Increasing energy efficiency in private households in Germany

Overview of existing and proposed policy measures

Workshop Report No. 12 within the project:
Soziale, ökologische und ökonomische Dimensionen eines nachhaltigen Energiekonsums in Wohngebäuden
Funded under the BMBF Programme „Vom Wissen zum Handeln - Neue Wege zum nachhaltigen Konsum“

Authors:
Felix Groba
Thure Traber
(DIW Berlin)

Berlin
Juni 2010

Outline

1 Introduction

In 2007, the German government announced both its climate target to reduce GHG emissions by 40 percent compared to 1990 levels by the year 2020, and the Integrated Energy and Climate Program (IEKP). The IEKP is Germany's framework designed to accompany and complement the national reductions induced by the European emission trading in order to put the country on a path that reaches this ambitious goal. While the German government sticks to the 40 percent target, estimates of the emission reduction effect of the IEKP gradually declined as more studies have been carried out. From the first IKEP-Scenario calculations in 2007 (BMU 2007) to the latest calculations conducted in Politikszenario V (hereafter UBA (2009)) the projected reductions have declined from 41 percent to 29 percent. Several reasons gave rise to these estimate reductions. First, the announced policy measures have not been implemented in their full scope and some measures still have not been implemented at all. Second, cross impact evaluation of some measures was largely neglected in earlier assessments. Third, the implemented policies have not delivered their expected effects. Therefore, many additional measures and policies have been proposed over the last years that promise to reach the agreed climate target.

While the energy supply sector has been addressed relatively successfully by the European Emission trading system (ETS), the Feed-in Tariff for renewable Energies (FiT) and, with minor success the CHP-Bonus for combined heat and power production, other sectors like transport or the demand side of energy did not deliver significant reductions. A sector of particular interest is the household sector where estimated carbon abatement costs are often low (MCKinsey (2007), Kemfert et al. (2007)). Yet, several market failures and imperfections are under discussion are suspected to prevent efficient technologies to gain market shares (Gillingham et al. (2009)). The objective of this paper is twofold: First, we give an overview on the potential market and behavioral failures effecting household energy consumption. Second, focusing on the German level, we summarize currently implemented policies which address specifically the household sector and assign these policies to the market failures they are addressing. Furthermore, we give an overview of proposed additional measures and set them in a theoretical perspective to make them assessable for subsequent evaluation.

2 Household behaviour and policy intervention

In market economies the use of resources is in principle determined by market forces. Under certain assumptions and conditions it can be shown that these market mechanisms allocate resources efficiently. The same is true for energy markets and efficient consumption of energy. However, in reality the theoretical conditions for an efficient allocation of energy resources are often not met. Identifying the degree of market or behavioral failures that create inefficiencies gives the opportunity for beneficial policy intervention.

This section gives an overview on the theoretical aspects of potential market and behavioral failures in energy efficiency markets. In order to align the theoretical section with the papers center on households, we only focus on market failures that are of relevance for individual consumer decisions. In subsequent sections of this paper we identify which of the market and behavioral failures are addressed by currently implemented, and potential additional policy measures targeting an increase in energy efficiency.

The general, neoclassical assumptions, relevant in the context of energy consumption of private households are:

- consumers are rational and utility maximizing by choosing the optimal bundle of goods taking into account their budget constraints and market prices,
- consumers have perfect and costless information about all goods and prices and are able to calculate optimal consumption bundles,
- there are no transaction costs involved in trading in the market,
- there is perfect competition among market agents.

When identifying potential market and behavioral failures the literature commonly conceptualizes around the energy efficiency gap. In general the energy efficiency gap is the difference between observed level of energy efficiency and optimal energy use with energy efficiency defined as the energy service provided per unit of energy input.[1] Thus, the efficiency gap is the underinvestment in energy efficiency relative to a description of the socially optimal level of energy efficiency.[2] Along this line of argument Gillingham et al. have assembled a list of commonly cited market and behavioral failures in the context of energy efficiency.[3]

- **Energy market failures:** *Environmental externalities and other external cost* of energy production and consumption are not fully reflected by market prices, which induces an overuse of energy relative to the social optimum. Additionally, actual consumer prices may not reflect marginal social cost as

[1] Jaffe 2004.
[2] Gillingham 2009.
[3] Gillingham 2009.

utilities commonly employ *average cost pricing* which could also lead to non-optimal energy consumption.[4]

- **Capital market failures**: *Liquidity constrains* as a market barrier for energy efficient investments have been identified quite early.[5] Consumers may not choose energy efficient products due to a lack of credit which may lead to an underinvestment in energy efficiency.
- **Information problems:** Consumers often *lack of information* about the availability and the savings potential from energy efficient products. This can lead to a systematic underinvestment in energy efficiency.[6] This problem can be linked to behavioral failures such as an inappropriate accounting of future cost reduction when making investment decision with respect to energy efficient acquirements.

  The *principal agent problem* is another informational market failure that may also leads to underinvestment relative to the social optimum. The principal may have incomplete information on the energy efficiency of a product or building while the agent has no possibility to recoup the costs of investments in energy efficiency.[7]

  A further market failure is *asymmetric information* potentially leading to adverse selection as information on the energy efficiency of goods cannot perfectly be transferred from the seller to the consumer and might thus be ignored in decision making.[8] It is apparent, that informational transaction costs for consumers are a central element in this context as they might be the source of the market failure as such.

  Lastly, *positive externalities from learning by using* may provide free information gathered by an adopter of energy efficient products to other consumers. Thus, the accumulation of knowledge about efficient investments may be not sufficient from a societal viewpoint.
- **Behavioral failures**: Psychological and sociological studies have shown that the assumption of perfect consumer rationality does not hold in reality. Aversion to risk, uncertainty, the use of short term discount rates, heterogeneity of preferences, transactions costs of searching and processing information, limited sensitivity to changes of energy service attributes and the relative unimportance of energy costs as a proportion of total expenditure lead to significant systematic biases in decision making.[9] The most relevant explanations of the behavioral deviation from standard economic assumptions are given by prospect theory, by bounded rationality and by heuristic decision making. The *prospect theory* of decision making under uncertainty postulates that individuals evaluate potential welfare changes with respect to a reference point, commonly the status quo. Furthermore, consumers are risk averse with re-

[4] Gillingham 2009 p 10.
[5] Blumenstein 1980.
[6] Howard and Sanstad 1995.
[7] Jaffe, Stavins 1994.
[8] Howarth and Sanstad 1995.
[9] Wilson, Dowlatabadi 2007.

spect to losses and risk seeking with respect to gains. Consequently, individual welfare changes are greater from expected losses than from gains of the same magnitude.[10]

The problem of individual *time inconsistency* can also be explained by prospect theory. In standard theory time consistency is ensured by trading off present for future consumption at a constant discounting rate. However, as empirical and experimental evidence reveals, varying, product specific individual discount rates well above market interest rates, give rise to underinvestment in energy efficiency.[11]

Another explanation for non-rational behavior is *bounded rationality* suggesting that individuals face cognitive constrains in processing information. This potentially leads to overconsumption of electricity. Linked to this aspect are problems of *heuristic decision making*. In order to reduce cognitive burden, individuals tend to follow sequential decision strategies that deviate substantially from conventional utility maximization assumptions.[12] This problem can eventually lead to an underinvestment in energy efficiency as future increases in fuel and electricity prices are ignored.[13]

The economic literature aims to identify market and behavioural failures which may present an opportunity for net-beneficial interventions. It becomes evident that not a single policy addresses all failures and imperfections. The degree of heterogeneity of agents and products in the energy efficiency market requires the implementation of a policy mix. Within this policy mix, each policy may address several of the identified market failures.

On the background of the theoretical scheme presented in this section, current policy measures in Germany will be outlined and the respective, targeted market and behavioural failures will be explained briefly.

[10] Kahneman and Tversky 1979.
[11] Wilson, Dowlatabadi 2007.
[12] Gillingham et al. 2009.
[13] Kempton, Mongomery 1982.

