National Energy and Climate Strategy

Government Report to Parliament on 20 March 2013

FOREWORD

Prime Minister Jyrki Katainen's Government appointed a ministerial working group on energy and climate policy to update the National Climate and Energy Strategy, completed in 2008. Key objectives of the strategy update included ensuring that the national targets for 2020 are achieved and to prepare a pathway towards meeting the long-term energy and climate objectives set by the EU.

Parliament's opinion on the 2008 strategy, according to which cost-efficiency, greater energy self-sufficiency and ensuring a sufficient and moderately priced electric power supply must be emphasised in the fulfilment of energy and climate commitments, has been taken into account in the strategy update. This updated energy and climate strategy is intended as a basis for the Government's positions, both in European Union negotiations and other international contexts, and in domestic policy preparation and decision-making.

Acting as a preparatory body for the ministerial working group on energy and climate policy, a network comprising key officials from various ministries prepared a background report in support of the strategy. This background report has not been discussed by the ministerial working group on energy and climate policy.

As outlined in the Government Programme, the long-term goal is a carbon-neutral society, which can be achieved by following the roadmap towards 2050, involving an increase in energy-efficiency and the use of renewable energy and drafted on the basis of various strategies. Work on the roadmap will begin in 2013.

CONTENTS

1 CURRENT SITUATION

Energy market development

Security of energy supply and inexpensive energy are key prerequisites for growth in the current global economy. In this respect, however, the development scenario involves uncertainties and risks. Demand for fossil fuels remains high due to the prospering of China and India, among other factors. The International Energy Agency IEA estimates that oil price levels will remain high and even further increase, which will also be reflected in other energy products. It is estimated that such price developments will involve strong fluctuations.

The gas renaissance does not concern Europe to the same degree as the United States. However, the tapping of shale gas reserves and growing global trade in liquefied natural gas will also curb gas prices in Europe. It could, therefore, be forecast that the competitiveness of gas will remain at a relatively good level. The coal supply and price outlook are stable, meaning coal is available at a competitive price. Nevertheless, the environmental requirements and fees imposed on fossil fuels notably reduce the attractiveness of coal as fuel.

Unless significant new policy measures are taken, global energy consumption will increase to the degree it becomes impossible to limit global warming to two degrees Celsius. According to IEA, all possible measures related to energy production and use need to be employed in order to reach the two-degree target. Efficiency of energy use must be improved and energy production should primarily be carbon neutral. Energy production based on renewable energy sources should be integrated into buildings and energy systems. In transport, the use of oil should be abandoned as soon as possible.

Norms, regulations and other policy instruments are employed in efforts to influence the behaviour of the European Union's internal energy market. A key instrument is the price of emission allowances, which has been low in recent times. The Finnish Energy and Climate Strategy, however, is based on the assumption that the EU will take the necessary measures to effect a significant increase in the price of emission allowances for the 2020–2030 period.

A further assumption is that the European Union's objectives regarding the promotion of renewable energy will remain the same, at least until 2020.

In 2020, the European Union's internal energy market will function in accordance with the objectives set, and sources of energy tied to networks (electricity and gas) will be chiefly transmitted on market terms. Through EU-level and national measures, the EU member states will be ever more tightly intertwined as part of the common energy networks. In addition, electricity trade between the EU and third countries is gradually developing, in line with the EU's internal market rules.

International climate negotiations

Finland is committed to the United Nations Framework Convention on Climate Change, the Kyoto Protocol and EU legislation in its climate policy. International cooperation is founded on the United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994, and the Kyoto Protocol, in force as of 2005. The objective of the international climate negotiations led by the United Nations is to stabilise greenhouse gas concentrations in the atmosphere, at a level that would prevent dangerous anthropogenic interference with the climate system.

Finland participates in the international climate negotiations as a member state of the European Union and complies with the Union's climate policy guidelines. At the same time, the member states' climate policy is largely steered by the EU climate and energy policy. In accordance with the first Kyoto Protocol commitment period, in 2008–2012 the EU (the EU-15) has reduced its greenhouse gas emissions by 8% from 1990 levels. For Finland, this meant the freezing of emissions at the 1990 level, in line with the EU's internal burden sharing agreement.

A key issue in the international climate negotiations has been to agree on a post-2012 agreement, which has been under discussion since the Bali Climate Change Conference in 2007. The Durban Climate Change Conference, held in late 2011, agreed on a roadmap with the aim of adopting "a protocol, another legal instrument or an agreed outcome with legal

force", which would be applicable to all parties. At the end of 2012, the Doha Climate Conference managed to agree on a work plan until 2015, which is the deadline for the new agreement's completion. The new climate agreement would then enter into force in 2020, with the aim of increasing emission reduction targets and taking account of the review process on the sufficiency of reduction targets, to be performed in 2013–2015.

It was further agreed at Doha that the second commitment period of the Kyoto Protocol would begin on 1 January 2013 and last eight years, until 31 December 2020. Countries participating in the second commitment period are as follows (with the quantitative emission reduction or limitation targets included): Australia (0.5%), EU (20%), Iceland (20%), *Kazakhstan (5%), Croatia (20%), Liechtenstein (16%), Monaco (22%), Norway (16%), Switzerland (15.8%), *Ukraine (24%) and *Belarus (12%).[1] These countries must examine their emissions targets by 2014 and possibly tighten them. Any surplus emission units from the first commitment period can be transferred in full to the second period. However, significant restrictions were placed on the purchasing of these emission units, and they will be transferred to a separate reserve.

Emissions by countries that have joined the second commitment period account for less than 15% of global greenhouse gas emissions. Of the countries that participated in the first commitment period, Russia, Japan, New Zealand and Canada have now withdrawn from the second commitment period.

The European Union's energy and climate policy

Set in 2008, the targets and measures under the EU climate and energy package steer the preparation and implementation of climate and energy policy at national and EU level. The targets set are:

[1] *May withdraw

Table 1-1. The EU's energy and climate targets for 2020

Targets for 2020	The EU	Finland
Reduction of greenhouse gas emissions [1)]	-20%	EU-level target
ETS emissions [2)]	-21%	EU-level target
Non-ETS emissions [2)]	-10%	-16%
Share of renewable energy sources in final energy consumption	20%	38%
Share of biofuel in transport fuels	10%	20%
Improving energy efficiency [3)]	+20%	EU-level target

[1)] base year 1990
[2)] base year 2005
[3)] in comparison to development as estimated in 2007

In 2009, the European Council outlined that carbon dioxide emissions must be reduced by 80–95% by 2050.

In March 2012, the European Commission issued a communication and a draft decision concerning carbon sinks, accounting rules and action plans for the LULUCF (land use, land use change and forestry) sector. The accounting rules proposed by the Commission are largely in line with the accounting rules for the second commitment period of the Kyoto Protocol, agreed on in Durban in December 2011. They do, however, expand the mandatory reporting of various land use categories and amend the definitions used. In addition, the Commission proposes the gradual inclusion of the LULUCF sector in the European Union's emission reduction targets. The common calculation rules with respect to carbon sinks, agreed on in Durban, and the lack of clarity involved in handling carbon sinks within the EU, are the cause of major uncertainty in defining Finland's emission reduction commitments.

Since the meeting of the Environment Council in December 2011, Finland has been negotiating with the Commission on various solutions intended to compensate Finland for the discontinuation of the possibility to offset emissions from deforestation. Negotiations with the European Commission, and later with other member states, will continue with reference to how Finland's issue is resolved, on the basis of the Environmental Council's conclusions adopted in March 2012.

Climate Act

In accordance with the Government Programme, the Government will prepare a proposal for, and make a separate decision on, the possible enactment of a national climate act. The purpose of the climate act would be to steer the reduction of emissions not covered by the emissions trading scheme. A long-term emissions reduction target would be included in the act. The act would make emission reduction measures more systematic and predictable.

2 IMPACTS OF PREVIOUSLY DECIDED MEASURES

2.1 Meeting the emission reduction targets

The emissions trading system sets a binding cap on the total amount of greenhouse gas emissions. In this way, the system ensures that the emissions trading sector (e.g. electricity production, energy-intensive industry, a large share of district heat production, and aviation chiefly) meets the greenhouse gas emission reduction targets set by the EU.

With regard to the non-emissions trading sector (such as building-specific heating, transport, waste management, agriculture, F-gases and machinery), the emission reduction targets could be achieved through previously decided national measures, as indicated by the most recent emission inventories and calculations. Furthermore, positive development in the balance of forest sinks and the implemented Finnish purchasing programme for the Kyoto mechanisms ensure that Finland will be able to meet its emission reduction targets despite the non-ETS sector involving uncertainties. However, meeting the emission target will require that a decision acceptable to Finland is reached within the EU with regard to discontinuation of the possibility of offsetting emissions from deforestation, agreed in Durban in late 2011.

2.2 Achieving the renewable energy targets

Previously decided measures will suffice to meet the renewable energy targets for 2020, 38% of final energy consumption. In Finland, the use of renewable energy is increasing in a frontloaded manner, which means that, during the entire period of 2010–2019 Finland will already exceed the annual minimum targets for renewable energy set by the EU. When nearing the end of the review period, the estimated likely use of renewable energy and the obligations set by the EU will again converge.

While the EU has set the obligation of a 10% share of renewable energy in transport fuels for 2020, Finland has set a higher national target of 20%. Legislation is being employed to ensure the achievement of this goal, by placing a biofuel blending obligation on liquid fuel

suppliers. This will force them to meet their renewable energy obligations at annual level. However, the EU's proposal for a directive to limit the use of food-based first generation biofuels to 5% is creating uncertainty in this respect. Further uncertainties surround the launch of large-scale production of second generation biofuels due to the fact that only one out of three applications for large biodiesel plants was granted support in the EU's NER300 process.

2.3 Achieving the energy efficiency targets

The 2008 climate and energy strategy set the energy savings target at 37 TWh (as calculated from final consumption) by 2020. Electrical energy accounted for 5 TWh of this target, and thermal energy and transport fuels for the rest. Final energy consumption would then amount to 310 TWh in 2020. With respect to electricity, this goal will be met primarily due to slower economic growth and structural changes in the economy. As regards other forms of energy, this target may not be met, in which case the final consumption target of 310 TWh will not be fully achieved. This is partly due to a change in statistical methods, which corrected the earlier underestimation of the historical energy consumption which was used as the basis for the preparation of the 2008 strategy.

The indicative objective, set out in the Energy Services Directive to enhance the efficiency of energy use by 9% by 2015, will be met. Even if no new measures are employed, energy savings exceeding 12% will probably be achieved. Since there are significant differences in how the objectives are defined in the 2008 climate and energy strategy and the Energy Services Directive, these are not directly comparable. New energy efficiency targets, such as the indicative national energy efficiency target for 2020, are included in the Energy Efficiency Directive replacing the Energy Services Directive, and in force as of December 2012.

2.4 Securing self-sufficiency in electricity sourcing

The 2008 climate and energy strategy estimated that in the baseline scenario the electricity consumption in 2020 will amount to 103 TWh. In the objective scenario the energy consumption was estimated to be 98 TWh. Since then, the economic development has changed, and it is estimated that previously decided measures will lead to energy consumption of around 94 TWh in 2020.

The 2008 climate and energy strategy set the goal of securing self-sufficiency in electricity sourcing. In this respect, developments are proceeding as anticipated. Until the third nuclear power unit in Olkiluoto is in operation, Finland will be heavily dependent on imports during the colder winter months. Even thereafter, self-sufficiency will remain short of European targets. Moreover, depending on the price relations between fuels, electricity has been imported into Finland even in the presence of idle domestic capacity. In the 2020s, the self-sufficiency target will, however, be met, when the nuclear power units that have been granted favourable decisions-in-principle become operational, and small-scale or otherwise decentralised energy production becomes more common.

3 STRATEGY GUIDELINES

3.1 EU energy and climate policy after 2020

Adopted by the European Union in December 2008, the climate and energy package sets the following targets for 2020: member states will reduce their greenhouse gas emissions by at least 20% from 1990 levels, increase the share of renewable sources in final energy consumption within the EU to 20%, on average, and improve energy efficiency by 20% on average, in comparison to the business-as-usual trend.

