FRIEDRICH EBERT STIFTUNG

Study

Resource Efficiency Gains and Green Growth Perspectives in Estonia

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- Estonia's energy production is dominated by fossil fuels, including domestic oil-shale. The share of renewable energies (biomass, windpower) has rapidly increased since 2007. Although CO2-intensity has been falling in recent years, it still remains more than twice as high as the EU average. Both the energy sector and industry remain significant emitters of greenhouse gases.

- The main potential for energy savings and increased effiency lies within the building sector: better insulation of buildings, improved transmission networks, introduction of heat metering, stricter thermal standards. Furthermore, there is a potential in the transport sector: more efficient cars, e-mobility. Measures are supported by government through credit guarantees and direct investment grants.

- Estonia has implemented a range of policy measures: quantitative goals and targets, new energy effiency requirements, tax reform with increased taxation of fossil fuel products, research and development. Altogether, this has raised the awareness of energy efficiency, energy saving and climate change. Most importantly, energy gained from renewables is promoted with purchase obligations and feed-in tariffs. However, the government has not yet abolished subsidies to oil-shale energy production.

- Taken altogether, policy measures to support a green economy remain fragmented and mainly driven by external forces, such as the EU. Although environmental issues have been high on the society's agenda since 1990, people's understanding of the relations between the economy and the environment remains low.

Content

1. Current Situation

Estonia, officially the Republic of Estonia, is a state in the Baltic region of Northern Europe. It is bordered to the north by the Gulf of Finland, to the west by the Baltic Sea, to the south by Latvia (343 km), and to the east by Lake Peipsi and the Russian Federation (338.6 km). Across the Baltic Sea lies Sweden in the west and Finland in the north. The territory of Estonia covers 45,227 km^2 and has a temperate seasonal climate. Estonia is a democratic parliamentary republic and is divided into 15 counties and 246 municipalities. About 68 per cent of the population is urban. The capital and largest city is Tallinn. With a population of 1.34 million, Estonia is one of the least populous members of the European Union, Eurozone and NATO. Today, Estonia has the highest GDP per person of any country that used to be part of the Soviet Union. GDP (PPP) was 27.6 billion USD (2010), which makes 20,608 USD per capita (see Table 1).

Estonia is listed as a High-income Economy by the World Bank and a High-income OECD member. The United Nations lists Estonia as a developed country with a Human Development Index of »Very High«. The country also ranks highly for press freedom, economic freedom, democracy and political freedom and education.

Although the country and its share of global trade are small, the development of the Estonian economy over the past decade has been relatively rapid due to EU accession, liberal economic conditions and the stable conservative fiscal policy of all governments since the restoration of independence in 1991. Also important is the promotion of export-oriented industries through credit guarantees and investment support (see Table 2).

The energy and material content of Estonian GDP are four to five times higher than the EU average due to the low efficiency of energy production and the depend-

Table 1: Development of GDP, Estonia, 2006–2010

		2006	2007	2008	2009	2010
Gross domestic product (GDP)	Billion USD current PPP	25.7	28.5	29.2	26.6	27.6
GDP per capita	USD current PPP	19 134	21 262	21 802	19 876	20 608
Gross national income (GNI) per capita	USD current PPP	18 134	19 795	20 626	19 414	19 682
Household disposable income	Annual growth %	11.5	12.6	0.1	–7.9	–

Source: OECD.

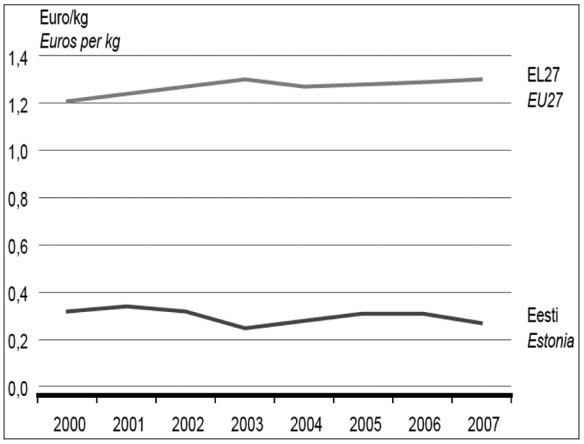
Table 2: Trade by commodity groups and major trade partners, Estonia

MERCHANDISE TRADE 2010	Value		Annual percentage change		
2010			2005-2010	2009	2010
Merchandise *exports*, f.o.b. (million US$)	11 605		9	-27	28
Merchandise *imports*, c.i.f. (million US$)	12 252		4	-37	21
Share in world total exports 2010	0.08		Share in world total imports 2010		0.08
Breakdown in economy's total exports			Breakdown in economy's total imports		
By main commodity group (ITS)			By main commodity group (ITS)		
Agricultural products	16.0		Agricultural products		13.5
Fuels and mining products	18.6		Fuels and mining products		18.5
Manufactures	64.7		Manufactures		67.1
By main destination			By main origin		
1. European Union (27)	60.9		1. European Union (27)		64.5
2. Russian Federation	14.8		2. Russian Federation		10.5
3. United States	4.2		3. China		6.9
4. Norway	3.2		4. Japan		2.1
5. Nigeria	2.2		5. United States		2.0

Source: WTO.

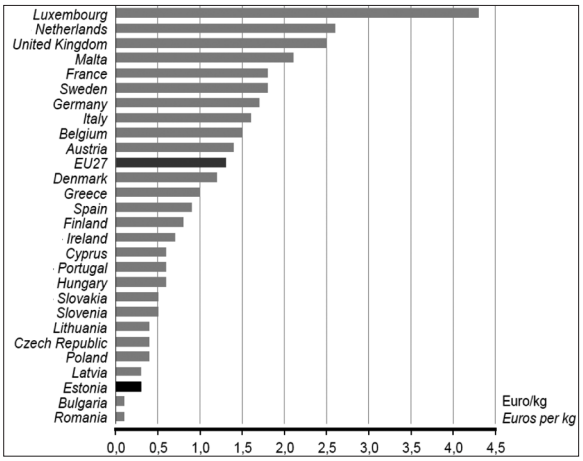
ency of energy sector on domestic mineral rich oil-shale and the low efficiency of natural resource use.

Figure 1: Material productivity of Estonian GDP (EUR/kg)



Source: Eurostat.

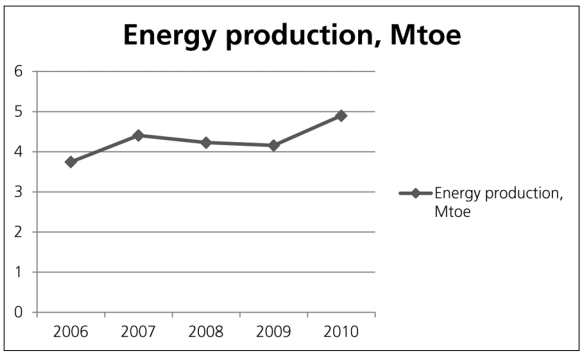
Figure 2: Material productivity of EU member states, 2007



Source: Eurostat.