3 Existing household sector-specific measures

Energy consumption in residential and commercial buildings represents approximately 40% of total final energy use and is accounting for 36% of the EU's total CO_2-emissions and for about half the CO_2 emissions not covered by the EU's Emission Trading System.[14]. Several initiatives on European and national levels have been taken to address the potentials of emission and fuel expenditure reduction by increasing efficiency and reducing consumption of energy in private households.

The European Union has presented a variety of plans, directives and communications to set up the framework for energy efficiency policies. Naturally, EU-directives require member states to reach a particular result but do not dictate means of achieving the target. This leaves leeway for legislative and administrative implementation. The current, overarching policy framework on the European Level was defined in 2005 with the EU-Commissions ***Green Paper on Energy Efficiency***[15] which reemphasized existing energy saving measures and spelled out additional options to achieve a sustainable, competitive and secure energy supply in Europe. Based on the consultations launched by the green paper, the ***Action Plan for Energy Efficiency 2007 - 2012***[16], presented in 2006, emerged as another corner stone. The plans` intention is to reduce energy consumption by 20% by 2020. The stated objective is to provide the most energy efficient buildings, appliances, processes, cars and energy systems to EU citizens. It aims at mobilizing the general public, policy-makers and market actors to support the dissemination of energy-efficient infrastructure and products. The 75 specific actions in 10 priority areas aspire to increase the yield of energy production and distribution, to facilitate financing and investments in the sector and to encourage rational energy consumption behavior. A decisive criterion for choosing appropriate measures is cost-efficiency, favoring measures and products with the lowest life cycle costs including environmental damages.

The largest share of final energy consumed by households is contributed to heating processes and end use appliances such as information and communication technologies and lightning (Figure 1). The subsequent sections give an overview of existing, relevant policies on the European and especially on the German level and put them into a theoretical perspective.

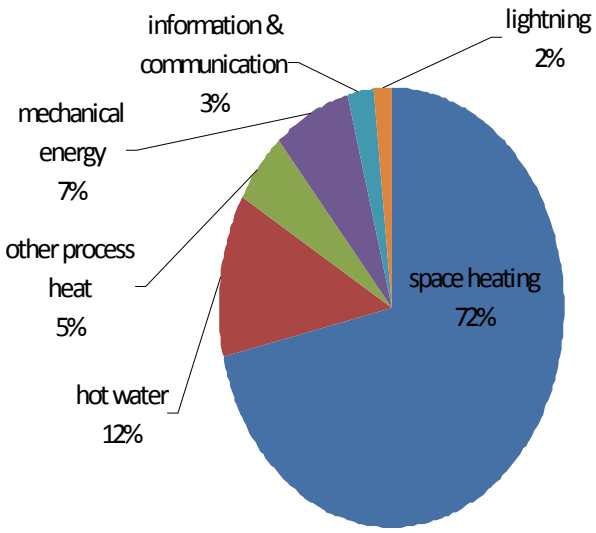
---

[14] European Commission (2010): EU Energy and Transport in Figures, Statistical Pocketbook 2010, pp. 183 - 206

[15] COM(2005) 265.

[16] COM(2006) 545.

Fig. 1. Final energy consumption of households by application in %



Source: Bundesverband der Energie- und Wasserwirtschaft e. V. (BDEW), Endenergieverbrauch in Deutschland 2007, Teil A: BDEW-Projektgruppe „Nutzenergiebilanzen“, 12/2008

3.1 Space heating and domestic hot water

The insulation of buildings during construction or retrofitting measures is likely to be one of the main levers for increasing energy efficiency and reducing emissions from space heating and domestic hot water consumption. Implementing different demand and supply side policies, such as raising consumer awareness, offering financial assistance and creating appropriate standards for insulation and heat production, could provide a significant contribution for achieving the European Union's overall climate and energy objectives.

3.1.1 European Level

On the European level, the 2002 Directive on Energy Performance of Buildings[17], which addresses policies aiming at supply and demand side changes, is of main importance. Other directives, such as the Directive of Energy End-Use Efficiency and Energy Services[18] and the Ecodesign Directive[19] are of relevance as well but are of particular importance with respect to end-use appliances and electricity services efficiency:

- **Energy Performance of Buildings Directive – EPBD** (2002/91/EC)

  This directive and the subsequent recast in early 2010 constitute the current legal framework for energy efficiency on residential and tertiary sector buildings. The main objective is to prescribe an energy saving target for member states and to establish a common ***methodology to calculate and rate the integrated energy performance of buildings***. It suggests the ***creation of minimum standards on the energy performance*** of new houses and existing buildings that are subject to major renovation. The directive aims to create a ***system of energy performance certification*** for buildings and ***requires regular inspection of boilers and central air-conditioning systems***. Member states shall ensure that ***information*** on energy efficiency measures and financial and legal frameworks is transparently available to all market actors and that ***market barrier reduction*** is promoted. Finally, the directive suggests that ***financial instruments*** shall be strengthened and ***additional funds*** shall be made available. In order to assure that necessary actions are taken on all necessary levels, the directive sets its scope to all market actors - energy distributors, system operators, retail energy sales companies and final customers.

  In regard to a common methodology for the calculation of minimum standards in the various member states, the directive lays out an integrated approach focusing on the building's insulation quality and relevant aspects of

[17] Directive 2002/91/EC
[18] Directive 2006/32/EC
[19] Directive 2005/32/EC amended by Directive 2008/28/EC

heating and cooling installations, lighting systems, the position and orientation of the building and heat recovery.

These provisions and energy performance requirements have been clarified and strengthened in an adopted recast of the directive in May 2010. In regard to the integrated approach of defining standards, the directive specifies a benchmarking methodology for calculating cost-optimal levels of minimum requirements on the energy performance of buildings. Cost-optimality is defined as the minimum of lifecycle costs including investment, maintenance, operating, energy, and disposal costs.[20] Member states shall also set minimum energy performance requirements for technical building systems such as ventilation, heating, lightning and hot water equipments as well as building elements, such as roofs and walls. Thus, as will be outlined later, while the Ecodesign directive regulates the energy efficiency of products in the market, the EPBD targets the energy efficient assembling of these products in technical systems.

- **Energy End-use Efficiency and Energy Services Directive** (2006/32/EC)

The scope of this directive is quite broad as it applies to retail sale, supply and distribution of energy with respect to electricity, natural gas, district heating, heating oil, coal and lignite, forestry and agricultural energy products. Thus, although more relevant for the section on energy end use appliances, it also applies to heating as an energy service and heating products. The directive promotes the introduction of indicative is perceived as an umbrella to complement and improve the implementation of existing EU energy efficiency legislation such as the directives on energy performance of energy saving targets of 9% by 2016 by each member state. Generally, it buildings, combined heat and power[21] and energy labelling of appliances.[22] The directive intends to set up the institutional, legal and financial framework needed to reduce market barriers to efficient energy end use. Therefore, it requires member states to establish ***national energy efficiency action plans*** outlining intermediate targets which had to be achieved in 2009 and measures to achieve defined savings targets. It also created a framework for a harmonized measurement system for energy savings to guarantee the comparability of national savings and actions. Furthermore, it encourages the development of a market for efficient energy services and of new energy saving programs and policy measures.

Member states are required to provide transparent information on energy efficiency improving policies and programs. The ***supply side policy obligations*** require member states to refrain businesses from activities that obstruct the supply of services and programs improving energy efficiency, to inform final consumers on programs to increase energy efficiency and to cooperate in voluntary agreements or market based measures aimed at increasing energy efficiency. Member states are hold to repeal national legislation and regulation that currently might create market obstacles for reaching energy saving targets.