Due to the long-term view needed in climate policy and the long time horizon of low-carbon investments, in the coming years it will be necessary to define EU climate and energy policy targets beyond 2020. In this, a stand needs to be taken on whether several targets are required in the future, or on whether a simple emission reduction target will suffice. With regard to the emission reduction target, the issue of sharing the required reductions between the emission trading sector and non-emission trading sector, i.e. the effort sharing sector, must be resolved. It must also be assessed whether national-level targets are required, or whether a sufficient result can be achieved through a common EU target. Setting a separate national target for the emissions trading sector would not be possible, however, as the ETS is the EU's common system.

Finland must be prepared for the possibility that the EU's own climate policy proceeds faster than international climate negotiations. Besides the costs of climate policy, we should take better account of the opportunities and benefits related to climate policy. The transition to cleaner technology and a low-carbon society in general could open up major opportunities for Finnish trade and industry.

1) *Emission reduction targets for the period after 2020 must be in line with the general objective of limiting global warming to two degrees Celsius. Preparations will be made for the discussion on setting an emission reduction target for 2030. In addition, it will be examined whether other, comparable targets are required for energy policy, alongside the emission reduction target.*
2) *Setting only one target which has the planned steering effect, that is, the emission reduction target, is likely to yield the highest cost-efficiency. Targets set by the EU*

for renewable energy would bring predictability to investors and developers of technology. The renewable energy target, be it a common EU target or a member state-specific target, should be indicative or a moderate binding target, to allow for sufficient room for national energy policy and possible changes in national conditions. Three separate targets set at the EU level would prevent the optimisation of measures. For this reason, the possible EU energy efficiency target should be indicative, and Finland should be able to define its own national target. Energy efficiency is already widely promoted in the EU. In the future, common measures, such as energy-efficiency standards for equipment, will be employed to an increasing extent.

3) *As steering methods for renewable forms of energy continue to be employed in the 2020s, EU-level harmonisation of legislation that steers support systems should be pursued, alongside improved cost-efficiency.*

3.2 Energy efficiency measures

Conservation of natural resources and cost-efficient reduction of greenhouse gas emissions are the key objectives for energy efficiency. In addition to climate protection, saving energy improves security of supply, reduces energy costs and cuts other emissions generated in energy production. In international comparison, Finland ranks among the top with respect to many energy saving measures and the efficiency of energy use. Cogeneration of heat and power, systematic energy audits and good coverage of optional energy efficiency agreements, are good examples of effective energy saving. However, in some sectors, such as transport and agriculture, fewer actors have joined the agreement system.

According to the Energy Efficiency Directive, in force as of December 2012, EU member states must set their indicative national energy efficiency targets for 2020, based on primary energy or final consumption. While the directive does not set country-specific efficiency targets, in the coming years the Commission will monitor, through reporting by member states, whether the EU is achieving the 20% energy efficiency target, and will take possible further measures.

Since the completion of the 2008 climate and energy strategy, several policy measures for energy efficiency and energy saving have been decided on and implemented. When factoring in the impact of previously decided measures, estimated final energy consumption in Finland would be 325 TWh in 2020. Due to a change in statistical methods, this figure is not, however, directly comparable with the figures presented in the 2008 strategy. Statistics Finland updates the time series for energy statistics when calculation methods change, or when it obtains more detailed or updated data. In the most recent energy statistics, final consumption for the previous years has been reviewed. For example, actual final consumption in 2006 was 11 TWh higher than assumed during the preparation of the 2008 strategy.

4) *A target will be set to level off growth in final energy consumption, by improving energy efficiency so that, in 2020, consumption will be 310 TWh at a maximum.*
5) *A national energy efficiency action plan will be drawn up in accordance with the Energy Efficiency Directive.*

6) *An energy efficiency act will be prepared, particularly for implementing the Energy Efficiency Directive. The Ministry of Employment and the Economy will be responsible for the preparation of the act in cooperation with the Ministry of Transport and Communications, the Ministry of Agriculture and Forestry, the Ministry of Finance, and the Ministry of the Environment.*

7) *The possibility of establishing an energy efficiency obligation scheme for energy companies, and combining this with other measures, will be examined without delay.*

8) *A long-term strategy on improving the energy efficiency of buildings will be prepared, observing the time limit set in the Energy Efficiency Directive.*

9) *In accordance with the Energy Efficiency Directive, an energy conservation plan for central government buildings will be prepared and its monitoring and implementation will be incorporated into corporate-level financial planning and management.*

10) *Energy efficiency will be implemented in public procurement by the central government, in accordance with the Energy Efficiency Directive. State organisations will be obligated to actively promote cleantech and green procurement. At local government level, a recommendation will be made for the promotion of cleantech and green procurement. The emergence of pioneering municipalities in energy efficiency will be promoted.*

11) *Energy efficiency agreements and energy programmes for the local government sector will be further developed as part of the Energy Efficiency Directive's implementation.*

12) *The emergence and growth of international energy efficiency business will be promoted. The energy efficiency agreement system and the strategic centres for science, technology and innovation will be harnessed in the development of new business. As part of the strategic programme for cleantech, operation models that could be exploited to boost business growth will be promoted.*

13) *An analysis will be conducted to examine the extent to which increasingly promoting the use of renewable energy in district heating plants is a more cost-efficient way of reducing emissions, in comparison to renovation investments that improve energy efficiency.*

14) *Opportunities for the more forceful promotion of improved energy efficiency in road transport will be assessed without delay, including energy subsidies to improve the energy efficiency of public transport and goods transport and to curb the increase in the cost of transport services, as well as incentives for the acquisition of vehicles that are more energy-efficient. This assessment will be carried out as part of the implementation of the programme to reduce mineral oil consumption.*

15) *Implementation of the national intelligent transport strategy will be ensured in different modes of transport, in order to improve the energy efficiency of the entire transport system.*

16) *Determined energy efficiency targets will be set for the energy consumption of information and communications networks and IT infrastructures, which is on the increase.*

17) *The sustainability of services based on information and communications technology will be assessed, as part of the energy efficiency commitments.*

18) *Farms will be encouraged to promote energy efficiency through various means, for example measures included in the Rural Development Programme.*

3.3 Flexible mechanisms and carbon sinks

Flexible mechanisms

Flexible mechanisms for the sector not covered by the emissions trading system form an integral part of the EU effort sharing decision and the Kyoto Protocol. These mechanisms are an efficient tool in promoting the reduction of emissions. They can be employed to improve cost-efficiency by avoiding the most expensive domestic emission reduction measures. Flexible mechanisms can be used, as necessary, to achieve the annual emission targets, observing the limitations set in the effort sharing decision. Obligations set by the Kyoto Protocol may also require the use of flexible mechanisms. This could mean both buying and selling emission units.

19) *A separate strategy will be prepared in 2013, for the focus areas and timing of the sustainable use of flexible mechanisms over the period 2013–2020.*

Forestry and carbon sinks

At the Durban Conference of the Parties in December 2011, calculation rules were agreed for the LULUCF sector (land use, land use change and forestry) for the second commitment period of the Kyoto Protocol starting on 1 January 2013. The most significant changes concerned the calculation rules for forest management measures, the cap placed on forest carbon sink credits, and eliminating the possibility to offset emissions from deforestation. Due to the discontinuation of the possibility of offsetting emissions from deforestation through forest sinks, the LULUCF sector could create annual net emissions of 2.5–3.5 Mt_{CO2} for Finland in the second commitment period of the Kyoto Protocol. Finland is the only EU member state in which annual forest carbon sink credits are insufficient to offset the annual calculated emissions from deforestation and afforestation during the second commitment period. Since the Environment Council meeting of December 2011, Finland has been negotiating with the Commission on various alternatives to compensate Finland for the elimination of the possibility to offset emissions from deforestation.

20) *Finland will negotiate on full compensation for the discontinuation of the possibility of offsetting emissions from deforestation through forest sinks,*

affecting the second commitment period of the Kyoto Protocol that began in 2013. This relates to a decision taken at the Durban climate change conference (December 2011), differing from the first commitment period of the Kyoto Protocol.

21) *As regards solutions concerning carbon sinks, such as the inclusion of the EU's sinks as part of the climate and energy policy commitments, Finland's aim is to align the accounting rules agreed within the EU with the reporting and accounting rules agreed for carbon sinks at Durban in December 2011. This would minimise the differences in reporting and accounting between the EU and the United Nations Framework Convention on Climate Change (UNFCC).*

22) *In various fields of operation, the aim is to keep deforestation at a minimum through good planning.*

23) *Data on surface area affected by deforestation will be specified, and information on Finland's greenhouse gas emissions will be improved to ensure the fair allocation of climate obligations.*

3.4 Additional measures by 2020

The baseline scenario is being employed to estimate the impact of previously decided measures on future development. According to this scenario, Finland will largely meet the targets, set by the EU for 2020, for reducing greenhouse gas emissions, promoting renewable energy and increasing the efficiency of energy use. However, achieving the objective of an energy turnaround (emission reductions of at least 80%), outlined in the EU's low-carbon and energy road maps extending to 2050, requires a switch to a more ambitious development path from the baseline scenario.

Revised baseline scenario

This chapter outlines a set of cost-efficient additional measures likely to be implemented in accordance with various ministries' plans. In the context of this strategy, the package formed by the baseline scenario and the accompanying additional measures is termed the revised baseline scenario. The additional measures will have an impact both in 2020 and thereafter. With respect to some of the measures mentioned in this chapter, an implementation decision has already been made.

Additional measures/the clean energy package

A package of measures, the so-called clean energy programme, has been outlined in connection with the preparation of this strategy. The aim of the programme is to balance Finland's current account by investing in domestic production of clean energy in order to replace imports, creating tens of thousands of new jobs in the energy cluster, and reducing Finland's greenhouse gas emissions to a level that is on track to meet the EU's 2050 target in 2025. According to the programme, a clean energy lead market will be established in Finland, alongside energy and environmental sector centres of expertise and reference sites. The success of Finnish companies especially in growing markets, such as China, Russia, India and Brazil, can be boosted by supporting the internationalisation of companies in the cleantech sector.

In terms of its energy objectives, the clean energy package can be summarised as follows:

- An approximately 20% reduction in the use of mineral oil will be pursued. Most of this cut will originate in road transport, while the rest comes from replacing oil heating. Increased investment will be made in development projects for domestic biofuels. The adoption of new motor technology will be supported, while creating the infrastructure and incentives to purchase low-emission cars.
- Use of coal in power plants will be for the most part replaced with new emission-free energy production, such as nuclear power and wind power (9 TWh). In addition, the net import of electricity will be largely replaced. Most coal used for heat generation in cities will be replaced with biomass. Further use will be made of the opportunities provided by heat pumps, solar heat and the energy efficiency of buildings. Building-specific small-scale generation of energy will be promoted.
- Approximately 10% of natural gas will be replaced with biomass-based solutions, which enable the replacement of imported gas while utilising the current gas pipelines and power plants.

To become a reality, the developments outlined above require significant investment in the stock of equipment producing and consuming energy. According to initial estimates, the investment needs total approximately 20 billion euros. The largest investments concern nuclear power plants that have been granted favourable decisions-in-principle, biorefineries and a plant for the production of synthetic natural gas, as well as the construction of additional wind power. In addition to this, during the clean energy programme period approximately 6 billion euros will be allocated to strengthening the electricity and gas networks and investments will be made in cars that reduce traffic emissions.

The public administration has employed and continues to employ various measures to promote the objectives of the clean energy package. These include emissions trading, taxes levied on heating fuels, taxes levied on transport fuels, taxes levied on the acquisition and use of vehicles, as well as various financial incentives granted by Finland or the EU, and positive decisions-in-principle for two nuclear power units. However, the package of measures would require additional public funding, as well as the addition of further measures. First of all, it would require the construction of the new nuclear power units; the possible continuation of the feed-in tariff for wind power, in some form, for wind turbines that become operative between 2020–2025; securing the use of renewable sources of energy in heat and power cogeneration plants; possible incentives for the acquisition of low-emission vehicles; as well as incentives to make the transition from mineral oils used as

heating fuels to other sources of energy, either through fiscal or other means, in case the desired progress is not otherwise achieved.

