



Sustainable and secure energy supplies

Status, targets and political & financial tools

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The Nordic Council of Ministers

was established in 1971. It submits proposals on cooperation between the governments of the five Nordic countries to the Nordic Council, implements the Council's recommendations and reports on results, while directing the work carried out in the targeted areas. The Prime Ministers of the five Nordic countries assume overall responsibility for the cooperation measures, which are co-ordinated by the ministers for cooperation and the Nordic Cooperation committee. The composition of the Council of Ministers varies, depending on the nature of the issue to be treated.

The Nordic Council

was formed in 1952 to promote cooperation between the parliaments and governments of Denmark, Iceland, Norway and Sweden. Finland joined in 1955. At the sessions held by the Council, representatives from the Faroe Islands and Greenland form part of the Danish delegation, while Åland is represented on the Finnish delegation. The Council consists of 87 elected members – all of whom are members of parliament. The Nordic Council takes initiatives, acts in a consultative capacity and monitors cooperation measures. The Council operates via its institutions: the Plenary Assembly, the Presidium and standing committees.

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Foreword

This booklet is intended to provide a common platform for discussions during the trilateral interparliamentarian conference on sustainable and secure energy supply 10-11 December 2004 in Oslo.

The Nordic Council, the Baltic Assembly and the Benelux Interparliamentarian Consultative Council decided to organise a joint conference on the very topical issue of energy. It is as important as ever before to discuss energy production, distribution and consumption. From a political point of view we see a number of different aspects of great importance which need to be addressed: Energy sources, energy efficiency, security of supply, consumer prices and the related production of gasses affecting climate are some of the more obvious approaches to the current problems. The whole discussion takes place under the umbrella of our mandatory challenge – to develop society's use of energy *sustainably*.

The eleven countries comprising the organising bodies of this conference have very different natural bases for their societies and they have chosen very different paths of development and energy supply solutions.

In order better to be able to understand the current situation of our common region the Conference Organising Committee has found it valuable to provide a comparison of the energy status and a review of the energy policies of the countries that is also reflected in the overall global energy discussion and EU policies.

The ECON Analysis AS consultancy company was asked to provide an outline of the situation. This booklet is the

result of their efforts. We very much welcome the study and underline that the views expressed do not represent the opinions or policies of any of the organising bodies.

It is our belief that the information will be found useful by the speakers and other participants at the conference, and that it will help us to better understand the differences between the countries. An understanding that we hope will lead to improved discussions and solutions to our common urgent challenge of developing a sustainable and secure energy supply for the benefit of our communities.

Looking forward to welcoming you to Oslo

On behalf of the three interparliamentarian bodies

Asmund Kristoffersen

Chairman of the Nordic Council Environment and
Natural Resources Committee, MP Norway

Külli Arjakas

Vice Chairman of the Baltic Assembly Environment
Protection and Energy Committee, MP Estonia

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List of Abbreviations

BAT	Best available techniques
CDM	Clean development Mechanism
CHP	Combined Heat and Power
EC	European Commission
ECCP	European Climate Change Programme
EMAS	Eco-Management and Audit Scheme
ETS	Emissions Trading Scheme
GDP	Gross domestic product
GHG	Greenhouse Gasses
IPPC	Integrated Pollution Prevention and Control
JI	Joint Implementation
MEUR	Million Euro
Mt	Million tonnes
Mtoe	Million tonnes of oil equivalent
MtCO ₂ e	Million tonnes of carbon dioxide equivalent
NAPs	National Allocation Plans
OPEC	Organization of the Petroleum Exporting Countries
P&M	Policies and measures
PSO	Public Service Obligation
R&D	Research and Development

RES-E	Renewably generated electricity
TGF	Testing Ground Facility
TPES	Total primary energy supply
UN FCCC	United Nations Framework Convention on Climate Change

1

Introduction

This report summarises the status and trends in promoting sustainable and secure energy supplies in the EU, with particular focus on the performance in Benelux, Baltic and Nordic countries including Iceland and Norway. The report deals with both the energy supply side and the energy demand side except the transport sector being outside the scope of this review.

This review has been prepared for the Nordic Council, the Baltic Assembly and the Benelux Inter-parliamentarian Consultative Council, who jointly wishes to address the challenges faced by their member countries.

1.1 Background

The EU Green Paper '*Towards a European Strategy for the security on energy supply*' (EU, 2000a), identifies some of the key challenges faced by the EU to change the current development leading to increased dependency on imported fuels, and with little geopolitical diversification in energy

imports. The business-as-usual scenario shows that import shares of energy consumption in the European Union will rise from the present 50% to 70% within 2030. More recent analysis basically confirms this conclusion and also concludes that the enlargement of the EU does not change this scenario significantly (EU, 2003f).

The Green Paper concludes further, that the EU will have to put special focus on regulating the demand side rather than the supply side as the options in the EU for regulation on the supply side is fairly limited. Finally, it points out that the EU will not manage to meet future and maybe even present commitments to reduce emissions of Greenhouse Gases (GHG) unless drastic measures are implemented. Areas that need to be addressed to change this scenario include, according to the Green Paper, the following:

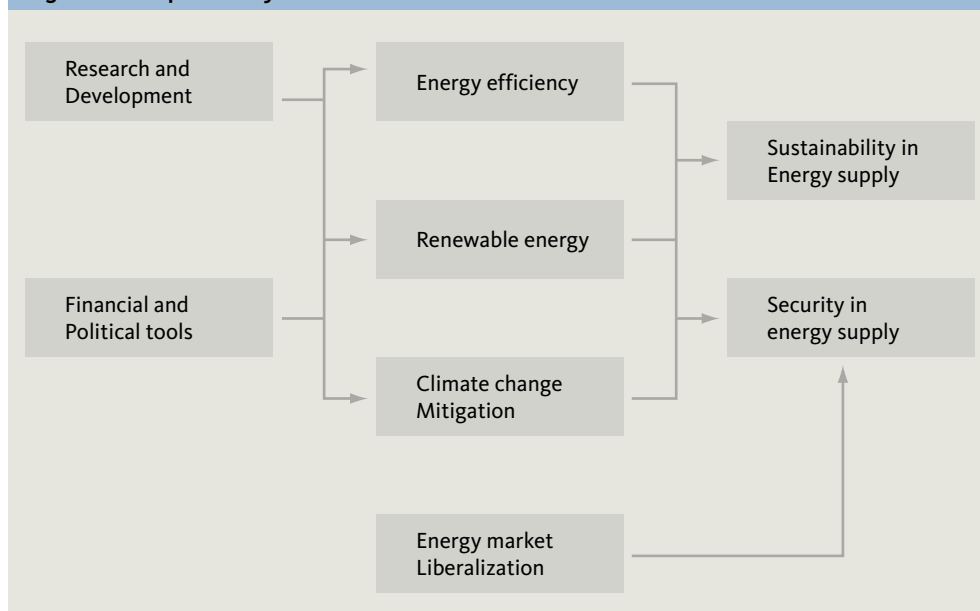
- Increased liberalisation of the internal market for gas and electricity;
- Introduction of fiscal instruments to spur changes in energy use;
- Securing market penetration of new technologies, in particular in transport;
- Introduction of measures to stimulate environmental friendly and energy efficient transport and to increase energy efficiency and utilisation of renewable energy sources in the building sector;
- Reinforced efforts to spur market penetration of renewable energy sources and research in nuclear reactor technologies including handling and storing of nuclear waste; and
- Reinforced oil storage policy measures and stimulate increased competition in the EU internal oil market, improve relations to countries exporting oil products to the EU-market and strengthening oil infrastructure (transmission).

In some areas, new efforts at Community and member state levels have been made to meet the challenges identified in the Green Paper. In this report, reviews are made on regulatory and other means provided by the European Commission (EC) and nationally by the Benelux, Baltic and Nordic countries.

1.2 Outline of the review

This review focuses on sustainable and secure energy supply applying an explanatory model illustrated in Figure 1.1 below.

Figure 1.1 Explanatory model



2

Findings

2.1 Dependency on energy imports

The economies in most of the countries studied in this review tend to increase dependency on energy imports. Except Denmark and Norway, the countries considered are net energy importers and their economies are projected to be increasingly relying on energy imports for the period 2000–2030. However, Luxembourg and Finland are projected to stabilise or slightly decrease their import dependency. Unlike the other countries, Denmark and Norway are net energy exporters, but the net level of energy export is projected to decrease. For Denmark, this will likely mean that the country will become a net importer of energy around 2010. The net energy export of Norway is projected to decrease to 500% in 2030 coming down from nearly 750% in 2000.

In 2020 OPEC is forecasted to cover 50% of the EUs need for oil. The present principal natural gas exporters to EU are Russia, Norway and Algeria. Gas imports from Iran and Turkmenistan will likely increasingly become important. The rate of dependence on gas imports from

Russia is likely to increase, as the consumption in the EU of natural gas is likely to increase substantially.

Decreasing dependency on energy imports and ensuring secure energy supplies therefore remains to be a challenge for most countries considered in this review as for the European Community.

2.2 Benchmarking

Liberalisation of energy markets is one measure to help securing energy supplies, RES-penetration being another as it may contribute to diversifying energy supplies. Third, the capability of reducing domestic GHG-emissions may also be taken as an indicator for securing sustainable energy supplies although GHG emissions does not entirely relate to energy supply and demand. When considering performances of the Baltic, Nordic and Benelux countries according to these three indicators it appears that further efforts are needed in many countries just to achieve the established targets.

The Baltic countries

In the Baltic countries significant progress is currently made to further open domestic energy markets according to EU-requirements. In Lithuania and Latvia the degree of liberalisation of power markets is quite high and exceeds that of Luxembourg and Belgium. The gas markets in Lithuania and Latvia are not as open as power markets, however, they are according to the European Commission (EC) to be considered as equally or nearly as open as the gas markets in Sweden and Luxembourg.

Table 2.1 Benchmarks and performance

	Liberalisation of energy markets in index points*		Distance to indicative RES-target in percent points**	Distance to Kyoto target in percent points
	Electricity	Gas		
Belgium	31.5	50	0–3	–23
Denmark	81.5	81.5	5–7	–38
Estonia	31.5	Na	In TPS the 2010 target 12% is mostly achieved already by now. RES based electricity consumption target to 2010 is 5.1%.	61
Finland	79	Na	5.5–10	–17
Iceland	Na	Na	No EU target	12
Latvia	62.5	25	Not available	50
Lithuania	62.5	25	Not available	46
Luxembourg	29	25	0.7–2.7	–6
Netherlands	62.5	50	3–4	–12
Norway	Na	Na	No EU target	–21
Sweden	62.5	12.5	0–5	3

Na = Not applicable;

* Based on benchmarking performed by the EC (see also section 7.2) where 100 is maximum score.

** The range between the optimistic and the realistic 2010-scenario according to EREF, 2004 (see also section 4.2)

No projections for the Baltic countries are available on renewable energy source (RES) penetration according to the EU indicative targets as set out. According to its indicative target Estonia is projected to reach 5.1% RES-share of total primary energy supply (TPES) in 2010 from 0.3% (2002). Latvia is to reach 49.3% (from 43% in 2001) and Lithuania to reach 7% (coming up from 3% in 2001).

Regarding Kyoto commitments, none of the Baltic countries faces any difficulties in meeting their green

house gas (GHG) emissions targets for the first commitment period 2008–2012. They are in fact projected to provide by far the largest over-delivery according to the targets under the EU-burden sharing agreement.

The Benelux countries

In the Benelux countries, electricity and gas markets are not yet fully opened. The Netherlands appears to be performing best in terms of implementing the relevant EU-directives, while Belgium and Luxembourg in particular, still have some way to go.

The Benelux countries may face difficulties in achieving their indicative targets for RES penetration in TPES – in particular the Netherlands, while Belgium and Luxembourg in the optimistic scenario are expected to reach targets and in the realistic scenario are foreseen to be 2.7 and 3 percent points behind the target.

Regarding targets for GHG-emissions reductions all three countries are behind their targets according to the EU burden sharing agreement and most significantly Belgium. However, the presented projections do not take into account the recently declared federal climate change strategy including the announced use of the Kyoto-project based mechanisms.

A specific opportunity for energy performance improvement lies in the instruments of benchmarking. Benchmarking energy efficiency (EE) of products and sectors is a starting point for the allocation of allowances in the Dutch National Allocation Plan (NAP) under the EU Emissions Trading Scheme (ETS), and partly of the Belgian one. This has raised much interest amongst other member states and the private sector. EU benchmarks (based on tCO₂/ton unit product or kCO₂/kWh) could become an important EU allocation method.