[20] EU Commission: COM(2008) 780 final
[21] Directive 2004/8/EC
[22] Directive 92/75/EEC

Also, disincentives in the national transmission and distribution systems that lead to unnecessarily high energy consumption have to be abolished. The text furthermore provides for the development of energy auditing systems for final consumers whereas the certification following such energy audits is equivalent to the procedure obtained in the Energy Performance of Buildings Directive. The directive supports that end-users should be provided with individual meters and informative billing indicating current actual prices and consumption, comparison of current consumption with previous consumption and contact details for information bodies providing detail on how to improve energy efficiency.

3.1.2 National Level – Germany

According to the EU-Directive on Energy End-use Efficiency and Energy Services the German government adopted a National Energy Efficiency Action Plan in 2006 lining out how to achieve the directives. It listed existing measures contributing to a reduction in emissions and lined out, which further measures are deemed necessary. Furthermore, the German government introduced the ***Integrated Energy and Climate Program*** (IEKP) in 2007 to translate the decisions of the European Council on climate conservation, renewable energies and energy efficiency. The IEKP specified additional measures from the national action plan and presented a portfolio of 29 measures aiming to achieve the emission reduction target of 40% by 2020 compared to 1990.

The subsequent paragraphs outline measures that apply to energy efficiency in domestic space heating and hot water consumption. In order to make clear which market and behavioral failures are addressed, the policy measures will be discussed in light of potential remedy of suspected market and behavioral failures.

The main instrument for the reduction of energy consumption of buildings in Germany is the energy saving law and its respective ordinances. Further important instruments are the governments CO_2-modernisation program and respective energy efficient rehabilitation and construction programs of the Kreditanstalt für Wiederaufbau and informational campaigns run by the German Energy Agency (DENA).

- **Energy Saving Law** (EnEG)
  The enactment of the Energy Saving Law (EnEG) requires the avoidance of unnecessary energy losses and the installation and operation of energy saving appliance systems when constructing new buildings. The law prescribes the dispersion of operation costs such that the energy consumption of the end-user can be appropriately measured and accounted for in energy bills. Thus, it establishes not only prescriptive standards but also incentive instruments targeting changes of consumption patterns.

  – ***Energy Saving Ordinance*** (Energie-Einspar-Verordnung ENEV)
    The current EnEV, effective since October 2009, specifies ***standards***

that reduce the allowed annual primary energy consumption of new buildings by 30% and increase the benefits of insulation by 15% on average. In regard to modernization of buildings, either the increased ***retrofitting requirements*** for major components have to be met or the buildings energy consumption has to be 30% below previous levels with an insulation performing 15% better. Retrofitting ceiling insulation in old buildings is obligatory beginning in 2011. Furthermore, accumulator heaters older than 30 years have to be removed until 2020. However, house owners are not required to renovate and measures are conditioned to be economically acceptable, leaving leeway for interpretation. The most obvious achievement was the introduction of an ***Energy Pass for Buildings*** to inform about energy characteristics of houses and to increase the enforceability of established requirements and standards. The enforcement of the ordinance was tightened by requiring certificates for realizing retrofitting measures and by penalizing infringements on construction and retrofitting requirements. The 2009 ordinance already constitutes a tightening of the previous 2007 energy saving ordinance. The current requirements for new building will be similarly increased with a new ordinance planned in 2012 which ought to guarantee a dynamic efficiency increase.
While in principle the effect of the ordinance reduces externalities from the production of energy, the inclusion of parts of the energy market in the emission trading system may only partially lead to reductions of emissions. Requirement for metering and accounting, however, may reduce problems caused by average cost pricing and subsequent excessive consumption. Furthermore, the energy pass provides information that may reduce inefficiencies due to asymmetric information, the principal agent problem and learning by using.

– ***Heat Cost Ordinance*** (HeizkostenV)
This ordinance regulates the billing of heat costs and warm water in tenancy and proprietary relationships and was last amended in 2009 The amendment allows landlords to increase the consumption based share of the ancillary rental expenses to 70% giving the tenant an incentive for energy saving consumption. Yet, it also increases the information requirement on behalf of the owner and requires usage bound accounting as well as the replacement of old heat cost and warm water meters that have been installed before 1981 with new equipment from 2013 onwards to allow for detailed consumption accounting. Additionally, the tenant has the right to rent cut backs in case the landlord did not fulfill the retrofitting requirements.
Consequently, the lack of information of tenants is overcome by clear consumption based accounting. Furthermore, the principal agent problem between landlords and tenants is addressed partially as now the landlord, in principle, has an incentive to invest in efficient retrofitting.

- **Financing Renovation, Retrofitting and energy efficient construction**

Since 2001, grants and low interest credits are made available mainly by four Programs. They are incentivizing investments in energy efficient construction and retrofitting measures of the housing inventory with federal funds provided mainly by the Kreditanstalt für Wiederaufbau (KfW). Most prominent programs are listed in the following.

– ***CO_2-modernisation program***

The CO_2-modernisation program was introduced in 2001 to supplement existing financing programs targeting CO_2-reduction and modernization. The program supports energy efficient retrofitting of buildings that have been constructed before 1995 by giving investors an additional incentive to renovation. The program is not solely targeted on the residential sector, but addresses the public sector, services and industry also. The government is providing financial resources via the KfW for either full scale renovation to newly build house levels or specific energy efficient retrofitting measures such as heat insulation, modernization of windows, and heating systems exchange. From 2001 until 2007 a total credit volume of €10 billion has been allocated. In 2006 and 2007 the program had a volume of € 3.4 billion and € 1.8 billion respectively, whereas the federal funds have been reduced from € 1.1 billion to € 850 Mio.. For 2008, considerable reduction of funds was planed. Yet, with the first economic stimulus package federal funds had been increased to € 1.4 billion in 2008 and to € 1.5 billion in 2009 and a credit volume of € 3.8 billion and € 4.1 billion has been provided.[23]

– ***KfW Energy-Efficient Rehabilitation***

This program also supports financing emission reducing modernization measures in residential houses with grants and low interest credits. It supports non-energetic modernization and maintenance measures as well as the deconstruction of rental buildings. Since 2009 the eco-plus program version of the program facilitates highly energy efficient single retrofitting measures such as insulation, window replacement and heater exchanges based on renewable energies, combined heat and power generation or district heating. In 2006 and 2007 the approved credit volume was € 2.8 billion and € 3.3 billion.[24] In 2009 the total approved credit line was € 3 billion whereas the credit volume for eco-plus modernization was € 675 Mio..

[23] UBA (2009): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau, October 2009, pp. 88- 91.

[24] Deutscher Bundestag (2008): Beitrag der KfW-CO2-Gebäudesanierungsprogramme zum Klimaschutz - Antwort der Bundesregierung auf eine Kleine Anfrage. Berlin, Vertrieb: Bundesanzeiger Verlagsgesellschaft mbH, Gesamtherstellung: Heenemann GmbH, Köln

– ***KfW Energy-Efficient Construction***
Introduced in 2005 the two lines of this program condition the financial support for the construction of new or the acquisition of residential houses to a primary energy consumption that is at least 30% or 85% or below the prescribed EnEV 2009 - norms. The program also encourages the installations of renewable energy heat equipment and cogeneration. The credit volume was € 2.2 billion and € 2.1 billion in 2006 and 2007.

– ***KfW Proprietary Program***
Existent since 1996, this program focuses on financing the construction of new or the acquisition and modernization of existing private residential buildings and owner-occupied flats. Within the program 30% of the total costs of and a maximum credit of € 100.000 are supported. In 2007 and 2008 the total credit volume was € 5.2 billion and € 4.5 billion of which roughly 70% went to acquisition and modernization. The program does not specifically target energy efficiency but as a majority of funds are used for modernization it is an important instrument for reducing emission from the residential sector.

These programs directly address the problem arising from limited credit market access and liquidity constraints of investors. Moreover, the KfW builds up and provides knowledge to potential investor, thereby limiting the information problem. Furthermore, as long as externalities are not accounted for by the emission trading system – e.g. in the case of domestic heat production – the policy also reduces environmental externalities from CO2 emissions.

