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Resource Efficiency Gains and Green Growth Perspectives in Slovakia

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- As Slovakia owns only limited primary energy resources (mainly brown coal), it strongly depends on imports of foreign raw materials (e.g. crude oil). Despite some success in reducing greenhouse gas emissions, long-term reduction targets seem difficult to reach. Energy consumption ranks still high among the EU27 average. Air pollution, chemical and physical degradation of soil assets, water pollution and damages to vegetation are considered the main environmental problems.

- Influenced by EU and other international organisations, there is a comprehensive legislative body concerning climate change and energy issues. However, many measures laid out are still not realised and there is no national strategy for greening economic growth. Besides low public awareness, Slovakia faces a number of other obstacles to implement further sustainable legislation: growing social inequalities and governmental passivity.

- The main potential for green growth lies in agriculture and in the renewable energy sector. The potential for the large-scale creation of green jobs seems low, as the share of sectors with high potential (especially agriculture) in total employment has been continuously declining. The main obstacles to green growth include: lack of political interest, unclear competences, lack of financial resources, poor innovation and research capacity, inadequate environmental education, insufficient support system for implementation of measures and increasing regional disparities.

Content

Introduction

Environmental technologies such as renewable energy resources, recycling technologies, sustainable transport technologies and the like are increasingly perceived as drivers of future economic growth, as well as saving natural resources and reducing emissions. Green growth is also gaining prominence in economic and development strategies. The definition of green growth is changing and expanding in the context of economic development. While older definitions of green growth were built especially on the growth of a specific eco-industry (Janicke 2011), newer definitions define green growth as the mainstream of core economic strategies. This reflects the risks of the continuing degradation of the environment from the standpoint of sustainable economic growth. The OECD Green Growth Strategy states: »Green growth means fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies« (OECD 2011).

Apart from the merely modest progress achieved over recent decades, the raw stock intensity of economic growth in the countries of Central and Eastern Europe and Central Asia is still high. Although politicians are aware of the looming environmental challenges, it appears difficult to reconcile long-term environmental sustainability with short-term social pressures and the challenges of catching up with Western Europe. In a series of national studies, the Friedrich-Ebert-Stiftung has facilitated the examination of conditions for economic development strategies that would depart from high raw material requirements while guaranteeing enough jobs to maintain social stability. In this way, they seek to contribute to the development of a green economy that is environmentally sustainable and socially inclusive.

The methodology of the study is based on common standards. In order to allow international comparability the study uses national and international statistical data. For the sake of international comparability of national studies in the FES project framework, the structure and main body of the study are limited; other more detailed examples from the Slovak Republic, as well as technical data and overviews can be found in the annexes.

1. Current Situation in Slovakia

1.1 Energy Efficiency, Greenhouse Gas Production and Pollution of the Environment

In electricity production and consumption, generation from primary energy resources (PER) remains dominant in Slovakia. Slovakia has limited fossil fuel resources, which means that in primary energy resources it depends on imports. The only domestic energy resource of significance is brown coal and lignite. Domestic PER cover only about 10 per cent of requirements and thus Slovakia has to purchase the other resources it needs, which entails a strong dependence on imports. In the interest of reducing energy dependence on foreign raw materials, it is necessary to move towards greater use of energy from renewable resources.

Currently, total energy consumption in Slovakia is about 700 petajoules (PJ). PER consumption in Slovakia is still about 90 per cent of the EU average. The industry sector, which has substantial energy intensity, has the highest electricity requirement. In Slovakia, its share in energy consumption is well above the EU27 average, as well as above the energy requirements of neighbouring countries. In 2009, the share of Slovak industry in final energy consumption amounted to 38 per cent (in the EU27, the average industry share was 24.2 per cent). Considerable energy intensity is also observed in the trade and services sector, at approximately 30 per cent, and in transport, where total energy consumption is trending upwards (it has increased by as much as 60 per cent since 2000). However, a number of other sectors have experienced a downward trend in energy consumption in recent years. Since 2000, consumption has dropped by 15 per cent overall, which is attributed to the negative impact of the current crisis. Compared to developed OECD and EU member states, Slovakia also has lower electricity consumption per capita (by some 20 per cent). Final electricity consumption in 2002–2010 had a balanced trajectory, with slight variations. In 2010, a total of 27,720 GWh of electricity was generated, an increase of 6 per cent on 2009. In terms of diversification of electricity generation resources, the largest volumes were produced by nuclear power plants, thermal power plants and hydroelectric power plants, in that order. Despite an upward trend, electricity generation from renewable energy resources (RER) is still low in Slovakia. In 2009,

the share of electricity produced from RER amounted to 18.8 per cent. It will be necessary to increase this share in the future.

Slovakia has adopted a national target of increasing the share of renewables in gross final energy consumption from 6.7 per cent in 2005 to 14 per cent in 2020. The share of energy from renewable energy resources is gradually growing. The use of biomass energy (nearly 70 per cent) now accounts for the highest proportion. The energy potential of biomass is shown in Table 1.

Table 1: The energy potential of biomass use

Type of biomass	Quantity (in tonnes)	Energy potential (in PJ)
Agricultural biomass for combustion	2,031,000	28.6
Forest dendromass	2,432,000	26.8
Wood processing industry	1,835,000	22.0
Biomass for biofuel	200,000	7.0
Municipal wood waste	300,000	3.6
Pressings and clinkers for the production of biofuels	400,000	8.4
Livestock excrements	13,700,000	10.0
Biomass grown for energy production	4,050,000	40.6
Total	24,948,000	147.0

Source: Action plan for the use of biomass in 2008–2013.

The best prerequisites for biomass production exist in agriculture and forestry. Agricultural land covers 49 per cent of Slovakia's surface area and forest land amounts to 41 per cent. Considering its potential, the use of biomass for energy in Slovakia is minimal in comparison to other EU countries. The energy potential of agricultural biomass constitutes up to 15 per cent of total Slovak energy requirements. Despite this, the practical use of biomass for energy is very low, accounting for only 2 per cent of energy consumption in Slovakia. More detailed information on the potential and prospects of biomass use in Slovakia is given in Appendix 1.

Total greenhouse gas emissions in Slovakia have a downward trend. In 2009, total greenhouse gas emissions accounted for 43,426.07 Gg CO_2 equivalents (excluding the LULUCF sector). Total greenhouse gas emissions including captures from land use and forestry sectors (LULUCF) in 2009 were 39,977.06 Gg CO_2 equivalents (the captures amounted to 3,449.01 Gg CO_2). This represented a reduction of 41.44 per cent compared to the reference year 1990. Compared to 2008, greenhouse gas emissions dropped by almost 10 per cent. The reasons for this decline are mainly the impact of the crisis and the subsequent economic recession. By sector, energy and transport account for 66.1 per cent (of which transport represents 21.6 per cent) and remain the most important. The agricultural sector accounted for 7 per cent of emissions and the waste sector 5 per cent. Growth of total greenhouse gas emissions is observed in transport, mainly road transport, and in industrial emissions of fluorinated gases (F-gases) substituting the freons banned by the Montreal Protocol (mainly HFCs and SF6).

The Slovak Republic is complying with its current international commitments (the Kyoto Protocol and the EU climate and energy package). In international comparisons of total production of greenhouse gases, the values for the Slovak Republic are below the EU27 average. Among these countries, Slovakia ranks 18. Although Slovakia has been able to stabilise greenhouse gas emissions, the OECD anticipates that their growth, particularly in transport and industry, in the post-Kyoto Protocol period harbours potential difficulties with regard to meeting medium- and long-term emission reduction targets. Therefore, climate change, the energy industry and transport should be more closely interlinked. Recommendations that could facilitate greenhouse gas emissions reduction include the abolition of subsidies on coal for electricity, termination of the exemption from excise tax for energy intensive industries and modernisation of railway infrastructure.

In 2009, 64,082 tonnes of sulphur dioxide, 85,598 tonnes of nitrogen oxides, 207,076 tonnes of carbon monoxide and 38,599 tonnes of solid pollutants (SP) were emitted into the atmosphere. The most significant producers of air pollutants are: US Steel Košice, Slovenské elektrárne Bratislava, Elektráreň Vojany, and ENO Zemianske Kostoľany Slovnaft/Bratislava.

Pollution of the Environment

Air Pollution

Diverse pollutants, whose increased production is mainly due to industrial development, urbanisation, transport and agriculture, pose a threat to air quality in the Slovak Republic. Currently, the most important harmful substances causing the deterioration of air quality include sulphur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, organic substances and dust particles. Emissions of basic pollutants (SP, SO_2, NOX, CO) have shown a continuous long-term decline (1990–2009), but the rate of decline has slowed significantly since 2000. In 2003–2005, a temporary moderate increase of emissions was observed; however, since 2005 a downward trend has been maintained. Similarly, a long-term downward trend of ammonia emissions, emissions of non-methane volatile organic compounds (NMVOC) and emissions of persistent organic pollutants (POPs) has been registered.

The decline in solid pollutants and sulphur dioxide was correlative with the change in the fuel base in favour of high-grade fuels, the introduction and improvement of separation equipment efficiency, the decrease in production and energy consumption and/or the closing of operations. Nitrogen oxides emissions showed a moderate decrease except in 1995, when a slight increase was recorded. The drop in nitrogen oxides volume was determined mainly by reducing fossil fuel consumption and decreasing the consumption and changing the composition of fuels used by retail consumers. In 2005, a more significant drop in SO_2 emissions from road transport – 77 per cent – was observed. This was due to the introduction of measures relating to the sulphur content of fuel (Decree of the MoEnvi SR No. 53/2004 Coll.), despite an increase in fuel consumption.

The denitrification of large energy sources contributed significantly to nitrogen oxides emissions reduction. The iron and steel industry has affected the development of CO_2 emissions most. The reduction in CO_2 emissions volumes in 1992 compared to 1990, their increase in 1993, as well as fluctuations in 1997–2004 are closely related to the amount of currently produced and processed iron and steel. The increase in CO_2 emissions was observed only in the sector of small sources (home heating) and it is related to the higher consumption of wood due to a rise in natural gas and coal prices. Emissions reduction in the road transport sector is related to the ongoing modernisation of the vehicle fleet with new generations of vehicles.

A drop was also observed in the production of ammonia, where the decline in 2009 was 62 per cent compared to 1990. Production of NH_3 emissions in 2009 amounted to 25,016.39 tonnes. More than 90 per cent of all NH_3 emissions originate in the agriculture sector, in livestock production and animal waste management. NH_3 emissions from the application of nitrogen fertilizers are also an important category in agriculture. NH_3 emissions from the sectors of energy/industry and transport are less significant.

A significant decline was also noted in the production of volatile organic compounds (VOCs), which decreased by up to 66.2 per cent compared to 1990. This development depended mainly on the decline in the consumption of coating materials and the gradual introduction of other types of coatings, measures in crude oil refining and distribution of fuel, gasification of combustion plants, in particular in municipal energy, and more catalytic converter equipped vehicles.

The downward trend in heavy metal production was a consequence of shutting down some outdated and inefficient plants, reconstruction of separators, changes in the raw material base and the transition to unleaded gasoline (MoEnvi 2004).

