European Centre for the Development
of Vocational Training

Skills for green jobs

Country report

Estonia

Preface

The world is coping with a host of environmental problems and an urgent need to reduce carbon emissions. A greener future also provides enormous potential for much needed employment growth. However, without suitable skills, this potential cannot be realised. Today, skills gaps are already recognised as a major bottleneck in a number of sectors, such as renewable energy, energy and resource efficiency, green building and retrofitting, environmental services, and green manufacturing. Training response measures are successful where they are coherent across policy domains, systemic and systematic, and targeted at disadvantaged groups. These training measures can only be effective if based on timely identification of skills needs.

The European Centre for the Development of Vocational Training (Cedefop) and the International Labour Organization (ILO) worked together in carrying out the project 'Skills for green jobs', identifying skills needed for greener economies with respect to structural shifts, and new, emerging and changing occupational profiles. The 'Skills for green jobs' study is embedded in the green jobs initiative, a joint initiative of the United Nations Environment Programme (UNEP), the ILO, the International Employers Organization (IOE) and the International Trade Union Confederation (ITUC), to assess, analyse and promote creation of decent jobs as a consequence of the needed environmental policies.

The Skills for green jobs - European synthesis report (Cedefop, 2010) covers six EU Member States: Denmark, Germany, Estonia, Spain, France and the UK, and Annexes 1-6 are summaries of the country reports. The ILO global synthesis report, Skills for green jobs: a global view (Strietska-Ilina et al., forthcoming), analyses the situation in all 21 countries involved in the study (Australia, Bangladesh, Brazil, China, Costa Rica, Denmark, Egypt, Estonia, France, Germany, India, Indonesia, the Republic of Korea, Mali, the Philippines, South Africa, Spain, Thailand, Uganda, the UK and the US). The reports are available at: http://www.cedefop.europa.eu (Cedefop's website; under 'Identifying skills needs', 'Skill needs in sectors') and: http://www.ilo.org/skills/what/projects/lang--en/WCMS_115959/index.htm (the ILO website).

Country reports benefited from major contributions from Kurt Vogler-Ludwig, Luisa Stock, Ida Bayer, Hanne Shapiro, Olav Aarna, Elvira Gonzales, Fernando del Rio, Cristina Castellanos, Cecile Mathou, Steph Charalambous, Michael Lawrie and Shane Beadle. The list of country experts is provided in each full country report.

NB:

The six full country reports are unedited and available only electronically. They were used as background information for Cedefop's *Skills for green jobs - European synthesis report*. Citations from the country reports are not permitted. They can only be taken from the synthesis report itself, available from Internet: http://www.cedefop.europa.eu/EN/publications/16439.aspx [cited 17.8.2010].

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Executive summary

This report on 'Skills for Green Jobs' in Estonia identifies the major challenges and priorities arising from climate change and the policies and strategies developed in response. The report identifies the major sectors with a potential for requiring skills for green jobs. The analysis focuses on relevant skills strategies and programmes, the existing and potential need for skills, and the techniques, systems and governance frameworks through which skill needs are anticipated and assessed. The research is based on a survey of the literature and interviews with experts from the relevant ministries, governmental agencies, case study companies, and training providers.

The Estonian economy has become increasingly greener, and this process must be understood in the context of political, social and economic restructuring that has taken place over the last two decades. Energy production, transport and household consumption have major negative impacts on the natural environment in Estonia. While Estonia benefits from oil shale as a principal mineral natural resource, this is also a major source of greenhouse gas emissions. In order to move towards a greener economy, the Government has defined four major lines of action:

(a) efficiency of energy consumption;

(b) diversifying the use of renewable energy;

(c) development of oil shale based energy production – increasing efficiency and decreasing environmental impact;

(d) decreasing overall environmental impact of the economy and development of green entrepreneurship.

The sectors with major greening potential include: the oil shale industry; energy, gas and water supply; waste management; and forestry and agriculture.

The relative size of the primary sector (especially agriculture) has decreased over time. The tertiary sector has become more important, while the secondary sector has held its share. Economic activities in both the services and manufacturing sectors are continuing to experience growth. The occupational structure reflects these changes, with an increase in the share of professionals and service workers. Employment in tertiary education has increased and at the moment it is 37%. This is due in particular to engineers and researchers playing a crucial role in the green restructuring process.

Green restructuring is heavily dependent on the development and implementation of new technologies and changing public attitudes. The skills response to green economic restructuring therefore includes not only initial and continuous Vocational Education and Training (VET), but also all levels of education. Due to the small labour market size it is difficult to make reliable forecasts of labour market needs on a sub-sector level. (Re)training needs are identified through the annual labour demand forecast. This data informs preparations for commissioned study places in initial VET, higher education, and adult education sectors.

The development of occupational standards for greening occupations demonstrates the importance of both technical skills related to new technologies as well as generic skills such as team work, communication, learning and entrepreneurship.

There is no single strategic document dealing with the green economy and green jobs in Estonia. Long-term strategic documents along with mid-term development plans and individual action plans encompass a range of sectors, including economy, education, research and development. These aspects are covered in other strategic documents, which also contain some skills development needs. Research, development and innovation strategies (namely ‘Knowledge-Based Estonia’) have played an important role in reshaping these sectors. This includes national programmes in key technologies and programmes for supporting the development of traditional industries (including oil shale and energy industries). These programmes, e.g. the National Energy Technology Programme, are concerned with the implementation of new technologies and the development of human capital.

The implementation of strategies and development plans for different aspects of education (general, vocational and training, higher and adult) has shown that these are developing to meet the needs of the green economy. Participation in different EU (European Union) programmes and the delivery of EU structural funds have played a catalysing role in human resource development in Estonia. Estonia currently does not have any programmes specifically targeted at skills development for green jobs.

Effective delivery mechanisms are based on a combination of private initiatives (either individual or corporate) and state support. A good example of this is the development of adult education and training, including in-service training during the last five years.

The key recommendations are as follows:

(a) to strengthen the coordination mechanisms between sectoral (and other mid-term) strategies and the Estonian National Strategy on Sustainable Development (Sustainable Estonia 21). Also, the commissioning of sustainability reports and discussion at associated roundtables should become a regular practice. Furthermore, the initiation of a long-term Lifelong Learning Strategy would be beneficial;

(b) to improve coordination between the development of modular occupational standards as prototypes for partial qualifications and the development of a new generation of modular national curricula for VET. This should be based on a learning outcomes approach;

(c) to bring qualitative (through occupational standards, national curricula, and school curricula) and quantitative (through the state order for study places) methods of skills need identification closer together. This should involve the regular functional mapping of competences in major economic sectors. and will also provide competency profiles for occupations.

1. Introduction

With 1.34 million inhabitants, Estonia is one of the smaller EU countries. The capital, Tallinn, has a population of 370,000, and the urban population overall constitutes over 70% of the total population. Russian is a minority language, spoken by about 30% of people and provided at all levels of education, and this sits alongside Estonian as the majority language. English and German are also widely spoken and understood.

The nature of the labour-market in Estonia, with small numbers in different economic sectors, means that forecasts and generalisations at the sub-sector level are not easily produced. It is also difficult to identify and assess the influence of different policies on a specific occupation. Policies tend to impact at a systemic level. These comments should be seen as limiting factors in the research.

The research is based on a literature survey and interviews with experts from the ministries: Ministry of Economic Affairs and Communications (MEAC), Ministry of Environment (ME), Ministry of Education and Research (MER), Ministry of Social Affairs (MSA) Ministry of Agriculture (MA); governmental agencies: Strategy Bureau of the State Chancellery, Statistical Office of Estonia (SOE), Estonian Qualifications Authority, National Examinations and Qualifications Centre, Enterprise Estonia; companies selected for case studies: Eesti Energia AS (Estonian Energy Ltd.), ABB AS; and training providers: Tallinn University of Technology (TUT), University of Tartu (UT), Estonian University of Life Sciences (EULS).

Political, economic and social restructuring in Estonia over the past twenty years represents an important context for the study. The Estonian economy has become increasingly greener, and this process must be understood in respect to wider restructuring processes. The overall aim of restructuring was to become a 'normal' democratic country with open competitive economy, with government policy on economic restructuring focusing on creating favourable conditions for economic development but not to intervene directly. Having experienced a dramatic economic collapse in the early 1990s (real gross domestic product (GDP)) dropped by almost 40% in the period 1989-94), Estonia became one of the fastest growing economies in Europe (GDP growth of 9.8% in 2005). During 1995-2007, the average growth of the economy was approximately 6%. In 2006, it was estimated that by 2010, the country would be at the level of approximately 62-63% of the EU average GDP.

Most trade (around 80%) takes place with other EU member states. The main trade partners are Finland, Sweden and Germany. Major exports are machinery and equipment, wood and wood products, textiles, agricultural and food products. Major imports are machinery and appliances, transport equipment, metals and agricultural and food products.

The unemployment rate is low compared to many EU countries (4.3% in 2007). Long-term unemployment, however, constitutes 53% of all unemployed (as of 2006), with high incidence particularly amongst non-Estonians. The financial and economic crises have caused substantial drawbacks in the economy from 2008 (in 2009 GDP dropped by 12.8%). During 2009, the unemployment rate abruptly increased to 15.5%.

Green economic restructuring is embedded and entwined within this overall context. The green economy is not a separate development in itself and therefore concepts of ‘green economy’ and ‘green-collar occupation’ have not yet become rooted in Estonia and sometimes cause confusion. Due to this, deciding which sectors of the economy have major greening potential and which occupations are part of the green economy have largely been a question of subjective reasoning.

Turning to the education and training system in Estonia, it is important to note how this has shifted from being a component within the Soviet framework. The general education system comprises of nine-years of basic school and three-years of upper secondary schooling. Initial VET is offered based on lower secondary or upper secondary education. The higher education sector is based on two types of higher education institutions (HEI): universities and professional HEIs. VET institutions, HEIs and a substantial number of other training providers offer diverse possibilities for adult education and training, including in-service training. Following the Soviet era, the research and development system has also changed with public universities and research institutions no longer separated. Industry-related applied research institutes have disappeared, however. Due to a reform in funding frameworks and developments in the curriculum since the 1990s, the overall mismatch between the supply of skills and what the economy demands is now not as so significant.

EU accession and membership has also impacted on Estonia’s development. It has served to significantly promote the strategic planning culture in Estonia. Participation in various EU programmes and the delivery of Structural Funds have played a catalysing role in the development of the green economy and human resource development.

2. Policy context

2.1. Key challenges and priorities for the green economy

2.1.1. Priorities

The term ‘environmentally friendly economy’ is typically used in Estonia instead of the term ‘green economy,’ more frequently used elsewhere in Europe ([1]).

The areas with the greatest impact on Estonia’s natural environment are the energy, transport and domestic sectors. In 2006 for example, the household, industry and transport sectors were the most energy intensive, being responsible for 41%, 21% and 20% of energy consumption in Estonia respectively. The level of energy consumption is also steadily increasing, especially for the industry and transport sectors. In the last seven years, energy consumption levels have increased 60% in the transport sector, and 20% in industrial activities. However, energy consumption has decreased slightly in the domestic sector, with households consuming 3% less energy in 2006 than they were in the year 2000 ([2]). Overall, there is considerable scope for energy efficiency to improve across all key sectors.

The development of the Estonia’s energy sector is based on the following three principles:

(a) the security of the energy supply;

(b) the environmental impact of energy production;

(c) the price of energy.

The most promising sectors for increasing the use of renewable energy are in transport and energy. Currently, 12-14% of Estonia’s electricity is produced using combined heat and power (CHP). During recent years, the share of renewable energy in Estonian energy consumption has consistently been around 16-18%, largely because of the dependence of households on wood fuel. Comparatively, the share of renewable energy in electricity production, however, is low; only 1.7% of total domestic electricity use in 2006 came from renewable sources. Nonetheless, there are some promising signs of renewable energy playing a potentially significant role in Estonia’s energy future. The share of electricity produced using renewable energy sources, for instance, has increased in recent years, mostly due to the active installation of wind parks in coastal areas, and further increases in the use of CHP.

On the whole, it is crucial to invest in developing energy technologies which contribute to environmentally sustainable and energy efficient energy production. This will require the

([1]) Development Plan for Environmentally Friendly Economy (2009).

([2]) Development Plan for the Estonian Fuel and Energy Sector (2004).

expansion of renewable energy sources, and that oil shale based energy production be made more sustainable. In the meantime, environmentally sustainable transport is also becoming an important issue in Estonia. The use of public transport has been gradually decreasing as the number of cars has increased. Nonetheless, public transport still accounts for 30% of domestic transport, 5% more than the EU average. Ensuring that this number does not decrease further is both a challenge and an opportunity.

A further area for development is in the construction industry. The 60s, 70s and 80s saw a rapid expansion in the number of inhabitants and, accordingly, of apartment buildings in Estonia. Consequently, roughly 60% of living space in Estonia was built during that period. Today, the majority of those buildings are in a bad condition, causing substantial energy losses and needing extensive renovation. Renovation of these buildings will result in estimated energy savings of 20-30%. Unsurprisingly, the annual volume of renovation between 2008 and 2010 is expected to reach 150.000 m^2, increasing further to an annual growth of 350.000 m^2 per annum during the period 2011-14 ([3]). Overall, this creates significant potential for new jobs to be created in the construction industry as well as in the development and use of new building technologies.

Lastly, although the importance of the primary production sector has decreased, it also presents significant greening potential. For instance, the forestry and timber processing is especially relevant to the development of green jobs, and a wider green economy, given that roughly half (50.6%) of the Estonia's territory is covered by forest ([4]). Moreover, the agricultural sector cannot be neglected. The environmental impact of the agricultural sector has already significant decreased over the last 15 years. There are significant opportunities in ensuring that this trend continues, especially with regards to dairy cattle farming and organic farming ([5]).

2.1.2. Challenges

The extent to which progress so far has managed to meet the three objectives mentioned above differs. Whilst Estonia is in a relatively favourable situation with regard to energy security and prices compared to other EU member states, Estonia has invested significantly less than the EU average in the environmental sustainability of energy production. This has partly been due to the specific characteristics of Estonia's energy production.

The environmental impact of Estonia's energy production and consumption is particularly high given that domestic energy production is largely based on oil shale; specifically, 90% of all electricity production is derived from oil shale. Indeed, 61.4% of all waste generated results from oil shale mining, oil shale energy production and oil shale based chemical

([3]) Development Plan for Estonian Households (2008).

([4]) Development Plan for Estonian Forestry (2002).

([5]) Development Plan for Estonian Rural Life (2007).

industry. Furthermore, the majority of Estonian air pollution and greenhouse gas emissions come from oil shale energy production or from the use of fossil fuels. However, whilst the use of oil shale has a high environmental impact given the significant amounts of resulting waste and greenhouse gas emissions, it does guarantee electricity supply and independence from imports.

As mentioned above, the rate of energy dependence in Estonia is particularly low. Domestic energy sources account for over 70% of the primary energy supply, 80% of which is based on oil shale and 14% on wood. Imported fuels, mostly natural gas from Russia and oil from Lithuania and Russia, comprise the remaining estimated 30% of primary energy supply. However, the lack of connections to Central European energy networks means the security of the electricity supply is decreasing.

Estonia is located in the area of the Baltic energy market that partly includes Russia as well as Finland. Currently, the only connection with other European networks is that which was established between Estonia and Finland towards the end of 2006, consisting of a HVDC submarine cable Estlink with a capacity of 350 MW. A similar situation dominates the natural gas network – since there are no connections with other EU member states, the only source of supply is Russia.

Although energy security is weakening, Estonia's environmental sustainability has been improving. Greenhouse gas emissions in Estonia have significantly decreased over the last two decades, largely due to significant structural changes in industry. In 1990, total emissions came to 43,594 tonnes of CO_2 equivalent, whereas in 2005, this had decreased to 20,658 tonnes of CO_2 equivalent, a 52.6% reduction ([6]). This is significantly greater than the EU goal of a 20% reduction, or the Kyoto protocol goal of an 8% reduction. However, Estonian energy production remains relatively carbon-dioxide intensive and improving energy efficiency will require further sustained investment in both environmentally sustainable energy and energy sources whose supply is relatively secure.

2.2. The response strategy

The following section summarises the general Estonian environmental policy, goal setting and strategic responses to meet the requirements of increasing the protection of the environment and reducing greenhouse gas (GHG) emissions.

([6]) The Estonian energy system has become somewhat more efficient in recent years (between 2000 and 2004, losses in electricity and thermal energy during transport, storage and distribution have decreased 15% and 18% respectively).

2.2.1. General environmental strategy

The Constitution of the Republic of Estonia, which entered into force in 1992, provides the legal basis for sustainable development in Estonia. The Act on Sustainable Development ([7]) was adopted by the Estonian Parliament (Riigikogu) in 1995 and accordingly, long-term plans on sustainable development have been developed for the energy, transport, agriculture, forestry, tourism, chemical industry, building materials industry and food industry sectors.

The Estonian National Strategy on Sustainable Development – Sustainable Estonia 21 – was adopted by the Parliament in September 2005 ([8]). The Strategy focused on the sustainability of long-term development of Estonia until 2030. The overall aim is to develop an economy which is globally competitive, as well as being environmentally sustainable and which preserves the traditional values of Estonia. Accordingly, the Strategy sets out four principles for the long-term development of Estonia:

(a) viability of the Estonian cultural space;

(b) growth of welfare;

(c) coherent society;

(d) ecological balance.

The Estonian Environmental Strategy 2030 ([9]) builds upon the principles of 'Sustainable Estonia 21' and serves as the basis for the preparation and revision of all sector-specific development plans related to the environment. The Strategy was approved by the Parliament in 2005 and defines long-term development trends for maintaining the natural environment in a good condition, given the links between the environment, economy and society. The National Environmental Action Plan of Estonia for 2007-13 ([10]) serves as the implementation plan for the initial stages of the Strategy.

These general frameworks are supported by several targeted, long-term and mid-term development plans which cover the whole spectrum of environmentally sensitive sectors of the economy, including:

(a) development Plan for the Estonian Electrical Energy Sector until 2018 ([11]);

(b) development Plan for the Estonian Fuel and Energy Sector until 2015 ([12]);

(c) development Plan for Oil Shale Resources Exploitation 2008-15 ([13]);

([7]) Act on Sustainable Development (1995).

([8]) Estonian National Strategy on Sustainable Development (2005).

([9]) Estonian Environmental Strategy (2007).

([10]) National Environmental Action Plan of Estonia (2007).

([11]) Development Plan for the Estonian Electrical Energy Sector (2008).

([12]) Development Plan for the Estonian Fuel and Energy Sector (2004).

([13]) Development Plan for Oil Shale Resources Exploitation (2008).

(d) development Plan for Enhancement of Biomass and Bio-energy Resources Exploitation 2007-13 ([14]);

(e) development Plan for Estonian Households 2007-13 ([15]).

The Government has also introduced more general measures. The current tax policy, for instance, targets the consumption and exploitation of the environment resources. The overall aim is to motivate companies and private consumers to invest in activities with lower environmental impacts and to use natural resources more efficiently and sustainably.

Environmental charges have a relatively long history in Estonia, having been in force since 1991. Most recently, the basis for environmental charges has been determined by the Environmental Charges Act which entered into force in January 2006. The Act determined charge rates for the period of 2006-09 on natural resources, air and water pollutants and types of waste. In June 2009, amendments were made to the Environmental Charges Act ([16]) setting new increased environmental charge rates for 2010-15. Over the years, charges have therefore been modified and charge rates have gradually grown in order to increase their impact. Importantly, revenues from environmental charges are transferred back into environmental protection, helping to reduce and avoid the pollution and damage that accompanies environmental resource management.

2.2.1.1. Renewable energy

There have also been significant developments to promote the use of renewable energy. In 2007, amendments to the Electricity Market Act ([17]) were adopted to introduce higher unit prices for electricity produced from the renewable sources and an obligation for the distribution network owners to purchase green electricity. In the near future, adoption of the EU Renewable Energy and Climate Package ([18]) will have significant impacts on Estonian policy. For instance, implementation of the package will substantially change trading rules for greenhouse gases.

2.2.1.2. Sustainable transport

Transport is also another policy area where the Government has been active. The Government set two main courses of action to promote the use of environmentally friendly transport when it approved the Transport Development Plan 2006-13 ([19]). Firstly, by broadening the opportunities to use environmentally friendly fuels, and secondly, by promoting public

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([14]) Development Plan for Enhancement of Biomass and Bio-energy Resources Exploitation (2007).

([15]) Development Plan for Estonian Households (2008).

([16]) Environmental Charges Act (2005).

([17]) Electricity Market Act (2003).

([18]) Renewable Energy and Climate Package (2008).

([19]) Development Plan for Transport (2007).

transport, in particular rail. To promote the use of environmentally friendly fuels, an excise duty exemption has been put in place until summer 2011; however, this has failed to increase the use of biofuels to more than 0.1% of the overall consumption of automotive fuels.

Furthermore, over the period 2007-13, Estonia will receive more than 52 billion Estonian Kroons (EEK) (€1 = 15,645 EEK). in European Union funding, with 24.7 billion EEK being allocated to development of the living environment. The most important sphere of activity, and financially the largest at seven billion EEK, is water management.

Regarding jobs and skills, the main development has been the approval in October 2008, by the Government, of the Estonian Action Plan for Growth and Jobs 2008-11 ([20]). To promote economic growth and competitiveness, the Action Plan defined four main challenges:

(a) developing an education system, which is more adaptive to the needs of the business sector, and modernising the labour law for promoting flexicurity of the labour market;

(b) increasing the capacity of the research and development sector and directing it more towards the needs of the business sector;

(c) developing a business and investment friendly environment, which strongly supports innovation and international competitiveness of companies;

(d) increasing the environment-friendliness of the energy sector while ensuring the security of the energy supply and the competitiveness of energy sector.

The Action Plan goes on to define nine objectives, among them improving the skills of the labour force. The Action Plan also envisages development of guidelines for environmentally friendly public procurement by 2011.

To summarize, currently there is no single strategic document which simultaneously addresses the green economy and green jobs in Estonia. These important aspects of sustainable and environmentally friendly development are covered in separate strategic documents, which contain some elements of skills development needs.

2.2.2. Green response to the current economic crisis

In November 2008, the Government approved the Estonian Strategy for Competitiveness 2009-11 ([21]). It links the latest initiatives of the Government (September 2008 – October 2009) with the Estonian Action Plan for Growth and Jobs 2008-11 and describes new measures and priorities of the Government.

In less than a year the economic environment in Estonia and Europe has changed remarkably. However, in light of the short-term challenges, the Government has decided to maintain the

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([20]) Estonian Action Plan for Growth and Jobs (2008).

([21]) Estonian Strategy for Competitiveness (2009).

primary focus on medium and long-term objectives, given that consistency in economic policy is an important prerequisite for further economic growth.

The key challenges identified in the Estonian Action Plan for Growth and Jobs 2008-11 remain relevant, although the new situation requires that the approaches be adjusted and a number of new measures be implemented – in particular regarding employment policies. The Government continues to prioritise research and development (R&D) policies, directing increased funding towards intensifying cooperation between R&D institutions and enterprises. In addition to the long-term challenges, the Government has prioritised the following medium-term objectives:

(a) adopting a conservative macroeconomic policy with the aim of keeping the public deficit within the limit of 3% of GDP, joining the Euro area in 2011 and maintaining low public debt levels in order to be able to sustain high investment levels and a favourable level of taxes in the medium and long-term;

(b) raising the export potential of enterprises primarily by improving the general business environment in order to increase investment and productivity. The aim is to maintain the share of exports relative to GDP at its 2008 level, through support measures for export companies;

(c) developing skills by increasing the financing of life-long learning, ensuring more resources for continuing education and retraining activities and using the period of lower employment to raise the skills of 50,000 people by at least one European Qualifications Framework (EQF) level;

(d) maintaining employment levels by improving the business environment and stimulating job creation, increasing public investments and providing additional subsidies with the aim of preventing long-term unemployment.

To better support the recovery of the labour market, the Government has adopted the Action Plan for Reducing Unemployment ([22]) in September 2009. The action plan foresees the extension of active labour market measures as well as increases in the financing of employment programmes in the years 2009-10. Among other activities, the action plan includes support for the creation of new jobs, measures for preventing inactivity, and enhancement of additional training and retraining opportunities. Also the availability and flexibility of career counselling will be increased. In total, active labour market measures will be financed to the amount of 459 million EEK in 2009 and 618 million EEK in 2010 within the framework of the programme 'Increasing the supply of qualified labour force'. The total expenditure on active labour market policy is expected to rise up to 0.42% of GDP in 2010.

Overall, the Government aims to support the recovery of the labour market through two main areas of activity:

([22]) Action Plan for Reducing Unemployment (2009).

(a) increasing the competitiveness of the labour force by raising skills and qualification levels for at least 50,000 people;

(b) retaining employment through supporting the creation of 5,000 new jobs by means of extending the wage subsidy scheme.

Specifically with regards to the environment, the Government plans to design a broader policy of green economic growth in the coming years ([23]). In addition to energy efficiency and renewable energy, an important part of this plan will be improving innovation in environmental technology and higher value-added activities in the use of natural resources. Overall, the Government has defined four major lines of action to enhance the environmental sustainability of the economy ([24]):

(a) increasing the efficiency of energy consumption;

(b) diversifying energy use, particularly towards renewable energy sources;

(c) increasing the efficiency and decreasing the environmental impact of oil shale based energy production;

(d) decreasing the overall environmental impact of the economy and encouraging green entrepreneurship.

The second of the above actions is playing an especially prominent role. For instance, preparations have begun for the Government to adopt an action plan specifically on renewable energy. Already, during the period 2009-13 the Government is investing 2.5 billion EEK in the field of energy efficiency and renewable energy. Together with subsidies for developing electricity production from renewable sources, the investments amount to 4.5 billion EEK. According to the forecasts, these subsidies will continue or increase so that the total amount of public investments to this sector will amount to at least 13.5 billion EEK ([25]).