In order to gain the full benefits from the package of measures in the form of new jobs and technology exports, the Finnish competence base needs to be strengthened. This in turn requires attention to the targeting of technology funding, public procurement and other measures included in the Cleantech Programme.

24) *In cooperation with the Ministry of Transport and Communications, the Ministry of the Environment, and the Ministry of Finance, the Ministry of Employment and the Economy will prepare steering measures aligned with the clean energy package. These measures will mainly be outlined in connection with preparing the roadmap to 2050 for Finland. Measures with a budget impact are aimed to be discussed in connection with the spending limits procedure for 2013 and 2014.*

Additional measures/construction

According to the baseline scenario, heating energy consumption in 2020 would be on a par with 2012, but slightly smaller in 2030 (by 0.5%). Under the revised baseline scenario, the heating energy consumption of residential and service buildings will decrease from 2012 to 2020, by approximately 9% (6.5 TWh). By 2030, the consumption of heating energy will have decreased by 20% (15 TWh) from 2012.

The revised baseline scenario starts from the premise of systematic property management and the improvement of energy efficiency whenever buildings undergo renovation (for example, the building envelope, ventilation, domestic hot water), which enables more cost-efficient implementation of energy-efficiency measures in comparison to those carried out separately. In the period 2012–2020, the estimated costs of energy-efficiency measures carried out in connection with renovation total 280–440 million euros per year. According to the revised baseline scenario, the Energy Efficiency Directive will have only a marginal additional impact on the energy efficiency of renovation construction by 2020, when account is taken of future requirements for renovation construction and other steering of construction.

Additional measures/transport

New transport measures pertain to the improvement in energy efficiency in professional transport and on the level of the entire transport system, the reconciliation of transport and land use, and the promotion of walking, cycling and public transport. Energy-efficiency measures are aimed at achieving an additional emissions reduction of at least 0.3 Mt_{CO2} by 2020. An equal reduction will be pursued by guiding choices regarding the mode of transport. The clean energy package also includes a set of additional transport measures.

Additional measures/agriculture

With respect to agriculture, it must be ensured that any additional emissions reduction targets do not entail the limitation of domestic production and the replacement of domestic agricultural produce with imported produce.

Additional measures/waste management

Under the revised baseline scenario, the placement in landfill of organic and other biodegradable waste will be restricted as of 2016, limiting the concentration of organic matter in landfill waste to less than 10%. A proposal for a decree on this issue is currently being drafted, and its entry into force is planned for 1 April 2013. Account has been taken of the decree's impact, in the form of reduced methane emissions and increased waste incineration.

There will be a significant increase in waste incineration, both under the baseline scenario and the revised baseline scenario, in which incineration volumes will continue to grow after 2015, due to restrictions in the placement of waste in landfill. In the 2020s, a total of 1.3 million tonnes of municipal waste will be incinerated in waste incineration plants annually. It is expected that co-incineration of municipal waste will remain at the current level (approximately 300,000 tonnes) until 2016. Thereafter, it is estimated that it will grow in the same proportion as the amount of waste generated. After 2016, volumes of municipal waste, intended for incineration according to the revised baseline scenario, will total approximately 1.6 million tonnes annually, or around 61% of generated waste. The

corresponding figures according to the baseline scenario are slightly over 1.1 million tonnes, or 43% of generated waste.

Under the revised baseline scenario, digestion will gain ground from composting, and the amounts of recovered landfill gas are expected to be lower than under the baseline scenario, due to less biodegradable waste being placed in landfills.

New gases

Finland has joined the coalition aiming at emissions reductions of short-lived climate pollutants (SLCP). Through international cooperation and national measures, it is possible to rapidly mitigate climate change and improve air quality. There has been a heavy increase in the use of fluorinated greenhouse gases and consequently in fluorinated greenhouse gas emissions, since such gases have been used to replace substances depleting the ozone layer, especially in air conditioning and refrigeration equipment.

25) *To curb greenhouse gas emissions from F-gases, the implementation of a partial ban on F-gases, including NF3, should be promoted through amendments to EU legislation. Global regulation should be promoted by employing mechanisms via the Montreal Protocol and alternatives to F-gases should be sought. The need for additional steering at national level will be investigated.*

A summary on emission trends in the revised baseline scenario

According to the revised baseline scenario, there will be a sharp decline in Finland's greenhouse gas emissions in the early 2020s. This is illustrated in Figure 3-1. The largest single factor contributing to this development is the expected completion of nuclear power units, in accordance with the decisions-in-principle made. After 2025, however, the decline in emissions will come to a halt, even when the additional measures are taken. To keep the emission trend on track in the post-2025 period, towards the target adopted by the European Council for 2050 (an 80–95% reduction in emissions from 2005 levels), further measures not yet included in the revised baseline scenario will be required.

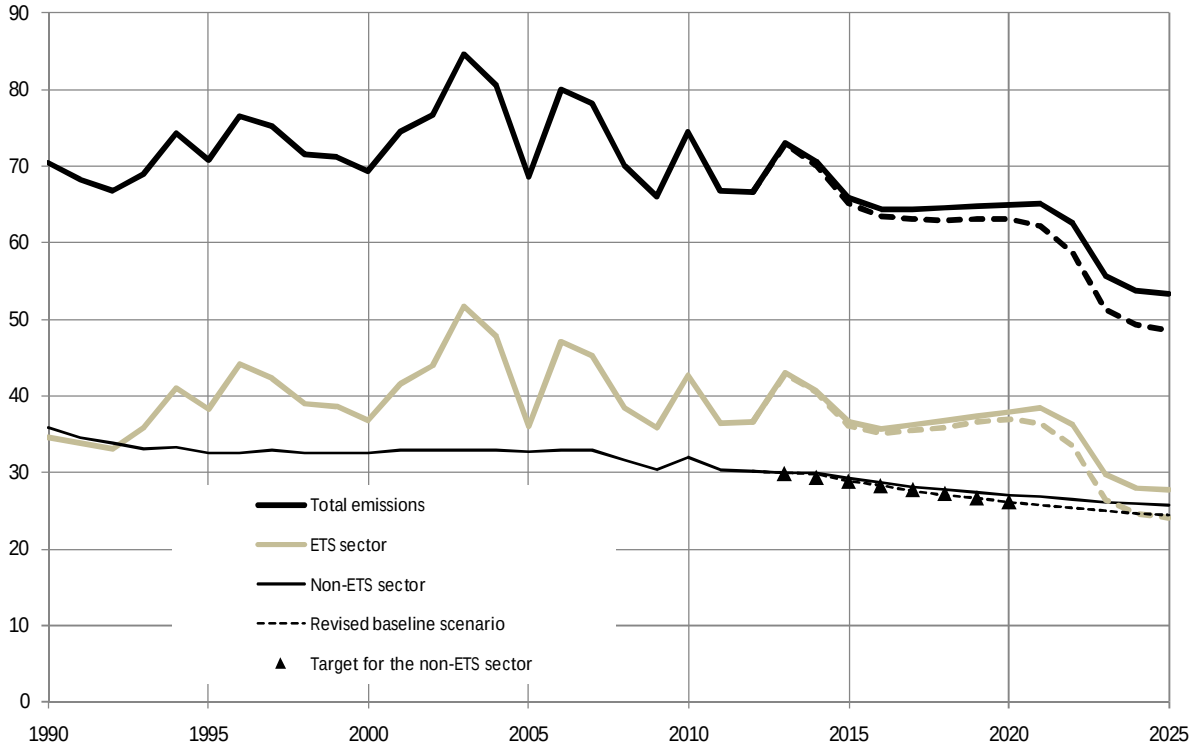

Figure 3-1. Greenhouse gas emissions from the emissions trading sector and the non-ETS sector in 1990–2025 under the baseline scenario (solid line) and the revised baseline scenario (dashed line), million ton CO_2 eq.

3.5 Stricter emission reduction targets in the EU

In international climate negotiations, an agreement has been made to limit the rise of the global average temperature to two degrees Celsius, compared to pre-industrial levels. It is estimated that in order to reach this two-degree target, the developed countries must make emission cuts of approximately 25–40% by 2020, in comparison to 1990 levels. At the same time, developing countries should reduce their emissions growth trend by 15–30% by 2020. By 2050, emissions reductions by developed countries should total 80–95% compared to 1990 levels.

Published in 2011, the Commission's roadmap for moving to a low-carbon economy begins from the premise that the EU should reduce its domestic greenhouse gas emissions by 80% by 2050, in order to remain on the two-degree trajectory. According to an analysis presented by the Commission, emission reductions of approximately 25% in the EU by 2020 would be consistent with the linear path towards reducing emissions by 80%. On the other hand, the 20% obligation included in the climate and energy package would clearly exceed the level defined by this linear path, necessitating a significant acceleration in the pace of emissions reductions between 2050–2050, in comparison to 2013–2020.

The EU is prepared to scale up its greenhouse gas emission reduction targets for 2020 from 20% to 30%, provided that other industrialised countries undertake similar emission reductions and, within their capabilities, key emerging economies make a contribution to emissions reduction efforts. As outlined in the Government Programme, a decision was made to investigate the impacts of this tighter emission reduction target on Finland (cost impacts, social benefits, impact on competitiveness and compatibility with the two-degree target, while taking account of commitments made by other EU member states). In accordance with the Government Programme, the Government will take a decision on supporting the EU's target of reducing greenhouse gas emissions by 30% by 2020, if the investigation confirms that there is a sound basis for doing so.

Due to the prevailing economic situation, a surplus of emission allowances has accumulated in the sectors covered by the emissions trading system. As a result, the price of emission allowances has been low. If the supply of emission allowances is not addressed, prices may

remain low, or even further decrease. The surplus of emission allowances will be transferred from phase two (2008–2012) to phase three (2013–2020) of the EU emissions trading system. According to the Commission's estimates, the oversupply of emission allowances will persist throughout the whole of phase three. While the emission targets set for 2020 for the ETS sector at EU level will be met due to weak economic development, continuously low priced emission allowances over a long period of time will undermine the emission trading system's key role – to provide an incentive for reducing emissions. In the current situation, the emissions trading system does not provide investors with sufficient incentive to invest in low-carbon production.

The Commission has initiated a process intended to address this issue. The options proposed include a transition to a target of -30% by 2020 and permanently retiring a significant number of emission allowances in phase three. One measure for rapidly influencing the significant surplus in the transition from phase two to phase three would be to postpone the auctioning of emission allowances, from the beginning of phase three to the phase's final years. Such a postponement alone would not tighten the emission reduction target for the ETS sector, nor would it have a significant impact on the average price of emission allowances in phase three. Under the first option, increasing the target would affect both the ETS sector and non-ETS sector. In such a case, the effort sharing agreement concerning the non-ETS sector would apparently require renegotiation. Permanent retirement of emission allowances would imply tightening the emission reduction target for the ETS sector in phase three.

Under the EU's original target setting, the adoption of more stringent emission reduction targets was conditional on similar measures being undertaken by other industrialised countries and emerging economies. This condition is not being met.

As outlined in the Government Programme, several studies have been conducted on the impacts Finland would face, should the EU adopt the -30% target for 2020. This examination begins from the premise that tighter emission reduction targets would apply to both the ETS and non-ETS sectors. In the sectors covered by emissions trading, applying more stringent targets would immediately increase the price of emission allowances, and indirectly the

price of electricity and fossil fuels. As a result, industrial competitiveness in the EU member states would weaken vis-à-vis third countries. For sectors not covered by the emissions trading system, national emission targets for 2020 have been determined in the effort sharing agreement. It has been estimated that increasing the emission reduction target from 20% to 30% would mean the tightening of the reduction target for the non-ETS sector in Finland, from the current -16% to -23%, provided the current basis for effort sharing is adhered to.

