The Green Deal	0.1404	6.7310
-40% Club	0.1228	6.5633
Low-Energy Building in the building stock	0.0965	6.3112
Code for Sustainable Homes	0.0542	5.1991
Informational Schemes	0.0400	6.5633
	CI =	0.1038
	RI =	1.32
	CR =	0.0786

Table 5.1-4: Instrument ratio for the goal strengthening the construction sector

Goal 3: Less dependence of fossil fuels:

	Ratio	Consistency measure
BAFA on-site consultation	0.2939	7.2742
-40% Club	0.2014	5.6349
Subsidies	0.1554	6.8451
The Green Deal	0.1456	6.8368
Informational Schemes	0.0851	7.1870
Low-Energy Building in the building stock	0.0692	5.7232
Code for Sustainable Homes	0.0495	6.8473
	CI =	0.1242
	RI =	1.32
	CR =	0.0941

Table 5.1-5: Instrument ratio for the goal less dependence on fossil fuels

5.1.3 Overall ranking of instruments

Tables 5.1-3 through 5.1-5 show that for both the first and last goal, BAFA on-site consultation would be the preferable instrument to use. On the second goal subsidies is narrowly more chosen above BAFA on-site consultation, where it is prioritized second. All goals have a consistency ratio below 0.1, making all results valid to sue according to Saaty (1980). The result to the third sub question of this research "*How are selected policy instruments prioritized by involved stakeholders for fulfilling the energy efficiency objectives for private housing in Overijssel using the analytical hierarchy process"* is given in table 5.1-6 in relation to their relative rankings over the three sub goals.

		Overall	Energy Efficiency	Construction sector	Fossil Fuel independency
1	BAFA on-site consultation	1 (0.36)	1 (0.39)	2 (0.27)	1 (0.29)
2	Subsidies	2 (0.16)	2 (0.15)	1 (0.28)	3 (0.16)
3	-40% club	3 (0.13)	4 (0.12)	4 (0.12)	2 (0.20)
4	Informational schemes	4 (0.11)	3 (0.13)	7 (0.04)	5 (0.09)
5	The Green Deal	5 (0.10)	6 (0.08)	3 (0.14)	4 (0.15)
6	Low-energy building in the building stock	6 (0.09)	5 (0.09)	5 (0.10)	6 (0.07)
7	The Code for Sustainable Homes	7 (0.04)	7 (0.04)	6 (0.05)	7 (0.05)

Table 5.1-6: Instrument ratio's overall

This result is checking in the survey by directly asking the respondents which thee instruments they think will be most feasible for use and most effective. They had to rank their top three instruments. The answer is derived by the modus of all respondents (raw frequencies of times the instrument is selected as number 1). The result of this question is given in table 5.1-7.

Rank	Instrument	Count
First instrument chosen	BAFA on-site consultation	26
Second instrument chosen	Subsidies / BAFA on-site consultation / Low-energy building in the building stock[22]	6
Third instrument chosen	The Green Deal	8

Table 5.1-7: Top three ranked instruments

The results of this question align with the overall AHP calculation for the first two goals – the Green Deal however is prioritized fifth according to respondent's pair-wise comparison answers, while low-energy building in the building stock is prioritized almost lastly. This discrepancy has no singular explanation; the ratios for the third through the sixth prioritized instruments however do lie close to each other, it may be just random error.

[22] As raw frequencies are used, multiple instruments can be chosen an equal amount of times, making multiple instruments be ranked equally

5.2 Most preferred instrument by stakeholder group

The results are also divided by stakeholder group in order to check whether different backgrounds (public vs private) show a difference in preferences for the instruments selected. The original goal was to segment all respondents into various categories of companies and governments, but many companies opted for the "other" option as they did not identify their organisation with one of the pre-mentioned option, even although it fits the description (one category given is construction company, but an installation company which essentially does the same job answered "other"). Respondents are therefore segmented into (1) municipalities and (2) companies. In order to check for differences due to public function. The survey sample is then segmented as below:

Category	n
Governments (municipalities)	16
Companies	27

5.2.1 Category 1: municipalities

For the category municipalities the results are not significant, making their responses statistically not valid. Concerning the weighing of goals the ratio's show that energy efficiency is the most important goal by far, but when checking for consistency the ratio is 0.27, making the result not significant as the threshold is < 0.1.

Overall most important goal for municipalities

	Ratio	Consistency measure
Goal 1: Energy efficiency	0.7531	3.2760
Goal 2: Construction sector	0.0629	3.3151
Goal 3: Fossil fuel dependency	0.1840	3.3679
	CI =	0.1598
	RI =	0.58
	CR =	0.2756

Table 5.2-1: Overall goal ratio for category municipalities

The same insignificant results can be seen when instruments are divided by the three goals, as shown in the tables 5.2-2 through 5.2-4.

Goal 1: Energy efficiency:

	Ratio	Consistency measure
BAFA on-site consultation	0.3823	8.2662
Subsidies	0.2202	8.1168
-40% Club	0.1262	8.3494
Informational Schemes	0.1202	8.2212
The Green Deal	0.0610	8.1734
Low-Energy Building in the building stock	0.0506	8.3497
Code for Sustainable Homes	0.0395	8.2286
	CI =	0.2073
	RI =	1.32
	CR =	0.1570

Table 5.2-2: Instrument ratio for the goal Energy Efficiency for category municipalities

Goal 2: Strengthen the construction sector

	Ratio	Consistency measure
BAFA on-site consultation	0.3038	8.2822
Subsidies	0.2560	7.8020
-40% Club	0.1243	7.6291
The Green Deal	0.1086	7.9287
Low-Energy Building in the building stock	0.0979	5.6242
Informational Schemes	0.0605	6.7833
Code for Sustainable Homes	0.0489	6.6207
	CI =	0.2477
	RI =	1.32
	CR =	0.1877

Table 5.2-3: Instrument ratio for the goal strengthening the construction sector for category municipalities

Goal 3: Less dependence of fossil fuels

	Ratio	Consistency measure
BAFA on-site consultation	0.3174	7.5128
Subsidies	0.1914	7.8751
-40% Club	0.1586	6.9990
Informational Schemes	0.1302	7.6542
Low-Energy Building in the building stock	0.0911	5.9557
The Green Deal	0.0750	7.3048
Code for Sustainable Homes	0.0363	6.3378
	CI =	0.2183
	RI =	1.32
	CR =	0.1654

Table 5.2-4: Instrument ratio for the goal independence of fossil fuels for category municipalities

For municipalities the results have been accumulated in table 5.2-5, showing the prioritized ranking of instruments both overall and specified into the separate goals.

		Overall	Energy Efficiency	Construction sector	Fossil Fuel independency
1	BAFA on-site consultation	1 (0.37)	1 (0.38)	1 (0.27)	1 (0.32)
2	Subsidies	2 (0.21)	2 (0.22)	2 (0.26)	2 (0.19)
3	-40% club	3 (0.13)	3 (0.13)	3 (0.12)	3 (0.16)
4	Informational schemes	4 (0.12)	4 (0.12)	6 (0.06)	4 (0.13)
5	The Green Deal	5 (0.07)	5 (0.06)	4 (0.11)	6 (0.09)
6	Low-energy building in the building stock	6 (0.06)	6 (0.05)	5 (0.10)	5 (0.08)
7	The Code for Sustainable Homes	7 (0.04)	7 (0.04)	7 (0.05)	7 (0.04)

Table 5.2-5: Instrument ratio overall for category companies

When checking this prioritized table with the consistency question asked in the survey, no similarities can be found. The results of the question are depicted in table 5.2-6. For the second instrument all three instruments given have the same amount of votes. Whilst subsidies and BAFA on-site consultation are indeed in the top three prioritized instruments, the Code for sustainable homes is unanimously prioritized last in the AHP and low-energy building in the building stock is also among the least prioritized.

Rank	Instrument	Count
First instrument chosen	Subsidies	8
Second instrument chosen	The Code for sustainable homes / Subsidies / Low-energy building in the building stock	5
Third instrument chosen	BAFA on-site consultation	8

Table 5.2-6: top three ranked instruments for category companies

5.2.2 Category 2: companies

The opposite is true when looking at the survey results of companies. Goal weighing resulted in a consistency ratio of 0.0061, which is significant. The most prioritized goal is again energy efficiency as shown in figure 5.2-7 below. Individual goals produce same low consistency ratios for instruments prioritized, as shown in tables 5.2-8 through 5.2-10.

Overall most important goal:

	Ratio	Consistency measure
Goal 1: Energy efficiency	0,6694	3.0070
Goal 2: Construction sector	0.0879	3.0071
Goal 3: Fossil fuel dependency	0.2426	3.0071
	CI =	0.0035
	RI =	0.58
	CR =	0.0061

Table 5.2-7: Overall goal ratio for category companies

Goal 1: Energy efficiency:

	Ratio	Consistency measure
BAFA on-site consultation	0.4157	7.4457
-40% Club	0.1553	7.4902
The Green Deal	0.1066	7.4418
Low-Energy Building in the building stock	0.1056	7.4304
Informational Schemes	0.1055	7.4301
Subsidies	0.0758	7.3911
Code for Sustainable Homes	0.0354	7.4478
	CI =	0.0733
	RI =	1.32
	CR =	0.0555

Table 5.2-8: Instrument ratio for the goal Energy Efficiency for category companies

Goal 2: Strengthen the construction sector:

	Ratio	Consistency measure
BAFA on-site consultation	0.2871	7.2788
Subsidies	0.2657	7.2288
-40% Club	0.1477	5.2204
The Green Deal	0.1359	6.8122
Low-Energy Building in the building stock	0.0837	6.3185
Code for Sustainable Homes	0.0400	6.7040
Informational Schemes	0.0400	6.7040
	CI =	0.1219
	RI =	1.32
	CR =	0.0924

Table 5.2-9: Instrument ratio for the goal strengthening the construction sector for category companies

Goal 3: Less dependence of fossil fuels:

	Ratio	Consistency measure
-40% Club	0.2906	5.3749
BAFA on-site consultation	0.2177	7.2101
The Green Deal	0.2062	6.6147
Subsidies	0.1293	5.9141
Informational Schemes	0.0542	6.2397
Code for Sustainable Homes	0.0529	6.2370
Low-Energy Building in the building stock	0.0491	6.1162
	CI =	0.0488
	RI =	1.32
	CR =	0.0369

Table 5.2-10: Instrument ratio for the goal independence of fossil fuels for category companies

These tables then indicate that most companies are quite single-minded in their answers. The pair-wise comparisons indicate that for the first and second goal BAFA on-site consultation is the most prioritized instrument, whilst it is the second most prioritized instrument for the third goal. The minus 40% Club is prioritized for the final goal by companies in the sample. All consistency ratios checked are within the margin of error (< 0.1), making all results valid and significant.

For companies finally the results have been accumulated in table 5.2-11, showing the prioritized ranking of instruments both overall and specified into the separate goals.

		Overall	Energy Efficiency	Construction sector	Fossil Fuel independency
1	BAFA on-site consultation	1 (0.36)	1 (0.41)	1 (0.29)	2 (0.22)
2	-40% club	2 (0.19)	2 (0.16)	3 (0.15)	1 (0.29)
3	The Green Deal	3 (0.13)	3 (0.11)	4 (0.14)	3 (0.21)
4	Subsidies	4 (0.11)	6 (0.08)	2 (0.27)	4 (0.13)
5	Low-energy building in the building stock	5 (0.09)	4 (0.11)	5 (0.08)	7 (0.05)
6	Informational schemes	6 (0.09)	5 (0.11)	7 (0.04)[23]	5 (0.05)
7	The Code for Sustainable Homes	7 (0.04)	7 (0.04)	7 (0.04)	6 (0.05)

Table 5.2-11: Instrument ratio overall for category companies

The results of the instrument prioritization by companies in the sample are also checked using the question in the survey. When asked how which three instruments respondents thought to be most effective, the results were in line with their responses to the pair-wise comparisons. The results to the questions are depicted in table 5.2-12.

Rank	Instrument	Count
First instrument chosen	BAFA on-site consultation	19
Second instrument chosen	Subsidies	10
Third instrument chosen	Subsidies	9

Due to the modus being chosen to rank instruments, subsidies come both on the second and third place. For the second ranked instrument no other instrument comes close to the choice of subsidies, with the nearest instrument BAFA on-site consultation only getting 5 votes. For the third ranked instrument the first other instrument with a high number of votes is the Green Deal with 7 votes. What is interesting to see is that whilst the -40% Club is prioritized second by companies; it is not visible in the direct question on instrument effectiveness.

[23] Shared last place due to exactly the same score

Chapter VI – Conclusions

The sub conclusions reached will first be presented in order to increase comprehensibility of the final conclusion and to generate a quick overview. The sub questions will be presented individually to show the linear path taken. After the sub conclusions have been presented the main conclusion of this research is presented and the recommendation to the province of Overijssel based on it.

6.1 Sub conclusions

6.1.1 Sub conclusion one: used policy instruments or packages

Which policy instruments or packages were used in five selected Western European countries between 2000 and 2013?

A total of seven instruments were found in selected EU countries based upon effectiveness criteria to use for a second part of this study in an application of these instruments to the province of Overijssel, which all have shown to have a positive impact on energy efficient improvements for private dwellings. The instruments are:

- Financial incentives
- BAFA on-site consultation
- -40% Club
- Green Deal
- Code for Sustainable homes
- Informational instruments
- Low-energy buildings in the building stock

Financial incentives are found to be able to overcome the financial barrier perceived by house owners as argued by Walls (2012. Financial incentives aim to make the initial purchase price barrier negligible by providing low-cost loans and subsidies for (part of) the purchasing price. The incentive can be paid in the form of loans, grants and/or allowances.

