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Energy Policy  
Highlights



# Energy Policy

## Highlights

*Energy Policy Highlights* showcases what the 28 IEA member countries identified as key recent developments in their energy policies. Each country contribution covers a range of energy-related topics, with best practices and policy examples from their respective governments, including objectives, characteristics, challenges and successes, and shared lessons. Each contribution underscores the changing nature of both global and domestic energy challenges, as well as the commonality of energy concerns among member countries. For example, many of the policies highlighted identify an urgent need to reduce greenhouse gas (GHG) emissions as a clear objective. Electricity, enhancing energy efficiency and increasing the share of renewables in the energy mix in a cost effective manner are likewise areas of common focus. Overall, the energy concerns reflect key areas of focus for the IEA – energy security, environmental protection and economic development.

On the end-user side, increasing public awareness of domestic energy policies through improved transparency and engagement is an important facet of policy support among IEA member countries. The successful implementation of policies and other initiatives benefitted from efforts to inform the public. The IEA hopes that *Energy Policy Highlights* will provide a useful point of reference and dialogue for the 2013 IEA Ministerial, and will help advance the Agency's well-established practice of co-operation and worldwide engagement through the sharing of experiences, best practices and lessons learned, among IEA member countries and partner countries alike.



# Foreword

The global energy landscape is changing quickly as a result of economic shifts and technological advancements. “Game-changers” such as the unconventional oil and gas revolutions, or the rapid retreat from nuclear power in some countries, will further accelerate this change. This transformation naturally has important consequences for the energy policies of International Energy Agency (IEA) member countries, which must respond by employing efficient and cost-effective measures to ensure adaptable and flexible markets that safeguard energy security while remaining consistent with international commitments.

The IEA has contributed to global energy discussions since its founding, providing member governments with analysis and policy recommendations to address their respective challenges. *Energy Policy Highlights* reflects this well-established practice of sharing experience and lessons learned among peers. In preparation for the 2013 IEA Ministerial, the IEA Secretariat invited members to showcase recent innovations in their energy policies. For the first time, members were asked to choose which measures they would like to highlight and share with other policymakers. We thought it would be interesting for members to see what steps their counterparts are taking to overcome energy challenges that are often very similar to their own.

I am delighted with the result. All 28 IEA member countries provided examples, all of which are included in this publication. These are “real-time” policies that respond to many concerns, ranging from ensuring reliable energy supply to helping customers make the best choice in electricity provider, to developing new programmes to promote research and development. Governments have shown creativity and flexibility in finding these solutions; their experiences and insights will certainly be of great interest to other

policymakers. It is also gratifying to see a number of IEA policy recommendations being implemented with good results.

*Energy Policy Highlights* groups members’ contributions under six thematic sections: general energy policies, energy efficiency, electricity, renewables, oil and gas, and research and development. These policy examples and best cases illustrate the range of topics and wide breadth of today’s energy challenges. Electricity and energy efficiency stand out as areas of particular interest. It is also striking that many governments emphasised the importance of proactive efforts to inform and engage stakeholders as critical to the success of their policy initiatives.

Reducing greenhouse gas (GHG) emissions is a clear objective of many of the policies, targeted by both improved energy efficiency and a higher share of renewables in the energy system. Given the current economic climate, these submissions unsurprisingly highlight the concern among member countries to find cost-effective and economically sustainable solutions. Another trend among the contributions is the importance of empowering consumers and of raising public awareness by means of transparent procedures.

I am confident that this publication, by showcasing the latest policy best practices of member countries, will provide a useful source of input for ministerial discussions and a basis for subsequent work within the IEA Secretariat. For this valuable resource, I wish to express my special thanks to all who contributed to this publication.

This publication is produced under my authority as Executive Director of the IEA.

**Maria van der Hoeven**  
Executive Director  
International Energy Agency

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# Overview of *Energy Policy Highlights*

*Energy Policy Highlights* reflects a key benefit of International Energy Agency (IEA) membership: sharing experience, and learning among policy makers and governments. In preparation for the 2013 IEA Ministerial, IEA member countries were invited, for the first time, to highlight recent developments in their energy policies. Their contributions are collected in this publication.

All members provided examples of their policies, and the range of chosen topics illustrates the broad scope of energy policies. However, substantial contributions in the areas of electricity and energy efficiency indicate them to be areas of particular current effort.

The contributions reflect the key IEA themes of energy security, environmental protection and economic development. The agreed international goal of greenhouse gas (GHG) emissions reduction is the driver for many contributions, and is targeted by both improved energy efficiency and a higher level of renewables in national energy systems. Economic pressures are evident, however, and the need to find economically efficient and sustainable approaches clearly concerns members. More generally, a number of contributions recognise the negative impact of rising energy prices on consumers. In some cases, this is countered by the attempt to make retail markets work better through increased awareness of consumers' purchasing power.

A number of contributions underline an increased need for transparency and engagement – raising awareness of energy

policy and proposed actions in order to gain public acceptance. Many member countries noted that the success of their initiatives had been facilitated by efforts to inform and involve the public.

## Energy policy

Several members highlight their energy policy reviews. The Czech Republic is currently updating its State Energy Strategy, particularly in light of declining lignite production. Germany aims to increase public understanding of its ambitious energy policy through annual reports on progress towards its goals. By introducing its Responsible Resource Development plan, Canada is modernising its regulatory system for project reviews in order to attain government goals.

The Netherlands successfully introduced a shortened procedure for energy infrastructure projects to secure national interest. Sweden, with its long-term priority of a fossil fuel-free vehicle fleet by 2030 and carbon dioxide taxation, is moving to a low-carbon economy. In June 2013, the United States announced its Climate Action Plan for steady, responsible national and international action to cut GHG emissions, based on three pillars: (i) cut carbon pollution in the United States; (ii) prepare the United States for the impacts of climate change; and (iii) lead international efforts to combat global climate change and prepare for its impacts.

## Energy efficiency

Energy policy continues to face the challenge of delivering energy efficiency. Even highly energy-efficient Japan is striving towards further energy savings as a response to its constrained energy situation following the Great East Japan Earthquake in 2011. Turkey has put in place a wide-ranging strategic and legislative framework to promote energy efficiency, including mandatory appointment of energy managers by large energy users, and an annual energy efficiency week to raise public awareness of the issues.

Several members highlight the approach of employing energy providers to deliver energy savings, some of which are backed up by a trading incentive scheme based on their respective obligations. Other countries are exploring methods of encouraging energy savings by helping householders and businesses with financial incentives: this could be through grants or by arrangements to undertake the measures now and repay the costs later through savings from energy bills.

Canada continues to raise the standards of its commercial building codes, while Portugal is seeking ways to improve energy performance in public buildings by standardising the contracts and approaches of energy service companies. A legal requirement for large energy-using corporations to assess their energy use in Australia is boosting the identification and adoption of energy efficiency opportunities. New Zealand is finding that a programme to increase the number of warm, dry homes through insulation, which particularly helps low-income households, brings benefits of improved health as well as energy savings.

## Electricity

Increasing the contribution of renewables to national electricity supplies in a cost-effective way is a challenge several members are attempting to meet. The UK government is embarking on the largest reform since electricity privatisation in order to introduce more renewables. The UK government hopes this reform will provide the tools for transition to its long-term vision: low-carbon technologies that are not only able to compete on a level playing field with fossil fuels, but also able to ensure security of supply in the short, medium and longer term. Germany is faced with the need to strengthen its grid system to enable greater flows from the north to the south to compensate for the variability of renewable sources; it is therefore streamlining its planning procedures for new grid projects.

Hungary highlights the importance of nuclear power in the energy mix and, in the face of an ageing specialist workforce, the need to train a new generation of experts.

In the face of difficult economic circumstances, several countries are seeking ways to make electricity markets more competitive, to increase consumer participation and to keep prices down. Belgium and New Zealand have run campaigns to convince consumers that switching electricity retailers is easy, aiming to encourage stronger competition between suppliers. As part of a wide-ranging market reform package, Australia is also exploring tariff structures that will enable consumer participation in demand-side management and the creation of a national energy consumer advocacy body.

Liberalisation of the electricity market in Greece coincided with a particularly severe economic crisis; attention is therefore focused on protection against fuel poverty, with the introduction of a special reduced tariff for electricity for low-income, vulnerable households.

Keeping the lights on understandably remains a key security policy objective of IEA member countries. Two countries highlighted their plans for handling shortages in electricity supply, and Korea has actually carried out a practice drill which demonstrates the considerable extent to which quick reductions in demand are possible through changes in the public's behaviour in energy usage.

## Renewables

Several countries are looking for cost-effective ways to increase the share of renewables in their energy systems. The Netherlands introduced a subsidy system with a sliding component, whereby the premium varies with market price. As well as the examples discussed above in the electricity section, a joint Norway-Sweden scheme provides a larger market for trading electricity certificates which promote renewables generation.

Some members already have considerable levels of renewables integrated into their systems and are coping well despite the variable nature of their output. Spain highlights the changes to grid operation which enable it to handle this variability; in early 2013 nearly half of its electricity consumption was, indeed, generated by renewable sources. Denmark is planning major investment in further wind turbines to meet its goal of 50% of electricity supply being generated by wind. Austria cites its considerable hydropower as contributing flexibility and security of supply not only to its own electricity supply, but also more widely to that of Europe.

## Oil and gas

High gas prices in particular national circumstances have proved to be of concern. Italy is reviewing its gas infrastructure and market mechanisms with the aim of keeping prices in check. Japan points to the changing structure of the gas market and highlights the approaches the country is adopting to strengthen its buying power, while Austria feels that its increasing gas storage facilities provide flexibility and security of supply.

On the oil front, and in line with an earlier IEA recommendation, Ireland has increased its security by rebalancing its holdings of strategic oil stocks so that 88 of its 90 days of stock obligations are held on the island, and dependence on stock tickets has been eliminated. Norway successfully increased production of oil in an environmentally safe way.

## Research and development

Several contributions highlight the continuing importance of research and development (R&D) in meeting future energy challenges. Italy wanted to ensure that sufficient R&D on electricity continued after privatisation of the electricity industry, and therefore developed a mechanism whereby such R&D is funded through a small premium on consumer prices. Korea has established an advanced smart grid test bed facility for testing cutting-edge smart grid technologies. France has launched a major new research programme aimed at bringing innovative energy projects to the market.



# Canada

## Responsible resource development

### Policy area/objectives

Natural resources account for 15% of Canada's gross domestic product (GDP) and 50% of its exports. When including spin-off industries, which also provide goods and services to the sector, natural resources account for close to 20% of GDP — nearly one-fifth of Canada's economy. The natural resource sectors also directly employ approximately 800 000 workers in communities across the country.

More than 600 major economic projects representing CAD 650 billion<sup>1</sup> in potential new investments are planned across Canada over the next ten years. To capitalise on these opportunities, the government of Canada has introduced its plan for Responsible Resource Development (RRD). RRD will modernise Canada's regulatory system for project reviews by delivering on four key objectives: (i) making project reviews more predictable and timely; (ii) reducing duplication of project reviews; (iii) strengthening environmental protection; and (iv) enhancing Aboriginal consultations.

### Main characteristics of the policy

The government's RRD plan, introduced in the 2012 budget, has delivered several changes to strengthen accountability and ensure a more effective and efficient regulatory system. Responsibility for reviews was condensed from more than 40 agencies down to three: the Canadian Nuclear Safety Commission,

the National Energy Board and the Canadian Environmental Assessment Agency. Clear and predictable review timelines were put in place to increase accountability, including maximum beginning-to-end timelines (12 months to 24 months) for project reviews, depending on the project.<sup>2</sup>

Resources are now more appropriately focused on major projects with the greatest potential for significant environmental effects, while smaller, more routine projects no longer require formal environmental assessments, but remain subject to the requirements of all other applicable federal and provincial laws, standards and permits. Duplication with the provinces is being reduced through the implementation of new tools, such as substitution and equivalency, to advance the objective of "one project, one review". In addition to improving the predictability and timeliness of the federal review process, environmental protection will be strengthened through the use of greater compliance and enforcement mechanisms, and new funding to advance measures to strengthen marine and pipeline safety. Notably, the government has put in place, for the first time, enforceable<sup>3</sup> environmental assessment conditions, including financial penalties from CAD 100 000 to CAD 400 000. This will double the number of inspections and comprehensive audits of federally regulated pipelines to identify issues before incidents occur.

1. As of September 2013, CAD 1 was roughly equivalent to USD 0.96.

2. A 12 month timeline is in place for standard environmental assessments, a 24 month timeline for review panels under the Canadian Environmental Assessment Act and an 18 month timeline for projects regulated under the National Energy Board Act.  
3. Under the Canadian Environmental Assessment Act, 2012.

Finally, the Government of Canada is ensuring consistent consultations with Aboriginal peoples and exploring new economic partnerships with Aboriginal groups. The 2013 budget provided CAD 618 million to allow Aboriginal peoples to participate more fully in Canada's economy and benefit from its growth. The government has also appointed a Special Federal Representative to engage Aboriginal communities on economic opportunities related to the proposed west coast energy infrastructure, such as oil and gas pipelines, and marine terminals. These efforts will help identify opportunities to facilitate greater Aboriginal participation in resource development, as well as in ongoing efforts to strengthen environmental protection.

## Challenges faced during implementation

Prior to the implementation of the government's plan for RRD, regulatory delays and unnecessary duplication across jurisdictions discouraged potential new investors and undermined the economic viability of major projects with no additional benefit for the environment. Fundamental changes were needed to create a modern, efficient and effective regulatory system to capitalise on these new investment opportunities, while ensuring strong environmental protection and creating meaningful opportunities for Aboriginal engagement and consultation.

## Why the policy is considered a success

These measures will make the review process for major projects more predictable and timely (a reduction from an average of four years to a legislated period of no more than two years), as well as facilitate investment and planning decisions to support job creation and economic growth, while improving environmental protection and enhancing Aboriginal consultation.

## Lessons to be shared

The plan for RRD was facilitated by the creation of the Major Projects Management Office Initiative – a partnership among 11 federal departments and agencies with key regulatory responsibilities for major natural resource projects. As part of this initiative, the Major Projects Management Office was established to serve as a single window into the federal regulatory process, and to provide overarching project management and accountability of the federal regulatory review process for major resource projects, while leading horizontal policy research and analysis to advance further improvements to the regulatory system for major resource projects. This whole-of-government approach across departments and agencies ensured effective collaboration across government on cross-cutting policy issues.

# Czech Republic

Responding to a changing energy scene: updating the Czech energy strategy

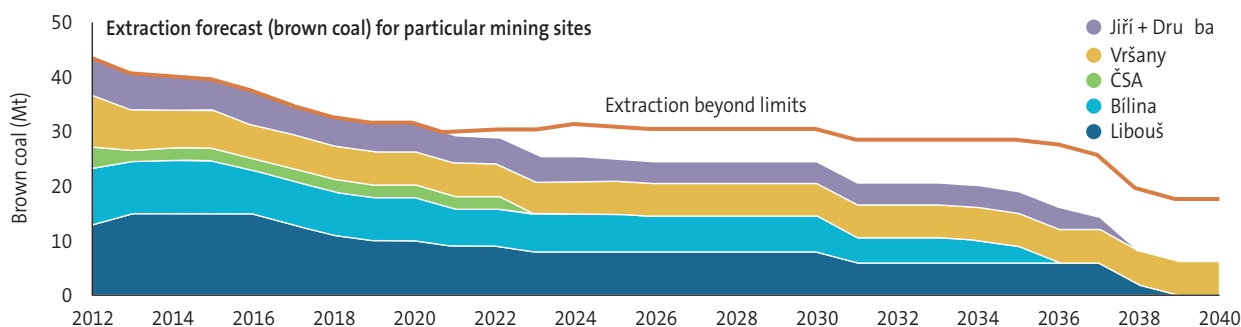
## Policy area/objectives

The current update of the Czech State Energy Concept (SEC) aims to facilitate transformation of the ageing Czech energy sector to generate adequate electricity and meet high supply standards in a cost-effective manner. It must resolve the problem of massive decommissioning of lignite power plants, stabilise the wholesale electricity market and find an optimal solution for preservation of the unique and effective municipal central heating system.

## Main characteristics of the policy

In order to preserve the comparative advantage of a cost-effective municipal central heating system that depends for more than 80% of its fuel on domestic primary energy sources in the face of rapidly decreasing lignite supplies (Figure 1), the SEC strives to re-direct available coal into heating and highly effective co-generation systems and find alternative fuels (waste, biomass and nuclear waste heat) not to increase energy import dependency.

**Figure 1** Decreasing mineable coal supplies in the Czech Republic



Note: environmental limits for mining on certain quarries were introduced by Governmental Resolution 444 from 1991; MT = megatonne.

Source: update of the State Energy Concept, Ministry of Industry and Trade of the Czech Republic, 2013.

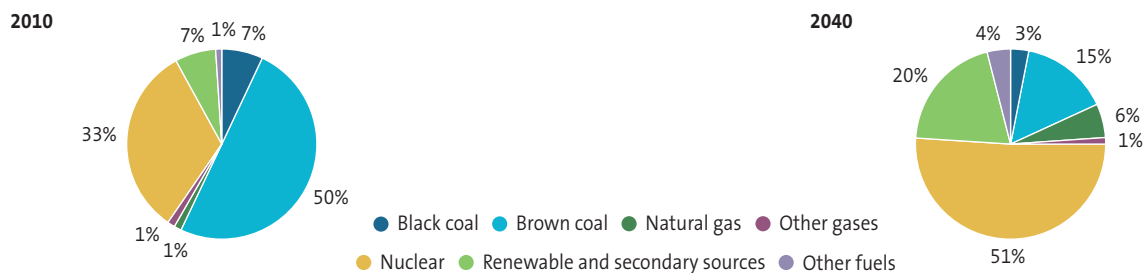
Power generation from decommissioned coal-fired power plants has to be replaced in a cost-effective and energy-secure manner, *e.g.* by increasing the shares of nuclear energy (by up to more than 50%) and an economically viable renewable energy supply (RES). Natural gas is perceived mainly as a provider of flexible balancing energy and as a co-generation

fuel. Wholesale energy markets – distorted by previous extensive RES subsidies – must be stabilised and rationalised to once again give sound investment signals, as investors currently are not willing to invest in any sources not subsidised by the state. Price-stabilisation measures will therefore have to be temporarily introduced.

The new power generation mix (Figure 2) must be able to fulfil generation adequacy criteria and must be “manageable”; hence, infrastructure refurbishment and upgrade, including demand-side management and accumulation systems, are supported (especially research and development [R&D] from the government side). The Czech Republic currently suffers from

loop-flows arising from discrepancies between power generation and infrastructure build-up in the Central and Eastern Europe region. This situation is not sustainable and must be systematically eliminated.

**Figure 2** Gross electricity generation mix in the Czech Republic



Source: update of the State Energy Concept, Ministry of Industry and Trade of the Czech Republic, 2013.

## Challenges faced during implementation

One of the biggest challenges for the SEC was to find broad consensus across the whole political spectrum. The update of the SEC has not been approved since 2004 (even though it should be done every five years). The most disputed topics of the SEC for the general public were the potential breaking of the environmental lignite coal limits, the share of RES and nuclear, and the energy savings potential. The resulting compromise draft is currently undergoing a Strategic Environmental Assessment (SEA).<sup>1</sup> Final approval is also dependent on comprehensive analyses, for which completely new methodology had to be developed, of the impacts of the SEC on the national economy, individual households and Czech competitiveness. Intensive debate

and negotiations are expected when pursuing partial goals (proposed in the document) before actually implementing the SEC.

## Why the policy is considered a success

The current SEC proposal has gained broad support both in the political arena and among professionals. Thanks to the goals included in the proposal, it provides clear implementation methodology for the public and regulatory authorities.

## Lessons to be shared

Wide public acceptance of the SEC proposal was facilitated by a technologically-neutral approach to energy resources, a focus on cost-effectiveness and the minimisation of negative impacts on the national economy, all accompanied by intensive consultation with key stakeholders.

1. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

# Germany

## Monitoring Germany's energy reforms: creating transparency and public acceptance

### Policy area/objectives

The German government, through its Energy Concept (2010) and its energy reforms (2011), has set itself the goal of making the country one of the most energy efficient and environmentally sound economies in the world, while maintaining competitive energy prices and a high level of prosperity. This ambitious and long-term project can only succeed with broad public acceptance.

Since Germany is breaking fresh ground in many aspects of its overall energy policy strategy, it is important to monitor this fundamental transition closely. The government has therefore established a process to monitor progress and to fine-tune measures where necessary. At the same time, the monitoring process – Energy of the Future – is designed to inform the public comprehensively about the restructuring of the energy system, to promote public participation and to increase acceptance of the reforms.

### Main characteristics of the policy

Germany's ambitious energy goals include a reduction in greenhouse gas (GHG) emissions by 40% by 2020 and by at least 80% by 2050, and a decrease in primary energy consumption by 20% by 2020 and by 50% by 2050 (base year 2008). The proportion of energy consumption covered by renewables is to rise to 30% by 2030 and to 60% by 2050.

Energy of the Future is long-term and fact-based monitoring process. It includes: (i) an annual monitoring report – the first submitted in December 2012 – outlining the facts and status of implementation of measures and progress towards goals; and (ii) a more detailed three-yearly progress report starting in 2014 that draws on multi-annual data and more granular analysis, for a more detailed assessment of future challenges and a better appraisal of the need for additional measures.

An independent commission of four distinguished energy experts scrutinises the cross-governmental monitoring process; their independent opinion is attached to the monitoring report. Public participation also plays a key role: citizens, companies and associations are invited to submit suggestions and ideas.

### Challenges faced during implementation

Work on the first monitoring report showed that in some cases improved energy statistics are needed in the future. For example, incomplete data on international energy prices and energy consumption in the household, transport and trade sectors can only provide a restricted view.



## Why the policy is considered a success

The public and the media appreciated the first monitoring report as a useful and comprehensive overview of the status of the energy reforms, welcoming the transparent procedure and public dialogue. Many associations, institutions and members of the public took the opportunity to submit comments. Consequently, important additional information – *e.g.* on heat consumption in households or on efficiency in the transport sector – was incorporated in the monitoring report and thus improved its quality and informative value.

## Lessons to be shared

The scrutiny of the independent commission of energy experts, as well as the use of verifiable data, strongly increased the credibility of the monitoring process. Furthermore, the first monitoring report showed the public that Germany is on track in the key areas of the reforms. Yet, in order to achieve the goals set out in the Energy Concept, both further reform steps and joint efforts by all stakeholders are necessary.

A comprehensive description and an English version of the first monitoring report are published on the Federal Ministry of Economics website: [www.bmwi.de/DE/Themen/Energie/Energiewende/monitoring-prozess.html](http://www.bmwi.de/DE/Themen/Energie/Energiewende/monitoring-prozess.html).

# Netherlands

## Shortened and simplified procedures for energy projects of national interest

### Policy area/objectives

In 2009, the national co-ordination procedure for energy projects of national interest was introduced as a response to complaints of the long procedures to realise major energy infrastructure like electricity grids or wind parks (e.g. 10 years to 15 years in the case of the national electricity grid). The long duration of the procedures was due to several causes: lack of alignment in permitting procedures; multiple possibilities for objection and appeal against a single project; involvement of different government levels with different views; and increasing “not in my backyard” (NIMBY) behaviour against energy infrastructure projects.

As a result of the long procedures, the security of the energy supply was endangered, economic opportunities were lost and the development of sustainable energy production (wind energy) was adversely affected.

The national co-ordination procedure for large energy infrastructure projects, part of the Dutch Environmental Planning Act, was introduced as a remedy. Its objective is to shorten and simplify spatial planning and permitting procedures for energy projects of national interest.

### Main characteristics of the policy

The basic idea of the national co-ordination procedure is that if a project is of national interest, the national government should

be responsible for making the decisions. Spatial decision-making is therefore done at the national level. The Minister of Economic Affairs and the Minister of Infrastructure and Environment jointly decide on a national land-use plan regarding the energy project concerned. This national plan automatically replaces the land-use plan of the local authority.