In terms of spatial assessments of air quality, the most affected areas are located around large industrial centres, such as Bratislava, Košice – Prešov, the lower Váh river area (Trnava, Sereď, Šaľa, Galanta, Nové Zámky), the upper Váh river area (Trenčín, Púchov, Považská Bystrica), the central Spiš area (Krompachy, Spišská Nová Ves), the upper Nitra region (Prievidza, Handlová, Partizánske and the like), the Hron river area (Žiar nad Hronom, Banská Bystrica, Zvolen), the Zemplín region (Vojany, Strážske, Vranov nad Topľou, Snina, Humenné), the Žilina basin (Žilina), Turiec basin (Martin), the Poprad basin (Poprad) and so on.

Degradation of Soil Assets

Degradation of soil assets is assessed from two aspects: chemical degradation and physical degradation. Serious

chemical degradation of soil includes soil contamination with heavy metals and organic pollutants, acidification as well as salinisation and sodification of soil.

In Slovakia, soil contamination is monitored at regular intervals. The results indicate that the largest concentrations above the limit involve arsenic, mercury, nickel, chromium, copper, lead, vanadium, zinc and cadmium. In geographical terms, the most affected regions include the mountain region of the Spišsko-gemerské rudohorie with presence above the limit of Cu, Pb, Zn, Hg, As, Bi, Be and Co, the Nízke Tatry region with presence above the limit of Sb, As, W and Cu, the mountain area of the Kremnické vrchy and the Štiavnické vrchy with presence above the limit of Pb, Zn, Cu, As, Cs, and the area of the Malé Karpaty with presence above the limit of As, Sb, Pb, Zn and Ba. Higher concentrations of these elements are mostly due to old environmental loads associated with mining activities in these territories.

The adverse effects of mining activities can also be seen in the alluvial soils of the Hron, Štiavnický potok, Slaná, Hornád, Pezinský potok and Smolnícky potok rivers catchment areas. Negative consequences of coal mining and subsequent development of the energy industry were manifested by a higher load on soils of contents above the limit of As, Ba, Cs and Hg in the upper Nitra region.

Industrial production has also significantly added to soil contamination. Increased levels of some elements related to manufacturing processes – for example, higher fluorine content in the Žiar basin due to the production of aluminium, chromium in the environs of the ferro alloy works in the lower Orava region and the like – can be observed in industrial zones.

In addition to industry, agricultural production has also contributed to soil contamination. Soils in viniculture and vegetable growing areas feature higher concentrations of copper, zinc and fluorine; intensively used agricultural land is characterised by higher contents of phosphorus, fluorine and partly cadmium. Local soil load caused by higher content of Pb, Cr, Cu, Zn and Hg also occurs in the environs of large urban settlements. Higher concentrations of As, Cd, Pb, Hg, Bi and Mo were detected as a consequence of cross-border emission transport in forest soils of the border Carpathian curve. Currently, Slovakia has a total of 1.4 per cent of contaminated soils and 0.4 per cent of significantly contaminated soils.

Although the production of polychlorinated biphenyls (PCB) ceased some time ago, organic pollutant soil contamination remains high. The most often exceeded values include fluoranthene (Fl), benzo(a)pyrene (BaP), benzo(b)fluoranthene (BbF) and many other compounds showing carcinogenicity and direct or late toxicity. However, in spatial terms, this contamination is only of a point or line nature.

Another factor endangering the quality of soil is salinisation. Weak to moderate salinisation with a salt content from 0.10 to 0.35 per cent has been recorded in selected locations of the Danube lowlands: Iža, Gabčíkovo, Zemne, Komárno-Hadovce, Zlatná na Ostrove and Malé Raškovce. High (0.36–0.70 per cent) to extremely high (above 0.71 per cent) salinisation was detected in the locations of Kamenín and Žiar nad Hronom where these salts are of anthropogenic origin.

Increased acidification occurred in 35 per cent of sites in the group of pseudoglei and pseudoglei luvisol on polygenetic loess loam and 28 per cent of sites in the group of brown soil and brown pseudoglei soils on loess, which represents active aluminium stress for cultivated crops.

The main results of the physical degradation of soils in Slovakia involve erosion risk to soils and the risk of avalanches and landslides. Currently, almost 40 per cent of agricultural land in Slovakia is endangered by water erosion, of which 24.1 per cent are extremely eroded soils. A very high risk of erosion is a threat to 3.3 per cent of agricultural land assets (ALA), high erosion risk to 9.2 per cent and medium erosion to 9.1 per cent. The soils in mountain and submontane areas, in particular the Vysoké Tatry and the Nízke Tatry, the Veľká Fatra, the Malá Fatra and the Východné Karpaty are the most vulnerable. The lowest level of water erosion is observed in lowlands.

In Slovakia, wind erosion is a serious problem, affecting some 5 per cent of agricultural land assets, of which 1.3 per cent is extremely vulnerable. Soils with lighter particle size and low in organic matter are highly susceptible to re-drying (and thus also to wind erosion), especially in periods without any vegetation cover (MoEnvi 2011). Heavily aired open lowlands – Záhorie, the Danube lowland and the East Slovakia lowland – are the highest risk areas. The South Slovakia basin has a moderate risk level and other regions of Slovakia show a low risk level.

Physical soil degradation is also enhanced by slope processes. Areas with slope disorder cover some 1,500 km^2, which is approximately 3 per cent of the territory of Slovakia. These disorders are the result of gravitational slope movements that occur mostly in mountainous areas. They are less frequent in basins and can be found sporadically in hilly areas. These slope disorders occur mainly in flysch rocks but also in core and volcanic mountain ranges in the form of dissected mountain ridges, block rubbles, block fields, rock glides and breaks. Slope disorders in inner Carpathian basins and lowlands include mostly slides and land flows, which are also found in the flysch and volcanic mountain ranges.

The highest avalanche risk, as is also the case for water erosion and landslides, is in Slovakia's highest mountains: the Vysoké and Nízke Tatry, the Veľká and Malá Fatra.

Some agricultural land assets are endangered by compaction. At present, 457 thousand hectares of land are potentially at risk of compaction processes and 19 thousand hectares are actually compacted. Brown earth is the most endangered, probably due to its intensive use. The reason for this phenomenon is improper management of agricultural land assets, in particular the use of heavy machinery.

Water Pollution

Although the development of water quality in Slovakia has recently shown a positive trend the situation still cannot be considered satisfactory. Based on the surface water monitoring carried out by sub-catchment area, it is possible to conclude that limits for selected general indicators and radioactivity indicators have been met in all selected monitoring sites. Hydrobiological and microbiological parameter limits, mainly in synthetic and non-synthetic substances, were mostly exceeded. The group of synthetic substances includes arsenic, cadmium, copper, lead, mercury and zinc. In the group of non-systemic substances, atrazine, di(2-ethylhexyl) phthalate (DEHP), fluoranthene, naphthalene, 4-nonylphenol, tetrachlorethylene, trichloromethane, cyanides and 4-methyl-2,6-di-terc butylphenol did not meet the annual average requirements.

In the territory of Slovakia, 75 groundwater bodies were identified for groundwater monitoring. Good chemical status was indicated in 82.7 per cent of groundwater bodies; poor status was indicated in 17.3 per cent.

Factors causing contamination of groundwater show considerable diversity. They are a consequence of industrial development, agriculture, urbanization and transport. Infiltrating rainfall water containing foreign substances from polluted air can be considered a secondary source of contamination.

In spatial terms, the most contaminated ground waters include water discharged from galleries featuring levels above the limit of Al, As, Cd, Cu and Hg. A high degree of contamination is also present in ground water in lowlands and basins with a high concentration of economic activity, be it industry or agriculture. In these areas, sulphates, chlorides, nitrates, phosphates, potassium, iron, manganese, aggressive carbon dioxide and many metals, especially copper, zinc and cadmium, occur in multiples of permissible concentrations.

Load and Damage to Vegetation

In Slovakia, systematic monitoring of vegetation damage is carried out in forest ecosystems. Slovakia's forest ecosystems are facing threats from several factors, abiotic, biotic and anthropogenic. Due to abiotic factors, mainly as a result of the harmful effects of wind, snow, frost and drought, 2.3 million m^3 of wood were damaged in 2010, of which wind accounted for 87.4 per cent . The largest biotic harmful agents in forests are bark and ligniperdous insects. Other harmful agents are phyllophagous and sucking insects, rot, tracheomycosis and game.

Spruce bark beetle, with a share above 95 per cent of total bark and ligniperdous insect infested wood mass, was the most important biotic factor. Out of woody plants damaged by bark and ligniperdous beetles, spruce (99.6 per cent) is the most strongly affected.

The main anthropogenic factors endangering forest ecosystems are disproportionate logging; replacing native forest with man-made monocultures; loss of forest ecosystems as a consequence of an expanding technosphere; threats due to recreational activities; and imissions. Imission-weakened and damaged forests (especially spruce, fir and beech) are more susceptible to

damage by abiotic and biotic factors. The area of imission-endangered forests is 4,202 hectares.

Defoliation, the loss of assimilative organs, can be considered the key indicator of forest health. Damage to forests is assessed in terms of five basic categories, ranging from intact to severely damaged The results of the national programme of forest ecosystems health monitoring indicate that 1989, when 49 per cent of trees were classified as in impairment categories 2 to 4, was the most critical year. However, as early as 1991 the situation significantly improved with only 28 per cent of forest ecosystems in this category of impairment. From 1991 until 1994, forest ecosystem health gradually deteriorated; in 1995, no significant changes were observed. In 1996–2000, the health of woody plants was the best; in 2000, the lowest share of damaged trees, 23 per cent, was recorded since monitoring began. In 2001, health deterioration mainly of deciduous trees – 31 per cent – occurred. In 2010, the share of trees in defoliation classes 2 to 4 (with defoliation above 25 per cent) in all woody plants together again increased by 6.5 per cent compared to 2009. The share of conifers in defoliation classes 2–4 grew by 4.1 per cent compared to the previous year, the share of deciduous trees in defoliation classes 2–4 increased by 8.4 per cent. At present, the share of trees with defoliation above 50 per cent is 2.4 per cent.

The most heavily damaged trees include oak, acacia, fir and spruce; hornbeam and beech are among the least damaged. Based on long-term development, it can be concluded that the health of forests in Slovakia, as indicated by defoliation and the degree of impairment, has stabilized in recent years, while fluctuations in individual years are caused mainly by climatic factors. From a spatial point of view, the most endangered forest ecosystems are found in the districts of Liptovský Mikuláš, Brezno, čadca Gelnica, Poprad.

With regard to the protection of habitats of European importance, in 60 per cent of forest habitats the conservation situation is unsatisfactory or poor. An unfavourable situation also exists in half of all shrub habitats, in 70 per cent of permanent grassland habitats and also in 70 per cent of freshwater habitats.

It can also be a concluded that the conservation situation affecting species of European importance is unsatisfactory. An unsatisfactory or poor condition is observed in half of evaluated vascular plants, in half of mammalian species, 70 per cent of reptiles and 90 per cent of amphibians.