BAFA on-site consultation is directly aimed at overcoming multiple barriers perceived by house owners. It provides direct consultation in order to increase knowledge of house owners concerning the energy efficiency of their dwellings by providing detailed reports on the actual savings attainable by their dwelling, which also reduces uncertainty perceived by house owners.

Other informational instruments are directly aimed to reduce the lack of knowledge holding house owners back in purchasing energy efficient improvements for their dwellings. Informational instruments can range from free council to low-income households to the pre-emptive working of product labels and construction guidelines.

The minus 40-Percent Club is a special informational instrument, in that it serves an exemplary role for the whole of society, showing that it is possible to reduce a household's carbon emission by 40 %. The 100.000 households are followed over multiple years with extensive media coverage.

The Request project of the EU program 'Intelligent Energy Europe' aims with the low energy in the building stock project to the development of quality construction standards, enabling a speed-up of knowledge and the establishment of higher building standards.

The Code for sustainable homes then is trying to overcome not only the informational barrier, but also tries to reduce uncertainty and address the bounded rationality house owners perceive. The instruments functions by simplifying the building process and increasing awareness.

The Green Deal finally is an instrument targeted to negate the financial barrier entirely by enabling energy suppliers to improve dwellings and paying for them through the energy bill. It does so by first improving information available, second by reducing uncertainty about actual savings and thirdly by letting energy suppliers pay for the improvements in the form of a property-linked loan (not personal).

6.1.2 Sub conclusion two: policy instruments / packages effectiveness

To what extent were selected policy instruments (packages) effective in achieving the policy goals they were expected to achieve?

Financial incentives are found to be able to overcome the financial barrier perceived by house owners. Stakeholder involvement in none or little; Contractors and suppliers can be indirectly involved in the actual execution of energy efficient improvements.

BAFA on-site consultation is directly aimed at overcoming multiple barriers perceived by house owners. It provides direct consultation in order to increase knowledge of house owners concerning the energy efficiency of their dwellings by providing detailed reports on the actual savings attainable by their dwelling, which also reduces uncertainty perceived by house owners. Many stakeholders are also involved in the usage of this policy instrument, of which most are independent energy advisors together with contractors, architects and suppliers.

Other informational instruments are directly aimed to the perceived informational barrier. Informational instruments can range from free council to low-income households to the pre-emptive working of product labels and construction guidelines. All kinds of stakeholders can be involved in informational schemes, ranging from marketers to architects to energy advisors.

The minus 40-Percent Club is a special informational instrument, in that it serves an exemplary role for society, showing that it is possible to reduce a household's carbon emission by 40%. 100.000 households are followed over multiple years with extensive media coverage, including many stakeholders in the process of improving the associated households.

The Request project of the EU program 'Intelligent Energy Europe' aims with the low energy in the building stock project to the development of quality construction standards, enabling a speed-up of knowledge and the establishment of higher building standards. It addresses the financial barrier by aligning professionals and consumers, and the informational barrier by raising the quality standards for buildings. The stakeholders involved in the project range from energy consultants to architects to construction companies.

The Code for sustainable homes tries to overcome not only the informational barrier, but also tries to reduce uncertainty and address the bounded rationality house owners perceive. The instruments functions by simplifying the building process and increasing awareness. The instrument employs the Building Research Establishment Global's EcoHomes as advisory stakeholders.

The Green Deal finally is an instrument targeted to negate the financial barrier entirely by empowering energy suppliers to improve dwellings and paying for them through the energy bill. It does so by first improving information available and diminishing this barrier, second by reducing uncertainty about actual savings and thirdly by letting energy suppliers pay for the improvements in the form of a property-linked loan (not personal). As this instrument is offered by the private sector multiple stakeholders are involved, most certified and associated as Green Deal assessors, providers and installers.

6.1.3 Sub conclusion three: instruments prioritized

How are selected policy instruments prioritized by involved stakeholders for fulfilling the energy efficiency objectives for private housing in Overijssel using the analytical hierarchy process?

The instruments were used as input in the multi-criteria decision-making tool Analytical Hierarchy process. Via a survey companies and governments within the province of Overijssel were asked on their opinion of the feasibility of found policy instruments when applied to the province of Overijssel.

The overall results fall within the error margins stated for the AHP, making them significant enough to base a conclusion on. The municipalities' stakeholder category is however not generating a significant consistency ratio, resulting in a partially unusable dataset. When looking at the companies' stakeholder category, the consistency ratio is significant. It seems municipalities are not single-minded concerning the policy options presented to them, and do not share opinions on the relative weights of the asked instruments. This might be due to a knowledge uncertainty concerning the instrument options. Even though these results proved not significant, they are remarkably similar to the results of both overall and companies' results.

The three goals set out by the province then have not been prioritized as equally important. Energy efficiency is by far the most prioritized goal, whilst strengthening the construction sector is perceived as least important. There are no significant deviations between respondent categories and the overall sample; the sample is quite unanimously concerning their opinion on the three goals. The instruments then are prioritized as depicted in table 6.1.3-1.

Instruments	Ratio
BAFA on-site consultation	0,3607
Subsidies	0,1598
-40% Club	0,1335
Informational Schemes	0,1142
The Green Deal	0,1005
Low-Energy Building in the building stock	0,0865
Code for Sustainable Homes	0,0448

Table 6.1.3-1: Overall best instrument ratio

6.1.4 Sub conclusion four: best fitting instruments

Which instruments are perceived best fitting for implementation by the province of Overijssel taking into account the effectiveness criteria used?

For all three goals, BAFA on-site consultation is prioritized the most, with only one second prioritization by companies for the third goal (fossil fuel independence) stated. BAFA on-site consultation also is prioritized overall with a ratio of 0.36, which is high enough to be certain that the sample is quite unanimous in their opinion that the usage of this instrument is perceived better than all other instruments. Due to the sample being two-third companies, which could benefit most from a policy measure like the BAFA on-site consultation instruments offers, the results may be skewed towards instruments they would be most profitable for companies. BAFA on-site consultation however has proven itself already as an instrument in Germany, with an advice implementation of 64% by house owners. The problem with this instrument however is the required linkage to financial incentives for house owners. Results from this instrument's usage are concerned by interactions with financial measures. Informing citizens on their own energy use has been proven the most effective, making the instrument a good candidate for adoption.

The second overall prioritized instrument is subsidy usage. In general, subsidies have been used for a long time and have proven their effectiveness. The companies' stakeholder category however prioritizes subsidies on the fourth place. This discrepancy is most likely due to subsidies being directed at house owners, not at companies. Consumers have to apply for a subsidy for companies to see profit of them. A direct involvement by offering free advice under the BAFA measure (subsidized by the government directly to companies) then is perceived more attractive. However as stated there, the instrument works best in combination with financial incentives like subsidies.

6.2 Main conclusion

The combination of free on-site energy savings advice and subsidies to pay for the large up-front costs are perceived to be the most effective by the sample in order to fulfil the three stated goals. What is interesting in this conclusion is that the Green Deal, used in the UK, offers exactly this, but is prioritized fifth by sample respondents. The difference between the Green Deal and the combination of on-site consultation and subsidies lie in the source of the subsidies (Green Deal: energy suppliers; Subsidies: governments). It would be possible to argue that respondents simply did not fully understand the working of the instrument, or perceive energy suppliers not able to fulfil this new role as 'loan bank'.

Addressing the main research question finally, a combination of instruments is perceived to be the most effective at realizing the three goals set out by the province of Overijssel. Taking the effectiveness criteria into account, the on-site consultation and subsidy usage cannot be seen as separate instruments; they work in tandem with each other, increasing their overall effectiveness. The instruments together tackle both the perceived financial barrier and the perceived informational barrier, whilst including stakeholders in the process. BAFA on-site consultation then offers the best candidate for adoption in order to fulfil the goals set out by the province of Overijssel.

6.3 Recommendations

The province of Overijssel currently engages in increasing energy efficiency for private households by offering a sustainability loan and a sustainability subsidy, trying to diminish the financial barrier. Construction companies are engaged by offering 48 hours of free marketing to help to promote their core businesses. Agreements are also made with housing corporations in order to make their housing supply more energy efficient in which the province provides (partial) funding through loans. The province has also initiated an experiment in 6 municipalities to make 50 houses energy neutral. House owners can apply for the program which can result in a cash-back up to €8000 for made investments.

All instruments used by the province then stem from a financial perspective. The financial barrier is central to the policy mix the province uses, but the effectiveness of these instruments has yet to be proven. Also, the province desires to lessen their use of subsidies and let the market fill theat function. Companies asked in the sample have prioritized subsidies as fourth most important; leading to believe their effectiveness is far from the best. This research shows that making money available for use is not enough to tackle the energy efficiency gap perceivable with private households; people need to be informed that (1) their house can save energy and (2) funding is available for it in multiple ways.

An instrument which would best enable the province of Overijssel to pursue their stated goals then would be comprised of several instruments which work in tandem. First of all, on-site consultation should be used with contracted advisors to show house owners that their residence can be more energy efficient and that it can be beneficial to them by calculating and presenting projected costs and benefits. Second, financial incentives like the sustainability loan should complement this advice in order to increase the chances of adoption of the efficiency measures. The province should also contact market parties with financial reserves / a strong financial position like energy suppliers to also engage in giving out loans similar to the British Green Deal example. Thirdly, people who are willing to make their house more energy efficient should be asked to be documenting their approach and the process of creating their energy efficient houses. These documentaries should then be promoted and advertised actively in order to reach the wider public; making certain that everyone knows what the costs and benefits really are.

The province of Overijssel then already has policies in place which fulfil the required roles partially. A further step is needed to create an integrated approach like discussed above. When this final step is taken the realisation of the predetermined goals ought to follow from policy implementation.

6.4 Discussion

The first step of this research has looked into policies used by five EU member states which assess energy efficiency for private households. The selection of countries is made in order to not get a too large sample, but not enough that no input data is provided. The selection however does include the risk that a good policy instrument is missed due to it being used by a not selected country. The boundaries of this research are therefore quite strict in order to fit within the timespan the research

has been carried out in. A follow-up study can address other countries in a comparative fashion, or to create an overview like this study has done.

The second step of this research entails a survey under 150 companies and municipalities within the province of Overijssel. Of these, a total of 43 respondents answered. The data sample this research uses has been quite small, making generalizability of this research relatively small. This is further reduced as all respondents were companies within the geographical boundaries of the province of Overijssel. In order to verify the results and increase overall reliability, structured qualitative interviews with both involved municipalities and involved companies should be included in follow-up studies. In these qualitative interviews it is possible to discuss question interpretation, information availability and stakeholder perception of discussed policy instruments.

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UNIVERSITEIT TWENTE.

Master Thesis Public Administration

Policy instruments to support the diffusion of near zero-energy housing in Overijssel

Appendices

In collaboration with

provincie Overijssel

Policy instruments to support the diffusion of near zero-energy housing in Overijssel

Research on the near zero-energy housing policy in multiple EU member states and the application of a decision-making technique on Overijssel

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Appendices

Appendix A – Context and policy goals of used EU countries

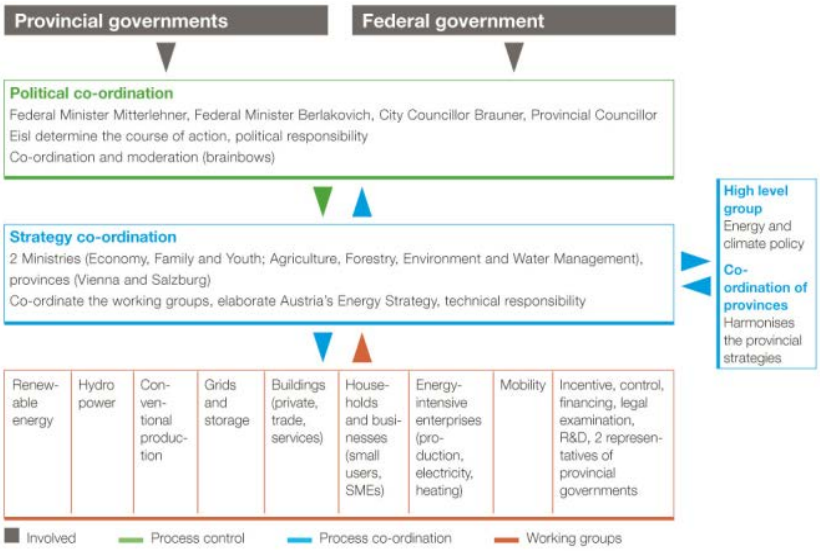
A.1 Austria

Context

Austria is a European land-locked country consisting of 9 independent federal states (Austria.info, 2013a). As a consequence the 'Länder' or provinces have a high amount of sovereignty concerning their policies. All however require to create action plans concerning energy efficiency (Austrian Federal Ministry of AFEW, 2010, p. 27). The country has a temperate climate with averages of 0 degrees Celsius in the winter and 20 degrees Celsius in the summer (Austria.info, 2013b). The population size is approximately 8.3 million, with a gross domestic product (GDP) of 207.53 billion Euros and a total primary energy supply (TPES) resolving around 33.25 Million tons of oil equivalents in 2008 (UNFCCC, 2011a). The most important legal arrangement is the 'Austrian Environmental Control Act', which identifies the 'Umweltbundesamt' as single national entity with overall responsibility for inventory preparation (Austrian Federal Ministry of AFEW, 2006). This institution is the primary stakeholder in Austria which monitors Austria's progress towards the Kyoto goals. Another primary stakeholder here is the Austrian Energy Agency, responsible for the NEEAP's.