The Nordic countries

The domestic power markets in Sweden, Denmark and Finland are considered as almost fully open according to recent assessment by the EC on the EU internal energy markets, while improvements can still be made on the domestic gas markets. In Sweden and Norway the domestic gas markets are small and gas is not available in Iceland. The EU-gas directive does not apply to Finland or Norway.

In Iceland and Norway, RES already plays the dominating role in electricity supply. The remaining Nordic countries and in particular Finland appears to face difficulties in meeting the indicative EU-target for RES penetration, but also Sweden and Denmark will in the “realistic scenario” lack behind targets. However, it is likely that the very recent decisions in Denmark to further increase the RES-share will close the gap.

Regarding the Kyoto commitments, Iceland and secondly Sweden are performing best and are the only two of the Nordic countries where projections currently indicate that targets will likely be met with current and additional measures. Finland, Norway and in particular Denmark are significantly behind targets according to recent projections.

Degree of energy market liberalisation, RES penetration and GHG emissions reductions are three indicators for securing energy supplies. In summary, complying with Kyoto commitments and EU RES-targets appears to remain a challenge to most of the Nordic and Benelux countries and more steps needs to be taken to fully liberalise electricity and gas markets in particular in the Benelux and Baltic countries.

2.3 P&M on sustainable and secure energy supplies

National and community initiated policies and measures (P&M) with the view of promoting sustainable and secure energy supplies address the supply side and increasingly also the demand side.

On the supply side, P&M are targeting liberalisation of energy markets, diversifying energy supplies by increasing penetration of RES in electricity supply and in transport and improving energy efficiency by increasing combined heat and power (CHP) penetration. RES have been subjected to a variety of measures in national regulations and support systems in most of the Nordic, Benelux and Baltic countries. In many countries, a combination of capital subsidies, fiscal measures and possibly feed-in tariffs are applied to support investments in RES-technologies. In the Baltic States (e.g. Estonia) the feed-in tariffs rates are relatively low and do not offer a significant incentive. Systems for quota obligations/green certificates have been established in Sweden, Belgium and Latvia. The need for improving existing and developing new technologies based on RES is also addressed in public R&D-programmes both at national and community level. Yet, there are concerns that some countries will not manage meeting current targets for RES-penetration (see table 4.1). In some countries CHP – and in particular CHP based on renewable energy sources – have been subject to support regimes similar to those of (other) RES-technologies. Due to a recent EU-directive, CHP is likely to penetrate further with the view of improving energy efficiency in energy supplies in some countries.

On the demand side, tools to help decrease the energy intensity of the economies by means of energy efficiency improvements and energy savings have been launched. On Community level a number of directives came into force recently including directives targeted at improving energy

efficiency in large buildings and introducing/reinforcing requirements for energy labelling of electric appliances. These initiatives remain to prove their effectiveness. More new directives and reinforcement of existing directives are also under way and in addition voluntary agreements are being implemented. Unlike the RES and GHG-emissions, binding targets for energy efficiency improvements have not applied until now, where the draft EU directive on energy services proposes binding targets for energy efficiency improvements in member states. It suggests a binding energy saving target at 1% per annum during the period 2006–2012 and 1.5% per annum for the public sector.

There are some significant differences in energy efficiency/energy intensity rates across the Baltic, Nordic and Benelux countries. The energy intensity of the Baltic countries is considerable higher than in the Nordic and Benelux countries (except from Iceland having a quite energy intensive economy). Though this can be explained by a number of factors it is likely that there remain feasible energy saving potentials not only in the Baltic countries, but also in Nordic and Benelux countries. It is believed that some countries may be likely to benefit from lessons learned in countries having successfully addressed energy efficiency improvements and energy savings.

In many countries, industrial energy saving programmes are built around an incentive structure combining energy/CO₂ taxation relief and industry-wide or corporate voluntary agreements on energy savings and/or CO₂-emissions reductions. This applies in the Netherlands, Denmark and Sweden and recently also Belgium. Technology procurement (Sweden) and voluntary agreements with equipment suppliers to phase out certain products with more energy efficient ones (Denmark) are examples of innovative measures. On the building side

Denmark has with some success had a mandatory energy audit programme for large buildings. The programme had strong similarities with the new EU directive on energy performance in buildings to be implemented by all member states by 2006. In the Netherlands the combined energy saving measures in the building sector over the period 1995–2002 have resulted in 7% CO₂ emissions reduction (2.4 Mt)¹.

R&D is often aimed at meeting long term objectives for development of energy supply systems and is often targeted at technology development prior to market introduction and market penetration which is the purpose of the measures and tools referred to above.

Despite decreases in recent years, Finland has the highest government spending (relative to GDP) on energy related R&D followed by the Netherlands and Sweden. Finland has highest relative R&D spending on energy conservation and power & storage technology. Sweden, Denmark and Netherlands have in relative terms, the highest spending on renewable energy.

The present national and EU policy programmes and support schemes – which combines different tools and instruments and are large in number – appear not to be sufficient in securing compliance with targets set out in the field of securing and sustainable energy supply. Room for improvements exists across the countries e.g. for improving energy efficiency and decreasing energy intensity, not only to meet current targets, but not least to meet future targets and commitments that may be necessary to secure a sustainable and secure energy supply.

1 Source ECOFYS 2004: “EVALUATIE VAN HET KLIMAATBELEID IN DE GEBOUWDE OMGEVING 1995–2002”

2.4 P&M on climate change mitigation

As a result of the United Nations Framework Convention on Climate Change (UN FCCC) and the Kyoto Protocol climate change mitigation has materialized as a separate policy issue for international cooperation, but synergies exist indeed between P&M for sustainable and secure energy supplies and P&M for climate change mitigation. Thus, use of fossil fuels is a major source of carbon dioxide emissions being the dominant GHG emitted in the Baltic, Benelux and Nordic countries.

Projections for GHG-emissions indicate that Denmark, Belgium, Norway, Finland and the Netherlands are facing difficulties in meeting their Kyoto commitments unless additional measures are taken to reduce domestic or other emissions as provided for in the Kyoto Protocol. It appears, however, from reviews of intended and planned P&M that rather than reinforcing measures reducing domestic emissions, the governments will largely rely on using the Kyoto mechanisms to achieve their Kyoto targets (commitments). While the Kyoto flexible mechanisms are designed to reduce GHG-emissions globally they may, however, not necessarily contribute to help securing sustainable and secure energy supplies domestically in the investor countries. Accordingly, use of the project based Kyoto Mechanisms by the Benelux and Nordic countries will not necessarily support efforts of sustainable and secure domestic energy supply – unless JI projects are implemented amongst these countries² – while it may do so in the Baltic countries to the extent that these countries host such projects under the Joint Implementation mechanism or participate in the EU ETS.

2 The Dutch JI Tender programme – ERUPT – now covers an JI project to be undertaken in Germany for example (see www.Carboncredits.nl)

An opportunity lies in the possibility to link the EU ETS with domestic offsets. This has been proposed by Germany and the UK and might be taken up in the evaluation of the ETS. With domestic offsets additional, non-mandatory energy saving projects can be promoted as offset for emissions in the ETS.

P&M for climate change mitigation will in the considered countries largely rely on the international measures provided for in the UN FCCC to comply with Kyoto targets for the first commitment period, which is a significant challenge to most of the countries.

3

Security in energy supply

3.1 EU policies and measures

Since the Green book (2000) raising the debate regarding secure energy supply, the EC has continued working on these issues. In December 2003, a new legislative package to promote energy sector investments and security of supply was proposed. This “Energy package” comprises: a proposal for an EU Directive on measures to safeguard security of electricity supply and infrastructure investments; a proposal for a Directive on energy service and energy efficiency; a proposal for new EU-regulation on Cross Border Trade in Gas; and Revision of the TENs (Trans European Networks) guidelines for electricity and gas. Each component of the package is still under negotiation.

3.2 Status and trends in Nordic, Benelux and Baltic countries

In the Figure 3.1, the net energy import in share of gross consumption is illustrated for selected countries as an indicator of import dependency. On average the EU-15 are currently importing about half of the energy consumption. According to projections, nearly 70% of the energy consumption in 2030 will be based on imported energy. The enlargement of EU does not significantly change the projections for EU-25 compared to EU-15. Nearly 70% of the energy consumption will still be based on imported energy.

Among the countries reviewed here Belgium, Luxembourg and the three Baltic countries are the ones depending mostly on imported energy. Norway and Denmark on the other hand are the only countries considered here, which are net exporters of energy. However, in the case of Denmark it is projected that Denmark will also become dependent on imported energy in 2010. Norway is a net exporter in the entire period 2000–2030, but the net energy export is projected to decrease from nearly 750% in 2000 to 500% in 2030.

Most of the countries, which are net importers, are projected to be increasingly dependent on imported energy in the period 2000–2030. The only exceptions are Luxembourg and Finland, which are projected to stabilise or slightly decrease import dependency during this period.

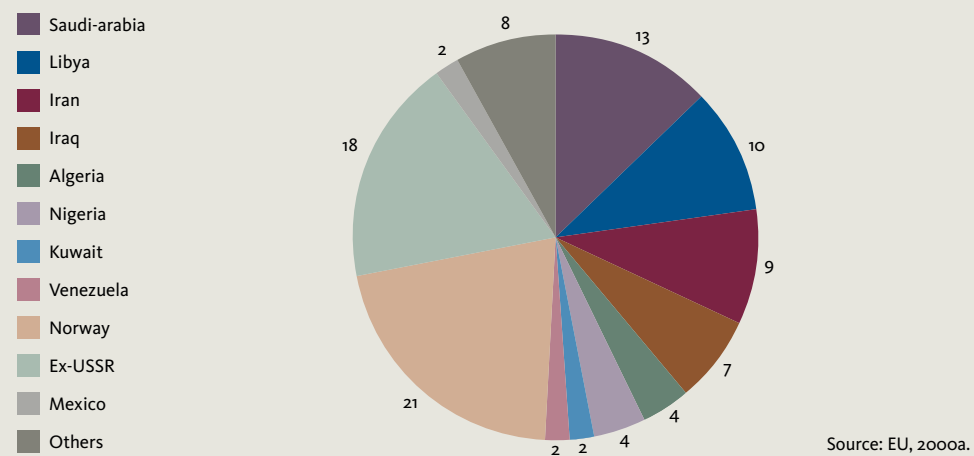
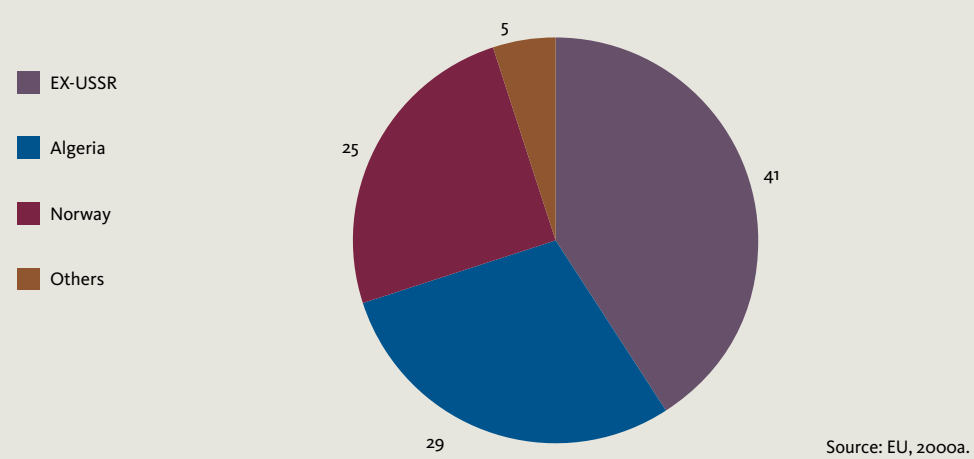
Figure 3.2 and Figure 3.3 illustrates the origin of gas and crude oil import to EU-15. In 1999, 45% of the crude oil imports came from the Middle East and about 40% of the gas was imported from Ex-USSR. The import patterns suggest that EU is vulnerable in case of political and economic instability within the major energy supplying countries.

More than 70% of the world's oil reserves are located in the member countries of OPEC. In 2020, OPEC will cover 50% of the EU's needs with production of the order of 55

Figure 3.1 Import dependency projections defined as net energy imports in share of gross consumption (in %)



Source: EU, 2003f.