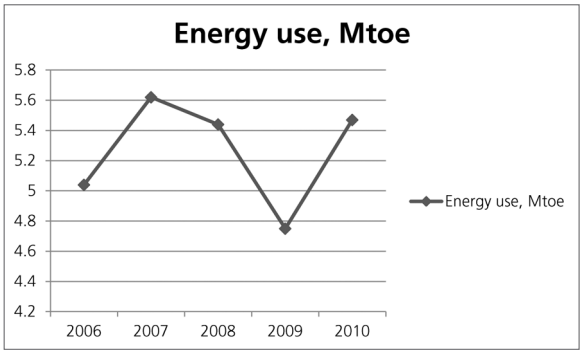
Estonia's energy production is heavily dependent on imported liquid fossil fuels for the transport sector and domestic oil-shale for electricity production. Natural gas's share in energy production is modest, but all gas is imported from the neighbouring Russian Federation. The share of renewable fuels and sources in primary energy production is relatively high due to the tradition of using biomass (wood) in heat production by households. In recent years there has been a rapid increase in wind power and biomass use in electricity production due to purchase obligations and attractive feed-in tariffs to support renewable electricity since 2007. Basic energy data from 2006 to 2010 (where available) are presented in the following figures. Availability of domestic renewable energy resources (wind, biomass) in Estonia is several times higher than needed to cover energy demand of the country.

Figure 3: Energy production, Estonia



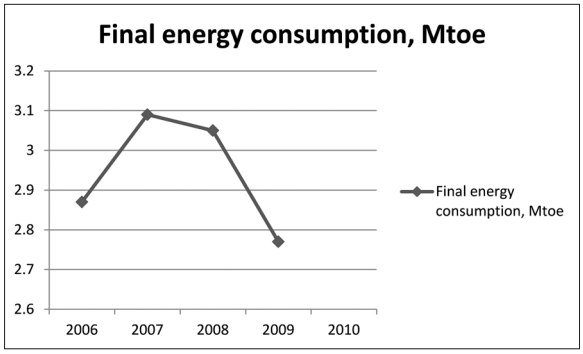
Source: World Bank.

Figure 4: Energy use, Estonia



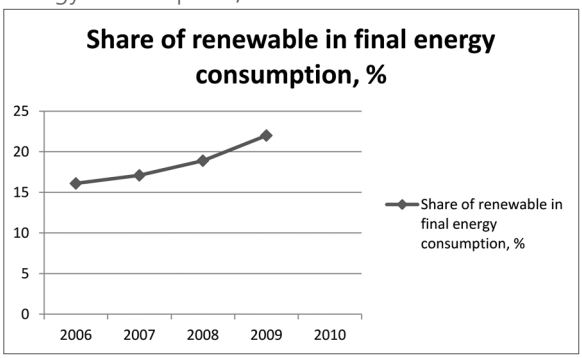
Source: World Bank.

Figure 5: Final energy consumption, Estonia



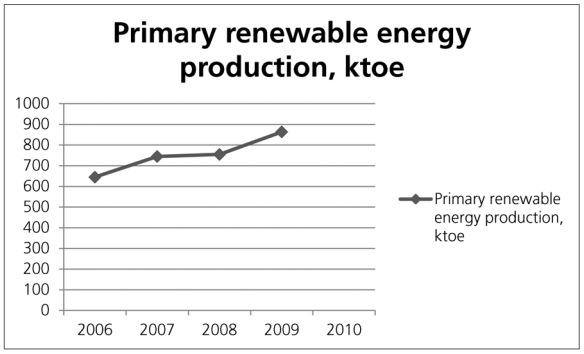
Source: World Bank.

Figure 6: Share of renewable energy in gross final energy consumption, Estonia



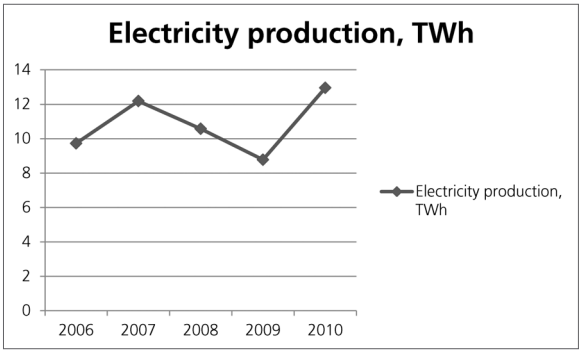
Source: Eurostat.

Figure 7: Primary energy production from renewable sources, Estonia



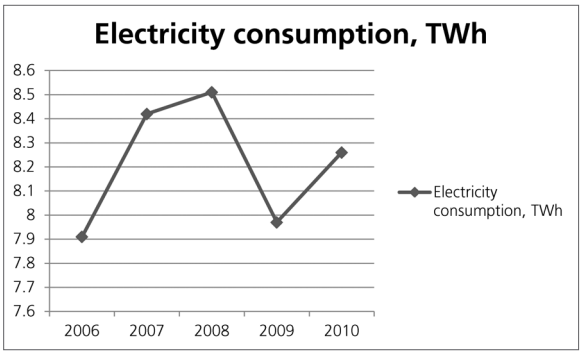
Source: Eurostat.

Figure 8: Electricity production, Estonia



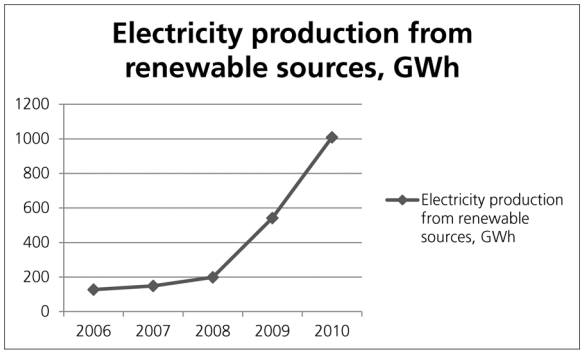
Source: World Bank.

Figure 9: Electricity consumption, Estonia



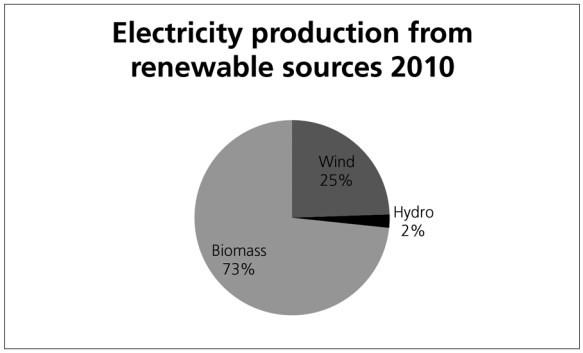
Source: World Bank.

Figure 10: Electricity production from renewable sources, Estonia



Source: Estonia's national report to EU Commission on RES development, 2011.

Figure 11: Distribution of renewable energy production by source, Estonia

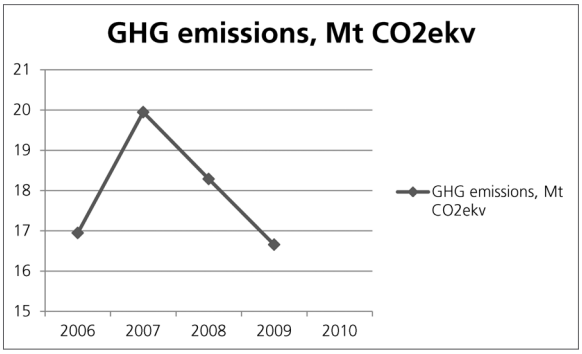


Source: Estonia's national report to EU Commission on RES development, 2011.