While some of the studies focused solely on assessing the impacts of meeting the targets for the non-ETS sector, some examined impacts at the level of the energy system and from the perspective of the entire national economy. According to these studies, the focus of measures with regard to reducing emissions in the non-ETS sector must be on cutting greenhouse gas emissions from all sectors, across all industries. It will not be possible to achieve this target in a cost-efficient manner through any individual or few measures or policies. Cost-efficiency can be increased using flexible mechanisms.

A tighter emission reduction target would weaken the economic competitiveness of Finland and the EU in general against third countries, unless they implemented similar measures. If additional emission reduction targets are set unilaterally, the Commission estimates the total output as approximately 0.5% lower in 2020 within the EU area. Studies indicate that, for Finland, the corresponding decrease would be 0.4%. A report completed in 2011 assesses the costs arising from a tighter EU emission reduction target, especially in the non-ETS sector in Finland. According to the estimate presented in the report, based on a model calculation, the direct cumulative additional costs incurred by the non-ETS sector as a result of a stricter target are around EUR 200 million in the period 2013–2020. A central assumption as regards the level of cost estimates is the maximum utilisation of flexible mechanisms and their price level. Notable uncertainty is involved in the cost levels of various emission reduction measures.

A tighter reduction target for greenhouse gas emissions would also reflect on other air pollution emissions. According to the assessment completed, in Finland's case the benefits gained from reduced air pollution would represent approximately 10–14% of the costs

resulting from a more stringent climate policy. The benefits calculation includes lower air pollution reduction costs, as well as health benefits arising from lower emission levels. In comparison to other member states, Finland would benefit less from the impact on air pollution levels, due to our rather good national baseline.

The impacts of a tighter reduction target on technology exports and competitiveness have also been outlined at general level. Renovation construction and the production of biofuels, for example, are among the industries that could benefit from a stricter target. Recent reports do not include an assessment of costs resulting from climate change or adaptation to climate change.

In light of the current view, the international preconditions for implementing the reduction targets are not being met in the short term, and there is no consensus among EU member states on tightening the emission target as originally intended.

26) *The EU's current emission reduction target for 2020 is insufficient from the perspective of the goal of limiting global warming to two degrees Celsius. Finland supports the EU's decision on its readiness to scale up the emission reduction target to 30% for 2020, provided that other industrialised countries undertake similar emission reductions and, within their capabilities, key emerging economies make a contribution to emissions reduction efforts. A decision was made at the Doha Conference of the Parties to the UN Framework Convention on Climate Change, that the parties must revisit their goals with respect to the emission reduction targets for 2020, by no later than 2014.*

27) *According to studies, tightening of the EU's emission reduction target for 2020 would somewhat increase the costs to the national economy. On the other hand, postponing the required emission reductions would probably increase total climate policy costs and slow down investments in clean technology. Finland is preparing to participate in EU-level and international negotiations on the reassessment and redefinition of emission reduction targets.*

28) *In the EU, the focus of preparations has shifted to planning emission reduction targets for the period after 2020. Unless the target for 2030 is set soon or the target for 2020 is increased, this could lead to setting a tighter target for 2030, in relative terms, in order to remain on track with respect to the targets for 2050. Finland will take a stand on these targets in 2013, in connection with preparations for the roadmap leading to 2050.*

29) *If the need to reform the emissions trading system, for example, leads to new discussions on the unilateral tightening of emission reduction targets for 2020, Finland will actively participate in this discussion, based on analyses and studies on the matter, prepared in line with the Government Programme.*

3.6 Renewable energy and peat

Forest-based biomass

Increasing the use of forest chips in multi-fuel boilers is the most central and cost-efficient way of increasing the use of renewable energy in the generation of power and heat. In multi-fuel boilers forest chips replace peat. Adopted in the summer of 2010, the Finnish national renewable energy action plan sets the 2020 target, for the use of forest chips in the generation of heat and power, at 25 TWh.

Use of forest-based biomass can be further increased by replacing coal use with it. Large-scale substitution of coal in the cogeneration of heat and power requires that either the current power plants, equipped with pulverised coal boilers, are replaced with new multi-fuel boiler power plants, further investments are made in current pulverised coal boilers (for instance gasifiers or a separate line for wood), or that refined wood fuels suitable for use in pulverised coal boilers (for instance torrefied wood, torrefied pellets or industrial pellets) are introduced. Based on these alternatives, there is considerable variation as to the share of coal to be replaced with forest-based biomass. The available options are limited by the location of the power plant, and the space available on the power plant site.

30) *The 25 TWh target for the use of forest chips in the generation of heat and power for 2020 will be adhered to. Forest chips will be substituted for peat, for use in multi-fuel boilers.*

31) *The replacement of coal with forest-based biomass will be promoted, so that the use of coal in power plants is mainly phased out by 2025. To achieve this goal, the sufficiency of energy subsidies for investments will be ensured, and the need for new support systems for promoting the use of pellets, torrefied wood or other biomass-based processed products in pulverised coal boilers, will be investigated.*

32) *It will be ensured that steering measures aimed at increasing the use of forest chips are based on a long-term view and are predictable. The impact of various energy subsidies on the wood market will be monitored.*

33) *The logistics of harvesting and transporting forest chips will be further developed, creating the preconditions for comprehensive, sustainable supply chains on market terms.*

34) *Heating entrepreneurship will be promoted, in order to increase energy production and use based on local biomass.*

35) *The share of decentralised energy production in the production of renewable energy will be increased. When planning national energy and regional policy, as well as the related promotion measures, account will be taken of the development of the use and distribution of decentralised energy production and innovative local solutions.*

36) *Production of biofuels and bioliquids will be increased. Their testing and adoption e.g. in shipping and air traffic, will be promoted, in response to the challenges set the by emissions trading system and to comply with the stipulations of the International Maritime Organisation, the International Civil Aviation Organisation and the EU.*

Field biomass and manure

In the future, other types of biomass, such agricultural biomass, will also increase in importance as a raw material in fuel production. Various field biomasses and manure are the most important agricultural biomasses suitable for energy use. In addition, various by-products and waste suitable for energy use are generated at different stages of the food production and processing chain. Biomass can be refined into energy through various means, e.g. burning, biogasification, and various production methods for biofuels

37) *In promoting the energy use of biomass of agricultural origin, a particular emphasis will be placed on the production and use of non-food crops or portions of crops, and the use of by-products and waste (incl. manure) originating in the food chain.*

Synthetic natural gas made of biological raw material (bio-SNG)

Synthetic natural gas based on biological raw material (synthetic biogas, bio-SNG) is produced by gasifying biomass and purifying the resulting product gas, so that it meets the quality and safety requirements set for natural gas. The adoption of renewable energy can be promoted by replacing natural gas with bio-based gas.

For now, the production costs of bio-SNG are significantly higher than the price of natural gas. Production and use of bio-SNG could, however, solve several issues related to replacing

fossil fuels. Since synthetic natural gas can be transferred through existing natural gas networks, no logistical issues are involved. Using synthetic natural gas alongside natural gas would be possible without making any investments in power plants. Finally, bio-SNG can be used as a transport fuel.

38) *Replacement of around 10 per cent of natural gas with synthetic natural gas made from domestic wood by 2025 will be pursued.*

39) *Possible funding for a bio-SNG plant from the second round of NER300 funding or other EU sources of funding will be supported.*

Ensuring the sustainable use of bioenergy

The Directive 2009/28/EC on renewable energy establishes sustainability criteria for biofuels and bioliquids. On 17 October 2012, the European Commission issued a proposal on including the indirect land use change impacts in the Renewable Energy Directive. In addition, the European Commission has announced that, at the beginning of 2013, it will issue a proposal on extending the sustainability criteria to cover the use of solid and gaseous biomass in energy production.

The role of forest-based biomass and other bioenergy is accentuated, particularly in efforts to replace the use of fossil fuels and peat in the production of power and heat, and in their cogeneration. Hindrances to the use of biomass and weakening of its competitive advantage in emissions trading will significantly complicate any attempt to reduce the use of fossil fuels and peat in Finland. Forest-based bioenergy represents the most significant and cost-efficient way of increasing the share of renewable energy in Finland. Finland has therefore striven to exert an influence, especially with respect to preventing the creation of unnecessarily unwieldy systems for verifying the sustainability of forest-based biomass. At the same time, it must be ensured that increasing the use of sustainable energy sources does not impose an unreasonable additional burden on the natural environment. At the moment, more research is still required on the related environmental impacts. The impacts on the natural environment will also vary, depending on the source of energy.

40) *Increasing the use of bioenergy, in line with Finland's objectives, must be carried out in a sustainable manner, without endangering the conservation of biodiversity, water protection and other environmental protection objectives. Regulation on the sustainability of bioenergy will be decided on in the EU, in order to create a functioning European market.*

41) *When preparing the sustainability criteria for bioenergy, efforts will be made to ensure that the criteria do not take a form that jeopardises or prevents the use of sustainable domestic biomass in energy production and in the related support measures.*

42) *In addition, efforts will be made to ensure that the burning of sustainable biomass remains carbon neutral in emission inventories.*

43) *Any possible negative environmental impacts, and the life cycle carbon balance of projects aimed at increasing the use of bioenergy, will be identified. Efforts will be made to prevent negative environmental impacts at the earliest possible stage.*

Wind power

Achieving the current 6 TWh objective for wind power requires the removal of non-financial obstacles to the construction of wind power. The challenges of land use and land-use planning related to the construction of wind power could be influenced by promoting the construction of wind power in larger wind farms, instead of individual turbines or small groups of wind turbines. Within the spending limits for central government finances, issued on 4 April 2012, a separate EUR 20 million appropriation has been earmarked for an offshore wind power demonstration project in 2015.

44) *Construction of wind power will be expedited by improving planning and permit procedures, and consequently, the granting of permits. The production target for 2025 is set at approximately 9 TWh. The previous target for 2020 is 6 TWh.*

45) *Determined efforts to remove obstacles to investment in wind power will be continued. Simultaneously, means of promoting the concentration of wind power construction in larger clusters will be investigated.*

46) *Preparation of the legislative amendments required by the offshore wind power demonstration project, as well as preparation of the principles for the selection process of the supported project, will be carried out in 2013.*

47) *A legislative amendment to clarify the procedure related to the distribution of the quota of 2,500 MVA reserved for wind power will be prepared.*

48) *In inland Finland, the number of areas with wind conditions suitable for power generation is limited. Promoting the sustainable implementation of offshore wind farms should be set as a joint long-term objective for the various branches of the public administration. In planning the location of offshore wind farms, account must be taken of information on the submarine natural environment, in order to prevent environmental damage. In addition, information on transport routes, vessel traffic and areas of winter navigation must be taken into account for reasons of traffic safety, alongside the needs of the Finnish Defence Forces.*

Energy use of waste

The new Waste Act (646/2011), in force as of 1 May 2012, implements the EU's Waste Framework Directive (2008/98/EC) and confirms the order of priority binding on professional operators, where the first priority has been allocated to reducing the quantity and harmfulness of waste, and the second priority to increasing the recycling and recovery of waste and reducing waste disposal in landfills. Waste recovery is considered to include re-use as material and the use of waste for energy.

For organic waste, material recovery will be enhanced and more strict limits will be imposed on its disposal in landfills. The recovery rate of landfill gas will increase. This is now estimated to be 33%, in 2025 approximately 38%, and from 2045 on approximately 40%. From the perspective of greenhouse gas emissions, utilisation of waste as fuel is usually a better option than disposal in landfill, as it is possible to limit more-harmful methane emissions through incineration. The CO_2 emission factor for waste fuel takes account of the share of fossil carbon contained in waste. Waste with a higher bio-percentage therefore has a lower CO_2 emission factor.