- **Renewable Energy Heat Law** (EEWärmeG)

The German governments aim is to increase the renewable energy share in heat supply from today 6% to 14 % in 2020. Therefore, the Renewable Energy Heat Law, passed 2009, requires 5% of the heat consumption of new buildings to be supplied by renewable energies. However, the law does not set standards or prescribes measures for the existing house inventory. In order to assist constructors to carry additional costs, the government linked the implementation of the law to the market incentive program which was created in 1999 to support the market introduction of renewable energies. On the supply side the law outlined that municipalities may introduce obligatory connection and utilization of renewable energies in district heating networks.

– ***Market Incentive Program***
The program supports the utilization of renewable energy appliances for heat supply and, since 2008, the installation of heat pumps. The Federal Office of Economics and Export Control (BAFA) made € 200 Mio. and € 300 Mio. available in 2008 and 2009 triggering invest-

ments of approximately € 3 Billion in 2009. The volume of the program was reduced to € 265 Mio. in 2010.

The market incentive program addresses two failures present in the energy market. On the one hand, it helps to overcome liquidity constrains for new and inexperienced renewable energy technologies in the capital market, and on the other hand, it helps to reduce externalities from the use of fossil fuels in the domestic heating sector, which is included only in parts in the emission trading system. By increased diffusion of renewable energy heat technologies, the program may also trigger improved learning by using effects.

- **Promotion and Support of Energy Counseling in Residential Buildings**

The Federal Ministry of Economics runs this in-house counseling program as advisory service for efficient and rational energy usage in residential buildings. It is an instrument to identify potentials for energy investments and inform about potential efficiency gains and existing support opportunities. House owners are supported financially to carry the cost of consultancy. Notably, the number of consultations has increased sharply since 1998 reaching its peak in 2006 when the programs budget was € 6 Mio. Since then the number of consultations decreased with a budget that was reduced to € 4.7 Mio. in 2008.

- **Informational Campaigns**

Informing consumers about energy efficiency opportunities and financial support schemes is an instrument which is used in a variety of ways. The German Energy Agency's (DENA) project on heat from renewable energies and the initiative Solar Heat Plus, aims to inform consumer on the potentials and support schemes for residential heat from renewables. The DENA projects „Energy Pass for Buildings" and „Quality Seal Efficiency House" offer background information und working tools to tenants and landlords with respect to the required energy pass. In the framework of the DENA program "Future Building" the exemplary project "Low Energy House in the Housing Stock" was instantiated to establish ambitious efficiency standards using innovative technologies and thus to prove best practices. While 375 buildings have been renovated reducing their energy demand by 87% on average, DENA established a network of regional competence center on low energy renovation.

The general purpose of informational campaigns is to decrease the lack of information on the side of potential consumers and investors. Particularly, these specific programs reduce principal agent problems between tenants and landlords. Moreover, they may also increase the benefits from learning by using as new technologies and construction techniques are established in the market from which constructors, architects and investors can learn.

3.1.3 Effectiveness of existing measures in Germany

The effectiveness of these measures with respect to their emission reduction contribution has been estimated by a study conducted for the Umweltbundesamt.[25] Assuming the financing mechanisms of the year 2008 are extended until 2030, the effects of the implemented policies have been modeled. The results suggest that from 2005 until 2020 roughly 14 MT of CO_2-equivalents and until 2030 additional 9 MT could be reduced (**Fehler! Verweisquelle konnte nicht gefunden werden.**). Relative to 1990 this corresponds to a reduction of 22% in 2020 and 34% in 2030 respectively. However, the study unveiled that with a tightening of existing policies significant additional emission reductions can be achieved. Therefore, in section two of this report, instruments that are already discussed in Germany will be presented alongside with best practice policy measures from other countries and some new policies ideas that might be worth to be analyzed further.

Table 1: CO2-saving of existing policies aiming at efficiency improvement in space heating and domestic hot water supply

Measure/Instrument	policy type	Direct Emission Reduction Effect in € Mio. T CO2-equiv.				
		2010	2015	2020	2025	2030
KfW - Energy-Efficient Rehabilitation	financial	3.4	5.5	7.7	9.9	12.1
KfW - Energy-Efficient Construction	financial	0.4	0.7	1.1	1.4	1.7
Energy Counseling in Residential Buildings Program	financial	0.2	0.3	0.5	0.7	0.8
Market Incentive Program	financial	1.6	3.1	4.8	6.4	8.0
KfW Proprietary Program	financial	-0.3	-0.4	-0.5	-0.6	-0.6
Energy Saving Ordinance	law	0.4	2.0	3.6	5.3	7.0
Heat Cost Ordinance	law	0.0	0.1	0.2	0.3	0.5
Renewable Energy Heat Law	law	0.3	0.9	1.5	1.9	2.4
Deduction due to overlapping		0.7	2.9	5.1	7.2	9.4
unweighted effect of policy measures		6	12.5	19.1	25.7	32.2
weighted effect of policy measures		5.3	9.6	14	18.5	22.9

Source: UBA (2009): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau, October 2009, p. 121.

[25] UBA (2009): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau, October 2009, pp. 88- 91.

3.2 Final energy using appliances and electricity

Electricity consumption in private households is responsible for a considerable share of total energy consumption. Lightning and the use of informaiton and communication technologies grows strongly and currently account for about 5% of final energy consumption. Reducing individual electricity consumption with supply and demand side policies such as by requiring end-use appliances to be more efficient, by providing households with information on the efficiency of appliances and consumption habits and by setting appropriate incentives for behavioural changes could be decisive to reduce consumption and CO_2-emissions.

3.2.1 European Level

Increasing electricity consumption efficiency in private households is a further main lever for the European Union to achieve its emission reduction target and to increase supply security. The Directive of Energy End-Use Efficiency and Energy Services[26], already mentioned in the previous section, and the Ecodesign Directive[27] are the most important documents in this respect. The Directive of Energy End-Use Efficiency and Energy Services introduced supply side obligations that require member states to refrain industry and businesses from activities that obstruct the supply of services and programs improving energy efficiency, to inform final consumers on programs aiming at an increase of energy efficiency and to cooperate in voluntary agreements or market based measures aiming at electricity consumption reduction. As mentioned before, and relevant here as well, the directive provides for the development of energy auditing systems for final consumer. According to the directive, end-users should be provided with individual meters and informative billing indicating current actual prices and consumption, comparison of current consumption with previous consumption and institutional contacts providing details on how to improve energy efficiency. Each of these steps, indirectly, gives incentives to consumers to adopt their consumption habits to efficient levels. The most relevant directive setting standards and information criteria for energy end using appliances is the Ecodesign Directive of 2005 and its respective commission regulations. Further elements of the legal European framework are the directive on labeling standard product information for energy using products and the Ecolabel regulation.

- **Ecodesign for Energy-Using Products Directive – EuP** (2005/32/EC)

This framework directive, revisited in November 2009, aims at an environmentally friendly, energy saving design of all energy appliances which use, generate, transfer or measure energy and all other energy related products which an impact on energy consumption. The text defines principles, conditions and criteria for set-

[26] Directive 2006/32/EC
[27] Directive 2005/32/EC amended by Directive 2008/28/EC

ting environmental requirements for energy using products. The directives explicit scope is the EU's internal market, making member state implementation of the directive obsolete as it applies directly to all products and parts produced and trade in the European market. This prevents that disparate national legislation on environmental product performance becomes an obstacle in intra-EU trade. Manufacturer and importer have the responsibility that products comply with the directives` standards and measures which also require consumer information with respect to environmental performance characteristics.