Synthetic evaluation of the overall environmental condition showed that in terms of concentrations of foreign substances the most heavily loaded territories are the industrial regions of Slovakia and/or old mining localities: the karst of the Spišsko-gemerský kras, the upper Nitra region, the Žiar basin, Strážske – Humenné – Vranov nad Topľou region and the environs of urban industrial centres – Bratislava, Košice, Prešov, Žilina, Banská Bystrica and Ružomberok. Higher concentrations of selected elements in soils can also be seen in the Malé Karpaty, Nízke Tatry, Kremnické vrchy and the Štiavnické vrchy. Lowlands with intensive agricultural production are also distinguished by a higher degree of groundwater contamination and increased content of phosphorus, fluorine and sometimes of cadmium. At the same time, these areas show a low level of spatial ecological stability. An increased degree of risk and damage to the land asset due to erosion and accumulation and slope processes exists in montane and submontane areas.

1.2 The Current Economic Strategy with a View to Developing a Green Economy

Slovakia's current economic strategy is strongly influenced by its integration into the EU, globalisation tendencies and the economic crisis. Under such conditions, it is difficult to quantify the extent to which an economic strategy is drafted by national authorities for the sake of long-term growth and the extent to which it is dictated by international commitments, policies of transnational corporations (TNCs) and ad hoc measures to address a crisis situation.

Slovakia is a small economy with a high degree of openness. Its international trade integration is above the EU average, as are its export performance and import intensity. Another feature of the Slovak economy is its relatively high energy intensity and symptoms of so-called jobless growth. The interdependence of economic processes, energy intensity and employment is of interest for the context of this study.

Slovak economic growth is significantly based on exports and is not directly linked with the development

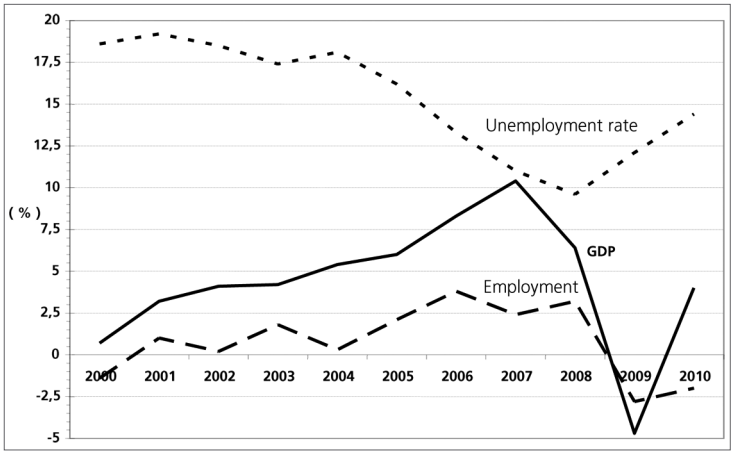
of employment. As shown in Table 2 and Figure 1, GDP growth in the first decade since 2000 was accompanied by far smaller growth of employment; indeed, sometimes they went in opposite directions, as in 2010, when economic growth achieved a year-on-year GDP increase of 4 per cent while employment suffered a year-on-year drop of 2 per cent. These figures indicate an overall shrinking share of employment in the creation of value added and GDP, which is also linked to the Slovak economy's diminishing potential to create jobs in general and in particular to create green jobs.

A more detailed analysis of Slovakia's external economic performance in Burda (2011) shows that in the long run, import intensity is due to raw materials and energy resources, in particular resources imported from the Russian Federation. Foreign direct investments in manufacturing industries that have a high export performance, but at the same time requiring the import of semi-products and components for the assembly of final products – namely the electrical, electronic and automotive industries – have significantly contributed to import intensity.

The Slovak economy's energy intensity is high. As shown in Table 3, Slovakia's energy intensity is the fifth highest among the EU member states, although it has fallen by about half since independence. It is expressed in relation to rising GDP. The Slovak Republic is expecting net energy consumption growth of 1.6 per cent per year. Therefore, the requirement to reduce energy consumption and associated emissions by 20 per cent can be met mainly by offsetting it with growth in renewable energy resources, RER. However, the strict political requirements laid down in Europe 2020, including R&D funding at the level of 3 per cent of GDP, will not be met by emerging economies only gradually breaking out of the crisis over the next eight years.

The decline in energy consumption in Slovakia after 1993 is linked to the reduction of traditional industries, the growth of the service sector and the replacement of primary production with assembly activities. According to the 2008–2010 National Reform Programme, the continuing high energy requirement of the economy (no figures given) is due to aluminium production, iron and steel production and refinery production. In addition, such production has high raw material requirements.

Figure 1: The development of GDP and employment in Slovakia



Note: Year-on-year changes in GDP and employment in per cent; real GDP in constant prices (2000); employment and unemployment according to Labour Force Surveys.
Source: Statistical Office of the SR.

Table 2: Development of selected economic indicators[a]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GDP[b]	0.7	3.2	4.1	4.2	5.4	6.0	8.3	10.4	6.4	-4.7	4.0
Employment[c]	-1.4	1.0	0.2	1.8	0.3	2.1	3.8	2.4	3.2	-2.8	-2.0
Real wages	-4.9	1.0	5.8	-2.0	2.5	6.3	3.3	3.5	3.3	1.4	4.4
Consumer prices	12.0	6.4	3.3	8.5	7.5	2.7	4.5	4.5	4.5	1.6	1.0
Unemployment rate[c]	18.6	19.2	18.5	17.4	18.1	16.2	13.3	11.0	9.6	12.1	14.4

Note:(a) Year-on-year changes in per cent, (b) real GDP in constant prices (2000); (c) Labour Force Sample Survey.
Source: Statistical Office of the SR.

Table 3: Energy intensity of selected economies

	1993	1996	1999	2002	2005	2008
EU27	240	212	193	185	181	167
EU15	212	185	172	166	163	150
Eurozone		190	179	174	173	161
Switzerland	102	102	100	96	93	89
Japan	98	104	106	102	98	90
UK	173	166	149	135	128	114
Austria	152	157	146	147	154	138
Germany	191	186	171	166	163	151
France	200	201	183	180	176	167
Poland	1,615	683	526	469	432	384
Hungary	777	615	521	465	444	401
Slovakia	1,005	896	800	810	681	520
Czech Republic	1,005	721	649	654	601	526
Estonia	1,263	1,240	891	696	617	571
Romania	1,198	1,079	930	853	731	615
Bulgaria	2,306	1,665	1,401	1,276	1,128	944

Note: Energy intensity of the economy measured as gross energy consumption divided by GDP (in 1995 prices) expressed in kg of oil equivalent per 1,000 Euros. The data in the 2008–2010 National Reform Programme (NRP) of the Slovak Republic slightly differ; for example, the value for 2005 is 848 and other values are also higher. Nevertheless, Slovakia is sixth from last in the EU27, followed by CZ, EE, LT, RO, BG.
Source: Eurostat.

1.3 Reserves in Short- and Medium-term Energy Savings and CO_2 Emission Reductions (Industry, Housing/Heating, Transport)

In energy policy, Slovakia, as an EU member state, builds on such European programmes as Europe 2020, Horizon 2020 and the EU Strategy for the Danube Region announced by the European Commission and Commissioner for Regional Policy Hahn in 2010 (COM (2010) 715/4). The strategy, in which 14 countries are participating, includes several priority areas directly linked to green growth:

- mobility and connectivity, as well as, within that framework, inland navigation (coordinated by Austria and Romania);
- sustainable energy industry (coordinated by Hungary and the Czech Republic);
- water quality (coordinated by Hungary and Slovakia);
- environmental risks (coordinated by Hungary and Romania);
- knowledge society, research, education, ICT (coordinated by Slovakia (Slovak Academy of Sciences – SAS) and Serbia (University of Novi Sad).

From among national documents, the following strategies are of particular relevance to green growth:

- Security Strategy of the Slovak Republic (approved by the National Council of the Slovak Republic in 2005);
- Energy Security Strategy of the Slovak Republic (SR Government Resolution 732/2008 of 15.10.2008);
- Strategy for Greater Use of Renewable Energy Sources in the Slovak Republic (MoEcon, 25.4.2007).

In the Security Strategy of the Slovak Republic, which covers all aspects of security, paragraphs 30 and 52 are relevant for the purposes of the present study:

»(30) Increasing the energy and raw materials intensity of industrial sectors and increasing demands for a higher quality of life deepen states' dependence on vital resources ... the likelihood of the emergence of raw material and energy crises. ... Competition for these resources and raw materials may even lead to armed conflicts ... and irreversible damage to the environment. […]«

»(52) The Slovak Republic perceives globalisation as an important factor shaping the security environment ... it will adopt measures to minimise ... environmental degradation, excessive utilization of non-renewable resources and uneven regional economic and social development.«

The Energy Security Strategy of the Slovak Republic is based on the following shares of individual fuels in the total energy requirement (energy mix): natural gas – 30 per cent, coal – 23 per cent, nuclear energy – 21 per cent, oil – 20 per cent, biomass – 3 per cent and other energy resources – 3 per cent. In terms of electricity production in Slovakia, the leaders are nuclear power plants

(with almost 60 per cent of total production), followed by thermal power plants (almost 30 per cent) and hydropower plants (almost 15 per cent of production). The priority of the strategy is to increase the use of renewable energy resources, mainly watercourses, biomass, geothermal and solar energy. Brown coal and lignite with biomass and hydropower potential are resources diminishing dependence on imports. Their mining appears to be on a declining trend. As mentioned in the section on economic strategy, the dependence of Slovakia on imported crude oil (99 per cent comes from the Russian Federation) and gas (98 per cent), is an area for concern. In addition to increased import requirements, the already mentioned high dependence on the Russian Federation is an issue. Possible options are the use of the Adria, Odessa, Bratislava Schwechat pipeline and the Nabucco, South Stream and North Stream pipelines.

According to the strategy, Slovakia anticipates an increase in electricity consumption of about 1.6 per cent a year until 2025. By further utilizing Mochovce power plant units (to 880 MW) and combined cycle at Malženice, opened in May 2011 (installed output 436 MW), the Slovak Republic will become an energy exporter. The Ipeľ pumped storage hydropower plant project (600 MW) is part of the country's Development Plan. According to an interview with the director general of Slovenské elektrárne, P. Ruzzini[1], units 3 and 4 of the Mochovce nuclear power plant will be on stream at the end of 2012 or 2013. After that, Slovakia will not need another large source until 2030. Slovakian progress in meeting the Europe 2020 commitments in terms of CO_2 emission reduction (because nuclear plants do not produce CO_2) is also expected.

It can be concluded that the strategy is not significantly grounded in renewable energy resources other than biomass. On the other hand, energy security achieved with new sources in Mochovce creates good conditions for their gradual development. Strategy data for renewable energy resources are summarised in Table 4.

1. Supplement to the Hospodárske noviny paper, Energetika, October 2010

Table 4: Gross consumption of RER, 2002–2005, projected to 2015 (in GWh)

Resource	2002	2003	2004	2005	2015 heat	2015 el.
Biomass	2,930	3,430	4,344	4,673	10,278	650
Biogas	38	42	66	57	1,111	370
Geothermal energy	63	53	54	94	278	70
Solar energy	10	11	12	14	278	10
Wind power plants						750
Total	3,041	3,536	4,476	4,838	11,945	1,850

Note: For the sake of consistency, data in terajoules (TJ) are converted into gigawatt hours (GWh), 1 GWh = 3.6 TJ.
Source: Energy Security Strategy of the Slovak Republic (SR Government Resolution 732/2008)

The strategy for greater use of renewables underlines their positive impact on sustainable development, protection of the environment and public health. However, in the Europe 2020 Strategy the target of increasing the share of renewables in total energy consumption to 20 per cent is not binding because several countries consider it unrealistic. To assess the importance of RER for a particular country, it is important to look at their overall and technical potential, as well as the energy that can be converted into other forms in one year. Data on the Slovak Republic are summarised in Table 5.

