The ECO-BUILD project

Deliverable 2

National and regional policy measures for improving the energy efficiency in the building sector

Work package co-ordination:
ICCR

Partner input from:
CIR
EiFER
TSB
ICF
ISIS

Start of the Project: 1 October 2007
Duration: 30 Months

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)

Dissemination level: Public
Publication date: June 2009
Table of contents

0 EXECUTIVE SUMMARY 5

0.1 ENERGY DEMAND IS GROWING 5
0.2 LIMITED POLICY IMPACT 6
0.3 NATIONAL ENERGY POLICIES AND IMPLICATIONS 6
0.4 MURE DATABASE ANALYSIS 9
0.5 CONCLUSIONS AND RECOMMENDATIONS 11

1 INTRODUCTION 14

2 BACKGROUND INFORMATION 15

2.1 THE CONSTRUCTION SECTOR 15
2.2 OVERALL ENERGY CONSUMPTION 16
2.3 THE EUROPEAN BUILDING STOCK 19
2.4 ENERGY CONSUMPTION IN THE BUILDING SECTOR 20

3 POLICY CONTEXT 22

3.1 EUROPEAN AND KYOTO TARGETS 22
3.2 NATIONAL ENERGY POLICIES 27

4 IMPLEMENTATION OF THE EU DIRECTIVE ON THE ENERGY PERFORMANCE OF BUILDINGS (EPBD) 37

4.1 INSTITUTIONAL RESPONSIBILITIES 37
4.2 STANDARDS 40
4.3 ENERGY PERFORMANCE CERTIFICATE 43
4.4 QUALIFIED EXPERTS 45
4.5 INSPECTIONS 46

5 SUBSIDIES AND INCENTIVES 48

5.1 AUSTRIA 48
5.2 GERMANY 51
5.3 ITALY 52
5.4 FRANCE 54
5.5 CONCLUSIONS 55

6 EFFECTIVENESS AND IMPACTS 57
6.1 AUSTRIA 57
6.2 GERMANY 61
6.3 ITALY 65
6.4 FRANCE 70
6.5 MURE DATABASE ANALYSIS – HOUSEHOLD SECTOR 71
6.6 EFFECTIVENESS AND IMPACTS: CONCLUSIONS 78

7 CONCLUSIONS AND RECOMMENDATIONS 80

7.1 POLICY NEEDS AND IMPLICATIONS 80
7.2 INCENTIVE MECHANISMS 81
7.3 ROLE OF POWER SUPPLIERS 82
7.4 BUILDING INDUSTRY PRACTICES AND NEW ORIENTATION 83
7.5 BEHAVIOUR AND ENVIRONMENTAL CONSCIOUSNESS 84

8 REFERENCES 86

ANNEX 1 – COUNTRY BACKGROUND DATA 89

ANNEX 2 – PROCEEDINGS OF 2ND ECOBUILDINGS WORKSHOP, 5-6 MARCH 2009 93
List of tables

Table 1: Size of the construction sector (2004) ......................................................... 15
Table 2: Total final energy consumption in selected countries ...................................... 16
Table 3: Final Energy Consumption of Households 1990 to 2005 (per capita in toe ........... 16
Table 4: Number of buildings and floor space of building stock (2006) ......................... 20
Table 5: Energy efficiency of the building stock by period (kWh/m² per year for heating and cooling) .................................................................................................................. 20
Table 6: Green house gases (GHG): trends and projections (2006 Data) ....................... 26
Table 7: Residential energy demand by fuel type in Austria 1990-2004 (PJ) .................... 28
Table 8: Selected Austrian U-values and international best practice ................................ 40
Table 9: Building efficiency regulation in Austrian states using U-values (W/m²K1) ........ 41
Table 10: Share of renewables in Austria 1990 - 2005 .................................................... 59
Table 11: The CO2 Building Refurbishment Programme 2005 – 2007, key data .............. 62
Table 12: CO2 reduction in German buildings 2005-2007 .............................................. 63
Table 13: Savings in final energy in the German building sector .................................... 64
Table 14: Impact of energy efficiency improvement measures in Italy ........................... 67
Table 15: CO2 mitigation impact in Italy ........................................................................ 67
Table 16: CO2 mitigation impact of White Certificates .................................................... 68

List of figures

Figure 1: Final energy consumption by sector in the EU-27 (1990-2005) ...................... 17
Figure 2: Types of energy consumption in households .................................................. 18
Figure 3: The European building stock by age .............................................................. 19
Figure 4: Kyoto emission reduction goals of the 15 EU member states for 2008–2012
(relative to base year 1990) .......................................................................................... 22
Figure 5: Climate change performance index .................................................................. 24
Figure 6: Austrian national transposition process of EPBD ......................................... 38
Figure 7: Residential Buildings per construction period (%) ......................................... 68
Figure 8: Number and status of all policy measures for households .............................. 72
Figure 9: Type of (ongoing) policy measures for households ......................................... 73
EXECUTIVE SUMMARY

This report comprises the second deliverable of the ECO-BUILD Project, funded under the EU FP6. The main focus of this document is on national policies and corresponding measures that have contributed to the reduction of energy consumption and increased energy efficiency in the building sector in Austria, Germany, Italy and France. Emphasis is placed on the national transposition of the European Union Directive 2002/91/EC on the Energy Performance of Buildings (EPBD) and complementary legislation is taken into consideration guiding the building sector in the respective countries. The impact of the EPBD and related initiatives and financial measures are explored with the aim of providing a contextual framework as to the type and impact of policies on energy demand in the building sector in the four countries examined.

The main findings of the report relate to the importance of the building sector in reaching European and national goals for greenhouse gas reductions and the success or failure of certain initiatives on the national level. The following summary presents the main results and conclusions of the analysis undertaken for this report.

0.1 Energy Demand is Growing

Energy consumption within the building sector continues to grow. National energy consumption in each of the four target countries of Austria, Germany, Italy and France differs slightly by sector, yet is dominated by transport and households (buildings) overall. Household final energy consumption increased by about 16% over 1990-2005 within the EU-27, as rising personal incomes permitted higher standards of living, with increases in comfort levels and the ownership of domestic appliances. This global trend was also reflected in Europe. Consumerism has increased the share of household appliances to approximately 21% of residential energy use, surpassed only by space heating and cooling demands. The GDP-energy nexus is exemplified in Austria, which recorded an increase of 15.3% in the average size of dwellings and a sharp rise in absorption rates for electrical household appliances of 110% for dishwashers and 402% for clothes dryers, boosted by higher, yet modest growth rates of 2% in 2004. Consequently, energy efficiency gains due to technological advancements in Europe are being offset by increased consumption attributed to a lack of environmental consciousness and limited understanding of energy saving practices.
0.2 **Limited Policy Impact**

The Kyoto commitments, enveloped in the EU 20-20-20 targets, are a paramount policy driver for reducing energy consumption. Yet, the national approaches and impacts have been mixed, underlined by varying levels of political commitment and measures implemented. According to the Climate Change Performance Index (CCPI) for 2009, Germany and France ranked high on account of successful legislative measures, whilst Austria and Italy were rated poor in the same context. However, according to Germanwatch and CAN-Europe, the publishers of the index, no country has demonstrated leadership and the genuine fortitude to bring about the necessary paradigm shift towards an integrated environmental consensus.

The EPBD is one of several EU policy directives aimed at promoting change in the building sector through harmonized standards, certification and inspections of systems. Complementary measures that have had important impacts are contained in the Directive on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC), which has encouraged countries such as Germany and Italy to mandate use of renewable technologies in certain building scenarios. Moreover, the Energy Efficiency Directive is playing an important role in delegating responsibility to other sectors and mandating power companies to meet specific energy saving targets, which, in turn, have fostered information campaigns on efficient practices targeted at households and property owners. Consolidating the fragmented building industry around harmonized building product standards is the challenge of the Construction Products Directive (89/106/EEC) and pending regulation underscoring the concept of life cycle planning. The impact of such normative measures has yet to be fully assessed, but initial indications as regards EPBD implementation to date suggest that a lack of expertise and legislative discrepancies on national and regional levels, weak political will and a lack of coordinated support on the part of stakeholders have thwarted significant energy savings in the building sector.

0.3 **National Energy Policies and Implications**

National policies are the means by which EU legislation is transposed to the country level. In such, national energy policies set the framework for measures undertaken by multiple sectors and help steer the role of institutional actors in practical implementation. By nature, they also prioritize local interests and place inherent values on energy resources. Respectively, the four target countries have adopted varying national policies each responding in their own way to the EU’s strategic parameters of sustainability, competitiveness and security of supply.
The **Austrian** Climate Strategy seeks to co-ordinate measures on different political levels and reduce energy consumption in eight sectors to meet the national Kyoto commitments. Its main three components include:

1. An assessment of currently available technologies that may lead to improvements in energy efficiency, ideally making use of available local sources of renewable energy.
2. Development of renewable technologies with long-term promise for reducing greenhouse gases.
3. Increase in cost efficiency using the flexible instruments for emission trading via the JI/CDM programme and the EU CO2 Emission Trading Scheme.

With its regionalized governmental structure, Austria has struggled to promote greater energy savings on the national level. Harmonization of technical building codes and energy targets aiming at alignment with subsidy levels across regions was initiated with the adoption of Article 15A to the constitution in 2004, constituting a paradigm shift in the country’s policy making. The Austrian experience has demonstrated a strong correlation among subsidy levels, energy targets and retrofits, underscoring the importance of institutionalizing common parameters to generate greater impact. Ambitious energy consumption targets have been proposed with thresholds of 36 kilowatt hours per square meter annually (kWh/m²/a) for new single dwellings and 20 kWh/m²/a for new multi-storey buildings, as compared with current levels of 90 kWh/m²a for multi-single family houses and detached houses estimated at 200 kWh/m²a. Demand for public subsides indicates € 100/m² as the average breakeven point for households to perform retrofit action. In addition, Austria’s continued reliance on oil for residential heating has encouraged a greater investment in research for the development of renewable technologies with an emphasis on utilizing local resources such as biomass.

**Germany’s** Energy Saving Regulation (Energieeinsparverordnung – EnEV) of 2002 - already amended twice: 2007 and 2008 - has been amongst the most important normative measures for buildings, despite an implementation deficit of 0% - 25%. Lessons learned indicate the need to ensure policies are enforced and incorporate monitoring and enforcement mechanisms from the outset and are reinforced by adequate budgets for financial assistance and incentives. Moreover, enhancing awareness and training opportunities and initiating legislative changes to allow energy saving contracting to play a larger role would augment energy savings across building types. Germany’s CO2 Building Refurbishment Programme has had a positive employment effect as well as helped in reducing energy consumption and CO2 emissions. Research shows that in 2005 around 55.3 kg/m²a CO2 were saved per subsidized m² of floor space in one and two-family houses, whilst the figure was 47.5 CO2 kg/m²a in 2007. This was due to a mix of solutions involving higher levels of insulation and the increased use of renewable technologies (biomass, solar, PV) and has served to highlight the paradox that a
reduction in the rate of CO2 emissions does not always correspond to an equivalent reduction in energy consumption. The latest Renewable Energy Heating Law 2009 (Erneuerbare-Energien-Wärmegesetz – EEWärmeG) is a complementary policy measure instrumental in promoting the use of renewable technologies in the building sector, mandating that 14% of energy used for heating is to come from renewable sources by 2020.

Italy's policies for energy performance in buildings has followed two tracks: the first being a ‘normative-prescriptive’ approach, adopted by the L. n.10/91 ‘Regulation for the implementation of the National Energy Plan regarding the rational use of energy, energy savings and the development of renewable energy sources’ and the law 192/2005, transposing the EPBD Directive. The second method involves the ‘White Certificate’ system and follows a cap and trade approach. However, policy has been hampered by incomplete implementation and poor enforcement, resulting in limited effect on the national level. The ‘White Certificate’ system, first introduced in 2001, was postponed until 2004 as part of a broader system reform, but it holds valuable promise for future gains in energy savings. The 2007 and 2008 Finance Acts (Law 296/2006 and Law 244/2007) were instrumental in finally providing economic incentives for energy savings in the household sector for legislation dating back to 1998. The 2007/8 Acts, in particular, provided a tax credit equivalent to 55% of the costs for enhancing energy efficiency through heating system upgrades, retrofitting the building envelope and small building renovations amortized over a period of 10 years. In its first year of implementation, 29,000 requests for tax credit were received, with estimated average costs of €8,800 per energy efficient refurbishment, and translated into primary energy savings equivalent to 5MWh per year and mitigation of approximately 1.1T/ year of CO2 per household. One of Italy's most successful programmes has been the Ministry of Environment's '10,000 PV Roofs National Programme', which supports the installation of small photovoltaic energy systems (PV systems), ranging from 1 kW to 20 kW, on buildings, roofs and terraces and helped by grants covering up to 75% of costs. A component of the programme entitled 'The Sun in Schools' benefited public and teaching institutions and coupled PV equipment and environmental and energy education for students on the national and regional levels.

The French Energy Law of 2005 adopted a novel integrated approach and set targets for energy efficiency and CO2 reductions of 2% per year by 2015. Moreover, the law introduced a system utilizing 'white certificates' as a tool to raise awareness across sectors as well as a sense of shared responsibility for reducing energy consumption and improving the national carbon footprint. The Energy Law was complemented by the National Climate Plan of 2004, which proposed additional measures to comply with the Kyoto commitments and specifically targeted energy savings in buildings with the new thermal regulations of 7.3 MteCO2 (of savings) for households and 3 MteCO2 of savings in public and private services. The French National Energy Efficiency Action Plan (NEEAP) emphasizes
demand-management in buildings as a key priority for reducing GHG emissions by a factor of four by 2020 and was supplemented by the Grenelle de l'Environnement Initiative, promoting multi-sector public dialogue on environmental issues. France's use of public awareness campaigns and information/advisory centres has been a preferred and valued tool in communicating energy efficiency practices and reaching out to a broad population base. Similarly, France's use of VAT tax reductions has been an important part of the country's energy strategy. Of a total of 25 million French households, 7% have benefited from energy retrofitting actions utilizing the VAT reduction, with 61% of households (in 2002) taking energy efficiency measures and generating an estimated investment of €2,640 per household.

Comparatively, the four countries have placed different policy emphasis on energy resource use in the building sector. In general support exists for the utilization of renewable energy technologies advanced by various types of financial incentives. Germany and Italy have mandated the use of renewable technologies in certain building types; policies respectively backed by subsidy schemes and tax credit. While Austria has seen an increase in the use of biomass and solar thermal for heating, policymakers have resisted from legislating such implementation preferring to generate action through provision of subsidies. France's use of VAT credits is promoting greater use of renewables; while on the other hand, the country has also adopted policies requiring energy suppliers to meet specific reduction targets by working with building owners and residents to increase efficiency practices.

0.4 MURE Database Analysis

An analysis of the household sector of the MURE Database (Measures d'Utilisation Rationnelle de l'Energie) undertaken by ICCR formed part of the ECO-Build Deliverable with the aim of building on existing information and learning about the inter-relationship between multiple policy measures. The following key results are highlighted:

- France exhibits the most diversified portfolio of policy measures, yet with the use of tax credits accounting for more than 20%.
- Germany demonstrates the greatest number of policy measures underway, with a total of 47, of which an estimated 1/3 have been completed. This reflects the country's comparatively early start with energy efficiency initiatives for the household sector.
- Italy evinces a disproportional preference for legislative action with more than 50% of total measures, yet the impact of actual implementation is
questionable, given the lack of either financial incentives or enforcement controls to reinforce policies.

- In Austria, financial subsidies are the key driver for energy efficiency actions and instrumental in ensuring that legislative measures are effective.

- In France, VAT tax reductions for energy investments, tax credits for efficiency renovations and the use of renewable technologies have resulted in the greatest impact over time.

- In all of the four target countries, tenants were among the least targeted groups, raising the question as to how best to address the issue of split incentives, the landlord-tenant dilemma or the challenge of developing strategies for changing end-user behaviour.
0.5 Conclusions and Recommendations

- **Need for heightened environmental consciousness**: The global financial crisis has prompted a time for reflection and re-prioritization of values, as it coincides with post-Kyoto negotiations and a deterioration in natural, economic and personal resources. These parallels represent an ‘opportunity in crisis’ and a unique chance for governments and individuals alike to re-assess personal, social and environmental values. It is an opportunity for governments to exert leadership to orientate policies towards broadening understanding of sustainability and the interdependence of nature and mankind. Through the concerted efforts of the EU and its Member States, it is an opportunity to encourage a change in behaviour and a higher level of environmental consciousness. This can be initiated through a series of educational and awareness-raising campaigns and demonstration activities, targeting all sectors of society, to understand the time urgency of environmental targets and required actions to meet them. Italy’s ‘Sun in the Schools’ programme, in which PV systems and environmental education were provided to primary and secondary institutions, is an example of a valuable initiative coupling technology and information to cultivate sustainable and long-term results.

- **Greater policy impact through monitoring and enforcement**: Strong national frameworks with supporting mechanisms for information dissemination, enforcement and monitoring are essential for promoting a unified and sustained policy impact. In this respect, attaining the necessary and higher levels of energy savings requires policies structured with long-term horizons and ambitious targets coupled to strong political leadership to ensure strategic consistency and fiscal support. Similarly, policy amendments should be reinforcing and promoting, building upon and correcting previous experiences, in order better to penetrate industry and related sectors. Monitoring mechanisms are essential in this respect, as are enforcement measures to ensure compliance, with the energy performance certificate providing a good example. Dissemination of information on legislative acts from the national level to local and regional governments on a timely basis and with clarity of intention and division of responsibility helps mitigate potential problems of competences and implementing authorities and ensures a harmonized policy position.

- **Financial incentives boost energy savings**: Encouraging refurbishments on a large scale to affect national carbon footprints requires financing from both public and private sources. The strong correlation between the availability of subsides and energy efficient retrofits gives governments the opportunity to link ambitious energy saving targets to financial assistance. Public financial incentives, such as
subsidies and grants able to be leveraged by private instruments like ‘green’ loans or lines of credit, are important to reduce short-term financial investment, amortize the balance over time and to accelerate the rate of retrofits. More innovative incentives, apart from deductions from taxable profits, are needed to address the issue of split incentives and allow landlords to realize the benefits of energy savings for multi-family buildings. Greater consideration should be given to the UNECE Committee on Housing and Land Management proposal for an ‘energy inefficiency tax’ as a means by which landlords with energy inefficient buildings are taxed until they meet energy performance standards. Such a scheme could also serve to influence the real estate and property management sectors and increase the appreciation for and value of energy efficiency measures.

- **Increasing role of energy suppliers:** In the current global environment, it is essential that power companies are encouraged to adopt a new energy paradigm that conveys a realistic valuation of energy costs (fully incorporating externalities, e.g. GHG emissions) and embraces modern technologies effectively to control and modulate the varying energy consumption levels of society and particularly of buildings. The EU Energy Services Directive (2006), which mandates the role of suppliers in energy savings initiatives, is an important complement to the EPBD and offers significant energy savings opportunities under a proper policy regime. Examples are offered by countries such as France and Italy, which have made good use of White Certificates to oblige energy suppliers to meet specified energy targets and work with their customer base, predominately in the residential sector, to foster efficiency behaviour. Increased partnerships between the building trade and energy companies offer new avenues in integrated building design and management, increased use of renewables through improved feed-in tariffs and advancements in the concept of buildings as power plants or energy producers. Such actions will, in turn, help drive down prices for renewable technologies and enhance market penetration.

- **New orientation for the building industry:** Buildings are multi-dimensional in their planning, construction and management and therefore warrant a broader orientation incorporating life-cycle and multi-disciplinary inputs in order better to promote cost-effective, energy-efficient and sustainable end products. Whole-system design approaches, including both passive and active measures, can reduce energy use by as much as 70% (WBCSD 2009). Tools, particularly ICT-enabled ones, with such examples as the Building Information Model (BIM), have the potential to reduce emissions in buildings by 15% by 2020. The holistic and integrated approach offered by such tools can reduce communication errors among construction project participants and greatly facilitate planning as well as
incorporate maintenance operations often overlooked, yet vitally important for buildings. To encourage use of more sophisticated methods by building professionals and practitioners on a large scale, technical training is necessary at all levels, coupled to the ultimate institutionalization of such practices in vocational/trade schools, academic institutions and industrial associations. The WBCSC Energy Efficiency in Buildings Report, ‘Transforming the Market’, goes further in suggesting the establishment of the new industrial profession of ‘system integrator’ to function as a facilitator among the various craftsman, technicians and building professionals with the competences to ensure the necessary synergies and energy-efficient parameters are met. Such a position would be particularly valuable in refurbishment work, requiring the greatest energy efficiency measures, and could serve as a means to encourage industry to reset its sights on renovation rather than new construction.
1 Introduction

This report comprises the second deliverable of the ECO-BUILD Project funded under the EU FP6. The project commenced on October 1, 2007, for 30-month duration. It is co-ordinated by the Interdisciplinary Centre for Comparative Research in the Social Sciences (ICCR) and works collaboratively with the following partners: TSB Innovations Agency Berlin GmbH (TSB Berlin), Institute of Studies for the Integration of Systems (ISIS), based in Rome, the European Institute for Energy Research (EIFER), located in Karlsruhe, Germany, and the ICCR Foundation (ICF) based in Vienna.