The EU parliament and member states agreed that self-imposed measures by the industry can be given priority to regulation if they are more efficient and if certain standard in the process of setting them up are fulfilled[28]. The directive makes no direct provision to mandatory requirements for specific products but prescribes conditions, criteria and a methodology of a ***framework process of consultations with member state experts to derive implementing measures***. Currently, ***directly effective implementing measures*** are taken on a product-by-product basis by the Commission which are supervised by a committee of member state experts. In this consultation process standards for defined priority products, such as heating and boiler equipment, electric motors, lighting, domestic appliances, office equipment, consumer electronics, ventilation and air conditioning systems have been defined. Also, previous EU-regulations are seen as implementing measures that have direct effect for all member states. Relevant implementing measures for the private household sector are:

Directives on efficiency requirements for:
- hot-water boilers fired with liquid or gaseous fuels (92/42/EEC)
- household electric refrigerators, freezers and combinations thereof (96/57/EC)
- ballasts for fluorescent lighting (2000/55/EC)

Commission regulation in regard to eco-design requirements for[29]:
- standalone circulators and product integrated circulators (EC No.641/2009)
- electric motors (EC No. 640/2009)
- household refrigerating appliances (EC No. 643/2009)
- televisions (EC No. 642/2009)
- no-load condition electric power consumption and average active efficiency of external power supplies (EC No. 278/2009)
- non-directional household lamps (EC No. 244/2009)
- fluorescent lamps without integrated ballast, high intensity discharge lamps, and ballasts and luminaries able to operate such lamps (EC No. 245/2009)

[28] European Consumers's Organisation (BEUC) (2010): Commission Guidelines for voluntary agreements under the Ecodesign directive, Brussels.

[29] European Commission – Directorate General for Energy: http://ec.europa.eu/energy/efficiency/ecodesign/legislation_en.htm

- simple set-top boxes (EC No. 107/2009)
- standby and off mode electric power consumption of electrical and electronic household and office equipment (EC No. 1275/2008)

Additionally, the commission is conducting preparatory studies to implement standards for further product groups such as solid fuel small combustion installations, laundry dryers and vacuum cleaners.

- **Directive on the Indication by labelling standard product information of the consumption of energy and other resources by household appliances** (92/75/EC)

The directive requires household appliances to display information on energy and other resource consumption. Consequently, suppliers have to establish detailed technical documentation of design calculation results and test reports. Member states have to take necessary measures guaranteeing that the obligations are met and that informational campaigns aimed at encouraging private consumers to efficient energy consumption are provided. Since the Directive was issued in 1992, several implementing rules on energy labelling for household appliances have been issued:

- electric refrigerators , freezers **(**2003/66/EC**)**
- electric ovens (2002/40/EC)
- air-conditioners (2002/31/EC)
- dishwashers (1999/9/EC)
- lamps (98/11/EC)
- combined washer-dryers (96/60/EC)
- electric tumble dryers (95/13/EC)
- washing mashines(95/12/EC, 96/89/EC)
- office equipment (No 2422/2001).

- **Ecolabel Regulation**

Until recently, several different EU directives and regulations (92/75/CEE, 94/2/CE, 95/12/CE, 96/89/CE, 2003/66/CE ,EEC No. 1980/2000) set the framework for a European wide eco-label to promote products with a reduced environmental impact compared to products in the same product group. As this framework requires the Eco-label to be clearly displayed it provides consumers with environmental performance information. The label is awarded to products meeting certain environmental requirements and specific criteria defined within an assessment matrix. These criteria have been set and reviewed by the European Union Eco-Labeling Board but product suppliers apply to the responsible national institution to get products awarded with the ecolabel. Thus, the terms of label using are concluded on a contract basis and using the label is subject to an annual user-fee. In order to qualify, products must be sold for end-use purposes, must represent significant volumes of sales and trade in the internal market, and must have considerable potential for environmental improvements. The Regulation also requires

the Commission and member states to promote the use of the eco-label through information campaigns and the coordination between the community's eco-label and existing national schemes. Several energy using products are subject to the eco-label scheme:

- Electrically driven, gas driven or gas absorption heat pumps (2007/742/EC)
- Portable computers (2005/343/EC)
- Personal computers (2005/341/EC)
- Refrigerators (2004/669/EC)
- Washing machines (2003/240/EC)
- Light bulbs (2002/747/EC)
- Televisions (2002/255/EC)
- Dishwashers (2001/689/EC)

- ***Energy Star Label Program:***
  Based on an US initiative in 1992 the Energy Star label aims at manufacturers of office information and communication technology equipment to voluntarily apply agreed energy performance specifications. As office equipment is responsible for a growing share of electricity consumption in the EU, the Commission adopted the label in 2005.

3.2.2 National Level – Germany

The National Energy Efficiency Action Plan and the Integrated Energy and Climate Program (IEKP) that have been outlined earlier, also set the framework with respect to energy saving measures targeting energy-using appliances. The extended part on European level policies indicates that major policies are made here

Specific policies that have been derived from this energy saving framework are:

- **Energy Appliances Law** (EBPG)

Transferring the Eco-design directive into national law, the Energy Appliances Law, introduced in 2008, prescribes the EU-Commission's implementing measures as binding for the national market. The law states clearly that products are only to be brought to the market if they conform to the requirements defined in the EU Commissions implementing measures. The law outlines informational duties of producers or importers and defines the Federal Institute for Material Research and Testing and the respective federal agencies as the responsible market control institutions for implementation. The law has been further specified with the Energy Consumption Labeling ordinance and Energy Maximum Consumption ordinance.

– ***Energy Consumption Labeling Ordinance (ENVKH) and Energy Maximum Consumption Ordinance (ENVHV)***
These Ordinances, enacted in the 1990's, basically transfer the EU framework directive on standard product information into national law. Thus, the European wide Eco-label prescriptions have to be visualized also for products on the German market, indicating technical information on the equipment and its consumption of energy and other resources.

– ***Further Energy Labeling voluntary industry commitments***
The Blaue Engel introduced in 1978 is a well known seal of environmental product quality as it is quite broad with respect to its product coverage. Another widely used quality seal is the GEEA-label that was assigned to TVs, computer, copy and fax machines, printer, power supplies, video recorder and battery chargers. Yet, it has recently been replaced by the Energy Star label. Since 2002 the German Energy Agency (DENA) is the national institution for coordinating the implementation of the Energy Consumption Labeling and the Energy Star Program. Therefore, DENA is the national focal point for producers, dealers and informing consumers with respect to European energy labels.

The EBPG and voluntary industry commitments address problems arising from insufficient information of consumers in regard to the energy consumption of specific products. Therefore, it may improve consumption decisions distorted by incomplete information. In case of underinvestment in energy efficiency of products, the law may reduce energy consumption and related externalities from energy production in case it is not covered by the European emission trading system. Thus, a reduction of externalities may also be expected.

- **Law of Opening the Metrology** (2008):

This instrument that has already been mentioned with respect to space heating and domestic hot water aims at clear and transparent accounting of electricity consumption. The law, introduced in 2008, aims at the introduction of smart-meter technology via the liberalization of the metrology market, relying on the private demand for the technology as it gives consumers the right to choose metering point operators. On the one hand, as smart metering allows for precise consumption based billing averaged cost pricing can be reduced which gives consumers the opportunity to adjust consumption to off-peak times. On the other hand, the impact of this policy might be marginal as electricity suppliers are not obliged to install the new technology to the benefit of all consumers.

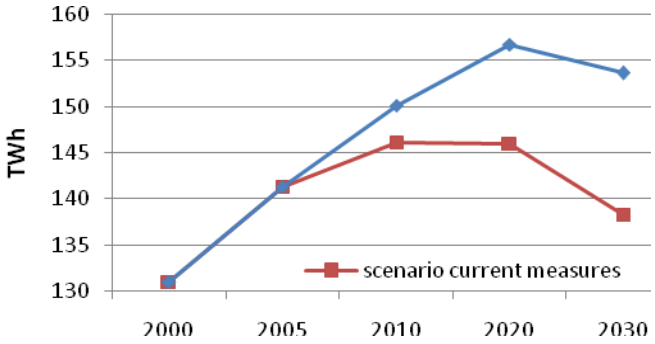
- **Informational Campaigns**

Additional to the programs in place, Germany is running several informational campaigns on the national, federal and municipality level to inform consumers about energy efficiency. The most prominent in this respect is the ***Initative for Energy Efficency*** started in 2003. The aim of the initiative is to raise awareness, and increase the profile and spread of energy efficient equipment in households and industry. By implementing non-obligatory provisions the initiative increases energy efficiency through changes in consumption, investment and usage behaviour. The campaign is realised by DENA, EnBW AG, E.ON AG, Vattenfall Europe AG and supported by the Federal Ministry of Economics and Technology.

