GREEN Innovation BG

Carbon Economy

Energy Efficiency

Renewable Energy Sources

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Good practices and policy options

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LIST OF ABBREVIATIONS

CF	–	Cohesion Fund
EAFRD	–	European Agricultural Fund for Rural Development
EC	–	European Commission
EEA	–	Executive Environment Agency
EMFF	–	European Maritime and Fisheries Fund
ERDF	–	European Regional Development Fund
ESF	–	European Social Fund
ESIF	–	European Structural and Investment Funds
EU	–	European Union
FITs	–	Feed-in tariffs
GDP	–	gross domestic product
GWh	–	gigawatt-hour
GHG	–	greenhouse gas
GWP	–	Global Warming Potential
HELE	–	High Efficiency Low Emissions
HFCs	–	hydrofluorocarbons
ICP	–	Investment Climate Program
IP	–	intellectual property
ITU	–	intermodal transport unit
KOE	–	kilograms of oil equivalent
MW	–	megawatt
NGIS	–	National Green Investment Scheme
NGO	–	non-governmental organisation
NPP	–	nuclear power plant
NTEF	–	National Trust EcoFund
OP	–	Operational Programmes
PFCs	–	perfluorocarbons
PM10	–	Particulate Matter up to 10 micrometers in size
RES	–	renewable energy sources
R&D	–	research and development
SMEs	–	small and medium enterprises
TEN-T	–	Trans-European Transport Network
TOE	–	tonnes of oil equivalent
TPP	–	thermal power plant
UMIS	–	Unified Management Information System for the EU Structural Instruments in Bulgaria
UN	–	United Nations
UNEP	–	United Nations Environment Programme

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Executive Summary

Green innovations are a key factor for achieving low-carbon growth and hold great potential for the competitiveness of small and medium enterprises. However, as a result of the economic crisis, SMEs have become reluctant to invest in green technologies due to a lack of sufficient financial resources. This requires that policymakers develop a comprehensive framework of policy measures and financial schemes that support the shift to low-carbon growth among SMEs. Despite Bulgaria's commitment to green growth in its economic and environmental policies, in line with its EU membership, progress is still relatively slow.

Overall data suggest that Bulgaria is beginning to decouple its economic growth from greenhouse gas emissions by shifting towards a less carbon-intensive economy. Still, in 2011 CO_2 emissions relative to GDP in Bulgaria amounted to 0.44 kg, compared to 0.20 kg in the EU. However, emissions of fluorinated gases, which have a much higher global warming potential compared to the other greenhouse gases, have increased sharply between 2000 and 2012 from 0.03 to 0.47 million tonnes of CO_2 equivalent, due to increased use of refrigeration and air conditioning technologies. Despite the outdated and inefficient technological base, Bulgaria's energy productivity is slowly improving and in 2013 reached 1.6 EUR/KOE. It remains lower than the EU average which amounted to 7.1 EUR/KOE in the same year. Energy efficiency levels are also slowly improving in all sectors of the economy. Energy poverty among the population is slowly declining, both as a result of rising incomes and energy efficiency improvements in the residential sector. It nevertheless remains high in comparison with the rest of the EU. In 2014, households spent on average 12.6 % of their income on energy products, compared to 14.4 % in 2012. The manufacturing and energy sectors are still lagging in terms of adopting greener, more efficient technologies, which would result in significant energy savings. The share of renewable energy sources in total energy consumption (18.9 % in 2013) is rising and is set to continue to grow in the next decade. However, this growth has been associated with very high feed-in tariffs (FITs) and poor regulatory framework causing financial losses in the energy sector, as well as popular discontent and backlash against green energy investment. Developments in the transport sector are primarily focused on road infrastructure, which accounted for 80.9 % and 75.9 % of passenger and freight modal split respectively. The share of renewable sources in road transport is about 5.6 % and there are very little incentives to use biofuel or hybrid/electric technology in road transport.

Bulgaria will continue to rely mainly on external resources to fund the adoption and development of green innovations. The EU funded Operational Programmes will continue to be the main source of funding for SMEs looking to introduce green innovations in their work. The Partnership Agreement on using EU Structural and Investment Funds for the programming period 2014 – 2020 between Bulgaria and the EU and the newly approved Operational Programmes place a strong emphasis on promoting energy efficiency, renewable energy sources, waste managements and green transport systems. Operational Programme "Innovation and competitiveness" will provide about EUR 1.4 bln to stimulate research and innovation, enhance SME competitiveness, support the shift towards

a low-carbon economy and promote resource efficiency. Operational Programme "Environment" will also provide some funding opportunities for SMEs through priority axis 2 "Waste", which is focused on municipal waste management. About 20 % of funds made available through Operational Programme "Regions in growth" will be dedicated to improving energy efficiency in municipal and residential buildings, which will likely provide funding opportunities for companies working in this field. An additional source of funding for green innovations is the Norway Grants funding mechanism. Currently the government of Norway and the European Commission have agreed on a total of EUR 210 mln for the next programming period part of which will be allocated to support green industry innovation.

Bulgarian SMEs must overcome several challenges to improve their competitiveness on the EU level and help the economy shift to low-carbon growth. First, as a result of the financial crisis, on average they had to make redundant 8 % of their staff and their added value decreased by 4 % between 2008 and 2013. Their recovery was slower compared to bigger enterprises due to their lower productivity and difficulty in diversifying their markets. Despite the positive attitude towards entrepreneurship and the relatively easy procedures to set up a new business, there are a number of structural obstacles that slow down SME growth. Business owners are still burdened with complex administrative red tape, especially in applying for and implementing EU – funded projects, as well as the slow progress in e-government rollout and lack of coordination between different authorities. Furthermore, local companies suffer from the lack of available funding, low levels of research and innovation, and poor environmental performance. In this regard, not many companies are investing in green technologies, with the exception of resource efficiency measures, which were mainly funded by Operational Programme "Competitiveness" 2007 – 2013 (with the period for implementation ending in 2015). Only 11 % of local companies have tapped into the eco-friendly market and offer green products to their customers.

Policy recommendations

In order to support the shift to low-carbon growth in Bulgaria, policymakers should adopt a holistic approach that is consistent with the country's long-term economic and environmental goals and is based on the current state of the economy. Each identified priority should be pursued through a varied policy toolkit with ambitious but realistic targets that are consistently monitored in order to follow their progress and adjust the measures accordingly. Authorities should provide widely available information about the benefits of green technologies to both individual consumers and business. Based on the findings in this report, Bulgarian policymakers should:

- Enforce strict environmental standards regarding pollution and greenhouse gas emission, while publicising the environmental impact of technologies.
- Reduce Bulgaria's reliance on fossil fuels and import dependency by promoting energy efficiency and renewable energy sources.
- Complete the liberalisation of the electricity market.
- Reduce technical energy generation losses by upgrading the electricity system and investing in High Efficiency Low Emissions (HELE) turbines in coal power plants.
- Reduce non-technical energy generation losses by exercising stricter control on the distribution grid to prevent theft and enforcing punitive measures for offenders.
- Continue to provide financial incentives and funding mechanisms to improve energy efficiency in the residential sector and distribute subsidies for low-income and marginalised consumers.
- Make feed-in tariffs for renewable energy sources more flexible so that they reflect the decreasing prices of these technologies and reduce the financial strain they place on the energy system.
- Continue to develop intermodal transport hubs across the country to encourage the use of public transport and reduce GHG emissions from the sector.
- Promote the use of biofuels and introduce measures to monitor the use of renewable sources in the transport sector.
- Facilitate the implementation of projects funded by the operational programmes by establishing clear selection criteria, accelerating financial reimbursement, reducing reporting procedures and setting up open channels of communication between managing authorities and beneficiaries.
- Create a secure and stable legal framework to attract private investments in green technologies by providing securities, grants and loans.
- Provide fiscal incentives for businesses that adopt green technologies that reduce their energy consumption and GHG emissions.
- Introduce a fast-track patenting procedure that reduces the application process for green inventions, which will benefit smaller companies looking to commercialise their product.

A key challenge for both policymakers and green business in Bulgaria is the very low purchasing power and sophistication of the local market, which makes any large scale new investment in green technology unlikely to get wide public support and acceptance. Bulgaria needs to change

the narrative of its green policies from confronting green investments with social hardships towards emphasising their common effects in the long term. Putting Bulgaria on a sustainable green path will very much depend on the success of stablishing a vibrant local green business community integrated in the international value added chains. The Bulgarian public will need to be educated as to the wider and longer term effects of environmental degradation, including through exposing its hidden costs on each individual and on the whole of society.

Introduction

Technologies, processes and products that have a lesser impact on the environment than their alternatives play an important role in addressing key economic, environmental and energy related issues both in Bulgaria and the EU. Furthermore, low-carbon industries are expected to yield economic growth and new jobs as they become ever more prominent in national economies. Given that the country is not very well endowed with energy resources, Bulgaria's economy and energy sector in particular can only benefit from the wider use of green technologies to increase competitiveness and address energy insecurity and high dependence on imports, as well as reduce harmful greenhouse gas emissions.

Small and medium enterprises (SMEs) are the backbone of the Bulgarian and European economies and therefore hold the biggest potential of adopting green technologies and stimulating green growth. However, as a result of the economic crisis, they are also most financially vulnerable and are hesitant to invest in new technologies. Therefore, policymakers need to develop a comprehensive framework of policy measures and financial schemes that support the shift to low-carbon growth among SMEs. Despite Bulgaria's commitment to green growth in its economic and environmental policies, progress is still relatively slow due to a number of reasons outlined in detail in this report.

On a strategic level, the promotion of green technologies is a top priority in the Europe 2020 strategy, as well as many other policy documents at the European and member state level. However, in Bulgaria key economic and environmental strategies that have closely interconnected priorities are not developed in conjunction with one another, thus missing the opportunity of establishing a comprehensive framework for low-carbon growth with clear assessment indicators and the necessary conditions for inter-agency cooperation. From a financial point of view, Bulgaria is very reliant on European Union (EU) funding for SME support, research and development and green technologies, primarily from nationally funded EU Structural and Investment Funds through the operational programmes. Based on the data presented in this report, it appears that these resources have not yet yielded significant improvements in terms of green innovations in SMEs and it rests on the next programming period (2014 – 2020) to achieve Bulgaria's low-carbon growth targets. Finally, most SMEs still lack the necessary information about the benefits of green technologies, which is also a reason for their reluctance to invest in low-carbon innovations.

Building on the *Green Innovation.bg 2014*,[1] this report tracks the overall progress made during the past year, provides policy recommendations on how to address the biggest obstacles in promoting green innovations, and presents examples of the successful application of green technologies by Bulgarian companies from different sectors.

[1] **Applied Research and Communications Fund,** *Green Innovation.bg 2014: Potential for Development*, 2014.

Green growth in Bulgaria

A number of indicators can help track Bulgaria's shift towards a low-carbon economy – a key prerequisite to ensure the sustainable rise in living standards without sacrificing the natural environment. Innovative technologies, processes and services that preserve the environment are a key contributing factor towards achieving low-carbon growth without changing drastically the established way of life. The rate of adoption of green innovations depends on a complex set of policy measures, private sector initiatives and changes in individual behaviour. This section outlines the results of the monitoring of progress towards achieving low carbon growth and provides recommendations for overcoming the main barriers which are delaying the process. The results are useful for policymakers who seek an overview of the current situation in Bulgaria and recommendations for measures in the main areas where green innovations can be introduced.