Due to the high concentration of power production, most electricity production coming from condensing oil-shale power plants with an efficiency of 32–36 per cent, a high share of fossil fuels in energy production and relatively high losses in the transport of electricity and heat and losses at final users, Estonia's energy sec-

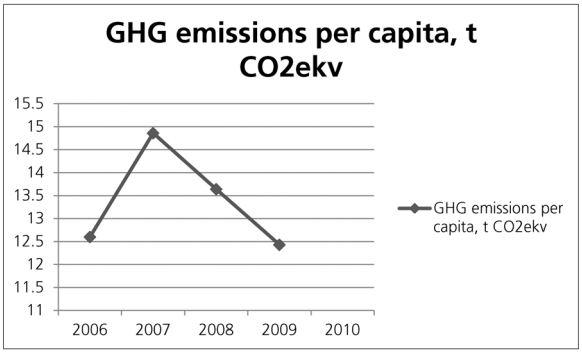
tor and economy are high emitters of greenhouse gases. Per capita GHG emissions were 12.43 t CO2ekv in 2009.

Figure 12: Emission of greenhouse gases (GHG), Estonia



Source: UNFCCC.

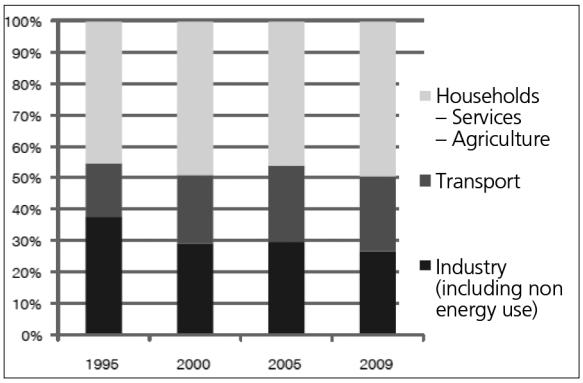
Figure 13: GHG emissions per capita, Estonia



Source: UNFCCC.

The energy sector is the biggest emitter of GHG in Estonia, accounting for about 70 per cent of total CO_2 emissions in 2010. With regard to possible mitigation measures it shoud be noted that the household share in energy consumption is relatively high and increasing (more than 30 per cent in 2010). The shares of agriculture and services are relatively small, together making up around 20 per cent, while the shares of industry and transport represent 25 per cent each.

Figure 14: Energy consumption by sector, Estonia



Source: Enerdata.

Over the period 1995–2009 primary energy intensity (primary energy consumption per unit of GDP) fell at the rapid pace of 4.4 per cent a year, which is more than twice the EU average. Nevertheless, the country's primary energy intensity, measured at purchasing power parity, remains 82 per cent higher than the EU average. Final energy intensity (final energy consumption per unit of GDP) decreased slightly less rapidly (by 3.8 per cent/year). This improvement in energy efficiency is linked to the sharp decrease in the energy intensity of the industrial sector (–7.4 per cent a year between 1995 and 2008); efficiency gains were lower between 2000 and 2008 (–4.1 per cent a year), which in part limited the reduction of final energy intensity over that period. The main reasons behind the shift towards higher efficiency are structural changes in production towards less resource and energy consuming products and assembling of pre-produced products, as well as the replacement of old technologies with modern and less energy consuming technology.

CO_2 intensity (CO_2 emissions per unit of GDP) fell by 5.2 per cent/year between 1995 and 2009; 47 per cent of that improvement was achieved through the fall in final energy intensity, 22 per cent through efficiency gains in the energy transformation sector and 21 per cent through fuel substitutions in favour of low-carbon energies. Despite that rapid improvement, Estonia's CO_2 intensity remains more than twice as high as the EU average, which is mainly due to the importance of oil shale in the country's energy supply.

Table 3: Energy and CO2 intensity of Estonian economy compared to EU average

Overview	2009	2000–2009 (%/year)
Primary intensity (EU=100)	182	-3.7
CO2 intensity (EU=100)	244	-4.7
CO2 emissions per capity (in tCO2/cap)	10.2	-0.7
Power generation		
Efficiency of thermal power plants (in %)	32	1.6
Rate of electricity T&D losses (in %)	11	-5.6
CO2 emissions per KWh generated (in gCO2/kWh)	878	-0.2
Industry		
Energy intensity (EU=100)	124	-3.9
Share of Industrial CHP in industry consumption (in %)	4	-4.6

Source: Enerdata.

Estonia's strategy is to develop an export-oriented economy as the domestic market is relatively small and growth is foreseen mainly via wider integration with global markets. As the government is applying an extremely liberal economic policy, at the moment there are no incentives promoting the switch to greener products other than the emission limit values established by the government and rising energy prices due to investment in production and transmission of power and heat, as well as due to opening up the energy market and the consequent leveling of energy prices.

More than 71 per cent of Estonian GDP is derived from the service sector, industry accounts for 25 per cent and primary branches (including agriculture) for approximately 4 per cent of overall output. The service sector experienced rapid development in the early 1990s as much of it did not even exist in the Soviet economic system. During the Soviet era the function of a large proportion of plants was to produce goods for the military and for Russia. Such production is now superfluous. Therefore many basic necessities had to be imported at first. Recent years have seen the growth of industry surpassing the increase of the service sector, which means that more and more necessary goods can now be produced locally.

The most important sectors of the Estonian economy are the processing industry (approximately 14.5 per cent of overall production), transport, warehousing and communications (10 per cent), commerce (13.5 per cent) and real estate, rental and letting, as well as business services (21 per cent). Agriculture and forestry amount to 2.2 per cent of overall production, construction approximately 7 per cent and government, education and health care to more than 17 per cent. The percentage of governmental administration, education and health care grew because they had to keep on working despite the economic and financial crisis.

Table 4: Contribution of main economic sectors to GDP, Estonia, 2009

	Current prices, million Euros	Real growth %
Agriculture and hunting	178.1	3.0
Forestry	100.8	10.6
Fishing	30.5	11.4
Mining and quarrying	155.0	-10.0
Manufacturing	1,713.7	-25.3
Electricity, gas and water supply	464.7	-5.3
Construction	832.4	-29.7
Wholesale and retail trade; repair of motor vecicles etc.	1,542,5	-19.1
Hotels and resturants	173.6	-23.3
Transport, storage and communication	1,321.5	-15.3
Financial intermediation	412.6	-31.4
Real estate, renting and business activities	2,557.5	-7.3
Public administration and defence, compulsory social security	922.9	1.3
Education	650.9	-2.8
Health and social work	504.3	-2.3
Other community, social and personal service activities	407.5	-14.4
GROSS VALUE ADDED	11,968.5	-14.7
Net taxes on products	1,892.3	-7.2
GDP AT MARKET PRICES	13,860.8	-13.9
Households final consumption expenditure	6,992.7	-18.8
General government fional consumption expenditure	3,048.7	0.0
Final consumption expenditures of non-profit institutions serving households	198.9	-3.5
Gross fixes capital formation and valuables	2,987.1	-33.0
Change in inventories	-399.8	
DOMESTIC DEMAND	12,827.6	-22.1
Exports of goods and services	8,962.8	-18.7
Imports of goods and services	8,115.7	-32.6

Source: Estonian Statistics Board.

Due to Estonia's small size it is impossible to produce locally all the products and services needed by local

people and enterprises. However, in order to be able to import them, something must be exported. That is why export holds such a prominent position in the Estonian economy and its growth. The volume of exports of goods and services amounts to 73 per cent of Estonian GDP; services constitutes about one-third of that. The main profit-making services provided by Estonian enterprises are related to transport and Russian transit but also tourism. More than two-thirds of Estonian industrial production is exported and export growth is driven both by global demand for innovative and green products and by relatively skilled and cheap labor.