3.2.3 Effectiveness of existing measures in Germany

The effectiveness of measures targeting final energy using appliances and electricity consumption in Germany has been assessed by the UBA study (UBA 2009b) mentioned before. The results suggest that without current measures the electricity consumption increase continues until 2020 and decreases slightly thereafter. The policy measures adopted are expected to only stabilize electricity consumption around 2005 levels as demand for end-using appliances continues to grow. In contrast to the aspired aim of consumption reduction, the development in the *current measures scenario* would be equivalent to an increase of 17.9% of consumption in 2020 compared to 1990 (Figure 2). This indicates that a substantial emission reduction cannot be expected from this sector if the government does not improve its policies. Strengthening the existing instruments and introducing additional measures is, thus, necessary for the fulfilment of the electricity consumption reduction target. As for the domain of space heating and domestic hot water supply, additional measures in the area of private household electricity consumption are discussed in section four.

Fig. 2. Development of Electricity Consumption of Private Households 2000- 2030



Source: Figures are extracted from UBA (2009b): Politikszenarien für den Klimaschutz V – auf den Weg zum Strukturwandel, October 2009, Dessau , based on AGEB (2008) and calculations at ISI and IEF-STE.

3.3 Green electricity

The Renewable Energy Directive (2009/28/EG) prescribes the enactment of laws in the member states that increase the share of renewable energies in total primary energy supply to 20%. In Germany the main instrument is the Renewable Energy Law and its feed-in tariff (FiT). The FiT establishes a fixed price for renewable energy sources and an annual digression of these tariffs for new vintages to overcome market barriers and to adopt to cost developments of renewable energies.

In addition, there are some measures addressing the demand side for green electricity. With the directive on a single European market for electricity (2003/54/EG) introduced in 2003, an electricity identification obligation was established to increase consumer awareness with respect to environmental effects of their electricity consumption. Moreover, the comparability and transparency of electricity contracts was increased, giving consumers the possibility for more informed decisions when selecting electricity providers. In Germany the Energy Industry Act (Energiewirtschaftsgesetz) which was introduced in 2005, transformed the directive into national law. However, these measures do not necessarily require suppliers to inform about electricity sources and additional environmental benefits of using renewable energies. Thus, the electricity identification obligation currently cannot replace the various green electricity labeling initiatives, but may increase the comparability of basic information required from electricity contractors.

Several initiatives to certify green electricity to increase market transparency and consumer information has been introduced in the past. The EUGENE Green Energy Standard was an international standard which was accredited to national green electricity labeling schemes. Initially financed by the European Union's CLEAN-E initiative, the project aimed at harmonizing green power labels. However, it was abandoned in 2009 as it became clear that labeling green power has to be tailored to the needs of the different national electricity markets and consumer expectations. In Germany, there is no government sponsored initiative on green power labeling, but various quality seals of green electricity can be obtained from, for example, the Technical Supervisory Associations (*TÜV),* Green Peace Energy, Grünes Strom Label e. V. . Unfortunately, the extent to which these labels have an impact on consumer behavior, especially on switching incentive of consumers from standard electricity contracts to green electricity, is not properly assessed.

4 Additional Measures

In the previous sections the energy and emission saving potential of implemented policies in Germany have been outlined, referring mainly to the study for the Federal Environmental Agency (UBA (2009)). The impression is that for bith issue areas, *space heating and hot water supply*, and *end-use appliances and electricity consumption*, a gap between policy effectiveness and pronounced energy saving targets remains. Therefore, several adjusting points for existing policies and further additional measures have been identified.

This section gives an overview of additional measures under discussion.[30] Additionally, it is also worthwhile to identify further instruments that have been implemented in other countries or seem feasible from an economic perspective. Thus, an overview and a brief discussion of best practices and potential new measures is given with some theoretical notations to establish the link between market failure and policy intervention.

4.1 Space heating and domestic hot water

In section three it was underlined that the implemented measures leave leeway for optimisation. Given the implementation of the following additional policies and tightening measures, a significant potential for additional savings could be realized:

(1) Tightening retrofitting requirements for heating boilers and heat systems; and strengthening certification schemes enforcement: Current requirements of the EnEV 2009 only apply to appliances taken into service before October 1978 and not for buildings with two flats of which at least one is used by the owner. If these retrofitting requirements would be tightened, significant energy efficiency gains and respective CO_2-reductions could be possible. With respect to the existing certification schemes on energy efficient houses, owners and investors have to document improvements which are currently subject to random inspection. Strengthening the inspection would improve compliance and increase the visibility and impact of the Energy Pass.

[30] This section is in part based on: UBA (2009b): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau, October 2009 and: Sina, S; Umpfenbach, K. (2009): Maßnahmenvorschläge zur Erreichung des 40% - Ziels der Bundesregierung - Vorstudie des Ecologic Instituts für die European Climate Foundation.

(2) Applying Renewable Energy Heat Law to old Buildings: The requirement for using renewable energies for heat services is mandatory for the construction of new buildings only. The installation of such devices on the existing building stock is currently not mandatory but supported by the market incentive program. Obligatory installation in case of renovation could reduce CO_2-Emissions more effectively and alleviate the common market failures connected with the diffusion of new technologies in the domestic heating sector. A specific example is the obligatory application of the Renewable Energy Heat Law to old Buildings in the federal state of Baden-Württemberg in Germany.

(3) Reduction of VAT for Renewable Energies: The reduction of the value added tax can trigger additional energy efficient retrofitting and renovation as it gives incentives to investors. The reduced revenue of the state might, at least partially, be offset by additional tax revenues induced by additional growth.

(4) Heat cost reduction rights for tenants and including energy efficiency in rent indices: Operating costs become increasingly important for tenants. Yet, landlords frequently disregard their rent share. Rent indices and brochures often only indicate cold rents and neglect overhead costs. But, this does not indicate the true price of living to potential tenants. Introducing a heat cost reduction right if the requirements for building insulation and heating appliances according to the EnEV are not met would give landlords the incentive to invest and to reflect true housing costs. Another instrument to unveil the operating costs is to require landlords to inform tenants on the energetic house quality. The existing energy pass offers an adequate mean for implementation in this respect.

(5) Heat contracting in residential housing market: The main advantage of heat contracting is that landlords do not need to invest own resources for the installation of new heating systems, the landlord heat billing costs and payment shortfall risks are passed to the contractor. Additionally, contractors have an economic incentive to conduct their energy supply and service obligations with efficient technology as production, emission and distribution losses are to their expenses. The user investor dilemma is reduced as, contrary to landlords, contractors can amortize their investments into the heating system through higher heat prices causing higher auxiliary expenses for tenants. Thus, according to current jurisdiction, landlords may only introduce contracting to tenants if the rental agreement is explicitly designed in such manner or if all parties agree to necessary changes. Another important aspect is, that if heat contracting is not amended with investments of the landlord into building insulation, the largest share of energy saving potential remains untouched. An aspect that has not been underlined yet is that similar to the electricity market,

consumers could get the opportunity to choose contractors according to their “green” energy sources.

(6) Tightening standards for KfW support programs: The specific support of retrofitting measures which reduces energy consumption of renovated houses to comparable energy efficiency standards as supported new buildings could be an adequate instrument parallel to the tightening of the ordinance in 2013.

(7) Obligation to connect renewable energies to the heat net: In order to reduce barriers for renewable energies in the heat sector, the renewable energy heat law currently gives municipalities the right to introduce a connection and usage obligation of renewable energies in district and local heat networks. Turning this optional policy into a general obligation to connect renewable energy to heat net works would ease the access of renewable heat to the market.