49) *To reduce methane emissions from landfills, the disposal of biodegradable and other organic waste in landfills for conventional waste will be further restricted.*

50) *Implementation of new waste legislation will enhance the prevention of waste generation, promote recycling and the use of waste as recycled material, as well as promoting the energy use of waste unsuitable for recycling and material recovery through an increase in incineration and the production of biogas.*

51) *Emission factors used for waste will be examined to determine whether they are up-to-date and whether any review is required.*

52) *Increasing waste recovery must be included as part of regional planning.*

Issues related to reductions in the use of peat and to the protection of mires and waterbodies

Peat plays an important role as a supplementary fuel for biomass in the production of electricity and heat in built-up areas and within industry. As a domestic source of energy, peat is of importance to regional economies and occupies a key role in ensuring security of supply.

Usage that alters mires usually reduces the carbon stocks in mires and increases greenhouse gas emissions into the atmosphere, as well as the leaching of organic matter and nutrients into water bodies. The Government resolution of 30 August 2012 on the sustainable and responsible use and protection of mires and peatlands steers the use of mires and peatlands, so that natural resources in mires are used in a sustainable manner, and environmental damage caused by such use (e.g. pollution load on water bodies) is reduced.

As outlined in the Government Programme, the utilisation of peat for energy will be reduced systematically due to emissions and other environmental damage caused, in such a manner that peat is not replaced by coal. During the transition period, peat will play an important role as a supplementary fuel. With the introduction of new technology and stricter emission reduction targets in the coming decades, however, the importance of peat will decrease in this regard.

53) *Research, monitoring and impact assessment related to the climate impacts of the use and restoration of mires and peatlands will be continued and enhanced, in order to reduce uncertainties regarding peatlands and their emission and carbon sink aspects, and for the cost-efficient targeting of climate change mitigation measures. Opportunities to steer the reduction in the use of energy peat, in order to focus it on peat that generates the greatest life cycle emissions, without causing significant additional technical or financial harm to energy production will be investigated.*

54) *Systematic reductions will be made in the use of peat for energy, in such a manner that peat is not replaced by coal. The Government sets the objective of reducing the use of peat for energy by a third from the average level of previous years (23 TWh), by 2025. Over the next 10–20 years, when the current power plants are in use, the need for peat in heating periods will be at least 11–13 TWh, since peat cannot be replaced with forest chips or other renewable fuel. In addition,*

reasonable multiannual peat reserves of approximately 6–8 TWh must be ensured to level out weather risks.

55) *After 2025, renewal of power plants and technical renovation will make a further reduction in the energy use of peat technically possible. At the same time, account must be taken of the availability of alternative fuels, and steering measures must be scaled with a view to avoiding the replacement of peat with fossil fuels and preventing an unreasonable increase in the price of district heating.*

56) *Production of peat will be targeted in accordance with the Government resolution on the sustainable and responsible use of mires and peatlands. The classification indicating the degree of naturalness for mires will be primarily applied to mires taken into use for the production of peat after the date of issue of the Government resolution. However, the Government will aim to direct new production of peat towards mires classified in categories 0–2 (in exceptional cases, 3) in the natural state classification, and to promote production on these mires by e.g. ensuring a rapid permit process. The Government will also promote arrangements whereby the old reserve mires in categories 4–5 will be exchanged for other production sites, or redeemed as conservation areas.*

57) *Over recent decades, peat and pulp production and agricultural production have resulted in large amounts of organic sludge accumulating at the bottom of water bodies, and continuously releasing methane into the atmosphere. Studies will be launched to investigate the amount of such emissions and possible measures to limit them.*

3.7 Measures required by developments in the European and national energy market

Developments in the Nordic retail market

The Nordic countries have examined the creation of a common retail market for electricity. In practice, this would mean that electricity suppliers could operate on a common basis across the Nordic countries. Such a development could reduce costs, increase competition and promote the effectiveness of the markets. If executed well, such a scheme would have hardly any adverse effects. The Nordic regulatory authorities have proposed that, in the first stage, a common procedure be created for consumer electricity invoices and for invoicing and information exchange systems. The model selected by the regulatory authorities is a supplier centric model, wherein suppliers would handle the invoicing of both electricity and network charges. Another option would have been to assign this task to grid operators. Problems related to the supplier centric model include issues such as the possible exclusion of small electricity suppliers and the weakening of contact with customers in the event of disruptions.

58) *Finland continues to support the development of the Nordic electricity market (including the retail market) towards a common, efficient market. At this stage, however, Finland is not ready to switch to the proposed, obligatory model involving a single invoice.*

Demand response and capacity markets

In cold winters, Finland is dependent on the import of electricity. In addition, increasing amounts of wind power, solar power and nuclear power, and to some extent, the import of electricity, require a flexible electricity system and capacity that accommodate both flexibility and low levels of use. Due to low usage, such capacity would not always cover its costs, making it an unattractive investment. In European discussions, it has been suggested that deficiencies in the existing energy system should be fixed using various capacity mechanisms or a capacity market. In practical terms, this would mean supporting other forms of electricity production besides renewable ones, in one form or another. A capacity market would increase fossil production, may lead to excess capacity and additional costs, including possible tax-like fees, and undermine the functioning of the current market model.

59) *Demand response with respect to the production of electricity will be increased, the construction of smart grids will be continued, the preconditions for building market-driven production capacity will be created and the closer integration of market areas will be promoted. These principles also serve electricity market development needs on a more general level.*

60) *The necessity of the current peak load capacity will be evaluated from time to time. If capacity markets are to be developed in the EU area in any case, they should be made as similar as possible. Finland is in favour of keeping the electricity system as market-driven as possible.*

Level of security of supply for electricity networks

61) *The legislative proposal for an electricity market act, to be issued in the spring of 2013, determines the principles underlying security of supply in the distribution network, regional networks and the national grid, as well as preparedness for exceptional situations.*

Development of the national grid to keep Finland as one price area

In theoretical terms, price areas for electricity are an efficient way of managing the transmission of electricity in the electricity network. Division into price areas reveals bottlenecks in electricity transmission and takes these directly into account in the electricity exchange's trading system. Market prices reflect real situations within the physical electricity network, sending signals to electricity producers and consumers on optimal placement. However, from the perspective of the electricity market system as a whole, the situation could be different. Switching into price areas would require operational and system changes, especially from market operators. Such changes would create expenses and their implementation would take several years at a minimum.

62) *The Finnish national grid must be developed with a view to retaining the entire country as one price area. Dividing the Finnish electricity market into several price or bidding areas would not be expedient. Instead, congestion situations inside Finland should be managed by developing the grid's transmission capacity and by means of counter trading. The Ministry of Employment and the Economy will monitor the development of congestion within Finland and may re-evaluate the need for a price area division, if necessary.*

Promoting small-scale electricity generation

By promoting small-scale electricity production, it would be possible to support local solutions and increase the use of renewable energy. Small-scale production often, although not necessarily always, concerns renewable energy. Small-scale generation typically occurs on a property or in its immediate vicinity, and the electricity produced is mainly intended for own use. Such small-scale generation can be carried out within a one-family house, a housing company, a commercial property, a small company or a farm. Electricity can be produced using solar panels, wind power, or small combustion installations for biofuels. The greatest financial gain for consumers lies in electricity production at the site of consumption reducing the need to purchase electricity.

In the context of Finnish electricity production, small-scale generation has rather limited potential. Nevertheless, in the future small-scale generation may play a significant role in reducing the consumption of purchased electricity needed in buildings during the hours of daylight, in seasons favourable to producing solar power. The promotion of small-scale generation will also create a lead market for Finnish companies operating in the sector. Finland has first-class expertise, especially in smart-grid solutions related to small-scale generation. Their export potential could be significantly promoted through domestic demonstration opportunities.

In legal terms, arrangements have been made for the access of small-scale production to the grid and the technical prerequisites for this exist. In practice, however, the nature of small-scale production would require the development of procedures that take better account of its special characteristics.

Temporal variation with respect to on-site consumption is typical of small-scale electricity generation. At times, properties may generate surplus electricity which the customer would like to feed into the grid. However, it has been difficult to find a buyer for this electricity, and the price does not always meet the expectations of small-scale producers, nor does it encourage them to make investments. In recent months, however, there have been encouraging developments in the electricity market. Growing numbers of suppliers have announced that they will buy all small-scale production on offer, and have openly disclosed

their network connection and compensation principles. Under such a purchasing procedure, the pricing principle for production has generally been the electricity exchange price minus a commission. If the customer's current supplier does not yet offer this service, the customer could enter into a contract with another supplier that does offer it. Statutory transfer into hourly metering of electricity consumption has enabled this change in attitude.

However, selling surplus energy at the market price determined in the electricity exchange would not render all forms of production financially viable. For example, further promotion measures would be required for any significant increase in solar energy generation. The net billing procedure has been proposed as one solution. This scheme allows the electricity user to sell their excess electricity production to the grid, for example in the summer, and use a corresponding amount of electricity from the grid when electricity is more expensive. However, additional benefits generated by net billing for small-scale producers would be significantly limited by the fact that, for legal reasons, net billing can apply only to the share of electrical power, not the transmission tariff or value added tax. From the perspective of steering effects, the weakness of statutory net billing lies in the fact that it does not encourage small-scale producers to optimise their production and consumption according to when there is, and is not, a shortage of electricity on the market. Statutory net billing may also involve similar problems, related to the interpretation of the constitution, as in the case of feed-in tariffs in a model where electricity users would be obligated to finance such tariffs. In addition, the system would impose additional costs on suppliers or grid companies responsible for net billing.

The Ministry of Employment and the Economy is funding a project to study both the centralised production of solar heat and property-specific production of solar heat, whereby excess production could be fed into the district heating network, in order to replace separate heat production with fossil fuel.

It would probably be most expedient to support market-price based solutions, such as the purchasing procedure, while possibly supplementing support for the viability of small-scale production through other means.

63) *Grid companies will be obligated to resolve issues related to connecting a small-scale producer to the grid within the given time frame.*

64) *During 2013, simple procedures will be created for connecting to the grid and for taxation, along with uniform guidelines for the selling and pricing of electricity produced by small-scale producers and the related billing procedures.*

65) *Any legal and optimisation issues related to the net billing procedure will be examined, and if the issues are deemed solvable, a model will be prepared for transferring to net billing.*

66) *Information on electricity companies that buy electricity from small-scale producers will be published in connection with the electricity price comparison service of the Energy Market Authority.*

67) *Small-scale electricity generation technologies available in Finland, along with their suppliers, will be listed.*

68) *The Government will assess developments on the markets with respect to excess electricity from small-scale generation during 2013. If necessary, the Government will prepare a proposal on a purchase obligation, should the above-mentioned measures prove insufficient and no certainty can be established on whether it is sufficiently easy to find buyers on the market for excess electricity derived from small-scale generation.*

69) *A working group will be established to investigate the opportunities for promoting small-scale generation. The working group will be tasked with evaluating the role of small-scale generation in the promotion of renewable energy and the energy efficiency of buildings in particular, including zero- or near zero-energy construction. In addition, the working group will consider measures to promote the viability of small-scale generation.*

Securing the position of natural gas

Securing the preconditions for the use of natural gas and the implementation of the LNG (liquefied natural gas) project could facilitate the maintenance of Finnish merchant fleet and the achievement of renewable energy targets. To enhance the confidence of gas users' in the functioning of the gas market, stability of gas prices and security of supply, the Finnish state should promote arrangements to create a competing gas supply without national state subsidies. One such opportunity is offered by the BEMIP (Baltic Energy Market Interconnection Plan) driven by the European Commission, to construct a new connection

for gas supply via the Baltic states to Central Europe, along with an LNG terminal on the eastern coast of the Baltic Sea.