Solar energy is a very promising option, as long as the efficiency of photovoltaic cells continues to experience improvement consistent with current research into third generation cells, for example, on the principles of plasmonics.

It is also necessary to mention barriers to the use of RER, which include investment costs, restrictions in protected areas, unsuitable chemical composition of geothermal water, low solar energy conversion efficiency, lack of detailed knowledge of wind conditions and the market, information and legislative barriers.

In terms of their utilisation, RER are competitive, in particular in housing (lighting and heating), and – albeit less so – in industry and transport (although the first prototypes of solar cars and even of light aircraft already

exist). However, given the low density of energy flow, as already pointed out by physicist and Nobel Prize laureate P. L. Kapitsa as early as 1973,[2] direct use of solar energy on a large scale is unrealistic. The economy of wind use for energy also makes this option unjustified and river dams are profitable only in mountainous areas. Physics has not changed since then; however, at the time Kapitsa published his calculations the world was going through the great oil shock. Awareness of climate change was also emerging. It also follows from Kapitsa's calculations that as long as mankind continues to rely predominantly on fossil and nuclear fuels, renewable resources are uncompetitive under market conditions and will continue to need subsidies for a long time, although justified rather in terms of climate change than an effort to achieve sustainable development and solidarity with future generations.

Table 5: Total and technical potential of RER in the Slovak Republic

Resource	Total potential [GWh]	Technical potential [GWh]
Hydropower	6,600	6,600
Large power plants	5,600	5,600
Small power plants	1,000	1,000
Biomass	33,400	33,400
Forest	4,700	4,700
Agricultural	7,950	7,950
Biofuels	1,950	1,950
Biogas	1,900	1,900
Other	16,900	16,900
Wind energy	not determined	600
Geothermal energy	48,500	6,300
Solar energy	54,038,000	9,450
Total	54,126,500	56,350

Source: Europe 2020 Strategy.

Moreover, renewable resources with low energy density are not a satisfactory solution for large agglomerations (for example, in Tokyo, off-take density is 40,000 kWh/m^2/year). At the same time, the Earth receives 1200–1300 kWh/m^2/year of energy from the sun, of which we can convert about 20 per cent.[3] Large cities cannot, therefore, do without fossil fuels. Here, the huge H/C (hydrogen/carbon) ratio, which grows in the sequence wood – coal – crude oil – gas, is important. These predictions do not reduce the importance of solar energy. Indeed, the 3 billion people living in rural parts of the planet are also a huge market. It is worth noting that currently, one-third of the global population has no access to a commercial power grid[4] (which also causes major health problems), which illustrates the potential for increasing the share of RER in the global energy market.

1.4 National Initiatives for Mitigating Climate Change

In the Slovak Republic, national initiatives for reducing emissions, improving air quality and mitigating climate change are underpinned by legislative acts and decrees of the Ministry of the Environment (www.minzp.sk).[5] For reasons of space we shall confine ourselves to outlining trends. National emission limits are stipulated in order to reduce soil eutrophication and acidification by at least 50 per cent compared to 1990. Ground ozone, volatile organic compounds and other things are also monitored. Under Decree 131/2006 Coll., national emission limits are as follows:

- sulphur oxides expressed as sulphur dioxide: 157,900 tonnes for 2007; 125,200 tonnes for 2008; 109,900 tonnes for 2009; 104,900 tonnes for 2010;
- nitrogen oxides expressed as nitrogen dioxide: 130,000 tonnes for 2010;
- ammonia: 39,000 tonnes for 2010.

The highest sulphur oxides emission quota (five-digit) are in these districts of Slovakia: Bratislava II, Prievidza, Košice II (see Table 6). Four-digit quotas apply to the districts of Nové Zámky, Žilina, Martin, Revúca, Zvolen, Humenné, Vranov nad Topľou, Michalovce, Rožňava – that is, industrial and energy industry sites. Progress in this area is slow, which favours the development of RER, further thermal insulation of houses and reorganisation of public transport.

2. Kapitsa, P. L. (1973).

3. Gruebler, A. (2004).

4. EC (2004), A Vision for Photovoltaic Technology.

5. Act 478/2002 Coll. on air protection as amended in 2003–2005, Act 401/1998 Coll. on air pollution charges as amended several times, and 13 decrees, the last being 52/2012 of 31.1.2012 are the principal ones.

Table 6: Maximum sulphur oxides emission quota in the SR for 2011 and 2012 (in tonnes per year)

District	2011	2012
Bratislava II	11,070	10,500
Prievidza	36,750	34,900
Košice II	10,750	10,200

Note: Decree 131/2006 Coll. was amended by Decree 52/2012 Coll. on 31.1.2012; under it, the 2013 and 2014 quota was tightened for Bratislava II (the values are 10,300 and 10,200, respectively), and for Košice II (the values are 10,000 and 9,800, respectively), while in Prievidza they remained unchanged.

Data on greenhouse gases are also included in the 2008–2010 National Reform Programme for Slovakia. From 1990 to 2006, Slovakia experienced a fall in anthropogenic greenhouse gas emissions of 32 per cent, in other words, 24 percentage points more than the target adopted under the Kyoto Protocol for 2008–2012. Slovakia is one of the few countries that do not follow GDP growth in these emissions, although the emission intensity of GDP generation is still three times higher than the EU15 average, according to the document.

2. Prospects of Green Growth and Efficient Use of Resources

2.1 Economic Sectors with the Potential to Produce Green Growth and/or Green Jobs

The International Labour Organization (ILO) defines green jobs rather broadly as jobs that help in reducing negative environmental impacts and create environmentally, economically and socially sustainable enterprises and sectors. The definition further states that green jobs are those which:

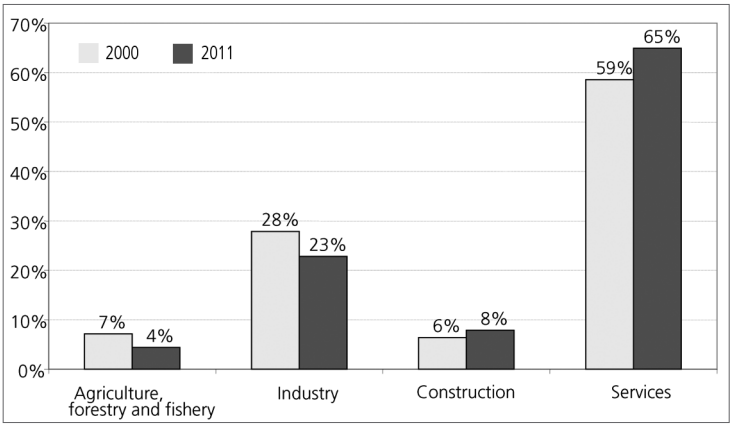
- reduce consumption of energy and of raw materials,
- limit greenhouse gas emissions;
- minimise waste and pollution; and
- protect and restore ecosystems.

Presently, the ILO is engaged mainly in examining and classifying relationships between climate change and the labour market with a view to assessing the negative impacts of climate change and identify jobs that would help in reducing these impacts and/or climate change itself. Green jobs are thus a tool of climate change prevention and protection and rehabilitation of the environment.

In the medium and long term, green jobs can result in significant social and economic effects, although they may be economically more costly in the short term. Especially in times of economic crisis, it is difficult to expect voluntary investments on the part of businesses in the modernisation of technologies and other practices that could generate green jobs. Creation of green jobs should be encouraged indirectly (incentive measures) and directly (for example, direct public investments in projects that create green jobs). A relatively simple approach is to combine active labour market measures (which are subsidised from public funds) with the creation of and support for green jobs. The volumes of jobs thus created are, however, small compared to total employment: currently, Slovakia's workforce numbers about 2.4 million, of whom 400,000 are unemployed. However, the volume of jobs supported within the framework of active labour market measures is only in the thousands.

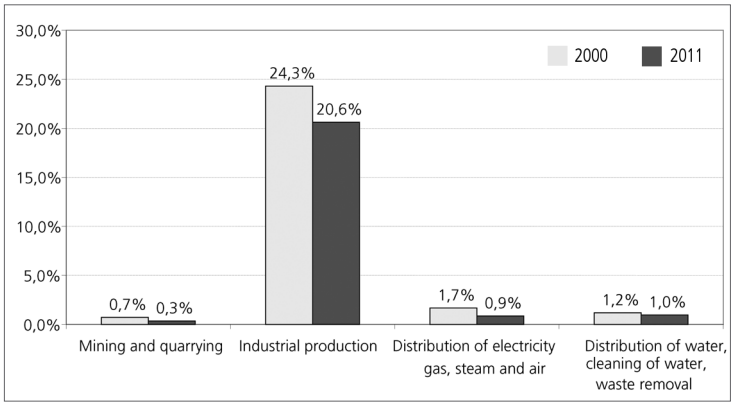
The development of the structure of employment in Slovakia in the past decade suggests a decreasing potential for the large-scale creation of green jobs as the share of sectors with high potential (especially agriculture) in total employment has been continuously declining (Figure 2). The use of agricultural land assets is also decreasing. Particular attention should be paid to developing the structure of employment in industry, which is the largest energy consumer and the largest source of environmental pollution. As shown in Figure 3, the share in total employment is declining in industries directly related to energy, such as mining and extraction, and energy supply and distribution. The situation is similar in the water supply, discharge, treatment and waste disposal sectors. These industries have the potential for creating green jobs, particularly in relation to RER, recycling and so on, but they employ fewer and fewer people.

Figure 2: Development of the employment structure by sector, Slovakia, 2000–2011



Source: Statistical Office of the Slovak Republic.

Figure 3: Development of the employment structure by industry, Slovakia, 2000–2011



Source: Statistical Office of the Slovak Republic.

The effects on employment will be conditional on green manufacturing and the programmes discussed in more detail in Section 2.2:

- renewable energy resources;
- raw materials recycling;
- environmentally more efficient transport.

However, growth may also be expected in the number of jobs in education and awareness-raising needed to achieve progress in green growth in Slovakia. This includes awareness-raising with regard to collecting, sorting and recycling raw materials, public environmental education and education in schools, which is in its infancy.[6]

2.2 Green Manufacturing and Technologies – Production in loco versus Imports

In this subsection we elaborate on environmental technologies in the key areas outlined in Section 2.1.