Renewables are further promoted through the Physical and Social Environment Development Plan 2007-13 ([26]), which enhances renewable energy production through structural funds. Within the framework of the implementation plan, approximately 1.36 billion EEK is planned for the development of the energy sector and the alleviation of climate change. These funds will be used for making electricity consumption more efficient, expanding the use of renewable energy sources and decreasing the emission of polluting substances resulting from the energy system.

There are also significant developments in other areas. For instance, the Minister of Economy and Communications proposed a 6.1 billion EEK package, aiming at supporting export sectors of economy and increasing energy efficiency of buildings. Renovation of energy

([23]) Estonian Strategy for Competitiveness (2009) p.19.

([24]) Development Plan for Environmentally Friendly Economy (2009) p.4.

([25]) Development Plan for Environmentally Friendly Economy (2009) p.4.

([26]) Physical and Social Environment Development Plan (2007).

wasting apartment buildings is also subsidized with 0.9 billion EEK. Overall, despite the recession, Estonia appears to be increasing efforts to develop environmentally friendly energy production and to increase energy efficiency.

The current recession has also convinced Estonian politicians and society at large, that recovery of the economy has to be based on thorough structural changes. The government regards it as necessary to ensure the further development of the business environment and to support structural adjustments of the economy. Accordingly, it has created national programmes for the support of entrepreneurship and the development of a knowledge-based economy. Estonia has selected entrepreneurship, research and development, tourism and internationalization as its strategic orientations.

2.3. The skills development strategy in response to greening

Greening the national economy is an essential part of Estonia's long-term strategy for development. A separate section of Estonian Action Plan for Growth and Jobs 2008-11 ([27]) and Estonian Strategy for Competitiveness 2009-11 ([28]) is dealing with education and labour market relations.

The priorities of the Estonian Government for the coming years are to raise people's qualifications and their sense of security by making the education system more effective, by intensifying efforts to promote lifelong learning, by focusing on reducing withdrawals from school, by promoting science and technology as fields of study to help ensure competitiveness and by helping higher-risk groups to enter the labour market. Besides improving people's skills, the Government is also hoping to encourage workers to return to Estonia ([29]).

Strategies and development plans for R&D, education and training which target sustainable development and environmental issues are of crucial importance. These strategic documents cover all sectors of formal education:

(a) general education ([30]);

(b) VET ([31]);

(c) higher education ([32]);

(d) adult education ([33]).

([27]) Estonian Action Plan for Growth and Jobs (2008).

([28]) Estonian Strategy for Competitiveness (2009).

([29]) Estonian Action Plan for Growth and Jobs (2008) p.57.

([30]) Development Plan for General Education (2007).

([31]) Development Plan for Vocational Education and Training (2009).

([32]) Higher Education Strategy (2006).

For instance, the Development Plan for Research and Development and Innovation 2007-13 – Knowledge-Based Estonia refers to national programmes in the priority fields of R&D. For transferring to a knowledge-based society, both the public as well as the private sector need more researchers and engineers than they have at the moment ([34]).

New measures are also being prepared for supporting traditional industries, which are oriented towards the implementation of new technologies and increasing the productivity of enterprises, the development of human capital and recruitment of leading development personnel and implementing professional design as a competitive advantage. The development of cooperation networks and clusters based on the initiative of enterprises will be promoted.

Continuous and extended support will be provided to projects developing new competitive technologies, products, services and processes, for which export orientation and environmental sustainability are considered significant advantages. Based on the needs of many traditional sectors of economy, support will be offered to projects that include testing and certifying, and design and productivity management, which in most cases are smaller in size, and lower in risk, than those which focus on technology development.

In 2007 a Committee for Sustainable Development representing different stakeholders from civil society has been established and charged with monitoring the overall implementation process. So far, the Committee has initiated the drafting of three sustainability reports ([35]):

(a) Estonian Human Resource Development Report (deadline February 2010);

(b) Estonian Sustainable Energy Report (deadline September 2010);

(c) Estonian Sustainable Transport Report (deadline November 2010).

Furthermore, the Research and Development Council, representing ministries, employers and academia, advises the Government on R&D policy issues. Such efforts to coordinate responses are critical in ensuring the successful delivery of the development plans. Although formal structures and coordinating bodies exist, the major institutional obstacle that hampers skills development for a transition to green economies is weak coordination of efforts between ministries and other governmental agencies.

Integration of environmental protection in education

Promoting green skills among the population is a part of environmental education in Estonia. In 2005, the Minister of the Environment and the Minister of Education and Research signed the Memorandum of Cooperation, which established development of environmental education

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([33]) Adult Education Development Plan (2009).

([34]) Development Plan for Research and Development and Innovation (2007) p.5.

([35]) Strategy Bureau of the State Chancellery.

as a priority for Estonia. The goal is to use the educational process to shape responsible citizens who value and care for the environment ([36]).

In December 2009, 350 million EEK were allocated to Environmental Investments Centre for the development of environmental education through the programme of promoting environmental consciousness ([37]). Furthermore, an Action Plan for Environmental Education 2008-13 was drafted in 2008, but has not yet been approved by the Government ([38]). The Action Plan describes three measures:

(a) development of the network of centres for environmental education covering counties and major cities;

(b) promoting the level of environmental education in formal education (national curricula for basic school and upper secondary school, national curricula for VET, higher education curricula);

(c) promoting environmental consciousness through adult education and media.

Environment and sustainable development is one of eight cross curricular topics in the national curricula for basic school ([39]) and upper secondary school ([40]). This cross curricular topic is aimed at forming socially active, responsible and environmentally conscious person, who preserves and protects environment, values sustainability and is able to find solutions to the problems of human and environment development.

Business management and entrepreneurship programmes are very popular among students in Estonia. The programmes are offered in 23 HEI and on all academic levels. Students who chose business administration as the field of study constitute 21% of the student body (approximately 68,000 students). Entrepreneurship is also one of the key competencies followed in the national curricula for basic school and upper secondary school. The Estonian Chamber of Commerce and Industry has initiated a project with other stakeholders to develop guidelines for entrepreneurship education from kindergarten to upper secondary education ([41]).

In Estonia, the necessity of lifelong learning is usually considered in the context of increasing professional competitiveness. It is less frequently realised that a learning person is an active person and participation in training courses supports the development of social networks. Nonetheless, it is recognised and valued however that non-formal education can help fill gaps

([36]) Environmental Education.

([37]) Environmental Education in a New Way (2009).

([38]) Action Plan for Environmental Education (2008).

([39]) National Curriculum for Basic School (2010).

([40]) National Curriculum for Upper Secondary School (2010).

([41]) Entrepreneurship Studies.

in the formal education system and can significantly support those who are educationally, socially or culturally disadvantaged ([42]).

The level of key competencies among the adult population has not been studied in Estonia ([43]). However, the lack of literacy in information technology among older people, low participation rate in lifelong learning, small voter turnout as well as low entrepreneurship and creativity show that the development of key competencies should be taken very seriously. Indeed, a liberal adult education system is in its nature most suitable for the adult population in order to promote these key competencies ([44]).

The concepts of sustainable development and a green economy are endemic by their very nature. Therefore it is best to develop a mindset based on general attitudes, behaviour and lifestyle rather than on strict regulations. Expectations about the prospects of the green economy are very high in the world. However, the appropriate measures need to be carefully considered and constructed, in order to avoid panic reforms in to the economy and/or the educational system of a country ([45]).

([42]) Estonian Non-formal Adult Education Association.

([43]) Estonia participates in the Programme for International Assessment of Adult Competences (PIAAC) that studies the ability of the population to calculate, read and solve problems in a technological environment.

([44]) Estonian Non-formal Adult Education Association.

([45]) Kattago, H. (2010) p.23.

3. Anticipation and provision of skills

3.1. Green structural change and (re)training needs

3.1.1. Green restructuring and its impact on the labour market

The potential for green restructuring of the Estonian economy is most obvious in the following sectors of the national economy:

(a) agriculture (biomass, bio-fuel and bio-energy; organic farming);

(b) forestry (complex management of forests, applying new technologies, production of wood pellets);

(c) mining and quarrying (applying new technologies, water management in mines; remediation of open quarry territories);

(d) electricity, gas and water supply (application of environmentally friendly technologies in energy production; thermal and/or power plants and boiler plants that use renewable energy sources; combined burning of renewable fuels, waste and oil shale; energy conservation in energy enterprises, electricity networks and heating pipelines; water management);

(e) manufacture of refined petroleum products, chemicals and chemical products (new technologies for producing motor fuels from oil shale and renewable sources of energy, new technologies for producing chemicals from oil shale);

(f) manufacture of wood and wood products (complex use of timber; new technologies for timber modification);

(g) transport and supporting transport activities (sustainable transport);

(h) construction (new materials and technologies for construction and renovation; renovation of old heating pipelines in district heating networks; construction of passive houses);

(i) real estate and renting activities (energy certification and energy auditing in apartment buildings; renovation and reconstruction of apartment buildings);

(j) other economic activities, e.g. leisure and tourism.

Greening of the economy has been an essential part of the restructuring process, which started in 1991 with Estonia's regained independence. Table 1 illustrates changes in the employment by major sectors with high greening potential between 1990 and 2016 (F means forecast made by MEAC), based on NACE two digit classification of economic activities.

Table 1: Employed persons by economic activity, (in 000s)

NACE	Economic activity	1990*	1995*	2000	2005	2008	2012F	2016F
1-2	Agriculture, hunting and forestry	140,2	58,7	38,3	29,4	24,4	26,5	26,6
1	..agriculture, hunting and related service activities	129,2	51,8	28,9	23,4	17,3	19,1	19,2
2	..forestry, logging and related service activities	11	6,9	9,4	6	7,2	7,4	7,4
10-14	Mining and quarrying	12,3	9,2	7,2	5,9	6,0	5,2	5,1
15-37	Manufacturing	212,1	157,7	129,2	139,5	138,5	150,5	130,6
20	..manufacture of wood and wood products	5,6	18,3	19,9	21,2	15,9	22,4	18,5
23-24	..manufacture of coke, refined petroleum products, chemicals and chemical products	16,7	8,8	3,4	4,1	4,8	3,7	4,2
27-33	..manufacture machinery and equipment	65,7	24,8	24,8	31,7	38,4	38,9	36,4
40-41	Electricity, gas and water supply	19	15,4	14,7	12,5	8,9	9,5	9,3
45	Construction	66,1	34,5	39,7	48,7	79,9	45,2	59,5
60-63	..transport and supporting transport activities	59,5	52,4	46,2	46,3	48,5	45,8	49,0
70	Real estate activities	34	31,2	40	46,4	11,0	15,6	11,3
71-74	Renting and business activities					40,9	33,9	41,0
80	Education	48,7	53,8	44,6	54,9	59,6	56,9	56,0
85	Health and social work	49,5	35,7	28,5	35	31,6	39,1	39,3
90-99	Other economic activities	33,6	29	29,6	31,1	32,4	35,3	34,3
	Economic activities total	825,8	633,4	572,5	607,4	656,5	625,4	630,3

* – persons aged 15-69; otherwise 15-74

Source: Statistical Office of Estonia (SOE), Labour Force Survey; MEAC.

Table 2: Employed persons by occupation (in 000s)

<table>
<tr><th></th><th></th><th>1990*</th><th>1995*</th><th>2000</th><th>2005</th><th>2012F</th><th>2016F</th></tr>
<tr><td>1</td><td>Legislators, senior officials and managers</td><td>94,2</td><td>72,5</td><td>76,9</td><td>76,9</td><td rowspan="3">70,9</td><td rowspan="3">78,6</td></tr>
<tr><td>12</td><td>Corporate managers</td><td></td><td></td><td>48,7</td><td></td></tr>
<tr><td>13</td><td>Managers of small enterprises</td><td></td><td></td><td>27,1</td><td></td></tr>
<tr><td>2</td><td>Professionals</td><td>108,9</td><td>76,3</td><td>79,1</td><td>85,9</td><td rowspan="2">178,6</td><td rowspan="2">179,1</td></tr>
<tr><td>3</td><td>Technicians and associate professionals</td><td>86,4</td><td>86</td><td>84,7</td><td>80,7</td></tr>
<tr><td>4</td><td>Clerks</td><td>46,2</td><td>32,9</td><td>28,4</td><td>29,4</td><td rowspan="2">106,6</td><td rowspan="2">113,6</td></tr>
<tr><td>5</td><td>Service, shop and market sales workers</td><td>57,2</td><td>68,1</td><td>66,3</td><td>73,5</td></tr>
<tr><td>6</td><td>Skilled agricultural and fishery workers</td><td>43</td><td>30,7</td><td>21,3</td><td>14,4</td><td rowspan="3">198,8</td><td rowspan="3">195,4</td></tr>
<tr><td>7</td><td>Craft and related trades workers</td><td>182,3</td><td>118,4</td><td>97,2</td><td>92,7</td></tr>
<tr><td>8</td><td>Plant and machine operators and assemblers</td><td>142,2</td><td>85,6</td><td>85,4</td><td>84,1</td></tr>
<tr><td>9</td><td>Elementary occupations</td><td>64,4</td><td>60,5</td><td>65,6</td><td>65,9</td><td>68,1</td><td>60,1</td></tr>
<tr><td></td><td>Total</td><td>825,8</td><td>633,4</td><td>572,5</td><td>607,4</td><td>625,4</td><td>630,3</td></tr>
</table>

* – persons aged 15-69; otherwise 15-74

Source: SOE, Labour Force Survey; MEAC.

The share of people employed with tertiary education has increased. In 2005, over 35% of those employed where educated to a tertiary level. Based on available statistics of admittance and the number of graduates, the proportion of those with higher education will continue to increase significantly (see Table 3 ([46])).

([46]) Lambing, M. (2006), p.5.

Table 3: Educational level (age group 15-74), (in 000s)

Breakdown of Estonian workforce according to education		1997	2000	2005	2016F
Labour force	Below upper secondary education	90,7	81,6	65,1	
	Upper secondary education	384,7	384,3	367,4	
	Tertiary education	207,6	196,5	227	
	Educational levels total	683	662,4	659,6	
Employed	Below upper secondary education	76,4	62,2	55,7	61,6
	Upper secondary education	343,8	328,2	333,8	344,0
	Tertiary education	197	182,1	218	224,7
	Educational levels total	617,2	572,5	607,4	630,3
Total	Below upper secondary education	279,4	263,5	235,7	
	Upper secondary education	523,4	538,3	528,5	
	Tertiary education	253	244,7	284,4	
	Educational levels total	1055,8	1046,5	1048,6	

Source: Statistical Office of Estonia, Labour Force Survey

There are no studies that correlate changes in the structure of economic activity (declining or growing sectors/economic activities) with green restructuring of the economy ([47]). Therefore, it is impossible to identify declining occupations as a result of such changes. This means that green restructuring of the economy in Estonia has led, and likely will continue to lead, to changes in the competency profiles of those employed in existing occupations and in the emergence of new green occupations (see Section 3.2).

Although the labour force surveys and forecasts indicate some shift inside large groups of occupations, there is no evidence of occupations or trades becoming obsolete as a result of environmental degradation, climate change or environmental policies in Estonia.

Occasionally, sporadic and ad hoc sectoral labour market surveys and forecasts have been commissioned (e.g. the forecast of labour force demand in forest and wood sector commissioned by MER ([48])). Recently, the Ministry of Agriculture has initiated a similar survey in the agriculture and forestry sectors ([49]).

Although environmental protection, the sustainable use of natural resources and the diversification of energy resources towards renewable are absolutely essential to development which is sustainable, the major obstacle in the successful, green restructuring of the economy is the attitude of consumers. Most importantly, it depends on how fast consumers accept the

([47]) Personal communication from Mario Lambing (MEAC) and Tiina Annus (MER).

([48]) Forecast of Labour Force Demand in Forest and Wood Sector (2005).

([49]) Personal communication from M.-K. Kerem (EQA).

concepts and accompanying measures on which a green economy must be based. Translating values into the desired actions is a significant challenge. Environmental sustainability can be integrated into all activities and aspects of everyday life, creating demand for ecologically sound solutions. It is important to promote their awareness and encourage their use ([50]). Consequently, the green restructuring of the economy has implications not only for the labour market, but also for society at large.

On the whole, past changes in the Estonian labour market are driven by policies, the innovation and implementation of new technology, and environmental pressure. Unfortunately, the relatively small size of the labour market, and the corresponding lack of significant sample sizes, makes it difficult to reliably forecast the future needs of the labour market on sub-sector level.

3.1.2. Identification of (re)training needs

The identification of training and retraining needs in Estonia is based on the labour demand forecasts prepared annually by the MEAC. MEAC has been preparing labour demand forecasts since 2003, and these are updated annually. Forecasts are used by MER as one of the inputs for preparing proposals for state-commissioned study places in initial VET, higher education and adult education sectors. The latest forecast (October 2009) covered the period up to 2016 ([51]). This forecast was based on the more detailed version of the National Classification of Fields of Economic Activity (EMTAK 2008) ([52]).

Three components of labour demand are forecasted: the creation of new jobs, dropout from the labour market (mortality and retirement) and labour movement between different sectors of the national economy. Projections are made for 35 sectors of the economy and five aggregated occupational groups.

Forecasts are based mostly on the Labour Force Survey prepared by SOE ([53]). The main problem with the forecast is the relatively small sample size (partly due to Estonia's relatively small size), based on approximately 15 thousand people in a year (1.4% of working-age population). Therefore it is difficult to get reliable and detailed estimates for sub-sectors ([54]).

Nonetheless, past data does reveal certain trends. In the last 20 years, the share of primary sector in Estonian economy, especially agriculture, has consistently declined. The tertiary sector has increased in importance, whilst the contribution of the secondary sector has remained largely the same. According to the forecast, employment in the primary sector will

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([50]) Kattago, H. (2010), p.22.

([51]) Labour Demand Forecast (2009).

([52]) National Classification of Fields of Economic Activity.

([53]) Labour Force Surveys.

([54]) Lambing, M. (2006), p.1.

continue to decline in the coming years, while employment in the service sector and the manufacturing industry is expected to grow.

Occupational data are coded in the Labour Force Survey on the level of 4-digit ISCO codes, but published on the 2-digit level. For the forecast, data for 10 ISCO major occupational groups are used. For the forecast, 10 occupational groups are aggregated into five groups to compare occupational structures in different sectors.

During the last 20 years, both the occupational and economic structure in Estonia has changed. The share of professionals (ISCO 2-3) and service workers (ISCO 4-5) has increased and it is likely that this trend will continue, but at a more moderate pace. On the other hand, the number of craft workers (ISCO 6-8) has decreased significantly. It is projected that the share of craft workers will remain at the current level (see Table 2). Estonia is using its own version of ISCO88 as a national catalogue of occupations, which was adopted in 1999. Therefore no new entries have been added during the last decade ([55]).

Besides data on the employment structure during the forecast period, the forecast also provides information on whether there is a need for any additional labour in particular sectors, or at different levels of education ([56]).

This information serves as an input for the following three advisory bodies, whose outputs form the basis of state commissioned study places in initial VET, higher education, and adult education sectors:

(a) the vocational education and training council;

(b) the higher education council;

(c) the adult education council.

These bodies advise the Minister of Education and Research on the need for state-commissioned study places. The composition of these bodies is diverse, including different ministries and governmental agencies (MER, MSA, MEAC, ME), employers associations, trade unions and education providers. Thus the councils also provide a platform for social dialogue in skills development issues related to respective sectors of formal education. As a result of expert analysis and social dialogue, the state order for the respective institutions (VET institutions, professional higher education institutions, and universities) is prepared across fields of study and groups of study programmes (according to ISCED97), and are then approved by the MER.

This system of the state commissioned study places began in 1995, but was originally limited to higher education. Similar systems were later introduced for initial VET, and more recently

([55]) National Classification of Occupations.

([56]) Labour Demand Forecast (2009) p.63-69.

(in 2008) for adult education and training ([57]). Currently, 47% of students in HEIs are on study places which have been state-commissioned ([58]).

The system is based on a contract between the MER and a training provider for the purchase of a certain number of graduates. The details are determined through a negotiating process, involving discussions between a number of players including the MER, other ministries (for instance, of the economy, labour and finance), social partners and training institutions.

A number of considerations are taken into account, including for instance: the foreseeable need for specialists in the labour market; a demonstrated ability of institutions to provide graduates; the proposals of ministries, local government associations, registered professional and occupational associations (unions) and training institutions; the funds designated in the state budget for state-commissioned education and training; and, national priorities concerning the importance of different fields of study ([59]).

Alongside all the above however, two considerations are especially important. Firstly, ensuring that roughly 50% of high school graduates have access to higher education and, secondly, that state funding should consider student preferences for so-called 'soft' disciplines, such as business studies and humanities.

Overall, the system is meant to ensure that there is an adequate supply of qualified personnel to meet the needs of the labour market ([60]). However, international evaluators have been critical about the appropriateness of a mechanism which depends on the intensive involvement of the state in determining and meeting the needs of the higher education sector ([61]). Possible problems include the relevance of the commissioned study places to the labour market, the impact on student choice and the supply of skills. Regarding the latter, for instance, it is not necessarily the case that a concentration of state-commissioned places in certain fields will address the shortages of qualified applicants in particular occupations; graduates with particular degrees do not necessarily take up employment in related occupations.

State-commissioned study places are based mainly on the quantitative aspect of labour market needs. However, there are also the competency profiles of different sectors, occupations and economic activity to consider. The labour market needs based on these competency profiles are formalised in respective occupational standards, developed in the framework of a vocational and professional qualifications system (see Annex 1). These occupational

([57]) Development Plan for Adult Education (2009), p.6.

([58]) Students in Higher Education.

([59]) Universities Act, 1995, Professional Higher Education Institutions Act, 1998; Vocational Education Institutions Act, 1998.

([60]) Estonian Higher Education Strategy (2006), p.8.

([61]) OECD Reviews (2007), p.40-43.

standards are developed by task forces established by the Professional Councils, which include representatives of employers, professional associations, and training institutions.

Until recently, occupational standards have been developed through a bottom-up process, where interested stakeholders groups agreed on whether there was a need to develop a new standard ([62]). The Development Plan for Adult Education 2009-13 ([63]) has however, since noted that the there needs to be a detailed methodology for forecasting qualitative changes in the competency profiles in the labour market. Currently these forecasts are made only on the macro-level, describing predicted changes in the labour market along 35 economic sectors and in five occupational groups ([64]).

3.1.3. Skills response

Currently, the addition of educated young people to the labour market is insufficient to bring about the necessary economic changes that will be required to successfully reorganise the economy, especially in light of Estonia's ageing population. At the moment the labour market is characterised by a mismatch between employers' demands for qualifications, and the actual skill levels of the generally older, working-age population. Therefore it is also necessary to improve the knowledge and skills base of those who already active in labour market ([65]).

This is exacerbated by a rather modest participation in lifelong learning to date, a trend which is especially acute in those who need it most, such as vulnerable groups and those with lower education levels (discussed further below). It is these groups especially who need additional training due to their typically outdated professional skills and their notable vulnerability to the structural changes which often characterise the economy.

Nonetheless, there has been a slow and small improvement in adult participation rates (aged 25-64) in lifelong learning. Whilst remaining consistently low (varying slightly between 5.4-6.7%) during the period 200106, the year 2007 saw the number of participants in lifelong learning rise to 7%. Moreover, in the first half of 2008, this rate increased further to above 10% (1st quarter of 2008 11.6%; 2nd quarter 10.1%) ([66]).

There have been several other developments in adult education in Estonia. During 2008, a new initiative in financing adult education was approved, namely the state financing of in-service training in vocational schools for working-age people. Offering free in-service training helps to update the knowledge of workers with low levels of education, therefore reducing both the likelihood and persistence of unemployment. Meanwhile, the share of adult

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([62]) Personal communication from M.-K. Kerem (EQA).

([63]) Development Plan for Adult Education (2009).

([64]) Labour Force Forecast (2009), p.3-4.

([65]) Lifelong Learning Strategy (2005), p.4-6.

([66]) Development Plan for Adult Education (2009), p.16.

education has increased in vocational schools. Although only 13,997 people participated in professional training courses in vocational schools in 2006, the number had risen to 20,281 by 2007. Changes in the number of adult students pursuing formal higher education are also encouraging; in 1993, 22% of the university students were over 25 years old, by 2005 this number had grown to 38% ([67]).

Most recently, the new Development Plan for Adult Education 2009-13 ([68]) was approved in September 2009. The strategy foresees a considerable expansion in learning opportunities for adults, and initiatives for attracting more people to the education and training system. The main aims include the overall improvement of skills and educational levels, and an increase in the numbers of adults participating in lifelong learning. A reduction in the share of people with no vocational education or professional specialisation, and the creation of a high-quality training system to provide opportunities for people wishing to increase their qualification level, are also high on the agenda.

These developments are especially important, given that in 2009, Estonia was struck by an extensive economic recession, resulting in a considerable increase in unemployment compared to previous years. While slightly over 30,000 persons had been registered as unemployed at the National Employment Agency (from the 1st of May 2009 Estonian Unemployment Insurance Fund) at the end of 2008, the number of registered unemployed persons had exceeded 70,000 by August 2009. By December 20, 2009 15.5% of the total workforce was unemployed ([69]) (in August 2008, the percentage was still under 3%).

According to the Estonian Human Development Report of 2008 ([70]), the greatest challenge in adult education is that the people least interested in participating in training courses and individual development are also those who are most vulnerable, and therefore most in need, namely individuals with lower levels of education, older people and people of other nationalities. Indeed, an investigation into the background of unemployed persons shows that these are the very people that are most likely to become unemployed. Offering adult training to these groups is especially important given the need to improve their position in the labour market.