The main focus of this document is on national policies and corresponding measures that have contributed to the reduction of energy consumption and increased energy efficiency in the building sector in the countries of Austria, Germany, Italy and France. Emphasis is placed on the national transposition of the European Union Directive 2002/91/EC on the Energy Performance of Buildings (EPBD) and considers complementary legislation that is guiding the building sector in the respective countries. The impact of the EPBD and related initiatives and financial measures are explored with the aim to provide a contextual framework as to the type and impact of policies on energy demand in the building sector in the four countries.

The information presented in this report is based on country case studies undertaken by the ECO-BUILD partners and discussions at the second Ecobuildings Cluster workshop on 5-6 March 2009 in Brussels. A summary of the workshop proceedings is attached as Annex 2 to this document and the complete proceedings including all presentations are available for download under www.ecobuildings.info. Information for the country case studies was derived from national and regional policy documents, from statistical offices, by analyzing existing research reports and, in a few selected cases, from expert interviews (see References).

This document is structured in seven sections. Following this introduction chapter two provides background information on the construction sector, energy use and the building stock in Austria, France, Germany and Italy. Chapter 3 is dedicated to the policy context and covers international agreements, such as the Kyoto Protocol as well as European initiatives and national strategies and policy regimes. Chapter 4 presents the status of the implementation of the EU Directive on the Energy Performance of Buildings and its impact on energy efficiency in the four countries that are the focus of this report. In chapter five the role of subsidies and incentive schemes is analyzed and chapter 6 deals with the effectiveness and impacts of a wide range of policy measures related to the building sectors. Finally, chapter seven presents some conclusions and recommendations derived from the analysis in this report and the ongoing work of the ECO-BUILD project.
2 Background Information

This section provides background information on the construction sector, energy consumption and the building stock in Austria, France, Germany and Italy. In addition, certain information is provided for more Member States or contrasted with the EU average to place it into a larger context or illustrate certain points.

2.1 The construction sector

In the European Union the construction sector employs approximately 5% of the workforce. Table 1 presents the specific numbers for the four countries covered by this study. While employment is around the European average of 5% in Austria, France and Italy, the German construction sector employs a significantly smaller part of the workforce, i.e. between 3 and 4%.

A second noteworthy fact is the large difference in the average size of construction companies. In Austria the average turnover of companies in the construction sector is just over 1 million Euros whereas in Germany it is around 600,000 Euros, in France 440,000 Euros and in Italy just over 300,000 Euros. This is also reflected in the average number of employees per company which ranges from more than 10 persons in Austria to 3 persons in Italy. In terms of policy implications it is highly relevant to keep in mind that changes in European regulation will affect several million SMEs in the construction sector in Europe rather than a handful of large enterprises.

Table 1: Size of the construction sector (2004)

<table>
<thead>
<tr>
<th></th>
<th>Number of companies ('000)</th>
<th>Turnover (EUR million)</th>
<th>Average turnover per company (EUR '000)</th>
<th>Employment ('000)</th>
<th>Employment (% of workforce)</th>
<th>Average number of employees per company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>24</td>
<td>28,000</td>
<td>1,160</td>
<td>252</td>
<td>5</td>
<td>10.5</td>
</tr>
<tr>
<td>France</td>
<td>382</td>
<td>169,000</td>
<td>440</td>
<td>1,548</td>
<td>5</td>
<td>4.1</td>
</tr>
<tr>
<td>Germany</td>
<td>227</td>
<td>142,400</td>
<td>620</td>
<td>1,624</td>
<td>3.5</td>
<td>7.2</td>
</tr>
<tr>
<td>Italy</td>
<td>563</td>
<td>186,400</td>
<td>330</td>
<td>1,748</td>
<td>5</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Source: Eurostat, European business – facts and figures 2007
2.2 Overall energy consumption

Overall final energy consumption currently averages 2.4 toe per capita in the Member States of the European Union. Table 2 shows the per capita consumption for Austria, France, Germany and Italy and the development of total consumption since the year 1990. The numbers illustrate the large increase in energy use in Austria (+42%), Italy (+21%) and France (+15%) during the last two decades. Only Germany experienced a decrease during the second half of the 1990s when it underwent successive years of recession and structural adjustment following re-unification.

In per capita terms Austrians consume 3.4 toe, i.e. 42% more than the European average, 62% more than Italians and 26% more than Germans. Much of this difference appears to be due to the transport and industry sectors because a comparison of household consumption in Table 3 below shows virtually no difference between Austria and Germany and a per capita difference of only 0.3 toe between Austria and Italy.

Table 2: Total final energy consumption in selected countries

<table>
<thead>
<tr>
<th>Final Energy Consumption (million toe)</th>
<th>1990</th>
<th>2000</th>
<th>2006</th>
<th>Per capita final consumption (toe, 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>19</td>
<td>23</td>
<td>27</td>
<td>3.4</td>
</tr>
<tr>
<td>France</td>
<td>136</td>
<td>152</td>
<td>157</td>
<td>2.4</td>
</tr>
<tr>
<td>Germany</td>
<td>227</td>
<td>218</td>
<td>223</td>
<td>2.7</td>
</tr>
<tr>
<td>Italy</td>
<td>107</td>
<td>123</td>
<td>130</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Eurostat, EEA, IEA, * toe refers to tonnes of oil equivalents.

Table 3: Final Energy Consumption of Households 1990 to 2005 (per capita in toe)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>0.72</td>
<td>0.78</td>
<td>0.75</td>
<td>0.84</td>
<td>+16%</td>
</tr>
<tr>
<td>France</td>
<td>0.56</td>
<td>0.57</td>
<td>0.65</td>
<td>0.70</td>
<td>+25%</td>
</tr>
<tr>
<td>Germany</td>
<td>0.75</td>
<td>0.80</td>
<td>0.79</td>
<td>0.85</td>
<td>+14%</td>
</tr>
<tr>
<td>Italy</td>
<td>0.42</td>
<td>0.43</td>
<td>0.46</td>
<td>0.51</td>
<td>+21%</td>
</tr>
</tbody>
</table>

Source: Eurostat
Regarding a breakdown of energy use by sector, household final energy consumption amounts to roughly 27% of all energy consumption in the EU (see Figure 1). This includes energy for heating and cooling, lighting, ventilation and household appliances. On the commercial/public side, a significant part of the energy consumption traditionally assigned to the industry and service sectors is actually used for the heating and cooling of buildings as well as for lighting and other electrical equipment directly related to the building. On the whole, it is estimated that approximately 40% of all energy in Europe is consumed by buildings (cf. WBCSD 2009).

For the household sector Figure 1 shows that energy consumption increased by about 16% during 1990-2005 as rising personal incomes have permitted higher standards of living, with increases in comfort levels and the ownership of domestic appliances. An additional driver was certainly the fact that real electricity prices in households fell over the same period.

Figure 1: Final energy consumption by sector in the EU-27 (1990-2005)

Source: European Environment Agency and Eurostat

Similarly to the overall EU data presented in Figure 1, national energy consumption in each of the four countries of Austria, Germany, Italy and France is dominated by transport and households (buildings) and only differs slightly by sector.

In Austria, the household sector dominates energy consumption at 34%, followed by transport at 31%, while in Italy energy consumption in the transport sector is only slightly ahead of household usage, followed thereafter by industry. A
breakdown of German energy demand by sector shows that both the household and transport sectors accounted for 29% of final energy consumption in 2005, with industry accounting for 27%. Of the four countries, France’s building sector represents the largest share of final energy consumption at of 42%, while transport accounts for 32% and industry for 20%.

Figure 2 below shows the average distribution of energy consumption in Western and Central European households in 1990 and 2005. Space heating still is the most significant component of household energy demand, and can vary substantially from year to year depending on climatic variations. However, it is the demand for electricity from appliances that has increased most rapidly in percentage terms in recent years. In Austria, for example, increased absorption rates of electrical household appliances were recorded an astonishing 110% for dishwashers and 402% dryers. It is valuable to correlate such figures to GDP growth rates which in 2004 amounted to 2.0% compared to a rate of 0.3% in 1993.

**Figure 2: Types of energy consumption in households**

![Energy Consumption Chart](image)

Source: WBCSD 2009
2.3 The European building stock

In the vast majority of EU Member States between 50% and 75% of the building stock were erected before the year 1970. Figure 3 gives an overview of the age of the building stock in the EU-15 countries and shows particularly large differences in construction activity after the year 1980. While in some countries like Italy and Germany only 10% to 15% of the building stock is less than 30 years old other major countries like Spain and France erected between one quarter and one third of the currently existing buildings during this time. Those numbers are highly relevant for energy efficiency considerations since the energy performance of buildings increased markedly during the oil crises of the 1970s (see Table 5: Energy efficiency of the building stock by period).

Figure 3: The European building stock by age

Table 4 shows the distribution between residential buildings and non-residential buildings in Austria, France, Germany and Italy in terms of number of units and floor space. Adjusted for the size of the population in all four countries the number of residential dwellings corresponds to slightly less than two persons per apartment or single family house. Average floor space is also very similar for all four countries and is in the order of 80m² per dwelling.
Non residential buildings are more difficult to characterize since they include very different types including, among others, office buildings, schools, public administration buildings, hotels and other tourism facilities. By and large, however, the limited data suggests that the total floor space of non-residential buildings is in the order of 50% smaller than residential floor space or, put differently, residential buildings account for roughly two thirds of the total floor space.

Table 4: Number of buildings and floor space of building stock (2006)

<table>
<thead>
<tr>
<th></th>
<th>Residential buildings</th>
<th>Non-residential buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Floor space (million m²)</td>
<td>Number of dwellings</td>
</tr>
<tr>
<td>Austria</td>
<td>300</td>
<td>3,863,000</td>
</tr>
<tr>
<td>France</td>
<td>2,135</td>
<td>28,800,000</td>
</tr>
<tr>
<td>Germany</td>
<td>3,301</td>
<td>35,800,000</td>
</tr>
<tr>
<td>Italy</td>
<td>n.a.</td>
<td>26,526,000</td>
</tr>
</tbody>
</table>

Source: National statistical offices

2.4 Energy consumption in the building sector

On average the energy performance of buildings is related to the period in which they were constructed. Table 5 gives an indication of the energy efficiency of the building stock by period and clearly shows the great improvements following the oil crisis of the 1970s. Before this period most buildings consumed around 200 kWh per m² and year for heating and cooling. During the last 30 years this number was gradually reduced to around 70 kWh. National and European legislation currently under preparation is likely to set limits of below 30 kWh for all new buildings from about 2015 onwards.

Table 5: Energy efficiency of the building stock by period (kWh/m² per year for heating and cooling)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria*</td>
<td>145–189</td>
<td>188–209</td>
<td>139–157</td>
<td>n.a.</td>
<td>70</td>
</tr>
<tr>
<td>France</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Germany**</td>
<td>123–220</td>
<td>168–189</td>
<td>99–119</td>
<td>70–99</td>
<td>65</td>
</tr>
<tr>
<td>Italy***</td>
<td>200–250</td>
<td>100–130</td>
<td>70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: *Kosz, M. et al. (1994); ** Diefenbach und Enseling (2007); ***Odyssee Project
In Austria, for the period 1990 to 2004, household energy efficiency registered improvement of 17.4% from 1990 to 2004 but the improvements have been outweighed or even surpassed by higher levels of consumerism and energy use. This trend is seen in the number of permanently occupied housing units registering an increase of 18.5%; moreover, the average size of dwellings also increased by 15.3%.

In France, over the same period, despite good measures promoted by the government, up to 40% of energy efficiency advancements have been offset by an increase in the average size of dwellings (measured in terms of a decrease of the energy consumption per m²). Households dwellings increased from 86 m² in 1990 to 91 m² in 2004, impacting space heating, and resulting in unit energy consumption of households related to the square meter of floor area (toe per m²) decreasing more rapidly than the energy consumption per dwelling (toe/dwelling).

In Germany and Italy energy efficiency in the household sector increased by 9% between 1990 and 2004. The German government is placing significant emphasis on efficiency in the building sector in its Energy Efficiency Action Plan (EEAP), with a focus on both existing and new buildings as well as on electrical appliances. A continuous decline in the use of both space heating (toward central heating) and total unit consumption per dwelling has been registered since 2002, with electricity consumption remaining relatively constant in part due to the consumer trend for household appliances and electronics.

In Italy the government measures to promote the use of renewable and efficient technologies, e.g.: solar thermal and insulation, have demonstrated improvements in the household sector with increased use of fluorescent compact lamps and electrical appliances of higher efficiency, interventions for the thermal isolation of the buildings, etc). Yet the following the general trend, efficiency efforts have been offset through the increased use of electrical appliances as well as air conditioners for cooling, representative of southern climatic tendencies.

Austria was the only one of the four countries which demonstrated an increase in the use of space heating for household energy between the years 1997-2005. On the other hand, Italy was the sole country to record an increase in the change in energy consumption per square meter, a trend reflective among southern countries, and accountable to enhanced standards of living and comfort levels. For EU 27, and similarly reflected in most all of the target countries is the rebound effect by which more than half of the energy efficiency gains are offset by increased use of electrical appliances and larger living accommodations driven by higher economic and comfort levels. This European and global trend underscores the urgency which by educational and awareness initiatives must complement appropriately structured policies to stimulate behavioural change to a higher level of environmental consciousness.
3 Policy context

3.1 European and Kyoto Targets

The building sector offers tremendous potential to curb energy demand and mitigate the levels of greenhouse gas emissions (GHG) as it makes up approximately 40% of the EU’s energy consumption of which more than 50% is from electrical power. Cost saving measures resulting from forward looking policies could potentially account for an 11% reduction in total energy consumption in the EU by 2020.

3.1.1 Kyoto Commitments and Performance

The EU member states have agreed in principle to meet the Kyoto commitments, enveloped in the EU’s 20-20-20-20 targets, relatively corresponding to a reduction of CO2 emissions, an increase in energy efficiency, and an augmentation in the use of renewable energy. Specifically under the EPBD, Member States are mandated to revise their policies for the building sector to address energy consumption and promote efficiency to contribute to the above targets. The reduction in energy usage (demand) through harmonized standards, more efficient building practices and use of renewable technologies would foster widespread benefits for the global environment, national governments through increased energy independence and individual households in reduced energy costs.

Figure 4: Kyoto emission reduction goals of the 15 EU member states for 2008–2012 (relative to base year 1990)

Source: Austrian Department of Environment 2006
The Climate Change Performance Index (CCPI) for 2009 published annually by Germanwatch and CAN-Europe, aims to enhance transparency in international climate politics, and in doing so, allows for a comparative overview of the commitment of the four target countries in addressing environmental concerns in relation to the Kyoto agenda. The CCPI evaluates and ranks, on the basis of standardized criteria, the climate protection performances of the 57 countries that, collectively, are responsible for more than 90 percent of global energy-related CO2 emissions.\(^1\) The overall country ranking is based on an agglomeration of a country’s emissions trends with a 50% weighting, emissions levels (30% weighting), and climate policy (20% weighting). Separate ratings are done on the three respective categories. According to the index data:

- Germany (ranked 5) and France (6) by demonstrating overall good performance in protecting the environment.
- Austria ranked (50) among the lowest within the EU, trailed only by Luxemburg, Greece and Cyprus in terms of the overall ranking.
- Italy ranks 44 on the CCPI with a overall rating of poor, and together with Germany is considered one of top CO2 emitters, each contributing respectively 1.60% and 2.94% to the share of global CO2 emissions.
- Regarding ‘level of emissions’, Germany was rated as poor and Italy as average.
- Regarding ‘emission trends’, Austria was considered very poor, due to upward tendencies attributable in part to energy consumption in the building sector and higher comfort levels and limited compensating factors. Italy’s emissions trends were rated as poor, while France’s were average and only Germany was considered good, in part as a result of its aggressive promotion of renewable energy use in the country, supported by the recent mandatory use of such technologies in the building sector.
- Regarding ‘climate policies’, both Austria and Italy’s were considered very poor, compared to France and Germany both rated as good an account of more successful legislative measures and incentives such as the availability of CO2 oriented financial/banking products for households with a leverage of 1 billion Euros as in the case of France. Austria and Italy are making use of the CDM financial mechanism under the Kyoto Protocol to meet their emission targets in developing countries, thus in part reducing the environmental onus on local sectors.

\(^1\) “Included are industrialised countries and countries in transition to market economies (Annex I countries of the Framework Convention on Climate Change) and all countries that cause more than one percent of the global CO2 emissions.” (The Climate Change Performance Index 2009)
Comparatively, the 2009 CCPI, assessed no country of the 60 ranked, as having truly taken exceptional strides to protect the environment, and therefore no ranking was given to the top three positions. Of the four target countries, clearly Germany and France have in general performed more responsibly and conscientiously in taking steps to protect the environment. Austria and Italy lag significantly behind, on account of weak level of climate policies compounded by growing energy consumption levels not offset for policy measures. Political leadership is needed on the part of both Austria and Italy to enact effective measures to reduce emission levels. Moreover, stronger commitment is needed on the part of all index countries to reduce CO2 emissions to prescribed levels and induce climatic improvements on a timely basis.

Figure 5: Climate change performance index

<table>
<thead>
<tr>
<th>CCPI Rank</th>
<th>Country</th>
<th>Score**</th>
<th>Partial Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Germany</td>
<td>65.3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>France</td>
<td>62.2</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Italy</td>
<td>47.1</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Austria</td>
<td>45.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Climate Change Performance Index (2009)

A review of the four countries’ specific activities in meeting the Kyoto targets reveals a similar pattern of action as highlighted in the CCPI. Moreover, closer examination reveals the important role the building sector plays in the Kyoto agenda and factors that can contribute to its advancement.

Austria’s Kyoto target for the period 2008-2012 stands at a total of 78.5 million tonnes of CO2 per year relative to base year emissions (1990). As per 2006 data, Austria’s emissions were 15% higher than the base-year level and well above its burden-sharing target of -13% for the period 2008–2012. Emissions are expected to further increase to a level of 17%, on the basis of existing policies and measures. In 2006, the building sector, specifically related to heating and other energy consumption, contributed 15.6% (14.2 Million tonnes CO2) - a decline in CO2-emissions from 1990 of -6.0% (1 million tonnes CO2) due to increased use of building insulation, substitution of energy carriers, mild winters as well as a shift of emissions from the district heating system and related electricity consumption to the energy production sector. Yet despite these efforts and energy consumption levels in 2006, equal to those in 1990, emissions emitted by the heating portion of the building sector were 2.3 million tonnes CO2 above the target of the national climate strategy. Austria expects to achieve its Kyoto targets through substantial
emission reductions from the implementation of additional measures, use of Kyoto mechanisms (financing emission reduction projects in other countries) and carbon sink activities, to reach a level 13% below base-year emissions. Yet, the country’s overall very poor ranking in the Climate Change Performance Index for 2009, suggests much greater efforts must be undertaken, with significant opportunities existing in the building sector, to meet its obligatory targets.

In 2006, France’s emissions were 4% lower than the base-year level of 563.9 Mt CO2, below its burden-sharing target of 0% for the period 2008–2012. Projections on the basis of existing policies and measures suggest emissions are to increase by 2010 to a level 1% above base-year emissions. Between 2005-2006, emissions decreased as a result of a decline in fossil fuel consumption for the production of public electricity and heat (partly due to increased hydropower production), lower energy use by the chemical industry and households, and lower emissions from agricultural soils (attributable to decreased use of synthetic fertilizer). CO2 emissions recorded the greatest increase in the transport sector by 19%, while in the households, tertiary and agriculture sectors, emissions in 2004 were 13% above their 1990 levels. Only industry has succeeded in reducing its CO2 emissions (-5% since 1990). To help respond to the challenges at hand several environmental initiatives, notably concerning the building sector, have been put in place. The building sector is of particular concern as its energy consumption has grown continuously over the last 30 years. By 2005, it consumed 42.5% of the total energy consumption in France, or 160.6 million petrol equivalent tonnes (PET). The building sector represents 23% of France’s total annual greenhouse gas emissions, or 534 PET of CO². France expects to achieve its target through emission reductions from the implementation of additional measures and carbon sink activities, reaching a level 4% below base-year emissions.