Table 5: Exports and imports by commoditiy sections, Estonia 2010

Commodity section by Combines Nomenclature (CN)	Amount (million euros)	Share, %
EXPORTS TOTAL	8,753.5	100.0
Machinery and equipment (XVI)	1,977.2	22.6
Mineral products (V)	1,376.9	15.7
Agricultural products and food preparations (I-IV)	835.5	9.5
Wood and products thereof (IX)	799.8	9.1
Metals and products thereof (XV)	795.8	9.1
Miscellaneous manufactured articles (XX)	668.5	7.7
Transport equipment (XVII)	572.3	6.5
Raw materials and products of chemical industry (VI)	395.0	4.5
Textiles and products thereof (XI)	302.5	3.5
Articles of plastics and rubber (VII)	280.0	3.2
Paper and articles thereof (X)	277.8	3.2
Other	472.2	5.4
IMPORTS TOTAL	9,241.8	100.0
Machinery and equipment (XVI)	2,171.4	23.5
Mineral products (V)	1,613.2	17.5
Agricultural products and food preparations (I-IV)	1,022.0	11.1
Metals and products thereof (XV)	827.5	8.9
Raw materials and products of chemical industry (VI)	736.5	8.0
Transport equipment (XVII)	656.5	7.1
Articles of plastics and rubber (VII)	519.6	5.6
Textiles and products thereof (XI)	459.2	5.0
Wood and products thereof (IX)	261.2	2.8
Paper and articles thereof (X)	224.7	2.4
Miscellaneous manufactured articles (XX)	207.8	2.2
Other	542.3	5.9

Source: Estonian Statistics Board.

Given the current energy consumption structure and recent development trends related to energy efficiency, the main potential for energy savings and consequently also greenhouse gas emission reduction lies with households: current heat energy use per housing floor is almost twice as high as in neighboring Finland and Sweden, also with regard to heat production. In the latter, efficiency gains are easily to be achieved in energy production by switching from low efficiency heat only production to co-production of heat and electricity, as well as by targeted investments to avoid heat-losses in heat transmission networks. There is also potential for energy efficiency in the transport sector as the current car fleet is rather old and fuel consuming compared to the EU average. However, at national level there are no incentives, besides increasing fuel prices, to switch to more efficient (smaller) cars and/or cleaner fuel use.

Industry has made the major contribution to the increase in aggregate efficiency: over the period 1996–2009 there was a reduction of the energy efficiency index of industry by 72 per cent (–9.4 per cent per year). During 2000–2009 the efficiency increase was slower but still high, at 6.8 per cent a year. Estonia is a small country and therefore in many branches of industry there are only a few enterprises. Efficiency improvements can be attributed to some structural changes in industry, in particular up until 2000. Particularly rapid improvement has taken place in the chemical industry, mainly due to the reorganization of oil shale processing. Machine manufacturing and the food industry were the other branches contributing to the efficiency increase.

Between 1996 and 2009, the Odyssee Energy Efficiency Index (ODEX) for the household sector as a whole decreased by 27 per cent. Due to poor statistics on energy consumption in households, the efficiency analysis has to be based mainly on case studies and expert estimations. The efficiency improvement (2.4 per cent) is to a great extent a result of the renovation of building envelopes – additional insulation of outer walls and roofs, replacing windows and so on. An important factor has been the introduction of heat metering (including hot water meters in apartments) which gives people an incentive to take efficiency measures. The specific heat consumption of new dwelling houses is lower due to stricter thermal standards in building codes. At the same time, there is an opposite trend – new dwellings are larger and higher living standards need more energy. The latest study on energy consumption in the multiple-occupant dwellings built as standard in the 1970s in Estonia's capital (Tallinn

Technical University 2010) revealed that average energy use per household is 238 kWh/ m^2 per year, with the share of space heating accounting for 62 per cent, water heating 13 per cent and use of electricity for running household equipment 25 per cent of total energy use.

Since 2010, the government has tripled support for housing cooperatives both by increasing credit guarantees and contributing with direct investment grants to the renovation of houses for the sake of energy efficiency gains. It has also allocated a large proportion of revenues from the sale of CO_2 quotas (AAUs) via the Kyoto Emissions Trade and the national Green Investment Scheme for the renovation of public buildings. Estonia has been successful in selling its surplus Assigned Amount Units (AAU) of saved CO_2 emissions to Japan, Liechtenstein, Spain and Austria and revenues from sales have been used for investment in private and public buildings, improvement and expansion of public transport and the establishment of country-wide infrastructure supporting electro-mobility. If support schemes continue to be as high in coming years, one may expect a relatively high increase in energy efficiency in the housing sector.

Between 1996 and 2007, aggregate energy efficiency in transport experienced a negative trend caused by the development of road transport. Due to poor data, it is difficult to evaluate the reasons for falling energy efficiency in road transport. The ODEX index indicates an efficiency improvement since 2008.

In order to mitigate climate change, Estonia is implementing a range of policy measures, including setting quantitative goals and targets to reduce greenhouse gas emissions; establishing energy efficiency requirements for buildings and introducing energy efficiency labeling systems for buildings, equipment and vehicles; providing credit, guarantees and support for the energy efficiency renovation of buildings in both the private and public sectors; implementing tax reform focusing largely on increased taxation of fossil fuel products; supporting research and development and raising awareness of energy efficiency, energy saving and climate, as well as promoting the development of renewables with purchase obligations and feed-in tariffs for electricity produced from renewables and from efficient co-generation. At the same time, the government has not yet abolished either direct or indirect subsidies to oil-shale energy production which are several times higher than support for renewable energy, distort the energy market and do not treat all energy producers fairly. Full electricity market opening is foreseen after 1 January 2013; today, the market is about 30–40 per cent open for larger consumers but not for households.

Mandatory targets set by the Directive on Promoting the Use of Energy from Renewable Sources for Estonia are as follows:

- 25 per cent share of RES in the final consumption of energy in 2020;
- at least ten per cent share of renewable energy in final consumption of energy in transport by 2020.

Indicative target set by the European Directive on RES electricity of 2001 is 5.1 per cent renewable electricity in gross electricity consumption by 2010. The share in 2010 was 10.4 per cent.

The indicative target set by the European Biofuels Directive of 2003 is for biofuels consumption of 5.75 per cent of petrol and diesel use for transport in 2010. The actual share of biofuel use as motor fuel in Estonia in 2010 was 0.2 per cent.

The »Long-term national development plan for the fuel and energy sector until 2015«, adopted by the Parliament on 15 December 2004, set the following targets:

- a target for biofuels of 2 per cent by 2006 and 5.75 per cent by 2011, calculated on the basis of energy value;
- a share of renewable sources of 12 per cent of gross national energy consumption by 2010. The target has already been achieved due to the high share of wood and wood waste in heat production;
- a share of renewable electricity of 5.1 per cent of gross national electricity consumption by 2010 and 8 per cent by 2015.

The strongest incentive for developing renewable energy production in Estonia thus far has been the purchase obligation and feed-in tariff for electricity produced from renewable sources and from efficient co-generation. In May 2007 the scheme for subsidising of renewable

sources and cogeneration was modified. According to the scheme producers had two options: either to sell electricity at a fixed purchase obligation price or receive a subsidy and sell electricity at a market price. According to the system established in 2007 the subsidies for production from renewable sources were paid only if the production equipment capacity was below 100 MW. In July 2009 the amendments to the electricity Market Act removed the capacity limitation. As a result, Narva Power Plants also began to receive the subsidy when they used wood chips in addition to oil shale fuel in electricity production. The amendment had a substantial effect on subsidy payments, raising the total amount in 2009 to 25.9 million euros, 4.7 million euros of which – or 18 per cent – went to Narva Power Plants. In 2010, the same figures were 45 million euros and 26 per cent, respectively.