The issuing of the necessary permits for a project continues to be in the hands of local authorities, but is subject to time limits which are imposed by the Minister of Economic Affairs. In case of opposition or reluctance in granting the permits, the Minister can direct or overrule the local authorities. All draft decisions concerning the project are published for consultation at the same time. There is one opportunity for appeal against the final decisions, and the court rules on all decisions at once within six months. The total average time for this formal procedure is about one year. However, this period does not include time for research for the environmental impact assessment (EIA). The EIA is the basis for the spatial decision and the permits, and often requires several years.

### Challenges faced during implementation

In order to gain time, the national co-ordination procedure often requires that the EIA, spatial planning and permitting be done in parallel. This is only successful if the project promoter and the different authorities involved co-operate very

closely. It also requires that the practitioners who conduct the EIA and the spatial planning have a high level of expertise. A challenge which has to be faced constantly is that not all local or regional governments welcome national interference in their local interests.

## Why the policy is considered a success

Experiences with the national co-ordination procedure have so far been positive. The average realisation time of a project has been reduced from ten to about one to four years, including the research period for the EIA.

## Lessons to be shared

One of the important remaining challenges is the lack of public acceptance for some projects. Opposition to high-voltage lines and windmills especially persists. Although NIMBY behaviour is, to a certain extent, inevitable in a small and densely populated country like the Netherlands, much can still be gained from good communication and participation with the different stakeholders in a project. Early dialogue with citizens affected by a project is essential, as well as early co-operation between the project promoter and the various authorities. Transparency, diplomacy and an open mind are required from all the parties involved.

# Sweden

## A vehicle fleet independent of fossil fuel by 2030

### Policy area/objectives

In 2009, the government adopted an integrated climate and energy policy package. One integral part of the package is the vision of a Swedish vehicle fleet independent of fossil fuels by 2030.

### Main characteristics of the policy

A number of regulations and economic incentives have already been introduced to fulfil this vision. The Swedish taxation system supports the purchase of environment-friendly vehicles through a tax exemption throughout the first five years. This incentive has been strengthened with the introduction of an extra subsidy for “super environment-friendly” cars emitting less than 50 grams of carbon dioxide (CO<sub>2</sub>) per kilometre, which targets plug-in hybrids and electric vehicles.

To promote alternative fuels, high-ratio blends of renewables into gasoline and diesel (E85, ED95 and biodiesel – 100% Fatty Acid Methyl Ester [FAME]) are subject to a full tax exemption. In addition, pumping stations which sell more than 1 000 cubic metres per year are required to offer a renewable fuel (*e.g.* E85). With regards to low-ratio blends into gasoline and diesel, there is no obligation today. However, from May 2014 the government is planning to introduce blending obligations which aim at an increased level of low blending. The new law also introduces a specific sub-quota for advanced biofuels. Low-ratio blends of renewables have so far been incentivised through the general tax

exemption on biofuels and the world’s highest CO<sub>2</sub> tax imposed on the European Union non-Emissions Trading Scheme (non-ETS) sectors.

Another government priority has been research, development and deployment of clean vehicles (including a demonstration programme for e-mobility) and advanced biofuels, with the focus on the production of biofuels based on feed-stocks originating from forestry.

Already in 2012, Sweden reached the binding European Union (EU) target that, by 2020, the share of renewable energy in the transport sector should be 10% in EU member states. The national long-term priority for 2030 is far more ambitious than this target; a special committee has been established to investigate the options for facilitating development in line with the vision for 2030. The committee, which involves all relevant stakeholders, will present its conclusions in December 2013.

### Challenges faced during implementation

Sweden has already largely phased out fossil fuels from electricity generation and the heating sector, so the transport sector is the largest remaining challenge. The cost and availability of renewable biofuels has led the Swedish government to invest heavily in research and development in this field. Another obstacle is the availability of environment-friendly vehicles. Car manufacturers work on a global scale and are reluctant to adjust their models solely for the Swedish market.

## Why the policy is considered a success

As the long-term priority is set for 2030, it is too early to make a final assessment of the results, but already this project has attracted much-needed attention to the transport sector and to the obstacles to be addressed in the fulfilment of the priority.

## Lessons to be shared

The setting of ambitious priorities triggers much-needed discussion and creativity.

# Energy and CO<sub>2</sub> taxation in Sweden

## Policy area/objectives

An important tool to achieve reduced GHG emissions targets is the use of economic instruments, such as CO<sub>2</sub> taxes and emissions trading. Pricing of CO<sub>2</sub> emissions is essential in order to make those who pollute pay for their impact on the environment. High energy taxes on fuels and electricity, as well as high CO<sub>2</sub> taxes on fossil fuels, effectively steer demand through environmental signals, putting an implicit price on fossil carbon while at the same time providing state revenues.

## Main characteristics of the policy

Sweden has long and successful experience in applying taxation on energy. Motor fuels have been taxed in Sweden since the 1920s. An energy tax on electricity, as well as on oil and coal used for heating purposes, has been collected since the 1950s. Taxation was later extended to cover liquefied petroleum gas (LPG) and natural gas as well. The oil crisis during the 1970s led to an increased awareness of the security of supply of oil products, which resulted in higher taxation of these products. Sweden complemented the energy tax with specific CO<sub>2</sub>

and sulphur taxes in 1991, as environmental policy was becoming increasingly important on the political agenda.

The prevailing principle has been to levy energy and CO<sub>2</sub> taxes on fossil fuels when used as motor fuels or heating fuels. The CO<sub>2</sub> tax is levied on fuels containing fossil carbon, and the Swedish CO<sub>2</sub> tax rates have been significantly increased over the years, with the purpose of achieving cost-effective emission reductions.

Sweden today has the world's highest CO<sub>2</sub> tax imposed on the non-trading (non-ETS) sectors and on households and services. In 2012, the general CO<sub>2</sub> tax corresponded to EUR 118 per tonne (EUR/t) of CO<sub>2</sub> (SEK 1.08<sup>1</sup> per kilogramme of CO<sub>2</sub>), which can be compared with current permit prices within the EU-ETS below EUR 10/t, or the minimum CO<sub>2</sub> tax levels in the EU proposal for a revised Energy Taxation Directive of EUR 20/t. Thus, for buyers of heating oil the price is almost doubled compared to the market price. The CO<sub>2</sub> tax has been the major incentive to reduce the use of fossil fuels, and the major driving force behind the rapid growth of bioenergy in Sweden, in particular for the district heating sector.

1. As of September 2013, Swedish kronor SEK 1 was roughly equivalent to USD 0.152.



## Challenges faced during implementation

The Swedish energy taxation system has been designed to strike a balance between fulfilling environmental objectives and accounting for the risks of carbon leakage. Hence, a lower tax level has been applied on fuels used for heating purposes by industry ever since the introduction of the CO<sub>2</sub> tax.

## Why the policy is considered a success

During its over 20 years of existence, the CO<sub>2</sub> tax has contributed to reduced fossil fuel consumption in Sweden, in particular for the household and service sectors and district heating production, where the full CO<sub>2</sub> tax has been applied. Today, the share of fossil fuels in district heating is less than 15%. The increase of biofuels (exempted from the CO<sub>2</sub> tax) has been

substantial during recent decades following a steadily increased level of the full CO<sub>2</sub> tax. Bioenergy today provides for over a quarter of the total energy consumption in Sweden.

## Lessons to be shared

A CO<sub>2</sub> tax has the advantage of being a market-based instrument, which at low administrative costs enables households and firms to choose measures to reduce fossil fuel consumption – and thus GHG emissions – that are best suited to their specific situation. The Swedish experience shows that emission reductions can be combined with economic growth. During the period 1990-2012, CO<sub>2</sub>-equivalent emissions were reduced by 20%, while at the same time economic activity increased by 59%. A tax also works well in combination with other instruments of climate and energy policy, such as green certificates, subsidies to renewables, and regulations that have been introduced after (or in some cases before) the tax.

# United States

## US Climate Action Plan

### Policy area/objectives

On 25 June 2013, US President Barack Obama presented the US Climate Action Plan for steady, responsible national and international action to cut the GHG emissions that cause climate change and threaten public health. The plan has three pillars: (i) cut carbon pollution in the United States; (ii) prepare the United States for the impacts of climate change; and (iii) lead international efforts to combat global climate change and prepare for its impacts.

### Main characteristics of the policy

Each pillar in the plan consists of a wide variety of executive actions the president can take.

The key mitigation elements are numerous:

- to cut CO<sub>2</sub> pollution from coal-fired power plants by directing the US Environmental Protection Agency to establish carbon pollution standards for both new and existing power plants;
- to unlock long-term investment in clean energy innovation by making up to USD 8 billion in loan guarantee authority available for a wide array of advanced energy projects that use fossil fuels;
- to accelerate clean energy permitting by: directing the US Department of the Interior to permit 10 gigawatts (GW) of renewables on public lands by 2020; setting a goal to install 100 megawatts of renewables in federally assisted housing by 2020; and deploying 3 GW of renewables in military installations;

- to expand the federal government's Better Building Challenge to focus on helping commercial, industrial, and multi-family buildings become at least 20% more energy efficient by 2020;
- to reduce CO<sub>2</sub> pollution by at least 3 billion metric tonnes cumulatively by 2030 through efficiency standards for appliances and federal buildings;
- to increase fuel economy standards by developing post-2018 fuel economy standards for heavy-duty vehicles;
- to leverage new opportunities to reduce pollution of hydrofluorocarbons (HFCs), direct agencies to develop a comprehensive methane strategy and commit to protect forests and critical landscapes.

The key climate resilience and preparedness elements also address several goals:

- to build stronger and safer communities and infrastructure by directing agencies to support local climate-resilient investment, and integrate climate risk-management considerations into planning and programmes;
- to pilot innovative strategies in the Hurricane Sandy-affected region to support resilience and reduce vulnerability to future large-scale flood and storm events;
- initiate the creation of sustainable and resilient hospitals in the face of climate change;

- to protect the US economy and natural resources by directing agencies to: identify approaches to improve natural defences against extreme weather; maintain agricultural productivity by delivering tailored, science-based knowledge to farmers, ranchers, and landowners; help communities manage drought-related risk by launching a National Drought Resilience Partnership; and expand and update efforts to reduce wildfire risks and prepare for future floods;
- to provide climate preparedness tools and information needed by state, local, and private-sector leaders through a centralised “toolkit” and a new Climate Data Initiative.

Key objectives of the international elements are equally ambitious:

- to enhance and expand international initiatives through forums such as the Major Economies Forum and the Clean Energy Ministerial, identifying new areas for bilateral co-operation;
- to combat short-lived climate pollutants, such as methane, hydrofluorocarbons, and black carbon through the Climate and Clean Air Coalition, Global Methane Initiative, and working under the Montreal Protocol to phase down the consumption and production of HFCs;
- to expand clean energy use by promoting natural gas development and fuel switching, the safe and secure use of nuclear power, and clean coal technologies;
- to cut energy waste by aggressively promoting energy efficiency in critical areas such as buildings, wastewater treatment and appliances;
- to launch negotiations at the World Trade Organization (WTO) towards global free trade in environmental goods, including clean energy technologies;

- to phase-out US fossil fuel tax subsidies, and collaborate with partners around the world toward this goal;
- to end US government support for public financing of new coal-fired power plants overseas, except for the most efficient coal technology available in the world’s poorest countries, or facilities deploying carbon capture and sequestration technologies;
- to strengthen global resilience to climate change by expanding government and local community planning and response capacities;
- to lead efforts to address climate change through international negotiations, seeking an agreement that is ambitious, inclusive and flexible.

## Challenges faced during implementation

Challenges are specific to individual actions and vary widely; the plan therefore sets specific measures to address each of them. Examples of such challenges are as follows:

- addressing the high costs of some types of technology development (such as the high upfront cost of carbon capture and storage);
- promoting the widespread investment in appliance and equipment efficiency (including properly balancing significant cost savings through efficiency gains with upfront capital investment costs);
- overcoming barriers to incentivising private sector action (and the wise use of government resources that avoid duplicating or crowding out private sector investments).

## Why the policy is considered a success

The United States will evaluate progress on the implementation of the Climate Action Plan regularly and sharing results and lessons learned. One key metric (although one that will only be measurable over time) will be reductions in US GHG emissions; the plan is designed to help meet the US commitment to reduce emissions in the range of 17% below 2005 levels by 2020, as agreed in the United Nations

climate negotiations. President Obama has also set a goal to double renewable electricity generation by 2020.

## Lessons to be shared

The United States looks forward to sharing the results of its efforts under this plan with the international community, and will provide regular updates on progress through both domestic and international reports.

# Australia

## Enabling industry to improve energy efficiency

### Policy area/objectives

Industry accounts for approximately 80% of Australia's total energy use.<sup>1</sup> The government's Energy Efficiency Opportunities (EEO) Program<sup>2</sup> aims to enable industry to become more energy efficient. Participating corporations are achieving financial benefits totalling around AUD 800 million per year.<sup>3</sup>

### Main characteristics of the policy

Participation in the programme is mandatory for corporations whose energy use exceeds 0.5 petajoules (PJ) (the equivalent of 10 000 households) in a financial year. Participating corporations are required to undertake an energy assessment which involves numerous components:

- senior leadership and management endorsement of energy performance objectives;
- involvement of experts and company staff with an influence on energy use;
- the collection and analysis of energy-use data to underpin an assessment;
- a systematic process to identify and evaluate opportunities to improve energy productivity;
- the presentation of outcomes to decision-makers and the board;

- public reporting of assessment outcomes.

The programme includes several key features:

- A focus on improving energy use in a business brings benefits in productivity, competitiveness and greenhouse gas (GHG) abatement.
- The legislative requirements are light-handed: only the process for assessing and reporting on energy use is mandatory for corporations. The actual implementation of the opportunities they discover is not mandatory, although many companies act to improve energy efficiency once the information is available.
- A wide range of comprehensive tools and information has been developed by the government to help corporations discover as many opportunities as possible.
- Promotion of a rigorous approach to energy assessment aims to permanently change behaviour within a company, beyond mere standards compliance. When corporations develop an understanding of how energy is used in their business, they are able to make decisions on implementation that fit with other business priorities.

In 2011, the programme was expanded to include companies in the electricity generation sector, increasing the coverage to nearly 60% of Australia's total energy use. As of 2013, corporations undertaking new developments and/or major expansion projects are also covered, thus helping to ensure energy efficiency is part of design considerations.

1. Available at: <http://eeo.govspace.gov.au/files/2012/11/Continuing-Opportunities-2011.pdf>.

2. As per the Energy Efficiency Opportunities Act 2006 and associated regulations.

3. As of September 2013, AUD 1 was roughly equivalent to USD 0.93.

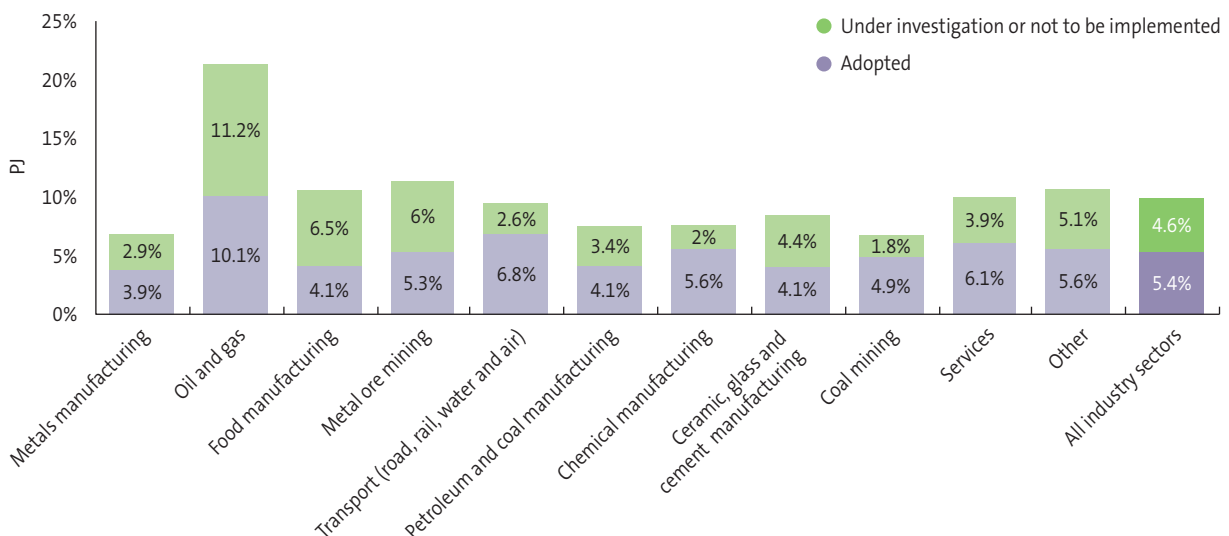
## Challenges faced during implementation

To address industry concerns about the programme's regulatory obligations, the Australian government works closely with corporations to develop tools and systems to support their participation in the programme, including guidance materials, industry workshops and dedicated industry support officers. Ensuring that key personnel in each corporation understand the programme's obligations and intent – from the board through to the staff member submitting reports – is an ongoing challenge.

## Why the policy is considered a success

In 2011, the majority of participating corporations completed their first five-year assessment cycle, reporting the identification of opportunities to save an estimated 164 PJ, with the adoption of 89 PJ (equivalent to 1.5% of Australia's total energy use), representing an annual emissions abatement of 8.3 million tonnes of carbon dioxide equivalent (MtCO<sub>2</sub>-eq) and net annual financial savings of over AUD 800 million. However, across all sectors of Australian industry, there is still potential for further savings, with 4.6% of identified savings remaining "under investigation" or "not to be implemented".

**Figure 3** Identified and adopted energy savings as a percentage of assessed energy use



Source: Commonwealth of Australia, 2012.

A regular independent review process of the EEO Program is undertaken at the mid-way and end point of each five-year cycle. The most recent review<sup>4</sup> estimates that of all the energy,

GHG emissions and financial savings reported by participating corporations, around 40% had been enabled by the programme, with economic (*e.g.* energy prices), environmental and social factors accounting for the remaining savings. The review highlights that barriers around access to information on potential

4. Available at: <http://energyefficiencyopportunities.gov.au/about-the-eeo-program/program-review/full-cycle-review/>.



opportunities have been significantly reduced during the programme's first five-year cycle. It also indicates a marked improvement in the knowledge, skills and systems available to identify, implement and track opportunities to improve energy productivity.

## Lessons to be shared

- Ongoing engagement with industry stakeholders – an integral part of the EEO Program's design and implementation – encourages corporations to embed energy efficiency as standard business practice.
- While standards and frameworks are useful tools to improve energy efficiency, without enabling legislation their efficacy will be limited. Some corporations do not have a strong economic incentive to pursue energy efficiency; therefore legislative obligations can be used to drive behaviour change.
- Compliance obligations must be balanced with tailored assistance, flexibility and appropriate guidance. This recognises corporations who have existing processes for improving energy efficiency and the unique needs of different industry sectors.
- Mandating the implementation of opportunities is not necessary to achieve the benefits from improved energy efficiency. Providing senior leaders and corporate boards with information to justify investment in energy efficiency allows decisions on implementation to be made at the discretion of the participating corporations.

# Canada

## Continuous building energy code improvements

### Policy area/objectives

Canada is committed to a cycle of continuous building energy code improvements. In 1997, Canada established a buildings code (Code 1997),<sup>1</sup> which set a minimum level for energy performance in the design and construction of new buildings and, in 1998, launched an incentive programme<sup>2</sup> for commercial buildings to push performance 25% beyond those minimum performance levels.

The next step was to incorporate progressive building practices into performance standards by 2012. In 2011, the *National Energy Code of Canada for Buildings 2011* (Code 2011) established a minimum energy performance level for buildings above three storeys and incorporated the latest standards and practices, such as natural lighting and enhanced ventilation. Adoption of Code 2011 is currently underway across all jurisdictions in Canada, with one exception that already incorporates stringent guidelines for building design.

### Main characteristics of the policy

Code 2011 provides minimum requirements for the design and construction of energy efficient new commercial buildings and covers the building envelope, systems and equipment for heating, ventilating and air-conditioning, service water heating, lighting, and the provision of

electrical power systems and motors. In 2020, the savings from these efforts are estimated to be worth CAD 350 million.<sup>3</sup>

In addition, efforts are already underway for the next iteration, Code 2015, which will include new equipment standards and regulations. Beyond 2015, future updates to the Code will include energy performance improvements that maintain Canada's collective progress toward net-zero energy buildings (*i.e.* maximising energy efficiency and providing for the use of on-site renewable energy such that buildings generate as much energy as they would draw from electricity, gas and oil sources). The national model energy code for buildings in 2015 will establish today's innovative practices as the new minimum standards for tomorrow.

### Challenges faced during implementation

Building codes are under provincial and territorial jurisdiction, with municipalities playing a key role in their implementation. The federal government therefore helps to bring together key stakeholders across all levels of government, industry and academia in order to continuously review and update the Code.

One challenge faced by Code 1997 was its focus on requirements to reduce energy costs. A building code focused on energy costs can encourage less efficient buildings that ultimately use more energy per square metre because the

1. The Model National Energy Code of Canada for Buildings (Code 1997).

2. The Commercial Buildings Incentive Program (CBIP) was launched by Natural Resources Canada.

3. As of September 2013, CAD 1 is approximately equivalent to USD 0.96.

cost of the particular fuel type used is lower. Code 2011 helps to overcome this drawback. In contrast to Code 1997, Code 2011 is an objective-based energy code that is fuel-type neutral, which will consequently result in the most energy-efficient design. Ultimately, this major shift from a code based on energy costs to one based on energy efficiency exemplifies how building codes can be developed to protect building owners from fluctuating utility prices. This new focus on the design and construction of buildings helps to ensure that newly constructed buildings will always be more energy efficient than in the past.

## Why the policy is considered a success

The policy will generate significant savings over a building's typical 40-year to 60-year lifespan. In 2020, buildings built to the Code

are expected to save 17 PJ of energy per year, or CAD 350 million in annual energy costs. More than 1 megatonne of annual GHG emissions are expected to be avoided in 2020 as a result. Efficient green buildings' improved lighting and air quality help to reduce sick days and increase productivity of building occupants. A building built to Code 2011 can also offer building owners a competitive advantage in the real estate market when leasing or selling.

## Lessons to be shared

In a country where building codes are the responsibility of provincial and territorial governments, the development of Code 2011 is an excellent example of what can be accomplished through strong and effective inter-governmental collaboration.

# Denmark

## The Danish energy-saving scheme: increased obligations on energy utilities

### Policy area/objectives

In 2006, with broad political support, the minister responsible for energy and the grid and distribution companies in the electricity, natural gas, district heating and oil sectors entered into a voluntary agreement to achieve annual energy savings.

The aim of the agreement was to create a solid framework for increased cost-efficient and market-oriented energy-saving efforts, with particular focus on achieving cost-effective savings.

### Main characteristics of the policy

This agreement effectively commits utility companies to the responsibility for increasing the overall savings, focusing on achieving energy savings in final energy consumption in all sectors. The utility companies are free to choose the methods they use to deliver savings in the most cost-effective way. This includes allowing utility companies to carry out savings measures outside their own supply area, and outside their own energy type.

In 2006, the total annual savings target for the scheme was 2.05 PJ, and responsibility for delivery was divided among the energy sectors involved. The total savings target has gradually risen since 2006. Because the 2012 Energy Policy Agreement determined ambitious goals for energy savings, the agreement between

energy companies and the minister for energy was renegotiated. The annual energy savings target in the two-year period 2013-14 is 10.7 PJ, equivalent to approximately 2.6% of the total energy consumption<sup>1</sup> in Denmark; the annual target for 2015 is 12.2 PJ.