Germany’s emissions for 2006, were 18% lower than the base-year level of 1,232.4, slightly above its burden-sharing target of -21% for the period 2008–2012. According to German projections, with the existing policies and measures, emissions will further decrease to reach a level 22% below base-year by 2010. With the implementation of additional measures and carbon sink activities further reductions could be realized to a level 26% below the base-year benchmark, allowing the country to surpass its target. During the period 2005-2006, emissions remained relatively stable, with the increases in fossil fuel consumption for the production of electricity and heat, by households, and iron and steel production being offset by decreases in road transport and decreased nitric acid production. For the period 1990-2006, reductions in GHG emission were recorded in all main source categories, with the greatest decreases in the energy and manufacturing industries as well as energy usage by households and services, despite that the latter makes up the main portion of emissions at 65% compared to only 16% for transport. The economic restructuring in the new federal states after German reunification accounts for much of the reductions in GHG levels.
Italy recorded emissions in 2006, 10% higher than its base-year level of 516.9, and well above its burden-sharing target of -6.5% for the period 2008–2012. Italy expects, with existing policies and measures, to reduce emissions to reach a level of 7% above base-year emissions by 2010. Yet, despite foreseen additional emission reductions to a level of 5% below base-year emissions as the result of the implementation of additional measures, use of Kyoto mechanisms to finance emission reduction projects in other countries, and carbon sink activities, such efforts will not be sufficient for Italy to meet its targets. However, these projections, however, do not take into full account of the emission restrictions confronting Italian industries covered by the EU Emission Trading Scheme, and which are expected to result in significant further emission reductions. During the period 2005-2006, emissions from households and services and adipic acid production decreased significantly. Introduction of abatement technologies for the chemical industry contributed to the latter’s decline. For the period 1990-2006, emissions increased over time, largely attributable to road transport, fossil fuel consumption for electricity and heat production and households and services.

Table 6: Green house gases (GHG): trends and projections (2006 Data)

<table>
<thead>
<tr>
<th></th>
<th>Austria</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total GHH emissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Million tonnes CO2-equivalent</td>
<td>91.1</td>
<td>541.3</td>
<td>1 004.8</td>
<td>567.9</td>
</tr>
<tr>
<td>GHG per capita</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tonnes CO2-equivalent/capita</td>
<td>11.0</td>
<td>8.6</td>
<td>12.2</td>
<td>9.7</td>
</tr>
<tr>
<td>GHG per GDP (current prices)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g CO2-equivalent/euro</td>
<td>353.2</td>
<td>299.5</td>
<td>432.7</td>
<td>383.7</td>
</tr>
<tr>
<td>Share of GHG in EU-27</td>
<td>1.8 %</td>
<td>10.5 %</td>
<td>19.5 %</td>
<td>11.0 %</td>
</tr>
</tbody>
</table>

Source: European Environment Agency

The four countries depict a mixed basket of interests and needs as well as levels of commitment to meet their respective Kyoto targets. Table 6 illustrates the varying levels of GHG emissions in relation to population size, income levels and economic activity among the EU-27. While Germany stands out as the largest CO2 emitter, it is the only one of the four target countries expected to surpass its Kyoto targets on account of offsetting actions and strong political leadership to decrease carbon levels. Austria on the other extreme, representing the smallest of the four countries, with a minimal share of total European emissions, portrays a contrary position, with emissions expected to further increase to a level of 17%, on the basis of existing policies and measures. Austria, despite its limited environmental impact, is not doing its fair share to meet the global Kyoto commitments. Comparatively, France and Italy lie in the middle from of this range, with both expected to reduce emissions in coming years, in part through greater restrictions on industry and increasing emphasis on the use of renewable energy technologies.
3.2 National Energy Policies

3.2.1 Austria

As in most other EU countries, the main objective of the Austrian energy policy is to reduce the consumption of fossil fuels and thereby reduce both dependencies on foreign energy sources to safeguard security of supply and address environmental concerns as embodied in the EU agenda. At the national level, the main overarching strategy to achieve those goals is contained in the Austrian Climate Strategy (adopted 2002) was revised 2007 to strength the framework for meeting the Kyoto commitments and in a similar context addresses energy reductions expected from the building sector. The Austrian Energy Agency is the government’s principle research and policy institution and works in cooperation with the federal and the provincial administrations ("Bund" and "Länder" respectively) to meet policy objectives, enhance energy efficiency, further use of renewable resources and foster innovation.

Austria, as a federal state, distributes responsibility for building sector policy among its three main levels of government, national, regional/provincial ("Bundesländer") and the local level ("Gemeinden"). By and large, the national level is responsible for overall strategies and concepts and, in some cases, for providing the framework legislation. Most operative legislative decisions fall within the competencies of the nine Austrian provinces. The implementation of those laws is partly the responsibility of the provinces and partly of the local communities. The Austrian Climate Strategy attempts to coordinate measures on different political levels and reduce energy consumption in eight sectors to meet the national Kyoto commitments. Its main three components include:

1. An assessment of currently available technologies that may lead to improvements in energy efficiency, ideally making use of available local sources of renewable energy.
2. Development of renewable technologies with long term promise for the reduction of green house gases.
3. Increase in cost efficiency using the flexible instruments for emission trading via the JI/CDM program and the EU CO2 Emission Trading Scheme.

The first two points are particularly relevant for the building sector as the development and utilization of improved technologies offers one avenue of great potential for significant energy savings. The climate strategy also proposes specific measures for improving energy efficiency in the building sector following the rationale that reduction of energy consumption can be achieved relatively easily and at relatively low cost. The proposed measures include:
1. 50% of all new buildings should meet low energy or passive house standards. As of 2015 onwards large residential buildings will only receive public subsidies if they meet passive house energy standards.

2. The rate of refurbishment for existing buildings should be increased to 3% per year from 2008 to 2012 and 5% thereafter.

3. Old heating systems should be replaced by more modern gas or biomass boilers or connected to district heating systems. In those cases where such a replacement is not feasible attempts to increase the efficiency of existing systems should be carried out. The Austrian provinces and communities are called upon to elaborate details for the local implementation of the above mentioned measures.

In June 2007, in accordance with the EU Directive on Energy End-use Efficiency and Energy Services, Austria prepared a National Energy Efficiency Action Plan. The plan stipulates the goal to increase energy efficiency by 1% in nine years, starting as of 2008, with a mid-term energy savings target of 17.9 peta joules for 2010 and a final goal of 80 peta joules for 2016. The plan incorporates a range of measures and embraces a wide spectrum of stakeholders and sectors, including public, private, industry, agriculture and transport. Specific measures include subsidy schemes for private housing, energy and climate-control programmes, third party financing in public buildings, public procurement, public transportation, energy advice and information campaigns, among others, with the building sector being at the forefront of the country’s energy efficiency agenda.

Table 7: Residential energy demand by fuel type in Austria 1990-2004 (PJ)

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>1990</th>
<th>2004</th>
<th>Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>71.8</td>
<td>74.8</td>
<td>+ 4.2</td>
</tr>
<tr>
<td>Gas</td>
<td>33.0</td>
<td>63.2</td>
<td>+ 91.7</td>
</tr>
<tr>
<td>Coal</td>
<td>26.6</td>
<td>5.8</td>
<td>- 78.1</td>
</tr>
<tr>
<td>Electricity</td>
<td>41.3</td>
<td>54.4</td>
<td>+ 31.8</td>
</tr>
<tr>
<td>District Heating</td>
<td>11.6</td>
<td>29.3</td>
<td>+151.9</td>
</tr>
<tr>
<td>Wood</td>
<td>57.5</td>
<td>55.2</td>
<td>- 4.1</td>
</tr>
<tr>
<td>Others</td>
<td>0.6</td>
<td>9.7</td>
<td>+1655.4</td>
</tr>
<tr>
<td>Total</td>
<td>242.4</td>
<td>292.5</td>
<td>+20.7</td>
</tr>
</tbody>
</table>

Source: Statistics Austria

Austria’s continued relatively high reliance on oil for residential heating (see Table 7) has encouraged the authorities to pursue a bottom-up approach to improve its methodologies for data collection on heating demand of residential housing as well as enhance information dissemination to households on energy saving opportunities. Average heating energy demand of multifamily buildings is estimated...
90 kWh/m²a, while for single family houses and detached houses is estimated at 200 kWh/m²a, signalling significant potential for energy savings in the building stock (Austrian Energy Agency 2008). Further development of biomass technologies to benefit the sector as well as utilize local resources is being supported. A similar effort is being placed on addressing the increasing electricity demand for household appliances with consumer oriented programs for energy efficient models.

3.2.2 Germany

Energy policy in Germany is a matter of concurrent legislation entrusting primary responsibility to the federal government, mainly the Ministry of Economics and Technology. Provincial governments may legislate on matters that have not yet been regulated by the federal government. The two main documents setting out Germany’s current energy policy are the “National Energy Efficiency Action Plan (EEAP) of the Federal Republic of Germany” in accordance with the EU Directive on energy end-use efficiency and energy services (2006/32/EC) and the Integrated Energy and Climate Programme also known as the Meseberg Initiative. While the National Energy Efficiency Action Plan addresses Germany’s responsibilities as set out by the EU, the Meseberg Initiative consists of 29 measures designed to set out and enforce Germany’s national energy policy. National energy policy underscores ensuring future energy supplies, promoting use of renewable technologies and safeguarding against environmental damage while reducing GHG emissions. In accordance with the goals set out in the Kyoto Protocol, Germany must reduce its energy consumption by 9 % over a nine year period. The country has set itself a much more ambitious target: reducing its emissions by 40% compared to 1990 levels by 2020. The implementation of the measures set out in the Meseberg Initiative alone will allow a 36% reduction to be achieved. Some of the instruments include:

- Amendment of the CHP law 2009 – the amended law promotes the construction of new heating systems and networks to allow the percentage of CHP used for electricity production to be doubled from 12% to 25% by 2020.
- Amendment of the (Energiewirtschaftsgesetzes - EnWG) 2005 allowing the liberalization of the electrical metering market. Innovative techniques for measuring including load-dependent tariffs which are intended to allow consumers to reduce costs and power plants to improve their load distribution. A further ordinance specifying standards was passed in May 2008.
- Renewable energy heating law (Erneuerbare-Energien-Wärmegesetz – EEWärmeG) in force since January 2009. 14% of energy used for heating is to come from renewable sources by 2020. New constructions are required to use a certain percentage of renewable energy sources. The scheme for the existing building stock will receive more funding, from €130 million in 2005 to 350 million in 2008 and up to 500 million from 2009.
• Report and draft of the amendment to the Energy Saving Regulation (Energieeinsparverordnung – EnEV 2002). From 2009 energy performance for buildings will be increased by 30%. A further similar increase is planned for 2012.

The most important piece of legislation regarding the energy performance of buildings is the German Energy Saving Regulation (EnEV) which addresses most of the requirements of the EPBD and was complemented by the Renewable Energy Heating Law (Erneuerbare-Energien-Wärmegesetz – EEWärmeG) which came into effect in January 2009. Building upon earlier legislation from 1976, which already defined a framework for thermal insulation, individual metering, and efficiency of heating and ventilation systems, the EnEV of 2002 allowed for the first time a holistic approach to energy consumption in buildings, calculating energy usage for both space and warm water on the basis of a building’s area / volume ratio, including installed systems, and requiring the avoidance of thermal bridges. The EnEV was amended in 2004 and again (the current version) in 2007 to incorporate those aspects of the EPBD which had not yet been transposed into German law. The planned 2009 amendment will call for maximum permissible energy consumption levels for buildings to be reduced by 30 % for new constructions and with 30 % higher requirements for refurbished stock. With the EnEV 2007, it is required that the German pre-norm DIN V 18599 standards be used to calculate energy consumption for non-residential buildings. With the planned amendment in 2009, these standards will be used to calculate the energy performance of residential buildings, thereby complying with the requirements set out in Article 3 of the EPBD. Generally speaking a property owner can chose an energy certificate based on the building’s calculated energy demand (calculated using DIN V 18599) or one based on the building’s metered demand. An exception exists for buildings with up to four apartments and constructed before 1977 which was the year the first ordinance placing minimum performance standards on a building’s insulation came into effect. Such buildings require an energy certificate based on their calculated demand.

The Renewable Energy Heating Act (EEWärmeG), which came into force in January 2009, allows Germany to join a handful of other EU states, including Spain, Portugal, Ireland and Italy in mandating the use of renewable energy technologies in new building construction. This law requires new construction projects to use renewable energy technologies or sources to meet space and hot water needs, to 50 % of a building’s energy requirements. The Renewable Act aims to increase the percentage of renewables used for heating from 6 % to 14 % by 2020 by requiring residential property owners to use renewable energy sources to meet 15% - 50% (depending on the source) of a household’s total energy consumption for heating and domestic hot water. Where it is not practicable to use renewable energy the building must reduce its energy consumption to 15 % below the requirements set out in the EnEV 2007. Legislation in the German federal state of Baden-Württemberg goes even further by requiring that existing buildings also incorporate renewable-energy-based heating systems as of 2010, where
refurbishment measures are being carried out. Other key pieces of legislation are the Renewable Energy Law (Erneuerbare-Energien-Gesetz (EEG)) and the Kraft-Wärme-Kopplungs-Gesetz (KWKG) ensuring a minimum guaranteed price for power generated from renewable energy and combined heat power (CHP) and the Energiewirtschaftsgesetz (EnWG) regulating the access to electricity grids and gas networks. The EEG can be seen as the main instrument of financial aid for renewable energy production in Germany for supporting the national goal of increasing the share of electricity production from renewable sources to 12.5 percent by 2010 and 20 percent by 2020 (§1 Abs.2 EEG 2004) as well as meetings its ambitious GHG emissions reduction targets.

3.2.3 Italy

The Italian energy strategy as outlined by the National Energy Efficiency Action Plan (NEEAP) and the Fourth Communication under the UN Framework Convention on Climate Change (2007) highlights synergies between the need to reduce energy dependency and address greenhouse gas emissions. The improvements in energy performance in buildings are pursued on two tracks: the first being a ‘normative-prescriptive’ approach, adopted by the L. n.10/91 ‘Regulation for the implementation of National Energy Plan regarding the rational use of energy, energy savings, and the development of renewable energy sources and the law 192/2005 transposing the EPBD Directive; whereas, the second method involves the ‘White Certificate’ system and follows a cap and trade approach. In the early 1990s, the law n.10/91 represented a highly innovative, comprehensive and far reaching set of rules and principles, however, its implementation has been incomplete and its enforcement weak. The framework law contains a number of principles implemented in the following years through Decrees, most of which have been reviewed with the law 192/2005. In particular, the implementing Decrees 412/1993 and 551/99 have established: stricter technical criteria for the construction of new buildings (buildings codes have been reinforced since 1975); rules for the design; installation and operation of thermal plant and a programme of inspection of boilers. The ‘White Certificate’ system was first introduced in 2001, but its implementation was postponed until the Decree of 20 July 2004, which newly regulated the entire system. The Decree requires electricity and gas distributors serving more than 100,000 consumers to achieve annual specific individual targets, set by the Electricity and Gas Authority (AEEG), by carrying out energy efficiency projects. This obligation can be fulfilled by direct operations or by outsourcing to related energy services companies (ESCO) or by purchasing the white certificate on the market. The system should play a key role in improving the energy performance of public buildings. In line with this is the M.D. 22.12.2006 ‘Financing measures for energy analysis of public assets’, which sets a programme aimed at analyzing the energy consumption and infrastructure plans related to schools, hospitals, public lighting and public buildings. Regions and provinces submit a list of the works to be realized and following ministry
approval start the procurement procedures with the Energy Service Company (ESCO).

Furthermore, Italy has recently promoted many actions aimed at supporting renewable energies through green certificate, incentives, feed-in tariff schemes. The following provisions apply:

- New buildings, or in case of restoration of existing heating systems, at least 50% of the annual primary energy necessary for the production of hot sanitary water should be provided using solar thermal sources. This limit is reduced to 20% for buildings located in historical centres.
- New buildings/major renovation, it is mandatory to (consider the) connection to the district heating network, if located nearby or install photovoltaics for electricity production with a power capacity of at least 1Kw for each unit apartment and at least 5 Kw for industrial building (>100 m2). The compliance with this obligation is subject to the technical feasibility of the renewable energy technologies, taking into consideration the building characteristics.
- The procedures to install photovoltaic systems (PVS) in existing buildings have been highly simplified and discounted tariffs are set for plants installed before the 31 December 2008 for a 20 year period.

During the last decade, Italy’s regional authorities have been progressively involved in energy policies formulation and enforcement. The devolution process started in the early nineties when regions were required to elaborate a Regional Energy Plan (PER) directed at monitoring and planning the energy market and managing energy efficiency incentives; this was confirmed by the law 112/1998 and ratified by the 2001 Constitutional reform, which recognized energy issues as shared competencies of the national government and the regions. However, the responsibility of securing energy, promoting competition and protecting the environment, were kept at national level. In all cases of shared competencies, the national government regulates the fundamental principles/general framework, while the regions regulate the application and manage the administrative procedures. However, such recently developed multi-level legislation still suffers from a lack of clear parameters and overlapping responsibilities.

3.2.4 France

The French Environment and Energy Management Agency (ADEME) is the key instrument of the state and partner to engage with the general public, the private sector and local authorities in the implementation of environment and energy policy.

The Energy Law of 2005, reinforced the earlier 2000 law (RT2000) and adopted several measures and set targets related to energy efficiency and CO2 (e.g.
reduction of the energy intensity by 2% per year until 2015. The Energy Law took an integrated approach and included the implementation of a system of mandatory energy saving targets imposed on energy companies, utilizing the instrument of “white certificates”, introduced as a new tool to raise awareness among all sectors of civil society and encourage a broad sense of responsibility for the environment. Energy providers such as EDF and Gaz de France are required to reduce energy consumption over a given period and demonstrate energy savings by working with their customer base. Mandatory reduction targets for the first three years were set at 54 TWh of energy savings, expressed in final energy and accumulated over the lifetime of the equipment or actions, with a 4% discount rate. Household targets were set at 50 kWh/m².

The Energy Law was complemented by the national Climate Plan of 2004 which proposed additional measures to comply with the country’s Kyoto commitments. Through these new measures, the Energy Plan identified a potential of emissions reduction of 16.3 MteCO₂ in transport (14 measures, for a budget of €41 million), 11.7 MtCO₂ in buildings (5 measures, for a budget of €8 million), 10.8 MteCO₂ in industry (9 measures), 16.8 MteCO₂ in the energy sector (12 measures), 5.9 MteCO₂ for agriculture and waste. In total, potential annual reduction of greenhouse gases could be 72.3 MtCO₂ in 2010 compared to the reference scenario. In buildings, the main measure concerns new thermal regulations (7.3 MteCO₂ of savings for households, 3 MteCO₂ of savings in public and private services). A fifth thermal building code came into force in September 2006, and expected to generate on average energy savings of 15%, compared to the previous standards of 2000.

In 2005, a tax credit scheme for the existing dwellings was reinforced for energy saving equipment, including low temperature boilers, condensing boilers, heating regulators, and thermal insulation products. For equipment employing renewable technologies, such as solar water heaters and other equipment using renewables, the tax credit increased from 15% before 2005, to 40% in 2005 and 50% in 2006. For other equipment, the tax credit was increased from a range of 15-25% in 2005 to 25-40% in 2006.

A compulsory energy efficiency label scheme for buildings has been in effective since November 2006. A CO₂ oriented financial/banking product for household with an expected leverage of 1 billion euro was started in January 2007.