2.2.1 Renewable Energy Resources, Particularly Solar Energy

In our view, the fact already mentioned that relatively less attention is paid to renewables is because Slovakia is a small and open economy dependent on stronger economies and also because of short-termist policymaking. We also have large nuclear capacity which, in combination with hydroelectric power, reduces the pressure to eliminate fossil fuels with a view to climate change, so that Slovakia's CO_2 allowances can even be traded.[7]

In 2005, the European Commission issued A Vision for Photovoltaic Technology[8] in the drafting of which Nobel Prize Laureate I. Alferov also participated. The study points out that solar energy has fallen behind wind power and biomass. Photovoltaic cells are still a niche application, although in 2030 they should generate 4 per cent of world energy. However, not only efficiency, but also durability and reliability of cells – often forgotten in the chase for efficiency – need to be improved. The cells are exposed to mechanical load by wind, winter–summer temperature cycles, moisture, icing and suchlike. Permissible power fall is up to 10 per cent over 12 years and up to 20 per cent over 25 years.[9] The technical potential of solar energy, heat and electricity generation is four times higher than the current worldwide energy requirement. The latest EC document in this area is A Strategic Re-

6. One example is the manual Nepohodlná pravda v triede (An Inconvenient Truth in the Classroom), a translation of a 2006 publication for US secondary schools, published by Priatelia Zeme (Friends of the Earth) and printed on recycled paper. It is also suitable for public awareness-raising with regard to climate change, the greenhouse effect, air protection, RER and so on.

7. Zelená energia z Mochoviec, Hospodárke noviny, 8. 9. 2011.

8. EC, DG Res. (2005).

9. F. Janíček et al. (2010).

search Agenda for Solar Energy Technology.[10] Projected data on photovoltaic cells are presented in Table 7.

Table 7: The economics of photovoltaic cells

	1980	2011	2020	2030	Long-term forecast
Price with a 100 kW system [€ / W]	above 30	2.5	1.5	1	0.5
Price for generation in southern Europe, [€ / kWh]	above 2	0.2	0.1	0.06	0.03
Return in southern Europe, [year]	above 10	1	to 0.5	to 0.5	0.25

Note: In 2011 prices.
Source: A Strategic Research Agenda for Solar Energy Technology, EC.

By comparison, Germany was headed for the 1 GW target in this area in 2010 and it is assumed that the Czech Republic has half the total installations in the new EU member states. The idea that solar energy is appropriate for southern countries is also inaccurate, although, indeed, it is more economically advantageous there. To illustrate the situation in Slovakia we refer to the data of the Ministry of the Economy, according to which more than 480 MW of photovoltaic panels were installed in 2011 (104 MW in Western Slovakia, 242 MW in Eastern Slovakia and 134 MW in Eastern Slovakia). New installations are continuously being added in Slovakia, but the solar boom is over. The overall capacity in Slovakia is estimated by the authors at between 500 and 550 MW of photovoltaic panels (including small installations not connected to the distribution network).[11]

In Slovakia, the main legislative documents in the field of renewable energy resources are Act No. 309 of 19.6.2009 on the promotion of renewable energy resources and high efficiency co-generation, Act No. 656/2004 Coll. on Energy Sector and Act No. 276/2001 Coll. on the regulation of network industries. Support for electricity from renewable resources can take the form of preferential connection of an electricity generation installation to the distribution system, subsidies and off-take of electricity at a loss, regardless of the output of the installation. Support is extended for a period of 15 years from putting the installation in operation or from its reconstruction and upgrading. The network operator is obliged to take all energy of this type. Support is administered by the Regulatory Office for Network Industries. The price of energy is determined in accordance with its nature, technology and output and is reduced when state aid was given for constructing the installation. The State Energy Sector Inspection is responsible for supervision.

Concerning support for solar energy in the Slovak Republic, the wording of Act No. 309/2009 is generally favourable; however, a number of other decrees and ordinances also apply. Ordinance of the Regulatory Office for Network Industries No. 2/2010 of 23.6.2010 determines the price of energy from renewable resources in relation to the capacity of the production facility. The following sample electricity prices illustrate the support given to promoting solar energy:

Price of hydropower from installations up to 1MW	€ 109 per MWh
Price of solar energy from installations up to 100MW	€388 per MWh
Price of wind energy	€ 81 per MWh
Price of geothermal energy	€ 196 per MWh
Price of energy from fermented biomass combustion	€ 145 per MWh

However, Slovenská elektrizačná prenosová sústava, a.s. (the Slovak Electricity Transmission System) announced on 11.6.2010, that no certificate for ground installation builders would be issued until the end of 2011. Smaller solar power stations on facades and roofs with an output up to 100 kW are the only option. The concern is to avoid a situation similar to the Czech Republic where rapid development of solar power plants resulted in an electricity price increase of 20 per cent. In compliance with the new Government Programme, Slovakia pushed prices for RER to market price levels, which is understandable in times of economic crisis. The price of biomass is the closest to the market level.

10. A Strategic Research Agenda for Solar Energy Technology, ed. N. Pearsal, September 2011.

11. The larger photovoltaic electric power stations (3 -4 MW) include Kosihy, Fotosolar Tornala and Gino Group Besenova (there are almost 25 power stations in this category).

Global development of photovoltaics has exceeded the optimistic forecasts of 2000 and 2001. Germany, followed by Spain and Italy, are market leaders in solar photovoltaics in Europe. The United States and Japan are the world leaders. China has increased production by 1,200 per cent since 2003. In 2020, photovoltaic systems should supply energy to one billion people and employ 2 million people (F. Janíček et al., Obnoviteľné zdroje energie II, FEI STU 2010, 186 p.). The advantage of photovoltaics is that it has no moving parts, is silent and does not produce any waste.

Installations of solar power stations with a higher output in Slovakia and the Czech Republic can be presented as an example: according to company documents of the Rožnov pod Radhoštěm-based Solartec, the Czech Republic has five installations with an output above 10 kW (including VUT Brno, Masarykova univerzita Brno and ČVUT). The Czech Republic has an installed capacity of 1 GW in photovoltaics. In Slovakia, Solartec has so far installed the highest output (100 kW) for Comenius University. AquaCity Poprad, which opened in 2007, is an example of modern architecture incorporating photovoltaics into buildings, complete with 148 m^2 of cells. The Tesárske Mlyňany solar park built in 2008–2009 with an installed capacity of 2,200 kW, production of 2.2 million kWh per year and a panel area of 70,000 m^2 is another example of a system installed in Slovakia (F. Janíček et al. 2010).

The potential of the solar energy industry in Slovakia is determined, among other things, by regional considerations. In Europe, the energy from the sun received by the Earth's surface in Norway is 700 kWh/m^2 per year, rising to 1,750 kWh/m^2 in Malta, but, for the sake of comparison, as much as 2,530 kWh/m^2 in Sudan. The radiation reflected from the Earth's surface (»albedo«) is barely exploitable. In Slovakia, at our latitude of 48° to 50°, the values range from 1,000 to 1,200 kWh/m^2 per year. In theory, this is 200 times more than our requirement. The difference between the south of the country (Komárno) and the north (Kysucké Nové Mesto) is not great, at only 13 per cent. The summer–winter fluctuation is more significant, as illustrated by the example of Komárno, which has 1,476 Wh/m^2 per day in January, 4,777 Wh/m^2 in April, 5,930 Wh/m^2 in July and 3,250 Wh/m^2 in October. Seasonality thus poses a problem for solar energy in Slovakia. The energy price is higher than the usual price from the grid, although compared with the peak energy price it is profitable. Price parity is expected by 2020; until then, subsidies are necessary.

Photothermal energy is used to produce hot service water, additional heating, water heating in swimming pools as well as industrial heat and/or cooling. Collection of data about photothermal cells is problematic because they operate locally and on an individual basis.[12] Table 8 presents information on the installed capacity of photothermal collectors (from F. Janíček et al.):

Table 8: Installed capacity of photothermal collectors, selected countries

Country	Million m2
Germany	5.604
Greece	2.826
Austria	2.085
Cyprus	0.450
Denmark	0.315
France	0.274
Poland	0.102

Source: F. Janíček et al. (2010).

The production and use of biofuels is still fraught with unresolved problems. Some countries produce ethanol from sugar cane or cereals and blend it with kerosene, thus substituting crude oil imports. The problem with this is that it crowds out food production as the world's population continues to grow. Therefore, research is targeted on the use of inedible bio raw materials, often waste biomass. However, the conversion of plant lignocellulosis into alcohol still requires considerable research.[13]

The low cost of wind energy – € 81 per MWh – in Slovakia suggests that wind power is not much in demand in Slovakia. As already mentioned, the potential is very low. A small wind park near Jablonica, Cerová-Lieskovská, where four turbines previously used elsewhere are installed, can serve as an example. Support for wind energy in neighbouring Austria is concentrated in the

12. The larger installations in Slovakia include a the penitentiary facility in Zeliezovce with a capacity of 320 panels and 132 collectors for water heating at Hliny in Zilina (energy equivalent 120 kWh of heat).

13. For more details, see R. Maheswari (2008).

north–south corridor on the border with Slovakia. Slovakia should also focus its efforts there.

2.2.2 Waste Recycling

Slovak legislation covers recycling and waste. Act No. 409/2006 Coll. on waste and on amending and supplementing certain other acts might be mentioned. It regulates the sorting and recovery of waste within the meaning of the regularly revised programme of the Ministry of the Environment. Under this law, a waste producer is a legal entity or natural person producing more than 500 kg of hazardous waste or 10 tonnes of other waste per year.

The law established the Recycling Fund (Section 55) as a non-state dedicated fund collecting money to support the collection, recovery and processing of spent batteries and accumulators, waste oils, used tyres, as well as plastics, paper, glass, vehicles and other commodities. Contributions to the Fund are paid by the manufacturers and importers of these commodities in accordance with follow-up regulations and calculation algorithms. The Fund may be used to cover the costs of collecting and recovering waste, processing old vehicles, searching for and applying new waste recovery technologies and the like. By way of illustration, in January and February 2012 the Fund granted four applications support totalling € 121,000.[14] One of them – with an allocation of € 51,000 – is for organising separated waste collection in Nové Mesto nad Vahom.

Waste management and recycling is becoming more and more important in our consumer-oriented societies. As early as 2007, the production of municipal waste per capita in Slovakia achieved a level of about 500 kg per year and it has been growing ever since,[15] while the reuse of waste is relatively low, in magnitudes of only a few per cent (for comparison, many developed countries are able to separate 30 to 60 per cent of materials such as paper, glass, metal and textiles from household waste). The quantity produced by the Sereč nickel smelting works, which rose to a volume of 6 million tonnes of muds and an area of 35 hectares between 1963 and 1992 can be given as an example.

Recycling old cars is a topical issue in Slovakia in the context of growing vehicular transport. Globally, 40 per cent of steel is recovered from recycling and the average lifespan of cars is 10 to 12 years. These factors are important for Železiarne Podbrezová (Iron Works Podbrezová). A tonne of scrap costs around € 200, whereas a tonne of the seamless pipes manufactured there costs 30 times more. The centre for metal waste processing at Hliník nad Hronom, whose majority owner is Železiarne Podbrezová, is one of the most modern facilities in Europe, disassembling 1,500 car wrecks a year. An operation for the disassembly of 1,000 cars per year is located in the nearby Závod SNP at Žiar nad Hronom.[16] In 2008, up to 30,000 vehicles were disassembled in Slovakia. In the event of an economic boom, this area will be a source of new green jobs in Slovakia.