Goals

Under the burden-sharing agreement of EU Member States (European Commission, 2008), Austria agreed to reduce its greenhouse gas emissions by 13% in 2012 in relation to the emission level of 1990 (UNFCCC, 2011a). According to the Energy Efficiency Watch, many good measures could be found especially in the buildings sector (Energieoverheid, 2013). The policy package used "combines all relevant elements, from legal minimum standards and other regulations to widely available financing and economic incentives to energy performance certificates" (Energieoverheid, 2013, p. 2). The Odyssee MURE project claims that the household sector in Austria has improved in energy efficiency by 34% over the period 1990-2010 (Odyssee MURE, 2012).



A.2 Belgium

Context

Belgium is a European country adjacent to the North Sea, divided into three regions (Flanders, Wallonia and Brussels-Capital) which contain ten provinces (Belgium.be, 2013b). The key actors are (1) the Inter-ministerial Conference for the Environment (ICE), consisting of the Federal Minister for the Environment, the Environment Ministers of the three regions and the Federal Minister of Science (UNFCCC, 2011b, p. 5), and (2) the National Climate Commission, which is responsible for a number of tasks related to national implementation of climate policy (Belgian National Climate Commission, 2009, p. 15). The country has a warm temperate humid climate with averages of 3 degrees Celsius in January and 18 degrees Celsius in July (Euro Weather, 2013). The population reached 10.8 million in 2010 (Belgium.be, 2013a), with a GDP of approximately 343,941 billion Euros in 2008 (Belgian National Climate Commission, 2009) and a TPES of 58.6 Million tons of oil equivalents in 2008 (UNFCCC, 2011b, p. 6). The building stock is deemed of low quality for three reasons. First, the Belgium housing stock is rather old due to a low demolition rate and only a small growth in the building stock (1%) (McKinsey & Company, 2009, p. 16). In 2007 only 20 % of houses were built in the past 20 years (Belgian National Climate Commission, 2009). Second, Belgium has a higher percentage of single-family houses than other EU countries (McKinsey & Company, 2009, p. 16). Thirdly, in Belgian house owners are not inclined to invest in energy efficiency features as double glazing and insulation, neither are there strict construction standards (McKinsey & Company, 2009, p. 16). 70.2% of households are house owners (Belgian National Climate Commission, 2009).

Goals

Under the burden-sharing agreement of the EU, Belgium agreed to reduce its greenhouse gas emissions by 7.5% in the period 2008 – 2012 in comparison to the base year 1990 (UNFCCC, 2011b, p. 1). The country has adopted a NEEAP for the period 2008-2016 which sets the energy saving target of 9% in all sectors (ABB, 2011).

A.3 Germany

Germany is a European country consisting of 16 independent federal states. As a consequence the 'Bündeslandër' or provinces have a high amount of sovereignty concerning their policies. The country has a temperate climate with averages of 0 degrees Celsius in the winter and 25 degrees Celsius in the summer (World Weather Online, 2013). The population reaches approximately 81 million, with a GDP of 701,49 billion Euros in 2013 and a TPES resolving around 335.28 Million tons of oil equivalents in 2008 (UNFCCC, 2011c). The most important legal arrangement is the 'Integrated Energy and Climate Programme' (IECP), which is Germany's key framework for climate and energy policies and measures. In recent light after the nuclear disaster at Fukushima, Japan, Germany has decided to a nuclear phase-out in 2022 (Breidthardt, 2011). However, how the energy gap will be overcome has not yet been decided.

The Energy Efficiency Watch deems the German National Energy Efficiency Action Plan (NEEAP) of high quality (Energy Efficiency Watch, 2013c). Their energy saving programme is most ambitious energy saving program in the European Union. Germany aims at an energy usage reduction of 30% by 2020, and an increase in the share of renewable energy by an equal 30 % (Power & Zulauf, 2011). For these goals to be met, Germany's energy saving program is based on three pillars (Power & Zulauf, 2011, p. 3):

1. A clear legal framework and tight regulation at the national level, requiring energy efficiency upgrades to buildings and increased use of renewable energy sources among electricity providers;
2. Strong financial incentives through subsidies and loans to reduce energy consumption in the built environment at all levels of government. At the national level, these are provided via a public investment bank sponsored by the German government;
3. Information, promotion, and behaviour change, working through regional and local bodies, developing enforceable standards through Energy Performance Certificates, and supporting model projects all over Germany

A.4 United Kingdom

Context

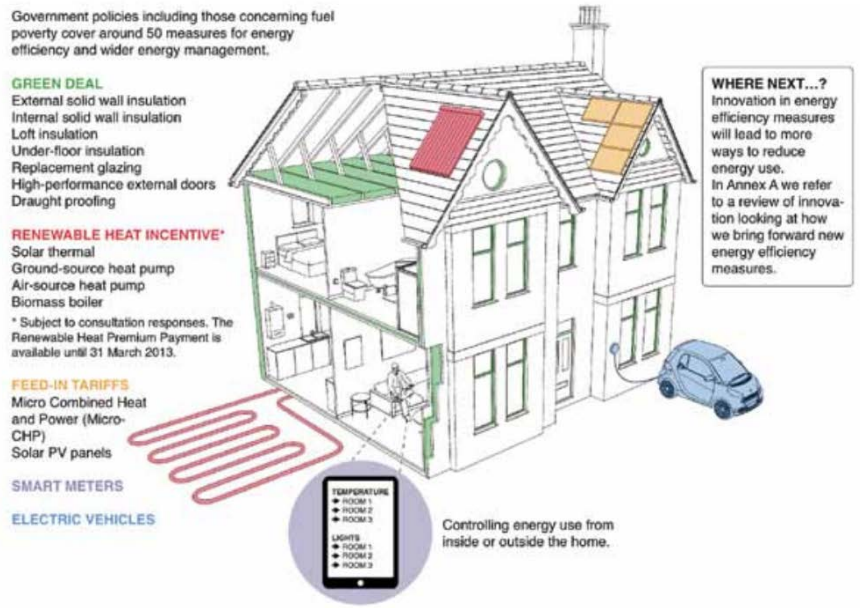
The United Kingdom is a European island country with an area of 242.495 km2, divided over the four areas: England, North Ireland, Scotland and Wales. These are subdivided as follows (Wikipedia, 2013a):

- England has 9 regions
- North Ireland has 26 districts
- Scotland has 32 council areas
- Wales has 22 principal areas

The country mainly has a temperate sea climate with averages of 1 degree Celsius in the winter and 22 degrees Celsius in the summer (Klimaatinfo.nl, 2013b). The population reaches approximately 61.06 million, with a GDP of 1338 billion Euros and a TPES resolving around 207.42 Million tons of oil equivalents in 2008 (UNFCCC, 2010e).

Goals

The UK has sets it strategy in the Climate Change Act of 2008, which for the residential sector is illustrated in figure 2.2.6 below (DECC, 2012a).



39 Analysis from DECC Insulation Statistics (July 2012)
http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/en_effic_stats/home_ins_est/home_ins_est.aspx

Figure 2.2.6 – UK energy strategy for residences

A.5 Sweden

Context

Sweden is a Northern European country consisting of 21 provinces. The country mainly has a temperate sea climate with averages of -6 degrees Celsius in the winter and 22 degrees Celsius in the summer (Klimaatinfo.nl, 2013a), although the northern regions have a polar climate with often snow, rains and extremely low temperatures. The population reaches approximately 9 million, with a GDP of 298.1 billion Euros and a TPES resolving around 49.6 Million tons of oil equivalents in 2008 (UNFCCC, 2011d).

Goals

The targets for Sweden has been set in the 2009 climate and energy bill. Sweden focuses on climate-related research, and is increasingly making use of economic and market-based instruments, shifting away from cross-sectoral investment grants (UNFCCC, 2011d).

A.6 The Netherlands

Context

The Netherlands is an EU country consisting of 12 provinces. The country has a temperate sea with averages between 3.1 degrees Celsius in winter and 17.9 degrees Celsius in summer (Wikipedia, 2013b). The population size is approximately 16.833.973 in 2013 (CBS, 2013) with a GDP of 531.0 Million US dollar and a TPES of 77.2 Million tons of oil equivalents in 2009 (UNFCCC, 2010f).

Goals

The Netherlands have written their energy goals in the 'Energieakkoord voor duurzame groei'. (SER, 2013). In this report the Netherlands outline their goals for energy saving in the residential sector. These goals follow the 'Trias Energetica' (SER, 2013, p. 17):

> Energy saving;
> Renewable energy generation;
> Clean and efficient generation from non-sustainable energy sources.

Following these three goals, the following targets have been established to meet in 2020, following the renewal of the EPBD (SER, 2013, p. 17):

> The targets from the European Energy Efficiency Directive (EED)(2006/32/EC), the renewal of the EPBD (2002/91/EC) and the Ecodesign directive (2009/125/EC);
> The targets resulting from covenants for energy saving in the build environment:
> Existing buildings: 300.000 existing dwellings and other buildings per year improving at least 2 energy label steps;
> New buildings: near-zero energy buildings from 2020 onwards (2018 for governmental buildings) in accordance with the EPBD;
> Rental dwellings: an average of energy label B in social rent dwellings, at least label C for at least 80% of private rent dwellings in 2020.

For private house owners, the Netherlands regard the loaning capacity as a significant barrier as this is still based on mortgage expenses instead of living expenses (SER, 2013, p. 20). In order to diminish this barrier the Netherlands is currently engaged with market stakeholders to research the effects of a loan linked to a property rather than a person (Based upon the juridical framework used in the UK Green Deal) (SER, 2013, p. 21).

A.7 Energy efficiency ambition of the province of Overijssel

The province of Overijssel desires to have an energy neutral private dwellings sector. However, existing private dwellings are nowhere near energy neutral and therefore these houses need to be upgraded to be more energy efficient (Priemus, 2005). The province of Overijssel currently offers a range of financial incentives, however the province recognizes the market potential and regards this potential high enough to fully enable a shift towards energy neutral or energy efficient housing construction. The province wants the market to take their role as facilitator of energy efficiency measures for households, and with that ensuring (1) households will be stimulated to make their house energy neutral, (2) market players be stimulated in facilitating energy efficiency measures and (3) give incentives to the construction sector to actively market energy saving solutions.

In order to attain these goals, the province has initiated the program 'Nieuwe Energie' (Province of Overijssel, 2013). The province sets its targets for 2020 at "20% new energy (i.e.: from sustainable sources) available for use in the province by companies, inhabitants, municipalities and the province itself. In the 'Nieuwe Energie' program the ambition of 30% CO2 reduction by 2020 has been fastened to 2017, the focus of the program lies at the use of bio-energy and reductions in the housing sector (Province of Overijssel, 2011). The province tries to attain these goals by connecting public and private organizations, knowledge institutes and society. The program consists of five sub-programs: (1) Energy saving companies and housing; (2) Wind energy; (3) Bio-energy; (4) geothermal energy and waste heat; and (5) Energy infrastructure (Province of Overijssel, 2011).

Appendix B.1 - Policy instruments classification according to Jordan, Wurzel & Zito (2010)

FIGURE 1
A TYPOLOGY OF NEPIs

	Regulator SPECIFIES the goal to be achieved	Regulator does NOT SPECIFY the goal to be achieved
Regulator specifies HOW goal is to be achieved	Command and control (regulation)	Technology-based regulatory standards
Regulator does NOT SPECIFY HOW goal is to be achieved	Most negotiated VAs; some MBIs; some regulation (e.g. EQOs)	Most MBIs; some VAs; informational devices

Russell, C. and R. Powell, (1996), 'Practical Considerations and Comparison of Instruments of Environmental Policy', in J. Van der Bergh (ed.), Handbook of Environment and Resource Economics, Cheltenham: Edward Elgar.

Appendix B.2 - policy instrument classifications

(Jordan, Wurzel, & Zito, 2003)	(Bemelmans-Videc, Rist, & Vedung, 1998)	McDonnell & Elmore (1987)	Stavins (2001)	Bressers (1994)
regulatory instruments	Stick (regulation / legislation)	Mandates (rules governing the action of individuals and agencies, and are in-tended to produce compliance;)	"command-and-control" regulations	Stick (regulation / legislation)
market-based instruments	Carrot (economic incentives)	Inducements (transfer money to individuals or agencies in return for certain actions;)	Market-based instruments: pollution charges; tradable permits; market friction reductions government subsidy reductions	Carrot (economic incentives)
informational instruments	Sermon (information)	capacity-building (transfer of money for the purpose of investment in material, intellectual, or human resources)		Sermon (information)
voluntary agreements		system-changing (transfers official author-ity among individuals and agencies in order to alter the system by which public goods and services are delivered)		

Appendix C - Participation Typologies

Source: (Reed, 2008)

Table 1 – Typologies of participation

Basis of typology	Example
Typology based on different degrees of participation on a continuum. Numerous alternative terms suggested for different rungs of the ladder (e.g. Biggs, 1989; Pretty, 1995a,b; Farrington, 1998; Goetz and Gaventa, 2001; Lawrence, 2006)	Arnstein's (1969) ladder of participation. Sometimes presented as a wheel of participation Davidson (1998)
Typology based on nature of participation according to the direction of communication flows	Rowe and Frewer (2000)
Typology based on theoretical basis, essentially distinguishing between normative and/or pragmatic participation	Thomas (1993), Beierle (2002)
Typology based on the objectives for which participation is used	Okali et al. (1994), Michener (1998), Warner (1997), Lynam et al. (2007), Tippett et al. (2007)

Appendix D - perceived barriers to energy efficiency purchases by consumers

Brown	Golove & Eto	Howarth & Andersson	Lorenzoni et al.	Schleich & Gruber
Low priority of energy issues	Misplaced Incentives	lack of information	Lack of knowledge	Information and other transaction costs
	Financing	Principal-agent problems	Lack of enabling initiatives	Uncertainty and risk
Capital market barriers	Market Structure	uncertainty about the benefits	Uncertainty and scepticism	Bounded rationality
Incomplete markets for energy efficiency	Regulation	lack of access to credit required	Distrust in information sources	Capital constraints
	Custom and Information		Social norms and expectations	Investor/user dilemma
	Gold Plating and Inseparability of Features		Externalising responsibility and blame	
			Climate change is a distant threat	
			Worry about free-rider effect	
			Other things are more important	
			Reluctance to change lifestyles	
			Fatalism	
			"Drop in the ocean" feeling	
			Lack of political action	
			Lack of action by business and industry	

The four resulting barriers:

	Information barrier
	Uncertainty and risk
	Bounded rationality
	Financial barrier

Sources:

Brown, M. A. (2001). Market failures and barriers as a basis for clean energy policies. Energy policy, 29(14), 1197-1207.