Green growth is monitored here through **four groups of macroeconomic indicators**:

Carbon economy: the volume of greenhouse gas emissions (GHG) is one of the main indicators that measures environmental degradation and climate change. The indicator shows overall trends in emissions, as well as how they are distributed among different sectors of the economy and how they relate to the economic output of Bulgaria.

Energy efficiency: one of the main ways of reducing GHG emissions is ensuring that energy resources are used in the most efficient way possible to maximize their output. This section looks at the extent to which energy efficiency measures have been adopted in all sectors of the economy, ranging from individual households to large businesses.

Renewable energy sources: one of the main sources of GHG emissions are fossil fuels, which most countries rely on for energy generation. Switching to renewable energy resources is a key factor in reducing harmful emissions, but achieving this shift has to heed the associated switching costs and social acceptability barriers.

Transport: as one of the main sources of GHG emissions, introducing cleaner technologies in both passenger and freight transport can make a huge difference to air pollution and quality of life, but this is also dependent on the overall transport infrastructure and the choice it provides.

The available data suggest that Bulgaria has not made significant progress in these four areas over the past year. The first signs of decoupling economic growth from GHG emissions are becoming apparent, but fluorinated gas emissions are rising sharply. Bulgaria's energy productivity is slowly improving, but is way lower than the EU average. In terms of energy efficiency, the situation is also improving. Energy poverty among the population is declining only very slowly, and remains a key constraint to green innovation. There is still much to be achieved in the industry and energy generation sectors. The share of renewable energy sources in total energy consumption has already risen to the levels agreed upon with the European Commission for 2020. But this has come as a result of weak regulatory framework and bad governance rather than policy intent, putting great financial strains on the energy sector and antagonising poor custom-

ers. The transport sector is increasingly focused on road infrastructure, with little incentive to use other modes and slow progress on the share of RES in the sector. It is very important to note that there is a significant data lag in this field and therefore the conclusions drawn may no longer be accurate. Policymakers rely on data to develop strategies, action plans and policy measures. Therefore it is important to prioritise the collection of statistical data that is related to low-carbon growth both at the national and European level in order to allow the relevant authorities to develop targeted measures and monitor their progress.

Given the extensive economic, political and social changes required to achieve low-carbon growth, it is not surprising that over the course of one year Bulgaria has only made limited progress. Policymakers are still reluctant to pursue low-carbon growth through a comprehensive set of policies, fearing negative political repercussions. The business sector has not yet tapped into the full potential of adopting more energy efficient and environmentally conscious technologies and processes. Due to higher prices or lack of choice, only a small part of household and business consumers choose green products and services. The slow uptake of green innovation has been further frustrated by the stagnant overall macroeconomic environment of the past few years.

Carbon economy

The concept of combining environmental protection with economic growth was first developed during the 5th Session of the United Nations Ministerial Conference on Environment and Development in 2005, where ministers from the Asia-Pacific region sought to limit the pressure on the environment deriving from the rapid growth in the region.[2] The idea has since been elaborated on by many academics, international organisations and individual governments, which have developed their own definition of the concept. This report uses the OECD definition, which states that **"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. To do this it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities."**[3]

Global warming, one of the main issues that green growth aims to resolve, has a negative impact on the biodiversity of ecosystems, as well as human settlements and agricultural activities and can cause extreme weather events such as droughts, hurricanes and rise in sea levels. Dealing with the consequences of greenhouse gases will require huge investments, which have been visible in the past year through the damaging floods in Bulgaria and in South-East Europe. **Switching to a low-carbon economy now by investing in greener technologies that produce fewer emissions will reduce the need to invest in mitigating measures in the future**, when our way of life will be altered much more significantly by climate change. Tracking the trends in GHG emissions in relation to economic growth is the most direct way of monitoring the process of decoupling production from environmental degradation.

Box 1. GREENHOUSE GASES[4]

Greenhouse gases are harmful because they can absorb infrared radiation, thus trapping heat in the atmosphere. There are four types of greenhouse gases, which differ greatly in their characteristics and effect on global warming. **In order to design effective policies to reduce greenhouse gas emissions it is important to take into consideration their source volume, ability to retain heat and how long they remain in the atmosphere.**

Table 1. CHARACTERISTICS OF GREENHOUSE GASES

Source	Share in global GHG emissions (2010)	Lifetime in atmosphere (years)	Global Warming Potential (100-year)*
Carbon dioxide (CO_2)			
Burning of fossil fuels (coal, natural gas and oil), solid waste, trees and wood products; transport; manufacture of cement; deforestation.	75 %	**	1

[2] Ministerial Conference on Environment and Development, Fifth Session, Seoul, Republic of Korea, 2005, Meeting summary, available at: http://www.unescap.org/events/ministerial-conference-environment-and-development-asia-and-pacific-2005 (accessed on 16.11.2015).

[3] OECD, "What is green growth and how can it help deliver sustainable development?" available at: http://www.oecd.org/general/whatisgreengrowthandhowcanithelpdeliver-sustainabledevelopment.htm (accessed on 16.11.2015).

[4] No new data on greenhouse gas emissions is available for 2013 onwards.

Box 1. GREENHOUSE GASES (CONTINUED)

Table 1. CHARACTERISTICS OF GREENHOUSE GASES (CONTINUED)

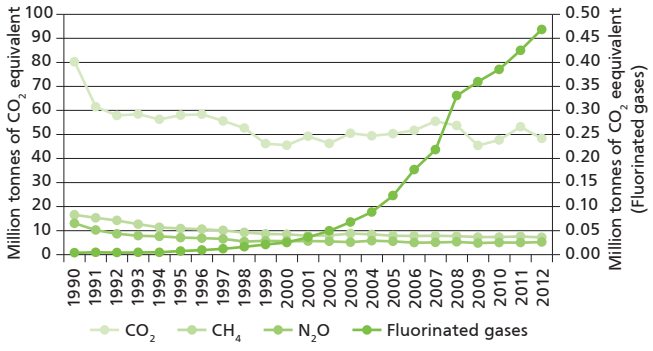
Source	Share in global GHG emissions (2010)	Lifetime in atmosphere (years)	Global Warming Potential (100-year)*
Methane (CH_4)			
Production, processing, storage, transmission, and distribution of natural gas; production and transport of coal and oil; rearing livestock as part of normal digestive process; decay of organic waste in municipal solid waste landfills.	16 %	12	28 – 36
Nitrous oxide (N_2O)			
Fertilizers; transport (burning of fossil fuels); production of adipic acid, used for production of synthetic goods.	8 %	114	298
Fluorinated gases: Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3)			
Only from human activities: Manufacturing of aluminium, semiconductors, circuit breakers; air conditioning systems in vehicles and buildings.	1 %	HFCs: 1 – 270 PFCs: 2600 – 50000 SF_6: 740 NF_3: 3200	HFCs: 12 – 14800 PFCs: 7300 – 12200 SF_6: 17200 NF_3: 22800

* Global Warming Potential (GWP) is a measure of how much energy the emissions of one tonne of a gas will absorb over a given period of time, relative to the emissions of one tonne of carbon dioxide. The larger the GWP, the more a given gas warms the Earth compared to carbon dioxide over that time period.

** Carbon dioxide's lifetime is poorly defined because the gas is not destroyed over time, but instead moves among different parts of the ocean-atmosphere-land system.

Source: United States Environmental Protection Agency, 2015[5].

Figure 1. GREENHOUSE GAS EMISSIONS BY TYPE OF GAS IN BULGARIA (1990 – 2012)*



* Excluding land use, land-use change and forestry.

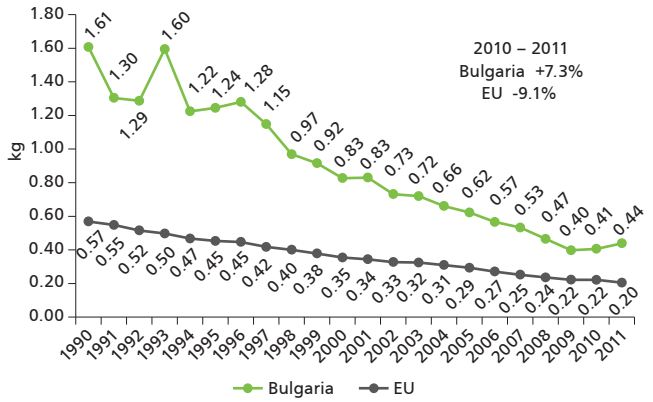
Source: European Environment Agency, 2015.

A closer look at Bulgaria's emissions trends for individual gases shows clearly the decline in carbon dioxide, methane and nitrous oxide since 1990. However, emissions of fluorinated gasses, which originate almost exclusively from refrigeration and air conditioning technologies, have sharply increased over the same period. While their volume is much lower than that of the other greenhouse gases, their lifetime and global warming potential are much higher compared to the other greenhouse gases and therefore need to be addressed by targeted public policies. A new EU Regulation[6] on fluorinated gases is in action since January 2015 which places a limit on the amount of fluorinated gases that can be sold in the EU by 2030, promotes the use of less harmful alternatives to fluorinated gases in certain types of equipment and requires checks, proper servicing and recovery of fluorinated gases at the end of the equipment's life to prevent emissions. As there are sufficient and cost-effective alternatives to fluorinated gases and the EC has provided guidelines in the new requirements for users and technicians of refrigeration, air conditioning and heat pumps, it is important that each government takes action to publicise these requirements to the relevant stakeholders and enforce Regulation 517/2014 on fluorinated greenhouse gases. Furthermore, policymakers should require manufacturers to provide consumers with clear information about the environmental impact of these appliances.

[5] http://www.epa.gov/climatechange/ghgemissions/gases.html

[6] Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006.

Figure 2. CO_2 emissions relative to GDP in Bulgaria and the EU (1990 – 2011)

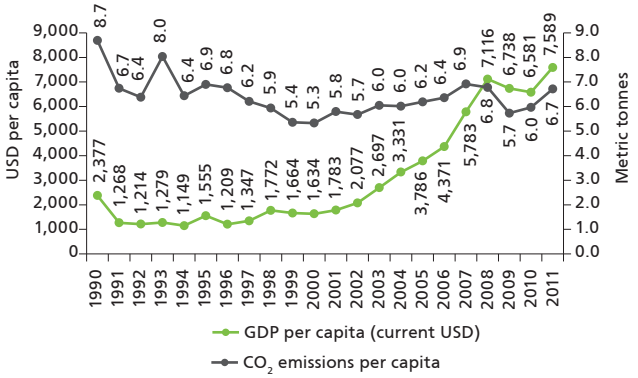


Source: World Bank, 2015.

The trend of CO_2 emissions relative to gross domestic product (GDP) is a useful indicator showing to what extent economic growth is becoming independent of greenhouse gas emissions rates. In the EU as a whole, despite the recovery from the 2008 economic crisis since 2010, CO_2 emissions relative to GDP have continued to decrease, as a result of the continued effort to substitute fossil fuels with renewable energy sources, improve energy efficiency across all sectors of the economy and shift towards knowledge intensive growth. On the other hand, **as Bulgaria began to recover from the crisis with a real GDP growth rate of 2 % between 2010 and 2011,**[7] **it also experienced an increase in CO_2 emissions relative to GDP**. This is the result of several characteristics of the Bulgarian economy and the decision of the Bulgarian government to administratively freeze electricity prices in 2010, stimulating a rise in consumption and the accrual of a backlog of debts in the system. In addition, successive governments have failed to close polluting power plants due to successful lobbying by plant operators. Power generation accounts for about half of all GHG emissions – and rising as a result of growing production and is still very reliant on fossil fuel power plants. Some of these plants are outdated, inefficient and highly polluting, suggesting that **economic growth is still dependent on polluting energy sources**.