2.2.3 Ecologically More Efficient Transport

With regard to more eco-efficient transport in the Slovak Republic, the already mentioned EU Strategy for the Danube Region, which points out that »freight transported on the Danube is only 10–20 per cent of that on the Rhine«, should be considered an important programme. As inland waterway transport has important environmental and efficiency benefits, its potential must be exploited sustainably. The solution builds on the NAIADES programme and the Joint Statement on Inland Navigation and Environmental Sustainability in the Danube River Basin. The target of increasing cargo transport on the river by 20 per cent by 2020 compared to 2010 requires:

- removing existing navigability bottlenecks on the river in order to accommodate type VIb vessels, that is, pushed convoys and inland waterways vessels with a draught of up to 2.5 m, all year round by 2015;

- development of efficient multimodal terminals at Danube river ports to connect inland waterways with rail and road transport by 2020.

Needless to say, green jobs are a key consideration with regard to strategic priorities.

14. See: http://www.recfond.sk

15. See: http://referaty/seminarky.sk/recyklacia

16. Roľnícke noviny, 6.6.2008, P. Ferárik.

2.3 Knowledge and Innovation: The Current Level of Technological Development

Mobilisation of the knowledge society and innovation are paramount for increasing resource efficiency and green growth in any country. Therefore, particular attention is paid to this issue in Slovakia. The relevant documents include:

- Europe 2020 Strategy. This supersedes the Lisbon Strategy, whose aims were not fully realised, and makes use of the »matryoshka« (Russian dolls) method: the unrealised programme is repackaged within a new, even more ambitious programme with more demanding parameters and an extended deadline, in this case 2020.

- Dlhodobá vízia rozvoja slovenskej spoločnosti (Long-term Vision of Slovak Social Development) Ekonomický ústav SAV et al., vydavateľstvo VEDA SAV, 2008 and the follow-up Development Strategy for Slovakia up to 2015.

- CERIM Project Report (Central European Research into Innovation Models).[17]

The relevant targets of the Europe 2020 Strategy for our study are as follows:

- 75 per cent of the population aged 20–64 shall be employed;

- in the EU, 3 per cent of GDP will be invested in R&D annually;

- the 20–20–20 target will be met, in other words, by 2020, emissions will be reduced by 20 per cent; energy savings and the share of renewable energy resources will increase by the same percentage.

The Innovation Union of October 2010 (Document No. 14932-10) builds on the strategy. It is a flagship initiative with a broader understanding of innovation, namely, technological innovation, non-technological innovation, application-driven innovation, eco-innovation and innovation in services. Europe is aware that it is falling behind the United States in this area and that global competition is growing, for example due to Chinese and Indian investment in R&D.

The situation in Slovakia according to the Slovak strategy up to 2015 does not tally with these goals. Commercialisation of R&D is low, Slovakia has an export-oriented processing economy, the innovation index is 53.7 per cent of that of the EU15 and over the next 5 to 10 years wages will grow slowly, which means that SMEs will be competitive mainly because of cheap labour. R&D funding has long been below 0.5 per cent of GDP and the trend is still downward.

Table 9 shows the structure of the innovation index in the Slovak Republic (from Šikula et al., 2010). The huge gap between Slovakia and the EU average is discernible mainly in respect of funding, knowledge performance and innovators. The low price of labour is an unfavourable indicator because it does not force companies to increase innovation. The results are summarised in Table 10.

Table 9: European innovation score, EIS 2008

Indicators	EU-27	SR	SR/EU-27, [%]
Human and financial resources	0.49	0.28	56.7
Human resources	0.48	0.34	72.2
Finance and support	0.51	0.20	38.8
Company activities	0.42	0.21	49.8
Company investments	0.42	0.31	74.4
Business cooperation	0.41	0.22	54.8
Knowledge performance	0.42	0.11	26.5
Outputs	0.50	0.40	79.1
Innovators	0.48	0.15	30.3
Economic effects	0.55	0.54	97.1
Summary innovation index, sii	0.47	0.30	64.2

Source: M. Šikula et al., Stratégia rozvoja slovenskej spoločnosti, Ekon. ústav SAV, Bratislava 2010, p. 416.

17. Project investigators Úrad SAV and Technologický inštitút SAV, 2008–2011, Principal Investigator I. Chodák, coordinator PVA Mecklenburg, Rostock, cooperation Inno AG, Karlsruhe, Germany, ERDF funding, Vienna subsidiary.

Table 10: Relative labour costs in selected countries based on the OECD average (OECD average = 100)

Country	Index	Country	Index
Germany	148	Portugal	74
The Netherlands	134	Czech Republic	62
France	123	Hungary	54
Japan	117	Poland	52
United States	106	Slovakia	46
Canada	94	Mexico	27

Source: Focus 3. 4. 2010.

Ways in which Slovakia can catch up should be analysed in several areas, in particular, the legislative framework for innovation, intellectual property, the organisation of technology transfer and innovativeness and innovation absorption capacity.

2.3.1 Legislative Framework for Innovation in the Slovak Republic

The legislative framework encompasses mainly laws promoting science and technology and the law on the protection of R&D. Laws promoting science and technology include: Act No. 172/2005 Coll. on the organisation of state support for research and development and on the amendment of Act No. 575/2001 Coll. on the structure of government functions and on the organization of central public administration as amended by Act No. 233/2008 Coll., and also Act No. 185/2009 Coll. on incentives for R&D and amendment to Act No. 595/2003 Coll. on income tax, as amended. The category of laws on the protection of R&D results includes five acts, including Act No. 435/2001 Coll. on patents, supplementary protection certificates and on the amendment of certain acts, Act No. 618/2003 Col. on copyright and rights related to copyrights, as amended, and Act No. 517/2007 Coll. on utility models and on the amendment of certain laws.

This shows that Slovakia has advanced legislation supplemented by a number of measures in the Higher Education Act in place in this area, though, more attention should be paid to the law on innovation.

2.3.2 Intellectual Property Rights in the Slovak Republic

The situation with regard to intellectual property rights is analysed by, among others, Švidročet al. (2009),[18] according to whom national patents are on the wane in the Slovak Republic, to be superseded by the European patent granted by the European Patent Office. The rights arising from employment relationships belong to employers, who may exercise their right to register a patent. The employee has an information obligation. If employers fail to exercise their claim within three months, however, the right reverts to the author.

This situation does not require changing; on the other hand, it should be noted that the annual number of patents in the Slovak Republic is only about 200, and in the Slovak Academy of Sciences (SAS), where this level was reached before 1989, it dropped to an average of 10 a year, although gradually doubling in recent years.

2.3.3 Organisation of Technology Transfer

In this area, Slovakia suffers from major shortcomings. Within the framework of the aforementioned CERIM project, technology transfer in Germany and other EU member states was surveyed. Let us mention as an example that in these countries, the universities and research institutes undertake technology transfer themselves or on the basis of an agreement with an external supplier, a technology transfer company. The scope of technology transfer activities is broad:

- business consulting;
- technology transfer agreements, licences;
- patents, marketing and fairs;
- spin-offs and start-up companies;
- know-how exchanges, transfer portals, networking, additional training;
- offering own infrastructure, measurements, analyses and audits.

18. J. Švidroň et al. (2009).

Various types of incentive are very important for technology – here the experience of the Nordic countries is strongly relevant. Positive examples include the TEKES Agency in Finland, founded in 1983, which manages €470 million a year for innovative, sometimes risky projects, which have produced some 700 patents, 500 new products and 400 improved processes in recent years. VINNOVA, a similar agency, operates in Sweden. Other examples include the Dutch Technology Radar targeted at the identification of future technologies important for the country, a venture capital fund in Germany within the framework of the Beteiligungsprogramme and the Seed and Venture Capital scheme in Ireland. In these countries, the emphasis is on the roles of institutions of higher education and/or of research organisations in commercialising the results.

All these activities are part of the second generation innovative models (2G); the 1G models (free-fall models) do not work. At the same time, the principles of the third generation models (3G) are starting to take shape. In summary, 2G models have a densely populated interface between research and commercialisation for bridging the gap that currently characterises the technology transfer process.

Given this state of affairs, there is an urgent need to promote technology transfer in Slovak science and research in conjunction with significant investments from the R&D operational programme under the structural funds (for example, the amount allotted to the Slovak Academy of Sciences (SAS) is in the range of €100 million. Reporting on the use of these investments is a matter of urgency. Funding of these establishments from national resources is still not settled, which makes the situation critical.

The CERIM project assessed the innovativeness and innovation absorption capacity of the Slovak application sphere on the basis of Slovakia's share in the resources of the EU's Competitiveness and Innovation Programme (CIP), with funding of €3.6 billion in 2007–2013. Here, Slovakia plays a passive role; the number of projects is in the range of two to five per year. Another indicator is state aid, which, according to the Ministry of Finance, is mainly channelled to agriculture. The R&D funds go through the APVV agency. An analysis of structural funds projects carried out by the Ministry of the Economy showed that technical calls are oriented towards funds for medium to low technologies, such as painting, woodworking, printing, food, plastics, packaging and cleaning. In 2009, only five of these projects were targeted on solar energy and ICT. Technology is usually acquired by purchase; the objective of the projects is new jobs.

In conclusion, the higher type of innovation or high-tech is developing very poorly; equally poor is the innovation absorption capacity of the Slovak application sphere.

3. The Role of Politics and Society

3.1 The Depth and Scope of the Public Debate on and Concerns about environmental Development

In Slovakia, environmental policy started to develop significantly only after the political and economic transformation. Until then, insufficient attention was paid to environmental issues. There were no regular measurements or quality assessments. Much environmental information was unavailable to the public and much was concealed. At that time, only non-governmental organizations played a more active environmental role, especially the Zväz ochrancov prírody (Association of Nature Protection Activists) that published reports on the state of the environment (Slovensko nahlas, Bratislava nahlas and the like) for the public, for which they were often censured by the regime. The general public tended to be passive; the environment was of little interest to them. Environmental awareness not only among the public but also among politicians was very low. Behaviour reflected this. Natural resources were plundered, ill-considered interventions in the landscape were implemented and excessive amounts of extraneous substances were released into the environment which resulted in significant contamination of its elements (water, soil, air). Pressure to intensify agricultural production was constantly growing, resulting in deforestation and de-greening of the agricultural landscape and subsequent distortion of spatial ecological stability. Thus, an intensely exploited mono-functional agricultural landscape emerged in the lowlands. No attention was paid to landscape aesthetics or waste, either. Consequently, the character of the landscape was defaced by numerous illegal landfills scattered all over Slovakia. This environmental burden still haunts the country.

Environmental policy improved after the transformation. However, more significant progress in this area was seen only after 1992 and the Rio conference. Slovakia has been actively engaged in the Rio Summit process. The LANDEP landscape planning methodology (Ružička, Miklós, 1982) was included in Agenda 21, Chapter 10, as one of the recommended methods for the integrated protection of natural resources.

Slovakia has declared its commitment to the sustainable development programme and has begun systematically to address issues of environmental protection and creation. The Ministry of Environment is the authority responsible for implementing sustainable development; some specific issues are the responsibility of the Ministry of Agriculture (protection of soil and forest assets) and the Ministry of the Economy (energy sector and efficient use of renewable resources). Social aspects are within the remit of the Ministry of Labour and Social Affairs, while environmental education and training are the responsibility of the Ministry of Education.