Figure 3.2 Origin of crude oil import to EU-15 in 1999 (in %)**Figure 3.3** Origin of natural gas imports to EU-15 in 1999 (in %)

million barrels per day, as against 32 million barrels per day in the year 2000. This willingness on the part of OPEC is reflected by production costs, which will remain extremely advantageous even in a scenario of low prices.

The role of the countries of the former Soviet Union may also prove to be particularly important for the EU as, in 1989, they were still the world's leading oil producers, with production of more than 11 million barrels per day. Production in this region could double over the next 20 years from 7.8 million barrels per day in 2000 to 14 million in 2020. The known reserves in the Caspian Sea basin (25 billion barrels) are roughly the same as in the North Sea and the USA. Potential reserves could exceed 200 billion barrels, i.e. 25 % of known reserves in the Middle East.

The rapid growth of natural gas consumption on some markets, such as electricity, households and the production of heat, could give rise to a new structural weakness in the EU. By 2010 demand could increase by 85 Mtoe to 410 Mtoe in EU-15. Among the Eastern European member states the demand for gas could increase by 40% to 80 Mtoe in 2010.

The principal natural gas exporters to the EU are Russia, Norway and Algeria, and in future probably Iran and Turkmenistan. With regard to the major reserves located in Russia (one-third of world reserves), a certain increase in dependence on that country appears inevitable. The rate of dependence from Russia is expected to increase under the effect of enlargement and pressure of consumption to over 60% in 2010 (EU, 2000a).

4

Renewable energy

4.1 EU policies and Measures

The White Paper (1997) on renewable sources of energy suggests formulating indicative targets to contribute to the ambitious indicative targets of doubling the overall share of renewables in the EU by 2010. It sets an indicative target of 12% for the contribution by renewable energy sources to the TPES within the EU by 2010 and contains a strategy and action plan to achieve this target (EU, 1997).

In 2001, the Directive on Promotion of Electricity Produced from Renewable Sources – Directive 2001/77/EC (EU, 2001a) was adopted. The purpose of the directive is to create a framework that will facilitate a significant increase in renewably generated electricity (RES-E) within the EU. It sets indicative targets for the share of RES-E in total electricity consumption at Union and member state level, which is broadly in accordance with the targets suggested in the White Paper.

The aggregate share of renewable energy sources in TPES in the EU-15 is to reach 12% in 2010 with a renewable energy share in electricity consumption of 22.1% At the EU-

EU directives for promoting transport biofuels (RES-T)

An important barrier to increase use of biofuels in transport and to develop the biofuels industry is the lack of competitiveness of biofuels against fossil fuels. In 2001, the EC adopted a package of measures relating to road transportation fuels including:

- (i) A Communication on alternative fuels for road transportation and on a set of measures to promote the use of biofuels;
- (ii) A directive on the promotion of the use of biofuels for transport; and
- (iii) A directive on the possibility of applying a reduced rate of excise duty on certain mineral oils containing biofuels and on biofuels.

The two directives entered into force in 2003. The directive (ii) sets indicative targets for RES-T penetration at 2% of petrol/gasoline/diesel consumed for transport purposes in 2005 raising to a 5.75% target for 2010. This suggests an annual saving by 2010 of 17.5 Mtoe and 35-40 MtCO₂e. National implementation of the directive shall be in place by 17 Dec. 2004.

The EC intends to follow up through a directive, currently being drafted, aimed at increasing pressure on member states to increase the share of greener, alternative automotive fuels up to 2020. It will require member states to produce action plans and could set alternative fuel use targets for 2010, 2015 and 2020.

The Framework directive on energy taxation (iii) allows member states to reduce the EU-regulated minimum excise duties on transport fuels in order to make biofuels more attractive to the end-user. A number of member states have presently won approval by state aid rules to reduce taxation on biofuels, while the Danish government has reported to the EC that it will not reduce excise duty rates on biofuels as it is considered as too expensive compared to alternative means of GHG-emission reductions.

Sources: European Climate Change Programme, 2003 *Second ECCP Progress Report Can we meet our Kyoto targets?*; ENDS Environment Daily.

15 level, targets for RES-E range from 5.7% (Luxembourg) to 78.1% (Austria).

For the ten new member states that have entered the EU in May 2004 similar RES-E targets have been negotiated and published in the Accession Treaty (EU, 2003b) ranging from 5.1% (Estonia) and 7.5% (Poland) to 49.3%

(Latvia). Given reference projections for total electricity demand the implied target for the EU-25 in 2010 is 21%

Not later than October 2002, member states were required to set national targets for penetration of renewable energy to be updated every five years. Member states are furthermore to prepare annually a RES-E performance monitoring report including reporting on measures taken. Every second year, the EC is to publish a report based on the member state reports. The first report is to be due not later than 27 October 2004.

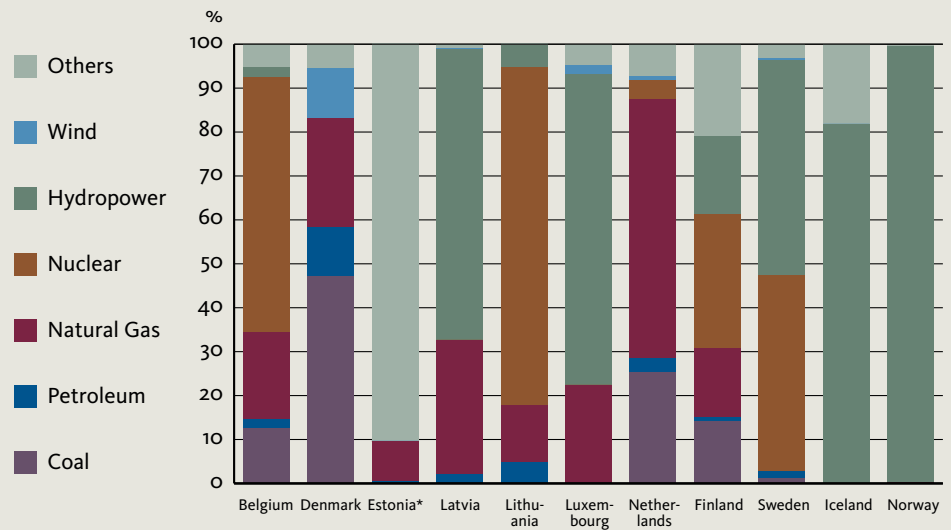
The 12% targets for renewables share of TPES is furthermore supported by directives regulating use of biofuels for transport. In addition, measures to promote the share of renewable energy in heat supply are under preparation by the EC.

4.2 Status and targets in Nordic, Benelux and Baltic countries

As illustrated in Figure 4.1 energy sources of electricity vary a lot between the countries. Hydropower is the dominating source in Norway, Iceland, Latvia and Luxembourg and also plays an important role in the Swedish and Finnish electricity supply. Wind power only plays a significant role in the Danish electricity supply where at the same time coal is the dominant source. Nuclear power is the dominant source of electricity in Lithuania and Belgium and also plays an important role in Sweden and Finland. In the Netherlands natural gas is the dominant source of electricity.

None of the EU member states included in Figure 4.2 below have yet fulfilled the targets agreed upon on the RES-E directive, however Latvia, Finland and Sweden are relatively close to the target. In Iceland and Norway almost all

Figure 4.1 Gross electricity production in selected countries in 2001 distributed by origin of sources



Source: Eurostat, Database of long-term indicators, 2004. Estonia* refers to oil shale based power production, currently 91%.

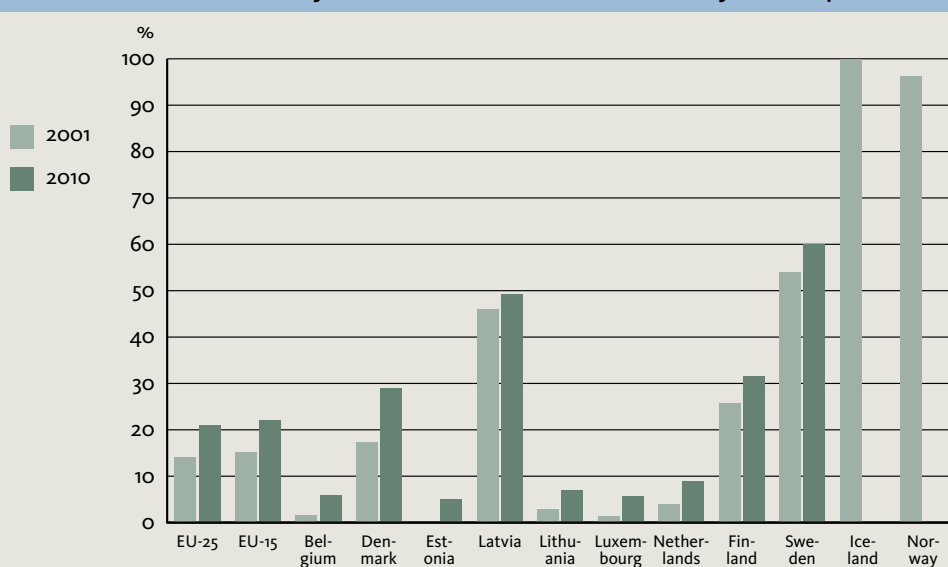
electricity is generated from renewable energy sources. Hydropower plays an important role in some of the better performing countries. It is important to underline, that hydropower production depends heavily on climatic conditions and is therefore vulnerable to climatic changes.

The European Renewable Energies Federation (EREF) assess that only Belgium and Sweden will fulfil their targets even in the optimistic scenario and if expectations are based on a more realistic scenario none of the countries will fulfil the targets³ (EREF, 2004).

Note that the EREF-estimate does not include the most recent development in Denmark where a Bill was passed

³ The analysis does not include the Baltic countries, Norway and Iceland.

Figure 4.2 Share of renewable energy in 2001 (including indicative targets for 2010)
– Contribution of electricity from renewables to total electricity consumption



Source: Eurostat, Database of Structural Indicators, 2004.

Table 4.1 EU targets and scenarios

	EU targets 2010	Optimistic scenario ^a	Realistic scenario ^b
Belgium	6.0	6	3
Denmark	29	24	22
Finland	31.5	26	25
Luxembourg	5.7	5	4
Netherlands	9.0	7	6
Sweden	60.0	60	55

Source: EREF, 2004

- a. Based on the assumption that all goes according to national plans, including all legal and administrative instruments for their execution enforced and no modifications threatening planning.
- b. Business-as-usual based on real world in respective countries, assumptions according to reality.

in the Danish parliament in 2004 suggesting provision of two new offshore wind parks (2×200 MW) and substitution of old wind turbines (onshore installations) with more efficient ones. The impact of these measures is expected to help raising the RES-share to 29% of total electricity supply before 2010 from the 2003-level at 20%

4.3 National policies and measures

The most common tools to promote renewable energy include capital subsidies, fiscal measures, feed-in tariffs, quota obligations/green certificates, competitive tenders and purchase obligations. Table 4.1 summarises tools currently applied in each of the countries considered⁴.

Capital subsidies can help to overcome the barrier of a high initial capital costs and is commonly used to stimulate investment for less economically viable renewable energy technologies. Capital subsidies are usually 20-50% of eligible capital costs, but in some cases subsidy is given over the total eligible capital costs, however, within the limitations of the Community guidelines on State aid for environmental protection. Loans with a low interest rate can also be considered as capital subsidies. Capital subsidies are applied in all the Nordic and Benelux countries, with exception of Denmark where previous subsidy programmes have been closed down in recent years.

4 The situation in Iceland is quite different from the other countries as less than 0.1% of the electricity supply origins from fossil fuels and the renewables share of TPES is as high as 70% (2000-figure). The remaining 30% is from fossil fuels (oil 27% and coal 3%) of which nearly all is for transport purposes. Accordingly, scope for increasing RES-penetration in the energy sector is less than in most other countries and currently no P&M to further promote renewable energy penetration apply in Iceland.

Table 4.2 Measures to promote renewable energy

Tools	Capital subsidies	Fiscal measures	Feed-in tariffs	Quota obligations / Green certificates
Denmark		✓	✓	
Finland	✓	✓	✓	
Norway	✓	✓		
Sweden	✓	✓		✓
Belgium	✓	✓	✓	✓
Luxembourg	✓	✓	✓	
Netherlands	✓	✓	✓	
Estonia		✓	✓	
Latvia			✓	✓
Lithuania			✓	

Source: ECN, 2003; Baltic Environmental Forum, 2003.