CO_2 emissions per capita (6.7 tonnes) in Bulgaria are slightly lower than the EU average, as well as the average across Central and Eastern Europe and the Baltics, where emissions per capita were 7.1 tonnes and 6.9 tonnes respectively in 2011, according to the latest available data. Bulgaria's trend is largely in line with most of the countries in Central and Eastern Europe, where CO_2 emissions per capita have not experienced a drastic change and have loosely followed the decline of heavy industries after the collapse of socialism and then risen slightly together with the higher living standards in the lead up to and after EU accession. Estonia and the Czech Republic have significantly higher CO_2 emissions per capita than the other countries in the region. The energy mix of both countries relies heavily on very polluting resources. About 85 % of Estonia's total electricity production is from shale gas, which has a very high carbon emission factor,[8] while coal prevails in the Czech Republic's energy supply.[9] Therefore, in 2011 the CO_2 emissions in these countries were respectively 14 and 10.4 tonnes per capita.

Figure 3. Greenhouse gas emissions per capita and GDP per capita in Bulgaria (1990 – 2011)



Source: World Bank, 2015.

The cost of switching to low-carbon growth

Achieving low-carbon economic growth requires significant changes to the most polluting sectors of the economy. In most countries, including Bulgaria, the biggest energy consumers and GHG emitters are power plants, the transport sector, inefficient buildings and fossil-fuel based industrial processes. On average **power generation and the transport sector require about 70 % of the investments aimed at reducing GHG emissions**.[10] In Bulgaria's case power generation must be a top policy and investment priority as it generates over half of total emissions. Policymakers have several options at their disposal including reducing the use of fossil fuels by substituting them with low-carbon energy sources, making old coal power plants more efficient and less polluting and reducing transmission and distribution losses by upgrading the

[7] Eurostat, 2015.

[8] OECD, Greenhouse gas (GHG) emissions, available at: http://www.oecd-ilibrary.org/sites/9789264185715-en/01/01/index.html?itemId=/content/chapter/9789264185715-5-en&mimeType=text/html (accessed on 15.09.2015).

[9] OECD Economic Surveys: Czech Republic, 2011.

[10] Climate Policy Initiative, *Moving to a Low-Carbon Economy: The Financial Impact of the Low-Carbon Transition*, 2014.

electricity grid, which all require both political willpower and substantial financial resources.

Bulgaria has delayed its shift to low carbon economy due to political gridlock and inability to manage new investments and regulatory requirements. As electricity prices are still regulated, any price increase aimed at raising the necessary funds for technological upgrades risks undermining the popularity of the government which proposes it. **Efforts to shift to low-carbon electricity have been met with increasing public disapproval** due to the high levels of energy poverty, low awareness about the financial and environmental benefits of investing in more efficient low-carbon technologies, numerous unpunished abuses of public funds and regulations in the past decade, and frequent changes in government resulting in inconsistent policy measures. As a result, the largest green energy generation investments, in refurbishing lignite power plants and in new renewable energy sources have become popular scapegoats for rising electricity prices, delaying their return on investment, and leading to the piling of large unpaid dues from the public supplier. The latter has in effect stifled any independent, i.e. not politically patronised investment in the sector.

The popular perception about investment in low-carbon technologies is that it is a large upfront public spending at the expense of other areas, and is related to huge abuses of politically connected private interests with public money. However, each low-carbon technology has different characteristics, which must be taken into consideration when making an investment by state-owned enterprises and by private investors. Renewable energy sources, transport and energy efficiency measures have the biggest impact on GHG emissions. While they require large upfront investments, there are additional long-term financial factors that need to be taken into consideration:

- *Operating expenses*. Switching to low-carbon electricity requires significant upfront investments, which are offset by much lower operating costs in the long run, particularly with regards to the much lower costs of mining and transporting raw materials. For example, unlike coal power plants, wind farms and photovoltaic power stations do not have mining and transportation costs for raw materials. Similarly, increasing the use of electrical vehicles and integrated public transport will initially require high investments, but will benefit from lower operating costs associated with the exploration and transport of oil in the long run.
- *Asset life*. Different fossil fuel and low-carbon have different asset lifetimes, but as a whole renewable power sources are slightly more long-lived. For example, coal investments have an average of 10 to 15 years of asset life compared to 20 years for renewable energy sources (RES). Therefore, the larger initial investment in low-carbon assets will be offset by their longer life and delay the necessary investments for their replacement.
- *Risk and required return*. Low-carbon technologies require higher financing costs than fossil fuel power plants, but these are offset by the lower cost of capital as a result of their lower risk. The growing costs of emissions make investments in clean energy resources and energy efficient buildings much less risky than fossil fuel reserves, which will become increasingly more expensive to burn. However, it is important to note that financing large-scale energy efficiency projects (for example in power plants or production facilities) is particularly challenging as the collateral required is beyond the means of many investors.
- *Stranded assets*. One of the major downsides of shifting to low-carbon resources is that fossil fuel power plants remain as "stranded assets", which lose value and cannot be used as collateral for future investments. With many coal power plants being closed in recent years, particularly in the USA, investors have sought different ways to repurpose them. Examples include turning coal power plants into gas-fired plants, but also property developments and even "server farms", as is the case with Google's plans for the Widow Creek's power plant in Alabama.[11]

In Bulgaria's case, there have been significant large-scale private investments in RES over the past few years, which suggests that investors see the financial potential these technologies hold in the long run, particularly as a result of the government's commitment to purchase electricity generated from renewable sources. However, the various changes in the regulatory environment that followed the initial surge of new power generation facilities have had a very detrimental impact on future investments in renewables, jeopardizing the long-term development of these technologies in Bulgaria. Energy efficiency has received significant financial support from different public schemes for small scale projects, primarily in the residential sector, while large scale projects in this field have not been planned. The Bulgarian government's decision to launch a EUR1 billion energy efficiency residential scheme has been seen as a very positive development, despite worries about abuse of public funds. Investments in green transport originate primarily from Operational Programmes funded through EU funds as there is very limited interest from private investors in this field. As the government

[11] **The Guardian, "Google to convert Alabama coal plant into renewable-powered data centre"**, available at: http://www.theguardian.com/environment/2015/jun/25/google-to-convert-alabama-coal-plant-into-renewable-powered-data-centre (accessed on 30.09.2015).

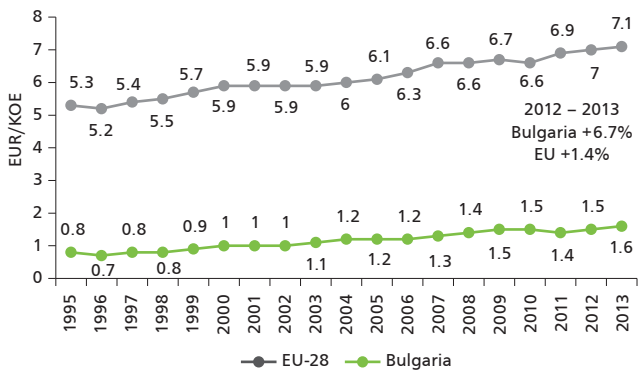
does not have sufficient funds to invest in low-carbon technologies, it must create a secure and stable legal framework to attract private investments that will complement public efforts, for example by providing guarantees, grants and loans. In order to ensure that these financial stimuli are better embedded in the value added chains of the local economy, the Bulgarian government need to pay particular attention to developing science and technology capabilities in green innovation sectors, including through attracting outsourcing investments.

Energy efficiency

There are two main approaches that can to be applied simultaneously in order to reduce GHG emissions: reducing energy demand and producing cleaner energy. The first requires improving the efficiency with which energy is used in all sectors of the economy, ranging from individual households to industrial facilities and power plants.

Bulgaria's energy productivity is slowly but steadily improving, while still remaining the lowest in the EU. Other member states from Central and Eastern Europe also have below EU average energy productivity rates, ranging from 2 EUR/KOE in Estonia to 4.6 EUR/KOE in Croatia. With rising living standards and consumption patterns in Bulgaria, increasing the output of the used natural resources by introducing new and more efficient technologies in all aspects of lives is of crucial importance. Research suggests that technologies with high potential to improve energy productivity already exist, but are not used widely enough to fulfil their potential.[12]

Figure 4. ENERGY PRODUCTIVITY IN BULGARIA AND THE EU (1995 – 2013)



Source: Eurostat, 2015.

The countries with the best energy productivity share two main characteristics: they are shifting towards knowledge intensive economic activities, which reduces significantly their energy demand (such as the United Kingdom, Switzerland, Singapore, and Hong Kong), or are introducing high energy and environmental standards, which require the use of more efficient technologies in all sectors of the economy. Germany is the main example as it is still a leading industrial country, but has also had an average 2.27 % annual improvement in energy productivity over the past 10 years. Bulgaria is in the process of shifting away from energy-intensive industries and this transitional period is a good opportunity for national authorities to promote the adoption of green technologies and processes by enforcing strict environmental standards.

Energy consumption is split between transportation, industry and households, with the latter accounting for 36 % of the total in the EU, thus holding the biggest room for improvement and requiring the strongest policy focus. As Bulgaria ranks second after Portugal in terms of energy productivity of households with 117 square meters heated with every equivalent 1,000 cubic meters of natural gas, naturally its improvement rate is one of the lowest at 0.41 % per year between 2000 and 2011. This is believed to be the result of the relatively warm weather, as well as the fact that many Bulgarians only heat part of their home at any given time in order to reduce their bills. Bulgaria's service sector is the least productive in the EU with only EUR 7 of value added per cubic meter of natural gas equivalent, 6 times less than the UK, with EUR 43, but the growth rate in this sector for Bulgaria is 2.15 %, putting it in 7th place in the EU (Romania's service sector has registered the highest growth rate in the EU – 4.9 %). Because services are non-tradables and are related to local income, it is not surprising that Bulgaria is in last place. Bulgaria also ranks last in terms of industry energy productivity with EUR 1.40 of GDP produced per cubic meter of natural gas equivalent consumed, but has improved by 4.37 % between 2000 and 2011.[13]

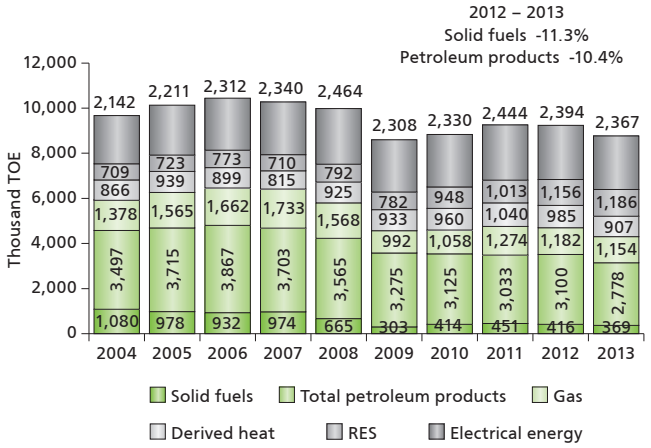
In order to improve Bulgaria's overall energy efficiency performance, policymakers must adopt a holistic approach based on clearly defined ambitious but realistic targets, to be pursued through a varied policy toolkit. For ensuring the sustainable improvement of efficiency in Bulgaria, policy makers have at their disposal several approaches including: high levels of regulation and standards enforced in a consistent and transparent way; allowing prices to reach their market value through the liberalisation of the electricity market; stimulating energy efficiency investments by mak-

[12] **Blok K., Hofheinz P. and Kerkhoven J.,** *The 2015 Energy Productivity and Economic Prosperity Index: How Efficiency Will Drive Growth, Create Jobs and Spread Wellbeing Throughout Society*, 2015.