70) *On 13 June 2012, the Cabinet Committee on EU Affairs outlined the following: To improve the functioning of the gas markets, the stability of gas prices and the security of supply of gas, arrangements for the creation of competing gas supply without national subsidies will be promoted. As a joint action with Estonia, the LNG terminal project, to be located on the coast of the Gulf of Finland, and the Balticconnector project will be included on the Project of Common Interest (PCI) list outlined in the EU's Energy Infrastructure Package, to enable Baltic and/or Finnish parties to the project (companies) to apply for EU funding.*

Smart metering of natural gas

Smart metering of natural gas refers to electronic metering of consumption and electronic transmission of metering data. Smart metering enables two-way communication between the consumer and gas supplier. Due to the small size of the market and national special characteristics, not all of the benefits normally linked to smart metering can be realised in Finland. Since consumers cannot switch to a different natural gas supplier, it would not be possible to create savings in this way. In addition, the consumer customers for natural gas are of very little importance to the transmission capacity of the gas network and to the evening out of peak demand. Consequently, the benefits gained from steering gas consumption with smart meters would remain minor. In any case, many natural gas companies have already made the decision to switch to using remotely read meters in measuring natural gas deliveries.

71) *At this stage, it would not be expedient to promote the smart metering of natural gas deliveries through binding provisions.*

3.8 District heating and cogeneration of heat and power

District heating and the cogeneration of heat and power, serving communities and industry, form an important element in the foundation of Finland's energy economy and energy policy. These production methods have a good efficiency ratio, while providing the opportunity for the cost-efficient use of wood-based sources of energy. Electricity production linked to district heating is regionally decentralised and advantageous in terms of security of supply. District heating is the only network business where pricing is not regulated under a special act. The need for a special act has been raised, particularly after the municipalities were granted the right, under certain conditions, to determine the heating method in their land use plans. However, the municipalities have only rarely taken this opportunity.

72) *Competition between heating methods will be secured also in the future, when consumers or builders make choices on the method of heating. This perspective will also be taken into account in environmental regulation.*

73) *District heating suppliers must safeguard confidence in pricing and openness.*

74) *At this stage, there is no need to create special regulation on price monitoring.*

The Energy Efficiency Directive requires member states to examine their opportunities for utilising cogeneration, district heating and district cooling, and to take the necessary measures to promote cogeneration if this proves the most advantageous alternative according to a cost-benefit analysis.

75) *The study required by the Energy Efficiency Directive on the opportunities of utilising efficient cogeneration and efficient district heating and cooling will be conducted by the end of 2015. The preconditions for implementing investments identified as cost-efficient in the aforementioned study will be secured through provisions or by creating incentives for cooperation between energy companies, municipalities and industry.*

3.9 Consumers and the steering of consumer measures

A significant proportion of emissions in sectors not covered by the emissions trading system are generated through consumption, travel, building-specific heating and choices of food. In the case of many consumer sector activities, such as electricity consumed and district heating, such emissions are released in the sector covered by the emissions trading system. While different households vary with regard to their situations and opportunities to have an influence, the average consumer can make a significant reduction in his or her carbon footprint through personal choices.

For this reason, consumer advice on the efficient use of energy and energy saving, as well as advice on promoting the use of renewable energy, is important and must be increased. There is a need to develop tools, online services and other services for comparing the impacts of one's own choices, and for finding solutions tailored to one's own situation and household.

76) *Advisory services, tools and best practices will be compiled to improve the energy and material efficiency of consumption and encourage the adoption of new solutions.*

77) *Public steering regarding housing, nutrition and transport will be developed, with the aim of encouraging consumers to make choices that reduce greenhouse gas emissions.*

Traffic accounts for a significant share, approximately 40%, of emissions in the sector not covered by the emissions trading system. Greenhouse gas emissions from traffic can be notably reduced by promoting public transport, walking and cycling. Moreover, promoting these means of transport in urban regions also reduces other environmental impacts caused by traffic, facilitates the smooth flow of traffic and improves traffic safety. Taking a longer view, influencing choices in the means of transport, and consequently, transport performance, will become necessary in order to meet emission reduction targets.

Service level is a key factor in making public transport attractive. An effective chain of travel services must be offered from door to door and, for example, park-and-ride facilities must be arranged. The use of public transport is supported by a well-functioning environment for

cycling and an attractive and safe setting for walking. The role of walking and cycling in transport system processes needs to be strengthened and mainstreamed. Cycling has considerable potential, especially as a substitute for short car trips. At the moment, 43% of all car trips are less than five kilometres in distance. A further way of promoting the use of public transport, cycling and walking is through mobility management.

People's travel choices can also be influenced using economic instruments. In the last fifteen years, for both environmental and financial reasons, road tolls have rapidly become more common in several EU member states. While employer-subsidised commuter tickets can be used to steer people towards using public transport, free parking offered by employers, kilometre allowances paid for using one's own car, and the right to tax deductions on expenses for travel between one's apartment and workplace can steer people's choices, regarding their means of transport and place of living, in an increasingly car-dependent direction.

78) *Public transport will be developed to provide a service package that is consistent and that includes a user-friendly, interoperable payment and information system.*

79) *The appropriate allocation of public transport funding will be examined, in order to increase the efficiency and incentive aspects of the system.*

80) *A long-term transport pricing strategy will be prepared. As part of this strategy, the possible introduction of various road tolls will be examined.*

81) *An overall reform of the benefits and financial incentives of work-based traffic will be carried out, with the aim of directing and encouraging the use of public transport, walking and cycling whenever practically possible. In the implementation of this reform, account will be taken of regional differences in Finland, acknowledging that it is not possible to fully replace private cars with public transport in commuter traffic. The overall reform must not hinder the mobility of labour. Commuter tickets will be made easier and more attractive to use.*

82) *Sustainable transport choices and the citizens' travel needs will be influenced by supporting distribution of information, marketing and mobility management efforts, as well as by utilising information and communications technology.*

3.10 Agriculture and food

While drought and, to some degree, large variations in weather conditions will have an adverse impact on conditions for cultivation in many current key production areas, in Finland global warming is expected to create the preconditions for increased crop yields. Since the increasing incidence of extreme weather events, plant diseases and pests may offset some of the potential benefit, in the long term Finland must prepare to increase its agricultural production to support global food security. Finland must continue to produce agricultural products in volumes that are sufficient to cover at least domestic consumption.

In order to reduce greenhouse gas emissions from food production, it would be expedient to increase the amount of perennial grass, especially in organic soils, and carefully manage the processing of manure from animal husbandry. It is vital that our current arable land remains in good condition, basic improvement of fields is attended to, and good agricultural practice complied with. In the coming decades, we need a broad selection of instruments to respond to the challenges of environmental protection and climate change. Such instruments will include investment and environmental subsidies for agriculture, training and advice provided to farmers, as well as support for innovation and research.

At the moment, agricultural support systems are undergoing reform for the new programme period of the common agricultural policy of the European Union, to begin in 2014. The preparation of this reform will promote the greening of the common agricultural policy and the related national measures, in support of the implementation of the climate and energy package. In addition, climate policy and energy efficiency objectives related to agriculture are taken into account in the development of agricultural support systems and the preparation of measures for the Rural Development Programme 2014–2020.

Clearing of peat fields has adverse climate impacts. It would be possible to reduce clearing by limiting the granting of support for new cleared peat fields, within the framework of EU regulations. The need to clear fields can be further decreased by developing the techniques used in the spreading and processing of manure.

Each year, the food chain generates 330–460 million kilograms of edible food waste, on average. This wastage amounts to 10–15% of food consumed. Among the various links in the food chain, households generate the highest amounts of food waste. Within several food product categories, the environmental impacts caused by food waste can be notably higher than those resulting from the manufacture of packaging and from waste management. An efficient way to reduce greenhouse gas emissions from the food chain would be to reduce waste in the various parts of the chain.

By-products and waste generated at various stages of the food chain could be utilised in energy production, for example. In promoting the energy use of biomass of agricultural origin, a particular emphasis will be placed on the use of by-products and waste (incl. manure) originating from the food chain, as well as on the production and use of non-food crops or portions of crops.

83) *Measures related to climate change mitigation will be planned and implemented so that they do not jeopardise Finnish agriculture or global food security.*

84) *Research on emissions from land use and agriculture, and on efficient ways of reducing emissions, will be increased to facilitate the correct targeting of measures.*

85) *Food waste will be reduced at every stage of the food chain, while emphasising the importance of food choices in reducing greenhouse gas emissions. Consumers in particular will play a key role in this.*

86) *In developing and promoting the energy use of biomass of agricultural origin, the focus will be on non-food biomass.*

87) *Measures to develop closed nutrient and material cycles in agriculture-based energy production will be promoted.*

4 DEVELOPMENT OF CLEAN TECHNOLOGY BUSINESS

4.1 Innovation policy related to energy and climate issues

Due to rapid population growth and the rise in standards of living, we are seeing rapid growth in global need for energy. Increased use of fossil fuels has increased greenhouse gas emissions and accelerated climate change. To curb climate change, efforts are being made to rapidly increase the use of renewable sources of energy. Meanwhile, the global challenges relating to water and waste management and the availability of raw materials, for example, have grown. Reconciling environmental and economic issues is therefore an increasingly important issue in politics and in business. Global economic and environmental challenges have given rise to international policy aimed at green growth, as well as a growing market for clean technology (cleantech).

Globally, cleantech is one of the fastest-growing sectors. The size of the global market is approximately 1,600 billion euros, representing around 6% of the world's GDP. The annual growth rate of the cleantech business is nearly 10%. Finland is in an excellent position to become a leading country in cleantech, and cleantech has been made one of the key themes of Finnish industrial policy.

International policy aimed at green growth seeks to promote economic development in a way that is sustainable from the perspective of natural resources and the environment. Generating green growth calls for joint measures in innovation policy and energy and climate policy.

Energy and climate policy entails plenty of regulation and support mechanisms. From the perspective of successful innovation policy, it is vital to develop tools that will enable us not only to meet the climate and energy targets, but to support the development of new innovations and technologies.

Stricter environmental objectives and regulation in the energy sector, as well as market based changes, will lead to global changes in the structure of energy production and in development work carried out in the sector. These activities will also be influenced by

political decisions made by key countries in the sector. In the future, innovation policy and climate and energy policy should be steered jointly, so as to enable Finnish players to be pioneers in launching their products and services in the markets created as a result of these market and policy changes.

88) *Existing funding mechanisms for innovation will be directed at renewable energy and clean technology (cleantech). When directing funding, account will be taken of global megatrends and the possibilities of achieving the low-carbon targets and implementing the related roadmaps, alongside the national energy economy.*

89) *Policy measures supporting innovation will be developed, such as market-based steering methods, standardisation and increasing the share of innovations in procurement. In legislative drafting, dialogue between the administration and trade and industry will be enhanced through a common forum.*

90) *Finland will aim to be a pioneer in the comprehensive utilisation of cleantech in urban environments. The tools employed in this will include the Innovative Cities (INKA) programme and growth agreements, some of which focus on renewable energy and energy efficiency in particular.*

4.2 Research and product development

Global megatrends and the related growth potential should be taken into account in directing investments in research, product development and innovation. Targets for research, product development and innovation activities should be set high, aiming at new globally operating leading companies, products and services. To ensure competitiveness, leading positions in the international market will be sought in various parts of the value chain.

The challenge Finland faces in creating new jobs in renewable energy lies in having a strong position in the field of bioenergy, where global growth is modest. In the most rapidly growing fields, especially with respect to wind and solar power and fuel cells, Finland has only a small market share.

When conducting research or product development into renewable energy, such energy should be viewed as a broad phenomenon that affects energy systems. Bearing this in mind, future business opportunities will not be limited to a certain form of energy or the related comprehensive deliveries. Current pressures for change relating to energy systems include the increasing importance of electric energy vis-à-vis other forms of energy, the growing need for producing back-up and balancing power, the increase in off-shore solutions, new smart grid solutions and dynamic optimisation of energy consumption, as well as energy storage solutions. All in all, the ICT and energy businesses will be further integrated into each other.