### Challenges faced during implementation

The design of the scheme had to take into account the challenge of “additionality”: in other words, some of the savings would have been carried out independent of the involvement of the utility companies. Several measures addressed this: in 2010 the overall savings target was increased by approximately 15% in order to adjust for additionality; furthermore, saving measures with low additionality were either taken out of the scheme, or the value of these measures was lowered significantly.

Allowing grid companies to undertake the task of carrying out savings measures themselves makes it difficult to secure low prices, as competition is limited.

For some of the smaller companies, administration of the agreement can be a challenge.

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1. Energy consumption excluding transport.

## Why the policy is considered a success

The average cost of savings reported in 2011 was approximately EUR 0.05 per kilowatt hour (kWh) in first-year savings, equivalent to EUR 0.005 per kWh when assuming an average savings lifetime of 10 years. The utility companies can recover the cost of the savings via tariffs. An independent evaluation conducted in 2008 showed that the scheme is considered very cost-effective, even when including the costs to consumers.

## Lessons to be shared

Letting the grid and distribution companies deliver the obligation scheme makes implementation of the annual savings target easier: the utilities are spread across the country and are already in contact with consumers. The arrangement also provides a secure and stable way to finance energy savings activities, because it avoids the difficulties of securing state financing.

# Ireland

## Energy-saving targets for energy suppliers

### Policy area/objectives

The programme of energy savings targets for energy suppliers is a central component of Irish energy efficiency policy, as well as of wider energy and climate policies. The first National Energy Efficiency Action Plan (2009) identified the potential for an energy savings programme targeted at energy suppliers. Given the extent of Ireland's national energy efficiency target (set at 31 925 gigawatt hours [GWh], with a gap-to-target of 8 000 GWh), additional measures would be required in order to meet the 2020 objective.

Following discussions between the Irish government<sup>1</sup> and the energy industry, new energy savings targets were introduced for all energy suppliers on a three-year cycle, initially for 2011-13 with a new iteration to be decided for 2014-17.<sup>2</sup>

### Main characteristics of the policy

The programme runs on a voluntary basis, with 19 energy suppliers – spread across electricity, gas, solid fuels and oil importers – currently signed up for voluntary energy savings agreements. Legislation underpinning these agreements allows the minister to impose energy savings targets on energy suppliers if they choose not to sign an energy savings agreement.<sup>3</sup>

Operation of the existing programme is delegated by the minister to the country's national energy agency (Sustainable Energy Authority of Ireland [SEAI]), which maintains a list of approved measures and associated energy savings. The list currently comprises 26 measures with more added on request (from energy suppliers or third parties) by the SEAI. All new measures, and actions undertaken by energy suppliers, are subject to appropriate monitoring, verification and audit.

Energy suppliers are required to submit an annual plan in advance of each operational year, setting out their programme of activity that will deliver their energy savings target. SEAI manages the operational aspects of programme delivery, including managing energy supplier performance. Trading is allowed in the event an energy supplier exceeds its energy savings target.

### Challenges faced during implementation

The introduction of energy savings targets for energy suppliers was particularly challenging because no similar arrangements existed prior to the programme's commencement. Even after extensive public engagement, the Department of Communications, Energy and Natural Resources (DCENR) found it hard to convince the energy suppliers of the merits of such a programme, and that it could add value to their consumer offering in liberalised markets, rather than detracting from their core business model.

1. Department of Communications, Energy and Natural Resources (DCENR).

2. In accordance with the Energy Efficiency Directive (2012/27/EU).

3. Energy Miscellaneous Provisions Act, 2012.



## Why the policy is considered a success

The adjusted three-year energy savings target to be delivered by the energy suppliers is 875 GWh, with the targets allocated by sector as follows: oil (33%); gas (15%); electricity (48%); and solid fuels (4%). After two years, 81% of anticipated energy savings will have been achieved, with energy suppliers striving to meet the full three-year programme target by the end of 2013.

## Lessons to be shared

The DCENR consulted substantively on all of the programme's parameters prior to its introduction. This commitment to transparency and dialogue enabled the department to build up trust and co-operation with energy suppliers, which facilitated the introduction and operation of the programme. The DCENR continues to engage with energy suppliers through a quarterly governance forum, at which issues of operational and strategic direction are discussed.

# Italy

## Energy efficiency policy implementation through White Certificates and 55% tax rebate schemes

### Policy area/objectives

The main implementation methods for energy efficiency policies in Italy are White Certificates (WhCs) introduced in 2005, and a 55% tax rebate scheme introduced in 2007. The WhCs scheme was introduced with the adoption of the first European Directive on the liberalisation of the electricity and natural gas market. Both schemes aim at a wide range of policy purposes, such as reduced GHG emissions, reduced energy import dependence, and development of the market for energy efficiency products and services. It is noteworthy that the two systems are implemented, respectively, as complimentary policy measures to the CO<sub>2</sub> reduction efforts in the European Union Emission Trading Scheme (ELL-ETS) and the non-ETS sectors.

### Main characteristics of the policy

WhCs are an example of a trading incentive scheme, promoting energy efficiency measures in the industry sector, both in the production process and in end-use products. Each WhC represents a savings of 1 tonne of oil-equivalent (toe). The scheme is based on energy-savings obligations imposed on electricity and gas distributors with more than 50 000 customers to achieve annual targets of primary energy savings. Financial penalties for non-compliance with targets are imposed and, in order to satisfy annual obligations, WhCs generated by interventions implemented by other operators or non-obligated parties can be bought on the

market. The trading mechanism is a central element of the system and it ensures, in principle, that savings occur where they are economically most efficient. Furthermore, the scheme is governed by a strong additionality criterion: only savings achieved above the market average or above legislative requirements are taken into account.

The 55% tax rebate programme provides tax credits to households for comprehensive or single retrofit energy efficiency measures, such as thermal insulation, installation of solar panels, replacement of heating and air-conditioning systems or comprehensive refurbishments. The total deductible amount is then distributed over a period of ten years.<sup>1</sup>

### Challenges faced during implementation

Energy Service Companies (ESCOs) are willing to accept long payback periods and have become the main actors in implementing projects: almost 400 different ESCOs have successfully implemented projects of 20 toe savings (equivalent to 20 WhCs) or more. Unfortunately, less than 20 GWh per year (GWh/yr) of nearly 27 000 GWh/yr of savings stem from measures related to the building envelope: the relatively short lifetime of project support (five years with some exceptions of eight years) makes projects with high upfront costs and longer payback times less attractive.

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1. Five years before 2011.

In the 55% scheme, the cost saved per kWh ranges from EUR 0.06 for comprehensive retrofit measures to EUR 0.15 for replacement of windows. In general, a comprehensive package of measures is more cost-efficient than single measures, at the price of greater complexity and at the risk of insufficient resources. The simultaneous implementation of both schemes together with regional schemes, giving rise to a potential problem of double counting, suggests the desirability of stronger compartmentalisation of incentive measures. Finally, at present the eligibility of interventions under the 55% scheme can only be extended annually, leaving operators with some uncertainty nearing the end of each year.

## Why the policy is considered a success

Both schemes have boosted the development of a market for energy efficiency services as well as the awareness among households of the multiple benefits related to the adoption of energy efficiency technologies and behaviours.

By 2011, more than 6 000 projects (of at least 20 toe each) had been submitted for WhCs and about 1 300 000 projects for the 55% scheme, providing an overall energy savings of more than 34 000 GWh/yr (2.2% of energy consumption in 2011) of almost 60 000 GWh/year saved at the national level thanks to all the energy efficiency policies implemented.<sup>2</sup>

## Lessons to be shared

WhCs represent an open-ended system widely adopted because any type of end-use energy efficiency measure qualifies for a certificate. Even if more cost effective, the 55% scheme is more widely spread at a household level and hence more difficult to administer. A wealth of quantitative and qualitative data at the project and programme levels is available, thanks to the bottom-up monitoring approach which characterises both schemes; this is helpful in the evaluation of both the rebound effect of policies and end-users' response to information and awareness-raising campaigns.

<sup>2</sup> Energy Efficiency Annual Report, 2011.

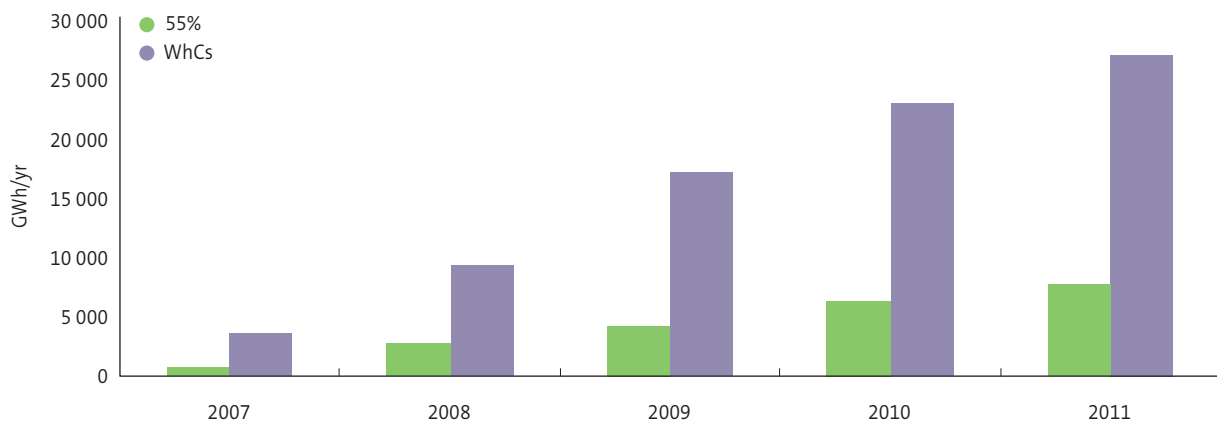
**Table 1** Energy savings: annual values (GWh/yr)

|      | 2007  | 2008  | 2009  | 2010  | 2011  | TOTAL         |
|------|-------|-------|-------|-------|-------|---------------|
| 55%  | 788   | 1 961 | 1 487 | 2 032 | 1 369 | <b>7 637</b>  |
| WhCs | 3 515 | 5 757 | 7 718 | 5 750 | 4 041 | <b>26 781</b> |

Source: Rifiuti di apparecchiature elettriche ed elettroniche (RAEE), 2011.

**Figure 4** Energy savings: annual values

Source: RAEE, 2011.

**Figure 5** Energy savings: cumulative values

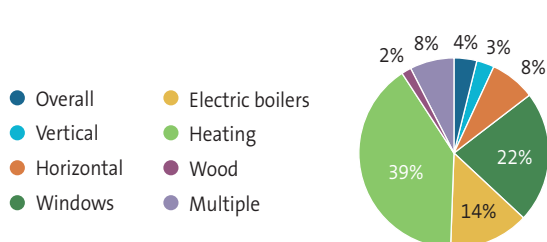
Source: RAEE, 2011.

**Table 2** Energy savings from 55% scheme (GWh/yr)

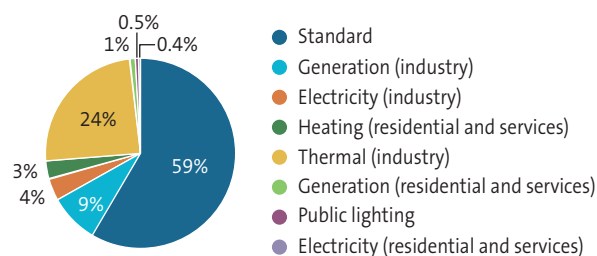
| Actions                                  | 2007       | 2008         | 2009         | 2010         | 2011         | Total 2007-11 |
|--|------------|--------------|--------------|--------------|--------------|---------------|
| Overall renovation of building           | 48         | 114          | 85           | 32           | 25           | <b>304</b>    |
| Insulation of opaque vertical envelope   | 21         | 39           | 42           | 69           | 50           | <b>220</b>    |
| Insulation of opaque horizontal envelope | 23         | 151          | 156          | 132          | 135          | <b>597</b>    |
| Replacement of windows                   | 142        | 305          | 297          | 570          | 383          | <b>1 696</b>  |
| Replacement of electric boilers          | 93         | 288          | 245          | 254          | 155          | <b>1 035</b>  |
| Use of efficient heating systems         | 268        | 614          | 626          | 961          | 612          | <b>3 081</b>  |
| Balanced flues and wood-fired boilers    | 20         | 49           | 36           | 14           | 10           | <b>130</b>    |
| Multiple selection                       | 173        | 401          | 0            | 0            | 0            | <b>574</b>    |
| <b>Total</b>                             | <b>788</b> | <b>1 961</b> | <b>1 487</b> | <b>2 032</b> | <b>1 369</b> | <b>7 637</b>  |

Source: RAEE, 2011.

**Figure 6** Energy savings from 55% scheme



**Figure 7** Energy savings across supply-side



Source: RAEE, 2011.

**Table 3** Energy savings from WhCs scheme (GWh/yr)

|                                       | Cumulative<br>2009 | Annual<br>2010 | Annual<br>2011 | Total         |
|---------------------------------------|--------------------|----------------|----------------|---------------|
| Standard/analytical schedules         | 13 539             | 1 047          | 1 099          | <b>15 685</b> |
| Time and materials projects:          |                    |                |                |               |
| Generation: industry                  | 1 700              | 569            | 31             | <b>2 300</b>  |
| Electricity: industry                 | 380                | 526            | 178            | <b>1 084</b>  |
| Heating: residential and services     | 484                | 247            | 67             | <b>798</b>    |
| Thermal: industry                     | 537                | 3 290          | 2 643          | <b>6 470</b>  |
| Generation: residential and services  | 190                | 0              | 0              | <b>191</b>    |
| Public lighting                       | 92                 | 40             | 1              | <b>133</b>    |
| Electricity: residential and services | 67                 | 32             | 21             | <b>120</b>    |
| <b>Total</b>                          | <b>16 990</b>      | <b>5 750</b>   | <b>4 041</b>   | <b>26 781</b> |

Source: RAEE, 2011.

# Japan

## Energy efficiency champion in pursuit of higher goals

### Policy area/objectives

Japan's energy intensity has improved 40% since the 1970s and is among the world's best, enhancing Japan's industrial competitiveness. Having experienced the challenges of a tight power supply and demand balance after the Great East Japan Earthquake (Fukushima nuclear accident) in 2011, Japan is revitalising its energy efficiency policy once again.

### Main characteristics of the policy

The government amended its Act on the Rational Use of Energy in May 2013. The act's first pillar aims to improve the thermal insulation performance of houses and buildings. The use of more energy-efficient insulators and windows will help reduce the energy consumption associated with air conditioning and water heating, which accounts for 60% of energy consumption in the housing and buildings sector. The government therefore recently added insulators and windows to the list of products covered by the Top Runner Program. This is a set of regulations which sets specific numerical energy efficiency standards at levels above the performance of the best products at a given time, and requires manufacturers and importers to meet those standards within three years to ten years. The programme serves to promote both energy conservation and innovation.

The Act's second pillar is the reduction of peak demand by promoting the introduction of technologies such as smart meters, energy management systems and storage batteries. Consumers' efforts to reduce the use of electricity from utility grids during peak demand hours will be evaluated positively, and will be taken into account when calculating the energy intensity improvement goal under the Act.

### Challenges faced during implementation

From 1973-2011, Japanese gross domestic product (GDP) grew by 2.4 times, while final energy consumption increased only 1.3 times due to substantial improvement in energy intensity. However, the improvement varies by sector. While industry's energy consumption decreased by 10%, the transport industry increased 1.9 times. Similarly, consumption in the housing and buildings sector increased 2.5 times due to an increasing number of households, greater use of appliances, and expanding office space. The housing and buildings sector therefore has the greatest potential for better energy efficiency.

Following the devastating earthquake and tsunami in March 2011, eastern Japan faced a substantial loss of power-generating capacity. Mandatory electricity demand restrictions were imposed on large businesses, and small businesses and households were encouraged to take voluntary measures through the Setsuden campaign. Energy-saving actions included changing working hours, installation of diesel



generators, switching off lights, and running trains and metros less frequently. As a result, peak power demand in East Japan was cut by over 15%.

Not all of the measures applied, however, would be appropriate during normal times. Even two years after the earthquake, with most of its nuclear power shut down, Japan still faces a precarious electricity supply and demand balance, especially during the peak seasons of summer and winter. The government, realising that excessive power savings can hinder production activities and exert a negative impact on the economy, is therefore addressing reductions in peak power demand as a major policy challenge.

## Why the policy is considered a success

The Top Runner Program has proven effective for the 26 appliances that it already covers. For example, the fuel efficiency of vehicles has improved by 50% from 1995-2010 and the energy conservation performance of

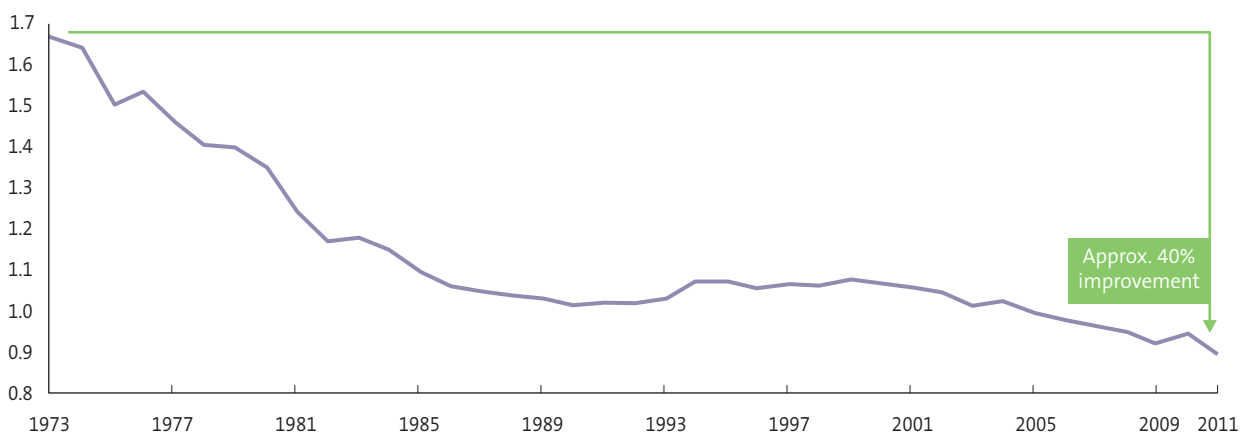
refrigerators improved by 43% from 2005-10. It is expected that the programme will be similarly effective for improving the energy efficiency of newly installed insulators and windows, and contribute to energy intensity improvement in the housing and buildings sector.

The success of cutting peak demand through the Setsuden campaign immediately after the earthquake can be attributed to the collective efforts of the Japanese people and the government's leadership in identifying the efficiency potential by sector and providing advice about how it might be achieved. However, the real challenge is how to save power without damaging economic performance.

## Lessons to be shared

Japan's energy efficiency is among the best in the world, but Japan's effort to make further improvements shows that even an efficient country can do better.

**Figure 8** Primary energy use per real GDP of Japan (Mtoe/1 trillion yen)



Source: Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry.

# Luxembourg

## Energy efficiency in buildings: a timetable for high performance

### Policy area/objectives

As part of an EU directive, Luxembourg is improving the energy efficiency of its building stock through the introduction of energy performance certificates (EPCs).

### Main characteristics of the policy

The European Union has devised a framework for member states to implement national calculation methods for energy performance in buildings and issue an EPC.<sup>1</sup> The provisions for energy efficiency in buildings have subsequently been strengthened, in particular by setting a schedule to implement the “nearly-zero-energy” buildings standard for new buildings in the European Union after 2020 (2018 for public buildings).<sup>2</sup>

Luxembourg implemented energy performance regulations in 2008 for residential buildings and 2011 for non-residential buildings. The regulations set a methodology to calculate the energy performance of buildings; the minimum requirements for new buildings, extensions and renovated elements of existing buildings; and, the most visible aspect of the regulation, the EPC.

Each time a building permit for a new building, an extension, or a renovation of an existing building is required, the documents providing

the calculation of the requested energy performance standards and the EPC must be attached to the application.

In addition, all existing buildings must be certified when they are sold or rented. The owner must present a valid EPC when the sale or rental contract is established.

The energy efficiency of the building is calculated by a qualified expert who also issues the EPC. The buildings can be labelled A through G, and for existing buildings the certificate also lists cost-effective measures for improving energy performance.

In 2012, a new regulation was introduced to reinforce energy performance requirements (primary energy and heating energy) in stages up to 2017 for new residential buildings and larger extensions of existing residential buildings. These will gradually lead to the “passive house” standard requirements for new residential buildings from 2018. The primary energy class and the final energy class will be raised from the class BC now in force up to class AB in 2015, to class AA in 2017.

### Challenges faced during implementation

The period to enhance the requirements for new buildings and the extensions of existing buildings to the passive standard is relatively short. The future standards were therefore published in advance in 2012 to allow the concerned sectors to prepare for the upcoming challenges.

1. Directive 2002/91/EC.

2. Directive 2010/31/EU.

To encourage future and current owners to build or renovate towards high energy performance buildings now, the grants system for energy efficiency measures was adapted simultaneously with the reinforcement of building requirements. The allocation of the subsidies is directly linked to the expected future energy performance class calculated in the certificate: the better the resulting energy performance, the higher the subsidy.

The enhancement of energy performance and the simultaneous adaptation of subsidy schemes were sustained by an information booklet launched by MyEnergy.<sup>3</sup>

## Why the policy is considered a success

The system received substantial acceptance and no major objections. The construction sector even welcomed the introduction of a predefined roadmap to increase efficiency requirements.

Also, the adoption of the schedule in the real estate market has been favourable. Advertisements in the media and on specific building internet sites prove that the energy performance of buildings often exceeds the mandatory requirements. The concerned sectors are clearly prepared to tackle the challenge.

Luxembourg is currently implementing a database for the EPCs in the residential sector. Once the database is operational, all experts will be obligated to upload the energy performance certificate they will have established.

EPCs for new buildings must be completed three years after their establishment with data about the real energy consumption of the considered building during that period, while EPCs for existing buildings already report the annual consumption data of the building. The information from these two EPCs will therefore facilitate middle- and long-term measurement of energy consumption in the residential sector. It will then be possible to define clear indicators of the increasing energy performance of residential buildings according to the gradual reinforcement of the requirements.

## Lessons to be shared

The introduction of mandatory requirements, paired with a financial support scheme and simultaneous information campaigns is the best method to increase the acceptance of stricter efficiency requirements in buildings. Financial incentives can be very effective in stimulating quicker implementation of efficiency measures in the existing and new building stock.

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3. The national body for information and awareness in the sectors of renewable energy and energy efficiency.

# New Zealand

## Warm up New Zealand: heat smart

### Policy area/objectives

A large proportion of New Zealand's homes are cold and damp, poorly insulated and relatively costly to heat. National and international research consistently shows that cold and damp homes are detrimental to people's health and can lead to lower productivity. Households consume about a third of New Zealand's electricity and about 13% of its energy. The Warm Up New Zealand: Heat Smart (WUNZ:HS) programme aims to increase the number of warm, dry and energy-efficient homes to avoid ill health and lost productivity, by insulating a total of 230 000 homes from the start of the programme in 2009-13.

### Main characteristics of the policy

The programme, managed by the Energy Efficiency and Conservation Authority (EECA), offers grants of 33% – up to New Zealand dollar (NZD) 1 300<sup>1</sup> – of the cost of installing ceiling and under-floor insulation to all owners (including landlords) of houses built before 2000. A grant of up to 60% of the cost of insulation is available for low-income home owners or tenants. Homeowners choose one of EECA's approved service providers to install the insulation. Both EECA and the individual providers stimulated demand for the programme through television and print media. Other key elements include ensuring the quality, safety and effectiveness of the retrofits,

and working with industry to manage their funding allocations and contracts. Funding was also available to contribute to the cost of installing new non-polluting clean heaters in insulated pre-2000 homes; however, this was discontinued in late 2011.

### Challenges faced during implementation

The cost of insulation is a significant barrier. Third-party funding from community, charitable or energy trust contributions made it possible to offer very low/no-cost retrofits to a number of low-income households, and local government has offered a system of low-cost finance which homeowners repay through property rates bills. Some banks also offer zero-fee costs for mortgage finance for retrofits.