Golove, W. H., & Eto, J. H. (1996). Market barriers to energy efficiency: a critical reappraisal of the rationale for public policies to promote energy efficiency. LBL-38059. Berkeley, CA: Lawrence Berkeley National Laboratory.

Howarth, R. B., & Andersson, B. (1993). Market barriers to energy efficiency. Energy Economics, 15(4), 262-272.

Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. Global environmental change, 17(3), 445-459.

Schleich, J., & Gruber, E. (2008). Beyond case studies: Barriers to energy efficiency in commerce and the services sector. Energy Economics, 30(2), 449-464.

Appendix E – Instrument selection criteria

Criteria	Factors
Environmental Results	
Assurance of meeting goals	
Do stakeholders have confidence that environmental goals will be or have been met?	Action forcing Monitoring capability Familiarity with use
Pollution prevention	
Can the approach promote use of strategies for preventing rather than controlling pollution?	Gives prevention an average Focuses on learning
Environmental Equity and Justice	
Does the approach seek equality of outcomes, full participation by affected communities in decision-making, and freedom from bias in policy implementation?	Distributional outcomes Effective participation Remediation
Costs and Burdens	
Cost-effectiveness and fairness	
Are we protecting human health and the environment at the lowest possible cost and with the fairest allocation of burdens for sources?	Cost-effectiveness for society Cost-effectiveness for sources Fairness to sources Administrative burden for sources
Demands on Government	
Are we protecting human health and the environment at the lowest possible cost and with the best use of resources for government?	Costs Ease of analysis
Change	
Adaptability	
How easily can the approach be adapted to new scientific information or abatement capability	Ease of program modification Ease of change for sources
Technology innovation and diffusion	
Are we encouraging new ways to achieve our environmental goals that lead to improved performance in quality and costs?	Innovation in the regulated industries Innovation in the EG&S industry Diffusion of know technologies

Figure 4.1: Criteria and factors for comparing policy instruments. Source: US Congress Office for Technology Assessment (1995)

US CO of TA (1995)	Criteria used in thesis	Indicator	Assessment
(Environmental) results	Furthers at least one of the goals set by the province	One of the goals is similar to the goals set by the province	Positive Neutral Negative
Costs and burdens	Negative side effects	Does not have significant negative side effects	Positive Neutral Negative
	Goal attainment / Evaluation available	Has estimates on energy savings, information on ex-post evaluations	Positive Neutral Negative
Change	Control	Does the regional government hold any power of the instrument, also after implementation?	Positive Neutral Negative
Application	is applicable by a regional government	The province of Overijssel should have the power necessary to implement the instrument	Positive Neutral Negative
	Role of stakeholders	Announces the role of stakeholders (for example energy service providers)	Positive Neutral Negative

Figure D.2: application of US COTA criteria in this research

Appendix F - Survey

SURVEY COMPANIES / GOVERNMENTS

De vragenlijst die u zo gaat invullen maakt deel uit van een onderzoek in opdracht van de Provincie Overijssel op het gebied van energie neutrale huizen. Het doel van het onderzoek is het selecteren van een beleidsinstrument wat effectief ingezet kan worden door de provincie om energie efficiëntie te promoten voor private huiseigenaren. In het kader van dit onderzoek worden diverse belanghebbende partijen zoals u gevraagd naar hun mening (vanuit uw organisatie denkende) over een klein aantal mogelijke beleidsinstrumenten die op dit moment gebruikt worden in een aantal andere Europese landen.

Het invullen van deze vragenlijst zal ongeveer 30 minuten duren, aan het einde kunt u aangeven of u op de hoogte wilt worden gehouden van de uitkomsten van het onderzoek.

Allereerst een tweetal vragen betreffende uw organisatie

Wat voor type organisatie is het?

Energieleverancier	Bouwbedrijf
Project ontwikkelaar	Netbeheerder
	Anders:

Wat is uw functie binnen deze organisatie?

Open vraag

Als tweede, een aantal stellingen over uw mening ten aanzien van doelstellingen van de provincie.

De provincie heeft drie doelen die zij verwezenlijkt zou willen zien met een beleidsinstrument: energie efficiëntie in private huizen; verbeterde werkgelegenheid in de constructiesector; en minder afhankelijkheid van fossiele brandstoffen (kolen, aardgas, aardolie).

Kunt u hieronder aangeven hoe belangrijk u de doelen vind in relatie tot elkaar, waar A staat voor dat het linker doel verreweg het belangrijkste is, het = teken betekend dat beide doelen even belangrijk zijn, en B staat voor dat het rechter doel het belangrijkste is.

Doel A	A		=		B	Doel B
Energy Efficiëntie	—	—	—	—	—	verbeterde werkgelegenheid in de constructiesector
verbeterde werkgelegenheid in de constructiesector	—	—	—	—	—	minder afhankelijkheid van fossiele brandstoffen
minder afhankelijkheid van fossiele brandstoffen	—	—	—	—	—	Energy Efficiëntie

Allereerst een aantal stellingen voor het doel Energie Efficiëntie. Kunt u hieronder aangeven in hoeverre de beide beleidsinstrumenten het beste zullen werken en het **meeste energie efficiëntie**

zullen bewerkstelligen? A staat voor dat het linker doel verreweg het belangrijkste is, het = teken betekend dat beide doelen even belangrijk zijn, en B staat voor dat het rechter doel het belangrijkste is.

INSTRUMENT A	A		=		B	INSTRUMENT B
Subsidies	__	__	__	__	__	Energieconsultatie op locatie
	__	__	__	__	__	Informatieve instrumenten
	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Energieconsultatie op locatie	__	__	__	__	__	Informatieve instrumenten
	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Informatieve instrumenten	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Proeftuin voor -40% uitstoot en energieverbruik	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Belanghebbenden bij elkaar brengen	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Vrijwillig convenant opstellen voor duurzame woningbouw	__	__	__	__	__	The Green Deal

Heeft u nog vragen of opmerkingen betreffende deze vraag?

De tweede groep stellingen betreft het doel het verbeteren van werkgelegenheid in de constructiesector. Kunt u wederom aangeven in hoeverre de beide beleidsinstrumenten het beste zullen werken en de **meeste werkgelegenheid** zullen bewerkstelligen? A staat voor dat het linker doel verreweg het belangrijkste is, het = teken betekend dat beide doelen even belangrijk zijn, en B staat voor dat het rechter doel het belangrijkste is.

INSTRUMENT A	A		=		B	INSTRUMENT B
Subsidies	__	__	__	__	__	Informatieve instrumenten
	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Informatieve instrumenten	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Proeftuin voor -40% uitstoot en energieverbruik	__	__	__	__	__	Belanghebbenden bij elkaar brengen
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Belanghebbenden bij elkaar brengen	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Vrijwillig convenant opstellen voor duurzame woningbouw	__	__	__	__	__	The Green Deal

Heeft u nog vragen of opmerkingen betreffende deze vraag?

De laatste groep stellingen betreft het doel het minder afhankelijk maken van fossiele brandstoffen. Kunt u wederom aangeven in hoeverre de beide beleidsinstrumenten het beste zullen werken en de **meeste onafhankelijkheid van fossiele brandstoffen** zullen bewerkstelligen? A staat voor dat het linker doel verreweg het belangrijkste is, het = teken betekend dat beide doelen even belangrijk zijn, en B staat voor dat het rechter doel het belangrijkste is.

INSTRUMENT A	A		=		B	INSTRUMENT B
Subsidies	__	__	__	__	__	Energieconsultatie op locatie
	__	__	__	__	__	Informatieve instrumenten
	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Energieconsultatie op locatie	__	__	__	__	__	Informatieve instrumenten
	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Informatieve instrumenten	__	__	__	__	__	Proeftuin voor -40% uitstoot en energieverbruik
	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Proeftuin voor -40% uitstoot en energieverbruik	__	__	__	__	__	Vrijwillig convenant opstellen voor duurzame woningbouw
	__	__	__	__	__	The Green Deal

INSTRUMENT A	A		=		B	INSTRUMENT B
Vrijwillig convenant opstellen voor duurzame woningbouw	__	__	__	__	__	The Green Deal

Heeft u nog vragen of opmerkingen betreffende deze vraag?

Welk beleidsinstrument denkt u zal het meeste positieve effect hebben op energie efficiëntie voor private huiseigenaren in de provincie Overijssel? Selecteer alstublieft de drie beste instrumenten naar uw mening en geef aan welke de beste is, welke de op 1 na beste en welke de op 2 na beste is.

__ Green Deal

__ Subsidies

__ Energieconsultatie op locatie

__ Informatieve instrumenten

__ Proeftuin voor -40% uitstoot en energieverbruik

__ Vrijwillig convenant opstellen voor duurzame woningbouw

__ Low-energy building in the building stock

Heeft u nog opmerkingen of suggesties voor dit onderzoek?

Wilt u gecontacteerd worden wanneer de resultaten van het onderzoek bekend zijn? Ja / nee

Hartelijk dank voor het invullen van deze vragenlijst. Wij waarderen uw tijd.

Appendix F – Survey reference sheet

REFERENCE SHEET

1 Subsidies

Het gebruik van subsidies kan ervoor zorgen dat energie efficiëntie door private huishoudens wordt verbeterd. Meerdere wetenschappers zeggen dat het gemis aan financiële middelen als een grote barrière wordt gezien voor huiseigenaren om in hun huis te investeren. Investeringen zoals het aanschaffen van bijvoorbeeld zonnepanelen, isolatie of warmtepompen worden dus minder gedaan; een subsidie zou mensen dus over de streep kunnen trekken om toch te investeren. Een mogelijke subsidie kan ook worden gegeven in de zin van leningen met lage rentepercentages, pure subsidies of toelages. Voor de provincie kan de doelbereiking met dit instrument groot zijn. Echter; het gebruik van het instrument is niet verzekerd, en de daadwerkelijke besparingen kunnen tegenvallen. Mensen kunnen denken “ik ben efficiënter met mij energie en dus goedkoper uit, ik kan nu meer gaan gebruiken voor dezelfde prijs”. Dit zogenoemde ’Rebound-effect’ zal voorkomen moeten worden voor het instrument om succesvol te zijn.

2 Energieconsultatie op locatie

In Duitsland is het ministerie van Economie (BAFA) op dit moment gratis advies aan het geven op locatie; dit wil zeggen dat onafhankelijke, erkende adviseurs adviezen gaan geven op de bouwlocatie aan huiseigenaren betreffende de mogelijkheden voor hen om energie efficiënte maatregelen toe te passen tijdens de bouw of verbouwing. Deze gratis consultatie heeft als doel het wegnemen van een andere barrière die mensen zien: te weinig informatie betreffende besparingen en voordelen van het energie efficiënt maken van hun woning. Het persoonlijke en gratis advies zorgt ervoor dat mensen bewuster nadenken over de keuzes die zij maken tijdens het renoveren of bouwen van hun woning. De doelbereiking van dit instrument is dus potentieel ook zeer groot, aangezien een van de twee grote barrières direct weg wordt gehaald en mensen oog in oog komen te staan met hun persoonlijke mogelijke besparingen.

3 Informatieve instrumenten

Informatieve instrumenten komen in veel soorten voor; van gratis energieconsuls voor huishoudens met lage inkomens tot aan energielabels voor producten, energie checkups voor huiseigenaren en bouwrichtlijnen. Deze instrumenten zijn er allemaal op gericht om mensen meer te laten nadenken over de keuzes die zij maken, en vooral over de keuzes die zij hebben betreffende het energie zuiniger maken van hun huis. Deze instrumenten proberen een gedragsverandering te bewerkstelligen richting een meer milieuvriendelijke, duurzame houding. Veel van deze instrumenten zijn gratis beschikbaar op energiewebsites en dergelijke. Doelbereiking van dit type instrumenten is zeer lastig te meten; zij hebben allen tot doel het weghalen van een informatiebarrière voor huiseigenaren.

4 Proeftuin voor -40% uitstoot en energieverbruik

In Duitsland is op dit moment een experiment gaande waarin huiseigenaren worden uitgenodigd om mee te doen aan een ‘race’ om een daling in hun uitstoot te realiseren van minimaal 40%. De huishoudens worden gedurende een periode van een aantal jaar gevolgd en hebben een voorbeeldrol voor de rest van de samenleving. De verbeteringen worden gehaald met behulp van beschikbare hulpmiddelen zoals leningen, belastingvoordelen en informatieve instrumenten. De regionale overheden proberen ook een interactief forum op te zetten waar ook nutsbedrijven en mediabedrijven worden uitgenodigd om toe te voegen aan de effectiviteit van deze voorbeeldhuishoudens.

5 Belanghebbenden bij elkaar brengen

In Duitsland wordt een instrument ingezet om specialisten samen te brengen op het gebied van energie efficiënte woningen. Hierin worden architecten, bouwbedrijven, projectontwikkelaars en ontwerpers bij elkaar gebracht om (1) de kennisoverdracht tussen deze partijen te bevorderen en (2) om energie efficiënte standaarden te ontwikkelen en te verhogen.