Fiscal measures may take different forms, which range from rebates on general energy taxes, rebates from special emission taxes, proposals for lower VAT rates, tax exemption for green funds, to fiscally attractive depreciation

Capital subsidies in Finland

The main policy instruments used in Finland to support renewables are fiscal instruments viz. refund for RES-E producers from tax revenues – and capital subsidies. Since 1999 the government has supported investments in production capacity from renewable energy sources. The Council of State decision 29/99 sets the maximum percentages of subsidy (percent of total capital costs) to investments in renewable energy at 30%, however, subsidies to wind power may be up to 30%. Priority is given to innovative technologies. The maximum percentages are applied to new technology only.

Source: ECN, 2003; IEA, Renewable Energy Database, 2004.

Fiscal measures in Belgium

One of the main policy instruments at Federal level for stimulating renewable energy is a tax abatement scheme for investments in renewable energy technologies in the industry which was introduced in 1992. The purpose of the scheme is to increase energy efficiency in the industrial sector and to increase supply of electricity from RES.

A percentage of the investment costs can be deducted from the taxable income. The percentage is determined by the Ministry of Finance on an annual basis and the rate of eligible deduction was 13.5% in 2002. The relevant regional governments are responsible for the certification of eligibility and conformity of the completed investment.

Source: ECN, 2003; IEA, Renewable Energy Database, 2004.

schemes, which must all be in line with the Community guidelines on State aid for environmental protection.

Apart from Latvia and Lithuania, all countries considered

Feed-in tariffs in the Netherlands

The Netherlands has actively supported renewable energy implementation since 1989. Since 2000 the most important policy scheme has been the REB ('Regulerende Energiebelasting'/Regulating Energy Tax): a combination of financial stimulation of green electricity consumption and support to renewable energy production. This policy scheme uses Green Certificates. In 2003 the REB was partly replaced by a feed-in system: the MEP ('Milieukwaliteit van de Elektriciteitsproductie'/Environmental quality of electricity production). The MEP was introduced in July 2003 with the purpose of stimulating the production and consumption of renewable electricity.

The MEP is paid to producers of electricity from renewable sources that feed in on the national grid, and is guaranteed for a maximum of 10 years. The level of producer support is differentiated for technologies. The highest support level (6.8 eurocent/kWh) will be granted for wind offshore, PV, small stand-alone biomass installations, hydro wave and tide energy. For wind onshore the production support is 4.9 eurocent/kWh for the year 2003. The subsidy is financed by a levy on all connections to the electricity grid in the Netherlands. The MEP producer support exists next to REB exemption for specific RE technologies.

Source: ECN, 2003; IEA, Renewable Energy Database, 2004.

here apply one or more fiscal instruments to support renewable energy.

The term *feed-in tariff* is used both for a regulated, minimum guaranteed price per unit of produced electricity to be paid to the producer, as well as for a premium in addition to

Feed-in tariffs in Baltic countries

In *Estonia* electricity produced from renewable energy sources will, according to the new Electricity Market Act, from July 1, 2003, be awarded with a premium price, which constitutes 1.8 times the maximum allowable production price of the Narva Power Plant (the major electricity producer in Estonia). This feed-in tariff will be available for a limited period (7 years for electricity produced from hydropower and biomass and for 12 years for other renewable energy sources, but only until 2015).

In *Latvia* the Law on Energy sets mandatory requirements for the licensed electricity distribution utility to purchase electricity from:

- Small scale hydropower plants (<2 MW) and wind turbines generators both launched by January 1, 2003, for 8 years, for a price that correspond to the double of the average electricity sales tariff. Thereafter the purchase price will be determined by the regulator;
- Energy facilities that utilize household waste or biogas (<7 MW) and launched by January 1, 2008, for 8 years, for a price that corresponds to the average electricity sales tariff; and
- Wind turbine generators (erected after January 1, 2003), biomass, including wood and peat, biogas, solar, sea tides and geothermal energy for the market price or the price determined by the regulator.

In *Lithuania* based on the Law on Electricity, a procedure for the purchase of electricity produced from renewable energy sources from plants having a total capacity of <20 MW has been approved. The States price and Energy Control Commission has established fixed purchase prices, above the purchase prices for the electricity produced at the power plants operating on fossil fuels, for a period of 10 years for electricity produced at:

- Hydropower plants and power plants using biogas – 0.20 LIT/kWh (5.8 eurocent/kWh)
- Wind power plants – 0.22 LIT/kWh (6.2 eurocent/kWh)

Source: Baltic Environmental Forum, 2003.

market electricity prices. Regulatory measures are usually applied to impose an obligation on electricity utilities to pay the (independent) power producer a price as specified by the government. The tariff may be supplemented with subsidies from the state. The level of the tariff is commonly set for a number of years to give investors security on income for a substantial part of the project lifetime. Many different adaptations of the instrument are applied. Feed-in tariffs are currently used in all countries considered here except Iceland, Norway and Sweden.

Quota obligations are used to impose a minimum production or consumption of electricity from renewable energy sources. The government sets the framework within which the market has to produce, sell, or distrib-

Quota obligations in Sweden

Since the nineties, Sweden has made use of subsidies and tax incentives to stimulate renewable electricity production. In May 2003 the Swedish Electricity certificate trading system was introduced with the purpose of promoting photovoltaic, wind power, biomass, geothermal energy, wave energy and small-scale hydro (under 1.5 MW).

The Quota obligation will increase from 7.4% in 2003 to 16% in 2010 and obliges consumers to have this percentage of their electricity consumption as 'renewable' through certificates. In practice, the suppliers will handle the quota, and can charge their customers for the electricity certificates. This charge must be communicated on the electricity bill, and is estimated to be around 0.55 eurocent/kWh.

In the initial phases of the scheme, energy-intensive industries are exempted from the obligation. The certificate price will be set on the market. However, there is a minimum price and a penalty level.

- The minimum price is the buy-out price at which the government promises to buy certificates from producers. This starts at 60 SEK/MWh in 2003 (about 0.66 eurocent/kWh).
- A penalty for non-compliance is set at 175 SEK/MWh (1.93 eurocent/kWh) in 2003 and 240 SEK/MWh (2.63 eurocent/kWh) in 2004.

Source: Baltic Environmental Forum, 2003.

ute a certain amount of energy from renewable sources. The obligation is imposed on consumption (often through distribution companies) or production. Governments may choose to establish ‘technology bands’ in order to protect technologies from strong competition by lower cost options. The quota can usually be traded between companies to avoid market distortions. A tradable *green certificate* is needed for this system. These green certificates provide an accounting system to register production, authenticate the source of electricity, and to verify whether demand has been met. Only Sweden, Belgium and Latvia have so far introduced quota obligations/green certificates markets.

5

Energy efficiency and energy savings

5.1 EU policies and measures

The EC Communication *'Efficiency in the European Community – Towards a Strategy for the Rational Use of Energy'* (1998) estimated the economic potential for improving energy efficiency between 1998 and 2010 to approximately 18% of the total annual energy consumption for 1995 (EU, 1998a). The European Council's Resolution on energy efficiency in the European Community (1998) stated that an indicative target to improve energy intensity of final consumption by 1% every year up to the year 2010 was an ambitious target and could serve as a useful guidance (EU, 1998b). The Communication and Resolution was followed up in 2000 by an *'Action Plan to improve Energy Efficiency in the European Community'* (EU, 2000b) proposing a target of 1% decrease in energy consumption every year until 2010.

A number of new directives targeted at improving energy efficiency in the Community have been drafted since the Action Plan:

- *Directive on Combined Heat and Power (CHP)*, which provides a framework supporting CHP in the internal energy market and contributing to more diversified and energy efficient supply systems in the EU. The CHP directive came into force in February 2004 and should be transposed to national legislations by 2006;
- *Directive on Energy Performance of Buildings* providing for minimum energy performance standards for new and existing larger buildings and for certification of energy performance when buildings are constructed, rented or sold and finally for regular inspection of boilers and air conditioning systems. The building directive came into force in 2004 and should be transposed into national legislations by 2006;
- *Directives on mandatory energy labelling*. In the last 2 years two directives on energy labelling have entered into force adding to energy labelling measures as given by the Framework directive (92/75/EC) on energy labelling of household equipment. The two directives provide for compulsory energy labelling of electric ovens and air conditioners and were to be implemented by member states in 2003;
- *Draft Directive on the establishment of a framework for the eco-design of energy-using products* will create a framework under which the EC can propose specific standards for energy efficiency. The directive was agreed by the EU council of Ministers in June 2004; and
- *Draft Directive on energy services* proposes binding targets on member states to save 1 % per year of all energy supplied between 2006 and 2012 except for energy intensive industries⁵. A 1.5% annual saving target is proposed for

⁵ To avoid duplication, industrial installations covered by the Emissions Trading and the IPPC Directives are excluded, leaving out about 75% of final energy consumption (EU, 2003a: 8-10).

the public sector. A key-mechanism is an obligation on energy supply companies (distributors and retailers) to offer energy services and energy audits to their customers. The proposal is regarded as a necessary supplement to the recently adopted legislation on the opening of the internal energy market, which mainly leads to efficiency improvements on the supply side.

Current assessment by the EC on the possibility of drafting a directive to ensure that energy efficiency is considered in public procurement adds to the list of measures targeted at energy efficiency improvements. Also there are efforts made recently by the EC to spur member states to utilise fully the opportunities provided for in the Integrated Pollution Prevention and Control (IPPC) directive to base permits to industrial and agricultural installations on best available techniques (BAT) also in terms of

Voluntary Actions and Commitments

Voluntary actions and commitments (both company individual and industry-wide) in the field of energy efficiency and CO₂-emissions reduction exist since the mid-1990s. They include e.g. voluntary energy labelling and eco-label targeted at changing consumer behaviour as well as actions to increase energy efficiency/reduce energy consumption for electric appliances including: standby TV, VCR, Audio and for white goods (washing machines, dishwashers, refrigerators and freezers). Furthermore, an Energy-EMAS is on its way based on the Eco-Management and Audit Scheme (EMAS), which is a voluntary scheme implemented by about 4000 Organizations and companies all over Europe.

Other voluntary actions include the (electric) Motor Challenge Programme open to industrial companies, under which the participants commit to an Action Plan to identify and implement energy efficiency measures. Finally, the European car manufactures have taken on voluntary commitments to improve the fuel economy for new passenger cars. The aim is to achieve an average specific CO₂-emission of 140g CO₂/km by 2008–9.

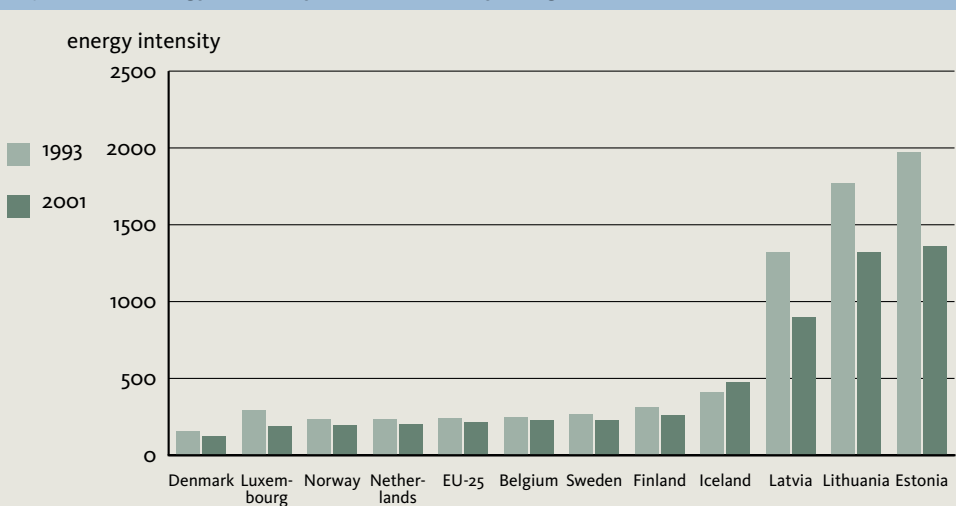
Source: European Climate Change Programme, 2003 Second ECCP Progress Report.

energy efficiency. This includes ensuring that member states have transposed the IPPC-directive correctly and that they are adequately addressing energy efficiency and emissions of GHG other than CO₂ when processing permits according to the IPPC-directive.