Motivating landlords to insulate their rental properties is a big challenge. The greatest health benefits experienced are by low-income households, many of whom are renters, but despite increased grants levels for landlords with low-income tenants, landlords have been slow to insulate rental housing as they do not believe they will recoup their costs.

A proportion of housing is in such poor condition that it is impossible or ineffective to insulate. In one case, for a particularly vulnerable group, a cross-agency effort was needed to help fund the repair of houses before they could be insulated.

1. As of September 2013, NZD 1 was roughly equivalent to USD 0.807.

## Why the policy is considered a success

The programme is on track to exceed the target of 230 000 retrofits by late 2013, with independent quality and safety audits showing a high pass rate. An independent evaluation of the programme estimated the energy, health and employment benefits to be over NZD 4 for every NZD 1 spent.<sup>2</sup> The majority of benefits are from improved health, with collateral benefits from reduced time off work and school, increased economic activity and employment, and energy savings.

## Lessons to be shared

Health benefits are mainly from reduced mortality of elderly people, but also from reduced hospitalisation and pharmaceutical costs, particularly in relation to asthma, and respiratory and circulatory diseases.

The largest benefits are experienced by low-income and “at-risk” households (the elderly, children, and those susceptible to diseases exacerbated by cold, damp and mouldy houses) and come mainly from the insulation retrofit component of the programme, not the heating component. The funding of clean heating did not show a positive net benefit. This may be because heaters only affect health outcomes if households have enough money to use them. The clean heating component of the programme has therefore been discontinued to allow the programme to focus on insulation, which delivers better value for money.

The evaluation also suggested that energy efficiency gains from retrofitting houses with insulation are limited by the extent to which households increase household temperatures (comfort levels) following these retrofits.

The independent evaluation suggested refinements to the programme, including prioritising the insulation component over the clean heat component; targeting insulation to houses in cooler rather than warmer areas to maximise energy savings; and targeting insulation to low- and middle-income earners and other at-risk groups in terms of illness to maximise health benefits.

A new insulation programme, which builds on these recommendations, was launched in mid-2013 (Warm Up New Zealand: Healthy Homes). It is designed to deliver a range of projects that offer fully funded insulation retrofits to households at risk of cold-related illness.

Retrofitting insulation can involve significant safety risks to people and property – such as fire from insulation installed over lights. Care needs to be taken with the contractual liabilities of approved installers to ensure the industry takes responsibility for safety and maintains good standards and practice. An auditing programme is also critical to maintain safety standards.

2. Grimes, A., *et al.* (2012), Cost Benefit Analysis of the Warm Up New Zealand: Heat Smart Programme, Ministry of Economic Development, Wellington.

# Portugal

## Improving energy efficiency in the public sector

### Policy area/objectives

The Eficiência Energética na Administração Pública (ECO.AP) programme aims to promote efficiency in the use of final energy in the public sector, which is mandatory for central government and optional for municipalities.

### Main characteristics of the policy

This programme considers three main areas of intervention:

- development of an energy efficiency barometer to evaluate and promote best practice in energy efficiency within the public sector;
- development of energy efficiency action plans to implement and disseminate best practices related to energy efficiency within the public sector;
- development of energy performance contracts for larger buildings, as a basis for contracts with ESCOs, to evaluate, propose, finance and implement energy efficiency projects in public buildings and for other public equipment.

### Challenges faced during implementation

This programme faces two major barriers:

- the existing legal framework for service contracting within the public sector is not completely adequate for energy performance contracts, since it was not developed for this purpose or for medium- to long-term contracts;

- experience of the energy efficiency market in performance contracts is lacking, as well as awareness of the financing companies for this contracting model.

### Why the policy is considered a success

The policy is still at the early implementation stage but has already achieved excellent acceptance both from ESCOs and the public sector, including municipalities.

A group of buildings and equipment has been identified which is perfectly suited to this contracting model; all the necessary documentation is currently under development in order to initiate the tendering procedures.

### Lessons to be shared

The development of a specific legal framework for the public sector will enable the conclusion of energy performance contracts between ESCOs and public authorities. Four public hospitals intend to launch a tendering procedure for energy performance contracts at present, and the development of the legal framework for these contracts has raised private sector interest in this contracting model. Portugal is expected to develop a sustainable market for ESCOs based on this work.

In addition, the development of an energy efficiency barometer enables a more complete characterisation of public buildings and equipment and their energy consumption.



# Slovak Republic

## A new financial instrument for energy efficiency

### Policy area/objectives

The European Bank for Reconstruction and Development (EBRD) is helping the Slovak Republic to tap its significant potential for energy efficiency. The EBRD, in co-operation with the Ministry of Economy and several banks operating on the Slovak financial market, launched the Slovak Energy Efficiency and Renewable Energy Finance Facility (SLOVSEFF).<sup>1</sup> The SLOVSEFF is a new financial investment instrument designed to improve energy efficiency, decrease electricity consumption and generate more electricity and heat from renewable energy sources, thereby leading to better environmental conditions and rational energy utilisation. In order to overcome various barriers hindering sustainable energy investments, EBRD funding has been complemented by grant funding from the Bohunice International Decommissioning Support Fund (BIDSF).

1. Further information available at: [www.slovseff.eu/en\\_index.html](http://www.slovseff.eu/en_index.html).

### Main characteristics of the policy

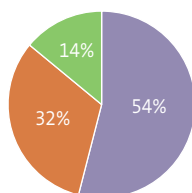
The first phase of SLOVSEFF (SLOVSEFF I) was established in 2007 to support energy efficiency in the residential and industrial sectors, and renewable energy projects. After successful implementation of the first phase, an extension of SLOVSEFF (SLOVSEFF II) was launched in 2010.

Loans between EUR 20 000 and EUR 2 500 000, as well as grants between 7.5% and 15% of the loan amounts and free technical assistance (including free energy audits) are available through local banks to private companies and housing associations for implementation of energy efficiency and renewable energy projects.

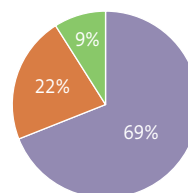
During the first two phases, the EBRD provided a total of EUR 150 million for the provision of loans to commercial banks, which was complemented by EUR 30 million from the BIDSF for the provision of incentive payments and technical assistance. Financial support to

**Figure 9** SLOVSEFF I and II: allocated loan portfolio by sector

SLOVSEFF I



SLOVSEFF II



● Residential ● Industry ● Renewables

Source: SLOVSEFF BIDSF Semi-Annual Progress Report, 2012.

680 projects in both phases as of December 2012 led to total primary energy savings of 553 GWh/yr and emission reductions of 110 kilotonnes of CO<sub>2</sub> per year.

The next phase of the programme is currently under preparation. While the first two phases were focused primarily on supporting energy efficiency in housing, the third phase should be primarily focused on energy efficiency in industry and renewable projects.

## Challenges faced during implementation

From the energy efficiency perspective, the conditions for the provision of loans and grants in the housing sector were set relatively low (*i.e.* a reduction of 15% of energy consumption before retrofit) compared to the high energy savings potential in the building sector. The programme evaluation showed that average projected energy savings of 35% (as compared to energy use before the retrofit) were achieved.

In light of these achievements, more ambitious targets for reaching energy savings are currently being set for any future phase.

## Why the policy is considered a success

SLOVSEFF's main advantage is the provision of incentive payments upon verification of implementation of all projected energy savings measures. Another advantage is that a simplified energy audit has to be performed for each project. These audits identify the main energy savings or renewable energy potential and recommend the key measures to be taken. On completion of the project, implementation of the measures is checked against the project plan.

## Lessons to be shared

Evaluation of the first two phases showed that more careful monitoring of achieved energy savings would be necessary to ensure more effective utilisation of public funds in future phases. Furthermore, the energy savings achieved in the first two phases demonstrated the necessity for more ambitious targets for any upcoming phases.

# Turkey

## Energy efficiency at the heart of energy policy

### Policy area/objectives

Turkey has embarked on an energy strategy targeting comprehensive liberalisation, the establishment of competitive markets and an investor-friendly environment. The legislative environment is being upgraded to be compatible with that of EU member countries.

In recent years, Turkey has attached increasing importance to energy efficiency to provide energy supply security for its fast-growing economy, and to reduce pollution. Turkey published its Energy Efficiency Strategy Paper in February 2012 to create a clear future plan and co-ordination among the public, the private sector and non-governmental organisations for increasing the effectiveness of energy efficiency studies. The strategy, together with the Energy Efficiency Law (2007), shows the formation of a legal and institutional framework to support energy efficiency is an important milestone.

Within this framework, the promotion of energy management plays a particularly important role.

### Main characteristics of the policy

The Energy Efficiency Law and associated regulations have wide coverage, including: increasing and supporting energy efficiency; setting up energy efficiency consulting companies; forming energy management systems; promoting energy efficiency investments (Productivity Enhancement Project and Voluntary Agreements); increasing energy

efficiency in transportation and buildings; preventing the sale of inefficient appliances and increasing awareness.

Under the Energy Efficiency Law, energy management is obligatory in large residential buildings and industrial plants.<sup>1</sup> In particular, large energy users in the industrial, commercial and public sectors must appoint or contract an energy manager to ensure the enactment of energy management activities. Major users must set up their own energy management unit. In industrial zones, an energy management unit may be established to cover a number of smaller users in the district. The General Directorate for Renewable Energy (GDRE) of the Ministry of Energy and Natural Resources, and authorised institutions such as universities, chambers of engineers and energy efficiency consultancy companies organise certification programmes for energy managers in residential buildings and industries.

Among other initiatives, an Energy Efficiency Co-ordination Board has been established with the participation of all the relevant organisations to effectively execute energy efficiency efforts across the country, as well as to monitor and co-ordinate the outcomes.

An Energy Efficiency Week – arranged in January each year – provides activities aimed at increasing energy efficiency awareness in society, increasing efficiency in the production and usage of energy, and promoting the national energy efficiency movement.

1. The Energy Management Programme began in 1996, but is not mandatory. The Energy Efficiency Law of 2007 made it mandatory for large energy users.

A support programme for efficiency improvement projects and voluntary agreements in industrial establishments was initiated in 2009. The GDRE provides investment support for efficiency improvement projects with a maximum payback period of five years. The investment support covers 20% of project costs up to a maximum of Turkish lira (TRY) 1 000 000.<sup>2</sup> For industrial establishments that have undertaken a voluntary agreement to reduce their energy intensity by 10% on average over a period of three years, the GDRE will reimburse up to 20% of their energy costs (to a maximum of TRY 200 000).

Total energy savings between the years 2009 and 2013 as a result of efficiency improvement projects – those that have been completed and those on which a decision of support has been made – is predicted to be 40 300 toe, involving total government support of TRY 8 900 000. In addition, 22 voluntary agreement projects by industrial establishments have been financed by the government. TRY 2 200 000 will be paid to these industrial establishments to provide energy savings of 44 500 toe per year.

## Challenges faced during implementation

The number of applications received by the support mechanism is small due to lack of awareness of the importance of energy efficiency.

Project approval and assessment periods may be long due to poorly prepared or missing documents submitted to support programmes. This generally arises from weaknesses in the infrastructure of energy consultancy firms.

2. As of September 2013, TRY 1 was roughly equivalent to USD 0.49.

## Why the policy is considered a success

A study comparing energy use in 2009 with that of 2000 showed total energy savings of 25.4 million tonnes of oil-equivalent (mtoe): 6.4 mtoe in the manufacturing industry, 10.7 mtoe in transportation and 8.3 mtoe in residential usage.

Energy efficiency remains high on Turkey's policy agenda, demonstrated by the interest in this topic in June 2013 at the 26th meeting of the Supreme Council for Science and Technology, Turkey's highest body for determining the scientific policies of the country. It was noted that despite the important success stories in the area of energy efficiency, there remains much to be done.

The following decisions were taken at the meeting regarding insulation and regional heating systems, as well as the efficient use of energy for street lighting, household electrical appliances, and means of transport, electric engines and compressors:

- to develop a business model with the support package in co-ordination with the Ministry of Energy and Natural Resources;
- to work on the regulatory legislation;
- to provide support from the relevant institutions and the ministries.

## Lessons to be shared

Energy efficiency issues are to be considered part of our daily lives; legislation and implementation should complement each other.

Energy efficiency measurement instruments are very useful for improving energy savings. Activities like training and certification programmes are also important for increasing public awareness. It is essential that these activities be supported by relevant government and private institutions.

# United Kingdom

## Green Deal: improving the energy efficiency of British properties

### Policy area/objectives

Launched in January 2013, the Green Deal is the UK government's flagship programme to help improve the energy efficiency of British homes and businesses. The Green Deal makes it possible for some of the cost of improvements to be paid for from resultant savings on energy bills.

### Main characteristics of the policy

The Green Deal provides a framework of accredited market participants, through which people pay for some of the cost of improving their homes and businesses using a type of loan which is paid back with the savings they can expect to make on their fuel bills.

Prior to signing a Green Deal Plan, an assessor will recommend improvements that are appropriate for a property and indicate whether they can be expected to pay for themselves through reduced energy bills. Green Deal Providers (the companies offering loans) will discuss with the consumer whether a Green Deal Plan is right for him/her and provide a quote for the recommended improvements.

Consumers can get as many quotes as they like, and they do not have to choose all of the recommendations made to them. Once they have chosen a Green Deal Provider, the Provider will write up a Green Deal Plan. The plan is a contract between the consumer and

the Provider – it sets out the work that will be done and the repayments. Installation must be carried out by an authorised installer.

The Green Deal Provider will help calculate the repayments, including interest, which the consumer will need to make. While the repayments should be no more than what a typical bill-payer should save, the actual savings will depend on how much energy the consumer uses and the future costs of energy. If the consumer moves, the new bill-payer will benefit from the improvements, and so will take on the repayments.

A requirement on larger energy suppliers – the Energy Company Obligation (ECO), worth an estimated GBP 1.3 billion<sup>1</sup> a year – will work alongside the Green Deal to provide additional support for viable packages of energy efficiency measures that are unlikely to be fully financed by the Green Deal. These packages could include insulation of hard-to-treat cavities or solid walls. The ECO will also provide insulation and heating measures to low-income and vulnerable households and insulation measures to low-income communities. An innovative brokerage system has been put in place to extend the availability of ECO funding beyond the energy companies themselves.

By 2020 the Green Deal and ECO could save UK homes and businesses 4.5 MtCO<sub>2</sub> per year, while helping millions to improve the comfort of their homes and control rising energy bills.

1. As of September 2013, GBP 1 was roughly equivalent to USD 1.58.

## Challenges faced during implementation

The policy is multi-faceted, which automatically presents challenges. It introduces a new financial mechanism, which can be transferred from one bill-payer to the next. Development of a robust technical framework for calculation of estimated energy savings required support, not only from industry and other experts, but also to reflect concerns of consumer groups. Supply chain partners need to build new systems to deliver the assessment, quote, and installation process effectively while meeting consumer protection standards.<sup>2</sup> Loans under a Green Deal Plan require funding, and the government helped facilitate the creation of a new industry-led, not-for-profit organisation to provide a source of funds as the Green Deal got under way.

## Why the policy is considered a success

The Green Deal market will take time to establish. However, early market participation is encouraging, including a solidly growing supply chain, with over 38 000 household assessments since January and contracts worth over GBP 130 million under ECO brokerage. Nearly 3 000 companies have been approved to operate under the Green Deal.

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2. Under the Consumer Credit Act.

## Lessons to be shared

Learning gained through Green Deal implementation so far demonstrates the value of several elements:

- the importance of a strong overall programme management process to ensure that all elements of this complex policy framework came together;
- the advantages of early and ongoing involvement of energy efficiency experts, supply chain participants, consumer groups and other stakeholders;
- the different skill sets needed within the team as policy development turned to implementation.

# Australia

## Energy market reform in Australia

### Policy area/objectives

Australia's electricity markets have undergone significant reforms in the past 20 years, in particular the establishment of the National Electricity Market (NEM)<sup>1</sup> in 1998 and the subsequent creation of national energy laws, rules and institutions. Australia's electricity sector faces a number of challenges. These challenges include the significant investment required in new and ageing networks to meet growing peak demand and ensure reliability of supply, and to enact Australia's transition to a clean energy economy.

Both federal and state governments are working towards implementing an ambitious and comprehensive package of reforms to deliver efficient energy markets and serve the long-term interests of consumers. The reform agenda includes strengthening of the regulatory framework to ensure network expenditure is efficient and avoids undue price pressures for consumers; the promotion of demand-side participation to assist in minimising peak demand and associated infrastructure expenditure; and enhancing competition and consumer engagement and protections in the energy market. These reforms will ensure consumers are not paying more than necessary for a reliable supply of electricity.

### Main characteristics of the policy

On strengthening the regulatory framework for energy networks, the co-operative reforms aim to improve energy market governance, regulatory outcomes, and the mechanisms for appealing decisions of the regulator.<sup>2</sup> This includes enhancing the governance and capacity of the energy market institutions, strengthening the rules which underpin the regulatory determination process, and tightening the mechanism by which network businesses can appeal the decisions of the regulator.<sup>3</sup>

On demand-side participation, federal and state governments have agreed to reforms that allow customers to choose innovative tariffs and other products to help them manage their energy costs, and to finance a metering device that supports these products. Customers will also have better access to their electricity consumption data. The Australian Energy Market Operator is developing a proposal for demand response mechanisms to be integrated into the wholesale market, which will initially be relevant for larger customers. Network reforms include changes to the incentive scheme for distribution networks undertaking demand-side projects, and clarification of how distribution networks should establish cost-reflective prices for their customers.

1. The NEM is a fully interconnected electricity market throughout New South Wales, Victoria, Queensland, South Australia, Tasmania and the Australian Capital Territory.

2. The responsibility for developing the NEM and its associated legislation lies with the Australian and State and Territory Energy Ministers via the Standing Council on Energy and Resources (SCER).

3. The "Power of Choice" review (November 2012) by the Australian Energy Market Commission (AEMC).



To enhance consumer engagement, a Consumer Challenge Panel was established within the Australian Energy Regulator on 1 July 2013 to strengthen consumer input in network regulatory processes. Australian governments have also agreed to establish a national energy consumer advocacy body by 1 July 2014.

Retail energy pricing reforms aimed at enhancing competition and innovation in retail energy markets for the benefit of consumers are also being undertaken. In February 2013, South Australia joined Victoria in deregulating retail energy prices due to the existence of effective competition; south-eastern Queensland recently announced its aim to deregulate retail electricity prices from 1 July 2015; and the Australian Energy Market Commission (AEMC) is finalising advice that prices be deregulated in New South Wales given the existence of effective competition. The reform package is also working to enhance the AEMC's reviews of retail competition across jurisdictions with a view to encouraging further retail pricing reform.

Australian federal and state governments have also developed and implemented the National Energy Customer Framework (NECF), which harmonises the regulation of the sale and supply of energy to customers across jurisdictions, including in relation to consumer protection. The NECF has been implemented in the Australian Capital Territory, Tasmania, South Australia and New South Wales, while Victoria and Queensland are aiming for implementation in 2014.

## Challenges faced during implementation

The most significant challenges in Australia's reform process continue to be: securing agreement of all participating state and territorial governments; balancing the interests of all stakeholders while ensuring delivery of

affordable, reliable, safe and secure electricity in the long-term interests of consumers; and the interface between energy policy and environmental policy. Reforms to benefit smaller customers (full retail contestability in all jurisdictions, national implementation of NECF and price deregulation where competition is effective in retail markets) are progressing.

Reforms that could deliver further economic benefits, such as the unwinding of cross-subsidies between consumers (thus encouraging more efficient levels of consumption and supply capacity in the long term) are often politically difficult to initiate. While less contentious incremental approaches can be taken by limiting the rate of change, it is important that such limits are not so tight as to prevent the eventual delivery of the intended reform.

## Why the policy is considered a success

Large increases in electricity prices in recent years, and the associated cost-of-living pressures on consumers, have placed greater public scrutiny on the operation and regulation of energy markets and have increased demand to deliver outcomes in the best interests of consumers. Australia's comprehensive energy market reform package therefore supports efficient investment and market outcomes that deliver a reliable energy supply at least cost to consumers.

## Lessons to be shared

Reforms in the NEM require agreement of all participating states and territories. Sustained policy and political commitments must be attracted and managed. Consumers must be able to participate in the debate on the reliability, cost, safety and security of the energy supply.

The long-term transition of the electricity sector to a lower carbon-emissions base requires that clean energy policy frameworks and measures be efficiently and effectively integrated with electricity markets.

While the fundamentals of the market design have proven themselves robust and resilient, decentralised power generation and greater demand responsiveness pose challenges for the design and management of Australia's energy supply. These issues are under current

consideration: given the importance of attracting new investment and of the reliable operation of the sector, such changes need to be considered with rigour and transparency, and with some degree of caution.

Further information on Australia's energy market reforms and support measures is available at: [www.ret.gov.au](http://www.ret.gov.au) and [www.scer.gov.au](http://www.scer.gov.au).

# Austria

## The German/Austrian electricity price zone: a success story

### Policy area/objectives

Since the beginning of energy market liberalisation, the traded volumes of electricity on the European wholesale markets have strongly increased. Markets are now more liquid and transparent, and are behaving according to the rules of demand and supply. This greater efficiency of the markets has brought benefits both for customers and producers.

### Main characteristics of the policy

As an illustration of growing liquidity, at the European Energy Exchange (EEX) alone, traded spot and future volumes have increased from 150 terawatt hours (TWh) in 2002 to 1 270 TWh in 2012. Not only the bilateral over-the-counter markets, which yearly account for a trade volume of about 500 TWh, but also particularly the energy exchanges have contributed to the establishment of liquid markets.

For the Austrian power industry, the common German-Austrian price zone is of particular interest. This is the most important zone on the derivatives market of the European Energy Exchange AG based in Leipzig and the day-ahead market of European Power Exchange-Spot (EPEX-Spot) based in Paris. The zone is large and forms a market covering in total about 600 TWh in sales to end-customers. It is well-established: as there is no cross-border congestion, it was possible to set up an active trading market and

power exchange a long time before market liberalisation, to the benefit of both Germany and Austria.

### Challenges faced during implementation

Close co-operation between Austrian and German market participants provided the basis for these achievements.

### Why the policy is considered a success

The yearly traded volumes in the German-Austrian price zone currently total more than 1 100 TWh. (for comparison, Austrian electricity consumption in 2011 was approximately 69 TWh) Over recent years, traded volumes have developed positively or have at least remained at a relatively high level. An increasing amount of generation from renewable energy, particularly from volatile wind power and photovoltaics in Germany, is now traded on the regulated spot market (auction offices at EPEX and Energy Exchange Austria [EXAA]). This short-term physical market already covers about 40% of the sales to end-customers in the German-Austrian price zone.

Approximately 180 market participants in that zone are already trading on the EPEX-Spot, with 70 from Germany and about 15 from Austria. More than half of the market participants are

not from either of the two countries, which underlines the closer relationship between European power trading industry and the EEX and EPEX-Spot marketplaces.

## Lessons to be shared

Through a single point of delivery, which includes both Austria and Germany, Austria can both benefit from the high liquidity of the existing market and contribute to security of supply in the big price zone by using its highly flexible power plants in the European context.

Both consumers and producers continue to benefit from the common, uniform price zone which is keeping the wholesale prices lower than if the price zone comprised only the Austrian market. This is especially reflected in energy prices for industry, where companies are much more willing to change supplier.

# Belgium

## More affordable energy prices: empowering the consumer

### Policy area/objectives

Many citizens lack the knowledge to compare complicated offers in order to reduce their energy bills by changing their suppliers, or simply to compare complicated offers in order to reduce their energy bills. This policy aims to improve consumer empowerment and to encourage stronger competition between the suppliers of gas and electricity, resulting in lower energy bills.