[13] **Blok, K., Hofheinz P. and Kerkhoven, J.,** *The 2015 Energy Productivity and Economic Prosperity Index: How Efficiency Will Drive Growth, Create Jobs and Spread Wellbeing Throughout Society*, 2015.

ing energy saving technologies more widely available and providing financial incentives to those who adopt them. All policy measures should be linked to clear objectives and indicators, which allow them to measure their progress, as well as widely available information about the benefits of green technologies for all consumers. Policymakers should encourage the use of existing low-carbon technologies and continue to stimulate the development of new green technologies by local researchers and entrepreneurs.

Figure 5. FINAL ENERGY CONSUMPTION BY PRODUCT IN BULGARIA (2004 – 2013)

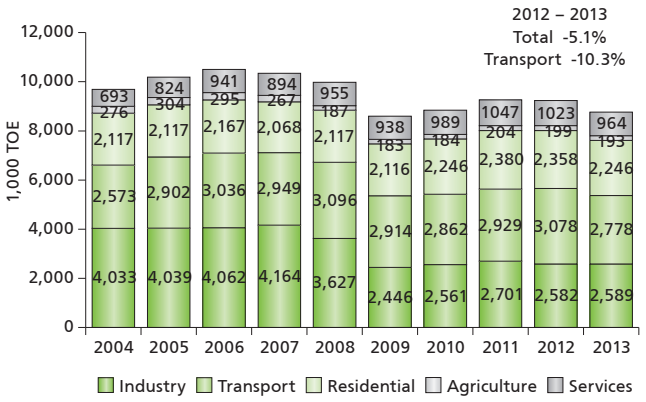


Source: Eurostat, 2015.

Bulgaria's final energy consumption has decreased slightly between 2012 and 2013 from 9,240 thousand TOE to 8,769 thousand TOE. However, the energy mix has remained almost unchanged between 2009 and 2013. The only notable changes have been in terms of petroleum products and renewable energy sources. In 2009, petroleum products accounted for 38 % of final energy consumption, while in 2013 their share was 32 %. On the other hand, RES have gone from 9 % to 14 % over the same period, in particular as a result of the policies encouraging the development of wind and solar power. Given Bulgaria's high dependence on imports of petroleum products, reducing their weight in the energy mix and increasing the presence of renewable sources which do not rely on imports of raw materials would be a positive development towards energy security and low-carbon growth. In order to achieve further independence, while still utilising domestic resources without increasing GHG emissions, policymakers can focus on further developing the renewables sector and introducing more efficient power-generating technologies.

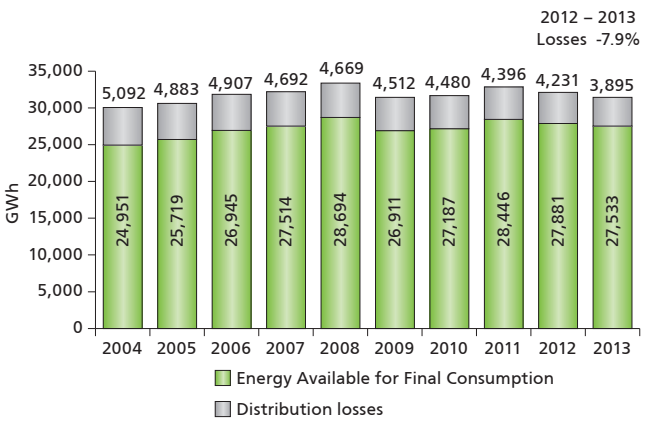
The **share of each economic sector in final energy consumption has remained virtually unchanged** between 2009 and 2013 with industry, transport and residential accounting for 29 %, 32 % and 26 % respectively in the latter year. **Final electricity consumption is also mainly split between** three sectors almost evenly, but these are industry (31 %), residential (38 %) and services (29 %), with transport accounting for only 1 % of consumption. The relatively even distribution of electricity consumption between the main sectors suggests that public policy aimed at energy efficiency should address all sectors of the economy in a targeted way. In order to improve energy efficiency in industry, policymakers can **introduce fiscal incentives for businesses that adopt green innovation**s, which are more efficient and consume less electricity. Public policy for the residential and services sectors should focus on promoting the use of energy-saving technologies for heating, appliances, and information and communication technologies. The transport sector on the other hand should become less reliant on petroleum products and switch to electrical vehicles, as well as promote the more extended use of public transport in urban areas and railways for long-distance journeys.

Figure 6. FINAL ENERGY CONSUMPTION BY SECTOR IN BULGARIA (2004 – 2013)



Source: Eurostat, 2015.

Figure 7. ENERGY AVAILABLE FOR FINAL CONSUMPTION AND DISTRIBUTION LOSSES IN BULGARIA (2003 – 2012)



Source: Eurostat, 2015.

In 2013, the equivalent of 14 % of the energy available for final consumption was lost in the distribution system. This represents a significant improvement compared to 2004, when distribution losses were equal to 20 % of the available energy, but it is much higher than the EU average of 7.5 % in 2013. Despite the broadly similar technological base of Central and East European member states, their electrical grids have registered different levels of distribution losses. Slovakia has only registered a 3 % loss in 2013, but this is only a marginal improvement compared to 5 % losses in 2004, while in Romania distribution losses increased from 15 % to 17 % over the same period. The biggest improvement was registered in Latvia, where distribution losses decreased from 16 % to 8.7 % over 10 years.

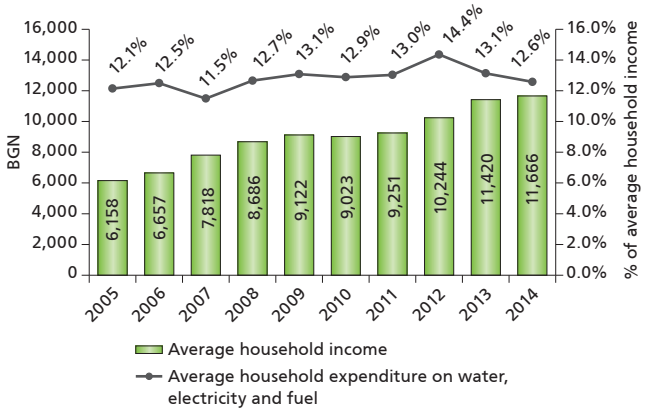
Power generation is one of the most inefficient sectors in Bulgaria and therefore it requires special attention from policymakers, who can use several tools to improve the output of power plants in relation to the raw materials used, while also reducing GHG emissions at the same time. The electrical grid is subject to two types of electricity losses. Non-technical losses include electricity theft, non-payment by customers, and errors in accounting and record-keeping. **In order to reduce non-technical losses utilities, in particular state-owned enterprises, should focus on reducing electricity theft by exercising stricter control on their part of the grid and increasing collection rates**, while policymakers can introduce punitive measures for those tampering with the electrical grid and provide subsidies for low-income and marginalised customers.[14]

Technical losses occur primarily in the distribution part of the system, which is the section closest to the final consumer. Consumers are not billed for the electricity lost during transmission and distribution. The cost of electricity losses is borne by the distribution companies. **The cost of technological upgrades necessary to reduce losses to an optimum level tends to be lower than the cost of the losses themselves**. Furthermore, efficiency improvements are much cheaper that new power generation facilities, particularly in thermal power plants (TPP), which are likely to remain the largest energy source due to the relatively low costs and wide availability of coal. Given that over 40 % of Bulgaria's installed electricity generation capacity relies on coal and that the mining industry plays a key role in a number of Bulgarian regions, it is unlikely that it would be substituted by cleaner technologies in the foreseeable future. **In order to consume less coal and water and have a smaller footprint on the environment while still generating the same amount of electricity, coal power plants should be upgraded with High Efficiency Low Emissions (HELE) turbines**. This technology maximizes the amount of electricity produced and, while it is up to 30 % more expensive that non-HELE turbines, its cost is offset by the greater efficiency and reduced expenses for fuel. Furthermore, when HELE technologies are used in combination with carbon capture and storage mechanisms, the CO_2 emissions of coal power plants can be reduced by up to 90 %.[15] Investing in technological upgrades of existing power plants is the most cost-effective way of shifting towards low-carbon growth, without requiring a complete overhaul of the local power generation system or the closure of existing facilities, which would lead to job losses and public discontent.

Energy efficiency in households and energy poverty

Low levels of energy efficiency are not only a problem for the country as a whole, but also for many individual households. Alongside high energy prices (relative to the average income), **low energy efficiency in the residential sector is one of the main causes of the widespread energy poverty in Bulgaria**. While the share of household expenditure on water, electricity and fuel has decreased over the past two years from the all-time high of 2012, it is still above the 10 % threshold of energy poverty.

Figure 8. AVERAGE HOUSEHOLD INCOME AND SHARE OF EXPENDITURE ON WATER, ELECTRICITY AND FUEL IN BULGARIA (2005 – 2014)



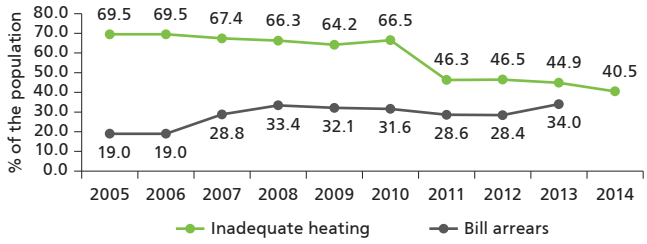
Source: National Statistical Institute, 2015.

The share of the population unable to adequately heat their home has also decreased in recent years, but this has probably been compensated for by accumulating bill arrears. Furthermore, inadequate heating and bill arears are much more prevalent among the most vulnerable social groups. In 2013, 60 % of the population aged 65 and over was unable to adequately heat their home, compared to the EU average of 12 %. Moreover, 46 % of Bulgarian

[14] **World Bank,** *Reducing Technical and Non-Technical: Losses in the Power Sector*, 2009.

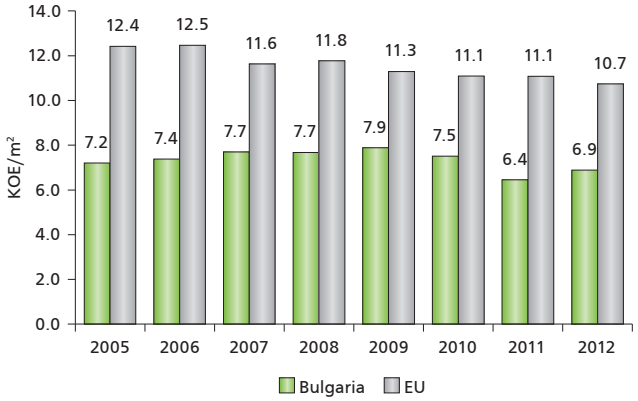
[15] **International Energy Agency,** *Technology Roadmap: High-Efficiency, Low-Emissions Coal-Fired Power Generation*, 2012.