(8) Feed-in-Tariff (FiT) for heat from renewable energies: Currently, local and district heat networks are characterised by the absence of market prices, as commonly heat is provided by regional monopolies where prices are administered. Therefore price transparency is not always given. The provision of renewable heat requires long term investments in technology. Considering this background, the introduction of a fixed guaranteed FiT, set on an appropriate jurisdictional level, could improve the basis for calculations of investment in renewable heat.

4.2 Final energy using appliances and electricity

The overview of the effectiveness of implemented policy measures in section two reported that these instruments are only able to stabilize electricity consumption at 2005 levels but cannot contribute to a significant consumption and emission reduction compared to 1990 levels.[31] The following tightening or additional policy measures might help to close the divergence between policy outcome and political goal:

(1) Introducing further, stricter minimum efficiency standards: The Eco-Design directive can serve as the cornerstone for a further introduction of binding and ambitious minimum efficiency standards of a broader set of energy using products. The enactment of further product specific implementing measures could be put on a fast track. Within the discussion of implementing further standards for a larger product group and dynamically adjusting existing standards introducing a top runner method is often proposed as it steers standards toward the best product in the market.

(2) Improving energy consumption labelling: The revision process for the quality seal of energy using appliances was set up with the *Directive on the indication by labelling standard product information of the consumption of energy and other resources by household appliances* (92/75/EC). However, that process could be improved and extended to further products.
In early 2010 the European Commission issued a draft directive in order to keep up with the advances in energy efficiency technologies with respect to televisions. This directive proposes additional energy classes to the existing label scheme. In May 2010 the European Parliament also adopted a package of energy efficiency laws including the proposed efficiency label scheme. Thus, it is now required that the energy consumption of household end-use appliances has to be clearly displayed in commercials to assist consumers in assessing expected running cost in investment decisions.

(3) Obligation to install smart meters: Requesting and supporting the broad installation of smart meters by energy suppliers would set consumption reduction incentives for private consumers. As smart metering also allows for real time electricity billing, consumers get an incentive to adjust their consumption patterns to the scarcities of the electricity sys-

[31] UBA (2009): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau, October 2009, pp. 127.

tem. This might also enhance the ability to integrate an increased share of fluctuating renewable energies.

(4) **Financial support for highly efficient electrical appliances or introduction of an energy efficiency fund:** The establishment of a market introduction program for highly efficient electrical appliances is proposed in the German national action plan but has not been implemented, yet. A program or a fund, supporting highly efficient household appliances and efficiency technologies in business, service and industry, would increase the market penetration of best available technologies.

With respect to end-use appliances and electricity consumption in private households, several best-practice policies from other countries have been identified[32]:

(1) **Offering free-of-charge counselling and information campaigns:** The increasing utilisation of existing counselling and information campaigns unveils great demand. Yet, most of the programs require a user charge which reduces their utilisation. The Danish Electricity Energy Fund introduced an interactive online portal with individualised and comparative consultation tools that allows users to analyse individual electricity consumption based on a set of usage habits and appliance endowment. The tool is free of charge and gives individualised recommendations for action with respect to changes in consumption habits and an overview of existing support schemes for purchasing efficient appliances.

(2) **Requiring individual feedbacks to the consumers from electricity suppliers:** Individual and comparative feedbacks from electricity suppliers to consumers should give information about specific household consumption. Moreover, the effectiveness of comparative electricity bill feedbacks can be increased by not only comparing to the abstract average household, but to the specific social context. Individual feedbacks are required in Norway and tested in some regions in Denmark and Germany. It has been shown, that such a feedback can lead to savings of 5-12%.

(3) **Introduction of electricity saving obligations and demand side management measures:** Energy consumption reduction requirements to the electricity industry, as they have been introduced in Denmark, Great Britain, Italy, France and Belgium, leave measures of achieving policy goals to the industry. The systems in place differ tremendously in their individual design. However, they target usage habits as well as the acquisition of energy efficient appliances. Alternatively, or additionally, a sys-

[32] Tews, Kerstin (2009): Politische Steuerung des Strom Konsums privater Haushalte. Portfolio eingesetzer Instrumente in OECD-Staaten, Forschungsstelle für Umweltpolitik FU Berlin, Berlin.

tem in which energy supply companies can purchase so called white certificates, issued for realised energy saving measures, would create a market for energy savings as companies that overachieve their energy saving requirements can sell certificates.

(4) **Progressive electricity tariffs**: These are mechanisms giving incentives for energy savings according to price differences. Examples are provided by Japanese electricity tariffs to private household and by the Vienna Public Utility Company (Wienstrom). In these cases the price per unit of consumed electricity increases with a certain amount, thus setting an incentive for consumption reduction.

(5) **Commercial and informational campaigns for energy efficient products:** These informational tools, going beyond product labeling, ought to influence the investment decisions of consumers towards efficient choice of household appliances. Austria, for example, introduced an online tool promoting the top energy efficient products for households which also allows for a in depth comparison of prices and other product characteristics. Informational campaigns initiated under the Danish Electricity Efficiency Fund, go even further as they are tightly linked to the governments grant programs for the purchase of energy efficient appliances and respective counseling programs.

(6) **Temporarily confined premium programs**: The disbursement of a premium can reduce the price of highly efficient products to a level comparable to average products. Thus, an incentive is given to the consumer to purchase appliances with a high efficiency standard. In the Netherlands, a temporally confined and subsidized program supporting the purchase of energy efficient household appliances, house insulation and the modernization of heating systems has been introduced quite successfully between 1999 and 2003 The system was running under the framework of the Regulatory Energy Tax and allowed to retrieve a share of the eco-tax paid if more energy efficient technology was used.

(7) **Dynamisation of efficiency standards (Top-Runner):** This instrument aims at a differentiation of the energy consumption label and a dynamic updating of energy efficiency standards for energy appliances. Currently, a comparable measure is only in place in Japan, which was introduced in the framework of the Energy Conservation Law. However, the frameworks of the Energy Consumption Labeling Directive, Energy Star and the Eco-Design Directive are appropriate to introduce this instrument also in Europe.

4.3 Green Electricity

Increasing the share of renewable energies in private household electricity consumption could be an important lever to reduce GHG emissions. The decisive question would be whether it is best to achieve this target by introducing appropriate supply or demand side policies. Either way, an idea for a demand side policy is:

Settting green electricity contracts on default: Studies in behavioural economics unveiled that many people prefer an environmentally friendly source of electricity. However, although green electricity might be available in the particular market, people do not buy it since the format of information presentation affects the choice of electricity.[33] Therefore, defining green electricity contracts as the standard option and allowing consumer to choose "dirty" electricity contracts in a way as they choose "green" contracts today, could be a way to increase the demand for green electricity from private households. There are also two best practice examples. A private initiative in Schönau, Germany, took over the local electricity net in 1997. Purchasing energy mainly from renewables, the company supplies green electricity by default, but allows consumers to switch to alternative contractors. The second example is given by Energiedienst GmbH which supplies a grid area also in Baden-Württemberg. Here, the supplier is offering a number of alternative contracts setting the standard contract on green default. This allows consumers to switch to a cheaper "grey" alternative and an even more expensive "greener" electricity contract which offers energy from new facilities. In both examples the share of people using green electricity was drastically higher than on German average as most of the people remained with the more expensive but environmentally friendly energy contract.[34]

---

[33] Pichert, D; Katsikopoulos, K. (2008): Green defaults: Information presentation and pro-environmental behaviour, in: Journal of Environmental Psychology, Volume 28 (1), pp.63-73.

[34] Ibid: p.66

5 Conclusion

This report gives an overview of current measures targeting energy efficiency in the household sector. Doing so, the focus of the work was on the two main energy consumption sources – space heating and hot water supply; and final energy using appliances and electricity. The report outlines the effectiveness of these policies in terms of their energy saving and emission reduction contributions. Starting from the insight that current measures are not sufficiently contributing to the overall energy efficiency and emission reduction target, potential additional policies have been summarized.