### Main characteristics of the policy

In September 2012, the Minister for Economy and the Secretary of State for Energy, in co-operation with the cities and municipalities, organised an information campaign. This campaign provided guidance to consumers in their search for the best energy supplier through easily accessible information sessions.

The regional energy regulators<sup>1</sup> provide price comparison simulators on their web-sites to enable the public to choose the most advantageous supplier.

The Federal Public Service of Economy, SMEs, Self-employed and Energy (FPS Economy) co-ordinated this process and, in co-operation with the cities and municipalities, organised information sessions to raise consumer awareness and to assist citizens with the application of this price comparison tool.

1. VREG, CWaPE, BRUGEL.

### Challenges faced during implementation

The announcement of the campaign provoked significant opposition at first. The cities and municipalities were not strong supporters of the initiative, which resulted in a poor estimation of participation by local authorities. Eventually, however, 93% of Belgian cities and municipalities did co-operate.

The FPS Economy mobilised substantial manpower to apply the concept “train the trainer”: staff, once trained, trained their colleagues in turn. Civil servants thus acquired in a short time the necessary expertise to conduct information sessions in the municipalities and cities.

The compensation system in case of a contract breach by a consumer switching suppliers was also re-examined and the legal framework was adjusted just before the start of the campaign. As a result, since September 2012, if the consumer gives notification of contract determination one month in advance, the supplier may not levy a fine for breach of contract. This new regulation has encouraged consumers to consider switching suppliers.

## Why the policy is considered a success

The turnout at the public information sessions was significant: approximately 72 000 consumers in total were personally assisted and informed about the possibilities for switching energy supplier.

More than 400 civil servants volunteered to provide guidance during the public information sessions in the participating cities and municipalities. Moreover, numerous municipalities provided positive feedback on this campaign, acknowledging a favourable response by citizens.

Citizens who were not able to participate in the information sessions were not forgotten: they subsequently received valuable information and necessary assistance from local authorities and social organisations. Municipalities and cities

which did not participate initially requested assistance for organising similar information sessions in the future.

With increased use of the price comparison simulators, about 400 000 households switched energy suppliers in the short term, and figures show that more are to be expected.

## Lessons to be shared

The government can play a significant role in raising awareness and mobilising consumers through the provision of targeted assistance and the distribution of clear information to help choose the most suitable supplier. This also encourages competition among suppliers.

A combination of motivated people and the right approach makes it possible to organise a successful campaign quickly, and even exceed the anticipated result.

## Electricity emergency policy: procedures for electricity shortfall

### Policy area/objectives

As part of emergency planning, a 2005 ministerial decree “assessing the load-shedding plan of the electrical transmission grid” provides two procedures to protect the electrical system against supply interruptions, one concerning sudden interruptions and the other concerning announced electricity shortfalls for significant, predictable periods of time. This regulation established measures to restore the balance between generation and consumption as soon as possible.

### Main characteristics of the policy

In 2012, the Directorate General for Energy, SMEs, Self-Employed and Energy (FPS Economy), in close co-operation with the Co-ordination and Crisis Centre of the Government (GCCC-FPS of the Interior) and the transmission system operator (TSO), Elia, developed a procedure to manage electricity shortfalls in accordance with the 2005 ministerial decree.

In the event of sudden interruptions (such as frequency variations due to storms or other exceptional climatic situations) several procedures are launched by the TSO Elia. If these

actions prove to be insufficient, then a load-shedding operation will be initiated manually or automatically to restore the balance and avoid further degradation of the electrical system. These measures allow TSO Elia to restore the balance without delay.

In the case of an announced electricity shortfall, the legal framework provides other measures to restore the balance. After detection of a shortfall threat, the TSO Elia will submit to the government a proposal of measures to limit the demand for electricity either through awareness-raising or by prohibiting the use of electricity for certain activities. It is then up to the government to decide which measures will be imposed on the final consumers. If, after exhausting all other possibilities, an imbalance between generation and consumption is confirmed, TSO Elia will be required by government order to initiate the load-shedding plan manually to reduce the energy demand of a limited number of consumers for the amount of time necessary.

## Challenges faced during implementation

The closure of nuclear plants has led to a loss of 2 000 megawatts (MW) of electricity, making Belgium structurally dependent on imports last winter. In the event of exceptional circumstances such as a long, sustained cold snap, coupled with little or no renewable energy in much of north-western Europe, the probability of electricity shortfalls could

increase. The existing co-operation between the involved authorities and the TSO Elia on elaboration of a shortfall procedure and an action plan with demand restraint measures was therefore accelerated. In order to monitor and adjust these activities, a steering committee was established between the authorities concerned and the TSO Elia.

Meanwhile, the plants were restarted in June and their activities will be reviewed. The steering committee will assemble when needed.

## Why the policy is considered a success

Close co-operation between the actors concerned has allowed much to be accomplished in a short period of time and has laid the foundation for co-operation with the other interested parties, such as the different network operators, to further optimise the load-shedding plan.

## Lessons to be shared

Devising effective emergency policies requires an understanding of the interrelationship of demand and restraint measures on different types of energy supply. The FPS of Economy and Energy is planning a comprehensive study about demand restraint measures across all energy vectors. Different kinds of supply interruption need to be tackled by significantly different procedures.



# Finland

## Improving security of electricity supply

### Policy area/objectives

The security of electricity supply in Finland is generally good. During strong storms, however, an average distribution network equipped mostly with overhead power lines can have very long interruption times. In December 2011 two severe storms hit Finland, leaving 9% of end-users out of electricity at the same time. The average interruption time was over six hours and the longest reported interruptions lasted 15 days.

Following a law-drafting process in 2012-13, the Finnish parliament approved an amendment to the Electricity Market Act in June 2013, which includes a requirement to improve the security of the electricity supply.

### Main characteristics of the policy

The amendment to the Electricity Market Act contains a requirement that distribution system operators (DSOs) improve the security of the electricity supply by setting time limits for the longest allowed interruptions due to storms or snow. The limit is six hours in cities, towns and communities, and 36 hours in all the other areas; these time limits must be met gradually by the end of 2028. Interim requirements are for the DSOs to meet these time limits for 50% of all their end-users (excluding leisure homes) by the end of 2019, and for 75% by the end of 2023. A DSO which operates in certain difficult conditions may be permitted a longer time frame (to the end of 2036) to meet the requirements.

The DSOs are free to select the measures they use to achieve these time limits, but in practice a key measure is to increase the share of underground cables. The DSOs are required to prepare a development plan showing the detailed actions they are going to take to meet the requirements, and the plan must be updated every two years. The plan is submitted to the Energy Market Authority, who can order changes to the plan if the listed actions are judged to be ineffective.

The amended Electricity Market Act also requires the DSOs to prepare and regularly update a preparedness plan, which includes information on repairing the network after storms. Furthermore, the amended Electricity Market Act changes the scheme for standard compensation that a customer is entitled to receive from a DSO in case of certain interruptions. For example, the maximum compensation is increased from EUR 700 to EUR 2 000 per year.

### Challenges faced during implementation

Even though the DSOs can select their own measures, in practice achieving the reduced time limits requires more underground cables. These new investments lead to increased distribution charges. The challenge in choosing the time limits of six and 36 hours was to balance the needs of society and the increased network charges. Politicians have accepted the costs entailed in this action because high supply

security is desired by society, although certain derogations were added by the parliament to reduce costs in rural areas.

The level of security of the electricity supply varies between different areas in Finland. The city plan area was selected as the criterion separating areas into six- and 36-hour time limits because this system is already widely used for other purposes.

## Why the policy is considered a success

The proposal in the amended Electricity Market Act to increase electricity supply security was well-received and approved by parliament.

It is estimated that a total investment of EUR 3.5 billion over the next 15 years will be needed to meet the time limits of 6 hours and 36 hours. This estimate includes costs that will not materialise due to the amendments made by the parliament, so the actual total

investment is expected to be somewhat lower. If not addressed, however, the interruptions in electricity distribution would cost an estimated EUR 3 billion over the same period of time. In this light, the net cost of improved supply security is rather small, and will even save money after the 15 year period thanks to fewer and shorter interruptions in electricity distribution.

It is considered that the installation of much more underground cabling will be required to reach the time-limit goals, after which only very few end-users will suffer the longest allowed 36 hour interruption times. Most interruptions will be much shorter, even during very strong storms; this will be a remarkable improvement.

## Lessons to be shared

Although limiting interruption times in electricity distribution due to storms or snow requires investment, and thus higher electricity bills, the savings from avoided interruptions can be significant.

# Germany

Green light for the co-ordinated, transparent and accelerated expansion of Germany's electricity grid

## Policy area/objectives

The German transition to the extensive use of renewable energy poses an enormous challenge for the electricity networks. The existing grid system is reaching its limits as more wind power from the north needs to be transported to demand centres in the south and west of the country. To ensure a secure energy supply in every region, the grid must be rapidly expanded and upgraded.

The federal government has therefore set the legal framework for a co-ordinated, transparent and accelerated expansion of the transmission grid. An important aim is to streamline planning and authorisation procedures for grid projects crossing Länder (state) and international borders, reducing the time required from ten to four years.

## Main characteristics of the policy

The ten-year Grid Development Plan (NEP) forms the basis for expanding the transmission grid. Since 2012, it has been drafted jointly by the four TSOs and updated annually, subject to approval by the Federal Network Agency. At least every three years, the federal government presents for parliamentary approval a draft of the Federal Requirement Plan Act – based on the NEP – stipulating the most urgent and necessary expansion projects, thus making them legally binding for the following authorisation procedure.

The Grid Expansion Acceleration Act (NABEG) aims at streamlining planning procedures by establishing a one-stop shop regulation authority. For grids that cross borders, the responsibility for planning and authorisation procedures is transferred from the Länder authorities to the Federal Network Agency. The uniform nationwide planning and authorisation procedure takes advantages of synergies by concentrating the responsibility in a single body, reduces red tape and increases transparency.

Public support is vital for speedy and successful grid expansion. The public can take part in every phase. The Federal Network Agency organises many meetings to inform the public in various parts of Germany and encourages them to voice their opinion. All planning documents, as well as the accompanying environmental reports, are published on the agency's website.

The Federal Ministry of Economics and Technology also established the Future-Oriented Grids platform to discuss relevant subjects and work out policy recommendations. This platform involves the energy industry (including network operators), consumer associations, environmental organisations, regional authorities, the German Energy Agency, representatives of research and development, the Federal Network Agency and federal ministries.

## Challenges faced during implementation

Different interests and intentions of the relevant stakeholders as well as fragmented authorisation procedures have often hampered and delayed necessary investments in grid expansion.

## Why the policy is considered a success

Through the Future-Oriented Grids platform, the stakeholders take a joint approach in tackling open issues and in delivering joint solutions for the future challenges of grid expansion and modernisation. With the new legal framework, the federal government laid the foundation for an accelerated expansion of the German high-voltage electricity grid.

The numerous activities to promote active public participation have sparked wide response. In 2012, more than 5 000 contributions were received overall during the consultations and were taken into account by the Federal Network Agency while assessing the draft of the grid development plan. The International Energy Agency (IEA) *Energy Policy of Germany 2013* welcomed the measures taken.

## Lessons to be shared

The first NEP process shows that keeping the public involved in grid expansion projects in their local area from an early stage is important to obtain public backing and acceptance of power line construction.

# Greece

## Combating energy poverty: the Social Household Tariff

### Policy area/objectives

Liberalisation of low voltage (LV) tariffs was carried out between 2010 and 2013, a period of severe economic crisis for Greece. In order to protect vulnerable consumers who suffer from energy poverty, the Greek government<sup>1</sup> introduced the Social Household Tariff (SHT).<sup>2</sup> The SHT, implemented in January 2011, gives a discount of approximately 40% on annual consumption of up to 5 000 kilowatt hours (kWh), compared with the normal household bill. The excess cost – the component not paid by the SHT beneficiary – is shared by all consumers via public service obligations.

### Main characteristics of the policy

Clear criteria define the categories eligible for SHT: vulnerable people on a low income. These include the longer-term unemployed, larger families, people with disabilities and those medically dependent on energy-intensive equipment.

The evaluation process for SHT beneficiaries is carried out through an electronic platform, which is managed by the Hellenic Electricity Distribution Network Operator, as well as the electricity suppliers.

The applications, controls and all required procedures are made via web applications and electronic exchange of data. The necessary documents to be provided by the applicant are: an electricity bill, his/her identity card number, and his/her tax registry number. After checks of the data by the relevant bodies (Ministry of Finance, Employment Agency), the electricity suppliers are informed whether or not the criteria are met and the SHT is granted to those eligible.

No further action from the beneficiary is required, as the competent authorities check the applicant's eligibility automatically at the beginning of every year. As long as the criteria continue to be met, the SHT continues to apply.

This is an electronic government-to-government process which aims to facilitate the process for consumers.

### Challenges faced during implementation

Since early 2013, the criteria for SHT eligibility have been broadened. There are currently an increasing number of consumers who are in need of discounted energy bills. The required family income information is derived from the income tax returns submitted to and cleared by the Ministry of Finance. Because this information refers to the financial year and not the calendar year, the low electricity tariff becomes available to vulnerable customers in many cases months – or even a year – after the financial difficulty of the applicant first

1. Through the Hellenic Ministry for Environment, Energy and Climate Change.

2. Directive 2009/72/EC on electricity market liberalisation.

began (*i.e.* the economic situation at the time of application may be extremely different from that shown in the cleared income tax return of previous year). The challenge for the MEECC (Ministry for Environment, Energy and Climate Change) is to find ways to improve the overall evaluation process.

## Why the policy is considered a success

Interest shown by residential consumers is the best way to assess the policy. According to the country's Public Power Corporation's data, by the end of 2012 approximately 280 000 customers had joined the SHT, while within the first-half of this year the number of beneficiaries increased by another 150 000.

## Lessons to be shared

The implementation of a special tariff system on electricity, such as the SHT, is an essential characteristic of liberalised electricity markets. Moreover, thanks to the flexible structure selected for the awarding of the SHT to vulnerable customers, this tool also tackles fuel poverty, which is particularly pronounced in Greece in this time of financial crisis.

# Hungary

## Keeping an eye on nuclear safety

### Policy area/objectives

The average age of nuclear personnel is increasing together with the age of the power stations: the nuclear industry currently faces the challenge of replacing a significant workforce within a ten-year period. Additionally, in countries new to nuclear power, thousands of people must be educated and trained, as they will be the next generation ensuring the safe operation of the nuclear facilities.

### Main characteristics of the policy

Since September 2012, the Technical University of Budapest has offered higher education nuclear programmes, with technical training held at the Maintenance Training Centre of the Paks nuclear power plant (NPP). This highly sophisticated training facility was established with the assistance of the International Atomic Energy Agency (IAEA). Equipped with a real reactor vessel and machinery, the facility is used to train national and international experts without risk of radiation. The programme offered by Hungary – supported by 30 years of professional experience – includes a complete nuclear training course about the safe operation of a new NPP.

The development and improvement of the nuclear training and education system is a top priority for Hungary: further enhancement of the country's higher education system is in progress, offering undergraduate to postgraduate level programmes to serve

increasing domestic and international demand. Hungary's nuclear education programme, which consists of personnel from newcomer countries and those that already use nuclear energy, contributes to international co-operation on nuclear safety culture.

### Challenges faced during implementation

Partner countries may have specific interests and needs; Hungary places a major emphasis on co-operation with partner countries when designing each programme. Although English is the language of education, some inter-cultural barriers must be overcome for a successful training.

### Why the policy is considered a success

One hundred and twenty experts from Vietnam, which is starting a nuclear programme, have been trained on the safe operation of NPPs. A considerable number of countries have shown interest in the experience and know-how in the area of NPP maintenance offered by Hungary.

### Lessons to be shared

Safety in the nuclear energy industry begins with education, and matures with the experience of employing nuclear energy.



# The path to sustainability: the national radioactive waste repository at Bataapati

## Policy area/objectives

Safe disposal of nuclear waste is crucial to the sustainable use of nuclear power. Hungary has constructed a USD 310 million repository at Bataapati, about 250 metres below the Earth's surface, intended for all low- and intermediate-level radioactive waste from the operation and future decommissioning of Hungary's power plants.

## Main characteristics of the policy

Strict legal principles<sup>1</sup> covering the application of atomic energy specify that radioactive waste and spent fuel shall be stored or disposed in accordance with the most recent, certified results of science, international expectations and experience, in such a way that human health and the environment are not threatened and that no unacceptable burden is passed on to future generations.

Hungary's national low and intermediate level waste repository was inaugurated in December 2012. The first disposal chamber can accommodate 4 600 drums of radioactive waste in 510 reinforced concrete containers. More chambers are to be built to eventually accommodate 40 000 cubic metres of waste.

Hungary's national legal system for nuclear waste is consistent with international standards. In addition to IAEA regulation, Hungary abides by European Council directives: the alignment with the Nuclear Waste Directive<sup>2</sup> will be completed this year.

1. Specified in Act CXVI of 1996 on Atomic Energy.

2. Nuclear Waste Directive (2011/70/EURATOM).

## Challenges faced during implementation

The storage facility was built by the Public Limited Company for Radioactive Waste Management,<sup>3</sup> formerly the Public Agency for Radioactive Waste Management (PURAM). Finding a suitable site was a challenge: the state-owned body carried out site investigations for more than ten years before finally focusing on building the repository within granite bedrock in the south of the country.

## Why the policy is considered a success

The new facility meets the highest international standards. In fact, the chief executive of PURAM, now a public limited company, has pointed out that the safety requirements of the new facility are considerably higher than prescribed technical and legal norms.

## Lessons to be shared

The sustainability of nuclear energy can only be achieved by establishing responsible radioactive waste and fuel cycle management practices. Bataapati demonstrates that with appropriate political intention, allocation of responsibilities and good communication with the public, success can be achieved.

3. Radioaktív Hulladékokat Kezelo Közhasznú Nonprofit Korlátolt Felelősségű Társaság (RHK Kft).

# Korea

## Nationwide blackout drill: saving electricity in a hurry

### Policy area/objectives

On 15 September 2011, when many power plants were closed for seasonal maintenance, parts of Korea had unscheduled rolling power cuts, triggered by unusually hot weather that led to a surge in power demand. The immediate response of the government was to prepare a plan to raise electricity prices during peak hours in an attempt to temper demand.

In addition, in order not to waste the crisis, the Ministry of Trade, Industry and Energy (MOTIE) decided to stage a nationwide blackout drill (The Drill). The Drill, a 20-minute power outage crisis response exercise, was carried out across Korea at 14:00 on 21 June 2012. It was a nationwide exercise in which all energy stakeholders were expected to participate to save electricity. According to the current power emergency manual, all sectors are requested to save energy and non-essential, non-urgent power supply is cut whenever power reserves fall below 400 MW (out of 79 000 MW). The Drill aims to save electricity at peak times to avoid further load shedding, and to raise public awareness about damage from a real blackout ahead of an expected sharp increase in power use in the summer.

### Main characteristics of the policy

The Drill was a voluntary emergency exercise in which all energy stakeholders were encouraged to participate to save electricity. In order to

promote the general public's participation in the exercise, a comprehensive campaign was organised by business associations across different industries, local government, civic groups and the media (TV, radio, web portals, advertising posters on the street, etc.). MOTIE encouraged each sector to prepare a specific action plan, including turning off air-conditioning systems, electronics and unnecessary lights, and shutting down production facilities temporarily. Business and industry associations, as well as industrial complexes, established their own power-saving plans in advance and joined the exercise. Large buildings consuming over 1 000 kilowatts (kW) turned off central air-conditioning systems, and encouraged their residents to save energy during The Drill. For households, detailed action plans were provided via community newsletters, electricity bills and campaigns led by civic groups. Public institutions saved power except for essential facilities for security and IT equipment. Schools conducted a power-saving exercise for an hour on a voluntary basis and delivered relevant information to students. "Vulnerable" facilities (hospitals, subways, traffic lights and elevators), severely hit during the 2011 load shedding, conducted emergency drills assuming an unexpected power cut, which included dissemination of information, rescue and evacuation exercises, and fault recovery. Inspection of emergency generators was also part of The Drill.

## Challenges faced during implementation

MOTIE, a policy-making institution, lacked the manpower and experience needed to initiate and implement The Drill. In addition, in the preparation stage, MOTIE faced challenges in gaining support from other ministries (overlapping with other emergency drills, hospitals' unwillingness to participate in The Drill, and inconvenience of the general public). After securing strong support from civic groups and having the media provide information on the foreseeable risks of blackouts, MOTIE was finally able to implement The Drill nationwide with the support of all related ministries.

## Why the policy is considered a success

During The Drill, electricity savings was measured at around 500 MW, which is equivalent to ten power plants with a capacity

of 50 MW each. According to the public opinion poll after The Drill, almost all energy stakeholders – from industry to students – responded positively. Media coverage showed that large hospitals are planning to hold an emergency exercise on a regular basis.

The Drill was clearly effective in raising public awareness of the potential damage of blackouts and how to save electricity in a hurry.

## Lessons to be shared

To be effective, a nationwide blackout drill requires systematic organisation with sufficient resources and general support from relevant ministries. The Drill helped the Korean general public to understand both the negative impacts of unexpected blackouts and how much electricity can be saved in an emergency situation. Now citizens are better prepared for any unexpected future emergency.

# New Zealand

## Managing risk in the electricity spot market

### Policy area/objectives

Due to New Zealand's reliance on hydro-generation and limited water storage, electricity spot prices are relatively volatile. Some electricity purchasers were choosing to purchase in the spot market without adequate hedge cover, and rely instead on lobbying in the media and to officials if they subsequently became exposed to excessive risk in dry conditions. A stress-testing regime was introduced in January 2012 to ensure that parties purchasing some or all of their electricity at spot prices internally assess their risk exposure to high electricity prices and be aware of the aggregate risk position of other parties in the market.

### Main characteristics of the policy

Towards the end of each quarter, grid-connected consumers and parties that purchase electricity in the wholesale electricity market are required to calculate the effect on their projected profit and shareholder funds for the next quarter for each of two stress-testing scenarios:

- capacity shortage: an eight hour period where prices are equal to New Zealand dollar 10 000<sup>1</sup> per MWh (NZD/MWh) which would characterise a short-term capacity issue;
- energy shortage: prices in the quarter average NZD 250/MWh, which would characterise a sustained low-inflow period.

These parties – about 25 in all – are required to report their results to their own boards and to an independent registrar appointed by the Electricity Authority.<sup>2</sup> The registrar provides collated results to the Authority in a form that ensures individual participants are not identified. The Authority prepares and publishes these aggregate results.

### Challenges faced during implementation

The main challenge was to convince the parties affected that the net public benefit was significant and would outweigh the combined costs they would each face to comply with the requirements. Grid-connected consumers, in particular, believed that they were unfairly targeted by the regime and the policy is without merit.

### Why the policy is considered a success

The five stress-testing reports received since the regime took effect have shown that there is a wide variety of risk positions within the market, with some participants choosing to have significant exposure to the spot market. The Electricity Authority is confident that the board of each disclosing party is now fully aware of its own risk position, and its risk position relative to that of other parties in the market.

1. As of September 2013, NZD 1 was roughly equivalent to USD 0.80.

2. The New Zealand electricity regulator.

The fourth-quarter of 2012 and first-quarter of 2013 periods have been dry and spot prices rose to levels that were nearly as stressful as the E1 scenario. Over this period there has not been any significant lobbying from parties operating in the market to ministers or to the media for unwarranted electricity conservation campaigns or changes to market rules to reduce their financial risk.

enabling parties that buy electricity on the spot market to assess the risk they are taking and then compare their own exposure with that of other participants. It has also reduced the ability of parties who have chosen to over-expose themselves to lobby for rule changes to their direct benefit. This light-handed regulatory mechanism has proven a useful alternative to the adoption of more coercive interventions that would require minimum risk levels to be maintained.

## Lessons to be shared

This public disclosure (in aggregate) of risk positions has contributed to the successful management of two recent dry periods by

## Empowering electricity consumers: What's My Number campaign

### Policy area/objectives

In 2011, the Electricity Authority (the electricity regulator) launched the What's My Number information campaign to promote to consumers the benefits of comparing and switching electricity retailers.