Figure 9. SHARE OF BULGARIANS UNABLE TO ADEQUATELY HEAT THEIR HOME AND HAVING ARREARS ON THEIR UTILITY BILLS (2005 – 2014)



Source: Eurostat SILC, 2015.

Figure 10. UNIT CONSUMPTION PER M² FOR SPACE HEATING WITH CLIMATIC CORRECTIONS IN BULGARIA AND THE EU (2005 – 2012)



Source: Odyssee, 2015.

households with one adult and one child had utility bill arrears in 2013 and this indicator has only been rising over the previous 6 years. This suggests that although over 250,000[16] households have been granted financial assistance by the Agency for Social Assistance over the 2014 – 2015 heating period, similarly to previous years, this state aid is still not enough to bring vulnerable households out of energy poverty.

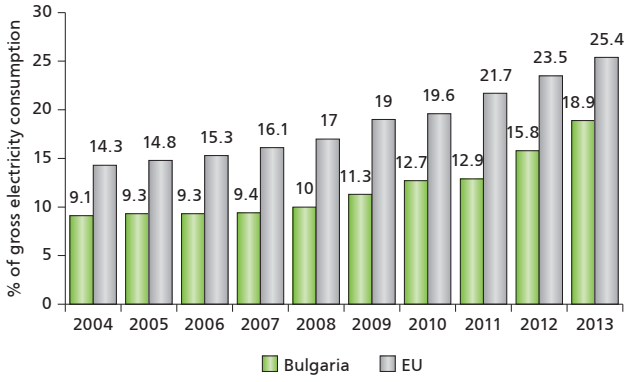
Only 5 % of all Bulgarian households were built after 2000[17] and therefore, most homes do not comply with modern energy efficiency requirements and would benefit from retrofitting with energy efficient windows, wall insulation and energy saving appliances, which would reduce their bills. Despite the high level of energy inefficiency in residential buildings, Bulgarian households continue to use less energy to heat 1 m² of their homes compared to the EU average, which is most likely the result of the widespread practice of not heating their homes adequately to consume less energy and thus lower their bills.

Renewable energy sources

In order to reduce GHG emissions and achieve higher levels of energy security, energy efficiency measures should be complemented by the use of cleaner energy sources that are not as polluting and do not rely on raw materials imports. Bulgaria has already met its Europe 2020 target in this regard, but the presence and use of RES must be examined in the wider context of the electricity grid as a whole.

Renewable energy sources are primarily used for power generation and their share in Bulgaria's electricity consumption has continued to increase over the past decade. This is in line with EU-wide trends, although Bulgaria is making progress at a faster pace than most other member states. Among Central and East European countries Hungary relies the least on RES with only 6.6 % of gross electricity consumption. On the other hand, Latvia is leading the group with 48.8 % of final electricity consumption in 2013 most of which originates from hydropower plants. The Latvian government has developed and is implementing a comprehensive national strategy, which includes measures and policies aimed to increase the share of RES in electricity generation, heating and cooling and the transport sector, but also reducing GHG emissions and raising awareness of the benefits of low-carbon technologies in all economic sectors.

Figure 11. SHARE OF GROSS ELECTRICITY CONSUMPTION GENERATED FROM RENEWABLE ENERGY SOURCES IN BULGARIA AND THE EU (2004 – 2013)



Source: Eurostat, 2015.

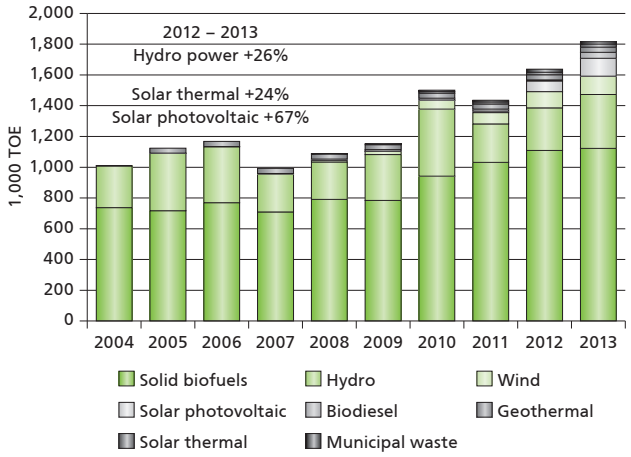
As the share of renewable energy sources in Bulgaria's energy mix is growing, it is important to take into consid-

[16] Agency for Social Assistance, available at: http://www.asp.government.bg/ASP_Client/ClientServlet?cmd=add_content&lng=1&sectid=8&s1=27&s2=1899&selid=1899 (accessed on 21.09.2015).

[17] National Statistical Institute, 2015.

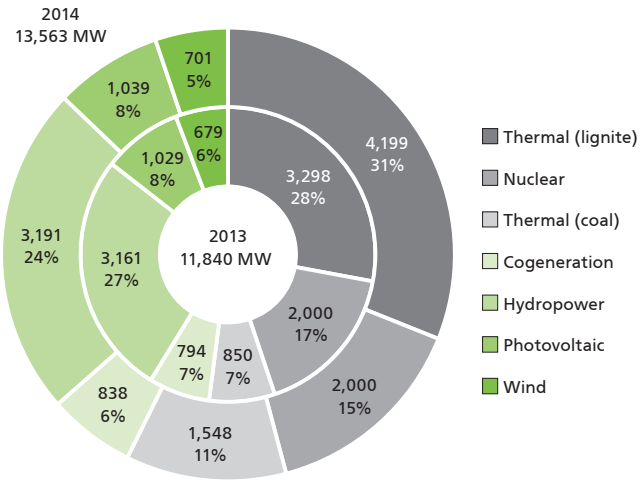
eration the weight of each source in the overall mix. In 2013, solid fuels represented 62 % of all renewable energy sources used for primary energy production. In Bulgaria, "solid fuels" mainly refers to wood and its by-products, which is used for heating by 34 % of households, according to the 2011 census.[18] In 2013, hydropower accounted for 19 % of primary energy production as the main RES source in electricity generation. As both wood and hydropower have been used for decades and have not been subject to innovative technological updates, this suggests that innovative low-carbon technologies are still not being widely used. Although RES are gaining a growing role in Bulgaria's energy mix, coal-fired power generation capacity has also increased between 2013 and 2014 by 1,599 MW.

Figure 12. PRIMARY PRODUCTION OF RENEWABLE ENERGY BY SOURCE IN BULGARIA (2001 – 2013)



Source: Eurostat, 2015.

Figure 13. INSTALLED ELECTRICITY GENERATION CAPACITY IN BULGARIA (2013 – 2014)



Source: State Energy Regulatory Commission, 2015.

[18] National Statistical Institute, 2011.

The future of renewable energy sources in Bulgaria

The Bulgarian economy was badly affected by the 2008 economic crisis, which led to slower economic growth and consequently a decrease in electricity consumption. Nevertheless, in its Plan for the Development of the Transmission Network in Bulgaria for 2015 – 2024, **the Electricity System Operator has indicated plans of further expanding generation capacity in Bulgaria over the next decade. A total of 2,212 MW of new generation capacity and upgrades to the electricity grid are expected to cost the state BGN 1.2 billion.** ESO estimates that Bulgaria's gross electricity consumption will range between 40,860 and 43,040 GWh by 2024; the peak load of the electricity grid is expected to be no higher than 7,960 MW, while the load on a typical weekday is estimated at 7,440 MW.

New conventional power sources (which also include some types of hydropower plants) include 200 MW to be added to Kozloduy nuclear power plant as a result of reconstruction work, 156 MW from Bulgaria's first gas-fired power plant in Haskovo and 166 MW from the Gorna Arda project. The Belene NPP is not included in the plan, and neither are blocks 9 and 10 of Maritza Iztok 2 TPP. The planned block 7 at Kozloduy NPP is expected to be in operation from 2025 onwards and is therefore excluded from the plan. Half of the new generation facilities will be based on renewable energy sources, primarily wind and solar power, which account for respectively 31 % and 24 % of all new generation capacity, which are expected to contribute to 19-20 % of final energy consumption by 2024.

The ten-year plan is based on a number of assumptions about Bulgaria's economic and demographic development and the technological progress in the sector. A positive trend in the European Commission's economic and energy forecasts up to 2050 is the decoupling of economic growth from energy consumption. **Bulgaria's GDP is expected to increase by almost 80 % between 2010 and 2050, while energy demand will only rise by 23 %.** This will be the result of a significant shift to the services sector, which will contribute over 70 % of total value added by the middle of the century. On the other hand, the EU expects growing energy demand from the residential sector, as a result of higher living standards and the growing use of electrical appliances, but also the lagging behind in the adoption of energy efficiency measures. Furthermore, Bulgaria's population is expected to decrease by more than 20 % by 2050.

While these forecasts should be taken carefully into consideration, bearing in mind serious risks from deviations from the reference scenario, Bulgaria should also invest in its

Table 2. PLANNED NEW GENERATION CAPACITY AND EXPECTED ANNUAL INVESTMENTS FOR CONSTRUCTION, EXPANSION, RECONSTRUCTION AND MODERNISATION OF THE ELECTRICITY GENERATION SYSTEM IN BULGARIA (2015 – 2024)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Nuclear (MW)	100	100									**200**
Coal and Gas (MW)	70	138	165	34	20			50		46	**523**
Wind (MW)	50	120	50	40	70	120	80	70	50	30	**680**
Solar (MW)	42	38	185	46	8	92	19	27	35	38	**530**
Hydro (MW)	7	3	1	1	1	1	3	47	60	71	**195**
Biomass (MW)	25	19	4	4	4	4	5	6	6	7	**84**
Total MW	**294**	**418**	**405**	**125**	**103**	**217**	**107**	**200**	**151**	**192**	**2212**
Share of RES of final energy consumption (%)	**14.91**	**15.49**	**16.07**	**16.13**	**16.25**	**16.65**	**16.92**	**18.00**	**18.58**	**19.11**	
Annual investment (million BGN)	**76.2**	**109.2**	**116.0**	**129.6**	**128.4**	**128.9**	**125.1**	**127.8**	**129.2**	**131.1**	**1,201.5**

Source: Electricity System Operator, 2015.

Table 3. EU FORECASTS FOR MAIN ECONOMIC AND ENERGY INDICATORS FOR BULGARIA (2010 – 2050)

	2010	2020	2030	2040	2050
Population (million)	7.6	7.1	6.6	6.2	5.9
GDP (EUR billion 2010 equivalent)	36.1	45.1	51.5	59.2	64.9
Added value (EUR billion 2010 equivalent)	31	38.8	44.4	50.9	55.7
industry	5.2	6.4	7.3	8.4	9.2
construction	2.2	2.6	2.8	3.1	3.4
tertiary	21.8	27.7	32	36.8	40.4
energy sector	1.8	2.2	2.3	2.6	2.7
Final energy demand (thousands TOE)	8,842	8,481	8,678	10,206	10,880
industry	2,541	2,774	2,868	3,031	3,120
residential	2,246	2,435	2,543	2,809	3,077
tertiary	1,175	1,352	1,381	1,359	1,402
transport	2,880	2,901	2,884	3,006	3,081

Source: European Commission, "EU Energy, Transport and GHG Emissions trends to 2050: Reference scenario 2013", 2013.

electricity system in order to meet both future energy demand and GHG emission targets. Renewable energy sources represent part of the solution to these issues, but investments should be made after taking into consideration the energy system as a whole and the challenges that need to be overcome in order to ensure the successful integration of RES in the grid.