([67]) Estonian Strategy for Competitiveness (2009), p.19.

([68]) Development Plan for Adult Education (2009), p.18.

([69]) Workers and unemployed persons aged 16 up to retirement age.

([70]) Estonian Human Development Report (2009), p.146.

Table 4: Registered unemployment according to levels of education

	Registered unemployment					Workforce (15-64 yrs)	%
	30/06/08	**20/09/08**	**31/12/08**	**31/03/09**	**30/06/09**		
First level or lower	3,490	3,995	6,144	11,372	12,984	74,200	17.5
Second level	10,158	12,057	18,562	34,088	41,271	373,300	11.1
Incl. secondary education	4,853	5,673	8,662	15,808	19,645	163,100	12.0
Incl. vocational training	5,305	6,384	9,900	18,280	21,626	210,200	10.3
Third level	3,301	3,982	5,545	9,258	12,195	223,800	5.4
Unspecified	23	31	56	261	650		
Total	**16,972**	**20,065**	**30,307**	**54,979**	**67,100**	**671,300**	**10.0**

Source: Statistics Estonia and Estonian Unemployment Insurance Fund, 2009

Accordingly, MER directed its efforts towards the creation of learning opportunities specifically for people with low and average competitiveness and education levels, for instance by legalising work-related training as a type of state-commissioned education (SCE). The financing of continuing education and retraining possibilities in vocational education institutions and institutions of professional higher education providing vocational education began in 2007, funded by the state and the resources from the European Social Fund (ESF). Even though the proportion of participants in lifelong learning has increased as a result, there is still a long way to go before the educational needs of these groups will be adequately met.

Until recently, active labour market policy measures in Estonia were the sole responsibility of the Ministry of Social Affairs. However, at the beginning of 2008, the Government confirmed the division of responsibilities regarding the funding of work-related training, under an Annex to the Lifelong Learning Strategy 2005-08 ([71]). Consequently, the MSA now funds the training of the unemployed and vulnerable groups through the Labour Market Board (now the Estonian Unemployment Insurance Fund ([72])), whilst the MEAC funds enterprises that wish to train their employees (through the Enterprise Estonia ([73])). Lastly, MER has assumed responsibility for financing the continuing education and retraining of persons through educational and training institutions ([74]).

This restructuring of funding responsibilities was well-suited to a stable economic situation with a high employment rate. However, under the conditions of the economic recession that

([71]) Lifelong Learning Strategy (2005).

([72]) Estonian Unemployment Insurance Fund.

([73]) Enerprise Estonia.

([74]) Development Plan for Adult Education (2009), p.13.

took place in 2009 and the sudden increase in unemployment, these measures are now in need of rapid and extensive improvements which can balance different needs. People now have to be directed towards qualifications and skills that are of priority for the economy. Accordingly, financial models have to be developed which take account of what schemes are in demand. However, individuals must also have the opportunity to select for themselves a suitable training institution, teacher or training.

Although the main focus to date has been on updating the qualifications of the working-age population via vocational education and the help of state funds, it will be increasingly important to do so through higher education ([75]). For instance, in 2008, it became legal for the state, through SCE, to finance student places in institutions of higher education, which had not already been filled ([76]).

However, the participation of employees in further training courses requires employers to pay a fringe benefit tax on formal education and liberal adult education, which means many employers are reluctant to facilitate the further training of their employees ([77]). In order to address this issue, formal training and adult education expenses should be exempted from the fringe benefit tax in order to create a more enabling environment which provides employees with the opportunities to improve their qualifications.

The provision of national labour market services and the payment of labour market benefits in Estonia is organised by the Estonian Unemployment Insurance Fund through its regional departments, which are located in every county ([78]). Suitable labour market services are selected in accordance the needs of individuals and businesses. These regional departments provide assistance and advice to the unemployed and employers, as well as offering careers advice for those who are already employed but are, for instance, considering changing jobs.

Specifically, labour market services offered by the Fund include:

(a) providing information about the situation on the labour market and about labour market services and benefits;

(b) job mediation for job-seekers and the unemployed and assistance for employers by looking for workers who meet the criteria they submit;

(c) labour market training for unemployed people in which they obtain or develop professional and other skills designed to make it easier for them to find a job. The training can last for up to one year;

(d) careers counselling is designed to support people in making and implementing informed decisions relating to their career development;

([75]) Estonian Strategy for Competitiveness (2009), p.20.

([76]) Universities Act, Professional Higher Education Institutions Act (2008).

([77]) Development Plan for Adult Education (2009), p.14.

([78]) Estonian Unemployment Insurance Fund.

(e) work experience (in order for individuals to gain practical experience in the work place);

(f) temporary paid work which does not require professional or special training;

(g) the allocation of wage subsidies (a benefit paid to employers who hire an unemployed person);

(h) business start-up subsidy for unemployed people who are at least 18 years of age and have completed business training, have higher or vocational education in economics or have business experience;

(i) services designed for unemployed people with disabilities (adaptation of work premises and equipment in an employer's premises, the special aids equipment, communication support at interviews, working with a support person).

The following initiatives have been implemented during 2009 to improve the availability of additional training and retraining ([79]):

(a) a personalised training voucher system for the unemployed as an additional option for labour market training. Training vouchers enable the unemployed person to quickly find a suitable additional training course based on individual needs (through Unemployment Insurance Fund);

(b) training vouchers for employers with the aim to raise the skills level of managers and employees (through Enterprise Estonia);

(c) simplifying and shortening procedures for public procurement of labour market training to increase the availability of active labour market measures.

Alongside adult education, providing young people with the necessary opportunities is also becoming increasing important, especially given that, compared to other age groups, youth unemployment (15-24 years) has been increasing most rapidly. Youth unemployment tripled during 2009, amounting to 27% in the 2nd quarter of 2009. Youth unemployment is dominated by young men with a low educational level and without any vocational training. Most of the unemployed young people do not have any work experience, having only recently graduated from, or dropped out of, school. To better integrate young people into the labour market an extensive apprenticeship training scheme has been implemented to combine vocational training with real work experience ([80]). Work experience schemes have now been offered by many companies, enabling young people to gain practical experience, whilst allowing the employer to train a potential employee according to company-specific needs in a quick and flexible way (see Section 3.2.6).

In the current economic climate, it is critically important that responses are flexible enough to meet constantly changing labour market needs. Currently this is not the case. Often, the urgent need for employees with specific professional skills cannot be satisfied by Estonia's

([79]) Estonian Action Plan for Growth and Jobs (2008), p.17.

([80]) Implementation of Apprenticeship Training (2007).

current education system or through supplementary adult training. One possible response to this shortfall is the use of a temporary foreign workforce, which does have the necessary qualifications. Indeed, the Estonian Labour Market Board conducted a survey at the beginning of 2008, which revealed that 24% of enterprises who participated are interested in hiring foreign workers, especially skilled workers and specialists from Ukraine and Russia ([81]). However, this is not a deemed to be a suitable strategic skills response.

3.1.4. Case studies

3.1.4.1. Research, engineering and management in oil shale mining, processing and waste remediation

Production of energy, fuels and chemicals based on oil shale has a long tradition in Estonia, dating back to 1920s. The oil shale industry is concentrated in North-East Estonia, where significant oil shale deposits lay close to the surface and have substantial thickness. The oil shale based chemical industry was founded soon after mining of oil shale began in early twentieth century ([82]). Four oil factories were built in 1924-42, marketing their products as heating and impregnating oil, bitumen and motor fuel. Oil shale gas was burned in the companies' own power station. In 1945, the construction of a new oil shale processing complex started in Kohtla-Järve. From 1948, domestic gas, manufactured from oil shale, was pumped to St. Petersburg. Later the gas pipeline was also directed to Tallinn and other North Estonian cities.

Increasing crude oil prices on the world market have led to an increase in interest in alternative fuels, including shale oil and diesel fuels produced from shale oil. Therefore all shale oil producers in Estonia are investing in the development and implementation of new, more efficient and environmentally friendly technologies to increase the production of shale oil and products from shale oil.

The development of new technologies in the oil shale industry encompasses also environmental technologies needed to remediate the damage caused by decades of extensive and non-sustainable development of oil shale and energy sectors in Estonia. This particularly concerns re-cultivation of open cast mines, protecting further pollution of ground water and air with semi-coke and ashes, neutralising dangerous wastes. The extensive development of oil shale mining and oil shale based energy and chemicals production has caused severe environmental damage including mineral waste from mining, semi-coke from shale oil production, lakes of liquefied ash from power plants, polluted ground water, and large territories of exhausted open cast mines. There is a need to continuously ensure the purity of utilised resources and to find alternative ones.

([81]) Estonian Strategy for Competitiveness (2009), p.21.

([82]) Viru Keemia Grupp AS www.vkg.ee.

The Estonian oil shale industry (see Annex 1) includes three major enterprises: Eesti Energia AS, Viru Keemia Grupp AS, and OÜ Kiviõli Keemiatööstus. These enterprises comprise the backbone of the value chain from oil shale mining, production of liquid and gaseous fuels, and chemicals, production and distribution of energy. An important trend is export of Estonian know-how and oil shale technologies to oil shale rich countries interested in development of their national oil shale industries, e.g. Jordan, China, Kazkhstan, Ukraine. Investments in R&D and added value produced in the oil shale sector is higher than average in Estonia. In this respect oil shale processing can be considered a high technology sector.

The total number of jobs in oil shale industry is estimated at approximately 1,850 predicted to rise to 2,150 in 2016 ([83]). Foreseeable changes in the oil shale sector (substantial increases in the production of shale oil and products from shale oil processing) will create around two hundred additional jobs without causing major changes in the structure of the labour need. The majority of predicted jobs in the sector in 2016 belong to the group of plant operators: managers (250), specialists (500), operators (1200), skilled workers (200), unskilled workers (200). The qualification level will remain unchanged until 2016: 54% with secondary level qualifications and 38% with tertiary level qualifications.

The Estonian Development Strategy of Energy Related Technologies (EETS) Final Report ([84]) envisages Estonia's strategic perspective in developing the oil shale end to end value chain (see Annex 2). The vision is for Estonia to become one of the world's leading developers of technologies for oil shale processing and low grade oil resource utilisation. This means creating an oil shale cluster, encompassing major producers of oil shale, energy and chemicals, universities, and SMEs developing new technologies. The National Energy Technology Programme 2008-13 defines ([85]) the following objectives for technological development of the oil shale cluster:

(a) environmentally friendly mining with minimum production of unused by-products;

(b) CO_2-free production of electricity from oil shale, incl. combined combustion of oil shale and biomass;

(c) gas turbine using shale oil and/or liquid bio-fuel;

(d) technology for producing shale oil using oil shale pyrolysis (Galoter process) and hydrogenisation;

(e) technology for coproduction of shale oil and electricity;

(f) feasibility of producing diesel oil from oil shale;

(g) utilisation of waste products (ash, semi-coke, mineral waste from mining);

(h) utilisation of waste heat;

([83]) Labour Force Forecast (2009).

([84]) Estonian Development Strategy of Energy Related Technologies www.mkm.ee.

([85]) National Energy Technology Programme 2008-2013 www.hm.ee.

(i) commercialisation of the technological know-how.

Retraining needs and skills gaps/weaknesses

The R&D activity in Estonia for oil shale related technologies during the last years has been growing, but is still at a relatively low level. The scope of the projects is very wide, but clear focus is missing, local and international cooperation between research institutes, universities and companies is limited, and also there are only few projects from SMEs.

At present, Estonia has internationally recognised top level knowledge in the processing of oil shale for production of electricity and chemicals. Combustion technologies for oil shale have some distinct features, but a lot of the necessary know-how is related to more general technologies of mixed fuel boilers. Mining is an essential link in the total value chain of oil shale, but the technologies used are in use in the production of other minerals also. The problems and solutions of utilisation of different bio-fuels are essential for the future, and common to many other countries.

The key development areas in the total oil shale process are mining, chemical processing, combined power and heat production and waste remediation. In the production of oil shale, the application of mining technologies to oil shale specific challenges, e.g. selective mining and filling of emptied mines has to be developed. The increased use of bio-fuels, in combination with oil shale, needs stronger R&D support. In subjects where there is an internationally well established supply of commercial solutions, the national know-how development will be directed towards effective adoption and use of the available technologies.

In order to harvest the efficiency improvement and export potential of the oil shale industry, specific competences and skills need to be created. These competences mainly concern research and engineering in the oil shale sector.

Identification of skills needs

Skills required for the development of the Estonian oil shale cluster are identified in the EETS report ([86]) and fall into three groups:

(a) strengthening competitive advantage in the spearhead fields (technologies for oil shale processing and combustion);

(b) developing key technologies that are important for the oil shale industry (mining, combined electricity and fuel production, remediation of environmental impact);

(c) developing readiness for new technologies transfer and implementation.

([86]) Estonian Development Strategy of Energy Related Technologies www.mkm.ee.

The critical occupation for the oil shale cluster development is that of the researcher. This follows from the strategy documents (see Section 3.2.3) as well as from interviews with the industry leaders ([87]). Qualified researchers are needed for:

(a) strengthening of existing centres of excellence in the spearhead fields;

(b) strengthening such fields of research, which are important for the development of key technologies, but not developed enough to satisfy the needs of the cluster;

(c) efficient absorbing of new technologies developed elsewhere but relevant for the oil shale cluster.

The appropriate skills response is expected to come mainly from the universities, in cooperation with the oil shale industry and SMEs involved in the new technology development. It is necessary to increase the efficiency of preparing qualified specialists for R&D in the field of oil shale based energy technology and chemical technology, as well as to guarantee sustainability of the academic staff in these institutions.

Existing provision of education and training

Traditionally, the training of managers, specialists, operators and skilled workers for the oil shale industry in Estonia has been divided between two sectors of the education and training system:

(a) vocational education and training operators and skilled workers, which takes place in three VET institutions: Kohtla-Järve College (chemical plant operators), VET Centre in Eastern-Virumaa (underground and cast mine operators, skilled workers for the sector), and VET Centre in Narva (skilled workers for the sector);

(b) the Higher education sector, which prepares researchers, engineers and managers for the oil shale industry with TUT, Estonian University of Life Sciences, and University of Tartu as major players.

Training researchers and engineers in the field of oil shale mining, oil shale chemistry and technology, oil shale combustion, and oil shale technology management at plant, enterprise and state level has been an important part of TUT mission since 1930s ([88]). The Estonian University of Life Sciences works mainly in the fields of ecology, environmental technology and the use of alternative sources of energy ([89]). The strength of the University of Tartu is in fundamental research related to ecological problems and modern environmental technologies ([90]).

([87]) Personal communication from Dr. I.Aarna (EE).

([88]) Tallinn University of Technology www.ttu.ee.

([89]) Estonian University of Life Sciences www.emu.ee.

([90]) University of Tartu www.ut.ee.

R&D institutions involved in the oil shale sector have different schemes for their personnel in stimulating cooperation with industry and supporting spin-off companies. TUT has established the Technology and Innovation Centre, funded by Enterprise Estonia, which is an implementation unit of the SPINNO project in TUT (see also Section 3.2.4).

The skills response

The skills response in the oil shale sector has three major dimensions including study programme development at the universities, implementation of EU and national R&D programmes, and cooperation of universities with the oil shale industry. Until recently, research and academic studies in the energy related fields have been concentrating on oil shale based power engineering. To meet the challenges of developing the oil shale cluster, TUT, UT and Estonian University of Life Sciences have developed a package of study programmes in Chemical Engineering, Mining Engineering, Power Engineering, Environmental Technology and Industrial Ecology. Development of this package was integrated with the introduction of the 3+2 study system in 2002 and a revision of the study programmes in 2008-09.

The programmes cover Bachelor's, Master's and Doctoral level studies as well as applied higher education-type programmes. The programmes include different aspects of dangerous waste management, oil shale mining, processing and waste remediation. The programmes have been developed in close cooperation with major stakeholders in the oil shale industry. In many cases, representatives of the companies are members of the programme committee or serve as programme reviewers.

TUT is offering oil shale industry-related professional higher education programmes in Energy Technology and Fuel Technology, Bachelor's and Master's programmes in Industrial Ecology, Geo-technology, Chemical and Environmental Technology, and Thermal Power Engineering; Doctoral programmes in Chemical and Materials Technology, Power Engineering and Geo-technology, and in Mechanical Engineering ([91]). EMU is offering programmes Bachelor's and Master's programmes in Natural Resources Management and a Master's programme in Management of Biodiversity and Multifunctional Landscapes. A wide spectrum of doctoral study opportunities related to oil shale industry issues is also available ([92]). UT is offering programmes in Environmental Technology, encompassing all three levels of academic studies ([93]).

Doctoral students' research projects are, in most cases, part of larger R&D projects commissioned by the companies or projects in the framework of EU R&D Framework programmes, national research and technology programmes.

([91]) Tallinn University of Technology www.ttu.ee.

([92]) Estonian University of Life Sciences www.emu.ee.

([93]) University of Tartu www.ut.ee.

High level research in the oil shale sector is coordinated by the Centre of Excellence of Oil Shale and the Centre of Excellence in Sustainable Energy at TUT ([94]). The Centre of Excellence for Basic and Applied Ecology (in cooperation of UT and EMU) is covering ecological aspects in the oil shale industry.

Enterprise Estonia has granted support to the following projects: 'New solid fuel conversion technology for motor fuel production from kerogen to liquid' (TUT, 2009) and 'New technology for shale oil production' (TUT, 2009) ([95]). The Centre for Environmental Investments ([96]) is financing the R&D project 'Hydrogenisation of natural oils and oil shale organic matter', which aims at developing new environmentally friendly technology for producing high quality diesel oil from shale oil.

The Future Energy Technology Fund, established by Eesti Energia AS, has granted the Department of Thermal Power Engineering at TUT 0.5 million EEK for a feasibility study on combined combustion of oil shale and coal.

Assessment of the effectiveness and organisation of this response

Assessment of the National Energy Programme is envisaged in early 2011 ([97]). Results of concrete projects are evaluated by the implementing institutions. The programme output indicators are developed by the corresponding ministries in cooperation with the programme steering committee.

The National Energy Programme has not been sufficiently visible, and this is most likely due to the fact that the oil shale cluster has not defined itself as a cluster yet. Until recently it has been an initiative of the universities to involve them into the programme ([98]).

According to a survey commissioned by the Estonian Development Foundation ([99]), there is a need to emphasise the promotion of cooperation between enterprises:

(a) through branch associations (joint purchases, common entry into foreign markets, joint use and exchange of equipment, training of the labour force, joint logistical solutions, carrying out sector-oriented studies and dissemination of their results);

(b) regionally – between the enterprises of the area (solving environmental problems, retraining the labour force, etc.);

(c) with the state (entering the international market);

([94]) Centres of Excellence http://technology.ttu.ee/?id=12224.

([95]) Enterprise Estonia www.eas.ee.

([96]) Ministry of Environment www.envir.ee.

([97]) Private communication from Enterprise Estonia.

([98]) Annual Report 2008 (2009) www.ttu.ee.

([99]) The Estonian Economy Current status (2008) www.arengufond.ee.

(d) research and education institutions (research and development).

The Ministry of Education and Research is responsible for the human resource development aspects of the National Programme. This is accomplished via state commissioned study places mechanism. R&D activities at the universities are promoted through infrastructure funding, basic funding and funding of research programmes.

Table 5 illustrates the rate graduation from the oil shale related programmes in 2009 ([100]). Although these study programmes are oriented to the oil shale cluster, it must be noted that not all graduates will be employed in the oil shale industry and that these figures should be considered only as a proxy for the level of skills supply to the oil shale cluster.

Table 5: Rate of graduation in oil shale related courses

Type of programme	Programme	No of students	No of graduates
Professional higher education	Energy technology (TUT)	69	17
	Fuel Technology (TUT)	83	21
Bachelor's programmes	Industrial Ecology (TUT)	102	25
	Geo-technology (TUT)	147	39
	Chemical and Environmental Technology (TUT)	259	87
	Thermal power engineering (TUT)	82	19
	Natural Resources Management (EMU)	127	31
	Environmental Technology (UT)	146	36
Master's programmes	Industrial Ecology (TUT)	28	12
	Geo-technology (TUT)	106	34
	Chemical and Environmental Technology (TUT)	159	78
	Thermal power engineering (TUT)	45	15
	Natural Resources Management (EMU)	78	33
	Management of Biodiversity and Multifunctional Landscapes (EMU)	55	22
	Environmental Technology (UT)	85	36
Doctoral programmes	Geo-technology (TUT)	9	1
	Chemical and Materials Technology (TUT)	32	5
	Thermal power Engineering (TUT)	17	3
	Environmental Technology (UT)	24	3

The low rate of successful graduation within the doctoral programmes, especially in the science and technology field (see Section 3.2.4) is a critical barrier to the oil shale cluster development. This could be considered a by-product of deep restructuring of the economy on the one hand, and of the higher education and research system on the other.

([100]) Estonian Educational Information System www.ehis.ee.

There are two principal reasons likely to be behind this phenomenon:

(a) during the privatisation and restructuring process in the nineties, the enterprises of the cluster (especially Viru Keemia Grupp AS, and OÜ Kiviõli Keemiatööstus) had very limited need for research potential;

(b) the restructured research funding system was based entirely on publication rates and promoted excellence in fundamental research ([101]).

Further developments in both sectors (industry and academia) have, to a certain extent, alleviated these problems, but consequences remain.

3.1.4.2. In-service training at Eesti Energia AS

Eesti Energia AS (EE) is a state-owned company engaged in the production, sale and transmission of electric and thermal power ([102]). EE is also involved in the construction and maintenance of energy systems. The long-term goal of the company is to own enough power generation capacity to cover at least Estonia's electricity consumption and help ensure Estonia's energy security. The strategic vision for 2015 is to sell energy to two million customers in the Baltic Sea region and develop capacity to become a world leader in producing liquid fuels from oil shale.

Over the last decade, EE has significantly expanded the range of its operations. EE is competing successfully on the international energy market, having claimed more than 5% of the Latvian retail market, and strong expansion into the Lithuanian energy market is set to begin. EE's new proprietary oil production technology is likewise competitive on the world level. The company's strength lies in its integrated value chain from oil shale mining and the different services offered to corporate and private customers by 20 daughter companies (business units).

The power system managed by EE includes the Narva oil shale power plants (a total installed capacity of 2,380 MW), the Iru combined heat and power production (CHP) plant (190 MW), and the Ahtme CHP plant (30 MW), plus wind generators (70 MW) and restored hydropower plants. By 2016, EE is required to shut down all old energy generation blocks in Narva Power Plants and install two new 300 MW blocks based on fluidised bed combustion technology. EE aims to reduce its CO_2 emissions from 1.1 t/MWh (in 2007) to 0.8 t/MWh by 2015, and further to 0.3 t/MWh or less by 2025.

Achieving this will require maximum use of bio-fuels and waste to produce heat and power, generation of electricity in wind parks, as well as the expansion of heat and power co-generation. To lower the environmental impact of production, Narva Power Plants is

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([101]) Assessment of the Estonian Research Development Technology and Innovation Funding System http://www.hm.ee/index.php?047850.

([102]) Eesti Energia AS www.energia.ee.

investing in increasing the environmental safety of ash handling, removing sulphur and nitrogen emissions from exhaust gases, and ensuring that the plants can continue to function after stricter environmental requirements come into effect in 2012 and 2016. EE has also invested heavily in reforestation, having planted a total of 11.8 thousand hectares of forest and is one of the largest forest planters in Estonia.

EE is developing a solid heat carrier technology (Enefit) for liquid fuel production, and selling the know-how and solutions for key technical components to other countries wanting to exploit their oil shale reserves. The first such country is Jordan, which plans to open an electricity and liquid fuels production complex in cooperation with EE.

The Enefit technology allows the overwhelming majority of the energy contained in oil shale to be harnessed with significantly less environmental impact. By 2016, EE aims to produce at least 1.3 million tons per year of liquid fuels suitable for refining and twice as valuable as the current product, and to build a shale oil processing plant in Estonia with a capacity of 30,000 barrels per day.

In December 2009, the Board of EE adopted a decision to launch a new CHP as an extension of the present Iru coproduction power plant. This plant will process 220,000 tons of municipal waste, which amounts to 2/3 of Estonia's annual production ([103]).

EE is one of the major employers in Estonia. In 2007-08 the average number of employees was 8,417. As a result of separating transmission system operator Elering OÜ ([104]) from EE, the number decreased to 7568 in 2009 ([105]). The business strategy of integrating the value chain and providing environmentally friendly energy solutions has created the need for several new occupations:

(a) wind and hydro power plant operators and managers;

(b) electricity and heat coproduction plant operators and managers;

(c) fluidized bed combustion plant operators and managers;

(d) energy auditors;

(e) persons authorized to issue the energy certificate for buildings;

(f) technology developers and technology managers;

(g) intellectual property managers;

(h) technology transfer project managers.

([103]) Pressiteade prügipõletuse jaama kohta.

([104]) Elering OÜ is a state owned transmission system operator in Estonia. Using high-voltage power lines, it unites Estonia's biggest power stations, distribution networks and corporate consumers into an integral energy system (http://www.elering.ee/index.php?id=102&L=1).

([105]) Personal communication from the EE Personnel Department.

The substantial widening of the scope of activities and implementation of new technologies implies extensive training and retraining of the personnel.

Retraining needs and skills gaps/weaknesses

The skills needs have partially occurred as a result of structural change stemming from EU and national strategies and regulations. This is particularly true for the group of skills related to energy auditing, a new and growing part of EE's service portfolio. The expected competence profiles for energy auditing occupations are described in Section 3.2.5.