91) *The prerequisites will be investigated for establishing a national concept or research platform for wind power that would bring together expertise and support networking between companies, authorities and wind farm environments and the development of business in the sector.*

92) *Finland will be active in selected RDI projects at EU level, including the SET-Plan and Horizon 2020 instruments, and will actively seek European Commission funding for cleantech projects.*

93) *New market opportunities brought about by renewable energy production, such as covering the growing need for back-up and balancing power, smart grids, new forms of energy for transport, incl. fuel cells, and technologies that support reform of the forest industry, will be invested in.*

94) *The development and demonstration of smart energy grids will be invested in and the launch of new ICT-based energy efficiency products in the market will be promoted.*

95) *Energy and material efficient products, services and operating methods, as well as seizing on the competitive advantage offered by these, will be promoted.*

96) *Under the Emissions Trading Directive, a share of the revenues from auctioning emission allowances should be spent on developing and introducing low-carbon technologies.*

4.3 Competitiveness and development of the domestic market

Obligations imposed by the EU and international treaties strongly steer Finland's decisions when it draws up provisions and support mechanisms for renewable energy. As indicated by

several studies, subsidies directed at the energy sector, especially at renewable energy, in order to address climate change weaken the national economy, impose significant budgetary pressures on the state and undermine employment in other sectors. Meeting environmental objectives through domestic market mechanisms that support exports is the best way of reducing the cost impacts of mechanisms developed on environmental grounds, and converting them into clearly positive impacts.

Finland should actively develop its competitiveness in the energy market, from the investor perspective. Factors contributing to the competitiveness of the domestic market include at least the financial position, the duration of permit processes and the procedure applied, as well as the performance of the market in energy products and the related support systems. This will create a predictable market that attracts investments. The financing situation could be developed, e.g. by state financing companies and other actors.

97) *The financing situation for renewable energy and cleantech projects will be developed with respect to the state guarantee systems and the operating models of state financing companies, and by promoting the opportunities of small-scale investors to make investments in the energy sector.*

4.4 Supporting commercialisation and internationalisation

Finland is a strong exporter of energy technology and cleantech. In 2010, energy technology exports amounted to 6.6 billion euros. In the last ten years, energy technology exports have seen strong growth, typically around 10% annually. Energy technology forms a part of clean technology; in 2011, the total value of cleantech exports amounted to approximately 12 billion euros, representing nearly 20% of all Finnish exports. In 2011, Finland had over 2,000 companies operating in the cleantech sector. Their combined turnover (around 20 billion euros) accounted for approximately 11 % of GDP.

The international market for renewable energy is growing at a fast pace. According to the National Renewable Energy Action Plan documents, an investment need equivalent to electric power capacity of 179 GW in renewable forms of energy will emerge in the EU area

by 2020. The investment required for this capacity is around 350–600 billion euros. Globally, the market is around 1,000–2,000 billion euros. In addition, investment is needed in e.g. energy networks.

98) *Growth in Finnish energy technology exports will be pursued, to reach a value of 20 billion euros by 2020, and for cleantech exports to reach a value of 38 billion euros by 2020. Achieving this will require a growth rate of approximately 12% in export-oriented annual growth in the renewable energy and cleantech sector up to 2020. Monitoring of exports will be arranged through an appropriate party, for example the Finnish Customs.*

99) *Private sector instruments and programmes within Finnish development cooperation will be utilised to support business activities in the cleantech and renewable energy sectors.*

100) *Increasing account will be taken of the cleantech perspective in the education, research and competences of personnel in various sectors.*

4.5 Promoting demonstrations

In the technological development and commercialisation of their new innovations, one of the major challenges cleantech companies face lies in the implementation of demonstration investments. While capital investors fund part of these investments, state involvement would also be justified in terms of sharing risks. The state's role is accentuated by the fact that funding demonstration investments with borrowed capital, such as a bank loan, is highly challenging.

It is vital that demonstration projects are funded in Finland. However, the energy technology market operates globally, and obtaining a reference in Finland would not automatically support exports in all markets. For this reason, enabling reference investments outside Finland will be increasingly important in the future.

101) *The situation will be investigated in terms of forms of support for technologies, besides energy production, which contribute to mitigating climate change, with a view to their applicability to demonstrations from the perspective of companies.*

102) *National test and demonstration platforms will be established for forms of energy that have a global market, such as wind power, bioenergy, solar power, transport energy solutions, incl. fuel cells, and wave power.*

103) *Opportunities for supporting cleantech companies' demonstration projects abroad through mechanisms included in innovation, export promotion and development cooperation funding, will be investigated.*

104) *Information on reference projects implemented by Finnish players in Finland and abroad will be gathered and compiled in a manner appropriate for marketing purposes.*

5 PUBLIC SECTOR ACTIVITIES AT REGIONAL AND LOCAL GOVERNMENT LEVEL

The public sector, the state and municipalities, should occupy a more central role in promoting the sustainability of their own operations, investments and procurements. By reducing the use of materials and energy in their own activities and by making innovative procurements, it would be possible to save on tax revenues and create jobs, while protecting the environment. Cooperation between the state and municipalities has played, and will continue to play, a key role in achieving results.

In recent years, regional climate efforts have gained strength. Nearly all of Finland's regions have prepared their own climate strategies. Regional climate work could complement and support national measures to curb emissions, increase economic activity and jobs in Finland, and lead to the creation of practical innovations to reduce emissions and for sustainable consumption.

By taking better account of energy and climate criteria in public procurement, greenhouse gas emissions could be reduced, structural savings gained and operating expenses decreased. So far, however, energy efficiency or emission reduction targets have guided public procurement and investments only to a varying degree. This is partly explained by a lack of e.g. procurement expertise, guidelines and best practices.

Large urban regions occupy a central position in both causing and curbing climate change. In addition to meeting their global responsibilities, meeting the challenges posed by climate change is essential to ensuring the vitality of and well-being in urban regions, sustainably and in the long term. The uncontrolled expansion of urban regions has resulted in longer journeys to work and services, and increased use of private cars. In the peripheral zones of cities, land use planning and construction management should be employed to ensure a cohesive urban structure. A sufficient population base in built-up areas ensures economical municipal engineering, the arrangement of public transport and the availability and accessibility of services.

The Government has launched a local government reform, with the aim of creating a thriving municipal structure built on economically robust municipalities. Economically robust municipalities are capable of conducting successful policies in business and industry and carry out development work, and are able to efficiently prevent urban sprawl and address the challenges posed by climate change.

Fostering the cohesion of urban structures, sustainable development and social cohesion could be supported through the letter of intent procedure for land use, housing and transport between the state and large urban areas, as part of agreement-based urban region policy. These MAL letters of intent steer land use, housing and transport solutions and the order of their implementation, supporting the formation of a cohesive urban structure founded on sustainable forms of transport, where the location of services and workplaces has been considered from the viewpoint of accessibility.

The emission reduction targets under the climate policy require major investments in the development of land use, housing, transport, and in the production and consumption of energy in the largest urban regions. Enhancing the cohesion of the urban structure and the focusing of housing construction in areas near efficient public transport connections are among the keys to this. The development of higher-quality housing and transport solutions requires that the state and municipalities commit to experimental practices. Through bold goals and experiments, urban regions in Finland could be developed into forerunners in the development of low-carbon communities.

Land use, housing and transport must be reconciled in a manner that reduces the need for private car use, while improving the preconditions for using more environmentally-friendly means of transport. A strong basic municipality complying with the objectives of the local government and service structure reform would be capable of efficiently meeting the needs for the reconciliation of land use, housing and transport. In rural areas, the challenges posed by climate change could be addressed by increasing the use and production of energy based on local, renewable sources, improving energy efficiency, particularly within housing, construction and transport, favouring local food and energy, and developing local, combined solutions for e.g. service provision, in order to rationalise transports and travel.

Several energy and climate-related cooperation schemes are currently underway in the local government sector. Among Finnish municipalities, over 40% engage in systematic climate efforts, and some third have prepared a climate strategy. Over 50 municipalities or joint municipal boards have joined in the municipalities' climate campaign. For more than ten years, an energy efficiency agreement system has been in place between the municipalities and the state. Using the number of residents as the basis of calculation, around 70% of municipalities have joined this system. In Finland, 32 cities have joined the Covenant of Mayors system, which has more than 4,000 participants EU-wide. This system involves local and regional authorities, who commit on a voluntary basis to increase energy efficiency and the use of renewable sources of energy in their regions, in order to meet EU targets.

In Finland, there has also been a successful initiative for carbon-neutral municipalities (HINKU), where the municipalities, trade and industry, municipal residents, research institutes and experts collaborate in finding suitable means of reducing emissions. In addition, six large cities have agreed on close cooperation in this field. Pioneering municipalities, climate initiatives and best practices under development play a key role in activating the rather fragmented local government sector.

There has been recent dialogue with other Nordic countries, and studies have been conducted on the opportunities of harnessing domestic cost-efficient emissions reduction projects and/or programmes within the non-ETS sector, as an alternative to employing flexible mechanisms.

A low-carbon economy is one of the key priorities in the next EU Structural Fund period 2014–2020. A requirement has been set for the European Regional Development Fund to direct at least 20% of its funds to promoting energy efficiency and renewable energy. In the case of other funds too, sustainable growth and the low-carbon perspective are used as one set of grounds, for example with regard to skills in the European Social Fund and with regard to the utilisation of bioenergy in the European Agricultural Fund for Rural Development.

105) *Public sector actors will be encouraged to reduce greenhouse gas emissions from procurement and their own operations, while improving energy efficiency.*

106) *The achievement of climate objectives will be promoted in cooperation with the public sector and the entire production and service chain, e.g. by developing new operating methods and creating social and technological innovations and experiments.*

107) *In urban regions and built-up areas, enhanced cohesion of the urban structure will be promoted as part of planning a high-quality living environment. Dependence on private cars will be reduced through land-use planning, by steering construction in zones that offer the opportunity to walk, cycle and use public transport. Resources allocated for transport will be targeted at small, cost-efficient development measures that promote public transport, walking and cycling.*

108) *Municipalities will be encouraged to plan energy-efficient, high-quality communities, and planning and assessment tools employed to this end will be developed.*

109) *Enhancing the cohesion of the urban structure in major urban regions and reconciling regional land use and the transport system will be made more efficient by means of the MAL letters of intent and, if necessary, legislative amendments. The binding nature of the MAL letter of intent procedure will be increased by taking better account of service structures and the operating conditions of businesses. Promotion of a low-carbon economy is also one of the priorities in the forthcoming Structural Fund period 2014–2020.*

110) *Municipalities and the state will jointly carry out pilot projects to promote sustainable means of travel (for example, high-quality cycle paths to highlight the cycling opportunities in city centres and improve the image of cycling).*

111) *The management and assessment of environmental issues in state organisations will be enhanced by setting ambitious energy and environmental objectives, monitoring their achievement as part of central government budget planning, and strengthening networking.*

112) *A Government resolution will be prepared on directing public procurement to support the development of innovative and sustainable cleantech solutions (relating to, for example, energy and material efficiency and renewable energy) and their domestic market references. To achieve this goal, the sustainable procurement advisory service will be supported, risk financing instruments developed, and pioneering municipalities selected.*

113) *Annual transport emission targets will be prepared for central government organisations, to serve as guidelines in vehicle procurements and as methods used by the organisations in arranging transport.*

114) *Coherence of emissions calculations in regional climate efforts, as well as consistency of analyses on adaptation to climate change and the opportunities for utilising the results in the monitoring of national climate policy, will be strengthened.*

115) *The links between climate efforts and sustainable consumption will be strengthened at regional level, for example by developing tools to support municipalities and municipal residents in making energy- and material-efficient choices.*

116) *Opportunities for utilising cost-efficient domestic emission reduction projects and/or programmes outside the emissions trading sector will continue to be investigated. Opportunities for contributing to the required funding and launching a pilot phase for the implementation of such projects or programmes will be explored.*

6 ADAPTATION TO CLIMATE CHANGE

Alongside curbing emissions, adaptation to climate change forms part of climate policy. Finland's National Strategy for Adaptation to Climate Change was adopted, as part of the Government report on near future policy lines for energy and climate policy, in 2005. The adaptation strategy is aimed at strengthening and increasing Finland's ability to adapt to climate change, while reducing the costs incurred by society due to climate change.