To raise public awareness and assist households with their investment decisions for energy efficiency measures, ADEME established in between 2001 to 2003, 155 local information centres (280 advisers or 1.8 adviser per centre) for the period of 3 years. The overall budget was €15 million/year, co-financed by ADEME and local authorities, respectively at 33/66%. The role of the information centres was to provide advice to households, buildings professionals, companies and organizations, such as administrations, education, and associations.
3.2.5 **EPBD and Recast**

The Energy Performance of Buildings Directive - EPBD (2002/91/EC) and its recast is among the key EU legislations guiding the building sector. Yet, despite EU’s deadline for full implementation as of January 4, 2009, only six Member States have fully complied, whereas three Member States are in court and 12 are under infringement procedures. The reasons vary; yet include a lack of expertise, legislative discrepancies on national and regional levels, weak political will and a lack of co-ordinated support on the part of stakeholders.

The EPBD recast embraces the need for cost-effective action with the aim to strengthen the Directive as follows:

- Providing a methodology for Member States for calculating cost-optimal energy-performance requirements (‘comparative methodology’, which does not oblige Member States to change their existing national energy-performance calculation methodologies, but rather complement them with an economic calculation tool)
- Eliminating the 1000m² threshold for existing buildings when undergoing major renovations, mandating the display of energy-performance certificate in public buildings above 250 m² (instead of ‘above 1000 m²’ as today);
- Enhancing the role of the certificate (as an energy-performance indicator) in the market place (similar to CO2 labelling in advertisements for cars);
- Requiring the development of low/zero energy and carbon-building strategies by Member States;
- Strengthening the role of inspections for heating and cooling systems and;
- Encouraging national governments to lead by example in the energy efficiency of public buildings

The potential impact of the EPBD recast is estimated at 5-6% saving of the EU’s total energy consumption, 5% saving of CO2 emissions and the possible creation of 280-450,000 new jobs.

3.2.6 **Complementary European Directives and Policies to the EPBD**

The EU has enacted a number of legislative measures in the form of directives and/or regulations that influence the state of the building sector and help reinforce the EPBD, including the:

- Directive on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC)
• Directive 96/92/EC regarding common rules for the internal market in electricity
• Directive on Energy End-use Efficiency and Energy Services (ESD 2006/32/EC)
• Construction Products Directive (89/106/EEC)
• Directive (2005/32/EC) on Eco-design requirements of energy-using products

The recently updated Directive on the Promotion of Electricity from Renewable Energy Sources in the Internal Electricity Market (2001/77/EC), provide new avenues to further penetrate the building sector, while contributing to the broader 20-20-20 targets. A growing number of EU countries, including Germany, Italy, Spain, Portugal, and Ireland, are aggressively promoting the use of renewable energy technologies in buildings through obligatory regulations. The implementation of the European Directive 96/92/EC regarding common rules for the internal market in electricity led to a liberalization of European energy markets. The effect on the German energy market was significant and led to a distinct separation of structures for the generation, transport, distribution, and supply of energy resulting in increased market competition. The German experience demonstrates that policies which permit a bundling of technologies offer the greatest energy saving and cost efficiency.

The Directive on Energy End-use Efficiency and Energy Services (ESD 2006/32/EC), also known as the Energy Services Directive or the Energy Efficiency Directive, was adopted by the European Council on 14 March and formally entered into force on 17 May 2006, places emphasis on the function of actors and institutions for energy and services rather than focuses on specific technologies or measures. It aims to complement and improve the implementation of the EPBD as well as other energy related regulations such as Combined Heat & Power and energy labelling of appliances. The Energy Efficiency Directive defines and sets indicative targets, though non-mandatory on a national level, yet with the clear legal obligation to adopt appropriate cost-effective energy services and other efficiency improvement measures. Member States must achieve a minimum annual energy savings target of 9% by the ninth year in the period from 2008 to 2016. In line with this, each national government is required to produce energy efficiency action plans (EEAPs) in 2007, 2011 and 2014. In the submitted 2007 plans only Italy had proposed energy efficiency targets above the mandated benchmark. Similar to the EPBD, the public sector is expected to play a leading role with measures for green procurement and the like. This Directive is significant in extending responsibility to energy companies putting the onus of suppliers to increase efficiency and work with their distributors and/or end-users to reduce energy consumption. Countries such as France have gone beyond the Directive’s language to fine companies not compiling with specific targets, while both Italy and France have employed the use of White Certificates enabling utility companies to
meet the national energy targets, and thereby marrying legislative and market instruments in a manner that offers broader impact and multi-sector action.

The Construction Products Directive (89/106/EEC) and its proposed conversion to EU regulation are complementary legislative efforts to engage essential components of a complex and fragmented building industry. Health and safety concerns coupled with issues of sustainability and cost are essential factors to fostering industry commitment to energy saving as well as changing consumer behaviour towards the same. Similarly, the Lead Market Initiative for Europe aims to foster the emergence of efficient economic markets and enhanced societal value by working with key sectors that can encourage, among others areas, sustainable construction, renewable energy use and innovation for reduced energy consumption. A coherent mix of EU policies tailored to each market and guiding legislation, public procurement, standardization, certification, labelling, and complementary measures is seen as the basis for driving innovation in pursuit of integrated market sustainability. Fiscal incentives and financings schemes are essential to advance this undertaking. In this context, the EU Economic Recovery Plan offers financial opportunities, yet has been called upon to integrate holistic approaches and projects that lead to long term sustainability with an eye to the inter-play of buildings in the overall urban and socio-economic context.

The Framework Directive 2005/32/EC on Eco-design requirements of energy-using products has the potential to force greater energy saving in the construction industry through the use of better designed and efficient products. The directive is also encouraging local communities to convert to 100% use of energy saving light bulbs as in the case of communities in Austria. The directive and its proposed recast is expected to increase in-roads to higher efficiency in the building sector.

Each of the of the above directives, and moreso their complementarity, presents opportunities for the building sector to improve its carbon footprint. Harmonization of construction materials criteria as well as improvements in the design and energy consumption of household products provides legislative avenues for each the EU members states to strengthen their building sector policies. Also, the combination of renewable technologies and passive energy efficiency measures as advocated by the related directives and supported by the EPBD bolster the basis by which new advances in energy savings for both new and existing structures can occur at a faster rate.

The Directive entered into force in 2003 and allowed member states until 2006 for its transposition into national legislation. The extent of implementation has differed by country, by which those with related pre-existing legislation and enforcement systems have been able to more rapidly comply with the EPBD requirements. The recasting and strengthening of the Directive may bring additional challenges to those countries still trying to adhere to the original legislation as well as develop the necessary impetus to encourage industry and policy makers to work together to employ regulatory and practical measures for advancing energy efficiency. The following section presents the process and status of implementation in Austria, Germany Italy and France. Following a section on institutional responsibility, it is structured according to the main elements of the EPBD, i.e. standards, certificates, qualification of experts and inspections.

4.1 Institutional responsibilities

The responsibility for the development of the national frameworks for the transposition of the EPBD lies with the national governments of the member states.

In Austria, the EPBD is the shared responsibility of the Federal Republic and the nine autonomous provinces. In general, many of the necessary legislative measures towards the implementation have been satisfied by most of the nine regions, with the exception of Lower Austria and Salzburg, due to complete transposition into local policies by 2009.
Figure 6: Austrian national transposition process of EPBD

Source: Austrian Energy Agency
In Germany the responsibility for the implementation of the EPBD straddles three ministries, mainly the Federal Ministry of Transport, Building and Urban Affairs, the Federal Ministry of Economics and Technology and the Federal Ministry of the Environment and Natural Conservation and Nuclear Safety, which is specifically responsible for Article 8 (inspection of boilers). With the adoption of the Energy Saving Regulation (Energieeinsparverordnung – EnEV) of 2002, the main elements of the EPBD such as energy performance requirements on the basis of a standardized methodology and compulsory energy certification for new buildings were implemented under German law. Issues relating to air-conditioning and lighting were subsequently incorporated in the 2007 amendment to the EnEV. The EnEV is a federal law binding for all member-states. Each of the member-states is required to implement the measures, for example by issuing an edict (Hessen) or implementation regulations (Berlin, Mecklenburg-Vorpommern). The federal -states are required to implement all aspects of the law, although flexibility as to the identification of the responsible institutions, required qualifications for certification experts and how to deal with exceptions and exemptions is given.

Italy adopted a general framework in 2005, for the EPBD on the national level, and each year thereafter has enacted additional legislation to address all aspects of the Directive. Energy policy is delegated in part to the regional governments and autonomous provinces, allowing for implementation and adaptation of national policies to local conditions, as deemed necessary. Several regions of the country initiated their own requirements, including certification schemes, in advance of the national framework in part driven by climate priorities, market opportunities and/or political interests.

In France the Ministry of Labour, Social Cohesion and Housing together with Ministry of Economy, Finances and Industry (Articles 8, 9) share responsibility for implementation of the EPBD. In 2005, the government promulgated an energy policy with a framework for the transposition of the EPBD. France has set targets for low energy consumption of 50kWh/m²/year for all public buildings and the tertiary sector as of 2010, with residential housing to meet the targets by2012. The ambitious goal of having the building stock produce positive energy is set for 2020.

The respective countries have pursued different tracks in meet their EPBD responsibilities. While the German and French governments have taken strong national positions, announcing ambitious nation-wide targets to guide regional implementation, the national governments of Austria and Italy have pursued less active roles, rather delegating to most responsibilities to the local levels.
4.2 Standards

Standards set the foundation for construction and retrofit actions in buildings and dictate energy usage levels for years to come. Harmonization of standards, despite being a recognized priority goal, has suffered from lack of uniformity across the EU territory.

Austrian policy stipulates energy performance of buildings through the building codes, guided on the national level, yet implemented by the individual provinces. In 2007, a quantitative system was developed on the national level for the calculation of building energy consumption with the assistance of the Austrian Institute for Construction Engineering and can be found together with the ‘OiB-Guidelines’, under www.oib.or.at. Austrian building regulations fall short of the international best practice, suggesting significant potential for the improvement of building energy efficiency in Austria.

Table 8: Selected Austrian U-values and international best practice

<table>
<thead>
<tr>
<th>Fabric element</th>
<th>Lowest Austrian value</th>
<th>Highest Austrian value</th>
<th>International best practice</th>
<th>Difference best practice in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer walls</td>
<td>0.35</td>
<td>0.50</td>
<td>0.25</td>
<td>40</td>
</tr>
<tr>
<td>Roofs</td>
<td>0.20</td>
<td>0.25</td>
<td>0.13</td>
<td>54</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.285</td>
<td>0.50</td>
<td>0.20</td>
<td>43</td>
</tr>
<tr>
<td>Doors</td>
<td>1.7</td>
<td>1.90</td>
<td>1.0</td>
<td>70</td>
</tr>
<tr>
<td>Glazed doors</td>
<td>1.70</td>
<td>1.90</td>
<td>1.50</td>
<td>13</td>
</tr>
</tbody>
</table>

Sources: Austrian Energy Agency and UK Energy Saving Trust.

Austria also suffers from a variance in building standards throughout the nine regions. Some the provinces such as Burgenland and Vorarlberg have imposed stricter regulations surpassing the national guidelines, yet the lack of national harmonization has been a weakness in advancing energy efficiency, particularly refurbishment work, across the building industry and country.
Table 9: Building efficiency regulation in Austrian states using U-values (W/m²K)

<table>
<thead>
<tr>
<th>State</th>
<th>Burgenland</th>
<th>Carinthia</th>
<th>Lower Austria</th>
<th>Upper Austria</th>
<th>Salzburg</th>
<th>Tyrol</th>
<th>Vorarlberg</th>
<th>Vienna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall concrete</td>
<td>0.38</td>
<td>0.40</td>
<td>0.40</td>
<td>0.50</td>
<td>0.35</td>
<td>0.35</td>
<td>0.50</td>
<td>461</td>
</tr>
<tr>
<td>Wall in masonry</td>
<td>0.36</td>
<td>0.30</td>
<td>0.20</td>
<td>0.16</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>+40</td>
</tr>
<tr>
<td>Wall in separate operating units</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>+24</td>
</tr>
<tr>
<td>Outside wall, doors, passages, etc.</td>
<td>0.30</td>
<td>0.30</td>
<td>0.26</td>
<td>0.25</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>+25</td>
</tr>
<tr>
<td>Roof: flat roof building units</td>
<td>0.35</td>
<td>0.30</td>
<td>0.25</td>
<td>0.25</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>+25</td>
</tr>
<tr>
<td>Roof: slope roof building units</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>+25</td>
</tr>
<tr>
<td>Windows</td>
<td>1.00</td>
<td>0.80</td>
<td>1.00</td>
<td>0.90</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>+12</td>
</tr>
<tr>
<td>External doors</td>
<td>1.70</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
<td>1.80</td>
<td>+12</td>
</tr>
<tr>
<td>Walls in ground</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>+25</td>
</tr>
<tr>
<td>Floors in ground</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>+25</td>
</tr>
</tbody>
</table>

As part of the EPBD implementation, a software tool has been created taking into account more than 200 building elements and allows the user the option of customizing the data input or working with default values. The Austrians have incorporated other elements into the system, including a climate model which allows for data collection on heat storage in the building as well as information on the utilization of renewable energy technologies. This undertaking reinforces the national goal of reducing foreign energy dependence and increasing the amount of reliance on renewable technologies, currently at 25% of total energy consumption. A more simplified methodology has also been established to document the energy use in existing buildings with the aim to issue certificates for many public buildings during 2009, and particularly for the large inventory of approximately 200,000 units (buildings and apartments) held by the City of Vienna. Austria strives towards a passive house standard in the future for all its building stock, with the exception of historical buildings, as one means of becoming more energy independent. The development of the standards in compliance with the EPBD moves the country closer to this threshold. As of 2009, under Article 15A of the constitution, the Austrian government introduced stricter measures to cut energy consumption in the building sector underlined by the goal of national harmonization. The higher energy saving thresholds include new single home dwellings at 36 kilowatt hours per square meter annually (kWh/m²/a) and 20 kWh/m²/a for new multi-storey buildings.

Germany developed national standards for energy calculations based upon the pre-norm DIN V 18599 which allows a holistic approach including the thermal shell, lighting, appliances, heating, ventilation, cooling and hot water supply;
climatic conditions are also given consideration. Germany opted for the development of national standards rather than making use of the new European CEN standards because of the lack of CEN's interdisciplinary, holistic approach as well as timing of their availability. The German set of standards are not based on climatic zones, as in the case of Italy, but rather upon calculated energy demand for new buildings and/or metered consumption for existing building, with an adjustment factor for the standardization of weather conditions throughout the country. DIN V 18599 does not contain parameters which buildings must meet but rather describes the method by which a building's energy performance is to be calculated. The minimum energy performance standard is described in the EnEV. The maximum annual primary energy consumption for a residential building depends, among other things, on the ratio of the building's transmission surface (A) and building's volume (V) and on the kind of heating used in the building.

The Italian law 192/2005 ‘Transposition of the EPB Directive: energy performance of Buildings’, amended by the 311/06, prescribes minimum requirements for new buildings and existing buildings with a total floor area of over 1000 m2 which undergo major renovation/reconstruction works. The implementation of it is delegated to the regions, whose local authorities can adopt stricter standards. Italian energy performance requirements are dependent on six climatic zones, which measure the number of heating degree days and the building's shape factor, determined by envelope surface divided by building volume. The Italians adopted a number of the CEN guidelines to use as standards, particularly for heating performance calculation and system efficiency. These have been complemented by other nationally developed parameters supported by a number of marketed software, such as DOCET. The same minimum requirements are applicable to both new and existing buildings, assuming the latter is greater than 1000 square meters. New U-values for thermal transmittance for walls, ceilings, windows, roofs have been established and are being introduced in three stages from 2005 through 2010, with increasing level of strictness, for all renovations regardless of their extent. Standards for cooling systems and artificial lighting are still under development having been granted a three year extension by the EU. Proof of compliance is required at project completion. Enforcement of the regulations is the responsibility of local municipalities. Although national standards have yet to be developed, Italy has mandated new buildings to install solar thermal units for the production of hot water, covering a minimum of 50% of the energy consumption for its production on an annual basis.

In France, the methodology for new building energy performance, built upon pre-existing regulations, is defined in the national building regulation RT2005, which came into force as of September 2006. The aim of this new national regulation is to improve by 15% the building energy performance, with the objective to attain an improvement level of 40% by 2020. The regulation (RT
2005) sets out the method to calculate the following 3 main parameters (consistent with the EPBD requirements):

- The primary energy consumption $C_{ep}$ (kWh/m²)
- The carbon dioxide emission (kgCO₂/m²)
- The summer comfort: indoor temperature $T_{ic}$ (°C)

Requirements are specified for a number of factors, including U-values for windows and doors amongst other components, as well as levels of insulation are influenced by climatic zones as well as the type of energy source, with higher values permitted for electric heating over fossil fuels. For existing buildings energy performance is calculated by a method comparable to the RT2005 building regulation. As of 2008, premises greater than 1000 m² are obliged to meet the national performance requirements. Also, as of 2008, new standards on air conditioning performance and on boilers’ were introduced. In the tertiary sector calculations are conducted on the basis of energy consumption costs. A thermal regulation for “existing buildings” is being prepared, the minimum performance of construction materials will be defined by this regulation for renovations.

The previous paragraphs illustrate a central problem in attempting to harmonize standards at the European level. Currently Member States and even regions within those countries adhere to completely different ‘philosophies’ of setting standards for energy efficiency. The three dominant approaches focus on regulating either performance criteria of certain building components such as windows or walls (e.g. parts of Austria) or the overall energy performance of the building (e.g. Germany) or the net energy consumption thus taking into account the production of energy from renewable sources (e.g. Italy). Some regions also employ combinations of those three approaches and add further criteria, for example related to climate zones. This diversity complicates direct cross country comparisons and poses an obstacle for European subsidy schemes and targeted policy initiatives.

4.3 Energy Performance Certificate

The energy performance certificate offers high potential as a market instrument for the real estate industry and has been compared to the emissions labelling for automobiles. The aim embedded in the EBPD with the process of certification is to raise the level of awareness of residents and owners as well as the real estate industry and public as a whole of the market value of energy in relation to a building unit, and thereby pressuring the building sector to adopt energy saving measures.
In May of 2006, the Austrian parliament adopted the ‘Energy Certification Providing Act’ stipulating the conditions for the issuance of energy performance certificates (Energieausweis) as mandated in Article 7 of the Directive. The respective provinces in turn developed the local policies and procedures for their territories, often building upon past experiences (of issuing certificates) and updating legislation to include new specifications for lighting, heating and cooling. As of January 2009, it became mandatory for building certificates to be issued by owners for the sale and rental of existing buildings, whereas the requirement for new buildings came into force the previous year. Austria, together with Germany, is participating in the Projekt DATAMINE “Collecting Data from Energy Certification to Monitor Performance Indicators for New and Existing Buildings” which aims to create a database of energy usage in European buildings in order to allow for better comparison and valuation.

In Germany, certificates are mandatory for all residential buildings as of January 2009, and for non-residential as of July 2009. A new uniform design was introduced with the 2007 legislation (EnEV 2007) consisting of a four page form, including a page of technical definitions to facilitate understanding of the data and an annex outlining recommendations for cost-saving measures. However, no software tool has been developed by the government, which prefers to leave the task to the marketplace. To facilitate data collection for the energy calculation and the neutralization of weather conditions for existing buildings, two additional texts were added to the EnEV 2007; similarly, for new buildings reference values were set for heating and hot water and another for electricity consumption. EnEV 2007 makes the display of the certificate in public buildings mandatory.

In Italy, energy certificates became a matter of law in 2007, on an annual incremental basis. As of July 2009, certificates will be required for all buildings and individual apartments upon legal transfer. Many of the Italian regions have been exceedingly active in establishing local incentives to encourage certification beyond the minimum criteria set forth by the national government. For example, the region of Marche among others has introduced a voluntary certification on bio-architecture, known as ITACA, as a means to provide incentives. Yet, despite the national framework and benchmark criteria for certification, the devolution process has brought delays and confusion over the implementation of energy efficiency laws, hampered by discrepancies and lack of conformity at the local level among regions. The long delay in approving the authorizing degrees and adopting the national certification guidelines has jeopardized the law’s implementation. Some regions rely on a confusing and partial national framework (the ‘temporary framework’ contained in L.D. n.192/2005), while others have adopted regional legislation on the subject. The Lombardy Region has established the CENED as the local focal point for creating a certifiers registry and supporting and monitoring the energy certification process. Furthermore, the more recently approved L. D n. 112/08
has voided the articles of the L. D. n.192/2005 which established the right for the purchaser to declare null and void contracts signed without the energy certification. The controversial norm has weakened the overall system of energy certification for existing buildings.