5.2 Status and trends in Nordic, Benelux and Baltic countries

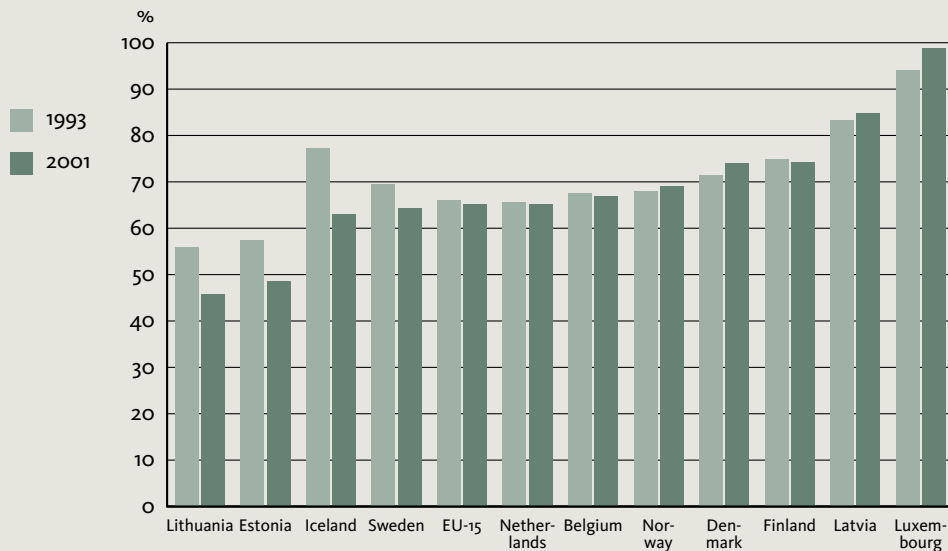
Energy intensity measures the ratio between the gross inland consumption of energy and the gross domestic product (GDP). Figure 5.1 illustrate the energy intensity of the 11 countries considered here, measured as the ratio between gross inland consumption of energy and GDP at constant prices (1995=100).

Figure 5.1 Energy intensity of the economy in kgoe per 1,000 Euro.



Source: Eurostat, Database of Structural Indicators, 2004.

Figure 5.2 Energy efficiency – final energy consumption in % of gross inland consumption



Source: Eurostat, Database of Long-term indicators, 2004.

The energy intensity in the Baltic countries in particular but also Iceland is quite high whereas the energy intensity in Denmark is quite low meaning that in Denmark relatively little energy is consumed to generate the GDP. The industrial structure of the economies is obviously an important explanation to the variations in energy intensity. It is notable that we see a clear improvement of the energy intensity from 1993 to 2001 in all three Baltic countries.

Figure 5.2 illustrates the energy efficiency for selected countries measured as the ratio between the final energy consumption and the gross inland consumption of energy.

The energy efficiency in most of the countries is at or above EU-15 level. Norway, Denmark, Finland, Latvia and Luxembourg have a high degree of energy efficiency,

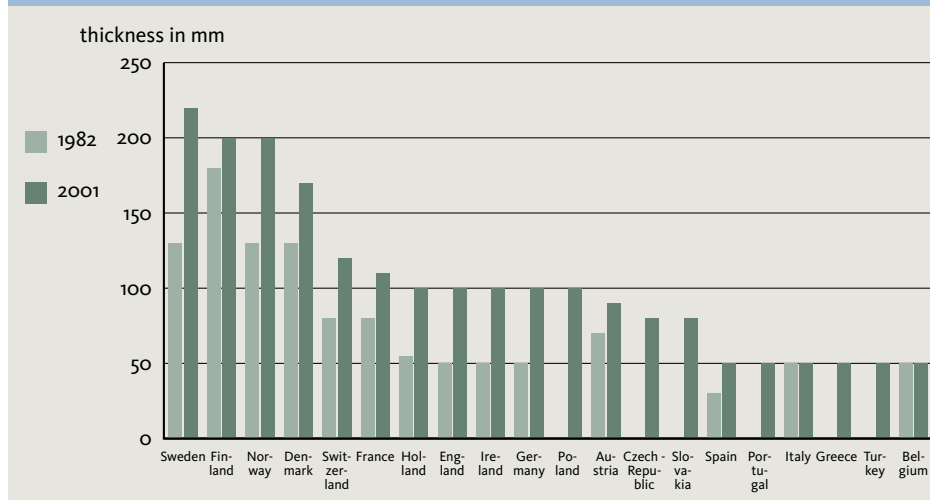
however, the very high level in for example Luxembourg is due to the fact that almost all energy consumption in Luxembourg is covered by imports. In Estonia and Lithuania the energy efficiency is significantly below EU-15 average indicating a high potential for promoting energy efficiency in these countries.

It is remarkable that the energy efficiency has actually decreased in countries like Lithuania, Estonia, Iceland and Sweden from 1993 to 2001. This further underlines the potential for energy efficiency improvement. In the rest of the countries investigated the situation is either status quo or just a slight improvement of the energy efficiency.

Energy saving potential by means of thermal insulation in buildings

The European Insulation Manufacturers Association (EURIMA) has funded two studies prepared by ECOFYS on the environmental and economic impact of thermal insulation of buildings in EU-15, Switzerland, Norway and Turkey. The studies conclude i.a.:

Insulation thickness in walls in Europe



- Emissions from the building sector in the countries covered by the study is projected to be 839 MtCO₂ in 2002 coming up from 710 MtCO₂ in 1999 and to rise further to a level of 865 MtCO₂ in 2010.
- Adding thermal insulation to existing buildings in the countries covered by the study could potentially reduce CO₂-emissions and energy costs for heating by 42% corresponding to annual reductions in 2010 of 353 MtCO₂-emissions. The bulk of this reduction potential is located in the moderate climatic zone – Belgium, Denmark, Germany, France, Great Britain, Ireland, Luxembourg, the Netherlands, Austria and Switzerland.
- Assuming equal contributions of all sectors to meet the Kyoto target, the maximum allowed CO₂-emissions of the building sector would be 653 Mt in 2010. However, if the whole potential of thermal insulation was realized, the sector could reduce emissions below this viz. to a bit more than 510 MtCO₂.
- Hence, a proportional contribution to climate protection can only be achieved in the building sector, through additional political initiatives promoting energy saving both in new buildings and in the existing building stock. The overall emission savings associated with the heating the European building stock would amount to 82 Mt/year (Energy Performance Building Directive, EPBD). This potential could be increased by 69 Mt/year if the Directive were extended to retrofitting all multi-family houses and all non-residential buildings (Extended EPBD>200 m²). By extending the Directive to the whole of the European building stock by adding single-family houses the additional potential, compared to the Directive, rises to 316 Mt/year (Extended EPBD all houses).
- On a relative basis the building sector in Eastern Europe exhibits even larger reduction potentials due to its extensive and partly neglected stock of fairly old buildings.

Sources: ECOFYS (2002). The Contribution of Mineral Wool and other Thermal Insulation Materials to Energy Saving and Climate Protection in Europe. ECOFYS (2004): "Mitigation of CO₂ emissions from the building stock", Febr 2004, see: http://www.ecofys.co.uk/uk/publications/documents/ecofys_report_EURIMA_final_160204.pdf

5.3 National policies and measures

In the countries considered here, a variety of policies and measures (P&M) applied are targeted at energy savings and energy efficiency improvements in various end-user sectors. Some P&M are due to national policies and priorities while others refer to EU policies and to EU-regulation to be transposed into national legislation. The table below presents some *examples* on commonly applied measures (exclusive R&D-programmes) and is not an exhaustive list.

Tools	Taxation and subsidies	Voluntary agreements	Other measures
Country			
Denmark	Energy and CO ₂ taxes on all end-use consumptions	On energy management/energy savings in exchange for CO ₂ -tax relief Energy labelling and phasing out inefficient products Consumer behaviour campaigns	Regulated prices on small scale CHP Energy labelling of houses and large buildings DSM-obligations for electricity service companies
Finland	Energy and CO ₂ -taxes Energy audits Heat insulation and heat supply systems in residential buildings.	Energy saving agreements with industry, public and service sector, electricity supply and distribution and CHP-supply	
Iceland	Vehicle taxation favouring energy efficient vehicles.		Promotion of energy efficiency in fishery sector by means of awareness raising and education.
Norway	Energy and CO ₂ -taxes. Capital costs subsidy eligible to EE in industry, service and household (waste heat, heat pumps). Subsidy to energy management, training, information dissemination in commercial & residential buildings		

Sweden	Climate Investment Programme incl. energy savings. Grants for solar heating in industrial & commercial buildings (until 2004)	Technology procurement (eg. heat pumps, refrigerators and washing machines) Energy/CO ₂ saving agreements in turn for energy tax relief in industry Energy saving in building sector	
Belgium	CO ₂ on industry Income tax relief on industrial and household investments in EE Solar heater, heat pumps, condensing boilers, utilities DSM-activities and supply activities, energy efficiency in service and household sector	Long term agreements with energy intensive industry and benchmarking EE	Free distribution of energy saving light bulbs
Luxembourg		Agreements on energy savings in industry	Energy performance standard for new buildings
Netherlands	Green taxes. Tax deduction on investments in energy saving	Long term agreements on EE with industry and benchmarking EE	
Estonia	VAT exemption on CHP. (DSM. CO ₂ -tax since 2000 for energy producers with capacity > 50 MW) Excise taxes on fuels	Energy audits and certification.	Planning measures targeted at EE improvements and energy savings. Several energy conservation programmes initiated in the 1990's. District heating renovation programme. Revision of building codes. Renovation programme for apartments. Energy labelling of household appliances.
Latvia	EE improvements in heat supply		Regulated prices for CHP. Planning measures for increasing CHP. Rehabilitation of Riga District Heating. Local Governments Credit Fund (heat supply systems and heat insulation of buildings)
Lithuania			National EE programme.

6

Climate change mitigation

In this section we focus on international cooperation regarding climate change mitigation measures as laid down in the Kyoto Protocol. Three flexible mechanisms are proposed – Joint Implementation (JI), Clean Development Mechanism (CDM) and Emissions Trading (ET).

JI and CDM are so-called project-based mechanisms as they allow for transfer between parties to the Kyoto Protocol of GHG-emissions reductions accruing from specific project activities. The JI is eligible for parties having taken on specific commitments for the first commitment period (2008–12) to reduce GHG-emissions (so-called Annex I countries), while the CDM allows for cooperation between Annex I countries and countries that have no such commitments in the first commitment period. The third Kyoto mechanism ET allows for trading between Annex I parties of emissions reductions, provided that the countries comply with certain requirements.

6.1 EU policies and measures

The EU has taken on commitments in the Kyoto Protocol to reduce GHG-emissions in the first commitment period by 8% of 1990 (base year) emissions equivalent to a reduction target at 336 MtCO₂e.

With the objective of creating a cost effective measure to achieve the Kyoto commitments the EU Emissions Trading Scheme (EU ETS) will be launched at community level to comply with the Kyoto target. The Directive 2003/87/EU on Emissions Trading, which came into force in October 2003, regulates the European-wide scheme for the first trading period in 2005–2007. The EU ETS puts caps on emissions corresponding to approx. 45% of GHG-emissions in the EU including 27% of emissions in energy industries and 18% of emissions in manufacturing industries. Operators in the EU ETS are allowed to use carbon credits from CDM- and JI-projects to fulfil the obligations given by the ETS-directive. The access into the EU ETS of such carbon credits from projects under the JI and CDM mechanisms are regulated by the EU linking directive, which was agreed upon in May 2004.

The directive allows for linking with other trading systems meeting certain requirements. Thus, the national ETS to be introduced in Norway as of 2005 is designed for linking to the EU ETS.

6.2 EU and member states targets and trends

The EU-burden sharing agreement stipulates individual targets of the EU-15 member states within the overall EU commitment to reduce emissions by 8% Individual EU-15 member states targets for 2010 are shown in Table 6.1.