In addition to these authorities, considerable attention is paid to the protection and creation of the environment by various NGOs that have implemented several important environmental projects focused on practical protection of the environment, efficient use of natural resources and environmental education. Despite the intensification of activities in the environmental field, environmental awareness still cannot be considered good. The environmental awareness of Slovakians is among the lowest in the EU. According to an EU survey (Attitudes of Europeans towards the Issue of Biodiversity, 2010), up to 65 per cent of respondents said they had never heard the term »biodiversity« and 25.5 per cent of respondents said that, although they had heard this term, they did not know what it means. The situation with regard to the NATURA 2000 network is even worse: as many as 75.9 per cent of respondents from Slovakia said they had never heard this term and 16.8 per cent of respondents had heard of it but did not know what it means. These results ranked Slovakia last among the EU member states.

3.2 The Role of the State, the Green Growth Strategy and Support for Environmental Objectives

By adopting the Government Resolution of 1992, which stipulated the use of the results of the UN Conference on Environment and Development in the development programmes of individual ministries, the Slovak Republic committed itself to the sustainable development programme to ensure green growth.

»Sustainability« was defined in legal terms in Act No. 17/1992 Coll. on the environment as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

The strategy, principles and priorities of state environmental policy (SEPS), drafted by the Ministry of the Environment and approved by Government Resolution No. 619 of 7 September 1993 and Resolution of the National Council of the Slovak Republic No. 339 of 18 November 1993 can be considered the first essential document in the effort to implement sustainable development principles. Measures to achieve the objectives of the strategy in all areas of the protection and creation of the environment were laid down in the first National Environmental Action Plan adopted by the government in 1996.

The State Environmental Policy Strategy (SEPS) of the Slovak Republic builds on the documents of the United Nations Conference on Environment and Development, in particular Agenda 21, the world's Sustainable Life Strategy, the Environmental Action Programme for Central and Eastern Europe and other international and global documents. The SEPS also draws on the Constitution of the Slovak Republic.

The SEPS draft follows an analysis of the status of the environment and its elements in Slovakia; the priorities of state environmental policy are determined and objectives in tackling environmental challenges are developed on this basis. The SEPS was elaborated in more detail within the framework of district environmental protection policies and in the National Environmental Action Plan of the Slovak Republic (NEAP) approved by Government Resolution No. 350 of 14 May 1996.

The transfer of environmental principles into the economic and social spheres is also part of the imple-

mentation of sustainable development. With regard to the economy, strategies, policies and state policy programmes on the development in industry, trade, tourism, energy industry, agriculture, forestry, transport and the building industry were prepared. In the social sector, a state social policy strategy defining the objectives and priorities of social development in Slovakia was drafted in compliance with the principles of sustainable development.

In 1997, the government approved a plan for the implementation of Agenda 21 and for the assessment of sustainable development indicators. To coordinate the implementation of sustainable development in Slovakia and mutual international cooperation in sustainable development the Government Council for Sustainable Development was established by Government Resolution No. 78/1999 on 27.1.1999.

In 2001, the National Strategy for Sustainable Development, approved by Government Resolution No. 978/2001 and Resolution of the National Council No. 1989/2002, was drafted. Strategic objectives and priorities were specified for the National Strategy for Sustainable Development and detailed in the 2005–2010 Action Plan for Sustainable Development of the Slovak Republic endorsed by Government Resolution No. 574 on 13 July 2005.

Regrettably, many measures laid down in the National Strategy and in the Action Plan have not been realised in practice. After the initial fairly active period in environmental policymaking, a slowdown can be observed, which reflects global trends. A similar passivity was seen at the Johannesburg Summit which shifted the core of responsibility for implementing sustainable development from the decision-making sphere to voluntary partnerships that should be established with a view to implementing sustainable development. This idea failed in practice and the past decade can be considered a very inert phase in the implementation of sustainable development. Environmental issues were overshadowed by emerging socio-economic problems due to the global crisis and ensuing recession.

Recently, environmental activities have experienced a revival after the adoption of the so-called green growth policy. In November 2011, an OECD meeting was held in Slovakia with the main objective of evaluating its environmental performance, for the second time since the Slovak Republic became a member state. According to the OECD, Slovakia has made positive progress in improving the environment and in raising living standards since the first evaluation 10 years ago. The OECD appreciated Slovakia's progress in harmonising the environmental framework with its obligations arising from EU membership. The application of an integrated approach to the prevention and control of environmental pollution, an effective system for the prevention of industrial accidents and an exceptionally complex environmental information system are acknowledged.

Slovakia is a poor performer in the application of eco-innovation. Continuing on the way to green growth, however, requires enhancement of the country's basic innovation capacity, for instance via higher education, international cooperation in science and technology and greater involvement on the part of the private sector in supporting science and research (OECD 2011).

On this basis, the strengths of Slovak environmental policy are as follows:

- accession and commitment to the sustainable development programme and green growth policy at the government level;

- establishment of the Government Council for Sustainable Development and of the Council for Integrated Landscape Management;

- drafting of a set of indicators for sustainable development and adoption of a Government Resolution on the regular review of indicators;

- adoption of legislation and programme documents supporting the implementation of sustainable development: a series of new laws, processing and approval of the SEP, environmental action programmes, the National Strategy for Sustainable Development, drafting of a model Regional Agenda and developing a methodology for the drafting of local Agendas 21;

- progress in adopting and aligning new legislation and programme documents supporting the implementation of sustainable development with the legal order, policies, individual directives and other EU documentation, ratification and implementation of international conven-

tions promoting the implementation of sustainability: the Rio Declaration, agreements on biodiversity, climate change, the Helsinki Convention on the Transboundary Effects of Industrial Accidents, the Lugano Convention on Civil Liability for Damage Resulting from Activities Dangerous to the Environment, the Aarhus Convention on Access to Information, the Strasbourg Convention on the Protection of the Environment through Criminal Law, the European Landscape Convention (the Florence Convention);

- the growth of international cooperation, as reflected in the increased participation of Slovak scientists and other experts in the projects of the 5, 6 and 7 EU Framework Programme, as well as international recognition of the landscape ecological research results achieved in Slovakia;

- a progressive approach to landscape protection and creation based on a geoecosystemic approach aimed at shifting from a black-and-white approach to landscape protection and creation to blanket landscape protection based on different degrees of protection, not to mention a wealth of strategic documentation and programmes guiding activities in the landscape;

- development of new study specialisations and research projects that enhance the tackling of priority areas in sustainable development, namely the social, cultural, economic, environmental and institutional aspects;

- extensive NGO activities in implementing sustainable development and green growth.

3.3 Policy Guidelines and Regulations Necessary for Rapidly Reducing Energy Losses and Promoting Green Growth

After the Rio Summit, Slovakia made substantial progress with regard to legislation furthering the implementation of sustainable development. A number of laws were adopted that were compatible with EU requirements, in particular, laws promoting the rational use of natural resources and environmental protection. A list of the most important conventions is given in Annex 3. As may be seen from the sizable number of conventions and guidelines, the Slovak Republic has fairly good environmental legislation. However, the legal enforcement and practical application of these conventions are poor. The lack of financial resources and/or their inappropriate allocation, as well as a lack of capacity for implementing the necessary measures are major hindrances in this regard. The persisting sectoral approach to addressing environmental challenges is also an issue. Although the integrated approach is a generally declared principle of Slovak environmental policy, it is insufficiently applied in practice.

In order to improve the situation the following measures must be taken:

- Integrated approaches must be applied; one natural asset cannot be protected to the detriment of others.

- Optimal use must be ensured of the territory of regions, municipalities, residential areas and the like in a landscape ecological manner: this means a complex process of mutual harmonisation of the spatial requirements of economic and other human activities with the landscape ecological conditions of a given territory resulting from the structure of the landscape; the result is land use consistent with the landscape ecological conditions of a given area, in other words, not limited or restricted by any feature of the landscape ecological complex.

- New and innovative technologies must be implemented. This entails the introduction of efficient technologies aimed at eliminating the production of pollutants above the established thresholds with a view to minimising extraneous substances and other contaminant loads on the individual elements of the environment, as well as the application of technologies using alternative energy and renewable energy resources, new technologies for waste processing, application of so-called green technology in transport and so on. Appropriate ecofriendly agriculture and forest asset management technologies must also be applied.

- Mainstreaming of regulations into sectoral plans so that areas can be used in an optimum landscape-ecological manner. Limits must be set for the exploitation of particular resources by both manufacturing and non-manufacturing entities in order to prevent the development of one sector being favoured to the detriment of another and to avoid conflicts of interest arising between individual sectors.

- Awareness-raising with regard to the principles and criteria for the sustainable use of resources – the basis of this entails the establishment of an effective system of education in the areas of landscape integrated management and sustainability. Only a well educated population will be able to put the principles and criteria of sustainability into practice.

- Effective tools must be applied – legislative protection, economic instruments and the like, especially regulations and standards to ensure the rational use of natural resources, as well as the protection of people, their health and the environment. From this perspective, effective economic instruments are such as taxes, levies, charges and fines for polluting the environment and damaging human health, as well as economic tools promoting environmental forms of management, technology, environmentally-friendly tools eliminating marginality of regions, social disparity and the like.

- Processing, regularly monitoring and reviewing the objective system of global/pan-European indicators measuring progress in the implementation of green growth, setting limits and enforcing hard corrective measures for exceeding these thresholds.

3.4 Main Barriers in Social Regulation

On the other hand, Slovakia also faces a number of barriers inhibiting successful implementation of green growth in practice. The main weaknesses include:

- continuing and/or growing passivity and indifference on the part of the government on sustainable development issues; this fact is also related to the global increase in passivity with regard to sustainable development witnessed at the Johannesburg Summit, together with the politicization of the issue and the discrediting of certain aspects;

- continued reduction of funding for the implementation of sustainable development, the application of eco-innovation, the implementation of environment friendly technologies and the development of environmental infrastructure;

- in the field of research, unnecessary waste of funds due to the duplication of research, inability to achieve a stronger presence in the international research arena, inability to make effective use of EU funds;

- weak support for entities applying ecological and environmentally-friendly management in the efficient use of natural and energy resources; the onerous administrative burden of applying for subsidies and grants;

- persisting energy intensity, mainly in industry;

- a continuing sectoral approach to sustainable development, absence of coordination in research, preferring economic benefits to social and/or environmental benefits, higher level of cronyism and corruption in the implementation of environmental policy;

- growth of poverty and other social problems which, to say the least, blunt people's interest in environmental issues, pushing the solution of environmental problems to the margins, but also growing demand and the proliferation of consumerism which is incompatible with the principles and criteria of sustainable development;

- negligence of coordination in education, promotion of sustainable development and so on, continuing lack of information from and passivity on the part of local government officials in the area of sustainable development;

- continuing low environmental awareness among the population, often as a result of insufficient education.

3.5 Role of International and European Standards and Directives in Environmental Policy

Recently accumulated environmental challenges – depletion of natural resources, environmental degradation, threats to biodiversity, landscape stability disturbance, increase of negative mental social phenomena and so on – go beyond a purely environmental framework and are becoming an existential issue (endangering the existential basis of human life). Thus, addressing sustainability challenges is an exigent need. Political leaders have also realised the seriousness of this situation and are beginning to address it systematically. Several specialist and even political events have been dedicated to issues of sustainability, while a number of legislative measures,

conventions and programmes have been adopted at the European and global level.