EE's business strategy has demonstrated the need for a new corporate culture as the business units were used working in isolation for a long time. The new strategic vision for the company identified the need for the following competences:

(a) holistic understanding of EE and its strategy, incl. the understanding of business model and value chain;

(b) holistic understanding of the free energy market, which will emerge as a result of 35% opening in April 2010 and 100% opening in 2013;

(c) ability to communicate with colleagues from other daughter companies;

(d) ability to contribute to the knowledge management at EE;

(e) ability to cooperate in an international environment.

The skills need at EE has three focal points ([106]):

(a) preserving high competence level in energetic (see Section 3.2.5);

(b) labour safety and first aid;

(c) management development.

The first and the third one stem from EE's business strategy. The second one is essential for each company.

Identification of skills needs

The skills need was identified mainly in the process of the EE business strategy development. The Board of EE is responsible for adopting and updating the strategy. The Board of EE, as a state owned company, consists of representatives of the Government, employers associations and experts in the field of power engineering ([107]).

([106]) Personal communication from the EE Personnel Department.

([107]) Eesti Energia AS www.energia.ee.

The process includes an extensive SWOT analysis (strengths, weaknesses, opportunities, and threats) and structured interviews with top managers and members of the board. The latter can also be considered as external experts.

The interviews with focus groups (management of the company, business unit managers, line managers) arranged annually serve as an input for drafting in-service training programmes for a year.

The need for in-service training is dependent on the business strategy, the budget forecast, changes in the job profiles of major occupation groups, the level of employees' knowledge and skills, and results of annual development interviews ([108]).

In-service training plans and budgets are prepared for each business unit.

Existing provision of education and training

EE has hired graduates of TUT for specialist (engineer and dispatcher) and lower level unit/plant manager positions. Technicians and skilled workers have been hired amongst the graduates of different VET institutions in Estonia. These institutions have become increasingly capable of offering continuous VET and open university courses ([109]), including state sponsored courses.

EE has cooperation agreements with the Estonian University of Life Sciences, TUT, Virumaa College at TUT and East-Virumaa VET Centre. Cooperation agreements with universities include offering training courses for the employees of EE and offering apprenticeship placement opportunities for the students.

In-service training of employees has also been an essential part of EE strategy. This function cannot be totally outsourced to education and training institutions. Development and implementation of new, often proprietary technologies and the development of corporate culture are essential components of in-service training, which has to be carried out by EE itself. Some in-service training courses are offered by other companies, like ABB AS, Eetel-ekspert OÜ, E-Katedraal, Ohutusekspert OÜ, and the Technical Control Centre.

The skills response

The personnel training and development strategy at EE is based on three pillars ([110]):

(a) sponsoring education and training of new employees through cooperation agreements with higher education and VET institutions;

([108]) Personal communication from the EE Personnel Department.

([109]) Tallinn University of Technology www.ttu.ee.

([110]) Personal communication from the EE Personnel Depart.

(b) in-service training and re-training of employees, their motivation and formation of values and attitudes stemming from EE business strategy;

(c) investing in the development of managers of all levels (six levels in total) taking into account their multicultural nature (60% of them are Russian speaking).

The personnel department is responsible for the management of in-service training at EE. A holistic training system has been established with central management and distributed implementation. The training policy at EE is based on the principle that the 'training of trainers' is a guarantee of the sustainability of the system. In-service training covers practically all groups of personnel, and is provided through weekend university courses (with six thematic modules in a year over a six month period). The overall aim of the weekend university courses is to contribute to the professional development of the employees. Specific objectives include:

(a) developing a holistic picture of EE and its strategy;

(b) developing corporate culture;

(c) exchanging information and contributing to the knowledge management at EE;

(d) developing better understanding of the free energy market;

(e) offering practical knowledge;

(f) offering a forum for discussions.

The target group of the university is employees with at least one year of work experience at EE. The programme consists of lectures, excursions and seminars. Lectures and excursions are for those who have not previously participated in the course, while seminars are open to all interested employees.

Lectures and excursions are arranged in six modules (monthly):

(a) the strategy of EE, management and results;

(b) our own crude oil (excursion to Narva oil factory);

(c) our own crude oil mining (excursion to Narva open cast mines);

(d) production of electricity and heat (excursion to Narva Power Plants);

(e) power distribution as a business (excursion to different transformer substations);

(f) what EE is offering and could offer to its clients? (excursion to Virtual Client Service Centre and Dispatcher Centre of the distribution network).

Two seminars are held in the second half of the course:

(a) Estonian resources and myths (in Russian);

(b) free electricity market 11 days before opening of the market (in Estonian).

The first four modules and the first seminar are delivered at the Narva VET Centre. The lecturers are high level managers and specialists at EE. The lectures are translated into Russian and lecture materials are produced in Estonian and Russian. The number of participants in the lecture and excursion groups is limited to 100 and 30 in seminar groups.

The number of weekend university participants was 392 in 2008-09 and 192 in 2009-10. The average breakdown of participants by field of activity is: 40% from the oil shale branch, 40% from the electricity and heat branch, and 20% from the distribution branch.

Specific training courses have also been arranged for different target groups (skilled workers, technicians, line managers, engineers, dispatchers, heads of department, analysts) at EE:

(a) eight employees participated in the course for 'Person Authorized to Issue the Energy Certificate for Buildings' at TUT; six of them now have the professional certificate and this is their regular job;

(b) 111 employees participated in the course for Person Authorized to Issue the Energy Certificate for Buildings delivered by a chartered energy auditor from EE;

(c) 128 employees participated in the course for Energy Auditor delivered by a chartered energy auditor from EE;

(d) 280 employees participated in the training course on green energy;

(e) 97 employees participated in the training course on heat accumulators.

Assessment of the effectiveness and organisation of this response

The personnel department regularly collects and analyses feedback from participants and management. Until now, satisfaction of all stakeholders with the quality of in-service training at EE is very high ([111]). The concept of quality here encompasses both the content and organisation of training courses.

The in-service training system developed at EE has proved to be efficient and meets the strategic needs of the company. However, there is still room for improvement in enhancing the system.

Changes in the energy sector in Estonia have been relatively dramatic over the last 15 years, and the rapidly changing strategic environment creates new and even bigger challenges for in-service training. EE has been a focal point of issues and solutions, and the process of dramatic change for EE will continue, with the prospect of EE becoming a major consumer of municipal waste and operator of a nuclear power plant in Estonia.

([111]) Personal communication from the Personnel Management department of EE.

3.2. New and changing skills needs

The green restructuring of the economy in Estonia has led, and increasingly will lead, to changes in the competency profiles of the employees within existing occupations and the emergence of new green occupations.

In November 2009, the Innove Foundation (a Cedefop partner in Estonia) organised the first seminar on the green economy in Estonia. The conclusions from this seminar indicate an increasing demand for some groups of occupations and professions with specific technical skills related to green economy ([112]), including:

(a) engineers, designers and researchers involved in the green economy development;

(b) technicians capable of operating green technologies;

(c) architects, city and transport planners;

(d) consultants advising enterprises and consumers on the application of new technologies;

(e) energy auditors and environmental impact assessors.

3.2.1. New green collar occupations

This subsection deals with green collar occupations which have emerged recently as a result of climate change adaptation and mitigation. The list of occupational standards, developed at the Estonian Qualifications Authority (EQA) (see Annex 1) during the last years, includes some new green collar occupations (note that roman numbers indicate the qualification level in the 5-level framework):

(a) agriculture (farm-worker I, II, III (alternative agriculture));

(b) electricity, gas and water supply (waste management assistant III);

(c) manufacture of wood and wood products (Log sorting operator II; Log house builder I-III);

(d) real estate and renting activities (person authorized to issue the energy certificate for buildings III; energy auditor IV, V (see Section 3.2.5);

(e) leisure and tourism (wilderness guide II, III; rural tourism entrepreneur III).

Source: EQA.

An occupational standard for renewable technology technicians is currently under development at the Estonian Qualifications Authority ([113]). The experience to date of developing occupational standards for new green collar occupations indicates that both

([112]) Kink, M. (2010), p.33.

([113]) Personal communication from M.-K.Kerem (EQA).

technical skills related to new technologies, as well as generic skills such as team work, communication, learning and entrepreneurship, are important.

Amongst the engineers, designers and researchers who are driving technological change and innovation in the green economy, there are many new specialisations developing green technologies such as solar and fuel cell technologies. Nevertheless, it is difficult to predict which of the new green collar jobs will be subject to the highest demand during the greening of Estonia's economy.

3.2.2. Greening existing occupations

This subsection deals with new competencies and skill gaps which will need to be addressed in existing occupational profiles. Many of the occupational standards developed over the last few years relate to the fields of economic activity which have significant greening potential (again, note that roman numbers indicate the qualification level in the 5-level framework):

(a) agriculture (farm-worker I, II, III (plant-growing, animal husbandry); specialist on agricultural machinery III, IV; agricultural advisor IV, V);

(b) forestry (forest worker I, II; arborist II, III; forest technician III, IV; forwarder operator III; harvester operator III; forestry entrepreneur III; timber merchant III, IV);

(c) mining and quarrying (mine worker I-III; mobile machine operator (underground works, quarry works) II; mining engineer IV, V);

(d) electricity, gas and water supply (operator of thermal equipment I-III; water treatment operator I-III; land improver – hydro-technician I, II, III; electrical engineer IV, V; thermal power engineer IV, V);

(e) manufacture of coke, refined petroleum products, chemicals and chemical products (operator of chemical processes I-III; laboratory assistant II, II);

(f) manufacture of wood and wood products (timber processing line operator II);

(g) transport and supporting transport activities (mobile machine operator (road building) II; road engineer IV, V);

(h) construction (plumber I-III; pipeline fitter II, III; ventilation duct fitter I-III; architect III-V; civil engineer IV, V);

(i) real estate and renting activities (geodesist (surveyor, land surveyor) I-V; surveyor in land management IV; facility service man I-III; facility manager IV-V; real estate assessor III-V; real estate broker III).

Source: EQA.

All occupational standards have a respective qualification certificate supplement available on the EQA homepage ([114]). An occupational standard for the open space planner is currently under development at EQA ([115]).

3.2.3. Identification of skill needs

This subsection deals with methods, approaches, systems and institutional responsibilities involved in the identification of current and future skill needs for green jobs. Given that Estonia has not defined explicitly the concept of green jobs, and the associated labour market, it is difficult to add anything more specific to what has already been discussed in Section 3.1.2.

In 2006, the MEAC commissioned a study on the Estonian energy technology strategy. The R&D activity in Estonia for energy related technologies has been growing, but is still in a relatively embryonic state. Public funding via Enterprise Estonia during 2004-06 has been about €3 million, and has been limited to 26 projects. Whilst the scope of the projects is very wide, the focus is lacking. Moreover, local and international cooperation between research institutes, universities and companies is limited, and there are only few projects being led by SMEs ([116]).

Nonetheless, a process has been initiated which has brought together viewpoints of companies, research institutes, universities, and public sector in different energy related industry segments. Through this it has been possible to define three key areas for development:

(a) development and improvement of the entire oil shale process;

(b) mapping, utilisation, and development of renewable sources of energy;

(c) the study and development of new emerging sources of energy.

The following common horizontal objectives were also identified:

(a) reduction of energy consumption and improved energy efficiency;

(b) improved environmental sustainability;

(c) increased R&D investments and IPR value generation.

Each of these development areas and objectives is associated with a distinct set of strategic targets, which also determine the time span and orientation between long term research, and medium term application in industry.

([114]) Qualification Certificate Supplements.

([115]) Personal communication from Ms. M.-K.Kerem.

([116]) Estonian Development Strategy (2007), p.4.

The aim is to steer and facilitate development by means of three well defined, planned, and managed technology programmes each of which will last three to five years. Each technology programme will have its own strategy, steering committee, implementation plan, project manager, and risk level. Accordingly, the Energy Technology Programme (ETP) was adopted, which covers two development areas ([117]):

(a) oil shale technologies;

(b) new energy technologies, mainly based on the renewable sources of energy and the optimization of energy systems.

Most of the public R&D funding to energy related technologies will be channelled via the programmes to individual development projects. It is also essential for the successful execution of the programme that the relevant initiatives and activities will be coordinated, either under the same authority, or if need be, across different ministries (e.g., utilisation of oil shale, Ministry of Environment).

The steering committee of the programme will be responsible for the continuous adjustment of the strategy to meet the changing needs of Estonia. The steering committee will also select the individual projects to be funded within the programme and will ensure that the projects match the strategic targets of the programme.

Big oil shale reserves give Estonia a high level of energy independence. At the same time, there is a pressure to replace fossil fuels with renewable sources of energy due to environmental issues, but also due to the limited nature of the reserves for oil shale and other fossil fuels. The objective for the future is to maintain the high level of independence in the whole energy balance. Therefore, one of the key areas for development is to improve the processes by which oil shale is produced and used.

This requires the development and use of existing and new technologies, which will improve environmental sustainability of the process. Additionally, having a life-cycle approach that focuses on the end to end process will improve efficiency and effectiveness, maximising the benefits and minimising the problems from producing and using oil shale. Practical examples of optimization are the development and utilisation of selective mining methods, avoiding the burning of low concentration oil shale, the modernisation of boiler technology, the down-stream use of oil shale as raw material for chemicals, and collecting and using the ash and waste heat.

The future will bring stricter European rules and directives on the use of renewable sources of energy instead of fossil fuels. It is essential for Estonia to plan for, and develop, technologies which will provide the necessary opportunities for Estonia to utilise and capitalise on local sources of renewable energy.

([117]) National Energy Technology Programme (2008).

Utilising renewable energy (e.g., wind energy), is, to a large extent, more a political and investment decision than a technology development issue. Large scale use of wind power, however, raises problems of energy balancing, transmission, and backup power, which are system level technology issues for the entire national electricity supply.

Many countries have made significant investments into basic and applied research in the field of new emerging sources of energy such as solar, fuel cells etc. Nonetheless, there have yet to be major commercial breakthroughs. Untapped markets mean there are still considerable opportunities for Estonia to also invest in the development of the new emerging sources of energy and to start its own technology programme. A key objective is to create technologies which will lead to IPR revenue streams for Estonian companies and research institutes ([118]).

Part of this objective involves encouraging SMEs to invest more in R&D and improving the national and international cooperation between universities, research institutes, and companies. All of these developments are in line with common EU initiatives, thereby providing opportunities for Estonia to make significant contributions to EU programmes, and also to benefit from any relevant European funding for technology programmes.

Currently, energy related technologies in Estonia are mostly related to the oil shale production process:

(a) in terms of desulphurisation rate, Estonian energy production must comply with EU Directive 2001/80/EC by end of 2007, with a special transition period until end of 2015 for named plants in Ahtme, Narva, and Kohtla-Järve;

(b) compliance with the desulphurisation directive will require investment in excess of 10.000 MEEK;

(c) producing shale oil using the Kiviter technology has problems which require large investments e.g., storage of the semicoke emission of sulphur compounds contained in the produced gas;

(d) by 2030, distributed micro-energy may spread widely based on fuel elements, depending on developments in the energy technology;

(e) combustion under pressure will increase the efficiency of oil shale burning from the present 35% to 40-45%;

(f) a Galoter type of pyrolysis process adapted to Estonian needs is currently being investigated and developed by at least four different companies in parallel.

Essential areas of particular importance to the environment are the development of the transmission network to improve efficiency and reliability, and the new challenges brought about by the increasing use of wind power. Heat production and distribution systems are areas with especially significant potential for efficiency gains. However, this will require

([118]) Estonian Development Strategy (2007), p.18.

investment in both improving existing, and developing new, infrastructure. Overall, whilst there is a good general level of knowledge and skills, there is no specialist area in which Estonia excels in the international arena. However, Estonia's decisions to invest in certain technologies are motivated as much by political desire for Estonia to be an active participant who helps shape the world's energy future, as they are by developing energy solutions to meet the national needs of Estonia.

The fuel producing industries in Estonia can be divided into those which are based on oil shale and those which are based on various biofuels. In the processing of oil shale, and associated industries such as the production of chemicals based on oil shale, Estonia has present unique competencies. However, whilst mining is an essential link in the value chain of producing oil shale, the technologies used are also widely used in the production of other minerals and so require fewer unique skills and technology.

In terms of biofuels, the production of wood pellets already produces some income from exports. Estonia is well placed to capitalise on the opportunities associated with the use of different bio-fuels in the future. In terms of solar energy, applied research in solar cell technologies is well advanced in Estonia. Solar cell technology is currently being commercially used through internationally operating product vendors.

The development and implementation of new energy technologies in Estonia has implications for skills need on two levels:

(a) development and export of new technologies in spearhead technology used in oil shale production (see Sections 3.2.5 and 3.2.6);

(b) upgrading competencies important for key technologies that play a key in Estonia, such as biofuels.

The implementation of a system for analysing and forecasting quantitative and qualitative changes in the labour market is envisaged for 2013. This task is to be fulfilled through the joint collaboration of specialists from MEAC, MER, MSA and EQA ([119]). This will improve Estonia's ability to understand changes in the volume and structure of the labour market, and to then respond accordingly and provide the required skills through the appropriate use of higher, vocational and adult education.

3.2.4. Skills response

The successful green restructuring of Estonia's national economy heavily depends upon the development and implementation of new technologies (see Section 2.2), and a change in public attitudes. (see Section 2.3). Therefore the skills response strategy that will be necessary to meet the challenges of a transition to a green economy will need to include not only initial

([119]) Development Plan for Adult Education (2009), p.19.

and continuous VET, but also investment into all levels of higher education and general education.

A successful economic recovery will depend crucially on whether people are willing to raise their skill levels and qualifications according to the changing needs of the labour market. In order to improve overall skill levels in Estonia, several measures have been implemented in general, vocational, higher and adult education during 2007-08 ([120]), including:

(a) modernisation of higher and vocational education curricula and matching higher education learning outcomes with labour market needs. The principles of the APEL (accrediting prior experiential learning) system have been introduced;

(b) financial support for educational institutions to enable them to better attract foreign students to Masters and PhD degrees in Estonia. Measures have also been introduced to encourage them to stay longer and to forge ties with the Estonian labour market (especially in research and development work) after they finish their studies;

(c) launching the DoRa programme (programme for doctoral studies and internationalisation) to increase the quality and competitiveness of higher education;

(d) support for studies abroad for Estonian Masters level students in order to ensure the availability of highly qualified people;

(e) modernisation of the infrastructure (classrooms, learning equipment) of higher and vocational education institutions;

(f) raising the qualification of teachers in vocational and general education by developing a needs-based additional training system for teachers;

(g) promoting science and technology study fields by increasing the importance of science subjects at basic and secondary school levels and by increasing the freedom of choice for secondary school and vocational education students; developing curricula in technology and the natural sciences for non-formal education institutions;

(h) extension of additional training and retraining opportunities for adults through vocational education, higher professional education and non-formal education institutions;

(i) further development of the system for career services based on the needs of society and the labour market.

More recently, additional measures have been introduced to increase the competitiveness of the Estonian economy, including:

(a) launching a talent programme. The aim of the programme is to encourage young specialists to return to Estonia after graduating abroad by offering them job opportunities in the private and public sector;

([120]) Estonian Strategy for Competitiveness (2009), p.21.

(b) attracting school dropouts and early school leavers back to vocational and higher education (such as the programme 'Back to studies' launched by MER in December 2009). More flexible opportunities will be created for school dropouts to allow them to finish their studies, targeting those who were successful in their studies, but dropped out due to economic reasons. The studies will be combined with counselling and a study grant ([121]);

(c) enabling adults to participate in additional higher education training in state commissioned study places;

(d) targeting continued training measures at students who ceased studies during the economic boom period and entered the labour market before graduation, thereby supporting those who were successful in their studies and dropped out mainly for economic reasons;

(e) launching career information centres and developing career services. Career counselling will also be extended to those in employment. Career information centres will be opened at regional offices of the Unemployment Insurance Fund;

(f) introducing business start-up packages in order to create new jobs. The package includes entrepreneurship training, counselling, mentoring new entrepreneurs and providing additional training over two years after the creation of the enterprise;

(g) temporary relaxation in 2010 of conditions for wage subsidies and increasing the respective budget;

(h) ensuring the continued employability of the unemployed by organising job clubs and offering opportunities for voluntary work;

(i) increasing the quality and availability of labour market services via more extensive use of modern information technology, such as the development of e-services and mobile counselling.

In 2006, the Organisation for Economic Cooperation and Development (OECD) conducted an international comparative PISA (Program for International Student Assessment) survey in 57 countries. The results highlighted the accomplishment and aptitude of Estonia's students – in science Estonian students achieved 5th place, 13th in reading and 14th in mathematics. However, in order to maintain this level of achievement, it is important to update general education and specifically, the national curriculum for basic and secondary school. Accordingly, work on the new curriculum started in 2005. The national curriculum for basic school ([122]) and upper secondary school ([123]) has since been adopted by the Government in January 2010.

([121]) Programme 'Back to Studies' (2009).

([122]) National Curriculum for Basic School (2010).

([123]) National Curriculum for Upper Secondary School (2010).

The new curricula aims to create systematic connections between subjects, to increase freedom of choice for students and to focus more attention on topics related to sustainability and entrepreneurship. Furthermore, increased use of e-learning will develop young people's knowledge of information and communication technology, improve their competitiveness and also enable more flexible participation for those who lack access via more traditional methods.

The Vocational Education Standard ([124]) is a set of uniform requirements for initial VET. The content of VET studies is further determined by the requirements for professional skills set forth by the occupational standards. Specifically, the Vocational Education Institutions Act ([125]), amended in 2005, stipulates that all curricula in initial VET must be based on respective occupational standards. Consequently, a new round of occupational standards development has now been initiated, which would serve as basis for curriculum development. However, in the absence of an occupational standard, the content of study shall be coordinated with the relevant professional associations. In the case of curricula for internationally regulated professions or specialities, the prescribed volume of study shall arise from the requirements established by international conventions.

Through this system, MER is hoping to develop a holistic competency-based qualifications system in Estonia. This will promote the mobility of learners, enable the needs of the labour market to be mapped, and allow expected learning outcomes to be described for different levels of studies ([126]).

VET institutions prepare a curriculum for each profession or speciality being taught and for every type of vocational training. The curriculum is based on the Vocational Education Standard and the national curriculum. Once developed, the national curriculum for VET determines the aim of the studies, the requirements for starting and graduating, the modules of curricula, the possibilities of, and conditions for, electing modules and possibilities of specialisation. The national curriculum is reviewed if a new occupational standard is established, or professional skills provided in the standard are amended. The national curricula are also developed by the task forces, which include representatives of employers, professional associations, and training institutions.

The school curriculum is described in the form of general, basic and elective study modules. General modules establish knowledge and skills common to several fields of study. Basic modules establish knowledge and skills necessary for a profession, speciality or occupation. Elective study modules extend professional skills or are related to additional qualifications. Elective modules make up 5-30% of the volume of a curriculum.

([124]) Vocational Education Standard (2009).

([125]) Vocational Education Institutions Act (1998).

([126]) Smart and Active Nation (2007), p. 28-29.

All national curricula and school curricula for initial VET contain a compulsory module on labour and environmental safety ([127]). It is important to emphasise that modules of national curricula can be, and are, used independently to develop continuous VET courses (see Section 3.2.6).

Initial and continuous VET includes the following fields of study which are related to the development of a green economy:

- architecture and urban planning;
- construction;
- electrical and power engineering;
- mining and quarrying;
- chemistry and process technology;
- environmental protection;
- manufacturing of wood, paper, plastics and glass;
- forestry;
- agriculture, forestry and fishery;
- agriculture and animal husbandry.

Further examples of specialities in initial VET which have indirect links to the development of a green economy include:

- mobile machines technician;
- rolling-stock locksmith;
- railway mechanic;
- freight forwarder;
- logistician;
- specialist of small harbours;
- operator of chemical processes;
- laboratory assistant;
- nature tourism management;
- rural tourism entrepreneurship;
- rural tourism service;
- agriculture technician;

([127]) National Curricula for Vocational Education and Training.

- forest management;
- forestry technician;
- operation of forest machinery;
- arborist;
- environmental protection technician;
- restorer of wood and stone buildings;
- facility serviceman;
- land improvement and hydro-technics;
- land surveyor;
- electrician.

In January 2010, the Minister of Education and Research signed a decree, confirming a state order for commissioned study places in initial VET for the period 2010-12 ([128]). The list contains several green qualifications, such as for an energy technology technician at the Järvamaa VET Centre. Another strategy of MER is to popularise vocational education among young people through youth skills competitions ([129]).

In higher education, the main focus is on continuously ensuring the competitive quality of higher education institutions while maintaining their autonomy. Other priorities include the strengthening of the role of universities and professional higher education institutions as leaders of innovation for Estonian development, and increasing the internationalisation of higher education. In the near future, more attention will also be given to encouraging Estonian students who are studying abroad to return to Estonia after their graduation. According to the OECD, approximately 700-800 young people leave Estonia every year. Thus, it is estimated that there are approximately 5,000 people studying abroad at any one moment. Ensuring their return is therefore important to Estonia's economy. Currently, there are no comprehensive statistics about the number of Estonians who have left to study abroad, or of those, what proportion would be interested in returning.

To improve the quality of higher education, the Quality Assurance Agency for Higher Education (QAAHE) was established in January 2009. Between 2009 and 2011, the agency aims to strengthen the institutional capacity of HEIs by relicensing institutions, modernising the accreditation system and changing the principles for the recognition of national diplomas. A similar system will be implemented for VET institutions.

In the current economic climate, more young people are opting to continue their studies rather than enter a volatile labour market. Most of them prefer to study in fields where there are state

([128]) Personal communication from R.Oselin (Järvamaa VET Centre).

([129]) Smart and Active Nation (2007), p.23.

commissioned study places. As a result of the need to increase the popularity of science and technology as fields of study, the Government has considerably increased the number of study places in natural sciences over the past years. Accordingly, the structure in higher education is developing in line with the needs of an eco-innovation based economy.