Subsidy related regulations were further amended in February 2010. The most significant change in the system of subsidies payable to producers was the abandoning of the purchase obligation. At the same time, the circle of undertakings eligible for subsidies was enlarged. Since 27 February 2010 producers have had the right to receive subsidies in the following circumstances:

- from 1 July 2010 for electricity produced from renewable sources, excluding biomass (5.37 Eurocent/kWh);

- from 1 July 2010 for electricity produced from biomass in a cogeneration process (5.4 Eurocent/kWh); If the electricity is produced from biomass in a condensing process it is not subject to the subsidy; this is a new stipulation intended to limit inefficient use of renewable resources;

- for electricity produced in an efficient cogeneration process from waste as defined in the Waste Act, from peat or from the pyrolysis gas of oil shale processing 3.2 Eurocent/kWh;

- for electricity produced in an efficient cogeneration process with production equipment with capacity not exceeding 10 MW, 3.2 Eurocent/kWh;

- for the utilization of installed net capacity of oil shale using production equipment, if the production equipment starts operations within the period from 1 January 2013 to 1 January 2016, depending on the CO_2 quota price, 1.4–1.6 Eurocent/kWh.

Furthermore, the quantity of electricity produced from wind energy in Estonia and eligible for subsidy was increased from the earlier 400 GWh to the limit quantity of 600 MWh in a calendar year.

From the National Report to the European Commission (2011), we can highlight other policy measures implemented in Estonia to support the wider use of renewable energy:

- investment support for the wider use of sources of renewable energy in energy generation;

- investment support for bioenergy generation;

- investment support for adding value to forestry products;

- investment support for electricity producers who use wind as a source of energy;

- training sessions on regional energy planning to improve the administrative capacity of municipalities and their agencies with regard to the coordination of energy efficiency activities;

- thematic spatial planning for four counties related to wind energy development;

- devising the legal bases for developing off-shore wind farms;

- Estonia's electrical mobility programme: the introduction of electric cars and their charging infrastructure, as well as electricity from renewable sources in the transport sector.

The use of fiscal instruments to increase resource and energy use efficiency in Estonia has been steadily strengthened since June 2005, when the government adopted the National Strategy for Ecological Tax Reform. Since then, fees for environmental use (emission fees, fees for water use and water effluents, waste generation and landfill fees and natural resource extraction fees) have been doubled and increased annually by an average of 20 per cent. Excise duty on electricity produced from fossil fuels was also introduced. As the second phase of Ecological Tax Reform (ETR), since 2010 tariffs for major environmental emissions and resource use

have doubled, with annual tariffs to rise at the same 20 per cent rate fixed until 2015. The second phase of ETR also includes a rise in fuel and electricity excise (to fill in revenue gaps after the 2009 economic crisis) and the elimination of tax reductions for the use of fossil fuels for off-road vehicles and machinery in forestry, construction and mining. Such exemptions still exist for agriculture and fisheries, but their removal is planned in the near future, to be replaced with direct subsidies to the above-mentioned sectors.

National measures to support a green economy as such are fragmented, unsystematic and sometimes contradict the measures applied by government in order to support the current economic structure. There is no comprehensive national strategy at the moment dedicated to the promotion of the green economy and/or a low-carbon economy in Estonia. The National Economic Development Plan for 2020 (the so-called National Lisbon or Competition Promotion Strategy) contains an annex titled Development Plan for a Environment-friendly Economy, which merely describes measures already planned by and implemented as part of other valid strategies, such as the National Environmental Strategy for 2030, the National Energy Sector Development Plan 2007–2020 and the National Renewable Energy Action Plan 2007–2013.

For an economy to be sustainable and green it is not sufficient if a few sectors are »painted green« with minor efficiency improvements and an image change. A green economy is a rigorous political process involving vested interests and civil society. A green economy above all has to do with a change of lifestyle; it is not a matter of energy policy alone, but also water management, soil management, resources in general and, last but not least, education.

Much attention has been directed towards raising public awareness of the environment in Estonia, but not particularly sustainable consumption and the creation of demand for green products. Measures include development of environmental education and a network of county environmental education centers. Training days, seminars, national and international conferences and the activities of scientific centers and ecological reserves also contribute to raising awareness. Most of the awareness-raising initiatives are financed by the Environmental Investment Centre (Keskkonnainvesteeringute Keskus). More specific examples include raising the awareness of various stakeholders (for example, consumers and enterprises) with regard to bioenergy with the aim of increasing its usage in Estonia. Also, consumers are informed of different possibilities for saving energy. This includes the efficient use of energy in households, industry, services, the public sector and agriculture.

The principles of sustainable development are also considered in the curriculum of basic and upper secondary schools. Promoting interest in the natural and exact sciences in schools and raising the awareness of different groups in society (for example, employers, those working in education or politics and so on) with regard to innovation have a more implicit impact on greening the economy.

The implementation of environment-friendly production is promoted in particular in agriculture and energy. More general measures, such as supporting investments in production equipment and facilities, contribute more indirectly, for example in the processing industry.

Currently, greening the economy (for example, principles of energy-saving and/or protecting the environment) is not considered in procurement procedures. However, the introduction of such principles is planned up to 2013. A National Energy Technology Research and Development Programme has been created aimed at developing new energy technologies focusing on the use of renewable energy sources and developing the use of oil shale. Also, one important criterion in financing research and development activities and developing new competitive technologies, products and services in enterprises is that these activities are environment-friendly and clean. More indirectly, supporting the introduction and implementation of innovative technologies in enterprises also contributes to greening the economy, even though this is not the primary target of these measures.

As an example of entrepreneurial schemes, cooperation between research and development institutions and private sector enterprises is supported through technology development centers. Since the program was approved in 2002, five centers have been launched on biotechnology, nanotechnology, food technology and information and communication technology.

One of the aims of the Estonian research and develop-

ment and innovation strategy for 2007–2013 is focusing the research and development activities on specific subjects and creating knowledge in disciplines that are a priority for Estonia. For this purpose, research and development programmes are being initiated in areas such as energy, information technology and biotechnology. Furthermore, one of the activities planned within the framework of sustainable development is enhancing skills and training experts in sustainable energy during 2008–2013.

As a past example of such initiatives, biofuels were exempt from excise duty in 2005 until 1 January 2010. According to the report on implementation of the sustainable development strategy in Estonia, this provided the impetus for founding several enterprises producing biofuels.

During 2008–2013 the national waste management plan is to be renewed. For example, waste management facilities not conforming to requirements are being closed down and the creation of new regional facilities is being supported (including waste disposal sites and biowaste handling facilities). This will probably also lead to the creation of new jobs requiring green skills.

With more general investments in new innovative products and services, some impact on the creation of new green jobs may also emerge. However, the extent of this impact is currently unknown.

To make products and production technologies more environment-friendly, the principles for granting the European Community eco-label and eco-management and audit scheme valuation procedures are being introduced.

No specific ministry or government department has been set up to deal with green issues. Instead, responsibilities are divided within the existing structure. In terms of climate, environmental protection and resource use issues, the main responsibilities are with the Ministry of the Environment, whose responsibility is the development and implementation of the Estonian Environment Strategy 2030 and the respective action plans. In terms of sustainable energy policy, the sustainable energy division of the Ministry of Economic Affairs and Communication is responsible for implementing state energy conservation policy. In addition, the State Chancellery is coordinating two strategies, which also have an impact on the development of the green economy in Estonia: Implementation of the European Union sustainable development strategy in Estonia (in Estonian) and the Estonian action plan for growth and jobs 2008–2011 (in English).