In 2012–2013, the national adaptation strategy will be assessed with respect to its implementation and updated. In this strategy update, account will be taken of the EU's adaptation strategy, to be completed in 2013, the guidelines of the Government's 2009 foresight report, as well as results obtained from the Climate Change Adaptation Research Programme and other research projects.

117) *When updating the National Strategy for Adaptation to Climate Change, a concrete approach will be strengthened in implementing adaptation, the significance of the direct and indirect global, regional and local impacts and risks arising from climate change will be assessed, and measures will be targeted, in a cost-efficient manner, at the most significant impacts and key factors. The indirect impacts of worldwide climate change on Finland will be studied.*

118) *Possible synergies and conflicting aspects of climate change adaptation and mitigation objectives and measures will be taken into account in the adaptation strategy update.*

119) *Possibilities for adapting to climate change that is more severe than predicted will be explored, while supporting the preparedness of various sectors for more frequent extreme weather phenomena.*

120) *In order to improve society's ability to adapt, risk assessment methods and vulnerability assessments will be developed, including at regional and local level.*

7 THE REQUIRED RESOURCES, FUNDING AND MONITORING

Issues concerning financing needs are discussed and decided on within the framework of the central government spending limit decision and budget process. Table 7-1 presents energy and climate appropriations included in the state budget for 2011–2013. Most of these measures will continue beyond 2013.

Table 7-1. Energy and climate funding in the state budget in 2011–2013, million euros (the table is not comprehensive).

		million euros		
		2011	2012	2013
	APPROPRIATIONS	final accounts	estimated	budgeted
R&D	Energy technology research and development	210	184	176
	Climate research (ministries and the Academy of Finland)	16	21	7,9
SUBSIDIES	Electricity production subsidy (feed-in tariff/wind power plants, wood chip power plants, wood-fuel powered plants, biogas power plants)	0,1	33	125
	Fixed electricity production subsidy (wind power plants, wood chip power plants, biogas power plants, hydro power plants)	-	8,5	-
	Subsidy for land-use planning for wind power	1,5	1,5	1,5
	Repair and energy grants (residential buildings)	44	19	13
	Forest management and basic improvement subsidies (KEMERA)			
	Energy wood harvesting subsidy	14	11	12
	Energy wood chipping subsidy (discontinued at the end of 2012)	5,2	11,3	-
	Subsidies for the production of bioenergy (included in the 2012 budget for the last time, funds available until the end of 2014)	5,0	5,5	
	Certain climate measures under agri-environmental subsidies			
	Long-term grass cultivation on peat fields	0,3	0,3	0,3
	Use of liquid manure in fields	5,3	3,0	3,0
	Measures for winter-time plant coverage	33	30	30
	Renewable energy investment subsidies for micro enterprises under the Rural Development Programme	7,3	11	9,0
	Agricultural investment subsidies for heat plants using renewable energy	6,2	5,6	5,6
	Public transport subsidies	30	30	30
INFORMATION	Mobility management and other public transport development projects	1,0	2,9	2,8
	Communications, guidance, studies	4,6	3,9	3,9
OTHER	Kyoto mechanisms	7,0	0,4	2,0
	Promotion of cycling and walking	20	20	20
	Climate funding for developing countries (ODA, incl. FSF)	62	68	64
	Appropriations TOTAL	472	469	506
	BUDGET AUTHORITY			
SUBSIDIES	Energy subsidy for investments (enterprises and corporations; incl. biofuels and offshore wind power)	114	38	145
	Budget authorities TOTAL	114	38	145
ADDITIONAL ITEMS	Tax subsidy for production of electricity (until 2011)			
	Estimated share of energy repairs in the increased tax credit scheme for domestic costs			
	Certain tax reliefs and exemptions from taxes related to R&D activities and increasing the use of renewable energy			
	Interest subsidy loans for energy repairs in housing companies (Housing Fund of Finland)			
	Interest subsidy loans for low-energy houses (Housing Fund of Finland)			
	Loans, guarantees and investments by Finnvera plc and Finnish Industry Investment Ltd			

Table 7-2 presents preliminary estimates of the entirely new financing needs for 2014–2016, arising from the measures outlined in this strategy and its appendix (programme for reducing mineral oil consumption). However, since a significant proportion of the costs of implementing the strategy will be realised after 2016, these financing needs will be assessed more carefully in the future.

Table 7-2. Preliminary estimates of additional financing needs arising from the new measures in 2014–2016, million euros (the table is not comprehensive).

		million euros		
	APPROPRIATION	2014	2015	2016
SUBSIDIES	Public transport subsidies	22	22	22
	Mobility management and public transport development projects		2,0	2,0
	Subsidy for energy efficiency in transport		38	45
	Electricity production subsidy/expanding the feed-in tariff scheme to cover pellets (replacing coal)	5,0	5,0	5,0
	Promotion of wind power, land-use planning subsidy	1,5	1,0	1,0
OTHER	Promoting the MAL letter of intent procedure		15	35
	Administration reports required for promoting energy efficiency in construction and the use of renewable energy, developing assessment tools for the planning of energy-efficient, high-quality communities, long-term strategic work on construction	1,5	1,5	1,5
	Additional work following the Energy Efficiency Directive: reviews, communications, guidance, studies, development of the Farm Energy Programme	2,3	2,3	2,3
	Appropriations TOTAL	32	86	114
	BUDGET AUTHORITY			
	Energy subsidy for investments: e.g. additional needs following the clean energy package	15	15	15
	Budget authorities TOTAL	15	15	15

The above tables do not itemise funding for all energy and climate policy measures. Additional funding for projects is provided e.g. through business subsidies granted by ELY Centres and the EU funding systems. The various branches of the public sector will also incur expenses due to adaptation to climate change. Such expenses will be addressed in the National Strategy for Adaptation to Climate Change, to be updated.

Existing monitoring mechanisms will be utilised in monitoring the strategy. Such monitoring should be enhanced, however, and foresight scenarios should be prepared more often. These scenarios must be drawn up to enable separate examination and reporting for the ETS and non-ETS sectors. In addition, when assessing and monitoring the impact of measures,

attention should be paid to the division between the ETS and non-ETS sector. If improvements in the quality and content of monitoring are sought, however, new resources and operating methods need to be considered. In addition, possible amendments to legislation governing energy and climate matters will be assessed when developing such monitoring.

APPENDIX: PROGRAMME FOR REDUCING THE USE OF MINERAL OIL

In accordance with the Government programme, the Government will prepare a programme for the reduction of oil dependency, as part of the new energy and climate policy strategy. Since this strategy will be aimed at increasing the production and use of bio-based oil products, the focus will be on reducing mineral oil consumption.

Should no new measures be taken, in Finland the share of oil in total energy consumption will decrease from approximately 24% in 2011 to around 20% by 2020. This is one of the lowest figures in Europe, and in industrialised countries in general. In the future, the use of mineral oil will decrease, or be decreased in transport, as biofuels and electric cars gain ground, and in the heating of buildings as heat pumps and wood-based fuels become more common. In the heating of buildings, the use of oil should be replaced also with heating solutions that increase demand response, without significantly undermining the sufficiency of electric power supply in the coldest winter periods. Within the industry and electricity production, oil has been replaced with other fuels, where financially sensible. According to the revised baseline scenario, the share of mineral oil would fall to 17–18% by 2025. If it were possible to give up oil in building-specific oil heating at an accelerated pace, the share of mineral oil could be decreased to 16–17% and, based on intensified measures affecting transport, even below this figure.

121) *The target will be to decrease mineral oil's share of Finland's total energy consumption below 17% by 2025.*

Key measures for reducing the use of mineral oil include statutory biofuel blending obligations, more efficient use of energy in vehicle traffic, improving energy efficiency in general and promoting transport based on electricity or other power sources.

Unlike many other sectors, transport continues to depend almost entirely on fossil fuels as a source of energy. Successful transition to new forms of propulsion in the transport sector requires persistence, a systematic approach and cooperation between various actors. For this purpose, in January 2012 the Ministry of Transport and Communications appointed a

working group on future forms of propulsion in transport to consider a determined pathway towards zero-carbon transport.

Reducing the use of oil weakens the maintenance of transport equipment suitable for commercial oil transportation. Besides the distribution of energy and transport fuels, transport equipment is needed for the transportation of back-up fuels, in case of disturbances in the supply of natural gas and peat. In such situations, a large number of transport equipment may be needed. Another option would be to store considerable back-up fuel reserves at each site of consumption. A significant reduction in the use of oil requires development of the related legislation or arrangements. In the case of natural gas, the situation will be improved if and when the supply of natural gas is ensured through a gas pipeline to the European gas network, or with an LNG (liquefied natural gas) terminal and the related LNG reserve.

The programme for reducing mineral oil consumption is being drawn up as a result of this strategy. Some of the strategic guidelines below, which are closely related to reducing the consumption of mineral oil, are included in other parts of this strategy. These guidelines are reiterated here.

- *In cooperation with the Ministry of Transport and Communications, the Ministry of the Environment, and the Ministry of Finance, the Ministry of Employment and the Economy will prepare steering measures aligned with the clean energy package. These measures will mainly be outlined in connection with preparing the roadmap to 2050 for Finland. Measures with a budget impact are aimed to be discussed in connection with the spending limits procedure for 2013 and 2014. (guideline 24 in chapter 3.4)*

122) *Demonstration of second-generation biofuel production technologies and the launch of commercial production will be promoted.*

123) *Construction of facilities that manufacture biofuel from domestic waste and forest-based raw materials will be promoted, along with the use of such fuels in transport and heating.*

124) *The objectives and requirements set for the use of biofuels and bioliquids in transport and heating will be assessed, taking account of the limitations proposed by the European Commission in the use of traditional biofuels, and the impacts of*

this proposal on ensuring a sufficient supply of advanced biofuels. The required changes will be implemented as part of the distribution obligation.

125) *Similarly to the biofuel distribution obligation for transport, the opportunity to switch, cost-effectively, to a binding distribution obligation for biofuels intended for heating, will be explored.*

- *Opportunities for the more forceful promotion of improved energy efficiency in road transport will be assessed without delay, including energy subsidies to improve the energy efficiency of public transport and goods transport and to curb the increase in the cost of transport services, as well as incentives for the acquisition of vehicles that are more energy-efficient. This assessment will be carried out as part of the implementation of the programme to reduce mineral oil consumption. (guideline 14 in chapter 3.2)*
- *Implementation of the national intelligent transport strategy will be ensured in different modes of transport, in order to improve the energy efficiency of the entire transport system. (guideline 15 in chapter 3.2)*
- *Production of biofuels and bioliquids will be increased. Their testing and adoption e.g. in shipping and air traffic, will be promoted, in response to the challenges set the by emissions trading system and to comply with the stipulations of the International Maritime Organisation, the International Civil Aviation Organisation and the EU. (guideline 36 in chapter 3.6)*

126) *Technologically neutral financial and regulatory guidance related to alternative propulsion will be further developed, taking account of the cost-efficiency and limitations set by EU law. In addition, informative guidance related to alternative propulsion will be developed.*

127) *A plan will be prepared on the extent of a distribution infrastructure for alternative propulsion, in order to achieve sufficient coverage. Determined action will be taken to establish an LNG infrastructure in Finland, to serve maritime traffic, and in the future possibly also heavy traffic. The creation of a charging infrastructure for electric cars will be ensured, by taking this into account in building regulations and construction.*

128) *Influence will be exerted at EU level in order to establish uniform standards and guidelines.*

129) *Research on various vehicle technologies will be continued from the perspective of environmental considerations, safety and usability. When possible, use will also be made of EU funding. The advantages and disadvantages related to e.g. converting traditional cars (conversion into an electric, FFV or natural gas vehicle) will be examined.*

130) *Opportunities for changing the grounds for the calculation of car benefit, in order to base the benefit on the vehicle's CO_2 emissions, will be investigated.*

131) *When reducing the consumption of oil, it must be ensured that any decrease in transport equipment reserved for oil transportation does not weaken the current reliability and security of supply.*