The popularisation of natural and exact sciences and technology has so far progressed mostly on a project basis (e.g. the Environmental Investment Centre's environmental awareness programme has supported different projects in the field of environmental education). Therefore, the Government is now aiming to systematically promote formal studies in science and technology, to raise the relative importance of the field, diversify methods for studying and organize special-purpose scholarships ([130]).

In the 2006-07 academic year, the share of graduates in science and technology comprised 21.1% of total graduates at higher education level. In recent years, the share of state commissioned places in science and technology has increased (36% of students in state commissioned places studied science and technology in the 2006-07 academic year). Nonetheless, subjects in science and technology are generally characterised by a high rate of withdrawal. As these fields are the cornerstone for an economy based on eco-innovation, it will be increasingly important that the careers in science and/or engineering are widely supported early on during primary and secondary schools.

In 2007, a support framework was created for HEIs to reform curricula in order to bring them in line with learning outcomes and qualification frameworks. Curricula development will also be continued in the coming years. Another important change is the forthcoming funding system of three-year result-based contracts for HEIs. The contract between MER and an HEI defines the institution's tasks and development goals, responsibility of the HEI in strategic matters, as well as the number of students that must graduate ([131]).

Measures have also been introduced to make Estonia's education system more internationally compatible and competitive. For instance, universities are beginning to offer Masters programmes in English. There is also increased cooperation with foreign universities in order to promote common curricula. These measures are being supported by the MER through the establishment of international Master's programmes during 2008 and 2011. Furthermore, MER is planning to continue its investment in measures that will increase foreign students' participation in Masters programmes in Estonia, and that offers them working opportunities in areas where there are shortages in the labour market (see Section 3.2.5).

The past few years have also seen the creation of the APEL system for accrediting prior experiential learning, which was initially limited to higher education. In October 2006, amendments to the law concerning universities and professional higher education institutions were approved that called for the implementing of APEL according to uniform

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([130]) Estonian Strategy for Competitiveness (2009), p.20.

([131]) Action plan for 2006 – 2009 within the Estonian Strategy for Higher Education (2006).

principles ([132]). This change is helping specialists in the workforce to more easily commence supplementary studies. A similar system was introduced for VET in 2009 ([133]). This aims to: support the professional development of teachers and vocational teachers through supplementary training and updated qualification requirements; apply a special allowance to young teachers graduating from teacher training programmes and going to work in rural areas and smaller towns.

Meanwhile, the objectives of the ETP put substantial burden on the R&D system and the related research training at universities. The Research, Development and Innovation Strategy 2007-13 directs growing support from the state on the basis of the following principles ([134]):

(a) preference given to R&D which promotes internationally competitiveness;

(b) creation of preconditions for the RD&I system to grow and be oriented towards efficiency, first at all creating a sustainable community of researchers and entrepreneurs and creating an attractive environment for research and development, and technological innovation;

(c) preference given to innovation projects that create high economic added value.

Moreover, specific fields will be prioritised by initiating and implementing national research and development programmes, in order to:

(a) implement state-of-the-art technologies that provide high added value and the growth of productivity in many fields of life (information and communication technologies, biotechnologies, material technologies);

(b) achieve socio-economic objectives in the areas that are important for Estonia, for instance in energy, national defence and security, health care and welfare services, environmental protection;

(c) promote research related to ensuring the sustainability of Estonian national culture, language, history and nature and the Estonian state.

The objectives set out in the strategy will be achieved through the national research and development programmes and four measures, which are:

(a) development of human capital;

(b) organising the public sector RD&I more efficiently;

(c) increasing the innovation capacity of enterprises;

(d) policy making aimed at the long-term development of Estonia.

([132]) Higher Education Standard (2008).

([133]) Vocational Education Standard (2009).

([134]) Research and Development and Innovation Strategy (2007).

In order to ensure the number of researchers and engineers is comparable with the average of the European Union (eight researchers and engineers per 1000 employees), favourable conditions will be created for research and development at universities and other research institutions. PhD courses will be expanded and researchers and engineers working abroad will be invited back to Estonia. The career models and development opportunities of RD&I personnel will be addressed systematically, the transfer of people and knowledge between educational and research institutions and enterprises will be encouraged and the necessary conditions will be created to encourage students and researchers to start their own enterprises.

According to the higher education strategy, Doctoral studies will be expanded to 300 PhD graduates a year by 2013 (there were 157 in 2009). To achieve this goal, the state will gradually increase the number of state-subsidised PhD students, create possibilities for foreign students to come to Estonia, and support the studies of Estonian PhD students abroad. In addition, the state will ensure the support measures for Doctoral studies (including Doctoral grants and social benefits for PhD students) and quality evaluation, Doctoral schools will be developed, and Doctoral studies and Doctoral schools will be integrated with research and development carried out in the centres of excellence and the centres of competence.

New measures have also been prepared for supporting traditional industries, which are oriented towards the implementation of new technologies and increasing the productivity of enterprises, the development of human capital and recruitment of leading development personnel and implementing professional design as a competitive advantage. The development of cooperation networks and clusters based on the initiative of enterprises is also being promoted.

Continuous and extended support will be provided to the projects developing new competitive technologies, products, services and processes, for which export orientation and environmental sustainability are considered significant advantages. Based on the needs of many traditional sectors of economy, support will be offered for projects that include testing and certifying, and design and productivity management, which in most cases are smaller in size, and lower in risk, than those which focus on technology development.

Under the SPINNO programme, the development of technology transfer units at universities and HEIs, as well as the encouragement of entrepreneurship and the support for the commercialisation of research results will continue.

National programmes covering different areas of administration will be launched, and coordinated by the MER or the MEC. The implementation of programmes specific to one area, however, will be the responsibility of the respective ministry. To successfully implement national research and development programmes, administrative capacity, cooperation and initiative of the ministries will need to be strengthened.

3.2.5. Case studies on new green collar occupations

3.2.5.1. Energy auditors

Energy auditing of buildings is a new group of occupations in Estonia. It emerged as a response to EU directives 2002/91/EU and 2006/32/EU as well as the Energy saving action plan 2007-13 ([135]) adopted by the Estonian Government.

From January 1, 2009, all the buildings and apartments sold or bought are required to have an energy certificate. During the transaction the seller is obliged to hand over the energy certificate to the buyer. All buildings designed in 2009 and onwards must have an energy certificate. For new buildings, the energy certificate is issued by the architecture bureau. The construction company hands over the energy certificate to the owner along with other relevant documentation when the construction is finished ([136]).

The most energy intensive sectors in Estonia are households (41% of total energy consumption) industry (21%) and transport sector (20%). About 60% of the housing stock in Estonia, most of which are apartment buildings, were built during 1950-89 and the majority of these buildings are today in a bad condition with substantial energy losses and hence a need for substantial renovation. The average annual energy consumption of apartment buildings in Estonia is 250 kWh/m^2, whilst in the Nordic countries with similar climates this figure is below 150 kWh/m^2. During 2008-10 the total annual volume of renovation was 150.000 m^2 and is expected to grow up to 350.000 m^2 per annum during 2011-14 ([137]).

According to the Construction Act ([138]) the right to issue energy certificates is licensed by the Ministry of Economy and Communications. Enterprises registered for issuing energy certificates fall into three categories ([139]):

(a) enterprises issuing energy certificates;

(b) enterprises performing energy auditing.

An enterprise applying for the license to issue energy certificates has to employ at least one certified energy auditor of the appropriate qualification. This means requires qualifications to be formalized in an appropriate way.

([135]) Energy saving action plan 2007-2013 www.mkm.ee.

([136]) The legal framework for issuing the energy certificate is established by the decree No 107 of the Minister of Economic Affairs and Communications from December 17, 2008.

([137]) Development Plan for Estonian Households 2007- 2013 http://www.mkm.ee/index.php?id=1733.

([138]) Construction Act www.riigiteataja.ee.

([139]) Register of Economic Activities at MEAC http://mtr.mkm.ee/.

Skills gaps/weaknesses

The Energy saving action plan 2007-13 describes the status quo in Estonia. The measures undertaken by the state to meet the needs of the labour market in the field of energy saving are non-sufficient. The major issues are: lack of motivation, lack of training providers and lack of training courses. Professional associations and employers associations are not capable of disseminating the professional know-how and offering the necessary education and training. Therefore, state support in preparing training courses and coordinating the activities of different stakeholders is necessary. The following actions have been envisaged:

(a) identification of stakeholders and specialties (occupations, professions), mapping of training needs, formulation of training principles;

(b) development of state support schemes for training courses;

(c) state support to training courses and study materials publication; recognition of the best trainers.

No special surveys to assess the quantitative need for specialists in the field of energy auditing have been commissioned. A rough estimate, made by MEAC together with the Credit and Export Guarantee Fund (KredEx) in 2007, at the very peak of the construction boom, was that 300-400 auditors and 2000 persons authorised to issue the energy certificate will satisfy the needs of the labour market.

Identification of skills needs

In the beginning of 2008, a task force was established at the Estonian Qualifications Authority to develop professional standards for this new group of occupations. Different stakeholders were represented in this taskforce: Estonian Association of Heat and Ventilation Engineers; Estonian Society of Bio-fuels; Estonian Association of Civil Engineers; Estonian Association of Thermal Power Engineers; Institute for Thermal Power Engineering at TUT; Institute of Electrical Drives and Power Electronics at TUT; Estonian Qualifications Authority.

In July 2008, four national occupational standards were approved by the professional council for Energy, Mining and Chemical Industry and the professional council for Construction and Geomatics (representing employers, employees, professional associations and governmental agencies related to these sectors of the national economy) at the EQA (see Annex 1) ([140]):

(a) person Authorised to Issue the Energy Certificate for Buildings III;

(b) energy Auditor IV;

(c) diploma Energy auditor V;

(d) chartered Energy Auditor V.

([140]) Estonian Qualifications Authority www.kutsekoda.ee.

These four standards are valid until 03/06/2013, and define four professional qualifications of increasing autonomy and responsibility in the energy auditing sector.

The standards for the energy auditing sector define the following profession specific competences:

(a) preparation for energy auditing and consultation (acquisition of initial data and documentation; preparation of the action plan; preparation of the visit to the building);

(b) inspection of different subsystems of the building (heating system; warm water supply system; cooling system; ventilation system; electricity appliances; illumination system; outer parts of the building; assessment of the rooms climate; inspection and assessment of the energy consumption of a technological process);

(c) performing the techno-economic analysis for different subsystems of the building and for the whole building (heating system; warm water supply system; cooling system; ventilation system; electricity appliances; illumination system; outer parts of the building; assessment of the rooms climate; inspection and assessment of the energy consumption of a technological process; energy consumption analysis for the whole building; comparison with similar buildings);

(d) compiling the energy audit report (analysis of the collected data; report writing);

(e) consultation on energy efficiency issues (energy efficiency project management; assessment of the efficiency of existing energy production and energy consumption units; preparation of expert reports, development plans, feasibility studies; information dissemination, research and training in the field of energy efficiency);

(f) preparation and issuing the energy certificate (both for existing and new buildings).

The above list of competences corresponds to the Chartered Energy Auditor occupation. Lower ranks of the profession have a more limited scope of expected competences. The general requirement to enter the profession is an academic degree or diploma in engineering.

Existing provision of education/training for the energy auditors

The Estonian Association of Heat and Ventilation Engineers is nominated as an awarding institution for qualifications in energy auditing.

Until 2008, no systematic education or training meeting the requirements of the professional standards for energy auditors was offered either through degree programmes or in the form of further education and training courses.

Nevertheless, the existing education and training system is capable of addressing the identified skill needs. Although TUT is the only higher education institution of university standing in Estonia offering academic degrees in all fields of engineering, including civil engineering, electrical engineering and power engineering, it has the competence to offer education and training in the field of energy auditing of buildings.

The skills response

The skills and training for certified specialists in the field of energy auditing of buildings is provided by the Faculty of Civil Engineering in the Institute of Environmental Engineering at TUT. In 2007, TUT won the tender for the EU sponsored project, which included:

(a) analysis of existing practices of energy auditing;

(b) development of the procedures for energy auditing;

(c) development of regulations for issuing the energy certificate for buildings;

(d) developing of professional standards for an energy auditor and for a person authorised to issue the energy certificate for buildings;

(e) preparation of a training programme and study materials for energy auditors and persons authorised to issue the energy certificate for buildings;

(f) offering the training programme for 30 persons and a seminar for 20 persons.

The further education and training programme Energy Auditing of Buildings, developed in this project takes up 12 ECTS and includes 80 academic hours of lectures in 20 modules. The course content is shown in Table 6.

Table 6: Content of energy auditing of buildings programme

Module	Length (hours)
Grade-days and energy consumption in Estonia	4
Construction physics	6
Gas supply	2
Heating	8
Outer constructions of buildings	4
Heat supply of buildings	5
Energy efficiency and environmental protection	2
Air conditioning	4
Local heat production	5
Climate in the rooms (measurement devices)	4
Cooling and cool production	5
Water supply	4
Electricity supply of buildings	4
Ventilation (4+5 hours); Energy auditing of the buildings	5
Issuing energy certificate to the buildings	5
Measurements and uncertainty	2
Introduction to individual assignments	2

These modules are delivered by professors and lecturers from the relevant institutes of TUT. Several topics are covered by specialists from construction, electricity, gas and water supply industries. The estimated amount of independent work to undertake the course is 60 hours.

The requirement for graduation is the successful 'defence' of coursework in front of examiners.

A shorter training course for Persons Authorised to Issue the Energy Certificate for Buildings is also available taking up six European Credit Transfer Systems (ECTS) ([141]). This includes 40 hours of lectures and 40 hours of independent work. The course includes the following modules: grade-days and energy consumption in Estonia; heat supply of buildings; legislation on issuing the energy certificate; climate in the rooms; construction physics; ventilation; electricity consumption of buildings; local heat production; preparing energy certificate for a building; final test for a person authorised to issue the energy certificate.

Training for the first class of energy auditors was free. Subsequently, the participants or their employers have had to pay a tuition fee.

The first course for Person Authorized to Issue the Energy Certificate for Buildings was offered in March and April 2008. 39 applicants were admitted, mostly specialists in the field of civil or thermal engineering and with substantial practical experience. 37 participants graduated successfully and received certification. A seminar for energy auditors was also held in the framework of the EU sponsored project where 23 auditors participated.

Three further training courses have been offered to date:

- August-September 2008 – 24 auditors received certification;
- January-April 2009 – 38 received certification in two parallel groups.

The fourth class started in August 2009 with 24 participants, 15 of whom have already graduated.

The Open University at TUT does not set any entry requirements for the participants of these courses. However, to gain certification as an Energy Auditor, Diploma Energy Auditor or Chartered Energy Auditor, an academic degree or diploma in engineering is required. Participants come from the construction and energy sectors involved in installing heating and ventilation systems and renovating buildings. Among the participants, 11 persons have been delegated and paid for by the Estonian Unemployment Insurance Fund (see Section 3.1.3).

Assessment of the effectiveness and organisation of this response

Skills response offered by TUT has proved to be fully adequate ([142]). Courses are delivered by lecturers who are top specialists in the field and have participated in the development of professional standards.

([141]) Open University at TUT http://www.ttu.ee/?id=2998&koolitus=792.

([142]) Personal communication from M.-K.Kerem (EQA).

Feedback from participants has been always very positive. Feedback from recent courses underlined a need to increase the share of practical hours, to deal in more detail with good examples of real audits and possible special cases ([143]).

Graduation from the further training course in energy auditing of buildings and the course for persons authorised to issue the energy certificate for buildings is not a prerequisite to apply for certification on any level of the energy auditing profession. To date, the Estonian Association of Heat and Ventilation Engineers have certified 146 applicants in the profession of energy auditing:

(a) 89 persons authorised to issue an energy certificate for buildings;

(b) 35 energy auditors;

(c) 16 diploma energy auditors;

(d) six chartered energy auditors.

Currently, 121 enterprises are licensed to issue energy certificate for buildings and 63 enterprises are entitled to perform energy audits of buildings ([144]). Feedback from enterprises is also positive ([145]).

Due to the recession, the early optimistic forecasts about labour market needs for auditors no longer valid. Therefore, there is no current urgent need to substantially increase the number of professionals in the field of energy auditing of buildings, despite the fact that the government is subsidising 50% of the energy auditing costs for apartment buildings through KredEx.

3.2.5.2. In-service training and apprenticeship at ABB AS

ABB AS, a daughter company of the ABB Group in Estonia ([146]), is a supplier of products and systems for power generation, transmission, process and industrial automation. During 17 years of operation in Estonia, ABB AS has invested more than one billion EEK. The strategy of the company has been to gradually move from subcontracting to the delivery of medium and high technology products and services ([147]). For the last three years, ABB AS has won the title of Foreign Investor of the Year in Estonia from Enterprise Estonia. ABB AS has developed four production units in Estonia and created more than a thousand new jobs directly or indirectly related to the renewable energy and environment remediation sectors. About five hundred of them work in the production units of the company.

([143]) Personal communication from TUT Open University.

([144]) Credit and Export Guarantee Fund http://www.kredex.ee/11607.

([145]) Personal communication from the professional council for Construction and Geomatics.

([146]) ABB AS www.abb.ee.

([147]) Press release of ABB AS (15.10.2009) www.abb.ee.

The electrical machines factory in Jüri has become the world largest producer of wind generators in its segment ([148]). In 2002, The factory started producing primarily basic components of the wind generators – stators and rotors. Since 2007, the factory has been undertaking the whole technological process, from punching the details for stators and rotors to assembling and delivery of end products. The list of clients for the factory includes major developers of wind parks in the USA, Spain, and Germany.

The industrial electronics factory in Jüri is producing frequency converters for low voltage drives. Currently, the factory employs 120 persons most of whom are line workers. In the near future this number will increase substantially to meet the need of ABB for frequency converters. The clientele of the factory includes users of frequency converters all over the world, e.g. large end users like metallurgy, pulp and paper, machine building industries, and different systems integration enterprises. One of the major end users is wind energy sector.

The factory of low voltage systems in Keila is one of the leading producers of electrical installation equipment in the Baltics. The factory was established in 1992 and is expanding its market share in the region. The factory employs 75 persons, mainly line workers.

Other activities of ABB AS in Estonia include:

(a) design and delivery of complex power transmission systems. The unit has been developing since 1992. The engineering team performing design and project management tasks consists of 22 members and the clientele comprises enterprises building or owning 6-330 kV electricity supply networks;

(b) design and delivery of process and industrial automation systems. The activities of this unit are concentrated around developing complex industrial process control systems, including automation, robotics and electrical drives. 26 engineers are involved in different systems development projects and the clientale of the unit includes major energy supply, construction and water treatment comapnies;

(c) design and delivery of medium voltage energy distribution systems. This unit is delivering medium voltage equipment and consultancy for enterprises involved in energy transformation and distribution. Engineering team in Estonia consists of four persons.

ABB is also offering a wide spectrum of professional maintenance (complex measurements, diagnostics and repair) and supply and support services (including training and consultation services for their clients).

New jobs created at ABB AS belong to five major occupational groups: managers, engineers, technicians, skilled workers and line workers. The majority of new employees at ABB AS are line workers for the electrical machines, low voltage drives, and low voltage systems factories.

([148]) Press release of ABB AS (29.05.2009) www.abb.ee.

Skills gaps/weaknesses

A deep restructuring of the economy and education system in Estonia during the nineties led to substantial gaps between labour market needs and the corresponding supply from higher education and VET sectors. This gap is most evident in the engineering specialities at specialist (professional), technician (assistant professional) and skilled worker level. During the nineties, there was a shortage of engineering graduates, especially in the fields vital for ABB AS. The curriculum content and learning environment in the higher education and VET institutions in these fields was suboptimal, as laboratories were outdated and there was a shortage of study materials and appropriate apprenticeship possibilities.

Although the situation has improved significantly since ABB AS was established, there is still a gap between the needs of employees and the output of the Estonian VET and higher education systems.

In terms of skills gaps, this meant that the competence profile of the graduates on all levels did not meet the requirements of the employer. In the case of university graduates, this suggests that graduates are lacking not only a good knowledge of theory, but also very limited knowledge and practical experience of modern technology. This is likely to be a similar situation with college or VET institution graduates.

Identification of skills needs

All major occupations at ABB AS have competence cards, describing the expected competence profile of an occupation. These in-company occupational standards are not related to the occupational standards of the Estonian Qualifications system (see Annex 1). The cards are administered by the personnel managers of production units and revised on an annual basis or in the event of changes made in the technological process. An important input for these changes stems from interviews with line managers, production managers and company management.

Technical competences of engineers and technicians employed by ABB AS are mainly in the area of electrical drives, power electronics, electrical energy supply, systems and software engineering, and industrial engineering. Technical competences of line workers and skilled workers are also diverse but related to electrical and mechanical engineering.

An important aspect of the competence profile is transferable skills (communication, team working, and learning). In the last few years, there has been an increasing demand for transferable skills amongst line workers. This required change in their competence profile stems largely from the fast changing business environment of the high technology company. This will create a demand for more line workers with better transferable skills, and for them to acquire necessary technical skills faster and so that they may be flexibly placed in different job situations depending on the work situation in the factory.

Existing provision of education and training

Graduates for engineers' and technicians' positions are offered by the TUT ([149]) (programmes in electrical drives and power electronics, mechatronics, industrial engineering, and in computer systems), and at the Tallinn University of Applied Sciences ([150]) (programme in mechanical engineering).

VET institutions in Estonia provide a wide spectrum of programmes related to mechanical and electrical engineering, and electronics. ABB AS is expecting to recruit graduates for line worker, skilled worker and technician positions from Tallinn Technical College ([151]) (who run programmes preparing electricians, assemblers of electronic devices, automation technicians), Lasnamäe School of Mechanics (welders, automation technicians, CNC machine tool operators), Tallinn Industrial VET Centre (CNC machine tool operators, welders, machine-tool workers), Rakvere VET School (assemblers, welders). All listed study programmes are based on the respective national curricula ([152]) and indirectly on the national occupational standards ([153]).

The skills response

The personnel development strategy of ABB AS follows three major lines:

(a) offering in-service training possibilities to line workers, skilled workers, technicians, engineers and management;

(b) investing in the study possibilities and learning environment of future managers, engineers and technicians;

(c) direct involvement in the curriculum design and development for the corresponding study programmes.

ABB AS has a well developed system of in-service training programmes for all major groups of occupations: line workers, technicians, engineers and managers. The training portfolio includes continuous in-service training, new products training, specific competence oriented training, regular training implied by legislation (e.g. labour safety training) and ad hoc training (in response to product quality issues).

The Personnel Training Centre is responsible for planning and administration of companywide in-service training activities, e.g. related to the development of managerial competences (management of supply chains, conducting development interviews,

([149]) Tallinn University of Technology www.ttu.ee.

([150]) Tallinn University of Applied Sciences www.tktk.ee.

([151]) Tallinn Technical College www.tpt.edu.ee.

([152]) National curricula for VET www.ekk.edu.ee.

([153]) Occupational standards www.kutsekoda.ee.

presentation skills, finances and financial analysis). The Centre also develops guidelines and procedures for in-service training at ABB AS ([154]).

In-service training meeting the specific needs of employees of the production unit is organised by the personnel manager of the unit. This mainly concerns skilled workers (electrical machines factory, industrial electronics factory), engineers (automation project design, software development), product managers, and project managers.

Training plans are prepared in cooperation with production units and (re)training needs are mostly identified as a result of regular development interviews. Training courses are often provided by ABB Group (headquarter or other daughter companies), higher education institutions (TUT, UT and others) and well known Estonian training centres (EBS Management Training Centre, Mercury, Invicta).

In 2009, ABB AS arranged 882 in-service training courses with a total duration of 7256 hours. The majority of these courses were short internal courses (up to eight hours) and the average number of the employees at ABB AS was 1050.

All participants of an in-service training (in-house or external) receive an electronic feedback questionnaire. The respondents are invited to assess the quality of the trainer and to rate their satisfaction with the results. This information is submitted to the Personnel Training Centre via intranet and used as an input for future planning activities.

All new employees get a comprehensive overview of the company, major fields of activity, company management and personal development opportunities. ABB AS has a special inception programme for new specialists and managers. Depending on their position, the programme duration lasts up to four weeks. The inception programme for line workers includes workplace training and instruction on work environment and safety.

To secure future quality and availability of skilled personnel, ABB AS is working closely with Estonian higher education institutions. The company has cooperated with TUT, Tallinn University of Applied Sciences and Tallinn Technical College since 1992 when ABB started operations in Estonia, offering scholarships for the students of these institutions and practical training opportunities. The company has also supplied the laboratories with modern equipment, (such as industrial robots, frequency converters, servo-drives, automatic control devices and industrial software packages), offering apprenticeship opportunities for the engineering students in the respective fields, and participation in the study programme design. The total value of laboratory equipment, used in the regular study process as well as for training needs of ABB AS personnel and their clients, donated by ABB AS to TUT is over two million EEK.

([154]) Personal communication from the Personnel management Centre of ABB AS.

The scholarship programme of ABB AS aims at improving the image of engineering profession in Estonia by attracting talented young people to study power engineering and engineering sciences. The company is offering two types of apprenticeship: short term (up to one month) practice, including initial training and overview of the company, and work placements of 1-4 months, which includes initial training and real work experience. A mentor is appointed for each trainee, who is responsible for everyday coaching and providing adequate feedback. Work placement takes place in the Electrical machines factory, where the students work full time. An electrician's apprenticeship programme in the factory of low voltage systems is also under development in cooperation with the Tallinn Technical College.