What's My Number is intended to increase retail competition by changing consumer behaviour and perceptions (switching is easy and worthwhile), so as to put sustained pressure on retailers to offer competitive prices and service.

### Main characteristics of the policy

What's My Number is a NZD 15 million, three-year, mass-market multi-media campaign using television, radio, newspapers and magazines, online channels (including social media) and

outdoor locations, such as bus backs and billboards. The campaign encourages consumers to use an online tool to see how much they may be able to save on their electricity bills by switching retailers. The online tool also encourages consumers to act on information about better deals by enabling them to immediately begin the switching process.

### Challenges faced during implementation

What's My Number was developed because the market was characterised by customer "stickiness," with consumers electing to stay with the default retailer that supplied their region after the deregulation of the electricity market in 1999. Surveys undertaken in 2009 indicated that consumers were generally aware they could switch and saw switching as being relatively easy, but found comparing the

different retailer offers difficult and considered that any savings available would be eroded fairly quickly.

## Why the policy is considered a success

The campaign is considered a success for a variety of reasons:

- More consumers are comparing retailers. The number of unique visits to the main price comparison and switching website increased from 233 695 visits in 2009 to 505 576 in 2012. There are 1.7 million residential consumers in New Zealand.
- Switching rates have increased significantly since the campaign started and remain high by world standards: the rate of residential switching was 14.5% in 2009 before the campaign, but 20.6% in 2011 and 19% in 2012.
- The electricity sector is now seen as being more competitive. Surveys undertaken in 2011 and 2013 show that more consumers now perceive electricity retailers as being increasingly competitive relative to other retailing sectors, such as petrol retailing.
- Retailers are responding to the campaign by changing their pricing and discounting approaches, increasing innovation and product differentiation (*e.g.* time-of-use products and in-home smart products). Smaller retailers have grown since 2011, using the increased consumer attention on retailers from What's My Number to acquire customers by offering competitive prices.

## Lessons to be shared

Consumers in electricity markets have generally been slow to switch to more price-competitive retailers. The campaign demonstrates that customer awareness campaigns can have a significant effect on switching behaviour leading to improvements in retail competition if managed effectively.

Improvements in retail competition in the New Zealand electricity market have, however, also been dependent on other complementary initiatives such as: initiatives to make customer switching easier by reducing switch times; initiatives to improve liquidity in the hedge market; and structural changes to state-owned electricity generators that increased the geographic dispersion of retail operations.

# Switzerland

## Tender calls for projects and programmes for more efficient use of electricity

### Policy area/objectives

The grid levy on electricity – also used to fund feed-in tariffs – will be used to help finance selected energy efficiency measures that would not pay for themselves purely through the energy savings made. A series of tender calls for projects and programmes for more efficient use of electricity in industry and households has been launched by the Swiss Federal Office of Energy since 2010, with a varying budget of around Swiss francs (CHF) 10 million to 20 million<sup>1</sup>.

### Main characteristics of the policy

Companies and organisations may apply for the implementation of efficiency measures within the scope of an annual call for tenders. The main criterion is the cost-benefit ratio (promotion funding per saved amount of energy). In order to qualify, projects and programmes must meet additional criteria, including that the tender's financial contribution towards a project is at least CHF 20 000 and promotion funding is equivalent to a maximum of 40% of the investment costs.

The scheme aims to fund projects for appliances and process measures whose payback period is greater than five years and infrastructure projects with a payback period of more than

nine years. Support increases proportional to the increase in payback time: 20% support for a payback time of five years, rising to 40% for a payback time of nine or more years.

The scheme has two strands: one for projects and one for programmes. While projects are geared at putting in place the best available technologies, programmes focus on information barriers and behavioural change.

Tenders are scrutinised by a panel of experts who assess the costs and savings of the scheme and select those that have the best cost-benefit ratio. For each bid, they decide the appropriate proportion of the total costs of the project/programme.

### Challenges faced during implementation

Due to the low level of public awareness in the programme's initial phase, fewer projects were offered than funding was available, so that no real tendering could occur. With a marketing effort and improvement of the selection criteria, the popularity of the programme now attracts enough projects. Also, it is not always trivial to assess the additionality of projects, in particular because technologies (*i.e.* lighting) have evolved very quickly recently and new technologies become cost-efficient more rapidly than expected.

1. As of September 2013, CHF 1 was roughly equivalent to USD 1.10.



## Why the policy is considered a success

The quality of bids and level of competition for funding have improved through successive rounds, with the benefit of learning and experience. The documentation for the scheme and the method for assessing bids and for estimating electricity savings have also improved.

The Swiss tender calls for energy efficiency can be seen as the Swiss response to instruments addressing electricity efficiency, such as White

Certificate schemes. The Swiss programme is based on a bottom-up approach and is an addition to the existing minimal performance standards. The tender calls help to overcome investment and information barriers.

## Lessons to be shared

The Swiss tender calls for energy efficiency are, in effect, an instrument to address electricity system efficiency voluntarily, without the cost of intensive monitoring and enforcement schemes.

# United Kingdom

## Electricity market reform

### Policy area/objectives

Electricity Market Reform (EMR) is the most significant and radical change to the UK electricity market since privatisation.<sup>1</sup> EMR is a set of arrangements to ensure that low-carbon generation is an attractive investment opportunity and that the United Kingdom has a secure, affordable electricity supply.

### Main characteristics of the policy

The United Kingdom currently provides support to renewable electricity generation through the Renewables Obligation and relies on market forces to ensure sufficient capacity margins.

The UK's long-term vision for the electricity market is for a decreasing role for government over time, and the transition to a market where low-carbon technologies can compete fairly on price. This competition between technologies will drive down costs and allow the United Kingdom to meet its energy and climate objectives in the most cost-effective way.

However, the current market cannot be relied upon to meet the electricity challenge. Low-carbon technologies are at different stages of development; market failures mean low-carbon generation cannot compete fairly with fossil fuels; and there is no guarantee that the market will continue to deliver a reliable electricity supply.

EMR proposes Contracts for Difference (CfD), which will encourage investment in low-carbon technologies through price certainty for generators at a fixed level, known as the “strike price.” Generators will receive revenue from selling their electricity into the market as usual; however, when the market reference price is below the strike price, they will also receive a top-up payment from suppliers for the additional amount. Conversely, if the reference price is above the strike price, the generator must pay back the difference between the strike price and the market reference price.

This lowers developers' exposure to volatile wholesale prices, which in turn reduces their cost of capital. In this way, CfD makes low-carbon generation cheaper than it would otherwise have been for investors, developers and consumers.

As ageing fossil fuel power stations are replaced with more intermittent and inflexible generation, ensuring that there is enough generation capacity in place to prevent blackouts becomes increasingly difficult. The Capacity Market will act as an insurance policy against future blackouts and make sure that consumers continue to receive reliable electricity supplies at an affordable cost.

The Capacity Market works by giving all capacity providers a steady payment to ensure enough capacity is in place to meet demand. Capacity providers face penalties if they fail to deliver energy when needed.

1. [www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform](http://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform).

## Challenges faced during implementation

This programme is the most significant and radical change to the electricity market since privatisation. An investment hiatus must be avoided while planning and formulating the policies to deliver these reforms. A period of transition has therefore been allowed between the new market arrangements, which will come into force in 2014, and the existing Renewables Obligation, which will close in 2017. Projects have a choice of scheme during this period.

The government is also actively working with developers and generators to enable early investment decisions to progress wherever possible ahead of the enactment of the legislation; developers meeting certain evaluation criteria will be eligible to receive early investment contracts.

The programme is seeking to create an environment of “co-design” with stakeholders to enable shared ownership, understanding and commitment to the reforms. Expert groups are providing an opportunity to draw upon industry expertise to provide input on specific aspects of EMR policy design.

## Why the policy is considered a success

The proposals in the Energy Bill introduced in November 2012 were generally well-received. The EMR programme has met all its major milestones to date and is on track to implement the mechanisms in 2014.

Once implemented, the success of the programme will be measured in terms of the carbon intensity of generation, security of electricity supply, cost impacts and other impacts on the market.

## Lessons to be shared

Increased engagement with stakeholders, especially in the design phase of a major programme, can reap not only technical design benefits, but also added buy-in and commitment to the policy decisions and added value for money. Stakeholders outside the normal energy areas, including investors, bankers and consumers have played an important role in keeping the United Kingdom a good place to invest.

# Austria

## Hydropower in Austria

### Policy area/objectives

Austrian electricity generation is dominated by domestic hydropower, which makes a valuable contribution to the energy security and independence of the Austrian electricity supply and to the stability of European electricity supplies more widely.

### Main characteristics of the policy

Austria's great importance within the European energy system and the continued development of renewable electricity production in central Europe can be attributed to its Alpine storage plants. Austria sees its role as a part of Europe's Green Battery. By supplying peak and balancing energy from their storage power plants in the Alps, Austria's electricity utilities also significantly support the stability of electricity supplies throughout Europe.

Austria, Germany and Switzerland therefore plan the expansion of pumped-hydro storage power plants through enhanced co-operation according to a joint statement from May 2012. The three countries agree that the increased integration of renewable energy in the future electricity supply cannot be realised without a corresponding expansion of transmission and storage capacities.

The construction of power plants also contributes to the strength of the Austrian economy through the creation of green jobs.

### Challenges faced during implementation

To create and enhance social acceptance in this context, especially regarding the "not in my backyard" (NIMBY) problem, timely and comprehensive information exchange is paramount.

### Why the policy is considered a success

The use of hydropower as a renewable energy source is highly significant for Austrian electricity production: in 2011 around 57% of total domestic electricity generation of 66 terawatt hours (TWh) came from hydropower plants. The production of other renewable electricity reached over 10% of total electricity generation in 2011. In fact, with about 70% of electricity generated from renewable energy sources, Austria has the highest proportion in the European Union.

### Lessons to be shared

Sufficient storage capacity is an essential prerequisite to the construction of additional renewable energy plants, and thus critical to the achievement of energy and climate policy objectives.

# Denmark

## Wind energy to cover 50% of electricity consumption in 2020

### Policy area/objectives

In 2012, the Danish government, with broad political participation from parliament,<sup>1</sup> established an ambitious energy agreement through to 2020. Its initiatives point toward the long-term goal of full conversion to renewable energy by 2050. The goal for 2020 is that wind energy cover 50% of Danish electricity consumption.

### Main characteristics of the policy

Denmark has particularly good conditions for wind power, with substantial wind resources, large, shallow offshore areas and a long history of wind power. Since the 1970s, wind energy in Denmark has evolved from a bottom-up, citizen-driven movement to today's wide distribution of wind initiatives, with many enterprises involved in the development and production of wind turbines. On this basis, Denmark houses many experts in wind energy who have up-to-date knowledge from universities that collaborate with the industry. Investments in wind energy – together with some of the leading turbine producers in the world, secure framework conditions and strong and stable political backing – contribute to the creation of green growth in Denmark.

The goal for 2020 is that wind power will account for 50% of Danish electricity consumption. This goal will be met by a massive investment in wind energy: 1 800 megawatts (MW) of new onshore wind power and 1 500 MW of new offshore wind power.

To meet the offshore goal, two large wind farm projects are planned: 600 MW in the Baltic Sea and 400 MW in the North Sea; the remaining 500 MW will be placed in coastal areas, including 50 MW of test turbines.

Onshore, wind power turbines totalling a capacity of 1 800 MW are expected to be erected. Old turbines are planned to be decommissioned during this period, so that in the end the final additional capacity will be 500 MW.

### Challenges faced during implementation

The primary challenge is to find suitable sites, while taking account of people and the environment. Central authorities plan areas for the offshore wind power, while it is up to the local governments to decide where to install onshore wind power. Local protests against wind turbines onshore are a growing challenge. Placing all turbines offshore is not a solution as of yet, however, the costs of offshore turbines are much higher than that of onshore.

1. All other parties in parliament except one participated in the agreement.

It is therefore necessary to support local governments in their efforts to develop new sites and offer incentives to nearby neighbours, such as compensation for loss of property value, and a scheme where owners of wind turbines must auction at least 20% of the shares to neighbours.

On the technical level, integrating large amounts of fluctuating wind power demands other adaptations to secure the energy supply. Here there are three main instruments in use: strong transmission grids and well-functioning energy markets; flexibility in production and consumption, and close integration with the heat, gas and transport sectors; and smart grids to implement intelligence in the power system.

## Lessons to be shared

In order to fulfil ambitious targets – such as the Danish energy agreement of 2012 – it is important for investors in the market to have stable and transparent political conditions on a long-term basis. There is a tradition of entering into broad political energy agreements in Denmark, which could be regarded as “gentlemen’s agreements.” This means that the agreement will stay in force regardless of changes in government.

# The Netherlands

## Promoting renewable energy: Dutch entrepreneurs race for subsidies

### Policy area/objectives

Energy from renewable sources is relatively expensive in the Netherlands, but demanding renewable energy targets must be met.<sup>1</sup> It is therefore particularly important that the available budget of the support scheme for renewables, the Stimulerend Duurzame Energieproductie (SDE+), be spent as efficiently and effectively as possible.

The SDE+ is a technology-neutral instrument: renewable electricity projects, renewable gas projects and renewable heat projects compete with one another for the available budget. The scheme is designed so that the level of subsidy keeps up with the market price of energy. With high energy prices the subsidy amount is lower, and vice versa.

### Main characteristics of the policy

The SDE+ is financed by a levy on the energy bill of households and businesses. The SDE+ provides a per-unit-of-energy<sup>2</sup> subsidy to cover the extra costs of producing renewable energy; the level reduces if energy prices in the market are higher.

The scheme has one budget ceiling in which all eligible renewable energy technologies compete with one another. The least expensive technologies may apply first. If there is any budget remaining after the completion of the first phase, the second phase opens, etc.

To increase competition between technologies even more, the SDE+ has a so-called “free category.” An expert bureau calculates the support level to cover the extra costs of producing renewable energy for a reference installation. It is estimated that, with that level of subsidy, 80% of all projects may have a positive business case. Of course, individual projects might be less costly, perhaps because they have a favourable location or access to cheap biomass. Entrepreneurs who think they will be able to produce renewable energy below the calculated support level may submit an application in the free category in an earlier phase, but will receive a lower payment. The motivation for entrepreneurs is: the earlier you submit, the more likely there will still be budget available.

### Challenges faced during implementation

The Netherlands is a relatively expensive country in which to generate renewable energy: its geography and climate preclude less costly options such as hydro and solar, and scarcity of space due to its dense population complicates the deployment of cost-efficient technologies such as onshore wind generation. However, the SDE+ scheme seems to be countering this problem.

1. The EU Renewable Energy Directive (2009/28/EC) allocated a binding target of 14% in 2020 to the Netherlands. In the recent coalition agreement, the Netherlands set a new and more ambitious renewable energy target of 16% in 2020.

2. Kilowatt hour (kWh), normal cubic meter (Nm<sup>3</sup>) or petajoule (PJ= 1 quadrillion [10<sup>15</sup>] joules).



Technology-neutral support schemes usually promote mainly near-market technologies, which are most efficient, over less well-developed ones. For the first two years this was also true for the SDE+. In the first-year biogas projects received more than two-thirds of the budget. In the second year, renewable heat projects became eligible for subsidy, and as a result many geothermal projects received nearly 60% of the budget. Nevertheless, the SDE+ also supported more innovative projects that applied in the free category (*e.g.* more than 800 large-scale solar energy projects in the first two years). Apparently, some investors are willing to contribute financially to renewable energy themselves (*e.g.* for marketing purposes). In 2013, as a result of the increased budget, there is far more variation in projects supported: 224 large-scale solar energy projects, 33 onshore wind farms and 104 renewable heat projects, but also several tidal energy, large-scale solar water heating, hydropower and renewable gas projects.

## Why the policy is considered a success

The SDE+ is more cost-effective than previous schemes, in which renewable energy projects were supported for an average subsidy of approximately EUR 0.07 per kilowatt hour (EUR/kWh). As can be seen from the table

below, under SDE+ an increasing contribution to the renewables target is obtained at a lower cost per kilowatt hour (kWh).

The SDE+ is well designed to accommodate price decreases in the manufacturing costs of different technologies, for example the price decrease in solar energy from 2010-13 from EUR 0.42/kWh to below EUR 0.15/kWh. When renewable energy options become competitive, they are omitted from the SDE+ (for example, waste incineration projects).

## Lessons to be shared

It is beneficial to diffuse the influence of lobbying by introducing competition among renewable energy projects. Separate budgets per technology make support schemes receptive for lobbying. Competition is a tried and tested way of promoting efficiency.

The subsidy scheme should be designed with an annual review to respond to changing market conditions, with a reduced subsidy when energy prices are high.

Recognise the limits of government policy with respect to setting tariffs and allocating budgets. Design the scheme in a way that accommodates price decreases of technologies by allowing projects to apply for a lower support level.

**Table 4** Summary of SDE+ opening rounds, 2011-13

|   | SDE+ 2011       | SDE+ 2012       | Preliminary results SDE+ 2013  |
|---|-----------------|-----------------|--|
| Available budget  | EUR 1.5 billion | EUR 1.7 billion | EUR 3.0 billion  |
| Number of committed projects                              | 740             | 244             | 488  |
| Subsidy based on electricity market price of EUR 0.05/kWh | EUR 0.04/kWh    | EUR 0.02/kWh    | First phase: EUR 0.02/kWh<br>Second phase: EUR 0.03/kWh<br>Third phase: EUR 0.04/kWh |
| SDE+ contribution to renewable energy target              | 0.4%            | 0.7%            | 1.1%   |

Source: NL Agency, 2013.

# Norway-Sweden

## Encouraging renewables through the market: a joint Swedish-Norwegian electricity certificate system

### Policy area/objectives

A common Norwegian-Swedish market for electricity certificates was established on 1 January 2012, with the objective of increased renewable electricity production in a more cost-effective manner. Sweden has had an electricity certificate scheme since 2003. A joint Norwegian-Swedish certificate market is larger, with more actors, and thus has higher liquidity than national markets. This is expected to improve market functioning, contribute to better competition and stabilise prices. A common market is also expected to contribute to more efficient resource exploitation.

### Main characteristics of the policy

Norway and Sweden have a combined goal of establishing 26.4 terawatt hours (TWh) of new electricity production based on renewable energy by 2020. Norway and Sweden each impose an obligation on energy producers to buy electricity certificates corresponding to 13.2 TWh by 2020. Production can be located in either of the two countries, since the electricity certificates can be traded across the border to fulfil the national obligations.

The electricity certificate system is a market-based and technology-neutral support system that promotes new electricity production based on renewable energy sources. Electricity producers in Norway and Sweden whose electricity production meets the requirements

of the Norwegian Electricity Certificates Act and the Swedish Electricity Certificate Act receive one electricity certificate for each megawatt hour (MWh) of electricity producer over a 15 year period. Demand for certificates is created by the statutory duty of electricity suppliers and certain end-users to purchase certificates corresponding to a proportion of their electricity sales or electricity use. A technology-neutral system leads to increased competition between the different renewable technologies and drives prices down. With a market-based approach, the certificate price is determined by the market.

### Challenges faced during implementation

Going from a national to a bilateral Renewable Electricity policy is challenging. The cornerstone of co-operation is an agreement between Norway and Sweden on a common market for electricity certificates.<sup>1</sup> The agreement deals with issues for which a common view is necessary, but each country also has its own certificate legislation that provides a certain amount of national flexibility.

With the market in place, it has been important to have regular and close contact between the ministries responsible for the certificate system and the energy agencies administrating the system. This has proved important for the proper handling of information that can have an impact on the market.

1. [www.government.se/content/1/c6/19/00/26/54fa9e12.pdf](http://www.government.se/content/1/c6/19/00/26/54fa9e12.pdf).

## Why the policy is considered a success

The common Norwegian-Swedish certificates market is still in an early phase. The annual report for 2012 showed that the market is working and that new electricity production based on renewable energy sources is developing in line with the 2020 targets. Capacity additions in 2012 are expected to deliver a yearly average of 3.2 TWh of renewable electricity. The spot price for certificates in 2012 varied between EUR 16 per MWh (EUR/MWh) and EUR 24/MWh according to Svensk Kraftmäklings. This means that the average cost for the consumers is relatively modest in an international comparison.

As acknowledged by the European Commission, the common Swedish-Norwegian electricity certificate market is the first example of a joint support scheme and, indeed, of a co-operation mechanism under the directive on the promotion of the use of energy from renewable energy sources (2009/28/EC).

## Lessons to be shared

The establishment of a joint support scheme requires strong political will from both countries. Norway and Sweden have an integrated electricity market and have roughly the same potential for development of new renewable electricity production; this has been a facilitating factor in their joint electricity certificate system.

# Spain

## Variable production in the Spanish power system: a future model already in operation

### Policy area/objectives

Spain's peninsular electricity system operates with a high proportion of renewable technologies, much of it wind generation. Managing this variable output while maintaining the expected level of electricity supply security is a challenge, particularly given its limited connection to other power systems.

The European Union 20-20-20 target implies that by 2020 around 40% of the electricity consumed in Spain should come from renewable sources. Around 48% of electricity demand was supplied by renewable generation in the first-half of 2013, and the peninsular system has been operating with a proportion of renewable generation similar to the one expected in 2020. Much of the renewable capacity has variable output: over 22 000 MW of wind power and over 6 000 MW of solar power, or nearly 30% of installed capacity.

The variability of renewable energy sources and corresponding forecast uncertainties are an important challenge for the integration of renewable sources, particularly with regard to the country's weak interconnected systems. Imbalances in the electricity system must not be greater than a certain maximum value and must be corrected in no more than ten minutes. Otherwise, the interconnection with France could overload or even trip, isolating the peninsular power system from the rest of Europe. The Transmission System operator (TSO), Red Eléctrica de España (REE), developed approaches and technical requirements

to handle this, and is currently reinforcing the France-Spain interconnection for 2014. This reinforcement will increase the current exchange capacity between the two countries, as well as the capability to react to variability and uncertainty. Nevertheless, this new France-Spain link is insufficient and must therefore be complemented by other interconnection lines on the Spanish-French border, so that the Spanish electricity system can reach a transfer capacity of at least 10% of total installed capacity, as agreed at the EU Barcelona Council in 2002 and reiterated at the May 2013 European Council.

### Main characteristics of the policy

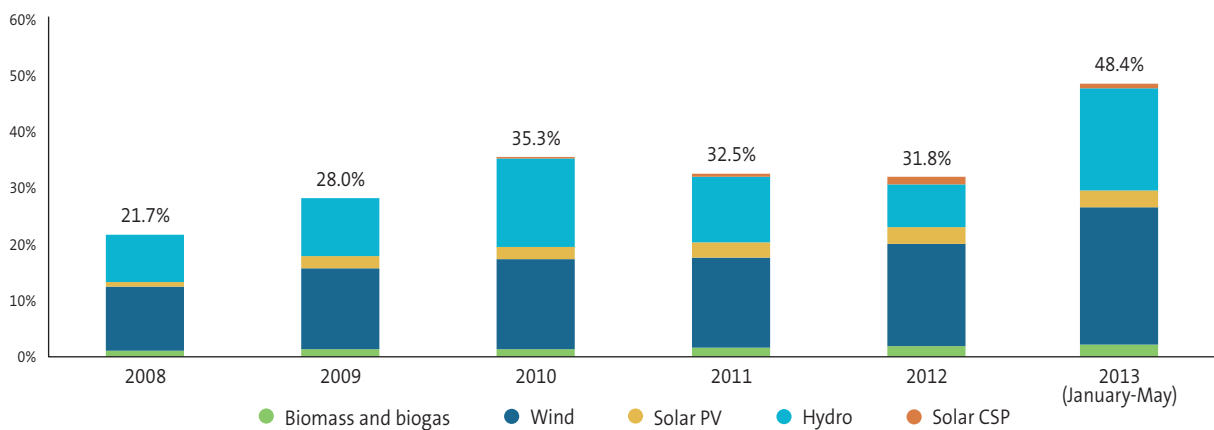
Renewable energy –coming in most cases from unmanageable primary resources – can lead to production variability. It is important to guarantee appropriate reserves, both upward and downward, to restore system balance quickly and efficiently. This makes wind and solar forecasting tools essential for effective operation of the system.