2. Prospects for green growth/ resource efficiency

The green economy is globally growing rapidly, pushed by global environmental concerns and lack of progress in implementing the Millennium Development Goal for the elimination of poverty and in changing consumer values. One of the goals of the European Union for the coming decade is to regain global competitiveness by developing the green economy. Also for Estonia, switching from the current economic model to the green economy is key for sustaining socio-economic wellbeing and the quality of the environment and for creating new jobs in manufacturing, construction and services.

Based on current resource use and energy use statistics and the production structure of the Estonian economy, it is obvious that the greatest potential for greening the economy is in mining, energy production, construction materials production and construction, as well in households. In agriculture, the potential lies in switching from conventional intensive and energy consuming agri-practices to organic agriculture using and maintaining ecosystem services. The potential for new job creation in agriculture also lies in its huge biomass-for-fuel production capacities and more intensive use of agricultural waste than is the case today. In services, further development of ICT infrastructure and related services is provides strong potential for new resource and energy efficient jobs. The invention and development of Skype, the creation of software for mobile phone payments for different daily services or individual mobile phone tracking and positioning related tools, mobile phone based addressing and payment systems for mail and parcel delivery are just some examples of the capabilities of Estonian ICT companies.

The ageing of the population is also creating growing demand for specific (including health care related) services. New jobs are needed to help satisfy this demand. A particular branch of the economy in which green jobs can increasingly be created is waste management, to-

gether with growing demand for recycling and re-use of waste materials, especially electronic waste, packaging material, plastics and mineral materials.

In other sectors of the economy, such as transport, forestry and wood processing or manufacturing, the potential for efficiency gains in resource and energy use are also high compared to the EU average and consequently the reduction of negative environmental impacts could be enormous. However, the potential of these sectors for creating new »green-collar« jobs is much smaller, if renewable fuels production from forestry based biomass is excluded.

Green jobs can be created by technology change and by developing low-carbon and low-resource products and services; by applying in product development eco-design principles; by increasing energy and material use efficiency; by implementing environmental management systems; and by rising consumer awareness and using green procurement.

In energy production sectoral potential for green growth and creation of green jobs lies in the rapid deployment of renewable energy sources, the replacement of today's highly concentrated and inefficient fossil oil-shale-using condensing power-plant power production capacities with more distributed and efficient co-generation plants using biomass and by reducing losses in transmission. Also feasible is the production of biofuels and fuels from waste, to satisfy increased demand for low-carbon energy both in Estonia and in neighboring countries. There is huge potential for green growth in the wider production and use of equipment and components for energy production from renewable energy sources: wind turbines, towers, blades, transformers, electrical appliances, PV panels and solar-heat panels and heat pumps.

In mining, green job development is possible by reducing demand for raw mineral construction materials and replacement of raw materials with recycled ones. One aspect of the heritage of the Soviet era in Estonia is the huge quantity of abandoned military, industrial and agricultural infrastructure (buildings and facilities) which are derelict and pollute the landscape. Demolishing abandoned infrastructure, crushing and production of the recycled filling and construction material and its use for building road infrastructure would decrease the need to open new mines and quarries for sand, gravel and limestone. Mining residuals and wastes from oil-shale extraction and combustion (6–8 million tonnes of waste per annum at current oil-shale use level: ashes, limestone) should be used for the replacement of raw mineral materials. As oil-shale filter ashes properties are close to cement, increased use for filter ashes in the construction material industry has vast potential for creating new jobs.

In construction, the renovation of energy-wasting buildings to make them energy efficient, the construction of new low-energy buildings both for housing and for business use; production and increased use of insulation materials; wider use of renewable and reused building materials; producing and using energy efficient heat pumps for heating; energy recycling ventilation devices, construction details and so on, provide good opportunities for new jobs.

One sector that is already making a substantial contribution to enhancing energy efficiency and to the preservation or restoration of the environment is Estonia's wind energy cluster. The wind energy cluster was established by companies who were willing to benefit from and contribute to the rapidly and innovatively evolving wind power development in Estonia. Besides the wind power producers mostly involved in the construction of wind parks and power production, the cluster also provides work for many industries. The cluster's partners include companies in metalworking, IT, wind energy development and electricity production, as well as educational and research institutions. The umbrella organisation of the cluster is the Estonian Wind Power Association. In addition, the wind power cluster cooperates with other communities who share a common interest in the wind energy sector, for example the electrical car cluster and the wind energy clusters of other countries.

In 2011, ABB, the leading power and automation technology group, opened its first production line for solar string inverters and an engineering center in Jüri, Estonia, to meet growing long-term demand for solar-power technology. The new production line has an annual capacity of 400 megawatts and can rapidly expand in response to the growing long-term demand for solar inverters, if required. The engineering center supports the solar inverter business as well as the motors and drives factories based at the same location. ABB has been operating in Estonia since 1992. Currently, the company em-

ploys 1,130 staff at four production sites. Over the years Estonia has become an important high-tech production hub for ABB and has been home to one of three global feeder factories for wind power generators. The speed with which Estonia adopts new technology is shown by the recent order from Kredex, the Estonian state-owned export credit agency, for more than 500 ABB electric car chargers, to be installed across the country. The charging station model chosen for the project, the Terra 51 DC fast charger, can fill up an electric vehicle in 15–30 minutes. Estonia's plans to space these fast chargers a maximum of 50 kilometers apart along main roads will eliminate drivers' concerns about the maximum range of their electric cars.

The growing number of electric vehicles is driving a global market opportunity for charging solutions, including sophisticated monitoring systems and software to support the electric grid. Earlier in the year, the Estonian government started its push for a better EV charging network, providing 507 Mitsubishi i-MiEV electric cars to social workers around the country. In addition, Estonia offers subsidies of up to 50 per cent for private EV purchases.

Manufacturers Konesko and Goliath Wind are preparing to produce small wind generators in order to satisfy the potential distributed generation market in Estonia and globally. In 2008, Renewable Energy Group Ltd, Durham University, the British National Renewable Energy Centre and private individuals founded Goliath Wind. The Estonian Development Fund and private investors have become shareholders. Patented technology was used to develop an innovative direct drive generator. Goliath Wind's innovative small-scale generator the GW 3-100 is a 3 megawatt wind turbine optimised for wind class IIb and III. Its philosophy reflects simplicity and modular design, achieved by passive air cooling and a 12-phase ring generator made of manually replaceable parts. Goliath uses its own innovative ring generator technology with permanent magnets from special composites in order to achieve maximum corrosion protection.

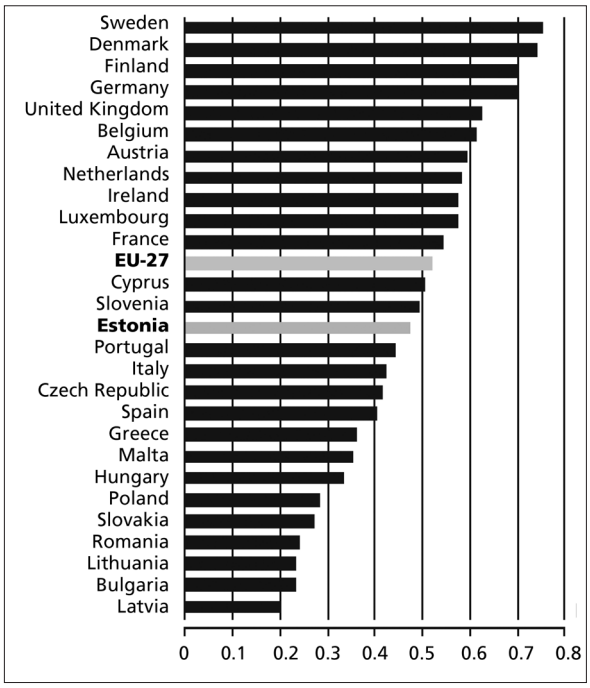
According to Eurostat, total expenditure on research and development in Estonia increased from 0.71 per cent of GDP in 2001 to 1.62 per cent of GDP in 2010. Nonetheless, Estonia remains far behind the average of the 27 member states of the European Union (2 per cent of GDP in 2010). Estonia has not been able to achieve the financing objectives set in the strategy 2002–2006 »Knowledge-based Estonia« (1.1 per cent of GDP in 2004), nor has the European Union achieved the goal of increasing total expenditure on research and development to 3 per cent of GDP by 2010.