6 Vrijwillig convenant opstellen voor duurzame woningbouw

In het Verenigd Koninkrijk wordt op dit moment een convenant gebruikt waarin nationale standaarden zijn opgenomen om industrieën te begeleiden in het ontwerpen en bouwen van duurzame woningen. De ‘Code for sustainable homes’ meet de duurzaamheid van een woning tegen 9 verschillende categorieën van duurzame ontwerpen, waarin de gehele woning als geheel een rating krijgt. Elke categorie is opgebouwd uit ‘credits’ die ontwerpers kunnen verwerven door de gebouwen te bouwen naar de specificatie van de standaarden gezet in de code.

7 The Green Deal

De Green Deal is een instrument gebruikt in het Verenigd Koninkrijk wat ondernemingen in staat stelt om consumenten energie efficiënte maatregelen voor hun woning aan te bieden. Het idee hiervan is dat ondernemingen zelf de dialoog aangaan met consumenten om hun huizen bijvoorbeeld te isoleren of van zonnepanelen te voorzien. De initiële investering wordt hierbij gedaan door bijvoorbeeld de energieleverancier, en wordt afbetaald via de energierekening van de huiseigenaren. Een belangrijk element hierbij is dat alleen maatregelen die zichzelf kunnen betalen gedurende de looptijd van de ‘green deal’ kwalificeren voor het instrument. De lening voor de

investeringen is ook niet gekoppeld aan personen, maar juist aan het vastgoed. Als de huiseigenaren dus verhuizen tijdens de afbetaling, blijft de afbetaling gehecht aan de woning en zal dus voor rekening komen van de volgende eigenaar van de woning. Degenen die de voordelen van de investering dragen, dragen ook de kosten hiervoor.

Appendix G – Policy Instruments categorized by country

All instruments named here are courtesy of the involved country's National Energy Efficiency Action Plans. Descriptions texts are all un-adapted copies of the NAEEP's and thereby owned by the creator of the document. I take no responsibility or ownership for these texts. My addition is the application of the framework criteria used in this thesis in the form of a table.

G.1 Austria

Instrument	Instrument category	Responsible body
Energy taxes	market-based instruments	Austrian Government
tightening construction law requirements	regulatory instruments	Governments of the federal states
subsidy for efficient heating systems	market-based instruments	Governments of the federal states
subsidy for the building shell	market-based instruments	Governments of the federal states
national recovery plan / renovation voucher	voluntary agreements	Municipal loans Public Consulting GmbH, building societies
statutory provisions to promote district heating		Federal authorities, federal states
smart metering	informational instruments	Federal states (Upper Austria, Vorarlberg, Salzburg, Burgenland and Vienna already implemented)
energy advice for households	informational instruments	Governments of the federal states
Research and development	informational instruments	Federal authorities, state governments
Education, training and information/Raising awareness	informational instruments	Governments of the federal states
Energy labelling	informational instruments	Federal Ministry of Economy, Family and Youth

G.1.1 Energy Taxes

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Positive
Control	Negative

Energy taxation in Austria comprises of the following taxes:

Electrical energy
natural gas
coal
petrol
diesel
heating oil
extra light heating oil

G.1.2 Tightening construction law requirements

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Positive
Control	Negative

In Austria, the thermal quality of buildings is determined as part of the federal building law and/or of the building regulations of the federal states. These instruments contain binding quality criteria for buildings. The requirements vary from federal state to federal state; hence these provisions may determine e.g. the U loads for the components, energy properties or LEK values. These building regulations and laws not only contain requirement in respect of the building shell, but also in respect of the technology employed for facility management. The guidelines of the Austrian Institute for Construction Engineering serve as the basis for the harmonisation of the building regulations and laws. One of these guidelines, OIB Guideline No 6 on energy saving and thermal insulation, exists since 2007 and was implemented by all federal states. This guideline contains requirements with regard to the maximum heating consumption of residential and non-residential buildings - both in respect of newly constructed and comprehensively renovated buildings.

G.1.3 Subsidy for efficient heating systems

In the federal states the enhancement of the thermal quality of residential buildings and the expansion of efficient heating systems are supported by the funds earmarked for residential building subsidies.

The subsidy is paid in the form of loans, grants and/or allowances.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.1.4 Subsidy for the building shell

In the federal states the enhancement of the thermal quality of residential buildings and the expansion of efficient heating systems are supported by the funds earmarked for residential building subsidies.

The subsidy is paid in the form of loans, grants and/or allowances.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.1.5 National recovery plan / renovation voucher

Subsidies are provided for measures to improve thermal insulation (building shell as well as windows and doors) and to improve the weather generation systems of residential buildings and commercially used buildings that were erected before 1 January 1999 or which are at least 20 years old. Household action 2009: The maximum subsidy level amounts to 20% of the (thermal) renovation costs and/or a maximum amount of € 5000.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

Household action 2011: The maximum subsidy level amounts to 20% of the (thermal) renovation costs and/or a maximum amount of € 5000 plus € 1500 in the case of conversion from heat generation systems to systems based on renewable energy sources.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral

G.1.6 Statutory provisions to promote district heating

Goal attainment	Positive
Negative side effects	Positive
Control	Negative

The Act to promote district heating (FWFG) provides in addition to subsidies for district heating system subsidies for district heating pipeline and distribution systems. The subsidy is paid out as an investment grant. The KWK Act provides for investment grants for new and subsidies for the operation of existing KWK facilities for public district heating provision. Hence both acts provide a contribution to the provision of district heating infrastructure. The instruments used by the federal states to implement the targets are regionally disparate and include i.a. compulsory connection under certain circumstances, promotion of district heating connection for private households and businesses, promotion of the expansion of district heating, in particular the expansion of biomass block and district heating.

G.1.7 Smart metering and informative billing

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

Smart meters and informative billing were introduced in Austria on the basis of the Electricity Industry and Organisation Act (EIWOG), adopted in 2010. Smart Meter pilot projects were introduced in three Austrian federal states. Installation of nearly 24 000 smart meters complying with the necessary requirements pursuant to the Methods Document, as part of the voluntary agreements, was reported at the end of 2010. These meters are evaluated below in the energy savings specified.

G.1.8 Energy advice for households

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Neutral
Control	Positive

In Austria, the energy advice bodies of the federal states offer advice with regard to energy for households. The quality of the energy advice is ensured by means of a standardised training, consisting of a standard course (A level) and an advanced training course (F level).

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Neutral

G.1.9 Research and development

Control	Negative

According to the energy research survey conducted by the Federal Ministry for Transport, Innovation and Technology (BMVIT), expenditure of the public authorities for energy research in Austria amounted in 2009 to EUR 92.3 million. Direct financing accounted for 85 % of this expenditure and own research by research institutes financed by federal or state funds for 15 %. More than one third was spent in the field of energy efficiency. The increase of 46 % expenditure for research in this field was disproportionally high in recent years. Projects in basic research as well as in applied and industrial research are supported. Research by other bodies (e.g. companies) financed by their own resources are not reflected in the above mentioned figures.

G.1.10 Education, training and information / Raising awareness

Criteria	Assessment
Furthers at least one of the goals set by the province	Negative
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Positive

Measures in the field of education, training as well as information and awareness-raising are offered by Austrian Government and federal states. On a federal level, the 'klima:aktiv' climate protection initiative is one of the most important information and awareness-raising programmes (see in this respect, Chapter 3.2.4, '). The energy agencies of the federal states offer a comprehensive range of information and services in addition to energy advice. The range includes educational programmes for more efficient use of energy for citizens (evening events and excursions) as well as advanced training courses for craftspeople (ranging from one-day seminars to fully-fledged training courses). In addition, numerous activities to inform the general public about careful use of energy are offered, including events, fair presentations, newspaper ads, brochures, website information, etc.

G.1.11 Energy labelling

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The consumption indication ordinances contain requirements for a label ('energy label'), the data sheet, information (in print) and the measuring and inspection procedures for the following appliance categories: refrigerating appliances and freezers, laundry dryers, dishwashers, lamps, electric ovens, durable and consumer goods as well as air conditioning equipment.

G.2 Belgium

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive

Instrument	Instrument category	Responsible body
Strengthening Minimum Energy Efficiency Standards for household appliance and for appliances in stand-by and off mode	Regulatory instruments	National government
Introduce a minimum energy performance threshold for rental housing	Regulatory instruments	Regional government
Tax deduction for the construction or purchase of a new low energy, zero energy or passive building and for the complete or partial renovation of a property into a low energy, zero energy or passive building	Market-based instruments	Regional government
Thermal regulation for buildings	Regulatory instruments	Regional government
Act structurally on the demand through progressive reinforcement of the requirements of the EPB (building energy performance) regulations:	Regulatory instruments	Regional government
Insulation and energy performance regulations for buildings	Regulatory instruments	Regional government
Green Certificates for renewable electricity and high yield cogeneration	Regulatory instruments	Regional government
Grant energy subsidies for: Insulation, Passive construction and low-energy renovation, heating systems, efficient household appliances, means of production of renewable energy, cogeneration, etc.	Market-based instruments	Regional government
Energy Fund and other horizontal Funding	Market-based instruments	Regional government
Develop sustainable neighbourhoods: with renovation, new construction and public initiatives	voluntary agreements	Regional government

G.2.1 Strengthening Minimum Energy Efficiency Standards for appliances

is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

The Ecodesign Directive 2005/32/EC (now revised as 2009/125/EC) was transposed into Belgian law by the Law of 11 May 2007 amending the Law of 31 December 1998 on product standards. The Ecodesign Directive lays down rules to improve the environmental efficiency standards (in terms of minimum energy efficiency) of energy-using products (EuP) and energy-relating products (ErP) on the basis of ecodesign.

G.2.2 Minimum energy performance threshold for rental housing

Criteria	Assessment
Furthers at least one of the	Negative
Criteria	**Assessment**
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Neutral
Control	Positive

In the BCR, 55.5% of existing homes are rented. Studies demonstrate that the share of rent and the increase in charges linked to a dwelling might, by 2030, account for the entire income of the most vulnerable people. The Order of 17 July 2003 establishing the Brussels Housing Code defines the basic requirements for rented homes (i.e.60% of the Brussels housing stock) in terms of the safety, fitness and equipment. This Code will be amended to introduce a threshold for energy unfitness: this would enable tenants in homes with excessive energy consumption to be protected.

G.2.3 Tax Deduction

By means of the Law of 10.08.2001 a tax reduction was introduced in Article 14524 of the Income Tax Code for energy-saving expenditure in private dwellings. This tax reduction is the subject of paragraph 1 of the said Article 14524 and applies in the 2010 income year (2011 assessment year) to:

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

- expenditure on replacing old boilers or on maintaining a boiler;
- expenditure on the installation of a solar-energy water heating system;
- expenditure on the placing of solar panels for converting solar energy into electricity;
- expenditure on the placing of all other equipment for the generation of geothermal energy;
- expenditure on the installation of double glazing;
- expenditure on insulating roofs, walls and floors;
- expenditure on the placing of a heat-regulating device for a central heating installation using thermostatic valves or a room thermostat with time control;
- expenditure on an energy audit.

G.2.4 Thermal regulation for buildings

Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

This measure covers two distinct aspects:

Thermal regulation of 1996, relating to the construction, reconstruction or conversion of residential, office or school buildings, imposing a minimum insulation level of 'K55' for new dwellings.

Transposition of Directive 2002/91/EC (initial EPB Directive):

- regulation imposing minimum insulation levels on new buildings and major renovations (> 1000 m2): the savings therefore result from the transition for new dwellings to this more stringent 'K45' insulation level from 2008.
- introduction of an energy certification procedure for existing dwellings: which consists in certification in the event of a real estate transaction (sale, letting) for all buildings already built (permits prior to 01/05/2010). Certification is being introduced by stages from 01/06/2010 to 01/06/2011.

G.2.5 Act structurally on the supply side

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

Four strands of actions are implemented to avoid pitfalls that might complicate or discourage implementation of a series of cost-effective actions relating to energy efficiency, either because of the difficulty of finding a contractor willing and/or trained to carry them out, or because the proposed completion deadlines are too long or costs are too high:

The contractors called on to perform energy-related renovations (usually independent) are generally saturated with work. They therefore tend to focus on large projects (with a higher profit margin), compared to certain types of small energy-related renovations, which might be particularly cost effective for the user (very quick payback).

The rapid development of building techniques in this area means that a major effort is required in terms of continuing training, and contractors sometimes propose solutions which are no longer optimal.

- 1st strand: establishing a participatory process, the employment environment alliance
- 2nd strand: creating a platform between actors in the area of sustainable building (Ecobuild cluster)
- 3rd strand: creating specialised training on building design on execution
- 4th strand: giving expert advice (sustainable building facilitator to professionals)

G.2.6 Insulation and energy performance regulations for buildings

From 1 September 1992, the initial insulation rules in the Flanders Region imposed thermal insulation requirements on new buildings in connection with an application for an urban development permit: an overall heat insulation standard of K65 and requirements for the thermal transmission coefficient (U values) of the walls of the heatlosing surface of a building. New buildings with an urban development permit from 1 September 1993 must meet an overall insulation standard of K55.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

In order to significantly increase the energy performance of the entire building stock, not just homes but also other buildings, minimum energy performance and indoor climate (EPN requirements) obligations have, since 1 January 2006, been imposed on new buildings and new activities in existing buildings for which an urban development permit is required. The requirements vary according to the type of activities and the purpose of the building.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive

G.2.7 Green Certificates for renewable electricity and high yield cogeneration

Control	Positive

Allocation of Green Certificates for small (Residential) installations producing electricity using photovoltaic panels (for installations of less than 10 kW). The certificates are allocated to each beneficiary household based on the electricity produced by its installation. It is up to each to exchange them on the green certificates market.