Access to real-time information about the production of renewable energy is necessary to make reliable production forecasts. In order to supervise, control and integrate renewable energies, the TSO commissioned the Centro de Control de Régimen Especial (CECRE) in June 2006. Through the CECRE, the TSO receives real-time data from wind and solar capacity telemetrically. Over 2 000 renewable facilities producing more

than 10 MW of electricity throughout Spain are integrated through intermediate renewable energy source control centres, sending installation information in real time to the TSO and executing TSO orders. This hierarchical structure, together with the applications developed by REE, is used to continuously analyse the maximum amount of wind generation that can be supported by the system.

Following approval of the grid code in 2007, Spain's wind farms have fault ride-through capabilities, which have solved certain types of wind generation tripping. For this reason, production curtailments have not been required since 2008.

**Figure 10** Percentage of renewable energy in the Spanish peninsular system



Source: Red Eléctrica de España (REE), S.A., 2013.

## Challenges faced during implementation

At the technical level, the integration of large amounts of intermittent generation requires adequate transmission and distribution energy planning. Environmental issues and public opposition have been a challenge for the Spanish-French interconnection, as the grids have to pass through areas of high environmental value.

## Why the policy is considered a success

The introduction of large-scale renewable energy technologies in the Spanish power system has not been the source of any incidents affecting consumers, and the necessary supply security has always been preserved. The number and severity of imbalances between generation and demand have also remained very low, similar to levels ten years ago, thus indicating the stability of the system.

## Lessons to be shared

The peninsular power system has demonstrated that renewable generation is able to achieve large-scale penetration without affecting system security; however, observation and controllability of renewable energy generators must be ensured by the TSO in order to adapt in real time to circumstances that may arise unexpectedly. The CECRE is a good example of how this goal can be achieved.

Grid codes defining the minimum technical requirements for all generation and demand facilities must be adapted to the new scenarios expected in the system; for example, in terms of the amount of variable renewable generation.

Renewable energy integration is more challenging for weak interconnected systems, so it is essential to increase the international exchange capacity among neighbouring countries. A reinforcement of the France-Spain interconnection is planned for 2014 and additional interconnection projects are being studied.

# Austria

## Natural gas use and storage in Austria

### Policy area/objectives

Domestic gas production in Austria since the early 1970s has proved insufficient to meet demand. Nevertheless, natural gas is a cornerstone of Austria's energy supply. This has been made possible by the development of gas storage.

### Main characteristics of the policy

As a consequence of Austria's increasing demand for gas and more or less constant domestic production (around 1.7 billion cubic metres [bcm] in recent years), import volumes have risen significantly, from 1.6 bcm in 1972 to 9.2 bcm in 2011.

Gas storage has always played an important role, helping to make constant deliveries compatible with seasonally fluctuating consumption. Now gas can also be put in temporary storage for later use.

Former gas fields were, when depleted, transformed into storage facilities. The evolution was particularly dynamic during the last decade. The working gas volume of storage facilities on Austrian territory was 4.1 bcm in 2008, 4.5 bcm in 2009 and currently stands at 7.4 bcm. Storage levels usually reach their top values at the end of September or early October. After that the levels go down and reach their bottom values at the end of March or early April.

### Challenges faced during implementation

The creation of gas storage facilities is not only technically challenging but also requires enormous investments; attracting adequate investment depends on the foreseeable development of the gas market. In addition, not only the storage facility itself but sufficient pipelines have to be built, which are not always publicly acceptable. Nevertheless, during recent decades not only was Austrian gas storage capacity increased as planned, but the necessary transport infrastructure was constructed to integrate the storage facilities into the Austrian and European gas markets.

Given the seasonal fluctuations in demand, storage facilities are needed to equalise supply and demand patterns over time.

### Why the policy is considered a success

More than 80% of Austria's annual gas consumption today can be stored in the existing storage facilities, adding substantially to the security of its domestic gas supply.

The storage sites on Austrian territory, however, are not only important for the national market but also for neighbouring countries such as Slovenia, which has no storage of its own, and Germany; in fact, the storage facilities near the Austrian/Bavarian border are primarily oriented towards the German market.



## Lessons to be shared

Storage proved its merit as a supply-security instrument in January 2009 during a two-week gas shortage. The gas, normally delivered from the east, was almost totally compensated for through increased withdrawals from storage facilities.

# Ireland

## Rebalancing of strategic oil stocks in favour of wholly owned stocks on the island

### Policy area/objectives

In 2007, the Irish National Oil Reserves Agency (NORA) held approximately 75 days of Ireland's total 90 day stockholding obligation. NORA was heavily dependent on stock tickets, and much of its wholly-owned stocks were held abroad. In the 2007 Energy Policy Paper, the government committed to "rebalance the strategic oil reserve by maximising Ireland's wholly-owned stocks of oil and the level of stocks held on the island, subject to increased storage availability and value for money considerations."

### Main characteristics of the policy

NORA funding (via the NORA levy on oil products) doubled from EUR 0.01 per litre

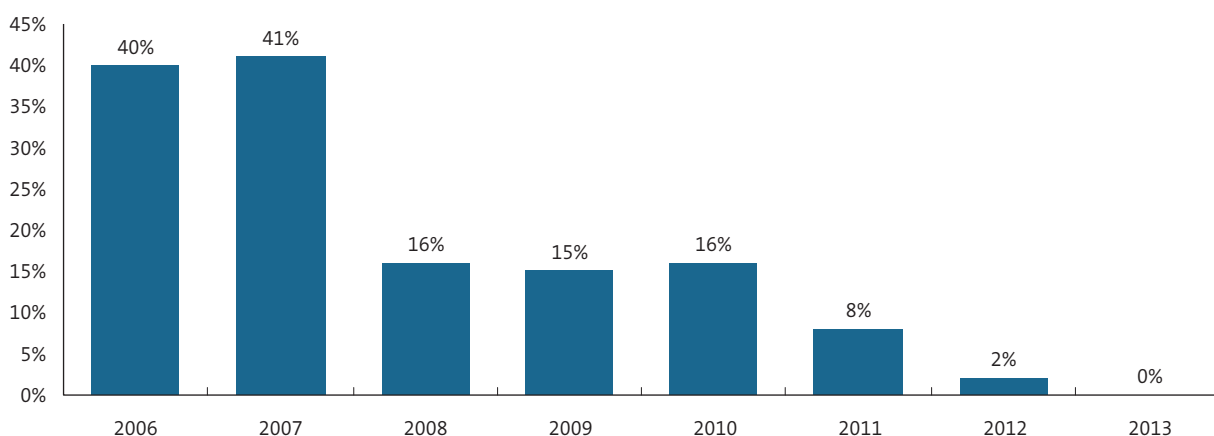
(EUR/l) to EUR 0.02/l 2009. The NORA levy is ultimately included in the price paid by the end consumer of the oil product.

NORA maximised the use of existing commercial storage, and refurbished and commissioned three new storage facilities, providing a total additional 32 kilotonnes of product storage. The results are depicted below, with stock tickets eliminated and over 70% of stocks held on the island.

### Challenges faced during implementation

The lack of available physical oil storage infrastructure required NORA to develop its own new storage facilities, requiring time as well as additional funding and staffing resources.

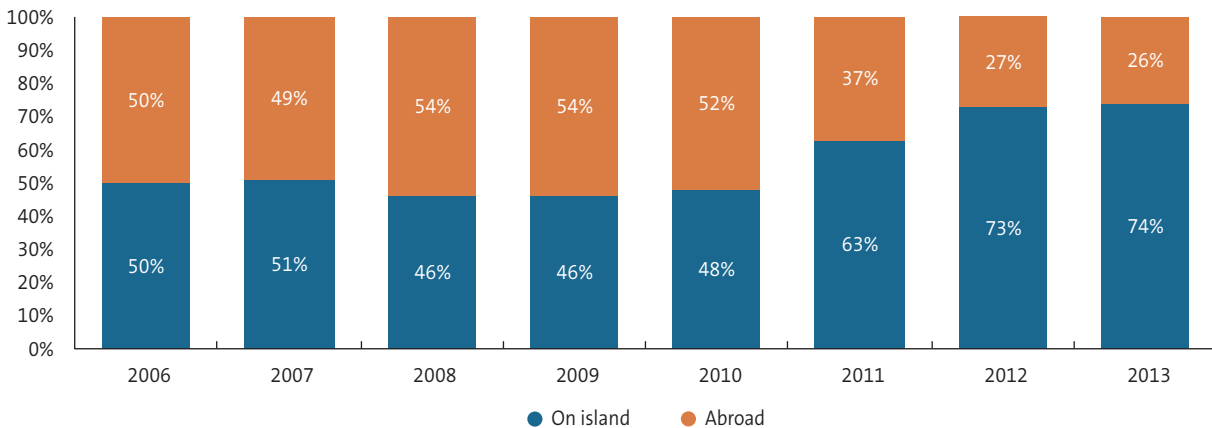
**Figure 11** Stock tickets as % of NORA total obligation volume



Source: NORA, 2013.

Figure 12

Stocks held on the island of Ireland and stocks held abroad (including stock tickets)



Source: NORA, 2013.

In line with the new European Union (EU) Oil Stocks Directive, since 2007 NORA has progressively increased its stockholding obligation while implementing this strategy. NORA now holds 88 days of Ireland's 90-day obligation.

## Why the policy is considered a success

As an island nation with limited refining capacity and no indigenous oil production, the availability of product stocks on the island improves Ireland's supply security, particularly in the event of a local disruption (e.g. prolonged bad weather) which might make imports difficult.

The Irish administration and the International Energy Agency (IEA) considered that the over-reliance on stock tickets created vulnerability in the event of supply disruption, and this has now been eliminated.

Holding strategic stocks on the island of Ireland has indirect benefits to the regional and national economy.

## Lessons to be shared

Having a dedicated agency to implement the strategy was an advantage. NORA, with an average workforce of six, had the expertise and experience to meet the objective. Ring-fenced levy funding, which is not dependent on central state funding, enabled NORA to secure the financing necessary to continue implementing this policy at a time of budgetary cuts.

Enhanced benefits may be leveraged from the oil stocks located on the island; for example, consideration is being given to using strategic stocks as a secondary fuel source in power stations in the event of a gas disruption. NORA is also pursuing additional primary storage to ensure that stocks can be quickly and efficiently released if needed.

Having invested in rebalancing the strategic stocks, Ireland is now focusing on enhancing emergency plans to ensure the maximum beneficial impact of these stocks in a supply disruption.

# Italy

## Transition to a liberalised gas market: keeping prices down

### Policy area/objectives

The liberalisation of the Italian gas market – a strongly developed vertically integrated monopoly system since the 1960s – began in 2000, in the wake of European efforts to create an internal energy market. The concurrent liberalisation of the electricity market led to the switch from oil-fired plants to the more efficient and environmentally friendly combined cycle gas turbine (CCGT) plants.

The increased use of gas for both heating and power generation (gas-fired power generation tripled compared to 1997) has led in 15 years to a consumption increase of 50%, while domestic production halved and imports doubled. This situation pushed prices in Italy far above the EU average. The government identified gas price reduction as a cornerstone to improve the Italian industry's competitiveness, pursuing it by means of increased market liquidity, competition between operators and new sources of supply.

### Main characteristics of the policy

To pursue this objective, the Italian government decided to improve market mechanisms and infrastructures. After the implementation of the day-ahead market in 2010 and the balancing market in 2011, a gas exchange market will start in October 2013 with the aim of integrating the various exchange platforms and increasing market efficiency. Ownership

unbundling of the main gas transmission system operator (TSO), which was approved in May 2012 and is now fully implemented, increased access of non-incumbent operators. Meanwhile, new rules in the wholesale market, indexing prices to the relevant European virtual trading points instead of the previously used oil indexes of take-or-pay contracts, are providing a more competitive price signal.

Further integration of the European gas markets will come with the completion and implementation of new, unified EU network codes on congestion management, capacity allocation and cross-border balancing, as well as from the adoption of the European regulations on the streamlining of gas crisis management. Infrastructure improvements to enhance system competitiveness include: (i) improved allocation of capacity on the two main pipelines connecting Italy to the rest of Europe, (ii) the development of virtual and physical reverse flow capacity, (iii) the recently implemented optimisation of underground storage capacity allocation by auction mechanisms, (iv) the start of operations of a new liquefied natural gas (LNG) terminal off the shore of Tuscany, (v) other new LNG projects and (vi) possible future links to Caspian gas through the Southern Corridor. All these measures have been integrated, after public consultation, in the recently approved National Energy Strategy (NES).<sup>1</sup>

1. Link to NES page at the Italian Ministry of Economic Development site.

## Challenges faced during implementation

The main obstacles met in the implementation of the new market framework and in deploying infrastructures have been the long administrative procedures and the “not in my backyard” (NIMBY) effect. After the measures finally took effect in 2012, however, the PSV<sup>2</sup> gas price during the past winter was firmly aligned to the other European markets (see graph below). The challenge is to turn the present-day price decrease – due to decreased demand – into a structural price decrease, where gas prices will remain linked to those in the main European gas hubs. To achieve this goal, and facing reduced load factors, the NES promotes the realisation of new strategic import infrastructures – mainly new LNG terminals – by financing investments through general system charges, guaranteeing a minimum return on the investment. When demand increases again, the current surplus capacity will be available to new imports without generating congestion and affecting prices.

2. Punto di Scambio Virtuale, the Italian natural gas virtual trading point.

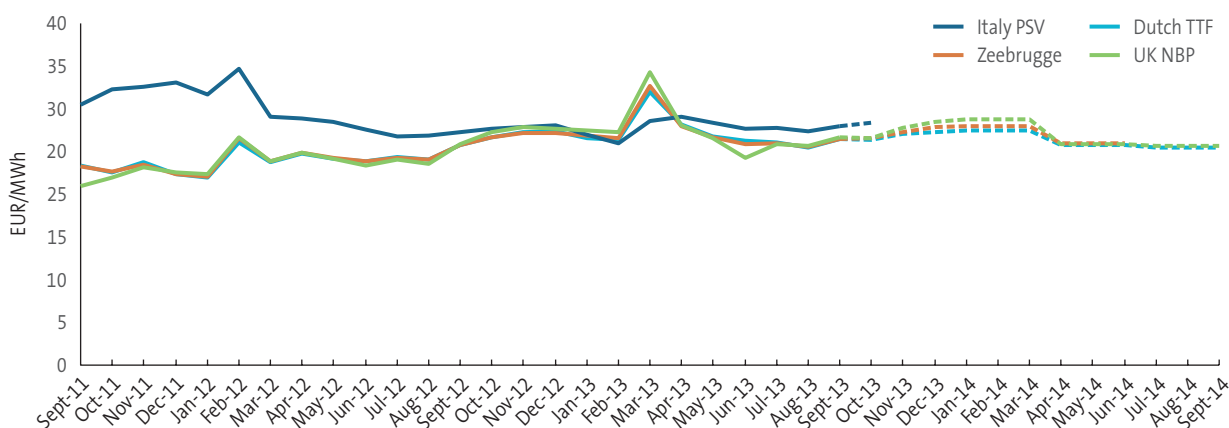
## Why the policy is considered a success

The success of the current policy is measured in terms of price differentials between the Italian virtual trading point and the main European gas hubs; the latest market data suggest that results are in line with expectations (see graph below).

## Lessons to be shared

Heavy reliance on natural gas can easily lead to price increases during a market liberalisation phase if adequate market design and infrastructure measures are not put in place. To keep prices in check, measures should be designed to increase liquidity, efficiency and competition.

**Figure 13** European spot prices



Source: Newsletter Gestore Mercati Energetici S.p.A. 2013.

# Japan

“The door is open towards competitive gas”\*

## Policy area/objectives

The natural gas market is at a major turning point, with prospects for increasing demand in the Asia-Pacific region, and with new supply from the shale gas revolution in North America and emergent suppliers in Africa and elsewhere. Meanwhile, global markets for natural gas are regionally segmented, with prices differing across regions.

Japan depends on imports for most of its natural gas supply, in the form of LNG. Securing LNG supplies in a stable and inexpensive manner is therefore critical to Japan's economy and industry. The same challenge is faced by other Asian countries where demand for LNG is expected to soar.

## Main characteristics of the policy

Japan is taking major steps aimed at procuring natural gas stably and inexpensively: (i) importing LNG from North America, where LNG prices are lower due to shale gas production; (ii) diversifying supplier countries by participating in upstream and LNG projects in Australia, Mozambique and Russia; and (iii) enhancing the buyers' bargaining power. Measures to enhance bargaining power include strengthening partnerships among LNG consumer countries, expanding support for projects that reduce LNG import prices, and promoting other energy

sources including restart of nuclear power, construction of highly efficient coal fire plants and developing methane hydrate domestically.

## Challenges faced during implementation

The shutdown of nuclear power following the Great East Japan Earthquake (Fukushima nuclear accident) in 2011 has increased Japan's dependence on LNG-fired thermal power generation, leading to the expansion of the nation's LNG imports by nearly 30%. Furthermore, Japan's LNG import prices, which are linked to crude oil prices, were at USD 16.4 per million British thermal units (USD/MBtu) as of July 2013, much higher than the US natural gas price of USD 3.6/MBtu, even when the cost of liquefaction and transport is taken into account. As a result, the overall cost of LNG imports to Japan has increased from around JPY 3.5 trillion<sup>1</sup> a year to around JPY 6.2 trillion between 2010 and 2012.

The challenge of addressing surging fuel costs is not limited only to Japan, but has increasingly become a crucial issue for other Asian countries, as natural gas demand in Asia is growing at the strongest pace compared to any other region.

1. As of September 2013, JPY 1 was roughly equivalent to USD 0.01.

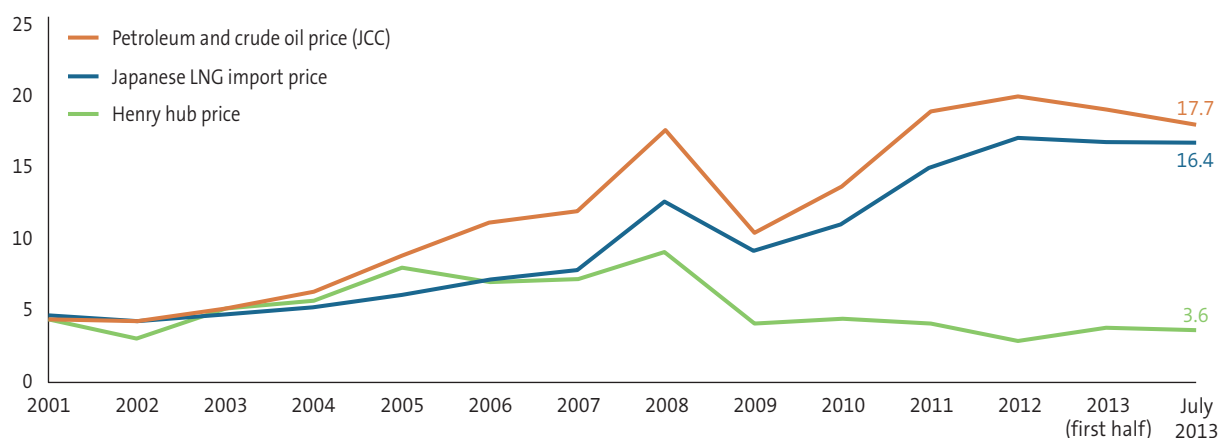
\* It was the theme of the second LNG producer-consumer conference held in Tokyo on 10 September 2013.  
Available at: [www.meti.go.jp/english/press/2013/0809\\_01.html](http://www.meti.go.jp/english/press/2013/0809_01.html).

## Why the policy is considered a success

Signs are emerging of developments towards a more liquid and convergent gas market. In relation to LNG imports from the United States, Japan is involved in projects equivalent to 15 million tonnes per year – nearly 20% of the nation's annual LNG consumption. In May 2013, the US government approved LNG exports from the Freeport LNG project to Japan, which accelerates new gas flow between North America and Asian countries.

Several new procurement contracts in the Asian gas market are now based on gas-on-gas pricing. The 2nd LNG Producer-Consumer Conference in Tokyo in September 2013 facilitates active discussion among key government and private players. The shifting balance of supply and demand points to a more globalised natural gas market. Growing LNG supplies, increased short-term trading and greater operational flexibility are likely to lead to increased market connectivity between regions and a degree of price convergence.

**Figure 14** Natural gas price trend (USD/MBtu)



Source: Trade Statistics of Japan, OILNERGY, 2013.

## Lessons to be shared

Japan has ensured stable procurement of LNG based on long-term relationships of trust with producers. Strengthening these relationships remains important to Japan. Furthermore, Japan co-operates with LNG producer and consumer countries, as well as the IEA, to identify new measures for the inexpensive and stable supply of LNG.

*Offshore production test of methane hydrate (flare from the burner at the stern of "Chikyu")*



Source: Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, [www.meti.go.jp/english/press/2013/0318\\_03.html](http://www.meti.go.jp/english/press/2013/0318_03.html)



# Norway

## Norwegian petroleum production and resources

### Policy area/objectives

Norway is currently producing 1.8 million barrels of oil per day, and gas production in 2013 will be approximately 107 bcm. About 44% of Norway's estimated resources have been exploited so far, and substantial volumes remain to be discovered.

Norway's petroleum resources belong to the Norwegian people, and the resources are managed in a way that benefits the entire Norwegian population. The primary objective of the petroleum policy is to facilitate profitable exploitation of oil and gas in the long term.

### Main characteristics of the policy

The Norwegian petroleum sector is now characterised by a high level of activity and a sense of optimism. Development is driven by years of high oil and gas prices, good exploration results and a stable and attractive policy. The government has taken the first steps towards accomplishing the high ambitions presented in its recent White Paper on petroleum activities.<sup>1</sup>

To achieve the objective of long-term, profitable exploitation of oil and gas, resource management is comprehensive and based on knowledge and facts, and the management framework is sensitive to health, safety and environmental issues.

### Challenges faced during implementation

The main challenges involved in Norway's petroleum policy are improved recovery from fields, development of discoveries and confirmation of new discoveries. The interplay between the state, oil companies, the supply industry and the research sector is also a challenging aspect of Norwegian petroleum management.

Curbing the decline in production from existing fields is very important for short- and medium-term profitability. It has been important to take a comprehensive approach to improved recovery at a sufficiently early stage in the various fields.

The government has approved a number of developments in recent years. Most of these are minor discoveries that will be tied into existing fields. Many of them have become profitable as a result of standardisation, accessible infrastructure, rapid project implementation and good product prices. A number of new, stand-alone developments in recent years have also halted the decline in oil production.

Access to prospective sites is essential for maintaining profitable activity, as it takes time to develop a new area. If a new area is opened today, it will not yield a significant contribution to production until around 2030. The government is therefore working diligently on new areas, and the parliament recently approved the opening of the south-eastern Barents Sea.

1. [www.regjeringen.no/nb/dep/oed/dok/regpubl/stmeld/2010-2011/meld-st-28-2010---2011.html?id=660966](http://www.regjeringen.no/nb/dep/oed/dok/regpubl/stmeld/2010-2011/meld-st-28-2010---2011.html?id=660966).

## Why the policy is considered a success

Petroleum activities have been crucial for Norway's economic growth, and for financing the Norwegian welfare state. In 2012, the petroleum sector represented more than 23% of the country's total value creation. The state's income from petroleum activities is transferred to a separate fund, the Government Pension Fund – Global. At the end of 2012, the fund was valued at approximately USD 650 billion. This corresponds to approximately USD 120 000 for every Norwegian citizen.

There are many reasons for the success of Norway's petroleum resource management: strong and competent regulation, gradual exploration, prudence in health, safety and environmental issues, and a stable, fair and attractive fiscal framework.