In France as of November 2006, energy performance certificate are required for the sale of building, and as of June 2007, energy performance certificate were required for new buildings and rented building and units. The certificate cites the energy consumption of dwellings and buildings and the impact of the energy usage on GHG emissions. Energy consumption is calculated on the basis of one of the assessment methods or on actual (invoiced) energy consumption for the past three years. The certificate includes technical recommendations on how to conserve energy in a cost-efficient manner and is required to be visibly displayed in public buildings over 1000m2.

Contrary to the widely differing standards, energy certificates in the framework of the EPBD were harmonized from the start at the European level. This makes them (in most cases) directly comparable across all Member States and is expected to facilitate benchmarking exercises and increased international cooperation. However, implementation and market acceptance on the national levels differ, and thus it is premature to gage their effectiveness as energy rating instruments.

4.4 Qualified Experts

The construction industry needs to prepare for the new legislative requirements by ensuring building practitioners acquire the proper level of training and qualification to properly operate with new technologies, calculation methods and efficiency techniques. However, this remains a challenge as the Eco-build project has learned in various stakeholder events, in part due to the fragmented and conservative nature of the industry.

Austrian regulations permit accredited professions within the building industry to serve as experts to support to the new processes mandated under the EPBD. Although not obligatory, a 17 day training course (partly via e-learning) has been developed by the regional energy agencies to familiarize industry practitioners of the new data collection and energy calculations procedures. Energy certificates must be issued by authorized experts within their professional trade.

The German law outlines a wide range of professions that may serve as experts for the certification process. It is not foreseen to institute a formal system of approval and certification of experts. Persons working in the construction and related industries, yet with limited energy specific experience, may become
eligible through completion of a vocational training course outlined in Annex 11 of the EnEV. The respective German states have also some degree of authority in defining a qualified expert. Penalties are foreseen for the unauthorized issuance of certificates as well as the lack of compliance by a landlord to provide a certificate to a buyer or tenant.

Italy has issued a national decree outlining the persons authorized to issue building accreditation coupled with mandated training courses. As per Italian policy, the regions have the authority to modify the criteria as deemed appropriate. Among the national requirements, it is mandated assessors execute a declaration of no conflict of interest or any involvement in a building’s construction or renovation.

In France, Decree n° 2006-1114 (2006) sets out the eligibility requirements for persons performing technical diagnostics within buildings. Certified persons must successfully complete an examination from an accredited institution. Similarly, individuals issuing energy performance certificate must also be certified and be independent from the building owner and have no links to companies or individuals involved in installation or construction work. A regulation on the former is pending.

The need for professional training will grow as the market for low energy and efficient housing expands. The different approaches to accreditation of experts are reflective in the Austrian and German models whereby additional training is voluntary compared to the mandatory requirements for industry tradesmen in France and Italy.

4.5 **Inspections**

The mandatory inspection of heating and cooling systems is a key requirement of the EBPD in that such systems can account for up to 60% of energy consumption of a building unit.

Austria has traditionally mandated the inspection of heating systems. The EPBD requirements strengthen the Austrian regulations by including an additional 15 year inspection as well as introducing inspections for cooling and air conditioning systems not previously required. Given the lack of initial local expertise, Austria benefited from a three year extension to develop its methodology, putting the new regulations into effect only as of January 1, 2009. Inspection reports are to be available and registered with the Gebaeude und Wohnungsregister – GWR or Central Austrian register for residential and non-residential buildings. Cooling systems with an output above 12kW will be subject to three inspection intervals of one, three and twelve years of varying
degrees of intensity in the effort to minimize costs and incrementally ensure compliance.

Germany formally decided to pursue option (b) of Article 8, not requiring mandatory inspections of heating systems for the sake of minimizing bureaucracy. Yet Germany has had a functional system in place since 1978, for the inspection of boilers, which in some aspects goes beyond the requirements of the EPBD. Inspections are often usually conducted and locally recorded by chimney sweepers on an annual basis. If the boiler does not meet minimum requirements, it must be replaced, and in this way, the heating systems of buildings are regularly updated. For example, boilers installed before 1978, have a mandatory replacement date, in many cases already met. Inspection of cooling systems is also required.

In Italy, legislation for the inspections of heating systems has been in place since 1991, yet was only sporadically implemented; in 2006, it was upgraded in accordance with of Article 8 of the EPBD. The law 192/2005 recalled the previous laws and expressly reinforced the regions’ responsibilities to carry out inspections, collect information and communicate results to the Ministry. The framework law promotes the creation of a ‘boiler maintenance’ database. The inspections are to be conducted in varying intervals from one to every four years depending on the heating boiler's power level. However, in 2006 only 5 regions had drafted local legislation on the subject and had limited capacity due to a lack of technical expertise to institute a monitoring system. Italy has been granted a three year extension for the development of guidelines for the inspection of air conditioning systems.

The French government is still finalizing its regulations for establishing a regular inspection system for boilers and air conditioning systems. Yet, general provisions to improve the energy performance by periodical controls sets out inspections every 4 years for boilers of an effective rated output of 20 kW to 100 kW, every 2 years for boilers of an effective rated output superior to 100 kW, as well as inspections for boilers older than 15 years.

Those countries with a history of heating system inspections, such as Germany and Austria, have been able to readily adapt to the new requirements and have augmented traditional practices with the creation of centralized databases. Italy and France are still formalizing local regulations and mechanisms to ensure compliance. All of the countries have struggled to comply with the requirements for cooling systems, in cases for lack of local experience, with some taking the available three year extension to complete the regulations.
5 Subsidies and incentives

Subsidies and incentive schemes are currently used in all Member States to stimulate investments into energy efficiency and the production of renewable energy. Those financial instruments complement the complex set of rules and regulations determining efficiency standards and labelling requirements. While rules and regulations set the general framework and are by nature inflexible subsidies and incentive schemes allow for short term and specific investment support in certain areas or for certain types of buildings. Subsidies are generally direct financial contributions while incentive schemes can take various shapes such as tax exemptions or attractive financing schemes.

The following section describes the main subsidy and incentive schemes for Austria, Germany, Italy and France. It is important to distinguish between support for energy efficiency investments and support for the production of renewable energy. In the former case the programmes or funds usually contribute a certain percentage to the investment into a new or existing building. The most commonly funded activities include thermal insulation and the replacement/upgrading of heating and cooling equipment. For the production of renewables support is usually granted in terms of subsidized feed in tariffs for the public electricity networks.

Subsidy programmes can be funded and managed at any level of government; for the four countries covered by this report only the programmes at the national and some of the most relevant examples from the sub-national level are covered in this report. At regional and local level a large number of additional programmes are currently running, e.g. for Germany it is estimated that several hundred programmes and subsidy schemes have been launched by the “Bundeslaender” and “Gemeinden”.

5.1 Austria

The country’s most important policy measure setting the premise for all subsidies in the building sector is Article 15a (B-VG16) of the federal constitution adopted in December of 2004 and revised in 2008, as part of the national transposition of the EPBD. The Article is the result of much negotiation between the national and regional governments to align energy targets and subsidy levels to achieve greater energy savings and cut emissions throughout the country. The Article will prioritize subsidies from new construction to renovation and mandate the provision of an energy performance certificate as a pre-condition for the receipt of public monies as well as advances opportunities for related tax reform, increased support for commercial structures and energy contracting for public buildings. Correspondingly, the Article introduces new
measures to cut energy consumption in buildings and sets higher thresholds for new single dwellings of 36 kilowatt hours per cubic meter annually (kWh/m²/a) and 20 kWh/m²/a for new multi-storey buildings as prerequisites for obtaining public subsidies effective as of 2012. Subsidies for oil-based heating are to be phased out and replaced with an increase in subsidies for renovation of heating and insulation installations in buildings built between 1945 and 1980 based for the first time on energy efficiency criteria. Energy efficiency standards for public buildings will be aligned with those of private buildings. Yet, most importantly, the Article effective as of 2009 will provide much needed synergies and coordination between national energy goals and local policies. With approximately €2 billion annually provided as public subsidies for housing programmes by the regional authorities, the disconnect between national and regional levels had a high opportunity cost and been a key obstacle in the country’s approach to energy savings in the sector.

Austria’s main environmental financial instrument, Klima Fund and its corresponding program, Klima:Aktiv, were established in 2004, on the national level to support innovation, demonstration and capacity building, with a specific cluster dedicated to building and refurbishment. Klima:Aktiv has become the national label for environmental consciousness and low energy buildings, in some sense more comprehensive than the passive house standard for its consideration of life cycle construction, mobility and health factors. Voluntary standards have been set for construction and renovation and as of 2009, for commercial buildings. Other programmatic activities include:

- General estimations of energy performance and saving potential
- Advisory services for the refurbishment of commercial buildings
- Education and training for building professionals and practitioners
- Online-Information platform for building technologies and planning
- Database of best practices in the building sector

In 2008, the Klima Fund funded 15 projects in the amount of €150 million, on the basis of their potential for stimulating systems change and multiple impacts. Examples of funding included the category of buildings as power plants (€17 million) and the project ‘Austria Rebuilds - Refurbishment Offensive to CO2 emissions and energy savings’. Yet, despite the results of some good demonstration projects, its valuable multi-stakeholder approach and aggressive marketing initiatives, the Fund have suffered from structural inconsistencies, with budgetary cuts foreseen in 2009, attributable to weak political consensus and conflicting industry priorities.

The Austrian Energy Strategy and proposed master plan in the current government programme (2008-2013) continues to prioritize thermal refurbishment (including insulation, upgrading of windows, doors, and coupled with biomass or solar heating) as the main strategy for energy savings in the
According to the Ministry of Environment, optimal insulations levels can result in 50% energy savings at the household level. In the government's economic stimulus programme for 2009, €100m Euros is budgeted for thermal refurbishment in the building sector to be divided equally between private households and small/medium business establishments and is expected to stimulate 650 Million Euro in additional investment, with the further foreseen benefit of creating 7,000 new green jobs for the industry. In addition, forecasts estimate 5.3 million tonnes of CO2 would be mitigated and a parallel savings of 800 million liters of heating oil, strengthening the country's energy independence and security of supply.

Yet, funding has been tainted by political disagreement to the best approach for advancing energy improvements in the building sector. The political debate stems from varying priorities of either increasing subsidies for renewable energy technologies (OVP) as promoted by the energy industry versus reducing emissions through stricter legislation and greater energy efficiency (SPO). In 2007, Austria's conservative Austrian People's Party (OVP) agreed to a compromise on subsidies for renewable technologies, settling for a budget increase from €17 to €21 million a year. Greater public and market incentives are necessary for the country to increase its utilization of renewable sources currently dwarfed by gas and district heating consumption. The country's E-Control report cites reduction in energy demand as the biggest challenge facing Austria's drive to meet its renewable energy targets.

A 2008 study initiated by the Austrian Ministry for Agriculture, Forestry, Environment and Water Managements (i.e.: Lebensministerium) demonstrates electricity consumption increased by 23.6% in private households between the years 1990-2007, with a total usage of 14,160 GWh recorded in 2007. On average, an Austrian household in 2008 had a total energy consumption of 4,417 kWh, of which 20.5% was for heating, 17.1% for hot water, 30% for large appliances, 8.6% for lighting and 4.2% for stand-by mode of entertainment equipment (e.g. TVs, stereos) equivalent to a usage of 128 KWh annually. It is estimated energy efficiency measures can produce saving of approximately 650 Euros per year per household. Yet, at the same time, increasingly higher electricity demand across Europe fuelled in part by consumer trends for energy demanding equipment and appliances warrants a broader policy perspective and complementary measures integrating the various EU directives addressing energy savings. As example, Austria in cooperation with the International Energy Agency has launched a program to reduce energy consumption through a public information campaign on the utilization of energy efficient appliances in homes, public institutions and businesses. The website www.topprodukte.at offers consumers information on energy efficient appliances, energy usage, prices and comparable models. Similarly, some local communities have taken the initiative to convert to 100% use of energy saving light bulbs with national

In 2007, only the federal government’s environmental subsidies totaled 82.3 Mio million Euros, generating a total investment volume of 411.7 million of which energy efficiency, connection to district heating, thermal building refurbishment were highlighted for the building sector with public buildings such as kindergartens, schools and institutional facilities receiving increasing focus. This figure does not include the individual set of subsidies provided by the respective regional governments but rather provides an indicative overview of the budget for environmental initiatives provided by the national government.

At the end of 2008, the Viennese parliament approved a budget increase to €4 million for several housing subsidy programs for existing structures, with emphasis on energy efficiency, particularly in regards to heating systems, with subsides ranging from €4,000-15,000 per eligible household. The additional governmental support is coupled with stricter regulations for energy consumption in line with the EPBD, including the requirement of having an energy performance certificate. City of Vienna’s Thewosan subsidy program, dating from 2003, and has been the principle instrument for improving energy saving and heating capacities for residential buildings. The financial support for energy saving measures can be up to a third of the total costs and has focused on increasing insulation levels, updating heating systems with renewable technologies and replacement of doors and windows. Challenges with many public buildings due to age and historical designation, has limited the degree of renovations in this class. On the other hand, as the country’s largest property owner, with over 200,000 units and 25% of the stock dating from 1945-1980, the local government has come under pressure to expedite its rate of refurbishments, currently a 2%, to help improve the national GHG emissions levels.

5.2 Germany

The implementation of the European directive 96/92 regarding common rules for the internal market in electricity in 1999, lead to a liberalization of European energy markets and changed the German energy market significantly. Since this time, Germany has had a distinct separation of structures for the generation, transport, distribution, and supply of energy. The main pieces of legislation relevant in the German Energy market are the Erneuerbare-Energien-Gesetz (EEG) and the Kraft-Wärme-Kopplungs-Gesetz (KWKG) to ensure a minimum guaranteed price for power generated from renewable energy and combined heat power (CHP) and the Energiewirtschaftsgesetz (EnWG) regulating the access to electricity grids and gas networks. The EEG can be seen as the main instrument of financial aid for renewable energy
production in Germany. Germany's declared aim is to increase the share of renewable energy in the provision of electricity to 12.5 percent by 2010 and 20 percent by 2020 (§1 Abs.2 EEG 2004).

The EEWärmeG law requires that buildings cover a percentage of their energy requirements with renewable energy. In turn, renewable energy technologies have benefited from various financial incentives, particularly for the provision of heat by solar thermal panels and biomass. Since 2001, the German Kreditanstalt für Wiederaufbau (KiW) has been a main source for funding and key actor in the promotion of energy efficient buildings both for renovation of existing stock and new construction. A main programme is the CO2 building refurbishment programme (CO2-Gebäudesanierungsprogramm) which provides subsidized long-term low-interest loans for comprehensive refurbishment resulting in a pre-determined reduction in CO2 (and equivalent) emissions. In 2008, the programme was increased by roughly 500 million for a total of €1.4 billion EUR, granting over 100,000 loans. The programme has had substantial effect on reducing CO2 emissions, reducing consumer energy costs and creating approximately 220,000 jobs in small and medium enterprises throughout the country. Moreover, half the buildings refurbished meet or exceed the requirements of the Energy Saving Ordinance suggesting market incentives can be a key driver in reducing energy consumption. Yet, experience has demonstrated the need for bundling of energy efficiency measures to enhance the impact on energy efficiency. The programme is funded until 2011 and will continue also targeting public buildings and facilities with the goal of achieving primary energy savings of 50 % per building. The government also supports use of combined heat and power generation (CHP) as another path for climate protection and generating higher overall efficiency compared to central power plants. The German government aims at saving 20 million tonnes of CO2 by 2010 through the promotion of CHP (§1 Abs.1 KWKG). Additionally, the EnWG regulates access to the electricity grids and gas networks. Network operators are thereby obliged to buy the energy generated in plants using renewable resources or using cogeneration.

5.3 Italy

Italy has pursued a dual approach to encourage energy saving by which both property owners and end-users as well as the power companies can benefit from economic instruments. For property owners, Italy offers a tax rebate (credit) in the amount of 55% of costs for enhancing energy efficiency through heating system upgrades, retrofitting of the building envelope and small building renovations amortized over a period of 10 years. Public demand for tax credits has been largely for the improvement of heating systems and windows. In addition, in 2006, the government committed €8 million for energy audits, certification and design of energy renovation in public buildings, and support for
photovoltaic plants which have reduced energy costs by 10% in certified buildings. Energy performance certification is required in all cases for access to public subsidies.

Italy’s ‘White Certificate System’ implemented in 2004, complements the EPBD by mandating large electricity and gas distributors to meet specific targets either through direct operations, working with energy services companies (ESCO), or purchasing White Certificates on the market. The Certificate testifies to primary energy savings of one tonne of oil equivalent (toe) at the price of €100/toe and is issued annually by Italian Manager of the Electric Market (GME). Energy suppliers work with end-users to reduce energy consumption through a number of energy efficiency projects; those pertaining to the building sector include thermal insulation interventions, bio-climate architecture and passive heating techniques.

One of Italy’s most successful programmes has been the Ministry of Environment’s ‘10.000 PV Roofs National Programme’ which supports the installation of small photovoltaic energy systems (PV systems) ranging from 1 kW to 20 kW on buildings, roofs, and terraces. The programme was successful due to provision of grants covering up to 75% of the total overhead costs of the photovoltaic panels. The programme was structured in three components:

- The National Programme for regions and public authorities. An estimated 453 PV systems have been installed on public buildings with power generation of 5.283 kW. Most of the requests came from public schools (60%) and, therefore a new Programme was initiated by the Environment Ministry in 2007 entitled ‘The Sun into School’ with a budget of €4.700.000 for the installation of PV systems on school roofs and related awareness raising activities.

- The Regional Programme for private and public buildings with a budget of €75.770.000 to be distributed to the regions based upon population levels. In 2002, the programme received 67,000 applications and financed the installation of approximately 20,000 systems. In 2003, the Programme was refunded by the Ministry in collaboration with the regional governments.

- PV–in–buildings with high architectural/historical value financed a number of projects up to 85% of costs in order to install PV with nominal power above 30 kW. In 2007, the programme ‘The PV in architecture’ installed PV systems of 1 to 50 kWp by testing experimental technical solutions for the specific buildings characteristics.

Enhanced training and building maintenance is contributing to Italy’s energy saving efforts. The National Agency for New Technologies, Energy and the Environment (ENEA) plays a coordinating role in the organization of information campaigns on energy efficiency, including training courses for energy managers, dissemination of best practices working through the Italian
The law 10/91 mandated administrations and large energy consumers (of more than 10,000 toe/year) to appoint an energy manager, responsible for promotion of energy savings. Furthermore, the law 192/2005, required the periodic publication of reports on public buildings, outlining their performance as to the requested energy efficiency standards, and that these reports be verified and signed by the internal energy manager. According to the database of energy managers managed by FIRE, records indicate the number of managers have remained largely constant around 2,500 individuals during the past decade, and thus was proposed the lowering of the threshold for their mandatory appointment (i.e. the WWF program requires the mandatory appointment of Energy Manager for all the multi-family buildings that consume more than 200 tep per year and spend more than € 130,000 per year in energy). ENEA also supports information campaign as the ones currently ongoing and managed by WWF ‘Generazione Clima’ and by ADICONSUM ‘Enerbuilding’ both directed at promoting energy efficiency measures in multi-family buildings. These campaigns offer direct information on the opportunities and incentives available, guidebooks and trainings for the building managers. FIRE, initially financed by ENEA has been able to continue its activities on a self-financing basis as a result of the greater interests on energy efficiency by local authorities and private companies.

5.4 France

On the national level France provides subsidies and incentives for energy efficiency in the building sector mainly through the national agency for housing (ANAH) and the French environment and energy management agency (ADEME). In addition, private households can deduct certain energy efficiency investments from their income tax or make use of a specific VAT reduction scheme. The latter was introduced in 1999 and has had important impact in the country’s energy strategy. The VAT rate for energy efficiency improvement works was reduced from 20.6% to 5.5% under the condition that the dwelling is already owned by the same person for more than 2 years. Owners also have to make a choice between the VAT reduction and the income tax reduction mentioned above. Among the entire population of 25 million of French households, 7% have benefited from either of those tax reduction schemes so far. In 2002, 61% of all households carrying out energy efficiency improvements claimed the VAT reduction. The average investment in those cases was 2,640 Euros per household.