G.2.8 Grant energy subsidies

These grants are awarded in respect of energy-related investments.

The policy of energy grants is continuously being expanded and improved. The grants focus on the most efficient energy savings in energy and social terms and are continually evolving to keep pace with market and technological changes. The amount of the grant is being reviewed in order to ensure that the accumulation of various public measures is not excessive, while ensuring that they continue to offer an incentive. Two systems are currently applied:

- 2011 energy grants for residential buildings (the amount of grants depends on income and where the investment is carried out);
- 2011 energy grants for tertiary sector and industrial buildings.

The grants are grouped together under the following categories:

- Studies and audits
- Insulation and ventilation (including passive construction, very low-energy renovation, green roofs, and external solar protection, etc.)
- High-performance heating
- Renewable energy
- Investments which are high-performance in energy terms (heating networks, cogeneration, relighting, frequency variators, etc.)
- High-performance household appliances (for the residential sector)

Evaluation of grants since 2004: 114 000 grants awarded for a total amount of € 68 million.

G.2.9 Develop mechanisms for financial support of sustainable renovation of buildings

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

SOCIAL GREEN LOANS

The IBGE-BIM has entered into a partnership with the alternative credit union, CREDAL, to make an interest-free loan available to Brussels households. The BCR's involvement not only covers the interest that would be payable on an energy loan but also the costs associated with the personalized assistance given to applicants and the risks of non-recovery of the money lent. Two categories of works can be funded: Insulation / ventilation and High-performance heating.

Currently there are 190 outstanding loans with only one case of default.

THIRD-PARTY INVESTOR - RESIDENTIAL

With regard to housing, the challenge is to:

- make the initial budget available to homeowners and landlords, including those without a guarantee/ ability to repay;
- make the mechanism large enough to ensure the that the expenditure is painless for the owner, i.e. involving no initial cash outlay and monthly payments which are lower than the energy savings.

A "Public-Households Partnership" (PPM), enabling home energy renovations to be prefunded (including in the case of rental), will be implemented. A Brussels public operator currently being created will be the sole contact point for households. It will fund a preliminary audit, which will be compulsory and free-of-charge, in order to identify the priority investments needed to achieve ambitious energy performance levels for the existing housing stock.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.2.10 Energy Fund and other horizontal Funding

Fund intended to finance actions aimed at the rational use of energy in the various sectors (excluding the public sector).

Target end-use All energy uses: heating, electricity, etc.

Target group All public sectors: Enterprises, households, service sector.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.2.11 Develop sustainable neighbourhoods: with renovation, new construction and public initiatives

Neighbourhood contracts are revitalisation programmes initiated by the BCR and implemented in various vulnerable neighbourhoods in partnership with the municipal authorities. These programmes consist of a number of operations within the same neighbourhood to be carried out over a period of four years (with an additional two years in order to complete the final works). These neighbourhood contracts have been adapted in order to speed up the energy shift of the building stock specifically in old and vulnerable neighbourhoods requiring revitalisation. Each year, a call for applications to the municipal authorities will be launched for new neighbourhood contracts, whereby priority will be given to projects offering a high ecological performance. A free eco-counsellor service will provide assistance with the energy management of small commercial businesses and with waste

management. Four neighbourhoods are selected each year. The neighbourhood contracts launched in 2010 and 2011 are already covered by the new arrangements (8 neighbourhoods).

G.3 Germany

Instrument	Instrument category	Responsible body
Energy Saving Ordinance (residential buildings)	Regulatory instruments	Regional governments
Energy certificate	Regulatory instruments	
Law on the promotion of renewable energies in the heating sector	Regulatory instruments	
Heating Costs Ordinance	Regulatory instruments	
Energy-using Products Act (EBPG): implementing measures for electrical appliances in private households	Regulatory instruments	National government
Ecological Tax Reform	Regulatory instruments	National government
Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP) – BAFA component	Market-based instrument	Federal Office of Economics and Export Control (BAFA)
Federal states' activities in the buildings sector	Market-based instrument	Regional governments
E-Energy – ICT-based energy systems	Market-based instrument	National government
Energy saving guidelines	Informational instrument	National government, Federal states
Energy Efficiency Initiative	Informational instrument	German Energy Agency
"future of housing" campaign	Informational instrument	German Energy Agency
Energy Consumption Labelling Ordinance	Informational instrument	National government
Energy counselling in consumer advice centres	Informational instrument	National government
Energy check-up for low-income households	Informational instrument	German Federation of Energy Conservation and Climate Protection Agencies
Minus 40 Per Cent Club for private households	Informational instrument	National government
Buy Smart project	Informational instrument	National government
BAFA On-site Consultation	Informational instrument	Federal Office of Economics and Export Control (BAFA)
Low-energy building in the building stock	?	

G.3.1 Energy Saving Ordinance for residential buildings

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive

Criteria	Assessment
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The Energy Saving Ordinance (EnEV) – like the Heating Systems Ordinance (1998) and Thermal Insulation Ordinance (1978) it replaced in 2002 – makes minimum requirements in terms of the energy quality of cladding and of systems engineering in new buildings and in major redevelopment work on existing buildings. Planned buildings must not exceed the annual primary energy requirement of a corresponding reference building and must be executed such that the cladding and the systems engineering comply with prescribed minimum standards. Where changes are made to existing buildings the affected component must meet minimum energy requirements. At the latest amendment in 2009 the minimum energy requirements were tightened up by an average of 30%. A further amendment to the EnEV is planned for 2012. The basis for authorisation of the EnEV is the Energy Savings Act (EnEG) of 1976, last amended in 2009.

G.3.2 Energy Certificates

Since 1995, every owner of a new building has been obliged in principle to issue an energy certificate. In addition to this, since 1 January and 1 July 2009 respectively, the seller, landlord or lesser is obliged to make an energy performance certificate available to interested parties in the event of sale, letting or leasing, and at the latest on demand. Among other things the performance certificate contains information on the year of construction, use of the building, usable surface area, type of heating, water heating, and type and percentage of renewable energies. In addition the energy certificate contains recommendations for modernisation, where a building has economically viable potential for energy savings. Two types of energy certificate are available: the needs-oriented performance certificate is issued on the basis of the calculated energy requirement, while the consumption-oriented performance certificate is based on the recorded energy consumption. In principle both types of energy certificate are permissible, but only the requirement certificate for new buildings. The legal basis for issue and utilisation of the energy certificate was formerly the Thermal Insulation Ordinance (1977), though since 2002 it has been the Energy Saving Ordinance. The period of validity of each performance certificate is 10 years.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.3.3 Law on the promotion of renewable energies in the heating sector

Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

The Renewable Energies Heating Act (EEWarmeG) is designed to increase use of renewable energies in the heating and cooling sector in respect of supply of energy to buildings. It requires utilisation of renewable energies, including solar energy installations or heat pumps, in construction of new buildings (so-called obligatory usage under Section 3, Para. 1 of the Renewable Energies Heating Act [EEWarmeG]). Compensatory measures such as utilisation of waste heat or improvement of thermal insulation may also be carried out. The objective is to increase energy efficiency.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.3.4 Heating Costs Ordinance

The purpose of the Heating Costs Ordinance, which is based on the Energy Savings Act (EnEG), is the creation of incentives to encourage economical use of energy by means of consumption-based metering and billing of heating and water heating usage. With the coming into force of the revised version of the Ordinance on 1 January 2009 the consumption-based component of the billing of heating costs increased to 70 % for certain buildings. This should create additional incentives for energy-saving and thus also for reduction of CO2 emissions in the buildings sector. In addition building owners are obliged to record, for connected heating systems by 1 January 2014 at the latest, the percentage of energy consumption accounted for by water heating, in principle by means of a heat meter. In addition the provisions of the Heating Costs Ordinance create an incentive to comply with the so-called low-energy building standard (thermal heat requirement of less than 15 kWh/m^2) in the Construction or redevelopment of apartment buildings.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

G.3.5 Energy-using Products Act (EBPG): implementing measures for electrical appliances in private households

Implementation in German law of the revised EU Eco-design Directive (2009/125/EC) (not yet carried out). Implementing measures for the setting of minimum requirements for the following energy-using appliances in private households:

- Simple set-top boxes (02/2009)
- Lighting (03/2009)
- Televisions (07/2009)

- Heating loop recirculation pumps (07/2009)
- Domestic refrigerators and freezers (07/2009)
- Domestic washing machines (11/2010)
- Domestic dishwashers (11/2010)

The implementing measure for standby (12/2008) is included in the calculation of the appliances' energy savings; the implementing measure for external power supply (04/2009) is not taken into account by contrast.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Neutral

G.3.6 Ecological Tax Reform

On 1 April 1999, with the law on the introduction of the Ecological Tax Reform of 24 March 1999, the first stage of the Ecological Tax Reform came into force. This increased petroleum tax rates on motor and heating fuels and implemented the electricity tax. The law on continuation of the Environmental Tax Reform of 16 December 1999 made provision for increases in four further steps of the petroleum tax rates on fuels and of the electricity tax rate on 1 January 2000 to 2003 respectively. In addition, on 1 January 2000 the then varying petroleum tax rates on heavy fuel oil for heat and power production were amalgamated into a single petroleum tax rate. Besides this, on 1 November 2001 spreading of the petroleum tax rates for petrol and diesel depending on the sulphur content was introduced. The difference of 1.53 cents per litre compared to sulphurised fuel was initially applicable to low-sulphur fuel with sulphur content up to 50 mg/kg and from 1 January 2003 to sulphur-free fuel with sulphur content up to 10 mg/kg. The fifth environmental tax bracket was modified on 1 January 2003 by the coming into force of the law on progressive development of the Environmental Tax Reform of 23 December 2002. Among other things the petroleum tax rates on natural gas and liquid petroleum and on heavy fuel oil were increased.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional	Positive

G.3.7 Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP) – BAFA component

The objective of the programme is to boost the sale of renewable energy Technologies by means of investment incentives and to improve their efficiency. The funding takes the form of a subsidy provided by BAFA. Among other things efficient heat pumps and solar energy installations are subsidised. The simultaneous construction of a solar energy installation and a heat pump is subsidised by means of a combination bonus. Since 2010 the funding has almost exclusively been aimed at the building stock.

G.3.8 Federal states' activities in the buildings sector

government	
Role of stakeholders	Positive
Criteria	**Assessment**
Negative side effects	**Positive**
Control	Positive
is applicable by a regional government	Negative
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

- Bavarian modernisation programme (Bavaria);
- Major modernisation programme – Programme B, (Hamburg);
- Climate protection programme plus component funding – Programme A (Hamburg);
- Thermal insulation in the building stock (Hamburg);
- State programme for housing funding, modernisation/restoration (Mecklenburg-Western Pomerania);
- Funding of subsidised housing (Lower Saxony, North-Rhine Westphalia, Rhineland-Palatinate);
- Schleswig-Holstein fund: energy-optimised building redevelopment (Schleswig-Holstein);
- progres.nrw, market launch (North-Rhine Westphalia);
- Climate Protection Plus Programme, General CO2 Reduction Programme (Baden-Wurttemberg)

G.3.9 E-Energy – ICT-based energy systems

Criteria	Assessment

Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

In the framework of the "E-Energy – ICT-based Energy System of the Future Programme" the federal government is funding six pilot projects up to 2013 which are designed to research and test the benefits of using information technologies such as smart metering in the energy sector. In view of the great importance of E-Energy for the development of renewable energies and for increasing energy efficiency, funding of the pilot projects is taking place in a cross-departmental partnership between the BMWi and the BMU. The BMWi is providing up to €40m for four pilot regions and the BMU is paying up to €20m to fund two additional pilot regions. Thus taken together with the contributions of the participant companies a total of about €140m is being mobilised for the development of the six E-Energy pilot regions. The objective of E-Energy is the development of new solutions which take account of the requirements of the transformation to liberalised markets, to decentralised and volatile generation structures, and to electric mobility, and at the same time guarantee the highest possible degree of efficiency, security of supply and environmental compatibility. Among other things information and communication technologies (ICT) play a key role in this. ICT can be used to operate intelligent energy systems in which a large number of power generation facilities communicate with both the power grids and the power-consuming end-user appliances. These intelligent energy systems include intelligent metering systems, so-called smart-meters. By means of improved information about energy consumption and the related costs these can to a certain extent form a basis for behaviour-based energy savings by energy consumers.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive

G.3.10 Energy saving guidelines

The energy saving guidelines drawn up by the federal government and the federal states for areas of application such as buildings, energy efficiency, energy management, mobility, procurement and financing are aimed at private households, private enterprise and the public sector. The guidelines are designed to motivate the respective target group and provide information about how to increase energy efficiency. The guidelines thus contribute to creating awareness and changing user behaviour and act as a springboard for energy efficiency investments. The information on energy-efficient technologies, financing and procurement options together with special subject areas and pragmatic approaches to finding ways of exploiting energy efficiency potential are being well received by all sectors. For example, the guidelines are leading to support for the execution of concrete contracting projects and the implementation of other energy efficiency measures in the municipal sector.

G.3.11 Energy Efficiency Initiative

Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Neutral

With the support of intensive public relations work such as provision of information brochures and internet services, the German Energy Agency's Energy Efficiency Initiative is essentially targeted at about 40 million private households, trade and industry, and service providers. The aim is to direct the attention and awareness of consumers in all areas of application of electricity to the issue of efficient use. The objective is to increase awareness for and the popularity of energy-efficient techniques for using electricity. In the results of the representative opinion surveys which have been carried out by the forsa research institution since 2003 alongside the project we are increasingly seeing positive changes in the attitude and behaviour of consumers in key subject areas communicated by the sub-campaigns. For example, by their own admission 61 % of the households surveyed took measures to save electricity in 2009. The initiative has succeeded in gaining the support of a strong network of agents, such as retail sales outlets and energy utilities, as active campaign partners.