Assessment of the effectiveness and organisation of this response

During the period 2005-09, ABB AS offered 17 apprenticeship placements for the students of TUT, 12 for the students of TKTK and 31 for the students of Tallinn Technical College, 26 for apprentices from Lasnamäe School of Mechanics, 36 for apprentices from Tallinn Industrial VET Centre, 16 for apprentices from Rakvere VET School. In 2008, ABB AS offered scholarship programmes for four VET and higher education institutions, with nine scholarships awarded. This includes the scholarship programme at TUT (the faculty of power engineering, the faculty of mechanical engineering, and the faculty of informatics) and Virumaa College of TUT in the north-eastern part of Estonia, preparing future specialists in energy technology.

Some in-service training projects have been sponsored by the Enterprise Estonia, e.g. in-service training for management and line workers at the factory of low voltage systems, in-service training in quality management (LeanFactory) at the same factory, and in-service training for shift and production managers of the Electrical machines factory ([155]).

The company is cooperating with different education and training institutions supplying graduates of expected competence profile and offering apprenticeship opportunities for their students. ABB AS has also contributed to the improvement of the learning environment of these institutions and is actively involved in the study programme development. According to an assessment of company management, the strategy has proved to be successful and will be continued ([156]).

ABB AS has established a well functioning in-service training system, which allows the company to follow its ambitious development aims. One of them has been successful in entering the wind generator market.

([155]) Enterprise Estonia www.eas.ee.

([156]) Personal communication from the Persanl Development Centre of ABB AS.

3.2.5.3. *Masters' programme in sustainable material and processes for energetics*

Rising oil prices and the possible dangers of catastrophic climate change lead to a very high priority of energy issues on the international policy agendas. EU policy focuses on creating a competitive internal energy market offering quality service at low prices, on developing renewable energy sources, on reducing dependence on imported fuels, and on doing more with a lower consumption of energy ([157]).

Estonia aims to develop technologies for utilising local fossil (oil shale, peat) and renewable sources of energy to the maximum extent. Large scale use of wind power, however, involves technical problems connected with energy balancing, transmission, and backup power, which present technology issues for the entire national electricity supply. Furthermore, in the early stage of emerging sources of renewable energy it is feasible for Estonia to invest in the development of renewable energy and start its own technology programme. One of the main targets is to create technologies from which Estonian companies and research institutes can create intellectual property rights revenues ([158]).

As a result of extensive consultations between the Government officials, representatives of energy sector and academia, the following three directions of development have been identified (see Section 3.2.3):

(a) development of the whole oil shale end to end process;

(b) mapping, utilising, and developing renewable sources of energy;

(c) study and develop new emerging sources of energy.

The National Energy Technology Programme ([159]) has been developed with an overall aim to:

(a) contribute to achieving the goals set by the European Council for the energy sector;

(b) improve competitiveness of the Estonian economy through better energy efficiency;

(c) increase the use of renewable energy in the Estonian economy;

(d) improve environmental sustainability.

With respect to R&D activities, the main goals of the programme are establishing internationally competitive human resources at research institutions, supporting companies in the development and implementation of energy technologies and facilitating work to reach these common goals.

Sustainable development requires means to optimize end-use efficiency and the concept of integrated value chain is operationalised more frequently in systems analysis. Instead of analysing energy systems starting from different primary energy sources analysis is shifting to

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([157]) European Commission http://ec.europa.eu/energy/.

([158]) Estonian Development Strategy (2007).

([159]) National Energy Technology Programme (2008).

the end-user. One of the consequences of this paradigm shift is that rather than being a problem for specialists, sustainable development and especially sustainable energetics ([160]) becomes a problem of generalists ([161]).

Sustainable development and energy related education need to address the future challenges of energy use, transport and supply, which will be different from the past in many ways. This means that Estonia has to develop skills in:

(a) superefficient end-use;

(b) increasingly diverse, dispersed, renewable electricity sources;

(c) shift of the key energy carrier from electricity to hydrogen;

(d) integrating and innovating the least-cost mix of all energy options.

Optimising use, conversion and production of energy requires an educated workforce to implement this shift. This need can be adequately addressed by the higher education sector, and to this end the masters' programme in Sustainable Material and Processes for Energetics has been developed. Starting in September 2009, the course offers a wide range of potential applicants from different backgrounds the opportunity to become generalists in sustainable energetics. The programme was developed in the framework of the EU sponsored programme 'Development of human resources for R&D 2008-11' and was launched as a result of an open tender for the development of academic study programmes offered in foreign languages (see Section 3.2.4). The project grant amounts to 5.85 million EEK.

Skills gaps/weaknesses

Design and implementation of future energy systems requires engineers who are generalists with a broad and interdisciplinary knowledge in all areas of energy use, conversion, transport and storage as well as in energy policy and economics. They need to be able to coordinate with specialists in other fields to understand complex issues, and to be capable of translating more technical language to disseminate this knowledge to the general public, politicians and administrators, by making it more accessible to wider audiences. This requires a kind of training that did not before exist in the higher education system, particularly in Estonia.

The Estonian context adds some specific features to the expected interdisciplinary body of knowledge and skills necessary in sustainable energetics. This is mainly because a substantial part of the backward value chain from the end-user to different sources of energy will also include oil shale (see Section 2). On the other hand, the diversity of other (renewable) sources of energy is gradually increasing.

([160]) Energetics is defined here as the scientific study of energy flows under transformation.

([161]) Meissner, D. et al (2009).

Classical engineers are specialists in the respective fields such as electrical engineering or machinery construction. Energy engineering education starts with the primary energy conversion machinery such as steam engines, wind power generators or solar cells, or with energy storage or transport devices. The complete system follows only in a subsequent step if at all. However, in order to minimize energy consumption, first of all, the energy needs of the end user must be analyzed and minimized, and only subsequently should the complete energy system be optimized.

In order to minimize consumption and to optimize complete energy systems, a very broad knowledge of all aspects of energy end-use and energy systems including distribution and management is required, which classical engineers specializing in a certain direction obtain at best after several years of practical work.

Identification of skills needs

Practical experience in Austria has shown a strong demand for such broadly educated engineers exists today in industry as well as in academia, administration and private as well as public institutions. Since the importance of energy saving and intelligent energy systems will rise significantly in the future this demand will even further increase. The integration of optimized energy use in the planning and construction of facilities, buildings, traffic and in urban planning as well as the need for research in new energy technologies will provide safe working places for many more engineers than a single education program can provide ([162]).

The main partner for the developers of the programme in identifying the skills need has been the Eesti Energia AS (see Section 3.1.4). According to their estimate, the need for Masters level graduates of a generalist type is 7-8 per year. The graduates are especially required in two particular units of the company – The Renewable Energy Business Unit (established in 2009), and also the Department for Development ([163]).

Several companies involved in the solar cells development and production are also interested in the graduates of generalist type, e.g. the CrystalSol is expecting six per year. With these companies the developers of the programme have established close cooperation. The cooperation also includes practical training placement of the students in these companies ([164]).

The Estonian public sector (the Ministry of Economic Affairs and Communications, the Ministry of Environment and several governmental agencies) is also considered to be a major destination for sustainable engineering graduates.

Existing provision of education and training

([162]) Personal communication from Dr.D.Meissner, TUT.

([163]) Personal communication from Dr. I.Aarna, head of the Department for Development at EE AS.

([164]) Personal communication from Prof. A.Öpik, (TUT).

Universities in Estonia offer traditional study programmes in materials science and materials technology. 'Traditional' in this case means that gradually the student will narrow his/her focus of studies into some narrower field on materials science or materials technology to become a good specialist in this field. As an example, academic study programmes in Technology of Materials (Bachelor's and Master's programmes) and Chemical and Materials Technology (Doctoral programme) are offered at TUT ([165]). The University of Tartu is offering programmes in Materials Science, encompassing all three levels ([166]).

At the moment, several universities offer courses on renewable energy systems and sustainable development. Some examples from countries neighbouring Estonia include:

(a) master's programme in Energy Management and Planning at the Aalborg University, which addresses mainly economic aspects ([167]);

(b) master's programme in Innovative Sustainable Energy Engineering at the Royal Institute of Technology (KTH), Sweden, which does not contain any subjects in materials and materials technology ([168]).

However, even worldwide, only very few of them ([169]) address the problem in the broad way necessary to change the paradigm in energy and energy related education. One good example is the BSc program in Eco-Energy Engineering at the Upper Austrian University of Applied Sciences ([170]).

The skills response

The Master of Science programme 'Materials and Processes in Sustainable Energetics' ([171]) has been developed by members of the Faculty of Chemical and Materials Technology at TUT and of the Faculty of Natural Sciences and Technology at UT. The programme development team is from the EU Centre of Excellence in Materials Science in Estonia ([172]). Their research teams participate in several EU R&D programmes and projects with a very high level of expertise especially in photovoltaics and fuel cells. The two year programme has two specialisations: Materials for Sustainable Energetics and Processes for Sustainable Energetics, in order to aim at the employment markets for scientists continuing their

([165]) Tallinn University of Technology http://www.ttu.ee.

([166]) University of Tartu http://www.ut.ee.

([167]) Aalborg University http://en.aau.dk.

([168]) Royal Institute of Technology http://www.kth.se.

([169]) Other examples include leading Universities in the US such as new programs in Harvard, Princeton and the MIT. In Europe several Universities now start to offer programs in Renewable Energy Technologies such as DTU in Risø, Denmark, KTH in Stockholm, Sweden, the Universities Ulm and Freiburg in Germany or Eindhoven and Utrecht University in the Netherlands.

([170]) Meissner, D. et al.(2009).

([171]) www.sustainableenergetics.eu.

([172]) Ministry of Education and Research http://www.hm.ee.

education in a PhD program and for master level engineers directly entering the labour market, respectively.

The programme objectives are ([173]):

(a) to cover the possibilities of minimising and optimising the use of energy based on thorough applied and practical interdisciplinary skills;

(b) to design, develop and improve materials for use in sustainable energy systems;

(c) to provide in-depth scientific understanding of energy materials;

(d) to create a broad and general understanding of all aspects of sustainable energy conversion, transport, storage and use.

The programme is designed to create an in-depth scientific understanding of specific properties and technologies for functional materials for solar energy energetics and environmental engineering. The students are expected to learn to coordinate and lead specialists to work together to create optimised systems and thereby provide best solutions for planning organisations, private and industrial users of energy as well as energy contractors and providers. Further study on the doctoral level is encouraged.

The programme has a general element for all students providing the fundamentals of sustainability, energetics and – depending on the educational background of the students – engineering for scientists and science for engineers, respectively. The students will then have to choose one of the two specialisations, i.e. materials for energy saving, conversion, transport and storage and environmental protection for those aiming at a scientific career, and processes of biomass utilization, construction engineering and industrial processes and environmental protection for those planning looking for engineering career.

With a very strong emphasis on end-user needs, the programme aims at whole-system engineering as required to improve the end-use efficiency. At the same time, specialization on a scientific career will be possible in the field of materials research with an emphasis on photovoltaics and fuel cells.

An important part of the programme is individual work, including a research project in the industry or in a research lab, which forms a total of about 1/3 of all credits. The research project encompasses three semesters. The Masters' thesis is also prepared either in a research group at the university or in industry, respectively, and can extend the research project further ([174]).

The first 19 students to the programme were admitted in September 2009. The programme is offered in English. Eight students are from Estonia, the rest from other countries (Austria,

([173]) Tallinn University of Technology http://www.ttu.ee.

([174]) http://www.sustainableenergetics.eu/.

China, Latvia, Mexico, Nepal, Russia). The student body is almost equally distributed between engineering and natural sciences academic background. The course is free for the students and additionally, they are entitled to a scholarship amounting 1,000 EEK per month.

Assessment of the effectiveness and organisation of this response

The programme is an initiative of the academic community in Estonia based on the identified need for a new paradigm in education and training of future engineers and researchers in the field of sustainable energetics. The programme presents a coherent response to the global challenges of sustainable development and the challenge of building a reversed supply chain from the end-user of energy to the primary energy sources. This initiative could not be expected from the government or industry. Since the background of the authors of the programme is natural sciences and engineering, the programme is still mainly a science and engineering programme trying to expand the view of the students beyond the current horizon of sustainable development.

The programme meets Estonia's needs in two aspects:

(a) preparation of engineers and scientists with a holistic and broad understanding of sustainable development and energy related issues and capable to implement it in the national and international context;

(b) increasing export potential of Estonian higher education sector. The programme seems to have a good chance of becoming a 'nucleus' for wider cooperation of universities in Europe in the framework of the so-called Euromaster programme envisaged by the designers of the programme.

It is expected that in the course of the transition assessment of study programmes, the Programme will be awarded full accreditation and starting from 2012, the MER will commission a sufficient number of graduates of the programme from TUT ([175]).

Estonia thereby not only prepares itself and its industry for dramatically changing boundary conditions in the energy field, but also takes a leading role in restructuring energy education in Europe and hopefully world-wide. Strong interest in implementing this model exists already in several African as well as Asian Universities. Close support of these activities will be given by the academic community and hopefully also by future graduates of this program.

Discussions are already underway to integrate the Estonian programme with programmes of some European universities to form a European Masters and integrated PhD program. An extension towards an integrated European PhD program is currently being planned, and includes e-learning and remote lectures to introduce the new paradigm also in other universities and countries. For example, the Moscow Power Engineering Institute with its

([175]) Personal communication from Prof. A.Öpik, TUT.

1000 students, and the International Sustainable Energy Development Centre under the auspices of UNESCO, has already expressed a strong interest in collaboration ([176]).

3.2.6. Case studies on greening existing occupations

3.2.6.1. Forestry

The volume of forests has significantly increased in the last 50 years, making it one of the biggest resources in Estonia both in natural and economic terms. The purposeful and prudent use of forests is considered to be crucial to ensuring sustainable development. More than a half of Estonian land, about 50.6% or 2.3 million ha, is covered by forest ([177]). 70% of the forests are commercial forests covering 1.5 million ha. One third of Estonian forests have been placed under different protection regimes. With a 30% proportion of protected forests, Estonia is far ahead of its neighbouring countries (Latvia 19.5%, Lithuania 18.7%, Sweden 12.3%, Russia 10.7% and Finland 7.2%). The most widespread tree species in Estonia are the pine, birch and spruce.

The optimal rate of logging defined in the Estonian Forestry Development Plan ([178]) is 12.6 million m^3 a year until 2010. As a result of developments during the dramatic transition of the nineties, logging reached a record level in 2000, almost equalling the increment of forest stands, i.e. almost 12 million m^3. Logging began to decrease as processing of raw material and provision of forestry based services increased in 2003. In 2006, coniferous wood (pine and spruce) constituted about 60% of the quantity of harvested timber. Birches are the most frequently harvested deciduous trees.

On average, 5800 ha of forest has been planted a year (in 2005-08, the average amounted to 6200 ha a year), for which purpose almost 14 million forest tree plants were used yearly. 69% of the planted areas were planted with spruce, 18% with pine and 12% with birches. Sowing was carried out on an average of 1400 ha a year. In addition to establishing forest cultures, natural forest regeneration (including sowing, planting of trees, cutting down competing plants) was promoted on almost 2000 ha a year. In order to establish forest cultures and to promote natural regeneration, almost 5300 ha of ground were prepared, i.e. mineralised, per year.

The importance of forests for Estonia is expressed in terms of their:

(a) economic aspect – forests as a source of revenue;

(b) social aspect – ensuring of employment and provider of recreation;

(c) ecological aspect – preserving the diversity of species and depositing carbon;

([176]) Personal communication from Dr. Dieter Meissner, TUT.

([177]) Estonian Ministry of Envirnment www.envir.ee.

([178]) Estonian Forestry Development Plan www.agri.ee/.

(d) cultural aspect – forest as a part of Estonian culture.

Estonia is pursuing a policy of multifunctional forest use satisfying simultaneously economic, social, ecological and cultural needs ([179]). According to the Estonian forest policy adopted by Estonian Parliament in 1997 ([180]), Estonian forests are a great natural and ecological resource. Two general objectives have been set for forest management:

(a) sustainable forest management maintaining biological diversity, productivity, regeneration capacity, vitality and potential to fulfil relevant ecological, economic and social functions, at local, national, and global levels;

(b) effective management of forests.

To measure the attainment of the objective, a system of balanced indicators is used which is based on the Improved Pan-European Indicators for Sustainable Forest Management, 2002, and covers both quantitative and qualitative indicators. The National Environmental Action Plan of Estonia for 2007-13 ([181]) envisages the following lines of action:

(a) long-term planning of the development of forestry with a view to balanced satisfaction of economic, social, ecological and cultural needs relating to the utilisation of forests;

(b) development of a system of incentives, benefits and regulations with a view to encouraging the management and sustainable utilisation of multifunctional forests;

(c) development of forestry-related information and monitoring systems to enable informed decisions to be made;

(d) improvement of the supervision system for reduction of illegal utilisation of forests.

Skills gaps/weaknesses

The National Forest Programme (2001-10) ([182]) was adopted by the Riigikogu in 2002 in order to promote the emerging private ownership of forests, develop the forest and timber industry, increase awareness about environmental protection problems and safeguard sustainable forestry (e.g. through inclusion in Natura 2000). The government recently initiated the preparation of the new National Forest Programme (2011-20) ([183]). The programme follows objectives set in the Estonian forest policy document.

Currently there are about 55,000 private owners of forests, the majority of whom follow the principles of sustainable forest management. Nevertheless, the results of recent audits show that the quality of private forest management is in general lower than in state owned forests.

([179]) Estonian Environmental Strategy 2030, www.envir.ee.

([180]) Estonian forest policy www.riigiteataja.ee/.

([181]) National Environmental Action Plan of Estonia for 2007-2013 www.envir.ee/.

([182]) National Forest Programme (2001-2010) www.agri.ee.

([183]) Valitsuse teade uue metsanduse arengukava algatamise kohta www.valitsus.ee.

Besides the weakness of state supervision, this is particularly caused by the weakness of support infrastructure, including state support measures, consulting, and development of necessary new skills and competences. As a result, the following three areas have been targeted:

(a) stabilising the use of resources;

(b) assuring long-term competitiveness of the forestry sector;

(c) efficient management of forests protection.

Changes in the forestry labour market needs are characterised by the following developments:

(a) there is a need for persons capable of managing forests of different ownership form, size and purpose;

(b) there is a need for persons capable of managing new technology and machines (e.g. harvesters and forwarders);

(c) there is a need for persons capable of carrying out sectoral analysis, research and development programmes and projects.

A recent development in the forestry sector is the decision by Eesti Energia AS to use low quality wood in the oil shale power plants from October 2009. This decision has two implications. On one hand, it is increasing the share of renewable energy and on the other, this has allowed the forestry sector to create an additional 500 jobs, mainly skilled workers.

Identification of skills

The Labour Force Forecast until 2016 describes the following quantitative changes in the forestry subsector ([184]).

The forestry subsector is responsible for 27% of jobs in the agriculture, fishery and forestry sector in Estonia. The major employer in the forestry sector is AS Metsäliitto Eesti, a Finnish capital based enterprise, producing annually about 750.000 m^3 of timber products. At the same time, State Forest Management Centre produces 2.1 million m^3 of timber.

The number of employees in the sector will stabilise around 7-8,000 (see Table 1) because of the increase in the timber production. According to the forecast, the share of skilled workers and specialists will increase and the need for unskilled labour decrease.

The job structure will heavily depend on strategic decisions taken by the board of the State Forest Management Centre and the direction of EU structural funds implementation. Increasing the share of forest regeneration will slow down the rate at which unskilled labour is no longer required, while increasing need for timber will cause increased need in skilled labour and specialists. Because of the high average age of employees in the forestry sector,

([184]) Labour Force Forecast www.mkm.ee/.

about 2400 of them are expected to leave the labour market by 2016, suggesting that demographic shifts could have consequences for the employment structure in the forestry sector.

Existing provision of education/training in the forestry sector

Initial training of forest workers, operators, technicians and entrepreneurs is carried out in two VET institutions: Luua Forestry School ([185]) (established in 1948) and Voltveti branch of Pärnumaa VET Centre ([186]) (established in 1925). Both institutions have long traditions in training future employees for this important sector of national economy.

Training of professionals for the forestry sector dates back to 1919, when the Faculty of Agriculture, Forestry and Veterinary Medicine was established at the University of Tartu. In 1951, a separate EULS ([187]) was established. EULS is offering academic programmes in forestry on all three levels. Experimental stations and trial plots, where students could undertake research work, also belonged to the faculty. Many graduates of EULS work as lecturers in VET institutions of a forestry profile or as mentors of practical placements.

The mission of EULS is to foster sustainable use of natural resources through knowledge based education. To support this, the university has created the initiative of 'green university'. The vision of the green university is a university with the smallest possible ecological footprint, a healthy and good working and learning environment, and a university that takes into account the principles of sustainable development in all decision making processes.

Skills response

The labour market needs and expectations in forestry have been formalised in a number of occupational standards, developed by the Professional Council for Forestry (see Annex 1) ([188]):

(a) logger I (the first qualification level in the 5-level qualifications framework);

(b) forest worker II;

(c) forwarder operator III;

(d) harvester operator III;

(e) forest technician III, IV;

(f) timber merchant III, IV;

([185]) Luua Forestry School www.luua.edu.ee.

([186]) Pärnumaa VET Centre www.hariduskeskus.ee.

([187]) Estonian University of Life Sciences www.emu.ee.

([188]) Estonian Qualifications Authority www.kutsekoda.ee.

(g) forest entrepreneur III;

(h) arborist II, III.

The Vocational Education Standard ([189]) is a set of requirements for vocational education and training whereby the content of studies is determined by the requirements for professional skills set forth by the occupational standards. In the absence of an occupational standard, the content of study is coordinated with the relevant professional associations. The study programmes in forestry belong to the broad group of studies in agriculture, and field of study in forestry.

Based on the occupational standards, four national curricula for the forestry sector have been developed during the period 2006-08 ([190]). The national curricula have been developed by a task force including representatives of employers, professional associations, and trainers and are based on the above listed occupational standards. The four curricula are described in a single document, containing descriptions of 50 general, basic and elective study modules for the corresponding four initial VET programmes: forest management, forestry, operation of forest machinery and arborist (see also Section 3.2.4). These 50 modules can also be used and to design shorter initial or continuous VET courses.

Table 7 illustrates how Luua Forestry School and Voltveti branch of Pärnumaa VET Centre have used these national curricula to design their study programmes. Regional representatives of the forestry sector are invited to participate in the process. The National Examinations and Qualifications Centre ([191]) assesses the correspondence of the school curriculum to the national curriculum.

Starting from October 2007, VET institutions have been offering short (up to 80 contact hours), initial, and continuous VET courses for adult learners, commissioned by the Ministry of Education and Research. The courses offered use modules of the national curricula for the corresponding sectors. Luua Forestry School and Voltveti branch of Pärnumaa VET Centre have both been very active in offering such continuous VET courses for the forestry sector employees.

During the period 2008-09, 326 persons participated in short VET courses (up to 80 hours) organised by state owned VET institutions in the study field of forestry and financed in the framework of state commissioned study places for adult learners. During 2008, the total number of participants in such courses has been 427, with 236 study places commissioned by the Ministry of Education and Research, three study places commissioned by the Unemployment Insurance Fund, 84 paid by the employers and eight paid by the trainees themselves.

([189]) Vocational Education Standard www.riigiteataja.ee/.

([190]) National Curricula for VET www.ekk.edu.ee/.

([191]) National Examinations and Qualifications Centre www.ekk.edu.ee.

Table 7: Graduates of Luua forestry school and Pärnumaa VET centre by study programme

Institution	Initial VET Programme	2004-05	2005-06	2006-07	2007-08	2008-09
Luua Forestry School	Forwarder operator	8	9	3	10	10
	Harvester operator			5	13	5
	Forestry (general)	37	19	11	15	10
	Forestry (arborist)			5	9	9
	Forestry (entrepreneur)			6		12
	Forestry technician			8	9	4
	Forestry merchandise			4	9	
	Wood further processing operator			8	5	
Luua Forestry School total		*45*	*28*	*50*	*70*	*50*
Pärnumaa VET Centre	Forest management			7	11	15
	Forestry	13	10			
Pärnumaa VET Centre total		*13*	*10*	*7*	*11*	*15*
Total		**58**	**38**	**57**	**81**	**65**

Source: Estonian Educational Information System

Funding from the Agricultural Registers and Information Board (PRIA) is also available for training people in the forestry sector. PRIA was established in summer 2000 as a government agency working in the area of administration of the Ministry of Agriculture. Establishment of the new agency was necessary in order to prepare and implement the SAPARD (Special Assistance Program for Agricultural and Rural Development) programme in Estonia ([192]).

Assessment of the effectiveness and organisation of this response

Starting from 2005, the graduates of initial VET institutions have had an opportunity to apply for a professional certificate in the corresponding occupation upon graduation or a year after graduation free of charge. About 70% of graduates have used this opportunity, with a 27% success rate ([193]). The number of professional certificates issued to the applicants in forestry related occupations is presented in the Table 8.

([192]) Agricultural Registers and Information Board (PRIA) www.pria.ee/support/forestry.

([193]) Kutsehariduse näitajad 2007-2009 www.hm.ee.

Table 8: 525 certificates issued since 2000

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Forest worker II					5	0	0	7	15	16	43
Harvester operator III								20	0	9	29
Forwarder operator III	5	4	8	9	7	8	5	5	16	14	81
Arborist II									14	14	28
Logger I					19	63	58	60	67	77	344
Total	**5**	**4**	**8**	**9**	**31**	**71**	**63**	**92**	**112**	**130**	**525**

Source: Estonian Qualifications Authority

Unfortunately it is very difficult to correlate Table 7 and Table 8, i.e. to find how many graduates of a VET institution have been awarded professional certificates. This is mainly due to problems associated with integrating the following two databases: the Estonian Educational Information System and the Estonian Professional Qualifications Registry.