The national agency for housing - ANAH operates a key programme directed at private households. It annually publishes a compendium of guidelines how to apply for federal subsidies depending on the status of the dwelling, i.e. depending on whether the unit in question is occupied by the owner, rented or
owned in a co-ownership structure (cf. ANAH 2009). In general, the agency will cover between 20% and 35% of the refurbishment costs directly related to energy efficiency improvements from thermal insulation or the use of renewable energy. In addition to those subsidies a special eco-bonus (called “éco-prime”) of between 1000 and 2000 Euros is paid if a dwelling classified under the two worst French energy classes ‘F’ or ‘G’ is improved by at least two levels on this seven level scale. Eligibility for this scheme depends on household income and buildings must be at least 15 years old. The ANAH budget for building refurbishment support is 591.5 million Euros for year 2009 (cf. Batiactu 2008).

An interesting property of the ANAH program is that it is not primarily designed for the reduction of energy consumption but is based on a social support concept (referred to as “energetic precariousness”). The idea is to reduce the living expenses of low income groups by supporting investments that will have a short payback time by reducing household energy bills.

ADEME is organized into different regional delegations providing technical advice, information and administering a range of subsidies and financial incentives. France has introduced a number of financial incentives, with a bias on the use tax credits to further renewable technologies and promote energy efficiency. With the successful track record of using tax credits, the government provides rebates up to 25% of the energy savings investment (credit d’impôts), and up to 40% in the case of renewable energy technologies. Other financial mechanisms support sustainable development through low-interest loans for investments in eco-buildings.

5.5 Conclusions

The analysis of subsidies and incentives in the previous sections shows the specific properties of different types of funding schemes in the building sector. Subsidies for the production of renewable energy in buildings appear to be most advanced in Germany where the high feed in tariffs for electricity from Photovoltaic panels (PV) have led to massive private investments in this area. Other countries also support investments in renewables directly connected to buildings but so far without any large scale impact as in the German case.

From a comparison of the country studies it appears that guaranteed payback times are crucial for triggering private initiative. In addition to the expected length of the payback period and thus the profitability of the investment a second main factor is the degree of uncertainty related to the calculations. For example, since the average annual hours of sunshine for any given location are well known and long term feed in tariffs have been guaranteed by the Germany government the installation of PV carries almost no risk of a misinvestment. On the other hand, the payback time and profitability of subsidized investments into
ground source heat pumps depends on assumptions of future development of alternative energy sources such as oil and natural gas and thus a strong element of uncertainty is introduced.

In terms of energy efficiency increases of the building itself subsidies and incentives are provided for cases of refurbishment or for new buildings whose energy efficiency standards significantly exceed the current regulations. All four countries provide similarly structured funding schemes but in chapter 6 below it is shown that small details in funding percentages or in eligibility criteria can have large effects on the impact of the programme. It is also interesting to note that countries like Germany and Austria are by no means internally homogeneous in terms of their subsidy and incentive schemes. Each region has different criteria for subsidies and many of them are changed at least once every year to adapt to the current dynamism of this field.

Recently some countries have started to create incentives by linking the more general financial support for the construction of new housing to energy efficiency standards. In some cases this is limited to social housing but in many regions this extends into the entire market for residential buildings.

Italy is the only country in this study where mandatory incentive schemes have been introduced to the residential sector via the energy providers. Those incentive schemes known as ‘White Certificates’ are being used in other countries as well but on a voluntary basis. The Italian system is interesting because it theoretically shifts the responsibility for energy savings to energy providers. The effectiveness of the system, however, depends on the amounts of ‘White Certificates’ available and thus will have very little impact as long as no political consensus emerges on significant energy reduction targets.

Finally, France is the only one of the four countries in which the support for energy efficiency investments is tied to social considerations. This links energy savings more directly to financial savings of private households is interesting not only from a social and political perspective but also from the viewpoint of awareness raising by demonstrating saving potentials to the general public.
6 Effectiveness and impacts

This chapter presents an assessment of the effectiveness and impacts of the various national and European policy measures described in the previous chapters above. Following a description of the impacts for each of the four countries two comparative sections draw conclusions across the entire groups of countries. The first one is based on an analysis of the MURE database which provides comparative information on energy efficiency policies in all European countries. The final chapter presents some overall conclusions on the effectiveness and impacts of single policy measures and different policy regimes.

6.1 Austria

On a national scale, Austria has taken perfunctory steps to address its environmental obligations under Kyoto and the EU, yet the impact of its policies and programmes are mixed at best. Opposing political priorities and weak policy measures have contributed to poorly framed climate change and energy saving agendas on the national level. Moreover, the inherent government structure, by which the nine autonomous regions (Laender) have the authority to interpret national policies for local implementation has thwarted advancements in energy savings and resulted in a fragmented and uneven approach to reducing energy consumption in the building sector on a national level. Despite some positive strides involving financial subsidies and the harmonization initiative for building regulations under Article 15A, national efforts to meet overall EU energy targets have fallen short due a limited global perspective, disparate political interests, provincial rivalry, and influential business and energy supplier lobbies.

6.1.1 EPBD Impact

The EPBD has had little to no impact to date in term of actual implementation. The lack of associated enforcement and penalties schemes, for example with regard to the energy performance certificate, represents an underutilized instrument, that only in 2012, when mandated to be used by the real estate industry, may become an important tool in raising public awareness of energy consumption and establishing a market value for energy efficient building units. Similarly, political decisions to construct seven (gas) power plants to produce electricity compared to the marginal opportunity of cost of energy refurbishments for more that 600,000 units of social housing stock questions environmental priorities and suggests a preference to address issues of security of (energy) supply at excessively higher costs without serious complementary and integrated measures to reduce overall energy consumption.
6.1.2 Regional Disparities and National Convergence

Regional differences despite of the existence of national guidelines for energy standards developed by the OIB reflect the lack of a unified national approach, which moreover has tainted the supply change and influenced the public and private financial support schemes. Notwithstanding that financial subsides are the driving force in encouraging energy saving in the building sector across the country (there exist over 2000 subsidy schemes in the country at all levels of government, ownership structure and building type), there have been no national harmonization nor common set of energy targets. To date, the regional governments set their own subjective types and levels of financial incentives with some prioritizing passive house standards, e.g.: Voralberg, while others such as Kärnten having no specific link between subsidy levels and energy efficiency. (See Annex of Austria subsidies by region/Laender). The regional government of Salzburg has opted for another set of building standards, said to be higher than the national guidelines, for the sake of local interests. This inconsistent pattern has swayed financial institutions to follow suit, launching marketing efforts for green credits/loans, irrespective of any specific energy targets. The Austrian experience has demonstrated a strong correlation joining subsidy levels, energy targets, and renovation activities, underscoring the importance of institutionalizing a common link to generate greater impact. Demand for public subsides indicates around €40 to €100/m2 as the average breakeven point for households to decide to undertake energy efficient actions. National convergence on this issue is anticipated with the final regional ratifications of Article 15A in 2009, which in a paradigm shift aims to align national and regional building standards and energy targets and subsidy levels accordingly. Many regions have already commenced their implementation; however, with the region of Salzburg yet to ratify the regulation, a national consensus is still missing.
6.1.3 Growing Role of Renewables

Austria has performed well in promoting use of modern technologies for new construction in the domestic market and similarly the passive house concept currently at 6% of market share.

Table 10: Share of renewables in Austria 1990 - 2005

<table>
<thead>
<tr>
<th>Renewables Share in TPES, 1990 and 2005</th>
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<tbody>
<tr>
<td>Production in Mtoe</td>
</tr>
<tr>
<td>Biomass and waste</td>
</tr>
<tr>
<td>Hydro</td>
</tr>
<tr>
<td>Solar/wind/other</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
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Sources: IEA and government submission.

In general, use of renewable energy sources, in particular biomass and solar thermal for heating, is better accepted than energy efficient practices and is so reflected in the market place where the solar usage is higher per capita compared to Germany. An important impact of such has been the evolution of an export industry for renewable technologies such as heat pumps, biomass systems and solar cooling equipment and know-how for the passive house design. The economic potential of Austria’s export market, fuelled by the increasingly obligatory use of renewables by many EU states, may be a contributing factor to stronger policy measures for use of modern technologies and energy efficiency measures in Austria itself. The construction industry is already demonstrating greater understanding and openness to low carbon buildings, in part due to the education and training programs offered to building professionals and practitioners by the state funded programs such as klima:aktiv. Low carbon housing is also more commonly accepted as well as by the prefabricated housing market. Nevertheless, greater societal and regulatory understanding of energy efficient building practices is still necessary, particularly for passive house, to abate the industry’s apprehension of legal liability for employing modern technologies.

6.1.4 Weak Political Commitment

Yet, the refurbishment of existing housing stock remains a major challenge. Public financial incentives have favoured new construction (85% of subsides)
compared to 15% dedicated to refurbishment and runs contradictory to the accepted industry understanding that the greatest potential for energy saving is in the existing building stock. As one of Europe’s largest property owners, the Austria federal state and its provinces have tremendous potential to reduce energy consumption in its public housing stock. Once again, political commitment is weak and no government has been willing to tackle the huge bureaucracy entailed to mobilize the necessary actors to mainstream energy efficient refurbishments in the public sector. Valuable demonstration projects within the public housing sector have not been replicated due to a resistance to break with traditional operational practices and prioritize energy efficiency on the national agenda. Moreover, a political sensitivity to upsetting the status quo of election supporters, many influential in the energy and construction industries, has delayed the broader application of technologies such as CHP, connection to district heating, and the active role of energy suppliers in reducing overall consumption. Austria’s conventional nature is also displayed in its approach to the planning of a new city subdivision, e.g.: Aspen See, in Vienna, slated for completed in 2025, which in theory would offer a gamut of opportunities to be designed as an Eco-city. Despite, a development of an ambitious master plan developed by Swedish planners, which envisioned rooftop gardens for cooling and reducing emissions, the actual implementation will be more in line with traditional practices, including connection to district heating systems, whereby waste is burned to produce heat and electricity, yet boldly coupled with geothermal technologies. Low carbon buildings standards will be promoted, yet the passive house standard will not be mainstreamed for lack of a long term track record of its operational functions. In general, priority is being given to mobility and transportation factors to reduce energy use, rather than structural and building elements per se.

Austria’s very low ranking among EU Member States in meeting the Kyoto commitments reinforces a lack of forward thinking and wherewithal on the part of the government to take stronger strategic action in the emissions producing sectors. Austria current generates approximately 60% of its electricity from (CO2 free) hydropower and aims to position itself as the leading hydropower generating country in Europe. In such respects, Austria suffers from the equivalent of a rebound effect by which its positive gains in one sector are offset by increased energy usage in others or simply lack of serious commitment. Prioritization of action in other sectors such as buildings would have important impact in meeting its 20-20-20 targets. Mass media campaigns and other public awareness initiatives would be among the necessary next steps to sensitive public opinion to change consumer behaviour and restructure political platforms, thereby building broad base support and enhanced public-private cooperation for constructive action towards a more timely and energy conscious environment.
6.1.5  **Impact of the 2009 economic recovery plan**

As a result of the financial crises the federal Austrian government launched an economic recovery plan in early 2009. 100 million Euros were dedicated to energy efficiency improvements of buildings, half of which was specifically earmarked for thermal improvements of single homes built between 1945 and 1999. Under this scheme 20% of private investments into building hull insulation, windows, doors and heating systems will be paid as a subsidy to the home owner (up to a maximum of 25,000 Euros). Somewhat surprisingly demand for this subsidy scheme by far exceeded the available funds and applications for more than 100 million Euros were received within only two months. A subsequent analysis showed that the average applicant actually invested 33,000 Euros, i.e. significantly more than the 25,000 Euros for which the subsidy could be requested.

The second interesting result relates to the amount of subsidies required to trigger refurbishment investments for energy efficiency purposes. In the Austrian example the average subsidy per square metre was only approximately 40 Euros and this was sufficient to trigger widespread investments of 275 Euros per square metre, i.e. a multiplier of roughly 6.5. This is in line with the assessment of the Austrian organization IG Passivhaus (cf. interview Mr. Lang) which estimated that less than 100 Euros subsidy per square metre is required in Austria to trigger widespread energy efficiency investments in the existing building stock.

6.2  **Germany**

6.2.1  **CO2 Building Refurbishment Programme**

Germany’s principle and most effective instrument for promoting energy efficiency has been the CO2 Building Refurbishment Programme prioritizing the existing building stock. This policy focus is further underlined in the newer German legislation which, along with further reducing the maximum permissible primary energy demand levels for buildings (EnEV) now also prescribes the use of renewable energy sources to meet a building’s requirements (EEWärmeG). This legislation perfectly encapsulates the concept of improving a building’s efficiency while using renewables to (partially) cover demand. The two legislative acts apply to both new buildings as well as to existing buildings, however, it is recognized that higher costs associated with refurbishment and improvement of an existing building’s energy balance warrants sustained financial support.
Data on the CO2 Building Refurbishment Programme demonstrates its impact in the years 2005, 2006 and 2007, and forecasts the scope of future CO2 reductions (see Table 11). The programme and its effects will continue to be monitored to determine long term effectiveness and help guide future policy positions. It can be seen in Table 11 2006 was the most successful year for the programme with the most loans, the highest CO2e reductions and the most energy savings. While 2005 registered more grants and higher CO2 reductions 2007 achieved noticeably higher energy savings. A change in insulation levels and heating measures from year to year explain the difference. Also, for example, 2007 saw an increase in the surface area, i.e.: amount of building insulated, as well as the quality of insulation used compared to the previous years. For the same period, biomass was less commonly used for heating after refurbishment. The higher insulation levels contributed to increases in the amount of energy saved, while other sources of heat energy other than biomass, which has a particularly low level of emissions, may partially explain why the rate of CO2 emissions was not correspondingly higher.

Table 11: The CO2 Building Refurbishment Programme 2005 – 2007, key data

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of agreed grants</td>
<td>24,429</td>
<td>43,451</td>
<td>23,373</td>
</tr>
<tr>
<td>and loans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2e reduction (t/a)</td>
<td>336,000</td>
<td>703,000</td>
<td>330,000</td>
</tr>
<tr>
<td>End energy saving</td>
<td>670</td>
<td>1,520</td>
<td>940</td>
</tr>
<tr>
<td>(Mio.kWh/a)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The CO2 Building Refurbishment Programme has also generated a positive employment impact. A credit volume of €1,861 million for 2007 corresponded to a total investment volume of €2,130 million with a total employment effect of 35,000 person years (20,500 direct and 14,500 indirect). This equals approximately to 16.5 person-years per €1 million. For the years 2005 and 2006, the figure is estimated at 18.3 person-years per €1 million. This difference can be ascribed to the increase in value-added tax in 2007 (19% compared to

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3 Grants were first available from 2007. In 2005 and 2006 the number given refers to the amount of loans. In 2007 the numbers are 20,582 loans and 2,791 grants.
16%) as well as increased productivity\(^4\). A negative employment effect, that is the loss of jobs caused by lower demand for energy was estimated to be around 1-2% of the positive employment effect in a previous study from 1999.\(^5\) Based on recent price trends, it is estimated that the refurbished homes will continue to achieve savings in their heating costs over the average life-time of the refurbishment measures (an assumed average of 30 years). While in 2010 the estimated savings will be €67, 308 million, this will increase to €85.9 million EUR by 2036\(^6\).

In addition, research shows that in 2005 around 55.3 kg/m\(^2\)a CO\(_2\)e were saved per subsidized m\(^2\) of floor space of one and two family houses while in 2007 the figure is 47.5 CO\(_2\) kg/m\(^2\)a (see Table 12).

Table 13 shows the savings in final energy that were also achieved.

**Table 12: CO\(_2\) reduction in German buildings 2005-2007**

<table>
<thead>
<tr>
<th>CO(_2)e reduction per subsidized residential unit</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single/Double Family home</td>
<td>Ca. 6.8 t/a</td>
<td>Ca. 7.3 t/a</td>
<td>Ca. 4.2 t/a (grants)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ca. 6.1 t/a (loans)</td>
</tr>
<tr>
<td>Multi-family Home</td>
<td>Ca. 4.3 t/a</td>
<td>Ca. 3.9 t/a</td>
<td>Ca. 2.9 t/a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CO(_2)e reduction per m(^2) floor space</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single/Double Family home</td>
<td>55.3 kg/m(^2)</td>
<td>58.5 kg/m(^2)</td>
<td>35.4 kg/m(^2) (grants)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>47.5 t/a (loans)</td>
</tr>
<tr>
<td>Multi-family Home</td>
<td>61.1 kg/m(^2)</td>
<td>50.8 kg/m(^2)</td>
<td>41.2 kg/m(^2)</td>
</tr>
</tbody>
</table>


\(^6\) The savings are calculated from 2006 for 30 years as measures carried out in 2005 will first achieve savings in the following year. 30 Years is the average estimated life-time of the refurbishment measures. The savings are given in inflation-adjusted 2007 EUR.
Table 13: Savings in final energy in the German building sector

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final energy saving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per subsidized residential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Double Family home</td>
<td>Ca. 13,200</td>
<td>Ca. 15,100</td>
<td>Ca. 14,700</td>
</tr>
<tr>
<td></td>
<td>kWh/a</td>
<td>kWh/a</td>
<td>kWh/a</td>
</tr>
<tr>
<td>Multi-family Home</td>
<td>Ca. 7,900</td>
<td>Ca. 8,300</td>
<td>Ca. 8,000</td>
</tr>
<tr>
<td></td>
<td>kWh/a</td>
<td>kWh/a</td>
<td>kWh/a</td>
</tr>
<tr>
<td>Final energy saving</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per m² floor space</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Double Family home</td>
<td>107 kWh/a</td>
<td>121 kWh/a</td>
<td>125 kWh/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(grants)</td>
</tr>
<tr>
<td>Multi-family Home</td>
<td>111 kWh/a</td>
<td>107 kWh/a</td>
<td>113 kWh/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(loans)</td>
</tr>
</tbody>
</table>


6.2.2 The German Energy Saving Regulation (EnEV)

The effects of the EnEV were evaluated in a 2006 report, which did not include the 2007 amendment, aimed at broadening the scope of the regulation to other building stock rather than introduce any major changes in its direction or application.

One of the main challenges was determining the extent to which the required measures within the EnEV were actually implemented. Earlier research assumed the implementing deficit of the EnEV was anywhere from 0% - 25%. Further research is necessary to learn the actual deficit levels and how to increase efficiency in implementation. The latest amendment due come into force in 2009, plans to reduce energy consumption in new buildings by 30%. With an implementation deficit of 25%, this reduction would cover the amount of energy that had failed to be saved in previous drafts but will, in effect, achieve very little in the way of further reductions. The deficit in the implementation of the EnEV implies energy saving on the basis of the 2002 EnEV of about 5,300 GWne and CO2 reductions of about 1.05 million tonnes are theoretically possible by 2012. With some allowed exceptions and assuming an implementation deficit of 25%, the maximum realistic energy saving potential of the EnEV has been estimated at 2,300 GWne with reductions of 450,000 tonnes of CO2 per year by 2012. The regulations on heating systems will save a further 0.75 – 1.0 million tonnes. This suggests a total saving of 5.7 – 5.95
million tonnes CO\textsubscript{2}, however, this data needs to be compared to the expected rise in emissions of the residential building stock, estimated between 6.97 – 8.53 million tonnes CO\textsubscript{2} by 2012.\textsuperscript{7}

To date, the lessons derived from the implementation of the EnEV and energy efficiency measures highlight efforts need to be drastically improved to address future projections. Underscored is the need to ensure policies are enforced, incorporating monitoring and mandatory controls as well as enhancing the amounts and forms of financial assistance and incentives, improving awareness and training opportunities and promoting legislative changes to allow energy saving contracting to play a larger role.

Germany's impact on the EU’s 20-20-20 targets has been outlined in the integrated climate and energy package and projects a total of 219.4 Mt CO\textsubscript{2} will be saved, of which 28.9 % will be achieved through the use of renewables (24.8% for electricity and 4.1% for heating) and 14.1% through building refurbishment and the renewal of heating systems. A further 6.5% is to be saved through cogeneration while related areas include energy savings through energy efficient products, smart metering and the replacement of electric storage heaters (11.6%). This amounts to almost two-thirds of the intended savings. The remainder will come from the renewal of fossil fuel power plants (6.8%); transport related measures (15.3%) and reductions in other greenhouse gases (16.6%). This is a total reduction of 36% compared to the base year, with Germany’s goal being a reduction of 40%. Within the context of EU energy policy Germany must reduce its greenhouse gas emissions by 14% compared to 2005 levels while at the same time increasing its use of renewables to 18%. According to the predictions contained in the progress reports Germany will meet its Kyoto targets by 2012, and with “additional measures” predictions are incorporated, Germany is estimated to overshoot its objectives by 58 Mt CO\textsubscript{2e}\textsuperscript{8}.