Compared to more developed countries, Estonia has fallen behind in applying for patents: 32.92 patent applications were filed with the European Patent Office per million inhabitants in 2009. Compared to the EU27 average, patent applications are four times lower in Estonia than in Europe, where on average 115.8 patent application per million inhabitants were submitted to the European Patent Office. High technology patents were given to Estonian patent seekers at a rate of 1.492 per million inhabitants (in fact, there were only two such patents) compared to the EU average of 7.147 patents per million inhabitants.

As a positive trend, private sector R&D investment has grown faster than public sector R&D investment. While in 1999 private sector investment made up only 23.9 per cent of total R&D investment, in 2004 the corresponding indicator was already 39 per cent. The rapid growth was caused by the low level of private sector R&D investments in 1999, but also by enterprises' closer cooperation with research and development institutions, as well as state support for enterprise research and development projects. Nevertheless, the share of the private sector in research and development is still considerably lower than in developed countries (63.1 per cent in the USA and 69.5 per cent in Finland, with an EU average of 55.5 per cent). This reflects the structure of the Estonian economy, which is dominated by low-technology small and medium-sized enterprises.

The data of the Community Innovation Survey for 2008 showed that Estonia belongs to the leading group of EU member states in terms of enterprise innovation. That is true for the share of innovative enterprises, innovation cooperation and the ratio of innovative expenditure to turnover. The EU ranking by enterprise innovation in 2008 was as follows: Germany 79.9 per cent, Luxembourg 64.7 per cent, Belgium 58.1 per cent, Portugal 57.8 per cent, Ireland 56.5 per cent and in sixth position Estonia with 56.4 per cent.

Table 20: Estonia's ranking with regard to the EU innovation index



Source: Eurostat.

The innovativeness of Estonian enterprises is generally influenced by the same factors as in the EU as a whole: the larger the enterprise or the higher its turnover the higher the probability that it will be innovative. The enterprises belonging to a concern are one and a half times more innovative than those not belonging to it; the same applies to those with foreign equity and those without it. On the most recent European Innovation Scoreboard Estonia and Slovenia were the only ones among the Central and East European countries with an innovation index just slightly lower than the EU mean. A few years ago Estonia was among the stragglers. The radical shift can be explained by the fact that Estonia's annual mean growth of innovation index during 2006–2010 was the second best in Europe after Portugal's.

The Estonian economy has grown very rapidly in recent years due to domestic demand, direct foreign investments and export growth. Despite this, productivity per employee in Estonia was only 69.3 per cent of the EU average in 2010. In the current phase of economic development, enterprises have been able to earn revenue without investing significantly in knowledge or skills. As a result, the competition strategies of most enterprises are based on scost advantage and/or the growth of domestic (credit) demand. Only a few sectors, such as telecommunications and financial intermediation, have high added value per employee and high long-term competitiveness.

In the processing industry, which has the highest employment rate (23.7 per cent), the added value per person is smaller than the Estonian average. The competitiveness of enterprises in several industrial sectors (for example, textiles, clothing and furniture) is decreasing due to rapidly growing labor costs as the growth of productivity cannot keep up with growing employment costs. Profits are decreasing and the dilemma arises of whether to relocate production in a country with lower labor costs or to switch to products and services with significantly higher added value. However, development of products and services with higher added value requires investment in equipment, development projects and highly qualified employees.

The trends for development and innovation among Estonian enterprises indicate that although enterprises are focusing on implementing new technologies, increasing production and improving quality there is still not enough attention to expanding product ranges and finding new markets. Therefore, substantially larger investments in the development of new products and services, which would lead to the formation of new and innovative economic sub-sectors, are vital for Estonia's long-term export capacity and green economic growth.

3. Politics and Society

Environmental issues have been high on society's agenda since the restoration of independence. During the economic downturn at the beginning of the 1990s, the crisis years of 1998–99 and the recent 2009 economic and financial crisis, attention and priorities have shifted to more social issues: securing a job, income and subsistence, often at the expense of environmental quality, sustainability of the earth's eco-system services and sustainable use of non-renewable natural resources. Despite the results of various opinion polls and surveys in which Estonian people express their concerns and willingness to protect the environment and even to pay for environmental improvements, people's understanding of relations between the economy and the environment, as well as the antagonism between economic growth

and sustainable use of natural resources remains low. This is reflected in the poor content and lack of analysis of media coverage of public debates on ecological tax reform, the future of energy and national sectoral strategies. This poor understanding is also reflected in the fact that reports on Estonia's growing ecological footprint – Estonians are among highest per capita CO_2 emitters in the world – have not triggered a wider public debate nor comprehensive action by the government to tackle overconsumption and inefficient resource use.

In the recent all-European survey (Flash Eurobarometer 342, 2012) on small and medium-sized enterprises (SMEs), resource efficiency and green markets, the results show that Estonian SMEs tend to be, in every respect, half as environmentally friendly and oriented towards resource efficiency as the EU27 average. The survey also revealed that Estonian SMEs are much more short-term oriented than their European competitors. Taking into account the fact that SMEs make up the majority of Estonian enterprises this indicates a vast potential for efficiency gains in production, if the proper incentives are introduced by the government, demand for the greening of products emerges and competition grows (see Table 21 on next page).

A third of EU SMEs (33 per cent) are making efforts to improve resource efficiency as one of their top priorities. Around a fifth mention financial and fiscal incentives or other forms of public support (23 per cent), the creation of a competitive advantage/business opportunity (23 per cent) and demand from customers or providers (22 per cent). Anticipating future requirements in terms of legislation (12 per cent) or professional/product standards (12 per cent) are less common reasons for improving resource efficiency.

Besides a limited number of flagship enterprises (ABB, Ecoprint, 4Energia, State Forest Company) the state is a major player in promoting green economy development and environmental goals. The major driving forces are still not national priorities but external forces such as EU climate, environment and energy policies, increasing competition over resources and energy and trends and changes in demand on the global market.

There is a long list of policy measures that have been implemented in Estonia to promote energy and resource use efficiency. The government's Strategic Bureau of the State Chancellery is responsible for overall strategic planning, advised by the Commission of Sustainable Development. The National Development Fund, an independent foundation established by the Parliament, leads and coordinates the envisioning of the country's economic development and supporting innovative private sector projects, one declared priority being to promote the Green Economy. The government unit responsible for energy issues is the Energy Department of the Ministry of Economic Affairs and Communication (MoEAC). MoEAC is supported in implementing energy efficiency measures by the state foundation KredEx and in promoting innovation and export by the foundation Enterprise Estonia.