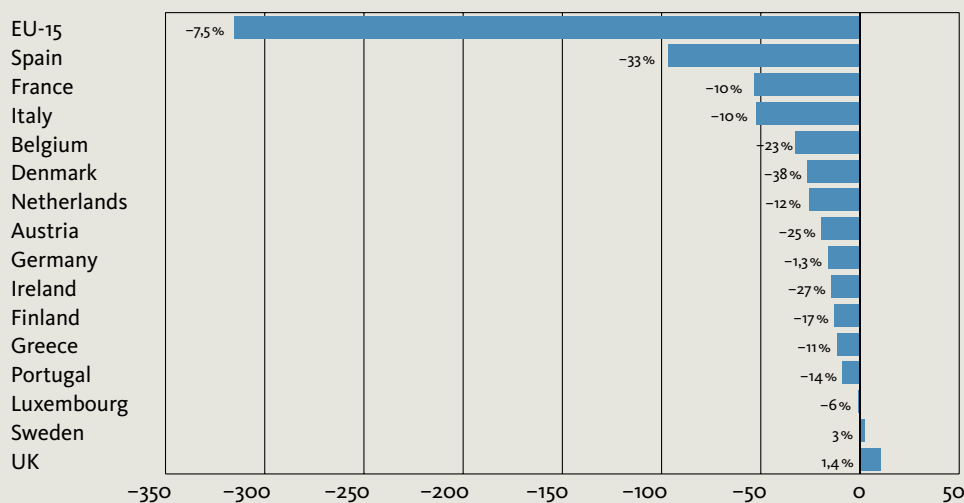
Table 6.1 Emissions targets of EU-15 member states relative to base year under the EU burden-sharing decision

Country	Base year emissions in MtCO ₂ e	Emissions target in % of base-year emissions level	Emissions target in Mt CO ₂ e
Portugal	61.4	+27	78
Greece	107.0	+25	134
Spain	289.9	+15	334
Ireland	53.4	+13	60
Sweden	72.9	+4	76
France	558.4	0	558
Finland	77.2	0	77
Netherlands	221.1	-6.0	208
Italy	509.3	-6.5	476
Belgium	141.2	-7.5	131
United Kingdom	747.2	-12.5	654
Austria	78.3	-13	68
Luxembourg	10.9	-20	9
Denmark	69.5	-21	55
Germany	1216.2	-21.0	961
EU-15	4204.0	-8	3868

Source: European Topic Centre on Air and Climate Change, 2003

Targets determined in the Kyoto Protocol will also be binding for new member states. Except for Hungary and Poland, which have emissions reduction targets at 6%, new member states with emissions reduction commitments under the Kyoto Protocol have taken on emission reductions targets at 8% of 1990 level (Malta and Cyprus have no targets and Turkey will become a Non Annex I party to the UN FCCC).

Figure 6.1 GHG-emissions projections and targets for EU-15 with existing domestic measures and policies (percent points and MtCO₂e)

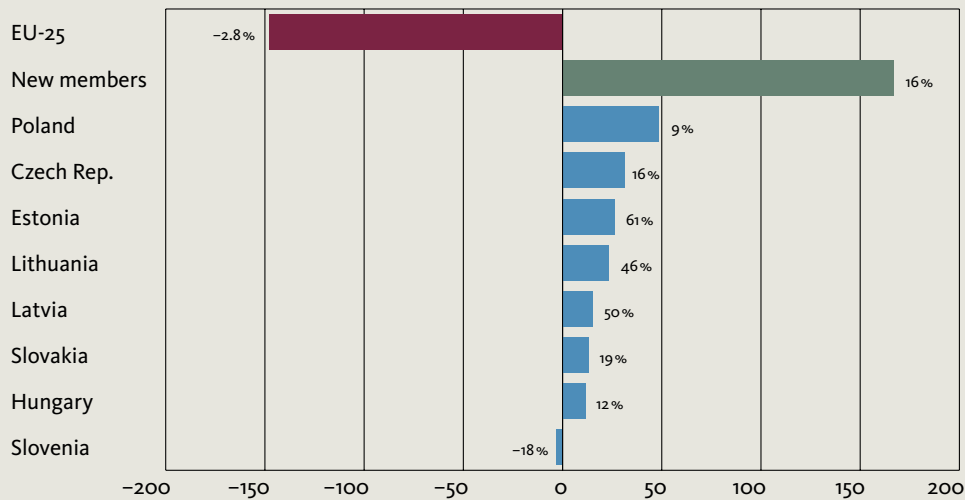


Source: European Topic Centre on Air and Climate Change, 2003.

The most recent projections for 2010 GHG-emissions reported under the EU monitoring mechanism indicate that emissions of EU-15 will only be reduced by 0.5% against the target of 8% and the EU-15 will accordingly fall short of targets by 7.5 percent points or more than 300 MtCO₂e. This relies on projected over-delivery by Sweden and the UK compared to the two countries targets under the burden-sharing agreement. Projections assuming no such over-delivery by Sweden and the UK, suggest the gap of EU-15 to increase to 7.8 percent points.

New member states have a surplus at 16 percent points of targets or more than 150 MtCO₂e. Accordingly, the EU-25 is projected to have a shortage of 2.8 percent points of target or nearly 150 MtCO₂e as illustrated in Figure 6.2. To which extent this surplus may be counted against the commitments of EU-15 member states will

Figure 6.2 GHG emissions projections and targets for EU-25 and acceding and candidate countries (in percent points and MtCO₂e)



Source: European Topic Centre on Air and Climate Change, 2003.

depend on the use of JI between EU-15 and new member states.

The projections shown in the above figures refer to national emissions taking into account expected impact of existing domestic measures⁶. Projections taking into account additional domestic measures are also available. These projections suggest the EU-15 gap would be reduced from 7.5 percent points to 0.8 percent points i.e. almost sufficient to comply with the EU Kyoto commitment. However, this relies on Finland, Greece, Ireland, Sweden and the UK reducing emissions beyond their burden-sharing targets. Assuming that these countries will not reduce emissions beyond their targets, projected emissions of EU-15 will be

⁶ Includes both national and EU common measures.

Table 6.2 EU-15 distance to target

Scenario for over-delivery by member states	Gap in percent points Existing measures projection	Gap in percent points With additional measures projection
No over-delivery	-7.8	-2.9
Over-delivery	-7.5	-0.8

Source: European Topic Centre on Air and Climate Change, 2003

reduced by 5.1 percent points of base year emissions and the gap will accordingly be 2.9 percent points.

None of the above mentioned projections account for potential impact of the EU ETS (tending to reduce most of the national emission projections). Neither do they include potential emissions reductions accrued by use of the CDM and the JI, which can be expected as a result of current government decisions and actions taken in some of the EU-15 member states on making use of the JI and CDM to meet Kyoto commitments. Further to this, additional achievements to comply with the Kyoto commitments and the EU-burden sharing may potentially be available from using carbon sequestration options provided for in the Kyoto Protocol (Article 3.3 and 3.4) and which have not been considered in the above projections. Eight member states (Austria, Belgium, Sweden, the

European Climate Change Programme (ECCP)

The ECCP was initiated and led by the EC. It was established in June 2000 with the mission is to drive forward EU efforts to meet the targets of the Kyoto Protocol. It was organised in 11 working groups and widely based on stakeholder-consultations. In its second progress report (2003), the ECCP presents following estimates of 2010-emissions reduction potential in EU-15 derived from EU energy-related measures currently in force and under implementation.

Policies and measures (P&M)	Reduction potential (MtCO_{2e})
Directive on RES-E	100–125
Directive on transport biofuels (RES-T)	35–40
Directive on CHP	65
<i>Sub-total, energy supply P&M</i>	<i>200–213</i>
Directive, energy performance of buildings	35–45
Energy labelling Directive (incl. New on electrical ovens and air conditioners)	21
Voluntary agreements (in implementation)	30–35
Framework Directive on Minimum EE requirements	180*)
Directive on Energy services	40–55
Motor challenge Programme (in implementation)	30
<i>Sub-total energy demand P&M</i>	<i>336–356</i>
Total energy sector related P&M	536–567

*) total technical potential but will depend on daughter directives

The list is not exhaustive and further GHG reduction potential may likely be available from measures like the EU ETS, directives on liberalisation of electricity and gas markets, further measures on RES-H (heat from renewables, under preparation), reinforcement of EE under the IPPC-directive, campaign for take-off & public awareness and Energy-EMAS. P&M targeted at other GHGs than carbon dioxide includes the Landfill directives estimated to leading to further reductions of methane emissions corresponding to 41 MtCO_{2e} and the EC legislative proposal on fluorinated gases and finally the CAP-reform envisaged to have a positive effect on carbon sequestration in agricultural sectors. In regard to the transport sector the ECCP concludes that measures prove difficult to implement and show slow progress, which is a big concern as emissions are projected to significantly increase (by 28% in 2010 of 1990-level in EU-15).

Source: Second ECCP Progress Report, April 2003, Can we meet our Kyoto targets?

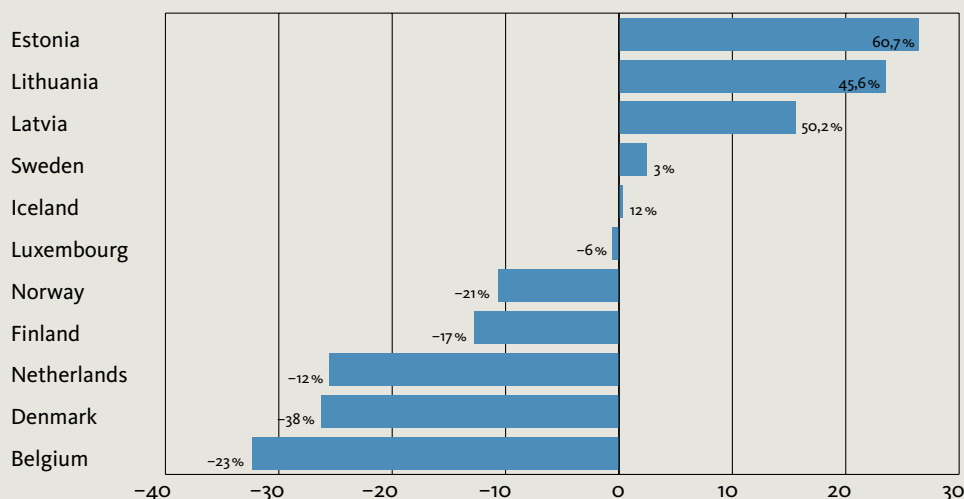
Netherlands, Portugal, Spain and the UK) have given early indications that they intend to make use of carbon sequestration options estimated totalling some 13 MtCO_{2e} annually for the first commitment period.

6.3 Status and targets in Nordic, Benelux and Baltic countries

When turning to the Nordic, Benelux and Baltic countries the picture is as illustrated in Figure 6.1 below, which illustrates the distance to targets of 2010-emissions projections with existing measures viz. implemented and adopted measures.

Estonia, Latvia and Lithuania are considerably within their emissions targets at 8 percent points reduction of base year levels and Sweden and Iceland are also on track to meet commitments. Sweden even over-delivers with approx. 2.5 MtCO₂e as does Iceland, however, with less than 0.5 MtCO₂e. The remaining countries included here are all behind targets in the “existing measures scenario” and additional measures will be needed for those countries to meet their Kyoto commitments. The most signifi-

Figure 6.3 Distance to targets for the Nordic, Benelux and Baltic countries (in MtCO₂e and percent points) with existing measures



Source: ECON Analysis based on European Topic Centre on Air and Climate Change, 2003;
Ministry of Environment Iceland, 2002, Ministry of Environment Norway, 2002.

cant relative gaps are found for Denmark, Belgium and Norway. Denmark and Belgium are short of targets by 38 percent points (or 26 MtCO₂e) and 23 percent points (or 32 MtCO₂e) respectively under the EU-burden sharing agreement. According to the Kyoto Protocol, Norway is allowed to increase emissions by 1% of base year level, but national emissions are projected increasing by 22% for 2010 unless additional domestic measures are taken.

6.4 National policies and measures

Except for Norway and Iceland, the Nordic, the EU directive on Emission Trading will cover all the Benelux, and Baltic countries and they have all submitted their National Allocation Plans (NAPs) for the first trading period of the EU ETS (2005–2007). The NAPs of Denmark, Netherlands and Sweden have been assessed and approved by the EC, while the NAPs submitted by Luxembourg, Belgium, Finland, Lithuania, Latvia and Estonia have been assessed and approved in September 2004 (there exists a preliminary schedule by now) by the EC. The EC finds that Denmark and the Netherlands have substantiated their declared use of the Kyoto Mechanisms. The assessment is based on the reported state of advancement of relevant legislation and implementing provisions at the national level and means in practical terms that the NAPs proposed by Denmark and Netherlands have been approved.