As discussed above, from a private investor's point of view renewable energy sources represent a good investment, as they are set to produce good returns over the next few decades, although these vary depending on the individual technology. For example, solar photovoltaic panels have decreased in cost and become more effective faster than expected, while wind power is not expected to experience as rapid a decrease in capital costs in the coming decades. Nevertheless, renewable energy sources are the only ones becoming increasingly cheaper, unlike conventional sources, the prices of which are expected to plateau in the coming decades. Furthermore, government support for renew-

able energy provides an additional element of security in terms of profits.

From a policymaker's perspective, however, renewable energy sources require careful planning in order to integrate them effectively in the electricity grid. Renewable sources only offer intermittent power and can cause sudden surplus or deficit of electricity, which needs to be balanced by conventional generation facilities to ensure that demand is met at all times. Additional investments might be necessary if the power source, for example wind, is located in an area that is not currently covered by the grid, therefore requiring additional upfront costs. The integration of new energy sources creates pressure on the grid, which needs to be upgraded in order to reduce losses and increase efficiency.

Policymakers should put in place effective policy and legislative measures to ensure that renewable sources do not become a financial burden on the energy system. Feed-in tariffs are the most widespread measure adopted across the world to accelerate investment in RES, and have been very effective given the rise of RES as a share of final energy consumption in many countries, including in Bulgaria. FITs are calculated on cost-based purchase prices, which have dropped relatively quickly as a result of continuing technological improvements and growing demand leading to lower prices. As costs of installing and operating renewable energy power plants have decreased, **FITs now provide a disproportionately high earning to investors and have therefore become very expensive for many consumers.** Bulgaria is no exception to this issue. FITs were initially set to really high purchase prices, which attracted a large number of investors to fund solar and wind power plants, resulting in very high costs for the National Electricity Company. In order to compensate for this, the government amended the Energy from Renewable Sources Act and introduced additional taxes for RES producers. A similar situation occurred more recently with biomass power plants, again as a result of high purchase prices set in the FIT calculations, suggesting that either prices in the sector dropped astonishingly fast in a very short time, or the authorities used older price indicators in their calculations. FITs have been increasingly seen by consumers in Bulgaria as a way of siphoning public money towards selected, politically connected private interests.

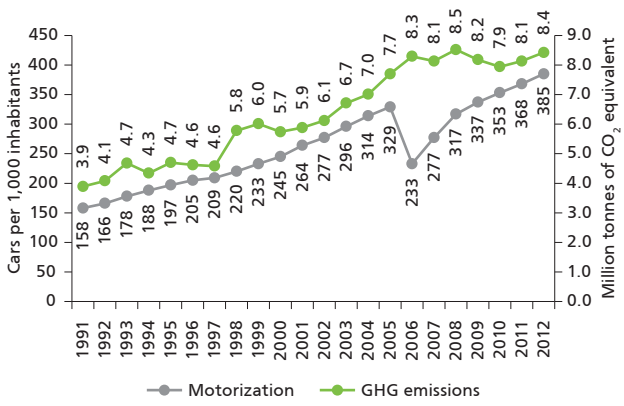
There are several regulatory measures that can help ensure the successful development of RES in Bulgaria, particularly with regards to FITs. First of all, the government should complete the liberalisation of the electricity market. This will raise energy prices, but it will also allow state-owned enterprises to raise the necessary funds to fulfil their obligations to RES producers and upgrade the electricity grid, so that it can accommodate the new generation facilities. Furthermore, the FIT scheme for new generation facilities should take into consideration the constantly changing purchase prices of renewable technologies so that it provides a sufficient incentive for investors, but does not create additional financial burden for the state-owned supplier.

Transport

Transport accounts for a large part of GHG emissions in Bulgaria. It is one of the sectors that require most attention in terms of public policy and investments. Trends in both passenger and freight transport have shifted over the past two decades in line with the overall economic development of the country.

As a result of rising living standards passenger transport in **Bulgaria has become reliant mainly on the road infrastructure as reflected by the rising motorisation rate**, which has both positive and negative implications. On the one hand, passenger transport is partly responsible for the rising levels of CO_2 emissions from the transport sector, as electric and hybrid vehicles are still very rare (in 2014 there were only 497 electric vehicles and 1,031 hybrid vehicles registered in Bulgaria). On the other hand, given that the government applies the "user pays" principle to the transport system, the growing motorisation rate offsets the demographic decline, which presupposes that fewer people are using the transport network and therefore are contributing to its upgrade and maintenance.

Figure 14. MOTORISATION RATE AND GHG EMISSIONS FROM TRANSPORT IN BULGARIA (1991 – 2012)

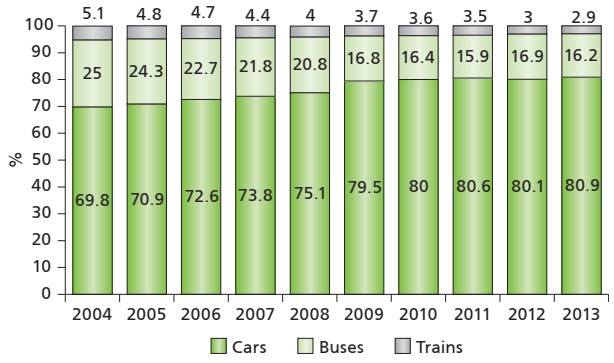


Source: Eurostat, 2015.

The rising use of road transport has a particularly detrimental impact to the railway system. The number of rail passengers halved from 50 million in 2001 to less than 25 million in 2014. Freight transport also decreased from

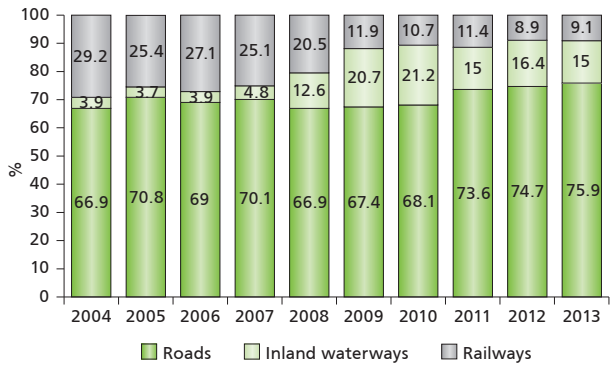
21.1 million tonnes to 13.7 million tonnes over the same period,[19] as a result of Bulgaria's shift towards more knowledge intensive growth, which no longer relies on large volumes of low-value produce and raw materials, but uses road transport for smaller volumes of products with a high value-added. The railway system also relies on the "user pays" principle like road infrastructure. Therefore, the sharp decline in the number of passengers and demand for freight transport services places the government under a huge financial strain to maintain the railway network. The problem is only expected to be exacerbated if the upward trend of road transport persists. While the need for less GHG intensive transport requires the government to increase costs on road transport to shift passengers to rail, this will also inevitably impose higher costs to socially vulnerable groups, at least in the short run. For example, Bulgaria is still taxing older cars with lower rates than newer and more environmentally friendly ones.

Figure 15. MODAL SPLIT OF PASSENGER TRANSPORT IN BULGARIA (2004 – 2013)



Source: Eurostat, 2015.

Figure 16. MODAL SPLIT OF FREIGHT TRANSPORT IN BULGARIA (2004 – 2013)



Source: Eurostat, 2015.

[19] National Statistical Institute, 2015.

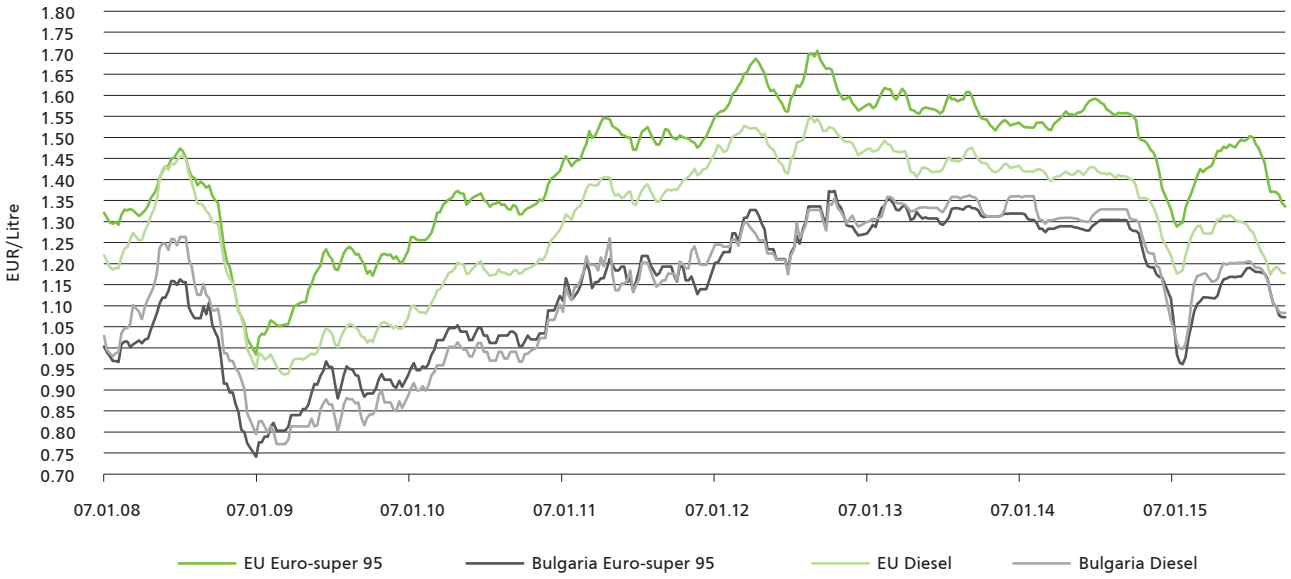
Choosing green transport

The choice of mode of transport for both passengers and businesses is based on a number of factors, including fuel prices, available options and incentives for cleaner transportation. Prices of both Euro-super 95 fuel and diesel decreased as the result of the 2008 crisis, but have been recovering since 2009, only to fall again over the past year as a result of the global drop in crude oil prices. As individual incomes and the economy as a whole have continued to grow over the same period, **relatively low fuel prices have facilitated the growing use of road transport for both individuals and businesses**.

Assessing the availability of different transport options is more difficult as there is a lack of consistent data at the national level. The distribution of the funding for transport projects from the EU-funded Operational Programmes (OP) can provide some indication of the government priorities in this field both in terms of transport mode and geographic location. This analysis excludes other investments funded by national resources. Over the 2007 – 2014 programming period, transport projects with the value of BGN 6,934.79 million were envisaged by OP Transport and OP Regional Development. As of October 2015, the total absorbed funds amounted to BGN 3,961.11 million – a 57 % absorption rate. These projects addressed four main transport areas: roads (ranging from international routes to municipal infrastructure), railways, intermodal transport, and inland and internal waterway transport (projects concerned with Vessel Traffic Management Information Systems). Overall, across the two OPs, 50 % of the actually paid funds were directed towards road infrastructure, over 2/3 of which being part of the national or pan-European transport axes in the form of motorways. 27 % of all funds were directed towards the reconstruction and upgrades of the railways system (OP Transport) and 14 % were directed towards improving intermodality (OP Regional Development).