The compilation of instruments and measures makes clear that there is a variety of levels of policy action. Improving consumer information, supporting financing conditions, introducing new technologies and improving market access are main intentions of additional policies. Some of these, however, might foil each other or might be ineffective if not accompanied by additional measures. Moreover, some of the policies might outperform other policies in the same field of action and use public funds more effectively. Generally, in order to give policy recommendation in regard to a specific proposal, first of all the economic rationale should be laid out clearly. Therefore, the underlying market imperfections and failures should be described thoroughly, and cost and effects should be estimated in future research.

6 Appendix

Table 2. Market & behavioral failures addressed by current &proposed measures

			Market Failures								Behavioral Failures		
			Energy Market		Capital Market	Information Problems							
		Policy Measure:	Externalities	Average Cost Pricing	Liqitidty Constrains	Lack of Information	Asymetric Information	Principal Agent Problems	Learning by Using		Prospect Theory	Bounded Rationality	Heuristic decision making
Existing Policy Measurs	Space Heating and domestic hot water	Energy Saving Law and Ordinance	*	*		*	*	*	*				
		Heat Cost Ordinance	*	*									
		CO2-Modernisation Program	*		*								
		KFW-Programs	*		*								
		Renewable Energy Heat Law	*						*				
		Market Incentive Program	*		*				*				
		Informational Campaigns				*	*		*				
	Appliances	Energy Appliance Law	*			*							
		Law of Opening the Metrology		*		*							
		Initiative for Energy Efficiency				*							

7 Literature

Blumstein, C.; Kreig, B. ; Schipper, L.; York, C. (1980): Overcoming Social and Institutional Barriers to energy Efficiency, in: Energy 5, pp. 355-375.

AGEB (Arbeitsgemeinschaft Energiebilanzen) (2008): Auswertungstabellen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2007 und Energiebilanz für das Jahr 2005. September 2008, Berlin, Köln (http://ag-energiebilanzen.de)

Bundesumweltministerium (2007): Bericht zur Umsetzung der in der Kabinettsklausur am 23./24.08.2007 in Meseberg beschlossenen Eckpunkte für ein Integriertes Energie- und Klimaprogramm, Berlin.

Bundesumweltministerium (2007): Eckpunkte für ein integriertes Energie- und Klimaprogramm, Berlin.

Deutscher Bundestag (2008): Beitrag der KfW-CO2-Gebäudesanierungsprogramme zum Klimaschutz - Antwort der Bundesregierung auf eine Kleine Anfrage. Berlin, Vertrieb: Bundesanzeiger Verlagsgesellschaft mbH, Gesamtherstellung: Heenemann GmbH, Köln

European Commission (2005): Green Paper on Energy Efficiency or Doing More with Less, COM(2005) 265 final, Brussels.

European Commission (2006) Action Plan for Energy Efficiency: Realising the Potential, COM(2006) 545, Brussels.

European Commission (2008): Proposal for a directive of the European parliament and of the council on the energy performance of buildings (recast), COM(2008) 780 final, Brussels.

European Commission (2010): EU Energy and Transport in Figures, Statistical Pocketbook 2010, Brussels.

European Consumers's Organisation (BEUC) (2010): Commission Guidelines for voluntary agreements under the Ecodesign directive, Brussels.

Gillingham, K.; Newell, R. Palmer, K. (2009): Energy Efficiency Economics and Policy, Resources for the Future Discussion Paper 09-13, Washington D.C.

Howarth, R.; Sanstad A. (1995): Discount Rates in Energy Efficiency, in: Contemporary Economic Policy 13, pp. 101 – 109.

Jaffe, A.; Newel, R. Stavins, R. (2004): The Economics of Energy Efficiency, in: Cleveland, C (ed.): Encyclopaedia of Energy, pp.79 – 90, Elsevier, Amsterdam.

Jaffe, A.; Stavins, R. (1994): The Energy Gap – What does It Mean? in: Energy Policy 22, pp.804-810.

Kahneman, D.; Tversky, A. (1979): Prospect Theory: An Analysis of Decision under Risk. in: Econometrica 47, pp.263 – 291.

Kemfert, C. , Traber, T. , T.P. Truong (2007): "Comprehensive package of climate protection could substantially decrease cost of emission reduction in Germany", DIW Weekly Report, No. 3, Berlin.

Kempton, W.; Feuermann, D.; McGarity A. (1982): Folk Quantification of Energy, in: Energy 7, pp. 817-827.

Levin, M.; Sanstad, A.; Hirst, E. (1995): Energy Efficiency Policy and Market Failures, in: Annual Review of Environment and Resources, 1995 (20), pp.535-555.

McKinsey (2007), Enkvist, P.-A., Naucler, T., Rosander, J.: A Cost Curve for Greenhouse Gas Reduction. In: The McKinsey Quarterly No. 1, 2007.

Pichert, D; Katsikopoulos, K. (2008): Green defaults: Information presentation and pro-environmental behaviour, in: Journal of Environmental Psychology, Volume 28 (1), pp.63-73.

Sina, S; Umpfenbach, K. (2009): Maßnahmenvorschläge zur Erreichung des 40% - Ziels der Bundesregierung - Vorstudie des Ecologic Instituts für die European Climate Foundation, Berlin.

Tews, Kerstin (2009): Politische Steuerung des Strom Konsums privater Haushalte. Portfolio eingesetzer Instrumente in OECD-Staaten, Forschungsstelle für Umweltpolitik FU Berlin, Berlin.

UBA (2009a): Endenergieverbrauch der Haushalte nach Anwendungsbereich , Dessau, http://www.umweltbundesamt-daten-zur-umwelt.de/umweltdaten/public/theme.do;jsessionid=39F84792F25AFEE52C79D8B628E0E939?nodeIdent=3533.

UBA (2009b): Politikszenarien für den Klimaschutz V – auf dem Weg zum Strukturwandel, Treibhausgas-Emissionsszenarien bis zum Jahr 2030, Dessau-Roßlau.

Wislon, C.; **Dowlatabadi, H.** (2007): Models of Decision Making for Residential Energy Use, in. Annual Review

Legal Documents

Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings

Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC (Text with EEA relevance)

Directive 2009/125/EC of the European Parliament and the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast) (Text with EEA relevance)

Directive 2004/8/EC of the European Parliament and the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC

Directive 2008/28/EC of the European Parliament and of the Council of 11 March 2008 amending Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products, as well as Council Direc-

tive 92/42/EEC and Directives 96/57/EC and 2000/55/EC, as regards the implementing powers conferred on the Commission

Bundesjustizministerium (2009): Verordnung über energiesparenden Wärmeschutz und energiesparende Anlagentechnik bei Gebäuden.

Verordnung über Heizkostenabrechnung in der Fassung der Bekanntmachung vom 5. Oktober 2009 (BGBl. I S. 3250)

Energieeinsparverordnung vom 24. Juli 2007 (BGBl. I S. 1519), die durch die Verordnung vom 29. April 2009 (BGBl. I S. 954) geändert worden ist

Energieeinsparungsgesetz in der Fassung der Bekanntmachung vom 1. September 2005 (BGBl. I S. 2684), das durch Artikel 1 des Gesetzes vom 28. März 2009 (BGBl. I S. 643)geändert worden ist

Erneuerbare-Energien-Wärmegesetz vom 7. August 2008 (BGBl. I S. 1658), das durch Artikel 3 des Gesetzes vom 15. Juli 2009 (BGBl. I S. 1804) geändert worden ist

Energiebetriebene-Produkte-Gesetz vom 27. Februar 2008 (BGBl. I S. 258)

Einheiten- und Zeitgesetz in der Fassung der Bekanntmachung vom 22. Februar 1985 (BGBl. I S. 408), das zuletzt durch Artikel 1 des Gesetzes vom 3. Juli 2008 (BGBl. I S. 1185) geändert worden ist