Norway is to introduce a national ETS from 2005 to be linked to the EU ETS. The Norwegian ETS has been presented to and approved by the parliament in August 2004.

Table 6.1 briefly summarises status of the countries use and intended use of the Kyoto mechanisms including participation in the EU ETS. It can be added to the table that the

Table 6.3 Use of Kyoto-mechanisms

Country	Tools	Project based mechanisms, JI and CDM	EU ETS and NAPs – present situation	Dedicated Climate Strategy
Denmark		Intended purchase ^a of Kyoto-units for 2008–12 is 18.5 MtCO ₂ e. Operational programmes are in place. First contracts are made.	The NAP, which is approved by the EC, is not very restrictive (~BAU).	Most recent Governmental Climate Strategy in 2003.
Finland		Potential use of JI/CDM mechanisms has not yet been decided, but a governmental pilot programme for purchasing JI and CDM has been launched.	The submitted and not yet assessed (by the EC) NAP is not very restrictive (~BAU). It is likely that new additional measures will be needed.	Review of climate change strategy expected in Autumn 2004.
Iceland		No intension so far to make use of the Kyoto Mechanisms.	Does not participate in the EU ETS and no plans for national ETS.	Climate Strategy in 2002.
Norway		No intended government spending on purchase of project based (Kyoto) emission reductions (besides participation in the TGF and the PCF).	National ETS from 2005. Will cover 10% of national emissions and has strong similarities with the EU ETS.	
Sweden		Current decision is that Sweden will meet its EU-burden targets without use of CDM and JI. Government pilot tender programme for purchase of credits under JI and CDM.	The submitted and approved NAP is quite restrictive compared to the other Nordic countries.	Climate strategy in 2002 suggest target at –4 % without use of carbon sinks and flexible mechanisms. Review climate change strategy expected in Autumn 2004
Belgium		Recently launched federal government purchase programme targeted at 10 MtCO ₂ e from JI and CDM.	The submitted NAP is not yet assessed by the EC (due Oct 2004)	Federal climate strategy in 2002. Key-instruments: CO ₂ -taxation and agreements with industries.
Luxembourg		Will make use of flexible mechanism and carbon sequestration.	The submitted NAP 3,5 Mt, BAU is 3,7; NAP is not yet assessed by the EC.	No dedicated climate strategy since the Sustainable Development Strategy in 1998.

- a. EC, July 2004, Communication from the Commission to the Council and to the European Parliament on Commission decision of July 2004 concerning national allocation plans for the allocation of greenhouse gas emission allowances of Austria, Denmark, Germany, Ireland, the Netherlands, Slovenia, Sweden and the United Kingdom in accordance with Directive 2003/87/EC.

Table 6.3 Use of Kyoto-mechanisms (cont.)

Country	Tools	Project based mechanisms, JI and CDM	EU ETS and NAPs – present situation	Dedicated Climate Strategy
Netherlands		Intended purchase of Kyoto-units for 2008-12 at 100 MtCO ₂ e. Operational programmes in place. First contracts are made. Ratio domestic/ Kyoto Mechanisms is 50/50; discussion underway to decrease domestic part, due to ETS and cost of national measures.	CAP 95Mt; above BAU; The NAP is approved by the EC.	Evaluation of National Climate Policy Implementation plan (1998) in 2005 to assess if domestic P&M should be reinforced, possibly increase in energy taxes, N ₂ O emission from chemical industry and storage of CO ₂ .
Estonia		MoUs for Kyoto flexible mechanisms signed with The Netherlands, Finland, Denmark and Sweden (under way). First JI projects with Finland in fuel-switch and wind energy sectors launched in 2003. Participation in BASREC TGF, also in Dutch SENTER programme. 21 JI pilot phase projects launched in 1990's. The biggest JI potential towards biomass based CHP and wind energy deployment, also energy efficiency and energy saving in DSM	The NAP is in process of assessment and approval by EC. It is hoped that the NAP will be approved by EC in September.	Greenhouse Gases emission reduction programme for 2003–2012.
Latvia		First MoUs signed, launched. Prototype Carbon Fund (landfill) launched in 2002(1). 22 JI pilot phase projects launched in 1990's.	The NAP is in process of assessment and approval by EC.	Climate strategy in place. Particular decree on JI
Lithuania		9 pilot phase JI projects launched in 1990's.	The NAP is in process of assessment and approval by EC Allocated EU-allowances 2005–7 is 42.5 MtCO ₂ e (preliminary figures)	No dedicated climate strategy.

Nordic and the Baltic countries participate in the BASREC Testing Ground Facility (TGF) aiming at supporting JI-projects in the Baltic Sea Region.

The EU had been considering in the ECCP discussions a JI Facility. The 'Linking Directive', linking JI and ETS postponed that discussion. Though new items on the table are currently how to facilitate JI within the EU and how to include domestic offset projects.

7

Energy market liberalisation

7.1 EU policies and measures

The Green Paper on the security of supply concluded that the integration of energy markets would contribute to security of supply provided that they were truly integrated. The existing provisions of the Gas and Electricity Directives on safeguards ought to be sufficient. The Communication from the Commission in 2001 '*Completing the internal energy market*' stated that the present Electricity and Gas Directives would not be able to fulfil the target of an Internal market for gas and electricity (EU, 2001b)

As a result in 2003, new Directives on Gas and Electricity have been adopted. These new directives require the Commission to issue regular reports on the functioning of the market on an annual basis (EU, 2003c & 2003d).

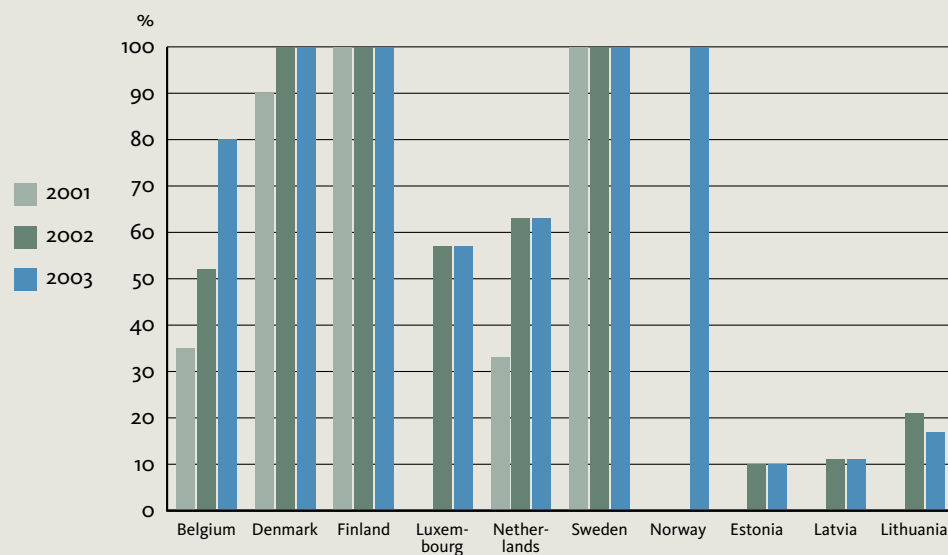
7.2 Status and trends in Nordic, Benelux and Baltic countries

The third benchmarking report on the implementation of the internal electricity and gas market provides an up to date status on the progress towards a liberalised energy market (EU, 2004a).

7.2.1 Electricity market

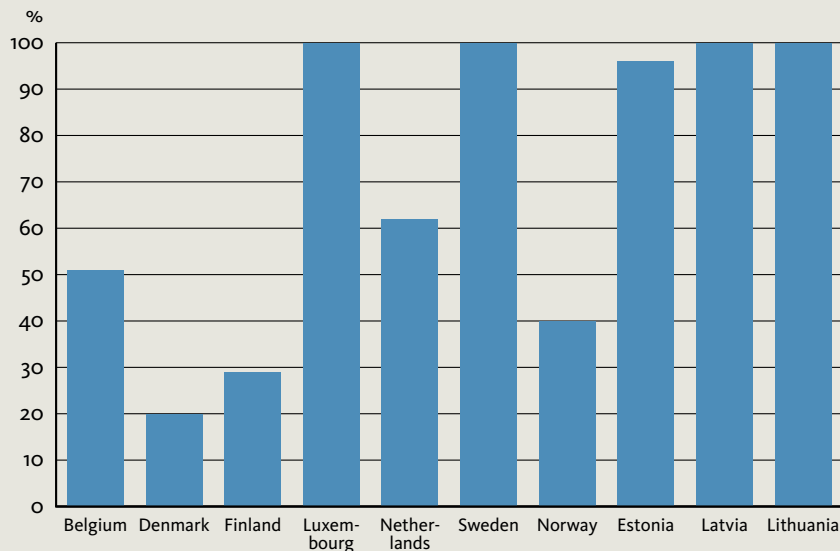
The development of the electricity market opening is often defined by the percentage that the consumption of the eligible consumers (those allowed to choose electricity supplier) represents as a proportion of total electricity consumption (Eurostat, 2003c).

Figure 7.1 Declared market opening of the electricity market in selected countries (in %)



Source: EU, 2001c, 2003e & 2004a.

Figure 7.2 Top 3 suppliers share of electricity consumption in 2001 in selected countries (in %)



Source: EU, 2004a.

As illustrated in Figure 7.1 progress has been made especially in Belgium and the Netherlands where the electricity market has opened significantly from 2001 to 2003. The Benelux countries still need to even more open in contrast to the Nordic countries where the market is totally opened by 2003. The electricity market in the Baltic countries has not yet opened significantly. Estonia, for example has received from EC special conditions to postpone the market liberalisation due to oil shale based power production development plans.

Figure 7.2 illustrates the top 3 suppliers market share of electricity consumption. 3 suppliers (or less) dominate the electricity market in Luxembourg, Sweden, Estonia, Latvia and Lithuania. The electricity markets considered here, which are least dominated by a few large suppliers are Norway, Finland and Denmark.

Table 7.1 Implementation of directive on electricity market liberalisation

Country	Score out of 8 maximum points
Denmark	7
Finland	6
Latvia, Lithuania, Sweden, Netherlands	5
Estonia, Luxembourg, Belgium	3

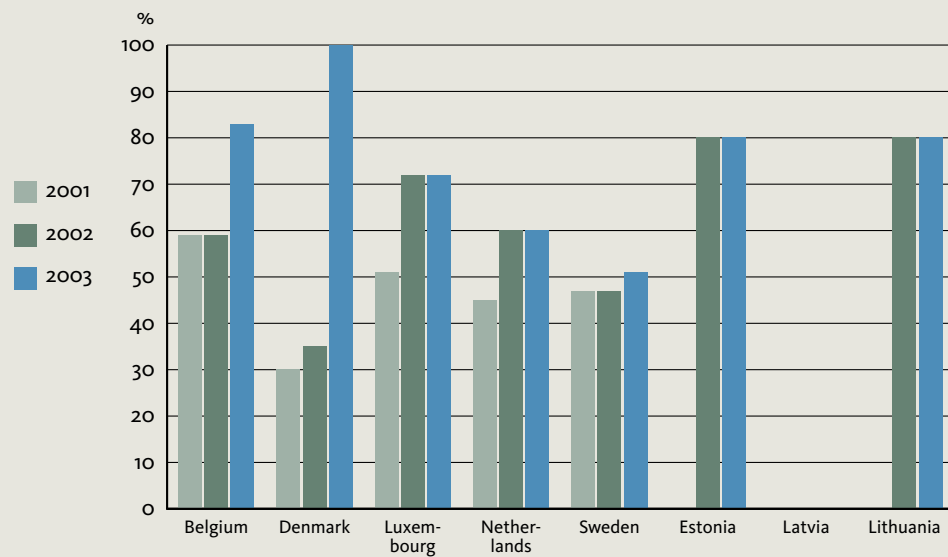
Source: Danish Energy Authority, 2004

In the recent status report from the EC on implementation of the energy market directives member states are benchmarked according to 8 indicators on efficient liberalisation of power markets. The result is shown in the table below.