6.3 Italy

In the last five years, Italian national and regional authorities have set a wide range of measures directed at promoting energy efficiency measures in the civil sector. Key elements of the policies include stricter energy requirements, energy performance certification, and green and white certificates making up


some of the fiscal incentives. However, the proper implementation of these measures has been slowed down due to bureaucratic and regulatory barriers. In particular, the delay of approving the technical Decree on national calculation methods and of the national guidelines on energy certification has hindered the enforcement of the buildings energy performance legislation and has resulted in fragmented application among regions.

Transparent and clear articulation of national, regional and local regulations is essential and has become a priority to avoid public disengagement and scepticism with energy policies. Signs of Italy’s citizenry perceiving energy certification as a bureaucratic and complex initiative rather than useful instrument intended to provide economic and energy savings is an important warning to policy makers to improve their processes. Already, disparities in implementation and enforcement on the provincial level have in cases reduced the impact of the energy efficiency policy. The potential for greater impact has been suggested by moving building codes from fabric item specific U-values to an overall maximum-design CO2 emission value, thereby allowing builders the flexibility in meeting the new targets in more cost efficient ways. Similarly, increased awareness of the targets and better understanding of sustainable building technologies within the industry would allow policy directives to be translated into practical application by the construction industry.

6.3.1 Policy Impact to Date

It is premature to fully assess the recently adopted set of energy efficiency policies in the building sector as in large part their effectiveness depends upon how the regional governments manage and monitor their implementation. However, the 2007 Italian National Energy Efficiency Action Plan (NEEAP) presented their energy saving impact (Gigawatt hour/year) presented in Table 14 below. This shows that the largest savings are to be expected from the use of more efficient heating systems and the thermal insulation of pre-1980 residential buildings. Other significant contributions will come from replacing traditional light bulbs by more energy efficient lighting systems and from the replacement of refrigerators and freezers.
Table 14: Impact of energy efficiency improvement measures in Italy

<table>
<thead>
<tr>
<th>Energy efficiency improvement measures</th>
<th>Annual energy saving expected in 2010 [GWh/year]</th>
<th>Annual energy saving expected in 2016 [GWh/year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Sector:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Thermal insulation of opaque surfaces of pre-1980 residential buildings</td>
<td>1) 3439</td>
<td>1) 12000</td>
</tr>
<tr>
<td>2) Replacement of single glazing by double glazing</td>
<td>2) 233</td>
<td>2) 930</td>
</tr>
<tr>
<td>3) Replacement of incandescent lamps (GLS) by fluorescent (CFL)</td>
<td>3) 1800</td>
<td>3) 4800</td>
</tr>
<tr>
<td>4) Replacement of dishwashers by class A appliances</td>
<td>4) 305</td>
<td>4) 1060</td>
</tr>
<tr>
<td>5) Replacement of refrigerators and freezers by class A++ appliances</td>
<td>5) 1210</td>
<td>5) 3800</td>
</tr>
<tr>
<td>6) Replacement of clothes washing machines by superlative class A appliances</td>
<td>6) 31</td>
<td>6) 410</td>
</tr>
<tr>
<td>7) Replacement by efficient electric water heaters</td>
<td>7) 700</td>
<td>7) 2200</td>
</tr>
<tr>
<td>8) Use of efficient air conditioners</td>
<td>8) 100</td>
<td>8) 540</td>
</tr>
<tr>
<td>9) Use of efficient heating installations</td>
<td>9) 5150</td>
<td>9) 28750</td>
</tr>
<tr>
<td>10) Balanced flues and wood-fired boilers</td>
<td>10) 1100</td>
<td>10) 3450</td>
</tr>
<tr>
<td><strong>Total Residential Sector</strong></td>
<td><strong>16,998</strong></td>
<td><strong>56,830</strong></td>
</tr>
<tr>
<td>Tertiary Sector:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Use of efficient heating installations</td>
<td>1) 5470</td>
<td>1) 16900</td>
</tr>
<tr>
<td>2) Incentives for using efficient air conditioners</td>
<td>2) 535</td>
<td>2) 2100</td>
</tr>
<tr>
<td>3) Efficient lamps and control systems</td>
<td>3) 1400</td>
<td>3) 4300</td>
</tr>
<tr>
<td>4) Efficient lamps and luminous flux regulating systems (public lighting)</td>
<td>4) 425</td>
<td>4) 1200</td>
</tr>
<tr>
<td><strong>Total Tertiary Sector</strong></td>
<td><strong>8,130</strong></td>
<td><strong>24,700</strong></td>
</tr>
</tbody>
</table>

Table 15 below presents the CO2 mitigation impacts of the energy efficiency measures on the building sector as valuated by the 2007 Italian Fourth Communication under the Framework Convention on Climate Change (million tonnes of carbon dioxide equivalent)

Table 15: CO2 mitigation impact in Italy

<table>
<thead>
<tr>
<th>Estimate of mitigation impact, by gas Mt CO2 eq</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Regulations (EPBD):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentives to the energy efficiency in Buildings (Budget law 2007)</td>
<td>2,64</td>
<td>5,31</td>
<td>8,71</td>
</tr>
</tbody>
</table>

Whereas the white certificates system was already included in the trend scenario contained in the NEEAP, the system extension and reinforcement adopted in 2007 together with the measures directed to promote the use of renewable energy source was evaluated as follows:
Table 16: CO2 mitigation impact of White Certificates

<table>
<thead>
<tr>
<th></th>
<th>Estimate of mitigation impact, by gas MtCo2 eq</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
</tr>
<tr>
<td>White certificates (extension to 2012 and 2020): End-use efficiency and energy services policies and energy efficiency standards</td>
<td>1.81</td>
</tr>
<tr>
<td>Energy efficiency policies such as diffusion of renewable energy sources</td>
<td>8.75</td>
</tr>
</tbody>
</table>

These forecasts assume the progressive implementation of the recently adopted measures and the application of all the planned supportive policies.

Regulatory measures imposing stricter construction standards have contributed to a progressive reduction of the primary energy consumption of new buildings. A survey conducted by the Energy Certification Centre in Lombardy Region demonstrated buildings constructed between the years 1993-2006 (as the first energy construction standards were implemented) to have a primary energy consumption of 35% less compared to the buildings constructed between the years 1961/1976 (which consumed approximately 220 kWh/m2). The survey demonstrated the buildings constructed after the implementation of the EPBD have an average primary energy consumption of 120 kWh/m2/year.

A key challenge in Italy is the aging state of the Italian building stock.

Figure 7: Residential Buildings per construction period (%)

In the residential sector, the 2001 census reported approximately 7.000.000 buildings were built before 1973, with approximately 3.000.000 between 1972-1991, and merely 761.000 buildings built after 1991. The significant quantity of the existing buildings coupled with the tendency to preserve such stock has required energy policies to include energy efficiency criteria for renovation work as a fundamental element. The Economic and Social Research Centre for the Construction and Land Use Market (CRESME) in the paper entitled ‘The
market Construction at 2010’ (L. Bellinci) reports that in 2001, the largest share of public and private investment (60%) of the construction sector was directed towards renovation projects (43%) and maintenance works (17%) whereas new construction attracted only 40% of the investment, reflecting an indicative change in the market compared to the 1960/70s when the majority of investment went into new buildings.

The first results on the energy performance certification requirement of the EPBD are available for the region of Lombardy which was first to regulate, with the adoption of local legislation, and institution of the procedure and monitoring of the certification process. The local focal point (CENED Certificazione Energetica Edifici), reported in the first year and half of implementation the web site received more than 5,800 contacts, registered 8,000 qualified experts, and recorded a continuously increasing number of certification requests. The CENED survey conducted on the provision of 1,000 certificates, recorded an average energy consumption for heating in the Lombardy region to be 180 kWh/m²a, corresponding to an Energy Class G, and confirming the general and national picture of an old and energy inefficient building stock.

The 2007 and 2008 Finance Acts (Law 296/2006 and Law 244/2007) were instrumental in putting forth economic incentives for energy savings in the household sector, despite related legislation dating back to 1998. In particular, the 2007/8 Acts, provided a tax credit equal to 55% of the costs of enhancing energy efficiency through heating system upgrades, retrofitting of the building envelope and small building renovations amortized over a period of 10 years. This policy measure implemented by the National Agency for New Technologies, Energy and the Environment (ENEA) published its results after the first year of implementation during which 29,000 requests for the application of the tax credit were received for 2007. ENEA estimated average costs of € 8,800 per refurbishment for energy efficient measures translated into primary energy savings equal to 5MWh per year, and thus a mitigation of approximately 1,1T/ year of CO2 per one household. The demand for such incentives recorded 14,000 applications (nearly 50% of the total) in electronic format, the vast majority of which were from the northern regions (Lombardy 21%, Veneto 15%, Emilia Romagna 11%, Piemonte 9%, Friuli Venezia Giulia 7%, Toscana 6% and Lazio e Sardegna 5%, Calabria, Basilicata and Molise less then 0,5%). The applications were foremost for retrofitting activities involving windows substitutions (35%), heating system upgrades (28%), installation of photovoltaic systems (25%) while a minority concerned mix interventions (11%) and the requalification of the entire buildings (1%). In addition at both national and regional levels, initiatives to support the construction of highly efficient new buildings have been started, including a tax credit of up to 55% for buildings and complexes with a total volume exceeding 10,000 cubic metres that achieve an annual primary energy limit per square metre at least 50% lower than the values set by law.
The French National Energy Efficiency Action Plan (NEEAP) identifies demand-management in buildings as one of its key priorities, with an overall aim of reducing GHG emissions by a factor of four by 2020. In turn, the National French Federation for public buildings and French Building Federation have welcomed the coherence of the European and national plans in favour of a sustainable building industry. The Grenelle de l’environnement, a key environmental initiative, initiated by the national government in August 2007, promoted a multi-sector public dialogue to solicit input on a full range of environmental issues aimed at addressing the climate change agenda, including a building sector element. However, the lack of a pronounced role for buildings, promoted civil society reaction resulting in several counter manifestations organized as “contre-grenelle” in October 2007, denouncing the governmental measures as being insufficient. Nevertheless, the “Grenelle de l’Environnement” at set ambitious targets such as a requirement for all new construction to be “net zero energy” as of 2020.

Since 1975, French policy has emphasized the following three types of programmes for improving the energy efficiency of existing buildings:

- Information and advice aimed at encouraging households to carry out energy saving improvements, in particular through a thermal diagnostic tool

- Regulation and standardization of heating systems, in particular regarding boiler performance as from 1975.

- Financial assistance, subject to various terms and conditions such as direct subsidies or tax incentives.

In the 2002 budget, building energy retrofits benefited from a tax reduction of 15% of expenses to a maximum of €8,000 per family.

Experience suggests that homeowners tend to spend smaller sums on less comprehensive improvements that are often not adequately efficient; an estimated 70% of energy efficiency investments cover mainly double-glazing (which is not the most efficient option), then door and wall insulation. The quality of the work is also often below the level required for energy-efficient buildings. In simulation analysis, solar PV is recognized as a key element in approaching zero net energy (WBSCD 2009).

The French have implemented the use of White Certificates as part of a three year pilot programme (2006-2009) to engage the involvement of all energy suppliers to meet specified consumption reduction targets. Suppliers have the flexibility to choose their activities in targeting their residential and tertiary client
base, including among others information campaigns, promotional and incentive programs. Suppliers not meeting the targets are subjected to fines of euro 0.02 per kWh over the targets. The programme aims to generate cumulated energy savings of 54TWh.

6.5 MURE Database Analysis – Household Sector

The MURE (Mesures d'Utilisation Rationnelle de l'Energie) database is a tool developed within the framework of the SAVE and 'Intelligent Energy - Europe' Programmes by a team of European experts, led and co-ordinated by ISIS (Institute of Studies for the Integration of Systems, Rome) and the Fraunhofer Institute for Systems and Innovation Research ISI (Germany) to show "demonstrable progress" as requested by the Kyoto Protocol. MURE provides information on energy efficiency policies and measures that have been carried out in the Member States of the European Union and is dependent upon a network of contacts within energy (efficiency) agencies established in all EU Member States to continuously update the database. In this respect, the following analysis conducted by ICCR as coordinator of the Eco-build, contains the caveat that only interpretation of available information was possible. ICCR chose to assess data only on the household sector of the total five data collection parameters of MURE, for its applicability to the building sector and Eco-build project. The MURE Database was one of the few centralized datasets identified by Eco-build that allowed for comparative analysis of the four target countries.

Legislation is instrumental to foster awareness and action towards a lower energy consuming society. National and local governments, often guided by EU policies, carry the primary responsibility and are looked upon by other sectors of society to set the cornerstone for energy policy in the broader sense and this context for the building sector. As a result of the EPBD and other related directives and regulations, a variety of policy measures have and are being employed by EU member states to address energy efficiency and consumption on the household level. The tracking of such policy measures comprises an important component to assessing the effectives of national energy policies.
According to MURE database in the household sector (see Figure 8), among the EU-27, Member States have on average 15 on-going policy measures implemented concurrently; a figure seemingly low on account of the status of the new Member States late start with policy implementation. Of the four target countries, according to MURE as of 2008, Austria was operating approximately 20 policy measures directed at energy savings for households, with no record of previously implemented or completed initiatives. Figure 9 below presents the types of policy measures in the household sector. Approximately 39% of Austria activities were legislative and regulatory in nature, followed by roughly 30% of activities dedicated to information and education, yet not necessarily related to the specific legislative norms. Limited measures (5%) were targeted to energy taxes in comparison to Germany where taxes were a significant (25%) policy component and equivalent in percentage to legislative elements. The data indicates Germany has the greatest number of policy measures underway with a total of 47 of which an estimated 1/3 have been completed, reflective of the country’s comparatively early start with energy efficiency initiatives for the household sector. Italy recorded 32 policy measures and France 26 with slightly less than 1/2 having been completed. Italy demonstrated a disproportional preference for legislative actions with more than 50% of total measures, yet they were not reinforced by either financial incentives nor enforcement controls, questioning the extent and impact of actual policy implementation.
In all four countries, financial measures, played an important yet not a predominate role relative to other policy measures, with the exception of Italy, where none were recorded. Information and education featured strongly among all the countries, whereas fiscal and tariff related policy measures were barely 5% in Austria and Italy, with none recorded in Germany, despite its heavy weighting on taxes. However, France was the exception with the most diversified portfolio of policy measures, and tariffs accounting for more than 20%.

Figure 9: Type of (ongoing) policy measures for households

Source: MURE Odyssee, IEE Project, May 2008

The database also provides a simulation modelling feature that provides a visualization of the impact of the policy measures, tailored to desired parameters. The radar graph, also known as a web chart, is used to assess the impact of all policy measures in each of the countries weighted over time.
For Austria, the radar graph illustrates the overwhelming impact of financial measures, largely in the form of subsidies for refurbishment of buildings, support for new construction, and grants for use of renewables, provided by the government authorities in very recent years and indicated as continuing into the future. Despite the significant investment (over 30% of total collected data) in information and education measures, such as training of building developers and chimney sweepers as climate ambassadors, the impact weighted over time, was not significant. Legislative measures, particularly those dating from the 1984-1993, involving heating system design standards, demonstrated relatively high impact together with cross-cutting measures, e.g.: energy taxes, yet only to 50% of the impact of financial measures, indicating the more important role subsidies play in the country.
In Germany, a series of legislative measures, implemented consequently since 1977, illustrate a resounding impact on energy consumption. Germany's early start with legislating standards for thermal insulation and heating systems and subsequent periodic amendments has led to a strong legislative cornerstone for addressing energy consumption in the building sector. Moreover, the coupling of legislative policies with financial measures illustrated in several cases have had impact of proportional nature and reinforced the effectiveness of such policies and their parallel approach. Financial measures led predominately by the national bank, KfW, targeted assistance to the modernization of existing homes with the aim of reducing CO2 emissions as well as advocating the utilization of renewable energy technologies, e.g.: solar. Energy taxes, categorized as cross-cutting measures, and introduced in the years 1994-2003 were also quite effective on a weighted basis.

Radar Chart - Germany
The radar graph of France illustrates a more proportional impact of the various policy measures weighted over time. Similar to Germany, France’s legislative measures displayed an early historical impact involving standards for building insulation, yet to a lesser extent in more recent years. Although France has offered substantial financial measures and incentives, it has been rather the use of fiscal/tariffs measures, specifically VAT tax reductions for energy investments and tax credits for efficiency renovations and renewable technologies that has resulted in the greatest impact over time. Such measures have been implemented in subsequent periods and often concurrently with legislative acts. Financial measures have had a low impact despite their propensity, and particularly those earmarked for specific technologies, e.g.: wood and solar. In recent years (period 2004-2013), there has been a noticeable policy change, with a reduction in the number of fiscal/tariffs measures and an increase in information initiatives, resulting in an impact of almost 45% for legislative awareness efforts, such as energy performance audits. Examples of individual, not weighted, measures with high impact included local energy information centres and the advertising campaign ‘faisons vite ca chauffe’.

Radar Chart - France
Italy's greatest policy impact on a weighted basis is recorded by far in the use of legislative information during the period 1994-2003, straddled by legislative measures in the prior and subsequent periods. However, on an individual basis, legislative information registered a low impact such as energy labeling for equipment and appliances. In recent years (period 2004-2013), financial incentives have complemented the use of fiscal/tariff measures to produce a moderate impact. A relatively large number of legislative efforts during the same period, involving regulations for heating and cooling systems and corresponding inspections, standards for efficient lighting as well as solar energy requirements, have reinforced earlier legislative acts and paved the way for greater energy savings.

Radar Chart - Italy

In a comparative analysis of the data of the four countries, it can be seen the legislative framework for energy saving policies in the building sector started earliest in Germany and France during the period 1974-1983, with often reinforcing policies in following years. This consecutive legislative approach was bolstered by supporting financial measures resulting in higher impact levels in the two countries. These efforts to some degree to correlate with both countries better performance in meeting their Kyoto targets. Austria and Italy share a similar profile with legislative measures commencing in later periods and thereby not benefiting from high impact levels due to the lack of a legislative framework. The target audience among the four countries also displayed some parallels with emphasis varying between the general public and
property owners. Germany largely concentrated its measures on landlords and owner-occupants as was the case in Austria, with the additional greater focus on housing associations in the latter. Relatively, the impact of measures on owner-occupants proved higher in Austria, possibly due to the pronounced provision of subsidies. France and Italy dedicated greater attention to the general public as a key target group, followed by owner-occupants in both countries. France’s overwhelming emphasis on targeting civil society relative to others groups, resulted in a mixed impact, whereas all of Italy’s public initiatives were assessed with low impact. In all countries, tenants were among the least targeted groups, raising the question of how best to address the issue of split incentives or landlord-tenant dilemma and challenge of developing strategies for changing end-user behaviour.

6.6 Effectiveness and impacts: conclusions

The previous sections presented the impact of policy measures in Austria, Germany, France and Italy. In general, harmonization and integration of European legislation at multiple levels, involving a number of directives and regulations, is contributing more effectively to improving overall energy saving in the building sector and achieving the 20-20-20 targets in a timely manner. Well structured national policy measures, reinforced with enforcement and incentive mechanisms, and coupled with increased public awareness form the cornerstone of a successful framework to reduce energy consumption and foster a progressively sustainable energy market.

The specific cases of the four countries in this study, however, shows that the national policy regimes differ widely both in terms of the numbers of policy measures and their types and areas of intervention. Each country emphasizes different aspects with France concentrating more on information and awareness raising, Austria and Italy on subsidies and incentives and Germany on legislative standards for thermal insulation and heating systems. This is not to say that, for example, France has not subsidy schemes but it highlights the most remarkable difference in the distribution and focus of policy measures.

Bilateral comparisons between countries highlight some interesting results regarding consumer reactions to financial incentives. For example, while subsidies in the order of below €100/m² are sufficient in Austria to trigger large scale energy efficiency investments by private households subsidies of well above €100/m² do not lead to a similar reaction in France.

A further difference between the countries is the distributions of priorities between new and existing buildings. All countries are slowly moving towards prioritizing the refurbishment of the existing stock and away from the more
traditional support for the construction of new buildings. Germany appears to be most advanced in this respect.