The development of the initial and continuous VET system for the forestry sector in Estonia, covering all aspects of the competence cycle (see Annex 1), has shown that the sector is moving towards a holistically functioning qualifications system ([194]). Because of different approaches to occupational standards and national curriculum design, it is still difficult to set clear criteria of correspondence between occupational standards and study programmes. This can be accomplished only if all entities in the competence cycle are described in terms of expected learning outcomes.

The technology in the forestry sector is changing very rapidly and in many occasions includes complex elements of information and communication technology (ICT). The Estonian Association of Information Technology Enterprises has initiated a project of mapping expected ICT competences in other branches of industry, e.g forestry ([195]).

3.2.6.2. Electrical power plant and network managers, engineers and researchers

The energy market in Estonia is set for a series of changes in the coming years. Carbon trading will be implemented in the coming years, the energy market will become totally open after 2013 ([196]) and neighbouring countries who are currently exporters of energy are expected to become net importers. Meanwhile, most of the energy production sections at

([194]) Pesonal communication from M.-K.Kerem (EQA).

([195]) Personal communication from J.Jõema (Estonian Association of Information Technology Enterprises).

([196]) Electricity Market Act.

Narva power plants, yielding more than 90% of the electric energy produced in Estonia, have to be shut down by 2016. Regardless of strategic decisions taken about the future of the sector, significant new investments are required.

Estonia intends to diversify its energy sources and develop towards distributed production. The diversified selection of sources for energy production will be a combination of local energy sources, non-renewable (oil shale, peat) and renewable (biomass, wind, water, sun, landfill gas, waste). Renewable energy sources and micro-energy are expected to expand considerably when compared to the current situation. Electricity from renewable resources is set to grow to 24% of total production by 2020 ([197]). This will be accompanied by extensive use of oil produced from oil shale (with four times less emissions of carbon dioxide) instead of direct combustion in Narva power plants (see case study on oil shale).

At the same time, there are inefficiencies and environmental problems associated with the current system of energy production. According to the assessment presented in the Estonian Environmental Strategy 2030 ([198]), concentration of energy production based on oil shale in North-Eastern has entailed:

(a) concentration of pollution;

(b) large losses in the transmission of electric energy;

(c) considerable vulnerability of the system in emergency situations;

(d) inhibiting the development of renewable energy sources.

Approximately 1.36 billion EEK is planned for the development of the energy sector and the alleviation of climate change through the Physical and Social Environment Development Plan 2007-13 ([199]). These funds will be used for making electricity consumption more efficient, expanding the use of renewable energy sources and decreasing the emissions of polluting substances resulting from the energy system. To enhance energy technologies, the Government approved the National Energy Technology Programme (2008-13) (see Section 3.2.3) which will serve as a framework for supporting the development of energy sector in Estonia, particularly the development of new energy technologies, mainly based on renewable energy sources, and optimisation of energy supply system ([200]).

These fundamental changes in the energy sector (opening of the energy market, diversification of energy sources, new energy technologies, highly decentralised production and distribution of electricity and heat) have caused significant changes in the expected competence profiles of the employees. This is particularly evident in the group of power plant and network managers, engineers and researchers.

([197]) Development Plan for the Estonian Energy Sector until 2020 (2009).

([198]) www.envir.ee.

([199]) www.envir.ee.

([200]) http://www.hm.ee.

Major changes will occur with the expected competence profiles of network managers. This will happen mainly because the management of the newly evolving electricity and heat distribution networks will occur in an economically more dynamic and diverse environment.

Skills gaps/weaknesses

New and more complicated technologies will cause shifts in competence profiles. The expected competence profile of graduates in power engineering has changed significantly because of the already occurred and foreseeable changes in the energy sector.

The sector is also in need of engineers capable of designing complex and diverse electrical power systems including energy sources of different nature and capacity. This also includes working in project teams of a diverse professional and cultural background.

The competence profile of network managers and engineers has traditionally been very technical and based on solid mathematical foundations in Estonia. Insufficient competences to combine economic, environmental and technical aspects of the energy system design and operation remains the major skills gap, and this is likely to inhibit the development of energy sector in Estonia ([201]).

Identification of skills needs

The Labour Force Forecast to 2016 ([202]) describes macroscopic quantitative changes in 34 sectors of the Estonian labour market, including energy, gas and water supply.

Employment in the energy sector is declining, mainly due to increased efficiency of energy technologies. Employment is expected to decrease by one thousand workers across the sector from 10.2 thousand in 2006-08 to 9.3 thousand in 2016. Although the total number of employed will decrease, the demand for new labour in the energy sector is greater than the Estonian average. This is caused by the high average age of the employees in the sector.

The qualification profile of workers in the energy industry has not changed significantly in the last decades. The majority of the employees are workers with secondary level qualification (63%), while 32% with tertiary level qualification.

Existing provision of skills needs

Study and research programmes in power engineering have been an important part of TUT programme portfolio since 1918 (see Annex 3). Nearly 100% of the power plant and network managers, engineers and researchers employed in Estonia are graduates of TUT ([203]).

([201]) Personal communication from Prof. T.Lehtla (TUT.

([202]) Labour Force Forecast www.mkm.ee/.

([203]) Personal communication from Prof. T.Lehtla (TUT).

Skills response

As a response to the needs of the energy sector TUT in cooperation with Eesti Energia AS, Four Energy (a daughter company of Vardar Ab, Norway developing several wind park projects in Estonia) and other stakeholders in the energy sector has developed new study programmes in power engineering. The programme package covers Bachelor's, Master's and Doctoral level studies, while according to the Higher Education Standard ([204]) on the Bachelor's level, there are two types of programmes: academic degree programmes (BSc) and professional higher education programmes (see Table 9).

The programmes were revised during the academic year 2008-09 as part of the overall study programme reform in higher education in the Bologna process framework. One of the requirements is that all study programmes have to be learning outcomes based and comparable with context free expected learning outcomes defined in the Higher Education Standard (see Section 3.2.4).

As a result of the reform, the programmes have become much 'greener', both through the revised goal setting and changes in the learning content. This is demonstrated on the example of the Master of Science in Electrical Power Engineering programme (120 ECTS) ([205]), which also includes a new specialisation in energy commerce.

The graduates of the programme shall be capable to start working as electrical power engineers in management, development and research of electrical energy industry, demonstrating creativity, initiative and responsibility as well as skills of managerial and team work. The objectives of the study programme are:

(a) to give wide base systematic and specific knowledge on specialty of electrical power engineering and on main applicable theories and methods;

(b) to teach formulation and possible solutions of power engineering problems considering the uncertainty of information;

(c) to give knowledge and skills for engineering design, taking into account requirements on economic effectiveness, reliability and sustainability;

(d) to give knowledge, skills and attitudes for teamwork, for continuing studies on doctoral level or in-service training and for professional competence development.

The electrical power engineering master's graduate:

(a) has systematic and wide knowledge in electrical power engineering as well as specific knowledge in the field of specialisation;

([204]) Higher Educatin standard www.hm.ee.

([205]) Study programmes at TUT www.ttu.ee.

(b) can creatively identify and formulate research problems related to electrical power industry and to solve them by adequate methods in given time frame and in conditions of restricted information;

(c) can compose and manage engineering projects, assess economic efficiency, reliability and sustainability the issues of engineering work in the field of specialisation;

(d) is able verbally as well as in writing present and argue problems, analyses, conclusion and underlying theories related to the specialty and participate in relevant discussions in the language he studied and at least in one foreign language;

(e) has knowledge in exact, natural, social and economical sciences in extent enabling onward progress;

(f) is ready to start working in the field of specialisation demonstrating at that initiative, responsibility as well as skills of leadership and teamwork;

(g) can identify proper needs for continuing education and professional progress and know effective methods of individual learning;

(h) has knowledge and skills according to the occupational standard of Diploma Electrical Engineer.

These expected learning outcomes are comparable with respective learning outcomes defined in the Higher Education Standard.

The content of the programme modules demonstrates the intentions of the programme designers to meet the requirements of the electrical energy industry:

(a) the Social and Economical Sciences Module (18.0 ECTS): Environmental protection and Sustainable development; Business Administration; Product Development; Energy policy; Project Management and Cost-Benefit Analysis;

(b) the Control Power Systems Module (25.0 ECTS): Energy system development planning; Optimal control of power systems; Large Systems; Information Systems in Power Systems;

(c) the Electrical Power Engineering Module (22.0 ECTS): Wind power; Design of Electrical Networks; Power System Stability; Distributed generation of electricity; Economics of power systems; Power Distribution Engineering; Nuclear Reactors;

(d) the Electricity Market Module (18.0 ECTS): Electricity market; Management Game of Electricity Market; Strategic Development of a Power System;

(e) the Energy Market Module (20.0 ECTS): Wind power; Global energy trade; Distributed generation of electricity; Management of economic energy use; Financial Markets and Institutions; Financial Decisions; Basic Marketing.

An essential part of the programme is final thesis (30.0 ECTS) which has to demonstrate the capability of problem solving in the field of specialisation.

Table 9: Student graduation from the 2009 programmes in power engineering

Type of programme	Programme	No of students	No of graduates
Bachelor's programmes	Electrical drives & power electronics	175	34
	Electrical power engineering	237	40
	Thermal power engineering	82	19
Doctoral programmes	Energy and geo-technology	68	5
	Thermal power Engineering	17	3
Master's programmes	Electrical drives and power electronics	71	17
	Electrical power engineering	106	24
	Thermal power engineering	45	15
Professional HE programmes	Energy technology	69	17

The course for European Energy Manager is offered through the Open University at TTU. This short course (12 days, eight hours), addressing managers and specialists of the energy sector enterprises, is aiming at developing competences for the implementation of energy management, energy efficiency and new energy technology projects ([206]).

Doctoral schools are one of the recent strategic developments in Estonian higher education. This initiative was launched in 2007. The faculty of power engineering at TUT is hosting a doctoral school in energy and geo-technology. The school has proved to be an efficient tool to increase the efficiency of doctoral studies and create interdisciplinary links. An interesting example is using models and methods of the theory of intelligent agents in smart energy grids.

R&D contracts have recently been signed with Four Energy, a daughter company of Vardar Ab, Norway developing several wind park projects in Estonia. The project is aiming at developing a transformer device as an interface between wind generators and fuel elements.

Assessment of the effectiveness and organisation of the response

The process of reviewing study programmes in power engineering at TUT has shown that many existing occupational standards cannot be used as an input for curriculum design. The reason is that the standards developed before 2007 are not competence based and do not define explicitly the expected learning outcomes. The Professional Council for Engineering (see Annex 1) has initiated revision of the framework standards for engineering related occupations.

Traditionally, power engineering has not been very popular among engineering students at TUT. Therefore competition for study places is low. This means that practically all successful applicants have been able to obtain state commissioned (free) study places. On the other hand, feedback from the employers about the quality of graduates is nearly always positive.

([206]) Open University TUT www.ttu.ee.

Optimisation of energy supply in large energy networks has traditionally been one of the strongholds of the Estonian engineering sciences ([207]). In the new economic and technological environment there is seemingly enough room for rising fundamental and applied research in this important field of R&D to a qualitatively higher level.

([207]) Scientific Thought in Estonia. Engineering Sciences (2007) www.akadeemia.ee.

4. Conclusions

4.1. Main ‘greening’ shifts in economies and labour market

During the last two decades the Estonian economy has become much greener. Two major directions of development towards a greener economy can be identified:

(a) implementation of new cleaner technologies in many sectors of the economy;

(b) remediation of the environmental consequences linked to the Soviet heritage.

Although there is no official ranking of the economic sectors with a major greening potential, this list is derived from share in total environmental impact.

Energy production, transport and households have major negative impacts on the natural environment in Estonia. Oil shale is Estonia’s principal mineral natural resource and is used for producing energy and for chemical processing. While this offers the country a high degree of energy independence, oil shale is responsible for over 60% of greenhouse gases emissions.

Some steps towards a greener economy happened automatically as a result of lower demand. For example, privatisation and lower production levels in the agriculture sector have significantly decreased environmental pollution. Nevertheless, the sector has further greening potential, especially in the field of organic farming and bio-energy production.

In the oil shale industry greenhouse gas emissions have decreased as a result of lower demand in the electrical energy and chemicals produced from oil shale. The oil shale industry and the energy production from oil shale are undergoing major green restructuring. The conceptual backbone of this process is an optimised integrated value chain from oil shale mining to end consumers. Technological development involves gradual reduction in the direct combustion of oil shale in power plants and instead directing it to new shale oil production plants. Shale oil fuel is substantially cleaner compared with oil shale and can be used in boiler houses or as a raw material for producing motor fuel. This new technology also has high export potential.

While the number of cars has multiplied and the share of railway transport has decreased over the last two decades, the transport sector has become greener in Estonia. Nevertheless, there remains potential for the transport sector to become even greener.

About 60% of the living space in Estonia was built between 1950 and 1989. Today, the majority of those buildings are in a bad condition and in need of renovation. There is substantial energy loss from them. This is a long-term process which will eventually bring energy savings of up to 30%. The construction sector therefore has considerable greening potential related not only to the reconstruction of Soviet era apartment buildings but also to district heating pipelines. New building materials and technologies are an opportunity for the sector, but also a challenge for R&D.

More than half of the Estonian territory is covered by forest, which by itself has a significant greening effect. Forestry and wood processing are an important part of Estonia's economy and have continuous greening potential. New technologies will also be introduced in these sectors.

Until recently, many of the developments in the waste and water treatment sector could be categorised as part of remediating the environmental consequences of the Soviet heritage. This includes the need to remediate the hazardous waste amassed over decades (radioactive waste products of uranium enrichment and the production of rare metals, terricones of semi-coke as a waste product from shale oil and gas production, and alkaline lakes of ash from oil shale power plants). It also includes the need to re-cultivate large territories of exhausted oil shale quarries, the need to rehabilitate polluted land, lakes and rivers. The greening potential of the sector is related to the implementation of new technologies.

Support from EU structural funds has played an extremely important role in the implementation of different projects towards greening the Estonian economy.

The Government has defined four major lines of action to enhance the environmental friendliness of the economy:

(a) efficiency of energy consumption;

(b) diversifying the use of renewable energy;

(c) development of oil shale based energy production – increasing the efficiency and decreasing the environmental impact;

(d) decreasing overall environmental impact of the economy and development of green entrepreneurship.

Restructuring of the economy has caused substantial changes in the macroscopic labour structure. The share of primary sector employment, especially in agriculture, has decreased multiple times. The tertiary sector has become more important while secondary sector has held its share. According to the forecast, employment in the primary sector will continue to fall in the coming years. Growing economic activities are in the services sector and also in the manufacturing industry.

The occupational structure has also changed. The share of professionals (ISCO 2-3) and service workers (ISCO 4-5) has increased, and it is assumed that this trend will continue at a moderate pace. Although the occupational structure has therefore changed, but no occupation has been rendered completely obsolete as a result of green restructuring. Clearly, this is due to there being a wider range of occupations in a small country. It is likely that most occupations in Estonia are characterised as those which require a greening of existing skills, as opposed to being entirely 'new' green occupations.

The share of the population with tertiary education has monotonically increased during the last twenty years and at the moment it is 37%. This could increase even further as engineers and researchers play a crucial role in the green restructuring process.

4.2. Skills implications and development

Green restructuring of the national economy is heavily dependent on the development and implementation of new technologies and changing public attitudes. The skills response to meet the challenges of green economic restructuring should therefore include not only initial and continuous VET, but also all levels of higher education and general education. The motivation among people to raise their skill levels and qualifications according to the changing needs of the labour market is one of the crucial factors for the forthcoming economic upswing.

4.2.1. Anticipation and identification of skill needs

Although environmental protection, sustainable use of natural resources and diversification of renewable energy resources are necessary for sustainable development, the major obstacle to green restructuring of the economy is consumer attitude. Consumer acceptance of the ideas of the green economy is crucial, but changing values in this way is a challenge. Green thinking can be incorporated into all aspects of everyday life, thus creating demand for ecological solutions. Green restructuring therefore has implications for society at large as well as for the labour market.

Estonia has recognised the importance of people’s environmental consciousness and the role of environmental education. Since the green economy is entwined with sustainable development it is important to foster general attitudes, behaviour and lifestyle choices. Environment and sustainable development are topics crossing the national curricula for basic school and upper secondary school. All national curricula for VET also include a module on environmental protection.

Changing labour market demand in Estonia is driven by policy measures, new technology implementation, innovation, and environmental pressure. Due to the small size of the labour market in Estonia it is difficult or even impossible to make reliable forecasts about labour market needs at a sub-sector level. The identification of training and retraining needs in Estonia is therefore based on the labour demand forecast prepared annually by the Ministry of Economic Affairs and Communications. This data feeds into the preparation of the state order for state commissioned study places in initial VET, higher education, and adult education sectors. Through expert analysis and social dialogue, the state order for the respective institutions is prepared across fields of study and groups of study programmes (according to ISCED97) and approved by the Minister of Education and Research.

The experience of developing occupational standards for greening occupations indicates the importance of both technical skills related to new technologies and generic skills like team work, communication, learning and entrepreneurship. Many engineers', designers' and researchers' competency profiles include competence in certain green technologies, e.g. solar and fuel cell technologies. Nevertheless, it is difficult to define which new green collar occupation are most demanded in terms of greening the economy in Estonia.

4.2.2. Response policies and programmes

During the last two decades Estonia has established a legal framework for sustainable development. Sustainable development has become the key phrase in the green policy context. The portfolio of strategic documents covering long-term development strategies (until 2020 or 2030), as well as a comprehensive set of mid-term development plans (until 2013 or 2015) together with the respective action plans encompass all sectors of economy, education, research and development. The Estonian National Strategy on Sustainable Development (Sustainable Estonia 21) has played an important role in broad conceptual terms. However, it has insufficient visibility in society at large and its role is limited in terms of coordinating policy planning.

There is no single strategic document dealing with the green economy and green jobs in Estonia. These important aspects of sustainable and environmentally friendly development are covered in other strategic documents, which also contain some elements of skills development needs. Most probably, in the process of preparing the EU Strategy for Growth and Jobs, the concept of the green economy will appear in the Estonian political vocabulary.

Research, development and innovation strategies (under 'Knowledge-Based Estonia', 2003-07 and 2007-13) have played an important role in reshaping these sectors. This includes national programmes in key technologies (information and communication technology, biotechnology, and materials science) and programmes for supporting the development of traditional industries (including oil shale and energy industries). These programmes, e.g. the National Energy Technology Programme, are concerned with the implementation of new technologies and the development of human capital.

To enhance energy technologies, the National Energy Technology Programme was adopted in 2008. This is a framework for supporting the development of energy technologies in two main fields: oil shale technologies and new energy technologies (mainly based on renewable energy sources). One of the objectives of the programme is to develop cooperative networks and clusters based on the initiative of enterprises.

Recent developments show that despite the fact that all stakeholders (the ministries involved, major enterprises of the sector, major research institutions) agree on the objectives and programme steering mechanisms, the implementation of the programme has somewhat stagnated. As pointed out in several surveys, the problem of cooperation and the lack of a cooperation culture is widespread and requires special attention.

The implementation of strategies and development plans for different aspects of education (general, vocational and training, higher and adult) has shown that these are developing to meet the needs of the green economy and sustainable development (e.g. increasing the viability of the Estonian cultural space, supporting welfare and cohesiveness and preserving ecological balance). Participation in different EU programmes (R&D framework programmes, Leonardo, Erasmus, Gruntvig, etc.) and the delivery of EU structural funds have played a catalysing role in human resource development in Estonia.

It can be concluded that the human resource development strategy in Estonia is basically environmental policy-driven rather than market-driven. Estonia currently does not have any programmes specifically targeting towards skills development for green jobs. It is agreed that the other programmes cover adequately these needs as well.

4.2.3. Effective delivery mechanisms

Recent developments have shown that effective delivery mechanisms are based on a combination of private initiative (either individual or corporate) and state support. A good example of this is the impressive progress on the development of adult education and training, including in-service training during the last five years. The participation rate has increased from 6% to about 10% and will reach 13.5% by 2013. State support has played crucial role in this. Another favourable development is the division of responsibility and better cooperation between the three ministries involved.

The division of responsibilities concerning adult education funding is that through the Estonian Unemployment Insurance Fund, the Ministry of Social Affairs will fund the training of unemployed persons and risk groups in the labour market; the Ministry of Economic Affairs and Communications supports enterprises that wish to (re)train their employees through Enterprise Estonia; the Ministry of Education and Research finances continuing education and retraining of persons through VET and higher education institutions.

The list of occupational standards, developed over the past few years, includes many occupations related to areas of economic activity with large greening potential. All curricula in initial VET have to be based on the respective occupational standards. The route from an occupational standard to the school curriculum includes the intermediate step of national curriculum for VET.

This initiated a qualitatively new round of occupational standards development, which could serve as an input for curriculum development. The Ministry of Education and Research formulated a goal to develop a holistic competence based qualifications system in Estonia. This will enable the mapping of the needs of the labour market, descriptions of expected learning outcomes for different levels of study and the promotion of learner mobility.

HEIs have reformed their curricula to bring them in line with learning outcomes and qualification frameworks. In higher education, the main focus is on continuously ensuring the competitive quality of higher education institutions while retaining their autonomy. The role of universities and professional higher education institutions as leaders of innovation for Estonian development has strengthened. Increasing the internationalisation of higher education is also of special importance.

According to several assessments, Estonia will upswing from the current economic crises better prepared for the challenges of the green economy.

5. Recommendations

5.1. Policy recommendations

The Strategy Bureau of the State Chancellery is monitoring the implementation of the Estonian National Strategy on Sustainable Development. For these purposes 26 indicators have been defined, which are analysed in the monitoring reports. All related ministries and other institutions are responsible for implementing the sustainable development goals, and monitoring and reporting in their respective fields. Coordination mechanisms between sectoral (and other mid-term) strategies and Sustainable Estonia 21 should be strengthened.

A civil society based Committee for Sustainable Development, representing different stakeholders, has been established and charged with monitoring the implementation process. The Committee has initiated the drafting of three sustainability reports (human resource development, sustainable energy, and sustainable transport). It is recommended that commissioning of such sustainability reports and public discussion on the findings at the sustainable development roundtables becomes a regular practice. This will increase the visibility of the Estonian National Strategy on Sustainable Development – Sustainable Estonia 21.

All important sectors of education and training are covered with various development plans and action plans. Each year the Ministry of Education and Research prepares 'Smart and Active Nation' (currently 2010-13), a 'moving average' 3+1 year development plan for its field of governance Nevertheless, several civil society organisations, e.g. Estonian Educational Forum and Estonian Cooperation Assembly, have invited the Government and the Parliament to initiate the preparation of a long-term Lifelong Learning Strategy (until 2020). This strategy could serve as an umbrella, coordinating development and implementation of different sectoral development plans. It is advisable that the preparation process will include all major stakeholders (Government, employer organisations, and civil society organisations representing different groups of learners).

During the painful restructuring period the Government has avoided setting any priorities, especially when it concerns economic development. Different sources of evidence suggest that for successful development towards knowledge-based Estonia it is essential to express the priorities more clearly.

5.2. Recommendations for education and training

The national qualifications system is an interface between the labour market and the lifelong learning system. The development of a holistic competency based qualifications system meeting the needs of the labour market and lifelong learners, and compatible with qualification systems in Europe was set as a goal by the Ministry of Education and Research in 2007. A conceptual model of a competency based qualifications system (the so called competence circle model) has been developed at the Estonian Qualifications Authority and has proved to be useful in conceptualizing different developments in the field of qualification systems design and implementation and in selecting the proper model for Estonia.

Until 2008 the professional qualifications system had little interaction with the formal education system and academic recognition. Learning outcomes based curriculum development and the valuation of prior learning have been introduced into the higher education and VET sectors as part of the Bologna and Copenhagen processes in Estonia. National curricula in general education have been learning outcomes based already since 1996.

New Professions Act (2008) introduced the new 8-level qualifications framework compatible with the European Qualifications Framework for lifelong learning (EQF). This created prerequisites for the integration of professional and academic qualification systems into a single competency based Estonian qualifications framework (EstQF). Learning outcomes certified as academic or professional qualifications are recognized by employers and professional associations. It is recommended that the development of modular occupational standards as prototypes for partial qualifications and the development of a new generation of modular national curricula for VET be better coordinated. The common learning outcomes based approach is a solid foundation for this.

State commissioning of study places in VET, higher education and adult education, (including in-service training) have proved to be the critical coordinating mechanism to translate labour market needs and expectations into an adequate skills response. The experience of the higher education sector has shown that the present model of state commissioning is probably not the best balance of society's and individual's needs. The experience of state commissioning of study places in initial VET is positive, because in most study fields (including those critical for green economy) it also meets the needs of students. Due to a limited time span, there is not enough experience in the field of adult education. It is recommended that the experience of state commissioning of study places be regularly assessed and the appropriate policy recommendations made.

The implementation of national R&D programmes should also be used to facilitate the creation of a cooperation culture between the stakeholders (ministries, enterprises involved, and R&D institutions).

5.3. Recommendations for further research and data collection

From this research it follows that until now the quantitative identification of skills need (state order for study places) and the qualitative identification of skills need (occupational standards, national curricula, school curricula) are quite separate activities. It is highly recommended that in the process of developing a national qualifications system, particularly in the process of building EstQF and referencing EstQF to EQF, that these two aspects of skills identification come closer to each other.

As part of the above processes it is advised that functional mapping of competences in major sectors of the economy become a regular activity. This will allow the identification, and hopefully on some occasions the forecasting, of changes in competency profiles for occupations, as well as labour market trends inside a sector. On the other hand, inclusion of partial qualifications into the national qualifications system will substantially increase the flexibility of the system, which means meeting the skills needs of the green economy in flexible manner.