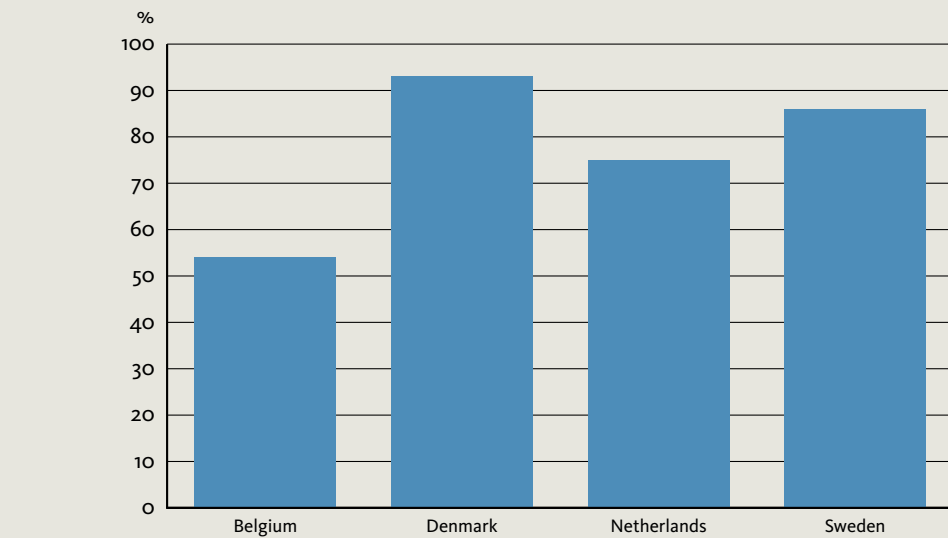
7.2.2 Gas market

Figure 7.1 illustrates to what degree the gas market has been open in each country. Among the countries considered only Denmark has a fully open gas market. However in all Benelux countries significant progress has been made from 2001 to 2003. Both Estonia and Lithuania have a relatively open gas market in contrast to Latvia where the market has not yet been opened.

In Figure 7.2, the top 3 suppliers market share of gas consumption is illustrated for some of the countries reviewed here. The available data indicates that a few large companies are dominating the gas supply. Only exception is Belgium where only about half of the gas consumption comes from the top 3 suppliers. It should be noted, however, that Belgium does not have domestic gas production but depends on imported gas.

Figure 7.3 Declared market opening of the gas market in selected countries (in pct)

Source: EU, 2001c, 2003e & 2004a.

Figure 7.4 Top 3 suppliers share of total gas consumption in 2001 in selected countries (in %)

Source: EU, 2004a.

Table 7.2 Implementation of EU directive on gas market liberalisation

Country	Score out of 8 maximum points
Denmark	7
Belgium, Netherlands	4
Latvia, Lithuania, Luxembourg	2
Sweden	1

Source: Danish Energy Authority, 2004

Similar to the power market, the EC has recently assessed the effectiveness in member states in liberalising gas markets according to the EU directive. It is assessed whether the member states meet 8 requirements sufficiently. As the EU directive does not apply to the markets in Norway and Finland, the countries are not presented in the table below which summaries the results of the benchmarking:

8

Research and development

8.1 EU R&D programmes

The vast majority of the EU R&D programmes are financed through the 6th Framework Programme for Research and Technological Development (FP6) and the Intelligent Energy for Europe (EIE) programme. The EIE-programme is the Community's support programme for non-technological actions in the field of energy. Actions or projects supported in the framework of the EIE-programme will be committed to remove market barriers to the increased use of energy efficiency and renewable energy sources. In contrast to the 6th Framework programme, the EIE-programme does not support costs related to investments in technologies. However many of the actions will have a link to one or more energy efficiency and/or renewable energy technologies.

The 6th Framework Programme for Research and Technological Development has a budget of EUR 17.5 billion for the

period 2003–2006 and included the following energy related R&D programmes:

- *Euratom Framework Program* (1,230 MEUR) targeted at nuclear research and;
- *Sustainable development and global change* (2,120 MEUR) incl.: *Sustainable energy systems* (810 MEUR for clean energy, energy savings, alternative motor fuels, fuel cells, energy carriers/transport/storage etc.); *Sustainable surface transport* (610 MEUR for environmentally friendly transport, interoperability, safety etc; and *Global change and ecosystems* (600 MEUR for greenhouse gas emissions abatement, water cycle, biodiversity, natural disasters, land management, climate change modelling etc.)

The EIE-programme has a budget at 215 MEUR for the period 2003–2006 and includes following programmes:

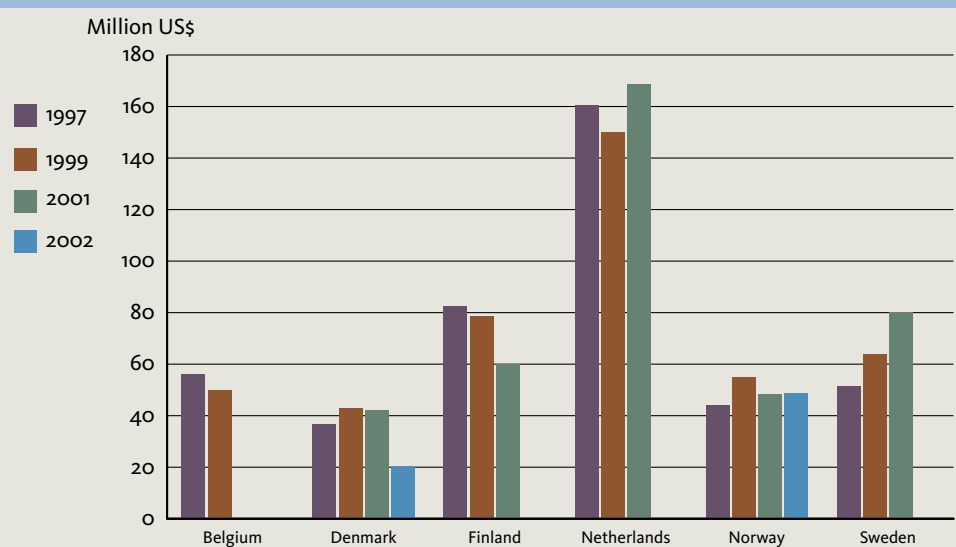
- *SAVE* (75 MEUR): Improvement of energy efficiency and rational use of energy, in particular in the building and industry sectors;
- *ALTENER* (86 MEUR): Promotion of new and renewable energy sources for centralised and decentralised production of electricity and heat and their integration into the local environment and the energy systems;
- *STEER* (35 MEUR): Support for initiatives relating to all energy aspects of transport, the diversification of fuels, such as through new developing and renewable energy sources, and the promotion of renewable flammable fuels (e.g. bio fuels) and energy efficiency in transport;
- *COOPENER* (19 MEUR): Support for initiatives relating to the promotion of renewable energy sources and energy efficiency in the developing countries, in particular in the framework of the Community cooperation with developing countries in Africa, Asia, Latin America and the Pacific.

8.2 Status and trends in Nordic and Benelux countries

The total governmental R&D budget for energy research in selected countries for the period 1997–2002 is illustrated in Figure 8.1. Among the countries reviewed here only Sweden has steadily increased the government R&D spending on energy research from 1997–2001. Finland on the other hand has in the same period steadily decreased its budget. The Danish budget has been relatively stable but was in reduced to about one half of previous years budget in 2002. The Norwegian budget has been relatively stable but was in reduced to about one half of previous years budget in 2002.

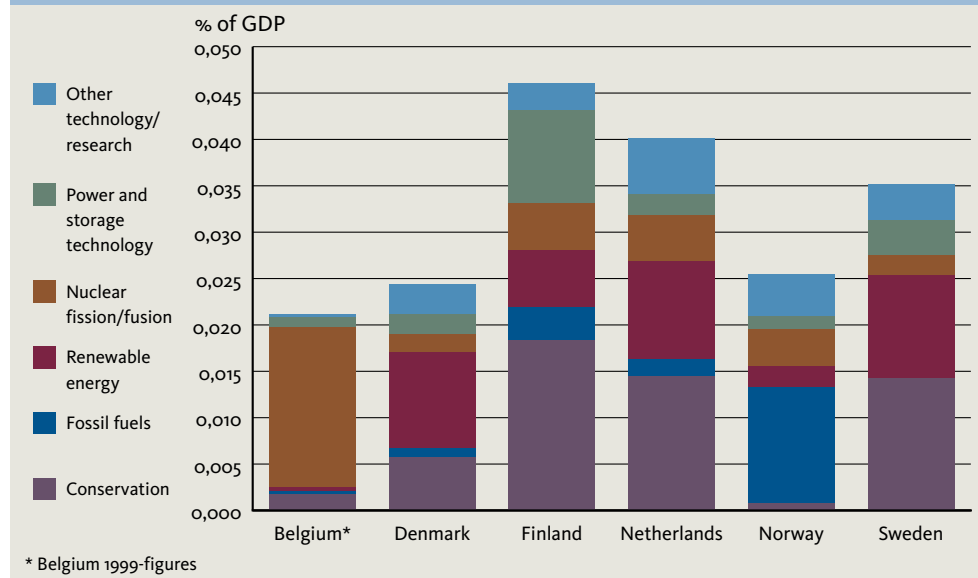
It should be noted that government spending only is considered here and that it constitutes only part of the picture of the actual R&D spending in the countries under discussion. Private sector funded R&D is thus not included. Neither is research funded by other sources such as the Danish research programmes in managed by the transmission com-

Figure 8.1 Total government expenditure on energy research and development in million US\$ (2002 prices and exchange rates)



Source: IEA, R&D database, 2004

Figure 8.2 Government expenditure on energy research and development in 2001* by research areas in percent of GDP



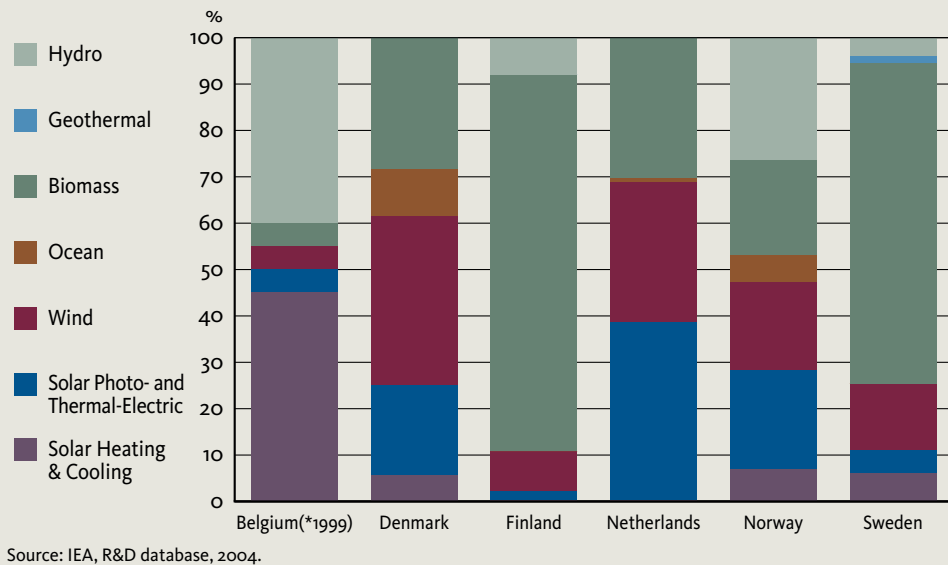
panies and sourced by the Public Service Obligation (PSO) tariff on electricity and gas consumption. In recent two years (2002–2003) these PSO-research programs equal the budgets of the government sourced R&D programmes.

Finland is the country where government spending on energy R&D constitutes the highest share of GDP followed by the Netherlands and Sweden as shown in Figure 8.2.

Renewable energy research has the highest relative priority within energy R&D in Denmark though the budget has decreased significantly in 2002. Renewable energy research also constitutes a substantial part of the energy R&D in the Netherlands and increasingly also in Sweden.

In Figure 8.3, renewable energy R&D budgets are broken down on research areas.

Figure 8.3 Government expenditure on renewable energy R&D in 2001 distributed by research areas (in %)



Solar energy research constitutes a large share of renewable energy R&D in Belgium and the Netherlands and to a certain degree also Norway and Finland. Wind energy is an important research area in Denmark and the Netherlands and to a certain degree also in Norway and Sweden. It should be noted that in spite of the drastic reduction of the total Danish energy R&D budget in 2002 the budget for wind energy research was in the same period increased (not illustrated).

In Sweden and Finland most of the renewable energy R&D concerns biomass energy. This research area also constitutes a substantial part in Denmark, the Netherlands and Finland.

Hydro energy research is an important element of the renewable energy R&D in Norway and Belgium and is also performed in Finland and Sweden. It should be noted that

although the share is high in Belgium the amount actually spent is low. The same argument goes for solar energy research in Belgium.

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