## Lessons to be shared

During the 44 years since the first oil discovery on the Norwegian continental shelf, oil and gas have become Norway's most important industry. During these years, the activities have undergone major changes and several areas of the petroleum policy have been adapted.<sup>2</sup> The main principles, however, have remained unchanged:

- value maximisation through diversity and competition;
- open dialogue between the authorities and the industry (both the oil companies and the supply companies) about how to add value and how to find solutions to new challenges;

- the exercise of national control through a transparent, predictable and adaptable framework;
- a tax system that ensures companies a reasonable return in relation to the risk they take and that rewards value creation while ensuring that the state receives an equitable share of the economic rent;
- a long-term perspective on the management of the state's petroleum revenues in order to ensure the basis for future prosperity and to share revenues across generations;
- a prudent and responsible fiscal policy guideline, where the use of the state's petroleum revenues takes into account fiscal sustainability in the long term and stable economic development in the medium term;
- sound management of the financial savings in a petroleum fund;
- a prudent framework as regards health, safety and the environment.

2. For a short summary of Norway's oil history: [www.regjeringen.no/en/dep/oed/Subject/oil-and-gas/norways-oil-history-in-5-minutes.html?id=440538](http://www.regjeringen.no/en/dep/oed/Subject/oil-and-gas/norways-oil-history-in-5-minutes.html?id=440538).

# Poland

## Gas market liberalisation

### Policy area/objectives

The Polish natural gas market is facing fundamental changes. Until now it has been a closed market, with one dominant supplier; it is now becoming an open market, competitive and ready for qualitative change. Developments in Poland's domestic gas market include the opening of an LNG Terminal in Swinoujscie in 2014, as well as the entrance of new market players. This is a significant change for both the gas suppliers and the consumers. Poland must adapt quickly to its role as a fully-fledged participant in the liberalised EU gas market.

### Main characteristics of the policy

The phase-out of regulated gas prices is already in progress. The Road Map for Deregulation of Natural Gas Prices, prepared by the advisory panel on the liberalisation of the natural gas market in Poland, lays the groundwork for the deregulation. The roadmap has implemented a number of changes so far:

An effective procedure for changing supplier was determined in distribution and transmission systems' network codes and approved by the president of the Energy Regulatory Office. The Minister of Economy's detailed conditions for the operation of the gas system were amended to introduce a virtual trading point, without a physical location in the transmission system, where gas trading could take place. This enables the sale and purchase of gas that is already in the transmission system. Gas trading at the virtual point will allow market participants to buy gas regardless of

supply direction, and will allow them to carry out stock market transactions as well as over-the-counter (OTC) transactions. These changes are expected to facilitate trade in natural gas, particularly by enabling trade on the secondary market. Consequently, the entrance of new entities to the Polish gas market is anticipated. Both acts will facilitate changes of supplier and increase the level of competition. The amendment of the detailed conditions for operation of the gas system – as well as the new Transmission Network Code of the TSO, OGP Gaz-System S.A. – concerned the initiation of the natural gas trade in the Polish Power Exchange (POLPX). The gas market on POLPX began operating on 5 December 2012. In the first half of 2013, 179 071 megawatt hours (MWh) of gas has been traded via the gas exchange on the day-ahead market for gas, and 285 577 MWh of gas has been traded on the Commodity Forward Instruments Market. Thanks to the recent amendment of the Polish Energy Law, trade will be possible without the intermediation of brokerage houses and commodity brokerage houses. The Ministry of Economy's regulation, issued on 28 June 2013, detailed rules for forming and calculating tariffs and settlements in gaseous fuel trade came into force on 25 July 2013. The main purpose of this act is to create transparent rules for calculating tariffs, especially for calculating transmission rates for entry and exit points, for short-term and interruptible capacity services, and for physical and non-physical backhaul capacity provided by the system operator. It also specifies rules for calculating payments for both bundled and unbundled services of storage space, an auction system allowing the TSO to sell transmission services at interconnection points, change from capacity units to energy units and transfer

charges for gas transmission to the distribution and seller's tariffs. The amendment of the Energy Law introduces an obligation to sell a certain amount of natural gas on the POLPX. The obligation of selling natural gas through the POLPX will be carried out in accordance with the following schedule: from the entry into force of the act to 31 December 2013, an amount not less than 30% of total high-methane natural gas put into the pipeline after the act entered into force; from 1 January 2014 to 31 December 2014, an amount not less than 40% of total natural gas; from 1 January 2015, an amount not less than 55% of total natural gas. According to the president of the Energy Regulatory Office, the requirement of public sales of natural gas will increase to 40% and then to 55%, and will provide grounds for exemption from approval of tariffs for customers who use more than 25 million cubic metres per year. The draft of the Gas Law Act suggests reversal of the gas tariffs model, releasing natural gas trading from tariff approval by the president of the Energy Regulatory Office. Tariffs could still be used exceptionally in justified cases. The purpose of regulated gas prices for households in Poland is primarily to protect the interests of customers on the market, which is dominated by one large supplier. Price regulation is therefore inevitable until the time when competition on the market eliminates the dominance of one company.

## Challenges faced during implementation

Poland is facing remarkable changes in its natural gas market. The introduction of a virtual trading point was the cornerstone of the new Polish gas market model. The introduction of the entry/exit system in the gas market allowed for a new design, and the implementation of the European Union's Third energy package was of a great importance. Unfortunately, the necessary co-operation between public

authorities and natural gas undertakings, and common agreement among stakeholders on the new construction of the gas market, are hard to achieve because of the divergent goals of market participants. In addition, the dominant position of the largest supplier on the market, lack of sufficient interconnector capacity and new gas infrastructure being built (new pipelines and the LNG terminal) is stalling the achievement of a fully liberalised market. The Polish energy law condition for lifting gas price regulation – *i.e.* sufficient competition on the gas market – has not been met, and the president of the Energy Regulatory Office has therefore not been allowed to release the gas price from regulation. Maintaining regulated prices may, however, prevent competition to thrive and create a “regulation loop.”

## Why the policy is considered a success

Because of Poland's long history of an internal, closed and non-competitive gas market, the recent amendments and changes are of great importance to the country's energy situation and to individual customers. Real success is still to be achieved: an open, transparent and liberalised gas market that would contribute to creating and maintaining a common energy market in the European Union.

## Lessons to be shared

Strong co-operation between stakeholders, on the national as well as European and international levels, is crucial to the success of the changes in the gas market. In the absence of such collaboration, the common agreement, essential for the proper functioning of market mechanisms in the gas sector, could not be achieved and key changes and developments would be blocked.

# Portugal

## Improving the security of Portugal's gas supplies

### Policy area/objectives

Portugal is improving the security of its gas supplies through major investments in: (i) expanded capacity at the Sines LNG Terminal; (ii) increased underground storage capacity at Carriço; and (iii) construction of a new interconnection pipeline with Spain. These projects also assist the integration of Portugal into the Iberian gas market.

### Main characteristics of the policy

The expansion of the Sines terminal was completed in 2012 and construction of new underground storage caverns in Carriço has commenced.

The first phase of the construction of a new, third interconnection pipeline with Spain has been launched. The project aims at minimising the impact of Portugal's less favourable geographical location within Europe on its access to secure gas supplies. It will integrate gas markets, promoting competition. Indeed, it is becoming a cornerstone of the development of the Iberian Internal Natural Gas Market.

### Challenges faced during implementation

Assessments of the benefits and consequences of structural infrastructure investments require a long-term perspective, but this was not compatible with some stakeholders' shorter-

term perception of the market. However, some previous opponents are now in favour of the extra flexibility allowed at the terminal.

The financial crisis plays a critical role in access to investment funding and business stability, while international energy markets and the business environment continue to change, in terms of supply and demand, with evidence of higher volatility than ever before.

### Why the policy is considered a success

The expanded Sines LNG Terminal is now able to receive larger and therefore cheaper LNG transportation vessels coming from distant parts of the world, thus diversifying the sources of natural gas to the Portuguese market. New market players are showing an increased interest in access to the terminal.

The new pipeline will ensure an uncongested interconnection between markets in the future, promoting competitiveness as well as quick access to underground storage facilities, thus enabling a more effective response in the event of an emergency.

With the increasing capacity at Carriço's underground storage site, Portugal will meet the standard required by the European regulation on security of supply. Enough storage capacity for gas reserves is ensured within domestic borders to allow for supply to the market in the case of a supply crisis, in particular to protected customers, to small- and medium-sized enterprises, and to gas-fired power plants.

## Lessons to be shared

The project's success was highly dependent on strong regional involvement among stakeholders, operators, policy makers and National Regulatory Authorities of the countries concerned.

Effective investment planning on strategic issues needs strong political engagement to assure the conditions for stable investments. A stable and harmonised regulatory environment

within the regions and across Europe plays a major role in the creation of a proper business environment to support market integration.

Global risk assessment is a fundamental tool for evaluation of security of supply.

# France

## Green innovation funding: the French programme of Investments for the future

### Policy area/objectives

Since 2010, the French Agency for the Environment and Energy Management (ADEME) has been in charge of four investment programmes to support testing in real conditions and demonstration plants for renewable energy and green chemistry, low-carbon vehicle, smart grid and circular economy projects. Totalling EUR 2.45 billion of credits, this initiative is part of the EUR 35 billion Investments for the Future (PIA) programme.<sup>1</sup>

The programme is already demonstrating its ability to unite companies and research partners, and to stimulate their innovation capabilities. Compared to other existing national research programmes, this new programme aims at bringing innovation to the market and focuses on specific fields set up by strategic roadmaps.

### Main characteristics of the policy

Specific fields eligible for funding include: (i) renewable energy and green chemistry (EUR 1.1 billion): development of new technologies in decarbonised energy (*e.g.* solar, wind), bioresources, low-carbon buildings,

energy storage and carbon capture and storage (CCS); (ii) smart grids (EUR 165 million): research and testing in real conditions to enable the integration of intermittent renewable energies into electrical grids and to promote “smart services” that improve energy demand management; (iii) circular economy (EUR 210 million): demonstration plants and circular economy industries, including waste management, soil and sediment remediation, ecodesign and industrial ecology; and (iv) low-carbon vehicles (EUR 950 million): development of innovative technologies and solutions focused on land and sea transportation.

To manage these projects, ADEME developed specific financial tools, bearing in mind the public objectives of job creation, activity development in the French territory, economic competitiveness and environmental benefits: (i) state aids complying with European Union regulations on competition. This type of support, the most widely used, consists of refundable grants, where the return mechanism is correlated to the project’s success, and of traditional (non-refundable) grants, mostly dedicated to research laboratories and small- and medium-sized enterprises (SMEs); and (ii) equity investment tools, where the state plays the role of market investor, one for SME projects and one for intermediate-sized and large enterprise projects.

The first 115 selected projects represent investments of more than EUR 3 billion, supported with EUR 940 million from the programme to date. Around two-thirds of

1. The “Programme d’Investissements d’avenir” (PIA) is steered by a committee under the prime minister, and green innovation funding has been operated by ADEME under the guidance of the ministries of Ecology and Energy, Industry, Research and Agriculture. On 9 July 2013, the French government announced that this programme will be supplemented by a second programme of Investments for EUR 12 billion, with energy transition as its priority.



allocated credits generate financial returns for the state, based on a risk/gain sharing policy, a new unique form of public-private partnerships in France.

## Challenges faced during implementation

Development phases (pilot, prototype, demonstration and testing in real conditions up to industrial launch) require increasing amounts of funds for an uncertain outcome; these features are hard to combine for a standard investor. Unlike conventional and less risky investments, financing innovation requires a deep understanding of technical and commercial issues, risks and opportunities, as well as a risk-management process through close project follow-up; and a high return of investment to finance part of the risk incurred.

## Why the policy is considered a success

When providing funding to demonstrators, a critical stage of innovation, ADEME has to reconcile the large scale of the projects with the smaller size of some of the projects' owners or partners. A significant proportion of the awards to date do, however, directly support SMEs: more than half of beneficiaries in number, and more than a quarter of credits allocated.

## Lessons to be shared

This large programme is a new tool designed to support innovative green projects and help companies – small and medium-sized as well as bigger – to bridge the gap from innovation to market. Dedicated to accelerate the shift to a sustainable, low-carbon society, this green innovation funding programme appears to be a promising innovation itself. For more information, please visit <http://investissement-avenir.gouvernement.fr/content/action-et-projets;www.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=24707;www.gouvernement.fr/premier-ministre/investir-pour-la-france-les-details-du-plan-de-jean-marc-ayrault>.

# Italy

## Research fund for the national electricity system

### Policy area/objectives

The programme develops research projects of general interest to the national electricity system, focusing on applied research and a system-oriented approach. The activities are aimed at innovating and improving the performance of the system in terms of economics, safety and the environment. The programme's coverage ranges from system governance to research and development (R&D) and deployment of technologies in the field of renewable sources of energy production, transmission and end-use. It is financed through a specific component of the end-user electricity price.

### Main characteristics of the policy

In the transition from a state-owned monopoly to a liberalised market, the Italian government<sup>1</sup> had established that research activities at a

system level can be included in the system costs that are paid for by end-users through the creation of the Research Fund for the National Electricity System. The relevant component of the electricity price is determined annually by the electricity regulator<sup>2</sup> and currently amounts to about EUR 0.015 per kilowatt hour.

The research fund finances several policy instruments (funds, expressed in million euros, refer to the current three-year programming period 2012-14):<sup>3</sup>

The research fund distinguishes between fundamental research, aimed at the general benefit of the users of the national electricity system, and industrial R&D, for the benefit of specific entities operating in the electricity sector or related sectors. The activities for the general benefit are entrusted by the government to public bodies or publicly owned R&D organisations.

**Table 5** Financial appropriations of the 2012-14 Electricity System Research Fund

|  |  |
|--|--|
| 1. System governance: EUR 68 million <ul style="list-style-type: none"> <li>a. system development programming</li> <li>b. system governance tools development</li> <li>c. system analysis</li> </ul> | 2. Production and sources of energy: EUR 109.5 million <ul style="list-style-type: none"> <li>a. databases, programmes, scenarios, measures</li> <li>b. CCS</li> <li>c. renewable energy sources</li> <li>d. nuclear fusion and fission</li> </ul> |
| 3. Transmission and distribution: EUR 23 million <ul style="list-style-type: none"> <li>a. legal framework</li> <li>b. technical framework</li> <li>c. strategic framework</li> </ul>                | 4. End-use energy: EUR 59.5 million <ul style="list-style-type: none"> <li>a. modelling</li> <li>b. components and facilities</li> <li>c. demonstration and development projects</li> <li>d. interaction with end-users</li> </ul>                 |

Source: decree of 9 November, 2012 of the Minister of Economic Development.

1. The Ministry of Economic Development.

2. The Regulatory Authority for Electricity and Gas.

3. The eligibility of research projects is established by the Cassa Conguaglio Settore Elettrico, a public financial body.

## Challenges faced during implementation

R&D projects are funded by electricity consumers and these resources must come back in the form of benefits resulting from the R&D activities. In particular, the agreements with the leading public R&D institutions are 100% financed with the resources of consumers, and the knowledge developed should be made fully available to all stakeholders through technology transfer and dissemination of results. This represents a considerable effort for all the actors involved in various capacities in the electricity supply chain.

## Why the policy is considered a success

The preliminary results seem to be successful: the main public R&D organisations have been encouraged to co-operate actively with private

industries in programmes focused on the development and demonstration of innovative systems and prototypes for the production of renewable energy for the general benefit of the users of the national electricity system. In some cases the knowledge developed has enabled Italian operators to successfully participate in R&D programmes funded by the European Commission under the Seventh Framework Programme on R&D.

## Lessons to be shared

The funding mechanism of the programme is working well and has strengthened the co-operation among public R&D organisations, universities and private companies, with the aim to promote industrial innovation projects in specific strategic technology areas.

# Korea

## Jeju smart grid test bed: a step toward smart energy

### Policy area/objectives

In 2009, the Ministry of Trade, Industry and Energy (MOTIE) selected Jeju Island, the country's southernmost island, as the site for a smart grid test bed. The Jeju Smart Grid Demonstration Project was inaugurated with the participation of 12 consortia consisting of 168 companies. The total investment was KRW 239.5 billion,<sup>1</sup> 30% of which was funded by the government.

MOTIE anticipated that the project would represent the world's largest smart grid test bed, enabling participants to test cutting-edge smart grid technologies. The project sought to verify smart grid technology; develop new business models; commercialise the newly identified business models; and export the advanced technology abroad.

### Main characteristics of the policy

The Jeju test bed has five project domains:

- “Smart Place”: advanced metering infrastructure and associated home-energy management systems, which lay the foundation for efficient energy use;
- “Smart Transportation”: electric vehicles (EVs) and electrical charging solutions which substantially contribute to EV transportation systems;

- “Smart Renewables”: the management of renewable energy sources and the establishment of micro-grids using them;
- “Smart Electricity Service”: provides the electricity market with new services such as real-time pricing and demand response;
- “Smart Power Grid”: a smart power infrastructure for the advancement of existing distribution and transmission systems in power grids.

The early stage of the project (December 2009 to June 2011) focused on constructing the infrastructure for Smart Power Grid, Smart Place and Smart Transportation to link the grid networks with consumers and EVs. The expansion stage (June 2011 to May 2013) integrated the operations of Smart Electricity Service and Smart Renewables, offering innovative power services and accommodating renewable energy sources to the grid.

### Challenges faced during implementation

In addition to the substantial government funding, companies and institutes had to invest in the project to facilitate the testing and timely commercialisation of the new business models they identified. A few companies dropped out due to delay to parts of individual projects, legal and institutional limitation, and uncertainty of the business outlook. Also, it took a considerable amount of time to stabilise the new technology due to frequent server maintenance and software modification.

1. As of September 2013, KRW 1 was roughly equivalent to USD 0.00093.

## Why the policy is considered a success

During the project, over 150 smart grid-related technologies were tested and verified in the real environment. Of the nine business models newly identified, six were implemented during the project: (i) commercialised smart appliances applicable to real-time pricing; (ii) EV rental service in Jeju; (iii) advanced building energy management system; (iv) advanced demand response system; (v) factory energy management system; and (vi) electric bicycle sharing service at Jeju National University.

By implementing smart grid technology, peak demand decreased by 3.6% in the test bed area and consumers were able to reduce more than 14% of their electricity usage via photovoltaic and smart appliances and energy storage systems.

## Lessons to be shared

Although participation from the residents of Jeju Island was not so active, the project raised awareness that the smart grid can contribute to promoting economic growth and energy efficiency, as well as to addressing climate change. Moreover, the project gave a clear policy direction for the expansion of the smart grid. The government enacted the Smart Grid Promotion Law in May 2011 and released the Smart Grid Master Plan in July 2012 to support the deployment of the smart grid nationwide.

# Glossary and list of abbreviations

|                 |  |             |   |
|-----------------|--|-------------|---|
| AEMC            | Australian Energy Market Commission                        | EPEX-Spot   | European Power Exchange – Spot                                    |
| AUD             | Australian dollar  | ESCOs       | Energy Service Companies  |
| bcm             | billion cubic metres                                       | ETS         | Emissions Trading Scheme  |
| CAD             | Canadian dollar  | EU          | European Union  |
| CBIP            | Commercial Buildings Incentive Program                     | EUR         | euro  |
| CCGT            | combined cycle gas turbine                                 | EUR/kWh     | euro per kilowatt hour  |
| CECRE           | Centro de Control de Régimen Especial                      | EUR/t       | euro per tonne  |
| CfD             | Contract for Difference                                    | EV          | electric vehicle  |
| CHF             | Swiss franc  | EXAA        | Energy Exchange Austria   |
| CO <sub>2</sub> | carbon dioxide   | FAME        | fatty acid methyl esters  |
| DCENR           | Department of Communications, Energy and Natural Resources | FPS Economy | Federal Public Service of Economy, SMEs, Self-Employed and Energy |
| DSO             | distribution system operator                               | g           | grams   |
| EBRD            | European Bank for Reconstruction and Development           | GBP         | United Kingdom pound  |
| ECO.AP          | Eficiência Energética na Administração Pública             | GDRE        | General Directorate for Renewable Energy                          |
| EECA            | Energy Efficiency and Conservation Authority               | GDP         | gross domestic product  |
| ECO             | Energy Company Obligation                                  | GHG         | greenhouse gas  |
| EEO             | Energy Efficiency Opportunities                            | GW          | gigawatt  |
| EEX             | European Energy Exchange                                   | GWh         | gigawatt hour   |
| EIA             | environmental impact assessment                            | GWh/yr      | gigawatt hour per year  |
| EMR             | Electricity Market Reform                                  | HFCs        | hydrofluorocarbons  |
| EPC             | energy performance certificate                             | IAEA        | International Atomic Energy Agency                                |
|                 |  | IEA         | International Energy Agency                                       |
|                 |  | JPY         | Japanese yen  |
|                 |  | km          | kilometre   |
|                 |  | KRW         | Korean won  |

|                       |  |             |   |
|-----------------------|--|-------------|---|
| KWh                   | kilowatt hour  | RHK kft     | Radioaktív Hulladékokat Kezelő<br>Közhasznú Nonprofit Korlátolt<br>Felelősségű Társaság |
| LPG                   | liquefied petroleum gas                                  |             |   |
| LV                    | low voltage  |             |   |
| Mt                    | million tonnes   | RRD         | Responsible Resource<br>Development   |
| MtCO <sub>2</sub>     | million tonnes of carbon dioxide                         | SDE+        | Stimulerend Duurzame<br>Energieproductie  |
| MtCO <sub>2</sub> -eq | million tonnes of carbon<br>dioxide-equivalent           | SEA         | strategic environmental<br>assessment   |
| Mtoe                  | million tonnes of oil-equivalent                         | SEAI        | Sustainable Energy Authority<br>of Ireland  |
| MOTIE                 | Ministry of Trade, Industry<br>and Energy                | SEC         | Czech State Energy Concept  |
| NABEG                 | Grid Expansion Acceleration Act                          | SEK         | Swedish krona   |
| NECF                  | National Energy<br>Customer Framework                    | SHT         | Social Household Tariff   |
| NEM                   | National Electricity Market                              | SLOVSEFF I  | Slovak Energy Efficiency and<br>Renewable Energy Finance<br>Facility (Phase One)        |
| NEP                   | Grid Development Plan                                    | SLOVSEFF II | Slovak Energy Efficiency and<br>Renewable Energy Finance<br>Facility (Phase Two)        |
| NES                   | National Energy Strategy                                 | SMEs        | small and medium-sized<br>enterprises   |
| NIMBY                 | not in my backyard                                       | t           | tonne   |
| NM <sup>3</sup>       | normal cubic metre                                       | toe         | tonne of oil-equivalent   |
| NORA                  | National Oil Reserves Agency                             | TRY         | Turkish lira  |
| NPP                   | nuclear power plant                                      | TSO         | transmission system operator  |
| NZD                   | New Zealand dollar                                       | TWh         | terawatt hour   |
| NZD/MWh               | New Zealand dollar per<br>megawatt hour                  | USD/Mbtu    | US dollar per million<br>British thermal unit   |
| OTC                   | over-the-counter   | WhC         | White Certificates  |
| PIA                   | Programme d'investissements<br>d'avenir                  | WUNZ: HS    | Warm Up New Zealand:<br>Heat Smart  |
| PJ                    | petajoule  |             |   |
| POLPX                 | Polish Power Exchange                                    |             |   |
| PSV                   | Punto di Scambio Virtuale                                |             |   |
| PURAM                 | Public Agency for Radioactive<br>Waste Management        |             |   |
| R&D                   | research and development                                 |             |   |
| RAEE                  | Rifiuti di apparecchiature<br>elettriche ed elettroniche |             |   |
| REE                   | Red Eléctrica de España                                  |             |   |
| RES                   | renewable energy supply                                  |             |   |





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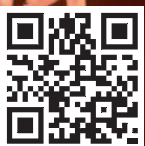
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