The major strategy document for the energy sector is the National Development Plan for the Energy Sector until 2020 approved by the Parliament in June 2009. The Development Plan of the Estonian Electricity Sector until 2018 sets strategic objectives for the power sector. The third National Energy Efficiency Programme 2007–2013 was approved by the government in November 2007.

There are no special programmes targeted towards energy efficiency in industry at national level. Nevertheless, efficiency improvement plays an important role in environment-related measures. The National Programme for the Abatement of Greenhouse Gases for 2003–2012, as well as the obligations of the European Emission Trade System, have contributed to efficiency improvements in industry.

The measures introduced by the National Housing Development Plan for the years 2008–2013 are carried out by MoEAC, together with KredEx and in cooperation with local authorities. In 2003, the state started to support the refurbishment of apartment buildings built before 1990. The assistance covers 10 per cent of renovation costs, increased in 2010 to 35 per cent of total costs. To apply for reconstruction assistance, an apartment building must have been through a technical inspection, which includes an energy audit. To conduct such an inspection and audit, the apartment association may apply for a subsidy of 50 per cent of the inspection or audit cost. A Government Regulation of December 2008 stipulates stricter minimum requirements for the energy performance of buildings. Tallinn University of Technology has started training courses for energy auditors. Energy efficiency certificates for buildings have been issued

Table 21: »Greenness« of SMEs in European Union

	Saving Energy	Mini-mising Waste	Recycling	Saving materials	Saving water	Selling your scrap mate-rial to another company	15Using predo-minantly renewab-le energy (inclu-ding own pro-duction through solar panels etc.)	Other (do not read out)	None (Do not read out)	Don'T know
EU 27	64	62	61	57	50	24	11	2	6	1
Belgium	47	50	54	36	32	17	16	4	9	1
Bulgaria	47	29	16	32	28	23	6	6	14	1
Czech Republic	77	67	62	64	56	26	12	1	7	0
Denmark	70	48	42	54	43	34	10	1	13	0
Germany	71	56	57	55	46	26	23	1	7	1
Estonia	41	30	33	32	27	13	4	3	26	2
Ireland	64	67	83	48	49	25	19	2	2	0
Greece	52	27	85	39	33	27	12	0	16	0
Spain	87	79	93	84	80	36	10	0	1	0
France	62	63	62	56	58	21	4	3	5	1
Italy	44	72	53	48	37	14	11	1	6	0
Cyprus	39	28	75	40	36	12	9	0	15	0
Latvia	70	45	13	63	48	24	8	1	14	2
Lithuania	60	25	15	43	44	17	3	2	19	2
Luxembourg	46	43	67	41	41	13	11	0	7	1
Hungary	69	49	21	55	47	20	7	3	5	1
Malta	65	52	74	38	45	20	5	0	6	0
Netherlands	63	56	46	50	24	24	23	3	7	2
Austria	73	46	52	43	38	14	20	6	6	2
Poland	58	35	37	42	41	24	4	2	8	1
Portugal	88	65	80	83	79	33	13	1	0	0
Romania	44	35	35	41	36	15	11	2	20	4
Slovenia	41	36	34	32	20	22	10	2	14	0
Slowakia	75	63	47	62	65	27	9	2	4	1
Finland	76	79	80	80	50	36	24	0	3	0
Sweden	48	49	64	49	30	19	18	4	7	2
United Kingdom	83	93	91	75	61	37	12	2	1	0
Croatia	57	31	33	48	34	26	6	2	10	0
Turkey	74	68	47	76	60	42	13	0	7	0
Macedonia	42	12	20	25	28	6	5	0	26	0
Iceland	51	51	65	57	24	22	12	3	6	5
Montenegro	51	18	19	27	42	11	2	0	35	0
Norway	59	76	67	48	15	29	27	2	4	0
Serbia	62	25	20	35	45	20	7	6	8	0
Albania	31	9	13	14	15	7	6	6	33	1
Liechtenstein	67	43	61	46	36	20	20	5	4	5
Israel	42	38	40	35	33	23	9	4	12	1
United States	74	82	85	71	53	51	15	0	2	1

Highest percentage per item

Lowest percentage per item

since January 2009. Estonia has a surplus (85 million units) of Kyoto Protocol assigned amount units (AAU). Since the end of 2010 Estonia has successfully sold a large amount of AAUs. The revenues from the sales are used in accordance with the relevant Green Investment Scheme (GIS). According to current GIS plans, almost 500 buildings in the public sector will be refurbished to make them more energy efficient.

There are no transport-related national programmes targeted directly at increasing energy efficiency. Nevertheless, there is an indirect impact as a result of measures planned in the Transport Development Programme for 2007–2013. The Plan has set the target of stabilising the absolute amounts of GHG emissions from transport. Increasing the share of public transport is foreseen as a key measure for reaching this target. Revenues from sales of surplus AAUs will be used for investment in electric road transport: creating infrastructure and purchasing electric cars.

The strongest incentives for energy efficiency in Estonia are prices and taxes. Almost all excise duties on fuels are harmonised with EU stipulations; only oil shale is partially exempt. In some cases (light fuel oil and electricity) the rates exceed the EU minimum by several times. Air pollution charges are imposed on the combustion of fuels. Eight groups of pollutants are taxed, including (since 2000) carbon dioxide. The gradually increasing charge rates are fixed up to 2015.

EU accession and adoption of the EU environmental acquis played an important role in driving Estonia's environmental and economic policies. Among the strongest drivers of changes in Estonia's energy production has been implementation of the EU Directive for the reduction of air emissions from large combustion plants and the introduction of the EU Emissions Trading Scheme. In promoting resource use efficiency, the requirements and targets of the EU Packaging Directive and Landfill Directive have played a key role. Despite the government's overall agreement with EU energy and climate policy targets and directions, the Estonian government has continuously fought against EU mainstream policies by demanding special treatment and derogations for Estonian oil-shale energy and chemical industry, thus counteracting sustainable development goals agreed both nationally and within the EU.

In order to support the development of the green economy, a wide range of measures are needed, the most urgent of which are:

- replacing GDP as a way of measuring society's progress with indicators which monitor the use of environment capital and progress in the transition to green growth/green economy (Green GDP, adjusted net savings and so on);

- measuring/calculating the value of and putting a price tag on ecosystem services;

- strengthening fiscal instruments, further implementing Ecological Tax Reform and abolishing direct and indirect subsidies to fossil energy, aiming at further internalisation of the external costs of energy products;

- implementing a tax on motor vehicles to promote the purchase of low-carbon emitting vehicles;

- mapping of the obstacles to and potential for a Green Economy;

- developing a comprehensive and integrated Long-term Strategy for Green Economy Development until 2050;

- introduction of measures to promote energy and resource use efficiency into shorter-term programmes using EU Structural Funds (Operational Programme for Regional Development and Rural Development Programme 2014–2020);

- adopting and implementing Green Public Procurement principles in the public sector;

- setting energy and resource efficiency criteria as determinants of eligibility to receive state investment support;

- adopting (more) stringent energy efficiency benchmarks for the design and construction of buildings and bringing products to the market;

- establishing incentives for the public and private sector to implement environmental management standards;

- ensuring a constant information flow to raise public awareness of sustainable consumption via public media channels.

There are no major social, cultural and political obstacles to the rapid deployment of a green, energy- and resource-efficient economy in Estonia apart from lack of awareness among consumers, the small size of the domestic market, lack of incentives and supporting infrastructure. Due to the openness of the economy and the country's dependence on global trends and drivers, however, these obstacles can easily be turned into opportunities with smart, systematic, comprehensive and targeted measures implemented by the government and the business sector.

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