Criteria	Assessment
Furthers at least one of the goals set by the province is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

G.3.12 "future of housing" campaign

Criteria	Assessment
Furthers at least one of the goals set by the province is applicable by a regional government	Positive
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Neutral

The German Energy Agency's "future of housing" motivation and information campaign is targeted – by means of press and public relations work, internet services, trade show appearances and the national "future of housing" congress – at house owners, tenants, engineers, architects as well as the construction sector, municipalities and residential property companies. The aim is to inform and motivate consumers, persons and companies involved in construction, industry, and the public sector about energy-efficient construction. The purpose is to establish products and services which make energy-efficient construction and redevelopment simple, reliable and affordable. In cooperation with the BMVBS the German Energy Agency initiates and manages projects concerned with the development of energy efficiency potential in the buildings sector. Under the "future of housing" umbrella brand a large number of projects for the improvement of energy efficiency in buildings are being carried out – from the development and launch of the "efficient building" seal of quality for residential buildings through national pilot projects, in which model buildings are redeveloped on an energy-efficient basis, to consumer information. Significant progress has been made in the market in promoting the relevance of the subject of energy efficiency in the buildings sector.

G.3.13 Energy Consumption Labelling Ordinance

Labelling requirement for large electrical domestic appliances (refrigerators and freezers, combination appliances, washing machines, clothes driers, domestic washer-driers, dishwashers, household lamps, air conditioners, electric ovens) pursuant to the Energy Labelling Ordinance of 30.10.1997 to show energy consumption, consumption of other important resources, and additional performance data. Classification in efficiency categories from "A++" to "G". Implementation of Directive 92/75/EEC.

Criteria	Assessment

G.3.14 Energy counselling in consumer advice centres

Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Positive
Control	Neutral

As a rule a half-hour specialist consultation on energy issues (solar energy, photovoltaics, geothermal energy, biomass, CHP, energy-efficient redevelopment/ new building construction, and energy-saving behaviour) which is offered to consumers at a charge of €5 at the information points in the consumer advice centres. As a rule several topics are dealt with in a consultation.

G.3.15 Energy check-up for low-income households

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Neutral
Negative side effects	Positive
Control	Neutral

The aim of the measure is the training of 800 long-term unemployed persons as so-called energy-saving assistants to demonstrate to consumers in 52,000 low-income households ways of saving money and conserving the environment by means of a careful approach to energy (in particular through reduction of CO2 emissions). The German Federation of Energy Conservation and Climate Protection Agencies (eaD) is responsible for the functional energy aspects and trains the participants, supervises the checks, monitors the database, and orders the necessary energy-saving items. The participant associations organise the measure by, for example, recruiting the participants through the competent employment agencies. In addition to this they find the households wishing to receive counselling, support the participants during the measure with their personal affairs and problems, and co-operate with the local employment agencies and consumer advice centres. The locations are networked and supported by the charitable services, by regional advisors in regional groups.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.3.16 Minus 40 Per Cent Club for private households

100,000 households are being recruited for the Online Energy Saving Account (ESA) of the Minus 40 Per Cent Club. The software calculates the CO2 figures for the heating energy and electricity consumption figures read off and records how the minus 40 per cent target (1990-2020) is achieved and exceeded. Participants are reducing their CO2 emissions by an average of 1.69 % p.a. Interim results, examples and solutions to problems are communicated on an ongoing basis. An in-depth study is being carried out of a thousand households with internal energy production (photovoltaic's, CHP) and another thousand with automated monitoring. In just under two-and-a-half years from

September 2008 the number of ESAs was increased from 8,000 to 100,000 by means of partnerships, for example with energy utilities, and media work. Online and e-mail consultations provide motivation by means of benchmarks, individual cost reduction potential, etc. Both reasons for success and problems are being identified for 1,000 ESA users as well as for the 1,000 users of automatic monitoring and for the 100 users of building energy management. The federal government is demonstrating the achievability of its target of a 40 % cut in CO2 from 1990 to 2020.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.3.17 Buy Smart project

The aim of the "Buy Smart" project is to promote the purchase of energy-efficient products. The project is targeted at public-sector and private buyers. In "Buy Smart" guides, performance sheets and computational aids created in the predecessor project for the office equipment, lighting, vehicles, domestic appliances, building components and green electricity product groups are being revised. These tender aids are being offered for free download on a new internet site, which also contains information on green procurement, labels, and a good practice database. The information is included in e-procurement platforms, making use of environmentally-friendly criteria free of additional expenditure for buyers. A further area of emphasis is intensive public relations work with the focus on assessment of life-cycle costs. Buyers and environmental managers are being addressed in a targeted manner by means of cooperation with networks. A quarterly newsletter is provided. Free consultations on green procurement have led to supervision of ten pilot projects. This EU-subsidised project is being carried out in Germany by the Berlin Energy Agency and it is being co-financed under the National Climate Protection Initiative.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Neutral
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.3.18 BAFA On-site Consultation

Funding is provided for an on-site consultation by accredited energy advisors dealing comprehensively with structural thermal insulation as well as heat generation and distribution including water heating and use of renewable energies. Additional funding has been available since October 2009 if the consultation is supplemented by means of recommendations for saving electricity, thermo graphic surveys, or air tightness inspections pursuant to DIN 13829 (so-called blower-door tests). The funding is granted as a part-financing package in the form of a non-repayable contribution which is paid to the applicant consultant. This is approved as project funding.

G.3.19 Low-energy building in the building stock

Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The “low-energy building in the building stock” pilot projects of the German Energy Agency on behalf of the German Federal Ministry of Transport, Building and Urban Development (BMVBS) for residential- and non-residential buildings are targeted with the help of planning aids, public relations work, guides and brochures at specialist designers, architects, craftsmen and construction project sponsors. The aim is to speed up transfer of knowledge about construction of low-energy buildings, to establish exacting energy-efficient redevelopment standards on the market, and to advertise, develop and launch on the market innovative technologies related to energy-efficient building redevelopment. The aim is to encourage imitation by means of transferable, economically viable redevelopment recommendations and examples. The residential property construction companies carry out their restructuring measures themselves. A bandwagon effect in energy-efficient redevelopment is observable and efficient building standards have been established in the market. More than 350 residential buildings and over 90 non-residential buildings have demonstrated that energy-saving construction methods can significantly reduce the energy requirement. A total of 6,300 residential units with about 350,000 m2 of Floor space were optimised for energy efficiency in the course of the project. On average the latter undercut the energy consumption requirements of comparable new buildings by 62 %.

G.4 United Kingdom

Instrument	Instrument category	Responsible body
The Green Deal	Market-based instrument	National government / energy companies
Building Regulations	Regulatory instrument	National government
Supplier obligations	Regulatory instrument	National government
Products policy (appliances)	Regulatory instrument	National government
In home displays / Smart meters	Informational instrument	Energy companies
Renewable Heat Incentive	Market-based instrument	National government
Warm Front Scheme to address fuel poverty	Market-based instrument	National government
Feed-in-tariff	Market-based instrument	National government
Code for Sustainable Homes	Regulatory instrument	National government
EU performance of buildings directive	Regulatory instrument	National government
Energy Savings Trust advice	Informational instrument	Regional governments
Product standards and labelling	Informational instrument	National government

G.4.1 The Green Deal

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The Green Deal is a market framework which will enable private firms in Great Britain to offer consumers energy efficiency improvements to their homes, community spaces or businesses at no upfront cost with repayments recouped through a charge made in instalments on their energy bill. The scheme is being established by the Coalition Government through the Energy Bill introduced to Parliament in December 2010 and should be available from late 2012. Operating across all types of housing tenure, the Green Deal will operate alongside a new Energy Company Obligation and has the potential to improve the energy efficiency of most of the 26 million homes in the UK, whether they are built with cavity or solid walls. A key element of Green Deal finance is that only packages of measures that pay for themselves over the lifetime of the Green Deal will qualify. It will allow householders and businesses to enjoy the benefits of efficiency measures and the energy bill savings they can bring, without the need for up-front finance. If they move to a different property, the charge will not move with them, meaning those in the property will pay from the savings they make. The UK government anticipates the Green Deal finance will come from the private sector. They are in discussion with energy companies, retailers and banks about how best to facilitate this.

G.4.2 Building regulations

From 2016 for homes and 2019 for non-domestic buildings, all new buildings in England will be required to be built to a zero carbon standard. The policy and standard has continued to undergo revisions since 2007 in order to protect economic and technical viability and ensure these requirements remain achievable.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

G.4.3 Supplier Obligations

Under supplier obligations the government uses some instruments to organize the supply side more energy efficient. Examples of these policies are the Energy Efficiency Commitment (EEC), the Carbon Emissions Reduction Target (CERT), the Community Energy Savings Programme (CESP) and future supplier obligations.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.4.4 Products policy (appliances)

A number of policies aimed at improving the energy efficiency of products purchased and used in homes, businesses and the public sector

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

G.4.5 Smart metering

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

Through smart energy meters and IHD, consumers will be provided with near real-time information on energy consumption, enabling them to monitor and manage their energy consumption, save money and reduce carbon emissions. Bills will be accurate and switching between suppliers will be smoother and faster. New products and services will be supported in a vibrant, competitive, more efficient market in energy supply and energy management services. The rollout will also support the development of a smart grid delivering improved network efficiency and responsiveness and supporting the uptake of electric vehicles and micro generation.

The rollout of smart meters by energy supply companies will involve visiting over 28 million homes and the replacement of around 49 million domestic gas and electricity meters. Government has a key role to play, particularly in setting the policy framework, revising the regulatory framework including updating consumer protections, and ensuring the necessary cross-industry arrangements are in place. DECC established the Smart Meter Implementation Programme to deliver these.

G.4.6 Renewable Heat Incentive

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The RHI has been developed to encourage the adoption of renewable heat technologies by providing a tariff based on the amount of heat produced. The RHI is expected to deliver annual carbon savings of 3.6 Mt CO2 per year outside EU ETS across all sectors. The United Kingdom is also investing in wave and tidal energy technology demonstration (UNFCCC, 2010e; UNFCCC, 2011d). The household part of the incentive is scheduled to begin in the spring of 2014. Currently house owners could use the Renewable Heat Premium Payment scheme.

G.4.7 Warm Front scheme

The Warm Front scheme (now extended to 2012) is one of the Coalition Government's key tools for tackling fuel poverty through energy efficiency measures among private sector households in England. Eligibility for assistance is based on a combination of income related benefits (mirroring those used to identify Cold Weather Payment recipients) and the thermal efficiency of the applicant's property (having a SAP rating of 55 or below). Households who are entitled to assistance under the Scheme can benefit from energy efficiency measures including efficient heating systems, insulation, and draught proofing. Since its launch in June 2000, the Scheme has assisted over 2.2 million households in England, with an average potential saving of over £650 per household per annum during the lifetime of the measures.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.4.8 Feed-In-Tariff

The Great Britain feed-in-tariffs (FITs) scheme is a financial incentive to drive investment in renewable electricity. Generators of renewable electricity are paid a fixed tariff over a number of years to make the up-front costs of installation worthwhile. The FITs scheme was launched in April 2010 and

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

covered renewable installations up to 5MW with tariffs designed to deliver a known rate of return.

G.4.9 Code for sustainable homes

The national voluntary standard for the design and construction of new homes became operational in 2007. It covers standards for energy, water and waste management.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

G.4.10 EU Energy Performance of Buildings Directive

The Energy Performance of Buildings Directive was adopted in 2002 by the European Parliament and the Council. It is designed to improve the energy efficiency of buildings and thus reduce carbon emissions, and lessen the impact of climate change. Full implementation in England and Wales was completed on 1 October 2008.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Neutral
Control	Neutral

G.4.11 Warm Homes, Greener Homes

"Warm Homes, Greener Homes" presents the United Kingdom's household energy management strategy for reaching the LCTP's goal of cutting emissions from fossil fuels in homes by 29 per cent by 2020.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Neutral
Role of stakeholders	Positive

G.4.12 Energy Savings Trust (EST) advice

Goal attainment	Neutral
Negative side effects	Neutral
Control	Neutral

Advice can be an important factor in tackling the barrier that a lack of information can represent to taking action on energy efficiency. DECC, the Scottish Government and Welsh Government provide grant funding to the Energy Saving Trust (EST) to support its provision of free, impartial, expert energy efficiency advice to consumers. In 2010/11, EST's contact centres dealt with nearly one million telephone and online enquiries across the UK, 43% of which were in Scotland. In addition, in Scotland EST gave face-to-face advice on 147,403 instances.

G.4.13 Product standards and labelling

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Negative

Reducing the energy intensity of the products used in the home not only contributes to energy savings, it also has the potential to significantly reduce energy costs for households. The UK has been working to adopt Minimum Energy Performance and labelling requirements for the first 21 priority products covered by the Ecodesign of Energy related Products Directive (ErP). Agreement has been reached on 13 products so far; the average annual net benefits of which will (by 2020) be £900m to UK consumers and Businesses. Products covered include Televisions, Washing Machines, Fridges, Domestic Lighting and restricting Standby and off mode power consumption. Work continues on the remaining products, including Boilers, water heaters, ICT, Tertiary lighting and Commercial refrigeration and Freezers.