Finally, it is recommended that qualitative skills need surveys be incorporated into the regular Labour Force Surveys performed by the Statistical Office of Estonia.

Annex 1

Vocational and professional qualifications system in Estonia

The national qualifications system is functioning under the auspices of the Ministry of Education and Research with two institutions responsible:

National Examinations and Qualifications Centre;

Estonian Qualifications Authority (Kutsekoda).

Impressive number of partners (employers' and employees' organisations, professional associations, HE and VET institutions) are involved in the development and functioning of the qualifications system.

Development of the qualifications system in Estonia started in 1997 when the National Examinations and Qualifications Centre was established by the Ministry of Education as an institution responsible for developing national curricula and carrying out state examinations. Kutsekoda was established by the Ministry of Social Affairs, employers and employees organisations as an organizational backbone of professional qualifications system in 2001. In 2004 Kutsekoda was attached to the Ministry of Education and Research.

Development of a holistic competence based qualifications system in Estonia has been explicitly formulated as a goal by the Ministry of Education and Research in 2007.

Vocational and professional qualifications system in Estonia is managed by the Kutsekoda (www.kutsekoda.ee). Development of the system was initiated by Estonian Chamber of Commerce and Industry in 1997. The system is covering all sectors of national economy. The target group are persons interested in official recognition) of their professional (vocational) competences. Substantial number of employees, employers and professional associations, as well as HEIs and VET institutions are actively involved in the implementation and development of the system.

The Professions Act (2001) provided the bases for the development of the institutional structure, requirements for professional qualifications and the conditions and procedures for the certification and award of qualifications. Professional (vocational) qualification means the level of competence (knowledge, skills, experience, values and personal characteristics) required in a given profession (vocation) and described in a professional standard.

Professions Act defined five competence levels. More than 800 occupational standards have been developed and are used in the assessment of persons' competence. The idea was to offer an opportunity to valuate competences regardless whether they are acquired at school or at workplace. More than 45.000 professional certificates have been issued based on the results of assessment.

Institutional structure

Institutional structure of professional qualifications system consists of professional councils, professional qualifications committees, awarding bodies and support structure.

Professional council is a body consisting of the representatives of employees, employers and professional associations of the corresponding area of economic activity, and the representatives of the state. Professional councils are responsible for the development of professional standards necessary for meeting the needs of labour market and the implementation and updating of the system of professional qualifications. Currently the labour market in Estonia is covered by 16 professional councils (functionally similar to the British Sectors Skills Councils):

- commercial service and other business activities;
- construction, real estate and geomatics;
- service;
- forestry;
- health care and social work;
- light Industry;
- engineering, metal and machine industry;
- food industry and agriculture;
- transport and logistics;
- energy, mining and chemical industry;
- information technology and telecommunication;
- engineers;
- justice and internal security;
- folk art and handicraft;
- culture;
- education.

Private or public legal entities or public agencies whose activities include the development of the corresponding field of professional activity or training may apply for a licence to award professional qualifications. Currently 86 awarding bodies are acting in different sectors of the labour market.

Professional qualifications committees are formed of the representatives of employees, employers and professional associations at the awarding bodies. These committees are responsible for the elaboration of the assessment procedures. The number of acting professional qualifications committees is 153.

Process and actors involved

The qualifications system is an interface between the labour market and the lifelong learning system (see Figure 1). Generic conceptual model of competence based qualifications system as an interface between labour market and lifelong learning system developed at Kutsekoda has proved to be very useful in conceptualizing different developments in the field of qualifications systems design and implementation and in selecting the proper model for Estonia.

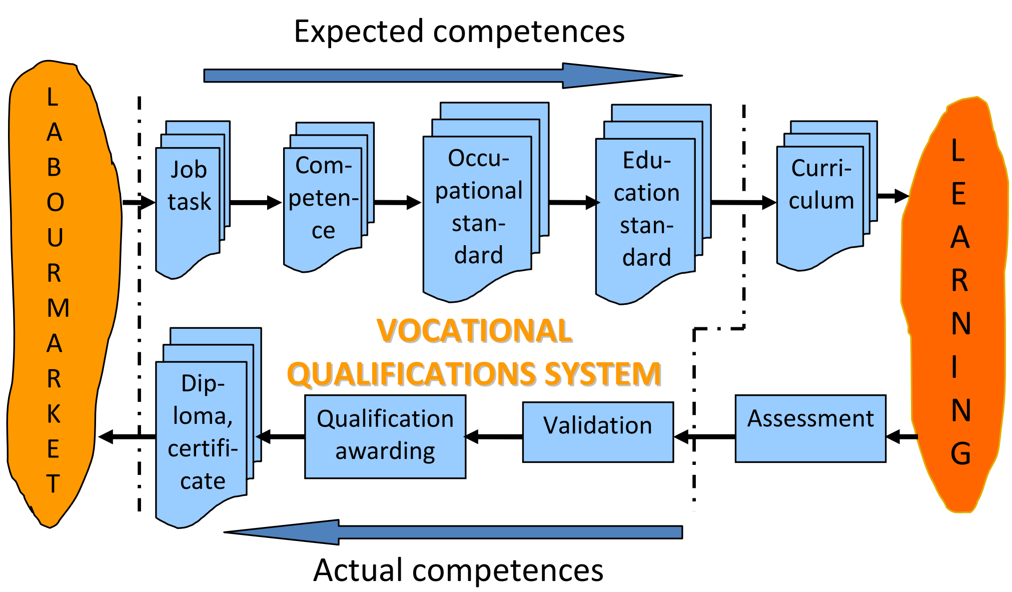
The awarding of professional qualifications is a process where the correspondence of person's level of professional competence to the professional standard applied for is assessed and a body which awards professional qualifications issues a professional certificate.

The system includes two major processes:

Development of expected competence profiles and qualification requirements (expected learning outcomes) in different sectors of labour market in the form of professional standards and curricula;

Assessment and certification of persons' real competences based on expected learning outcomes.

Figure 1: Competence circle



Source: Estonian Qualifications Authority

Since 1998, professional councils have approved more than 800 occupational standards, developed by numerous working groups according to the following procedure:

Gathering of viewpoints and suggestions from interested institutions;

Achieving a consensus between these suggestions;

Working out multi-level system of qualifications for the field of occupation;

Formation of working groups, which map the main occupations, develop the occupational standard, assign levels of qualification as well as the scheme for awarding the qualifications;

Approval and implementation of the occupational standard and other requirements by the professional council.

Listing the standard in the State Register of Professions by Kutsekoda.

Professional qualifications system had little interaction with formal education system and academic recognition until 2008. Learning outcomes based curriculum development and the valuation of prior learning (VPL) have been gradually introduced into higher education and VET sectors as part of the Bologna and Copenhagen processes in Estonia. National curricula in general education have been learning outcomes based already since 1996, although school curricula and assessment are not entirely learning outcomes based.

New Professions Act (2008) introduced the new 8-level qualifications framework compatible with EQF. This created prerequisites for integration of professional and academic qualifications systems into a single competence based Estonian qualifications framework (EstQF). Legal framework for wide application of VPL in different contexts has been developed and personnel of awarding bodies prepared for new assessment tasks. The new Professions Act foresees a possibility to award primary professional qualification at graduation from HEI or VET institution.

Learning outcomes certified as professional qualifications are recognized by employers and professional associations. Pilot projects for testing implementation of VPL, based on modular occupational standards (partial qualifications) and modular curricula are underway.

Competence framework

Professions Act from 2001 established a 5-levels competence framework. Professional qualifications are divided into five levels where level I is the lowest and level V is the highest:

level I – an employee performs his or her duties in similar situations, has acquired the professional knowledge and skills mainly in the course of professional training, may need guidance during work, is responsible for the performance of his or her duties;

level II – an employee performs his or her duties in different situations, in addition to the knowledge and skills acquired mainly in the course of professional training has experience, works independently, is responsible for the performance of his or her duties;

level III – an employee performs his or her duties in different and changing situations, in addition to the knowledge and skills acquired mainly in the course of professional training is masterly, ready to pass on his or her professional skills and knowledge, organises the distribution of resources and the work of others and is responsible therefore;

level IV – an employee performs duties requiring analysis and decision-making in changing situations, has professional knowledge and skills; organises the distribution of resources and the work of others and is responsible therefore;

level V – an employee performs duties requiring the expansion of knowledge base, problem solving, application of scientific theories and concepts, analysis, systematisation and improvement of the existing knowledge and teaching in changing situations, has extensive professional knowledge and skills, organises the distribution of resources and the work of others and is responsible therefore.

Descriptions of the above competence levels have proved to be too ambiguous, although for many years they served as a generic framework for designing professional standards and awarding qualifications.

Competence framework introduced in the new Professions Act (2008) is identical to EQF and serves as a backbone for EstQF. The new Higher Education Standard (adopted by Estonian Government in December 2008) defines competence framework for Bachelors', Masters' and Doctoral level qualifications. The Vocational Education Standard (to be adopted by Estonian Government in June 2009) defines competence framework for vocational qualifications obtained from formal education system. National curricula for comprehensive school (9 grades) and gymnasium define generic (key) competences framework on four levels.

Assessment and certification processes

Learning outcomes are assessed and certified by the professional qualifications committee. Professional qualifications committee has the right to establish special assessment committees if necessary.

Methods of assessment used are:

- self evaluation – description and analysis of work experience;
- peer evaluation – employer, co-worker, client;
- case study;
- work observation – at workplace, simulated;

- the evaluation of work results and outcomes – artefacts, documents;
- interview – oral questioning, behavioural interview;
- written test;
- portfolio.

Assessment and certification process is delegated to awarding bodies, which get their activity licenses from professional councils. There is only one awarding body for each occupational area. Most commonly awarding bodies are different professional associations. Before becoming an awarding body, they must form a professional qualification committee. In this committee all stakeholders have to be present: representatives of employers, professional associations, specialists.

All the main decisions in assessment and certification process are made by this committee. They decide what methods of assessment to use and how the whole assessment process is going to be arranged. The professional qualification committee can additionally form evaluation committees. The decision, whether the applicant has proved all required competences, is made by the professional qualification committee based on the evaluation committee's evaluation protocol.

Links to NQF and EQF

Until the year 2008 Estonia had academic (formal educational) framework of qualifications described in the Education Act and professional qualifications framework described in the Professions Act.

The new Higher Education Standard defines generic learning outcomes for Bachelors', Masters' and Doctoral level qualifications, comparable with Dublin descriptors and references these qualifications to 6th, 7th and 8th level of EstQF. All HEIs in Estonia had to redesign their curricula in concordance with these generic learning outcomes by September 1st, 2009.

The Vocational Education Standard defines generic learning outcomes for vocational qualifications obtained from formal education system. These qualifications are referenced to 2nd, 3rd and 4th level of EstQF. Although 44 national curricula for vocational education have been developed during the period 2004-2009, most of the curricula at VET institutions are still input based. New learning outcomes based curricula for VET will be developed and introduced by 2014.

Although national curricula for general education in Estonia have been learning outcomes based already since 1996, general education qualifications are not referenced to EstQF yet.

Development of occupational standards

Occupational standards are typically developed sector wise in Estonia. For this purpose the professional council establishes a task force. Draft occupational standards are sent out for wider consultation in the sector. Final amendments based on the results of the consultation are then made before the draft standards are submitted to the professional council for official approval.

The most general and commonly used methodology for occupational standards development is based on functional and occupational mapping of sectors, sub-sectors or occupations. This methodology, described briefly below, has been successfully used in several sectors in UK and internationally. Since 2010, the Estonian Qualifications Authority is also using this methodology for the development of occupational standards.

The aim of the functional and occupational mapping is to identify the work functions and the occupations within the sector.

Functional analysis is a method used to identify the required competencies of a productive function by means of a deductive strategy. By concentrating on the functions or outcomes instead of the activities, the descriptions produced are independent of the technology or methods used to achieve the function. In other words, instead of describing what people are doing, functional analysis describes what people have to achieve.

The functional analysis process can be applied to a single occupation, a group of occupations, to a sub-sector or to a whole sector. The difference is only one of scale. The same general model for analysis of occupations can also be used as the basis for analysing occupational functions in the sector.

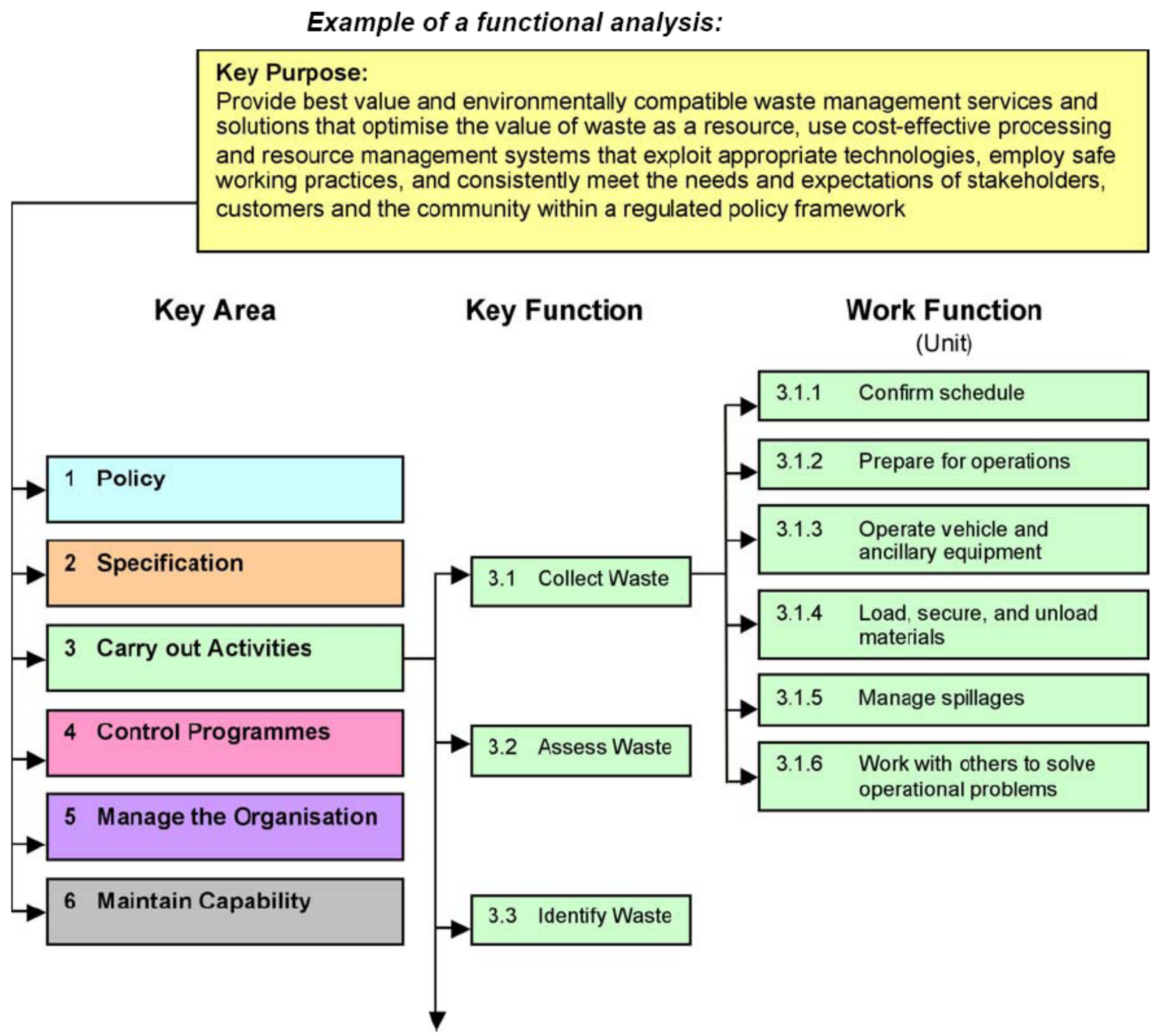
Most sectors can be broken down into sub-systems. Within each of these sub-systems there are groups of occupations and work functions that have similar process characteristics, even though their application may be different. A standard written for one sector can be adapted to meet many different work contexts and applications.

Each of these systems' areas can be further broken down, sometimes through several stages, into work functions for which competence units can be defined. The advantage of this framework approach is that it can be applied to any sector and it enables common functions to be recognised within and between sectors. This considerably lightens the workload in seeking matches with existing work roles and competence units and also introduces a rigour to whole-sector analysis that considerably simplifies and streamlines the process of occupational standards development.

The starting point for functional analysis is the development of a general statement – a key purpose – which encapsulates what the sector is there to provide. This is subsequently broken down into key areas that represent the sum of broad activities that are necessary to deliver this service. The process of analytical breakdown continues until the activities described represent a reasonable description that could be applied to individual work outputs against which a competence unit can be set. Figure 2 illustrates functional mapping approach for the waste management sector.

The mapping process goes only as far as defining distinctively different functions. It does not seek to delineate between the same function as it is applied in different sector contexts. For example, the function of 'plant maintenance' can apply to a very wide range of different job roles within the sector. The extent to which these variations in context need to be reflected in different standards is an issue that is part of the standards setting process.

Figure 2: Functional map for the waste management sector



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Similarly, there are a number of functions for which responsibilities within the work team are shared. For example, the function of ‘Maintaining a safe and healthy working environment’ is one that is shared within the work team:

The Plant Operative will – ‘contribute to’ maintaining a safe and healthy working environment, because the scope of their responsibilities is necessarily limited.

The Plant Supervisor will – ‘maintain’ a safe and healthy working environment, because, on the ground, they have functional responsibility for action.

The Plant Manager will – ‘ensure that’ a safe and healthy working environment is maintained, because they are ultimately accountable for health and safety.

Therefore, from this one function it will be necessary to develop three complementary competence units, probably at three different qualification levels, each reflecting the different level of responsibility. This differentiation is again applied at the standards setting stage.

Setting standards is an expensive, rigorous and time-consuming process involving considerable development work, consultation and testing. The final stage of the functional mapping process is therefore to identify all potentially relevant competence units that might be used within its future qualifications framework for the sector.

Because of the hierarchical structure of the functional map each of the functions appears only once. However, in occupations, the same function may be a component of several job roles. Hence, there is no direct read-across from the occupational to the functional map. In the same context, many occupations are multi-role and the functions of which they are made up appear in different areas of the functional map. It is at the qualifications’ design stage that the functional map becomes extremely useful as it is used as a menu from which functions comprising work roles can be drawn down.

The major challenge in establishing a valid and robust occupational map for a sector is to confirm those occupations that are truly unique to the sector. The occupational map will indicate all those occupations within the sector. It will also provide the basis for future research to identify all potentially relevant existing qualifications and where there are current gaps. The map will also identify those occupations, for which given professional council has either a primary responsibility or one that is shared with other councils.

The occupational map will also serve a useful purpose in providing career development information for the sector enabling professional council to show the routes and pathways to vocational qualification for each occupation.

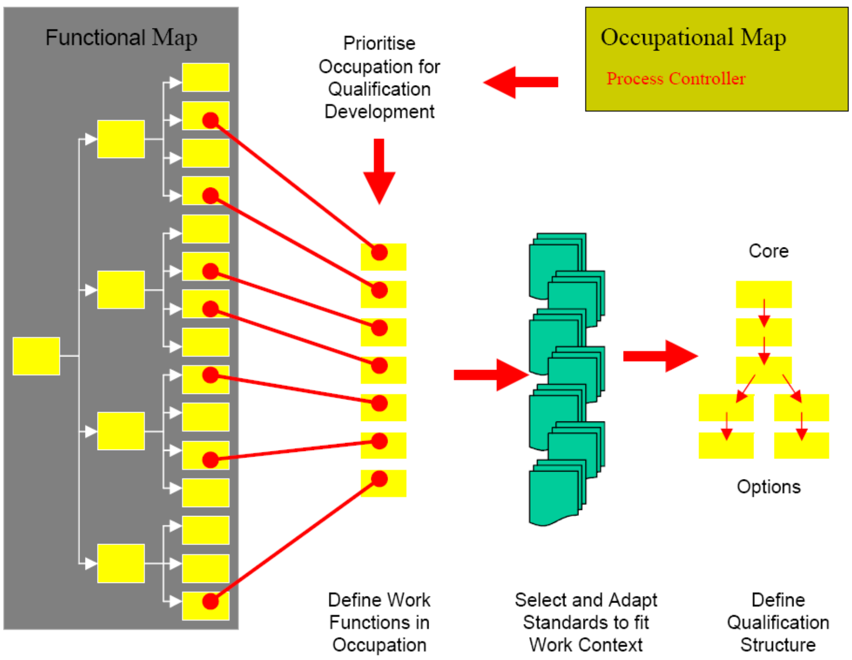
The process of developing occupational standards is normally linked to a commitment to develop the related vocational qualifications. However, some sectors have developed the standards for their sector in advance of a clear specification as to how they will be used in vocational qualifications. The standards can be used as a basis for recruitment and staff appraisal and for the specification of training within the sector or enterprise and have many other applications as well. Therefore, having a comprehensive framework of competence units is a major asset.

Once the competence units' development process has been completed, it remains for them to be grouped as occupations and for a structure to be devised for the award that properly reflects the variables in the occupation. Increasingly, vocational awards offer a range of options to take account of variations in the skills mix within jobs. Figure 3 illustrates the functional and occupational mapping process.

As part of the occupational mapping process, occupations are broadly classified into groups that reflect the main divisions within the sector. The NQF sets out the levels at which qualifications can be recognised. NQFs are designed to help learners make informed decisions on the qualifications they need, by comparing the levels (and possibly credit values) of different qualifications and identifying clear progression routes to their career.

The occupational map can only ever be an approximation of the levels structure within the sector. The actual decision on level comes at a later stage when each occupation is analysed in detail in terms of work functions and defined in terms of competence units.

Figure 3: Developing occupational standards and vocational qualifications



When the functional mapping is complete it should be complemented with the performance criteria, an extension of the functional analysis process, which includes three specifications: employment specification (with identification of performance requirement and Range), training specification (with identification of Skills and knowledge) and assessment specification.

Performance requirements are a specification of what has to be achieved in employment to meet the outcomes described in competence units and the Range describing the field of application, which are the tools, equipment, materials, methods or processes needed to achieve the performance requirements.

Skills are the evidence that proves performance has been achieved and Knowledge describes the necessary knowledge needed to achieve performance.

The assessment specification describes what will be assessed, the quality with which performance has to be achieved. The assessment specification identifies both what the person (employee or learner) must do and the knowledge which must be tested. Methods of assessment are not described; how the assessment will be made is determined locally.

Acronyms and definitions

APEL	Accrediting Prior Experiential Learning
CHP	Combined Heat and Power
EBS	Estonian training centres
ECTS	European Credit Transfer System
EE	Eesti Energia AS
EEK	Estonian Kroons
EETS	Estonian Development Strategy of Energy Related Technologies
EQA	Estonian Qualifications Authority
EQF	European Qualifications Framework
ESF	European Social Fund
EstQF	Estonian qualifications framework
ETP	Energy Technology Programme
EU	European Union
EULS	Estonian University of Life Sciences
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HEI	Higher Education Institutions
ICT	information and communication technology
KTH	Royal Institute of Technology
MA	Ministry of Agriculture
ME	Ministry of Environment
MEAC	Ministry of Economic Affairs and Communications
MER	Ministry of Education and Research

MSA	Ministry of Social Affairs
OECD	Organisation for Economic Cooperation and Development
PISA survey	Program for International Student Assessment
PRIA	Agricultural Registers and Information Board
QAAHE	Quality Assurance Agency for Higher Education
R&D	Research and Development
SAPARD	Special Assistance Program for Agricultural and Rural Development
SCE	State-Commissioned Education
SOE	Statistical Office of Estonia
SWOT	Strengths, Weaknesses, Opportunities and Threats
TUT	Tallinn University of Technology
UT	University of Tartu
VET	Vocational Education and Training

List of key resource people

Aarna, Indrek – head of the Department for Development, Eesti Energia AS

Annus, Tiina – head of the Analysis Department, Ministry of Education and Research

Aru, Heli – councellor, Ministry of Education and Research

Eek, Peeter – head of the Waste Deoartment, Ministry of Environment

Jõema, Jüri – director, Estonian Association of Information Technology Enterprises

Kasemets, Keit – director, Strategy Bureau of the State Chancellery

Kattago, Henry – head of the Division for Entrepreneurship, Ministry of Economic Affairs and Communications

Kerem, Maaja-Katrin – member of the board, Estonian Qualifications Authority

Lambing, Mario – expert, Division of Economic Analysis, Ministry of Economic Affairs and Communications

Lehtla, Tõnu – professor, dean of the Faculty of Power Engineering, Tallinn University of Technology

Linnas, Ingrid – programme manager, Open University at Tallinn University of Technology

Meissner, Dieter – visiting professor, Tallinn University of Technology

Mellikov, Enn – professor, Tallinn University of Technology

Normak, Argo – head of the Centre for Renewable Energy, Estonian University of Life Sciences

Oselin, Rein – Director, Järvamaa VET Centre

Peterson, Indrek – chairman of the Professional Council for Construction and Geomatics

Randma, Tiia – councellor in educational matters, Estonian Chamber of Commerce and Industry

Raudsepp, Kersti – head of the Refernet Estonia, Innove Foundation

Sahk, Jaanus – head of the National Energy Technology Programme, Enterprise Estonia

Soone, Jüri – professor, Tallinn University of Technology

Tampere, Helmi – chief expert of the Department for Labour Market, Ministry of Social Affairs

Toss, Kelly – head of in-service training programmes, Eesti Energia AS

Vabrit-Raadla, Maarit – director of the Personnel Management Centre, ABB AS

Vooremäe, Aret – head of the Department for Research and Development, Ministry of Agriculture

Öpik, Andres – professor, dean of the Faculty of Chemical and Materials Technology, Tallinn University of Technology

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