In terms of geographic coverage, OP spending on transport is quite skewed. Funding in southern Bulgaria is seven times higher than in the three northern regions, where a third of the country's population is located. In OP Transport, 96 % of funds were allocated in southern Bulgaria, where the majority of pan-European routes (highways) are concentrated and were therefore the focus of the previous programme period. In OP Regional Development, the distribution of funds was more balanced, with northern regions receiving about 40 % of the funds, 2/3 of which went towards the rehabilitation and reconstruction of 2nd class roads and 3rd class roads.

Figure 17. AVERAGE FUEL PRICES IN THE EU AND BULGARIA (2008 – 2014)



Source: European Commission, Weekly Oil Bulletin, 2015.

Table 4. DISTRIBUTION OF FUNDS FOR TRANSPORT INFRASTRUCTURE PROJECTS FROM OP TRANSPORT AND OP REGIONAL DEVELOPMENT IN BULGARIA AS OF OCTOBER 2015

OP	Priority Axis	Region	Total Budget (BGN million)	Actually paid (BGN million)
Transport	Development of railway infrastructure along the major national and Pan-European transport axes	Yugozapaden	720.02	454.32
		Yuzhen tsentralen	1166.70	349.94
		Yugoiztochen	449.26	261.12
		Total	**2,335.98**	**1,065.38**
	Development of road infrastructure along the major national and Pan-European transport axes	Severna i Yugoiztochna Bulgaria	8.85	2.94
		Severozapaden	68.08	30.00
		Severen tsentralen	102.61	27.89
		Yugozapaden	850.66	456.28
		Yuzhen tsentralen	446.73	325.96
		Yugoiztochen	503.41	503.41
		Total	**1,980.33**	**1,346.48**
	Improvement of intermodality for passenger and freight	Severen tsentralen	5.03	1.05
		Yugoiztochen	88.47	23.43
		Yuzhen tsentralen	12.38	0.64
		Yugozapaden	1,144.72	548.11
		Total	**1,250.61**	**573.23**
	Improvement of the maritime and inland-waterway navigation	**Severna i Yugoiztochna Bulgaria**	**79.94**	**51.91**
	TOTAL		**5,646.86**	**3,037.00**

Table 4. DISTRIBUTION OF FUNDS FOR TRANSPORT INFRASTRUCTURE PROJECTS FROM OP TRANSPORT AND OP REGIONAL DEVELOPMENT IN BULGARIA AS OF OCTOBER 2015 (CONTINUED)

OP	Priority Axis	Region	Total Budget (BGN million)	Actually paid (BGN million)
Regional Development	Sustainable and Integrated Urban Development	Severozapaden	20.63	16.06
		Severen tsentralen	29.26	10.00
		Severoiztochen	106.59	64.92
		Yugoiztochen	194.41	109.61
		Yuzhen tsentralen	44.31	24.54
		Yugozapaden	90.74	78.28
		Total	**485.93**	**303.42**
	Regional and Local Accessibility: Rehabilitation and reconstruction of 2nd class roads, outside TEN-T network and 3rd class roads	Severozapaden	100.98	100.48
		Severen tsentralen	71.68	57.47
		Severoiztochen	77.61	79.52
		Yugoiztochen	21.51	21.52
		Yuzhen tsentralen	128.74	111.03
		Yugozapaden	299.50	145.59
		Total	**700.02**	**515.62**
	Regional and Local Accessibility: Support for municipal roads within the urban agglomeration areas	Severozapaden	7.13	7.13
		Severen tsentralen	11.45	11.60
		Severoiztochen	21.91	24.70
		Yugoiztochen	16.78	17.15
		Yuzhen tsentralen	17.56	17.03
		Yugozapaden	27.15	27.45
		Total	**101.98**	**105.07**
	TOTAL		**1,287.93**	**924.12**
TOTAL			**6,934.79**	**3,961.11**

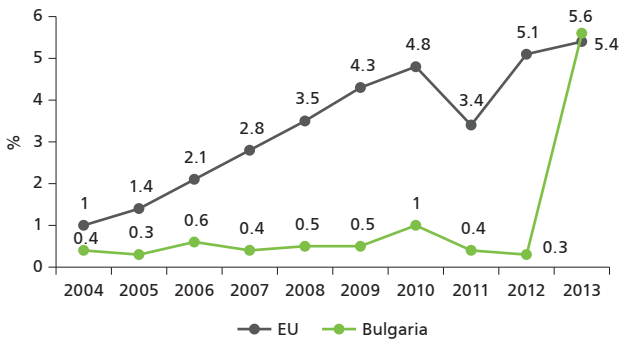
Source: UMIS, 2015.

The emphasis on improving and developing the road infrastructure suggests that road transport will continue to prevail over other modes of transport. From passengers' point of view, road travel remains the most convenient option as intermodality, which should encourage people to choose public transport, is almost entirely limited to the capital Sofia with projects targeting the extension of the metro network and the rehabilitation of the Central and Poduene railway stations. The remaining projects are in Rousse, Plovdiv, Pazardzhik and Bourgas. Based on the limited development of numerous intermodal hubs, which makes travelling by public transport less convenient than using personal vehicles, road transport is likely to continue to prevail unless there is a substantial focus on creating many other transport hubs in all parts of the country. From a business perspective road transport is also the most viable option due to the shift to more high value-added production and rising demand for consumer goods that need to be delivered timely and to numerous locations.

The third key factor influencing transport choices is the presence of incentives for greener options. Stimulating the use of public transport can play a key role in tackling CO_2 emissions and making cities less congested and polluted. Currently most towns with a population of over 50,000 provide some form of public transport and this covers more than 50 % of the population. However, as the routes don't always cover all urban areas, many have no choice but to use personal vehicles. With regards to transport between different villages, towns and cities, road transport is also often the only option, particularly for more remote and sparsely populated towns and villages, which don't have access to other public goods such as healthcare and schools.

One of the ways to offset some of the harmful emissions from road travel is to encourage renewable energy sources in the transport sector, and more specifically electric and hybrid technology, and biomass fuels. Three main strategic

Figure 18. SHARE OF RENEWABLE ENERGY IN FUEL CONSUMPTION OF TRANSPORT IN BULGARIA AND THE EU (2004 – 2013)*



* The sharp increase in the share of RES in transport in 2013 is due to the formal requirement to mix petrol and diesel with biofuels introduced in 2012 as stipulated by the Renewable and Alternative Energy Sources and Biofuels Act.

Source: Eurostat, 2015.

documents address this issue: the National Action Plan for Renewable Energy, National Action Plan for the Promotion of Production and Adoption of Environmentally Friendly Vehicles Including Electric Mobility in Bulgaria for 2012 – 2014, and the National Long-term Programme for the Promotion of Biofuels in the Transport Sector 2008 – 2020. The overall target for renewable energy in the transport sector is 10 %. In order to achieve this target, the National Action Plan for the Promotion of Production and Adoption of Environmentally Friendly Vehicles Including Electric Mobility in Bulgaria for 2012 – 2014 envisages a series of measures, including:

- Green public procurement of electrical vehicles;
- Eliminating taxes for electric vehicles;
- Lower registration fees for electric and hybrid vehicles;
- Lower tolls fees (vignettes);
- Subsidies for purchasing electric (BGN 5,000) or hybrid vehicles (BGN 2,500);
- Development of designated infrastructure for electric charging;
- Raising awareness of the benefits of using electric and hybrid vehicles.

Despite all the envisaged measures, **in 2014 there were only about 1,500 registered electric and hybrid vehicles in Bulgaria, which suggests that the action plan has not been successful so far in promoting these technologies.**

With regards to use of biofuels in the transport sector, the main regulatory incentive is a reduced excise fee for liquid fossil fuels mixed with biofuels in a predetermined ratio. Furthermore, there are plans to switch national and municipal transport vehicles to biofuel. Despite the official commitment to promote biofuels, very little has been done to support their wider use. According to the Bulgarian National Audit Office's "Audit Report on the Implementation of the Objectives of the European Union and National Targets for the Production and Use of Biofuels 2008 – 2012" there is no funding provided by the national budget for biofuel in the transport sector. Instead, municipalities and regional authorities, the main authorities expected to develop short and long-term plans for biofuel in the transport sector, are expected to seek funding from Operational Programmes, the "Energy Efficiency and Renewable Sources" Fund, the National Scheme for Green Investments, etc. The requirement to mix petrol and diesel with biofuels was only enforced in 2012 (this is reflected in the data, which shows a sharp increase in the use of RES in the transport sector in 2013). Finally, there are no administrative provisions to monitor the amount of biofuel consumed for transport, making any assessment and further planning very difficult.[20]

[20] **Сметна палата,** *Одитен доклад за извършен одит на изпълнение на целите на Европейския съюз и националните цели за производство и използване на биогорива за периода от 01.01.2008 г. до 31.12.2012 г.*, 2015 г.

Public policy and measures for green growth

With its ambition of being a global leader in environmental protection, the European Union is the driving force transforming the national policies of member states. This is even more so in countries such as Bulgaria with lower levels of awareness and traditions in this area. On the one hand, planning and the political goals set in relation to green innovation in the country's industry to a great extent are predicated on the mandatory harmonisation of the national legislation with EU law. On the other hand, the financial support mechanisms are set in motion primarily via the European Structural and Investment Funds.

Partnership Agreement between Bulgaria and the European Commission

The Partnership Agreement between Bulgaria and the European Commission is the national strategic document which outlines the management framework for the European Structural and Investment Funds (ESIF) in Bulgaria during the programming period 2014 – 2020. It includes support from five funds – European Regional Development Fund (ERDF), European Social Fund (ESF), Cohesion Fund (CF), European Agricultural Fund for Rural Development (EAFRD) and European Maritime and Fisheries Fund (EMFF). The Partnership paves the way for investments amounting to EUR 7.6 billion in projects under the cohesion policy for the period 2014 – 2020. The country gets another EUR 2.3 billion for agricultural development and EUR 88 million for the fisheries and maritime sector.[21] The investments aim to achieve tangible long-term results and mobilise additional national resources and private capital in order to boost employment in added value sectors and encourage sustainable economic growth.

The strategic document outlines the following four key and complementary priority areas based on which Bulgaria will implement the EU Cohesion Policy in accordance with the key strategy Europe 2020 for inclusive, smart and sustainable growth:

- Education, employment, social inclusion and healthcare for inclusive growth;
- Scientific research, innovation and investment for smart growth;
- Connectivity and green economy for sustainable growth;
- Good governance and access to quality administrative services.

As key priorities in the Europe 2020 strategy, the activities related to the development of an environmentally friendly and resource effective economy are set out in detail in the Partnership Agreement between Bulgaria and the European Commission as well. It outlines the main challenges and opportunities for the country in this area over the next few years; to this end, it takes into account the following key national strategic documents in the field of sustainable development and environmental protection:

[21] Partnership Agreement of the Republic of Bulgaria outlining the support from the European Structural and Investment Funds for the period 2014 – 2020, July 2014.

- National Environment Strategy;
- National Environment and Health Action Program 2008 – 2013;
- National Action Plan to encourage the manufacturing and speedy introduction of environmentally friendly vehicles, including electrical mobility in the Republic of Bulgaria for the period 2012 – 2014.

Thematic goals in support of the green economy and innovation

Under the Partnership Agreement with the European Commission, the Bulgarian government has opted to finance investment in all 11 thematic objectives in support of growth as set out in the regulations and in line with the strategic funding priorities. The determination to develop a resource effective economy and green growth is prominent within 6 of the thematic objectives envisaging activities in support of energy efficiency, increasing the use of renewable energy sources, waste management, development of environmentally friendly transport systems, etc.