These standards and mandatory measures are aimed at regulating national societal development on the same basis. However, this is not always successful, as shown by frequent failures to comply with commitments.

Adopting international commitments and standards in the environmental field is necessary because:

- ecological phenomena and processes – transfer of emissions, the movement of biota, ecological networks and so on – are cross-border in nature; they do not stop at the boundaries of administrative units but are determined by natural conditions;

- The adoption of societal standards systematically forces countries to address environmental issues, allows for a higher degree of control and a higher degree of application of positive solutions and obliges countries to comply with the required standards and measures.

When adopting common commitments and drafting standards, however, it is essential to take into account the fact that each country is characterised by specific natural, cultural, historical, socio-economic conditions.

3.6 Main Societal, Cultural and Political Obstacles to the Creation of a Low-Carbon Economy and Promotion of Green Jobs

The main obstacles to successful implementation of green growth include:

- persisting political lack of interest and passivity on the part of those responsible for implementing sustainable development, marginalising solutions to environmental problems, inactivity on the part of the executive as regards implementing sustainable development, inconsistent implementation of important government resolutions;

- unclear competence in the coordination of sustainable development, poor cooperation among individual entities;

- lack of financial resources for implementing programmes supporting sustainable development, stagnation of environmental research, absence of landscape ecological research coordination and of an overall environmental research policy, lack of an integrated approach to environmental challenges, duplication of research, underestimation of the time factor in research, thereby ignoring the objective monitoring of processes and changes taking place in the landscape, infiltration of corruption and cronyism into environmental research;

- poor integration of basic and applied research, communication problems – a gap between technical jargon and »plain language«, insufficient professional knowledge on the part of central and local government staff with regard to environmental issues, inability to implement measures arising from strategic documents and studies, purely formal drafting of strategic studies without practical implementation, a tedious process of applying environmental regulations to the environmental sectoral and regional development plans;

- inconsistent and unsatisfactory development of the Slovak Republic in the individual areas of sustainable development; one negative consequence of this development – in particular, in the social and economic sectors – is a further deepening of regional disparities;

- inadequate and disorganised environmental education, the absence of environmental education in elementary and secondary schools, preferring rote learning to a creative approach, lack of public awareness of environmental issues, preference for a value orientation inconsistent with the principles of sustainable development;

- constant pressure from business interests to occupy natural resources, continued inefficient use of natural resources – excessive exploitation and wasting of natural resources, absence of economic instruments to encourage environmentally-friendly economic activity, absence of economic evaluation of natural assets and environmental services, lack of clarity with regard to ownership of environmentally important territories;

- some leeway in the legislation, particularly in the area of competences: low level of control of compliance with legal norms, soft sanctions for non-compliance with laws, poor law enforcement and the like;

- continuing high energy and raw material intensity of manufacturing processes, slow pace of production re-

structuring, insufficient implementation of technological measures in manufacturing processes: low level of application of environment-friendly technological processes, low level of investment in the environment;

- continuing load on the elements of the environment; as a consequence of old environmental loads, insufficient overview of current actual load of individual landscaping elements, continued anthropogenic load on certain regions;

- formal adoption of strategic documents and international obligations: while Slovakia has drafted strategic documents of good technical quality and has acceded to all essential international conventions and protocols, their implementation is usually minimal; implementation of measures laid down in individual documents is postponed from one year to another, many are ignored and so the majority of these measures remain only rhetoric;

- insufficient support system for the implementation of environmentally sound technologies, the implementation of ecological farming methods, the development of eco-tourism and the like; areas under ecological farming are very small (around 5 per cent);

- within Slovakia, continued and sometimes increasing subsistence problems exacerbating people's lack of interest in addressing environmental issues, while marginalising the solution of environmental problems and, on the other hand, growing consumer demand and proliferation of consumerism, which is incompatible with the principles and criteria of sustainable development;

- increasing marginalisation of parts of Slovakia: on one hand, relatively favourable development of some regions, especially those with a favourable geopolitical and transport location, on the other hand, decline and lagging behind of peripheral as well as some other regions located outside the periphery. The economy has a significant impact on behaviour, poor areas become dilapidated, their inhabitants (first of all the young and educated) leave and the age structure continues to deteriorate.

Summary and Conclusions

Slovakia's economic strategy is strongly influenced by its integration into the EU, globalisation and the global economic crisis. Under these conditions, it is difficult to quantify the extent to which an economic strategy is created by national authorities in the interest of long-term growth and to what extent it is dictated by international commitments, the policies of transnational corporations (TNCs) and ad hoc measures to address the crisis.

Slovakia's international trade integration is above the EU average and its export performance and import intensity are also above average. A more detailed analysis of Slovakia's external economic performance by Burda (2011) shows that in the long-run, the Slovak economy's import intensity is due to raw materials and energy resources, in particular resources imported from the Russian Federation. Foreign direct investments in manufacturing industries that have a strong export performance, however, at the same time require the import of semi-products and components for the assembly of final products; that is, the electrical, electronic and automotive industries have contributed significantly to import intensity.

Currently, Slovakia's total energy consumption is still lower than the EU25 average, at about 90 per cent. The industry sector, which has a high energy intensity, has the highest electricity requirement. In Slovakia, its share in energy consumption is well above the EU27 average, as well as above the energy requirement of neighbouring countries. The Slovak economy's energy intensity is high (the fifth highest in the EU), although it has fallen by about half since independence. In electricity production as well as consumption, its generation from primary energy resources (PER) continues to dominate in Slovakia. Slovakia has limited fossil fuel resources, which means that in primary energy resources it depends on imports. The only domestic energy resource of significance is brown coal and lignite. Domestic PER covers only about 10 per cent of requirements; Slovakia has to purchase the other resources it needs, resulting in a high dependency on imported primary energy resources. In the interest of reducing energy dependence on foreign raw materials, it is necessary to move towards a higher use of energy from renewable resources.

Despite an upward trend, electricity generation from renewable energy resources (RER) is still low in Slova-

kia. In 2009, the share of electricity produced from RER amounted to 18.8 per cent and it is gradually increasing. The use of biomass for energy (nearly 70 per cent) now accounts for the highest proportion, not taking water use into account. Nevertheless, the use of biomass for energy is minimal in Slovakia compared to other EU countries, considering its potential. The energy potential of agricultural biomass constitutes up to 15 per cent of the total Slovak energy requirement. Despite this, in practice the use of biomass for energy is very low, accounting for only 2 per cent of energy consumption in Slovakia. In terms of their utilisation, RER are competitive, in particular in housing (lighting and heating), less so in industry and transport. The main barriers to the use of RER in the Slovak Republic include investment costs, restrictions in protected areas, unsuitable chemical composition of geothermal water, principally low solar energy conversion efficiency, lack of detailed knowledge of wind conditions and market, information and legislative barriers.

Another feature of the Slovak economy is growth without corresponding job creation (so-called »jobless growth«). The development in Slovakia in the past decade is indicative of an overall shrinking share of employment in the creation of value added and GDP, which is also linked with the diminishing potential of the Slovak economy to create jobs in general and, consequently, to create green jobs. In the medium and long term, green jobs can have significant social and economic effects, although in the short term, they may be more costly. On the other hand, the direct multiplying effects of such jobs (mainly due to the relatively higher intensity of labour utilisation – employment – compared to capital and technology) and indirect ones (mainly the introduction of green technology value chains), as well as an overall improvement in environmental quality, should be taken into account. The development of the employment structure in Slovakia in the past decade suggests a decreasing potential for extensive creation of green jobs as the share of sectors with high potential (especially agriculture) in total employment has continuously decreased, hand in hand with a decrease in the use of agricultural land assets. Particular attention should be paid to the development of the structure of employment in industry, which is the largest energy consumer and the largest source of environmental pollution. The share in total employment is declining in industries directly related to energy, such as mining and extraction, and energy supply and distribution; a similar situation exists in the water supply, discharge and treatment and waste disposal sectors. These industries have the potential to create green jobs, particularly in relation to RER, recycling, and so on; however, they are creating fewer and fewer jobs.

The situation with regard to environmental pollution is a concern. At this juncture, pollution of water, which is considered a key strategic resource of Slovakia, may be mentioned in particular. Although the development of water quality in Slovakia has recently shown positive trends the situation still cannot be considered satisfactory. Based on the monitoring of surface water carried out in sub-catchment areas it is possible to conclude that limits for selected general indicators and radioactivity indicators have been met at all selected monitoring sites. Limits were exceeded mainly in synthetic and non-synthetic substances, hydrobiological and microbiological parameters.

Total greenhouse gas emissions in the Slovak Republic show a downward trend. It is complying with its current international commitments (the Kyoto Protocol, the EU climate and energy package). In international comparisons concerning the total production of greenhouse gases, the values of the Slovak Republic are below the EU27 average (Slovakia ranks eighteenth).

Recently, environmental activities have experienced a revival since the adoption of the so-called green growth policy. In November 2011, an OECD meeting was held with the main objective of evaluating Slovakia's environmental performance, for the second time since the Slovak Republic became a member state. According to the OECD, Slovakia has made positive progress in improving the environment and raising living standards since the first evaluation 10 years ago. The OECD appreciated Slovakia's progress in harmonising the environmental framework with its obligations arising from EU membership. The application of an integrated approach to the prevention and control of environmental pollution, an effective system of prevention of industrial accidents and an exceptionally complex system of environmental information are acknowledged.

Slovakia is a poor performer in the application of eco-innovation. Continuing on the way to green growth, however, requires enhancement of the country's basic innovation capacity, for instance via higher education,

international cooperation in science and technology and greater involvement on the part of the private sector in supporting science and research. As regards applying innovation in Slovakia's green growth, it may in general be concluded that hi-tech is developing very poorly; equally poor is the innovation absorption capacity of the Slovak application sphere.

Despite many successes, Slovakia still faces a number of barriers impeding the successful implementation of green growth in practice. The main weaknesses include:

- continuing and/or growing passivity and indifference on the part of the government in sustainable development issues – this fact is also related to increasing global passivity with regard to sustainable development, as witnessed at the Johannesburg Summit, as well as the politicisation of the issue, the discrediting of certain individuals;

- continued restriction of funding for the implementation of sustainable development, the application of eco-innovation, the implementation of environment-friendly technologies, the development of environmental infrastructure and the like;

- in the field of research, unnecessary waste of funds on duplication of research, inability to achieve stronger presence in the international research area, the inability to make effective use of EU funds;

- weak support for entities practicing ecological and environment-friendly management and using natural and energy resources efficiently; administrative burden involved in applying for subsidies and grants;

- persisting energy intensity, mainly in industry;

- continuing sectoral approach to sustainable development, absence of coordination in research, preferring economic benefits to social and/or environmental benefits, increasing cronyism and corruption in environmental policy;

- growth of poverty and other social problems which, to say the least, blunt people's interest in environmental issues, marginalising the solution of environmental problems, but also growing demand and the proliferation of consumerism which is incompatible with the principles and criteria of sustainable development;

- negligence of coordination of education, promotion of sustainable development, continued insufficient provision of information by and passivity of local government officials in the area of sustainable development;

- continued low level of environmental awareness, often as a result of poor education.

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