G.5 Sweden

Instrument	Instrument category	Responsible body
Planning and construction legislation and energy requirements in building regulations	Regulatory instrument	National government
Energy certification	Regulatory instrument	National government
Repairs, maintenance or conversion and extension work (ROT)	Market-based instrument	National government
Grants & Tax deductions for: Windows and bio fuels, Conversion to sources of renewable energy, Solar cells, Solar heating	Market-based instrument	National government
Technology procurement	Market-based instrument	Procurement Group for Residential Properties
The Delegation for Sustainable Cities	Regulatory? instrument	National government
Low-Energy Buildings Programme	Market-based instrument	Swedish Energy Agency
Energy services	Informational instrument	Swedish Energy Agency
Become Energy-Smart – Renovate Energy-Smart	Informational instrument	Swedish Energy Agency
The energiaktiv.se web portal	Informational instrument	Swedish Energy Agency
UFOS Energi	Voluntary agreement	UFOS
The Construction/Living Dialogue	Voluntary agreement	Environmental Advisory Council
CERBOF – the Centre for Energy and Resource Efficiency in the Built Environment	Informational instrument	Swedish Energy Agency
Energy IT and Design	Informational instrument	Swedish Energy Agency
Taxation of energy	Market-based instrument	National government
The Environmental Code	Regulatory instrument	National government
Municipal energy and climate advice services	Informational instrument	Regional governments
Regional climate and energy strategies	Regulatory instrument	Regional governments
Ecodesign and energy labelling	Regulatory instrument	National government
ELAN – the Programme for day-to-day electricity use	Informational instrument	National government
The Co-ordinated Urban Development Programme	Informational instrument	Swedish Energy Agency
The Sustainable Municipalities programme	Regulatory instrument	Swedish Energy Agency
The Fjärrsyn [District Vision] Programme	Informational instrument	Swedish Energy Agency

G.5.1 Planning and construction legislation

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

The building regulations (Swedish abbreviation: BBR) constitute technical functional requirements and represent society's minimum requirements for buildings with regard to areas including energy management. The objective of the rules governing energy economy is to direct towards lower energy use by means of a clear and verifiable upper limit for energy use in new buildings. In the Swedish National Board of Housing, Building and Planning's building regulations, the requirements for the energy performance of new buildings take the form of a clear upper limit to how large the demand for energy supplied may be in order to heat the new building. The energy requirements are reviewed regularly.

G.5.2 Energy Certification

The Swedish system of energy certification is part of its implementation of Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings. An energy certificate is to be produced when a building is sold, rented or built or if the building in question is a large building occupied by public authorities or institutions that supply public services and is therefore often visited by the general public. The owners of buildings that are subject to this Act are under an obligation to ensure that there is a valid energy certificate for such buildings. If such a building is rented out or if it is a large public building, the owner must also ensure that the summary submitted as part of energy certification is also displayed in a clearly visible location. Most multi-dwelling buildings and business premises are subject to this requirement. Energy certification must include proposals for appropriate and cost effective measures to improve energy efficiency within the building. Whether or not to implement those measures is up to the building owner.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.3 Repairs, maintenance or conversion and extension work (ROT)

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Positive

Goal attainment	Neutral
Negative side effects	Neutral
Control	Positive

The primary motivation behind the government's introduction of the "ROT" deduction (which stands for the Swedish for repairs, maintenance or conversion and extension work) was to stimulate the labour supply and reduce black market labour. Many energy-saving measures are covered by the term ROT, which makes them deductible amounts. The ROT deduction was introduced on 8 December 2008. It is permissible to make a tax deduction for 50% of the cost of the building work carried out in residences or holiday homes. However, there is a maximum deduction of SEK 50 000 per person per annum. The tax deduction does not apply to new-builds or to conversion and extension work on new-builds.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.4 Grants (& Tax deductions)

The Swedish government offers multiple grants and tax reductions for among others windows and bio fuels, conversion to sources of renewable energy, solar cells and solar heating.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.5 Technology procurement

Technology procurement is a method of commencing a shift in the market and to spread new efficient technology (products and systems). Technology procurement is a process that has a number of different phases (activities) and actors. Technology procurement processes are primarily implemented in the fields of heating and air conditioning, hot water and sanitation, ventilation, white goods, lighting and industry. The Swedish Energy Agency has compiled a list of all the technology procurement processes within the energy field that it and its predecessors have carried out.

G.5.6 The Delegation for Sustainable Cities

The Delegation for Sustainable Cities has been tasked by the government with managing and deciding financial support for the development of sustainable cities. The support aims to create attractive and ecologically, socially and economically sustainable urban environments that help to minimise emissions of greenhouse gases and represent good examples of urban construction measures with integrated planning and applied environmental technologies. The projects must show the potential in the development of sustainable cities, act as showcases and facilitate the spread and export of sustainable urban planning, environmental technology and know-how.

Criteria	Assessment
Furthers at least one of the	Positive

G.5.7 Low-Energy Buildings Programme

goals set by the province	
is applicable by a regional government	Positive
Role of stakeholders	Positive
Goal attainment	Positive
Negative side effects	Positive
Control	Positive

The aim of the project is to stimulate energy efficiency new builds and conversion. The programme is collaboration between the Swedish Energy Agency, the Swedish National Board of Housing, Building and Planning, the Swedish Construction Federation, Region Västra Götaland and the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning (Formas). Energy consumption for those projects that receive funding must be at least 50% below the requirements laid down in the Swedish National Board of Housing, Building and Planning's building regulations and the project must have major value as a showcase.

G.5.8 Energy services

The government has tasked the Swedish Energy Agency with promoting the market for energy services in Sweden. The term energy services includes relatively simple products such as energy statistics and energy mapping, alongside more complicated services such as incentive contracts (Energy Performance Contracting (EPC), for example) and functional contracts where the power companies provide a specified indoor climate.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.9 Become Energy-Smart – Renovate Energy-Smart

On 1 June 2010, the Renovate Energy-Smart campaign was launched. The aim is for the environmental programme show home to generate interest, inform people, enable people to see the possibilities and contribute towards a dialogue that will drive forward energy efficiency improvements in multi-dwelling residences. The campaign was aimed at property owners and the managers of multi-dwelling residences, house builders, manufacturers, suppliers and installers of building products and various occupational groups in the building sphere, energy and building consultants, architects, municipal planning and construction case officers, trade and professional associations and banks.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.10 The energiaktiv.se web portal

The purpose of the portal is to support the implementation of measures proposed in connection with energy certification. However, the information applies just as much to energy efficiency measures that are not associated with the energy certificates. The structure is process supporting and guides users step by step from mapping to following up on measures. The website will be continually updated and expanded with material relating to energy services and energy management.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.11 UFOS Energi

Criteria	Assessment
Goal attainment	Neutral
Negative side effects	Neutral
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

Since 2004, UFOS has been working with the Swedish Energy Agency on energy and climate-related projects. This collaboration operates under the name UFOS Energi. By pooling and developing know-how, the focus is placed on measures that increase knowledge among actors with the ability to influence development towards a sustainable energy system. Since the beginning of 2004, this collaboration has resulted in, amongst other things, 19 publications/reports aiming at presenting the methods of improving the energy efficiency of the property stock. This publications, collectively, are referred to as UFOS Energi's "Energy library".

G.5.12 The Construction/Living Dialogue

In 1998, the Swedish government tasked the Environmental Advisory Council with promoting voluntary environmental work in the business community and decided to start-up a dialogue with the construction and property sector (the Construction/Living Dialogue) and with those involving in trading/transporting everyday goods (Future Trade). The result was the "Vision for 2025", which set out targets and strategies for a sustainable construction and property sector. In 2003, a secretariat was set up within the Swedish National Board of Housing, Building and Planning in order to support the Construction/Living Dialogue, which was a unique collaboration between businesses, municipalities and the government with the aim of making progress towards a sustainable construction and property sector in Sweden.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.13 CERBOF – the Centre for Energy and Resource Efficiency in the Built Environment

CERBOF24 is a research and innovation programme initiated by the Swedish Energy Agency. CERBOF is run in collaboration with actors in the construction sector. Secretariat services are provided by the Association for Innovation and Quality in the Built Environment. CERBOF's vision is for all use of energy and resources within buildings to be efficient and sustainable over the long term and for buildings to have a sound indoor environment. CERBOF's mission is to be the leading meeting place where the state, trade and industry, academia and consumers stimulate the advent of relevant research and innovation projects. CERBOF's activities are supposed to help bring about the utilisation of the results in commercial products, services, systems or methods. Research, development and demonstration that receive support are to

help achieve national energy and environmental targets and to bolster the competitiveness of Swedish trade and industry. The areas in which CERBOF is active are:

- the building as a technical energy system; and
- behaviour, processes and instruments.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.14 Energy IT and Design

The Energy IT and Design programme combines expertise in IT with design know-how and knowledge about human attitudes to, primarily, electricity, everyday goods and technology use. It is an applied programme and aims to result in a number of real prototypes and demonstration pieces: attractive design solutions that make individuals aware of their day-to-day energy use, informative IT solutions that provide detailed and useable information about energy and electricity consumption, simple but advanced IT solutions for the control and monitoring of electricity and energy use in the home and a relevant and motivational decision-making basis that will help change day-to-day habits to make them more efficient in terms of resource and energy use.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.15 Taxation of energy

The work that has hitherto been carried out within the programme aims to influence the municipalities' own energy use (in premises, transport, street lighting, sports facilities, etc.), but also to help citizens, households and local business communities to get involved in the work and for energy use by these groups to move forwards in a positive direction. The programme is characterised as a soft instrument focussed on network management and aims to complement and facilitate other activities and processes underway in the field of energy and the climate.

G.5.16 The Environmental Code

The Environmental Code is a mandatory and all-encompassing instrument within the environmental field that covers all activities and actions that have an impact on the environment. The basic provisions of Chapter 1 of the Environmental Code aim to promote sustainable development and are to be applied so as to promote economy with energy and raw materials. The general rules of consideration under the Environmental Code state that anyone who carries out an environmentally hazardous activity or implements a measure must be economic with raw materials and energy and, principally, make use of renewable fuels. The aim of this provision is to reduce the burden on the environment from the use of raw materials and energy in the course of the activities in question. The definition of environmental activities is broad and means that nearly all actors in society are covered by the rules of consideration under the Environmental Code. Certain types of activity require a special licence with specific conditions associated with them covering, for example, the maximum permitted levels of emissions.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.17 Municipal energy and climate advice services

Different actors' awareness of their own energy use, of measures to reduce it and make it more efficient and of energy-efficient technology are a prerequisite if energy use in society is to be made more efficient. Situation-specific and locally-based information and advice is usually more effective than general information in countering market failures connected with a lack of awareness and information. Since January 1998, Swedish municipalities have had the option of applying for state support to provide advice in connection with the local specifics. All 290 municipalities in Sweden have applied for and been granted subsidies, which means that the citizens of every municipality have access to a municipal energy and climate consultant.

G.5.18 Regional climate and energy strategies

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

Since 2010, the county administrative boards have received targeted State funding to work on energy and climate issues and to continue developing implementing the regional energy and climate strategies. The county administrative boards receive these funds in order to give tangible form to and co-ordinate the work with the regional energy and climate strategies. The funds are to be used to plan and implement actions and measures in collaboration with other regional and local actors and to coordinate regional energy and climate work. The actions may support the energy and climate work of both industry and the municipalities to develop and implement the regional energy and climate strategies. A little over three quarters of the funds may be used for the county administrative boards' own work, whilst the rest must be used to assist other local and regional actors to play their part in the on-going development of regional energy and climate strategies.

G.5.19 Ecodesign and energy labelling

The aim of ecodesign is to lay down requirements for environmental performance, usually energy efficiency, for the lifecycle of a product. Such requirements for manufacturers will lead to the disappearance of energy-hungry products from the market. The ecodesign requirement applies to all Member States of the EU and is regulated by Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
Goal attainment	Neutral
Negative side effects	Neutral
is applicable by a regional government	Negative
Control	Negative

G.5.20 ELAN – the Programme for day-to-day electricity use

ELAN began in 1998 and was terminated in 2009. The aim of the programme was to increase knowledge of how behaviour and values affect electricity use and to ensure the long-term development of skills in this field. The vision was to make up a knowledge hub where both energy companies and authorities can source information and expertise and to create a forum for dialogue in issues relating to energy use and behaviour.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.21 The Co-ordinated Urban Development Programme

The Co-ordinated Urban Development research programme aims to support and promote inter-disciplinary research and development projects concerning urban areas and urban development that are system focused and based on real practice, thereby reinforcing the development of knowledge and the skills base in relation to sustainable urban areas. The programme is a collaboration between the Swedish Energy Agency, the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning (Formas), the Swedish Environmental Protection Agency, the Swedish National Heritage Board and the Swedish Transport Administration.

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

G.5.22 The Sustainable Municipalities programme

Negative side effects	Neutral
Control	Negative

Sweden's municipalities have a special position in the national efforts towards sustainable development. The municipalities have a series of complex roles, for example as a supplier and consumer of energy and electricity. The Swedish Energy Agency's Sustainable Municipalities programme aims to help along the road to sustainable energy use within an energy system that is secure, cost-effective and that has little detrimental impact on health, the environment and the climate and where different actors' decision-making basis and decision-making processes are of high quality.

The processes that are activated within the Sustainable Municipalities programme involve various groups of actors whose activities have a bearing on a series of issues that are of key importance if the investment is to be a success.

G.5.23 The Fjärrsyn [District Vision] Programme

Criteria	Assessment
Furthers at least one of the goals set by the province	Positive
is applicable by a regional government	Negative
Role of stakeholders	Positive
Goal attainment	Neutral
Negative side effects	Neutral
Control	Negative

The Fjärrsyn programme aims to improve district heating companies' ability to realise the sustainable energy systems of the future through competitive commercial and technological development in line with the expectations and requirements of customers and society. Fjärrsyn incorporates three research areas and a demonstration section. The research areas are the surrounding world, the market and technology. The programme has room for both basic research and applied research and more applied projects. The focus is on research and development that can be directly commercialised or can in some other way benefit the sector directly.