The impact of the requirements of the EPBD for energy performance certification appears to be negligible so far in all four countries. However, experts interviewed for this study have claimed that the effects of mandatory certification will only be seen in coming years when an EPBD recast and corresponding national legislation ensure the mandatory publication of energy efficiency certificates for each sale of rental of a building or apartment.

Complementary to addressing the EU obligations, the four target countries have taken additional steps to strengthen their focus on the building sector. The four countries are party to the International Energy Agency's Implementing Agreement on Energy Conservation in Buildings and Community Systems (ECBCS), which focuses its work on ways to improve energy efficiency in buildings with an emphasis among others on developing techniques to analyze how energy use in buildings impacts on the interior, local, regional and global environments, the optimization of building envelopes, advancement of local energy planning, and enhancement of ICT use and design tools.
7 Conclusions and recommendations

This report addresses the context and main policy initiatives for energy efficiency in the building sector in Austria, France, Germany and Italy. It presents the background in terms of energy consumption and building stock as well as the European policy context in which developments are currently taking place. Finally it illustrates the impact of certain policy measures and incentive schemes.

The main findings of the report relate to the importance of the building sector to reaching European and national goals for Greenhouse Gas reductions and the (relative) success of certain initiatives on the national level.

The following paragraphs present the main conclusions of the analysis undertaken for this report.

7.1 Policy Needs and Implications

Integrated and mutually supporting legislation is instrumental to foster substantial and long term impact in the building sector by nature of its complex and inter-linked position in the man-made and natural environments. Buildings are multi-dimensional in their planning, construction, and management, and therefore warrant policies and actions that incorporate life-cycle and multi-disciplinary inputs to ensure cost effective, energy efficient and sustainable results. Attaining the necessary and higher levels of energy savings require policies structured with a long term horizons and ambitious targets coupled with strong political leadership to ensure strategic consistency and fiscal support. Similarly, policy amendments should be reinforcing and advancing, building upon and correcting for previous experiences, to better penetrate the industry and related sectors. The earlier legislative initiatives developed by France and Germany established the foundations, particularly in thermal insulation and energy performance standards, have had broader implications in related sectors and resulted in favourable impacts evidenced by their respectively good ratings in reducing their carbon footprints.

Strong national frameworks with supporting mechanisms for information dissemination, enforcement and monitoring are essential for promoting a unified and sustained policy impact. Foreseeing regional interpretations and ensuring transparency in national objectives is essential to guide regional and local policymakers towards uniformity when transposing EU legislation into local implementing regulations. Dissemination of information on legislative acts from the national levels to local and regional governments on a timely basis and with clarity of intention and division of responsibility helps mitigate potential problems.
of competencies and implementing authorities and ensures a harmonized policy position. Moreover, mutually supporting policies that, for example, set specific energy targets, yet with the flexibility to be met by passive measures and/or renewable technologies provide for important degrees of freedom, particularly vital in countries with strong regional authorities and local interests.

Monitoring and enforcement of building policies such as the energy performance certificate is necessary to ensure compliance and determine long term impact value. Currently, in Austria the certificate is only effective in regards to receipt of public subsidies but not officially enforced during property transactions. For the real estate market to fully recognize the new regulatory measure and society to value energy efficiency, enforcement mechanisms including penalties would be necessary yield more near term results.

### 7.2 Incentive Mechanisms

Policy must be complemented with incentives, particularly financial schemes, to have significant and sustained impact. This is more so the case in addressing existing structures rather than new buildings that can be planned and budgeted with energy saving standards from the onset. Encouraging refurbishments on a large scale to impact national carbon footprints require financing from both public and private sources, and can benefit both sectors through increased employment and economic activity in addition to energy savings.

The strong correlation between availability of subsidies and energy efficient retrofits provide governments the opportunity to link ambitious energy saving targets to financial assistance.

Learning from the recent Austrian experience of rapid absorption (less than 4 months) of €100 million in subsidies for thermal refurbishments, national policy targets can play a determining role in advancing the EBPD implementation even beyond EU criteria. The lack of inclusion of CO2 emissions levels on the Energy Performance Certificate is a weakness of the EPBD that national and regional governments can address, for example, by setting performance targets equivalent to the impact potential of CO2 emissions reductions and similarly subsidy levels. Such action would help raise awareness at the level of the general public and as importantly within the construction industry. In this respect, prioritizing policy measures that address existing building stock over new construction offer the greatest impact potential for reducing energy consumption levels.

Encouraging private household investment in energy efficiency requires offering short term and long terms benefits that raises individual utility as well as overall social welfare. The latter can be measured in reduced CO2 emissions through
the impact of refurbishment programs as seen in the German case and highlights the value of public investment. Individual short-term household benefits are predominately evident in reduced monthly utility bills which represent their payback on investment over time. However, it is the initial out of pocket investment that is often the greatest obstacle both for households and property owners alike in the case of refurbishment and requires incentive mechanisms to reduce the financial burden.

Various schemes have been preferred by the different countries, among them tax credits, including income tax and VAT reductions for investment and equipment, which have had high impact in France. Moreover, France offers a feed-in tariff for solar PV at five times the retail price of electricity (WBCSD 2009) denoting the type of incentives that can effectuate positive industry and household behavioural change. Public financial incentives such as subsidies and grants able to be leveraged by private instruments such as ‘green’ loans or lines of credit are important to reduce the short term financial investment and amortize the balance over time. More and innovative incentives, beyond deductions from taxable profits, are needed to address the issue of split incentives and allow landlords to realize the benefits of energy savings. The UNECE Committee on Housing and Land Management has proposed an ‘energy inefficiency tax’ as a means by which landlords with energy inefficient buildings are taxed until they meet energy performance standards. Such a scheme could also serve to impact the real estate and property management industries and bolster appreciation for and value of energy efficiency measures. Incentives that support an integrated and holistic approach to energy efficiency improvements, with proper sequencing for development processes, will serve to underscore the new path the building industry should pursue to maximize energy savings.

7.3 Role of Power Suppliers

Energy companies and utilities have an increasingly important role to play in energy consumption and savings on a global level. Their power generation capacities and network infrastructure form the backbone of productive economies and the cornerstone of living standards. Yet, in the current global environment, it is essential that power companies adopt a new energy paradigm that conveys a realistic valuation of energy costs (fully incorporating externalities, i.e.: GHG emissions) and embrace modern technologies to effectively control and modulate the varying energy consumption levels of society and more so of buildings.

Policy measures are essential to change the energy suppliers’ business as usual scenario of selling as much energy as possible to one that aims at maximizing energy efficiency and promoting awareness of energy consumption.
The EU Energy Services Directive (2006) is premised in these goals and promotes complementarity with the Buildings Directive, with emphasis on the use of the energy performance certificate and energy audits. Countries such as France and Italy have made good use of White Certificates to mandate energy suppliers to meet specified energy targets and work with their customer base, predominately in the residential sector to foster efficiency behaviour. France also levies an energy tariff on suppliers that fail to meet their targets reinforcing the important role power companies must play in reducing energy consumption.

Partnerships between energy suppliers and the building industry offer new opportunities to advance energy savings by participating in integrated design teams. Such cooperation would allow suppliers to meet their mandated efficiency targets and property developers at an early stage to assess best use of energy saving technologies, including smart metering, PV systems and the like. The benefits offered by new technologies exist on both ends allowing energy suppliers to better assess load demand, gage performance and manage flow, while in turn, customers are better informed of their consumption levels, efficiency alternatives and pricing options. Similarly, more aggressive feed-in tariffs negotiated by regulators and utility companies will accelerate the use of renewable technologies in the building sector as well as the help realize the concept of buildings as power plants or energy producers.

For the building sector to achieve its forecasted potential for energy reduction, government policies need to be of global perspective yet nationally strong in implementation. National priorities must be weighed with global urgencies to strike an environmental equilibrium that complies with international commitments, e.g.: Kyoto, and while making use of burden sharing mechanisms employ serious measures to curb national emission levels.

7.4 Building Industry Practices and New Orientation

The building industry as Europe's biggest employer has a central role to play in fostering greater energy efficiency on a cognitive and practical level both in new and existing structures as well as in private and public ownership. Yet, the current fragmented nature of the industry compounds the challenge to communicate new practices and technologies across many skill levels, occupational trades and supply chains. Once again, public policies can set the framework for energy saving and as a major client (with 40% of total output) demand a higher level of performance by adopting green procurement practices and higher industry output standards. Also, legislating and employing models as energy efficient contracting have the potential for multiplier effect within the public and eventually private sector building inventories.
Presently, the technologies exist to ensure energy savings in multiple buildings types, evidenced by numerous demonstration projects as noted in the Eco-Build first deliverable, Concerto Initiative experiences, among others. In parallel, models and initiatives for the building industry have been developed to foster an integrated and energy saving approach in design and development, including life-cycle analysis, Building Information Model (BIM), Energy Efficiency Buildings (EEB - model of the WBCSD), Lead Market Initiative (EC). Such tools, particularly ICT enabled have been documented by the Climate Group (2008) to have the potential to reduce emissions from buildings by 15% by 2020. Moreover, the holistic and integrated approach offered by these tools aim to reduce communication errors among construction project participants, documented by the Europe Innova, STAND-INN Project, which registered building damage comprising 5% of each investment and increased construction costs of 25-30%. BIM, offering a common platform for communication, life cycle costing, energy efficiency analysis, supplier project information, end product simulation, among other outputs, prototypes the ideal seamless functioning of a sustainable and energy efficient industry. Whole-system design approaches, including both passive and active measures, can reduce energy use by as much as 70% (WBCSD 2009).

The task at hand is to encourage use of these methods by building professionals and practitioners on a wide scale providing the industry with a new orientation and focus. For this to occur technical training at various levels is necessary coupled by the ultimate institutionalization of such practices by vocational/trade schools, academic institutions as well as industry associations. The WBCSC Energy Efficiency in Buildings Report ‘Transforming the Market’ goes further to suggest the creation of a new industry trade of ‘system integrator’ to function as a facilitator among the various craftsmen, technicians and building professionals with the capacities to ensure the necessary synergies and energy efficient parameters are met. Such a position would be particularly valuable in refurbishment work, requiring the greatest energy efficiency measures, and could serve as a segway to encourage the industry to refocus its horizons on renovation rather than new construction.

7.5 Behaviour and Environmental Consciousness

Societal understanding and acceptance of the need for a paradigm shift in thinking towards reduced energy consumption and a new environmental consciousness are among the paramount challenges before all. Alone government leadership and commitment to this task continues to fall short of the level of seriousness essential to effectuate real change to meet the 20-20-20 targets and lesser so for the building sector. Yet from a policy perspective it is government leadership that offers the best avenues for advancement through legislation, fiscal support and broad-based information dissemination. A multi-
sectoral approach underlines the necessary strategy to penetrate the echelons of society in a manner that connects with the human emotional state, offers financial feasibility and ensures sustained energy security. Leadership among all sectors to mobilize higher energy awareness in government, business and civil society and in turn put forth respective, yet mutually reinforcing solutions, will help contribute to broader understanding and value of individual and collective action in light of the enormity of the task. Sustained media campaigns coupled with sectoral initiatives to demonstrate leadership through action need to become the modus operandi whereby refurbishments in public housing, commercial buildings and individual household units set examples for others to follow. With governments encouraged to lead by example under the EPBD Recast, the Display Campaign, http://www.display-campaign.org, is a cost effective tool available for use by local authorities to educate tenants on energy consumption and efficiency measures within their public housing stock. Similarly, it offers opportunity for data collection for local energy planning and prioritization of refurbishment actions among their inventory.

In raising the profile of energy use it is important to prevent against the ‘rebound effect’ that tends to offset energy efficiency gains in certain areas with increased consumption in the same or others areas, and may range in the residential sector between 10-40% (Sorell, 2007). The growing trend of consumerism for household appliances and electronics has reduced much of the efficiency gains in Europe has seen in the cases of Austria and Italy marked by higher levels of living comfort. Education and graduated energy tariffs are among the measures that may help stem the rebound effect, allowing consumers to react on the basis on efficient household practices and economic costs. Information centres in the case of the French experience, yet ideally structured as one-stop-shops, offering a comprehensive overview to household energy savings, can be effective venues to help practically help advance environmental consciousness and action.
References


The Climate Change Performance Index (2009), authors: Jan Burck, Christoph Bals, Simone Ackermann, December 2008, www.germanwatch.org/ccpi.htm


EWärmeG BW 2008: Gesetz zur Nutzung erneuerbarer Wärmeenergie in Baden-Württemberg; Renewable Heating Act; http://www.landesrecht-bw.de/jportal/?quelle=jlink&query=ErnW%C3%A4rmeG+BW+%C2%A7+8&psml=bsbawueprod.psm1&max=true


IEE project Odyssee-MURE, Energy Efficiency in Buildings - Improving the database


Revision to Austria's Climate Strategy to reach the Kyoto targets (Anpassung der Klimastrategie Österreichs, zur Erreichung des Kyoto-Ziels 2008-2012 Vorlage zur Annahme im Ministerrat am 21. März 2007), Vienna Austria, http://sitemap.lebensministerium.at/article/articleview/71847/1/7781/


Interview partners:


Günter Lang, Director, IG Passivhaus Österreich, Netzwerk für Information, Qualität und Weiterbildung Geschäftsführer -1020 Wien, Hollandstraße 10/46, Expert Interview, Tel.: 0650 / 900 20 40, email: office@igpassivhaus.at, www.igpassivhaus.at, April 2009

Marion Jaros, project manager, Wiener Umweltanwaltschaft (Environmental Ombudsmann), Expert Interview http://www.wua-wien.at, April 2009

Enrico.Rose, advisor, Austrian Ministry of Environment, Expert Interview Tel: 43.1.51522-1319, enrico.rose@lebensministerium.at, April 2009

Annex 1 – Country background data

Austria - EPBD: Maximum annual final energy consumption per m² of floor area

Residential - New:

<table>
<thead>
<tr>
<th>Period</th>
<th>Energy Consumption Formula</th>
<th>Maximum Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 31.12.09</td>
<td>(H_{\text{BGF, WG, max, Ref}} = 26 \times (1 + 2.0/l_c)) [kWh/m²a]</td>
<td>but not above 78.0 [kWh/m²a]</td>
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<tr>
<td>After 01.01.10</td>
<td>(H_{\text{BGF, WG, max, Ref}} = 19 \times (1 + 2.5/l_c)) [kWh/m²a]</td>
<td>but not above 66.5 [kWh/m²a]</td>
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Residential - Major Renovation:

<table>
<thead>
<tr>
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<th>Energy Consumption Formula</th>
<th>Maximum Consumption</th>
</tr>
</thead>
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<td>up to 31.12.09</td>
<td>(H_{\text{BGF, WGSan, max, Ref}} = 34.0 \times (1 + 2.0/l_c)) [kWh/m²a]</td>
<td>but not above 102.0 [kWh/m²a]</td>
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<tr>
<td>after 01.01.10</td>
<td>(H_{\text{BGF, WGSan, max, Ref}} = 25.0 \times (1 + 2.5/l_c)) [kWh/m²a]</td>
<td>but not above 87.5 [kWh/m²a]</td>
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<tr>
<td>Non-Residential</td>
<td>–</td>
<td>New:</td>
</tr>
<tr>
<td>-----------------</td>
<td>---</td>
<td>------</td>
</tr>
<tr>
<td><strong>up to 31.12.09</strong></td>
<td>$\text{HWB}^*V_{,\text{NWG, max, Ref}} = 9.0 \times (1 + 2.0/\text{lc}) \text{[kWh/m}^3\text{a]}$</td>
<td>but not above 27.00 [kWh/m$^3$a]</td>
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<td><strong>after 01.01.10</strong></td>
<td>$\text{HWB}^*V_{,\text{NWG, max, Ref}} = 6.5 \times (1 + 2.5/\text{lc}) [\text{kWh/m}^3\text{a]}$</td>
<td>but not above 22.75 [kWh/m$^3$a]</td>
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<th>Non-Residential</th>
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<th>Major Renovation:</th>
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<tr>
<td><strong>up to 31.12.09</strong></td>
<td>$\text{HWB}^*V_{,\text{NWGsan, max, Ref}} = 11.0 \times (1 + 2.0/\text{lc}) \text{[kWh/m}^3\text{a]}$</td>
<td>but not above 33.0 [kWh/m$^3$a]</td>
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<td><strong>after 01.01.10</strong></td>
<td>$\text{HWB}^*V_{,\text{NWGsan, max, Ref}} = 8.5 \times (1 + 2.5/\text{lc}) \text{[kWh/m}^3\text{a]}$</td>
<td>but not above 30.0 [kWh/m$^3$a]</td>
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### Austria - U values (heat transfer coefficients)

<table>
<thead>
<tr>
<th>Building component</th>
<th><strong>U</strong> value</th>
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<tbody>
<tr>
<td><strong>External WALLS</strong>&lt;br&gt;Small WALL areas facing the external air (e.g. in the case of skylights) which do not account for more than 2% of the walls of the building as a whole which face the external air, provided ÖNORM B 8110-2 (absence of condensate) is observed.</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>DIVIDING WALLS between residential or commercial units</strong></td>
<td>0.90</td>
</tr>
<tr>
<td><strong>WALLS facing unheated parts of the building which are to be kept free from frost (with the exception of roof voids)</strong></td>
<td>0.60</td>
</tr>
<tr>
<td><strong>WALLS facing unheated roof voids or those that have not been extended</strong></td>
<td>0.35</td>
</tr>
<tr>
<td><strong>WALLS facing other structures along the boundaries of plots of land or building sites</strong></td>
<td>0.50</td>
</tr>
<tr>
<td><strong>WALLS AND FLOORS WHICH ARE IN CONTACT WITH THE GROUND WINDOWS, FRENCH WINDOWS, GLAZED or UNGLAZED DOORS (relative to the test standard measure) and other vertical TRANSPARENT BUILDING COMPONENTS facing unheated building parts</strong></td>
<td>0.40</td>
</tr>
<tr>
<td><strong>WINDOWS and FRENCH WINDOWS in residential buildings facing the external air (relative to the test standard measure)</strong></td>
<td>2.50</td>
</tr>
<tr>
<td><strong>Other WINDOWS, FRENCH WINDOWS and vertical TRANSPARENT BUILDING COMPONENTS facing the external air, GLAZED or UNGLAZED EXTERNAL DOORS (relative to the test standard measure)</strong></td>
<td>1.70</td>
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<tr>
<td><strong>ROOF WINDOWS facing the external air</strong></td>
<td>1.70</td>
</tr>
<tr>
<td><strong>Other TRANSPARENT BUILDING COMPONENTS facing the external air, horizontally or at an angle</strong></td>
<td>2.00</td>
</tr>
<tr>
<td><strong>CEILINGS facing the external air, roof voids (thoroughly aired or not insulated) and above passages as well as SLOPING ROOFS facing the external air</strong></td>
<td>0.20</td>
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<tr>
<td><strong>INTERNAL CEILINGS facing unheated parts of buildings</strong></td>
<td>0.40</td>
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<tr>
<td><strong>INTERNAL CEILINGS facing separate residential and commercial units</strong></td>
<td>0.90</td>
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**- Italy – Matrix of most important regulations**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Prompted by</th>
<th>Content</th>
<th>Implementation</th>
</tr>
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<tbody>
<tr>
<td>M.D. 27th July 2005</td>
<td>Ministry of Infrastructure</td>
<td>Law on the National Energy Plan promoting energy efficiency and energy savings - implementation art.10 L.10/91</td>
<td>National /Regions</td>
</tr>
<tr>
<td>L.n.296/2006 ( Budget law 2007)</td>
<td>Government</td>
<td>Municipal building regulations making the issue of a construction licences subjected to installing photovoltaic solar panels for producing not less than 0.2kw per housing unit</td>
<td>Government, Local Authority</td>
</tr>
<tr>
<td>Decrees 20th July 2004</td>
<td>Ministry of Productive Activities and Ministry of Environment</td>
<td>Introduction of the 'White Certificate' system: setting the obligation on electricity and gas distributors with more than 10,000 customers in 2001 to achieve the primary energy saving target of 2.9Mt toe per year though the implementation of energy savings projects in all energy end use sectors.</td>
<td>AEEG, GME and electricity and Gas distributors</td>
</tr>
</tbody>
</table>
Annex 2 – Proceedings of 2nd Ecobuildings Workshop, 5-6 March 2009

See separate Annex 2 document. This is also available for download from www.ecobuildings.info