The total amount under the five structural funds which will be allocated to the said thematic objectives stands at EUR 6.795 billion. The thematic objectives and strategic priorities are still not horizontally integrated between the sectors of innovation and green economy. Achieving such integration should be the main goal of the Managing Authorities of Operational Programmes responsible for EU funds management. It could help to achieve the goal of having a greater part of the added value under subsidised green initiatives in the local economy which would boost the level of adoption of green technology by households and businesses.

Table 5. THEMATIC OBJECTIVES WHICH ARE DIRECTLY RELATED TO THE DEVELOPMENT OF GREEN ECONOMY AND INNOVATION, REASONS FOR CHOOSING THEM AND SPECIFIC EXPECTED RESULTS

Reasons	Main funding areas	Key objectives
Thematic objective 1: Strengthening research, technological development and innovation		
Strategic funding priority 2: Scientific research, innovation and investment for smart growth		
• Inadequate institutional environment – lack of comprehensive long-term and specific national sector policies for R&D and innovation. • Low and ineffective investment in R&D and innovation – low share of GDP in R&D expenditure in the long term; ineffective incentives for the private sector to invest and perform R&D and/or to use the results of the research activities of academia. • Low level of cooperation between the stakeholders in the field of R&D and low value added of innovation. • Lack of human resources for R&D and innovation.	• Investment in R&D and innovation. • Strengthening of cooperation for innovation.	• Increase by 31.10 % of enterprises implementing innovative activities. • 200 enterprises supported and cooperating with research centres/other enterprises. • Supported development of technological parks, centres of excellence and competence centres. • 20 innovation clusters supported. • 30 % of the R&D costs of enterprises covered by the business programme. • National goal under the Europe 2020 strategy: R&D costs at 1.5 % of GDP by 2020.
Thematic objective 3: Enhancing the competitiveness of small and medium-sized enterprises, the agricultural sector and the fisheries and aquaculture sector		
Strategic funding priority 2: Scientific research, innovation and investment for smart growth		
• Low level of investment (financial and human resources). • Insufficiently modernised. • Insufficient capability to rapidly adapt best practices in the industry. • Insufficient degree of transition to green and resource-efficient production technologies • High level of exposure to natural hazards, including climate change. • Excessive administrative burden. • Limited access to international markets. • Grey economy hampering competitiveness.	• Investment in the internationalisation of enterprises, agricultural and forestry farms, fisheries and aquaculture to diversify the economic activities and support businesses which create competitive advantages for Bulgaria and the sector. • Investment in improving the business environment.	• Increased entrepreneurship by 10.2 % as of 2023. • Increased volume of exports of goods and services by SMEs by EUR 6.82 billion as of 2023. • 2,235 projects for growth and export supported. • 10 % share of exports in the overall turnover of supported enterprises. • Building and rehabilitation of irrigation and drainage systems in priority regions • Growth of productivity in the agricultural sector to meet the internal demand for agricultural produce. • Support investment in approximately 4,700 agricultural farms.

Table 5. THEMATIC OBJECTIVES WHICH ARE DIRECTLY RELATED TO THE DEVELOPMENT OF GREEN ECONOMY AND INNOVATION, REASONS FOR CHOOSING THEM AND SPECIFIC EXPECTED RESULTS (CONTINUED)

Reasons	Main funding areas	Key objectives
Thematic objective 4: Supporting the shift towards a low-carbon economy in all sectors		
Strategic funding priority 3: Connectivity and green economy for sustainable growth		
• Low level of energy efficiency in administrative buildings of state and municipal administration and multi-family residential buildings in cities. • Significant potential for use of renewable energy, but still its use is low. • Insufficient activities for development, transfer and profitable marketing of innovation with lower carbon emissions in the mid- and long-term. • Rising share of personal vehicles in city transport due to the lack of transport alternatives and problems with traffic jams in larger cities. • Low quality of urban transport services.	• Support for energy efficiency in the sectors of industry, services, transport, agriculture, fisheries and aquaculture, households. • Increased use of renewable energy sources for personal consumption • Investment in reducing greenhouse gas emissions • Development of environmentally friendly transport systems and encouragement of sustainable urban mobility, including intermodal.	• 16 % share of RES energy in the gross end energy consumption by 2020 (in comparison to 13.5 % for 2010). • Reduction in the energy intensity of the economy by a minimum of 5 kgoe per EUR 1,00/GDP by 2023. • 130,000 MWh energy savings in enterprises. • 40,000 tons CO_2 equivalent reduction in greenhouse gases. • Reduced end consumption at residential, public and commercial buildings. • Reduced carbon emissions based on the prevalent share of use of sustainable urban transport. • Increased share of enterprises with low-carbon production and increased energy efficiency in fisheries, aquaculture and processing.
Thematic objective 5: Promoting climate change adaptation, risk prevention and management		
Strategic funding priority 3: Connectivity and green economy for sustainable growth		
• Impact of climate change on drinking water availability, agriculture, forestry, tourism, fisheries and aquaculture, energy consumption, related services which determine the economic potential and the quality of life. • Significant risks associated with climate change. • Inadequate measures for risk management, including analysis and assessment of the risk of natural disasters, undeveloped early warning systems.	• Investment activities to prevent and manage climate change risk. • Public policy and building of administrative capacity to adapt to climate change.	• National Real-Time Water Management Centre created. • Having the capability to pursue an effective and efficient policy in relation to adapting to climate change, risk prevention and management. • Achievement of the goals to reduce greenhouse gas emissions in accordance with EU law. • Reduced risk of floods and drought.
Thematic objective 6: Protecting the environment and promoting resource efficiency		
Strategic funding priority 3: Connectivity and green economy for sustainable growth		
• Insufficient effort and investments in public works for protection of the environment (mainly in the sectors of water and waste management). • Lack of appropriate measures at national level and at municipal level for waste management, recovery and recycling of household and construction waste. • High level of biodegradable municipal waste, treated by disposal on landfills. • Deterioration of air. • Lack of incentives for biodiversity conservation. • Lack of extensive business and operations, processes and products to improve the resource efficiency. • Low quality of urban environment and public works in cities. • Need to preserve the national and cultural heritage, given the available unique immovable cultural heritage items.	• Investment in water management. • Investment in waste management. • Investment in limiting adverse impact on the environment, including in population centres. • Investment to protect biodiversity and natural resources. • Measures to encourage preservation, rational and responsible use of resources. • Measures to safeguard cultural heritage.	• Increased energy efficiency by 25 % by 2020. • Installations built to collect and treat waste water from population centres in priority regions. • Reduced quantity of waste and increased repeated use and recycling – by 68 % by 2023. • Information provided to improve water management, including monitoring systems and information systems. • Reduction in industrial water pollution. • Increased share of energy production through use of waste. • Improved environment and air, including in population centres. • Reduced PM10/NOx emissions. • Increased bio agriculture based on the improved quality of the environment and natural resources. • Conditions for environmentally friendly and sustainable fisheries created.

Table 5. THEMATIC OBJECTIVES WHICH ARE DIRECTLY RELATED TO THE DEVELOPMENT OF GREEN ECONOMY AND INNOVATION, REASONS FOR CHOOSING THEM AND SPECIFIC EXPECTED RESULTS (CONTINUED)

Reasons	Main funding areas	Key objectives
Thematic objective 7: Promoting sustainable transport and removing bottlenecks in key network infrastructures		
Strategic funding priority 3: Connectivity and green economy for sustainable growth		
• Transport infrastructure – network gaps and bottlenecks, outdated sections. • Insufficient connectivity of the main TEN-T network and the adjacent networks. • Imbalanced distribution of railways, with outdated operational and technical characteristics, including poor condition of the rolling stock. • Limited transport of loads. • Poor overall technical condition of the port and harbour infrastructure. • Insufficient intermodal terminals. • High death rate due to road accidents and lack of measures to ensure access to transport services for people with disabilities.	• Investment in TEN-T corridors with quality and operationally compatible transport systems and connectivity with the TEN-T network, including intermodal connections. • Development of environmentally friendly transport systems and encouragement of regional mobility.	• Statutory objective: 10 % share of the energy from renewable sources in transport as of 2020. • Predominant share of the use of sustainable transport compared to total transport. • Infrastructure built for intermodal and interoperable transport. • Increase in intermodal transport units transported by rail and water by 20 % in comparison to the 2011 base value. • Improved connectivity of the TEN-T network with the national road network. • Increased share of sections from the "main" and "extended" Trans-European Railway Network on the territory of the country equipped with modern signalling and telecommunication systems. • Increased quality of the railway infrastructure along the "main" and "extended" trans-European rail network on the territory of the country. • Saturation of road infrastructure <50 %.

Source: Partnership Agreement of the Republic of Bulgaria outlining the support from the European Structural and Investment Funds for the period 2014 – 2020.

Table 6. FUNDS ALLOCATED TO THE THEMATIC OBJECTIVES AND RELATED DIRECTLY TO THE DEVELOPMENT OF GREEN ECONOMY AND INNOVATION (IN EUR MILLION)

	ERDF	ESF	CF	EAFRD	EMFF	TOTAL
1. Strengthening research, technological development and innovation	488.2	0.00	0.00	39.9	0.00	528
3. Enhancing the competitiveness of small and medium-sized enterprises, the agricultural sector and the fisheries and aquaculture sector	592.9	0.00	0.00	376	40.5	1 009.4
4. Supporting the shift towards a low-carbon economy in all sectors	957	0.00	0.00	225.4	1	1 183.4
5. Promoting climate change adaptation, risk prevention and management	16.8	0.00	50	383.2	0.00	449.9
6. Protecting the environment and promoting resource efficiency	660.4	0.00	1 083.7	465.3	27.1	2 236.6
7. Promoting sustainable transport and removing bottlenecks in key network infrastructures	243.3	0.00	1 144.7	0.00	0.00	1 387.9
Total	2 958.6		2 278.4	1 489.8	67.1	6 795.3

Source: Partnership Agreement of the Republic of Bulgaria outlining the support from the European Structural and Investment Funds for the period 2014 – 2020.

Operational programmes in support of green economy and innovation

In addition to the detailed analysis of the social and economic situation in Bulgaria and a strategy for the development in the country in the next few years, the Partnership Agreement with the European Commission also contains a description of the seven Operational Programmes and the mechanisms for their implementation and coordination during the current programming period 2014 – 2020. Project activities related specifically to the protection of the environment and the development of a green and resource-efficient economy and innovation are present among the key investment priorities in the Operational Programmes discussed below.

OP Innovation and Competitiveness[22]

The Operational Programme is aimed at supporting technological development, innovation and entrepreneurship as well as the transition to a low-carbon economy in all spheres of production. The EU budget of the programme for the period 2014 – 2020 is EUR 1.182 billion.

Some of the key needs and challenges to the Bulgarian economy the OP addresses include the management and use of natural resources. Even though the industry has incurred substantial costs for protection and rehabilitation of the environment in Bulgaria over the past few years, Bulgarian SMEs lag significantly behind in terms of being environmentally friendly. The main reason for this is the fact that the country occupies the last place in the EU when it comes to resource productivity which is an overall threat to the sustainability of the economy. According to the analysis of OP Innovation and Competitiveness, Bulgaria also comes last with regard to the following indicators:

- Innovation for the environment;
- Share of SMEs with measures of resource efficiency;
- Share of SMEs offering green products;
- Share of SMEs receiving public support to implement measures for effective use of resources or for green products;
- Share of SMEs satisfied with the public support received.

Operational Programme Innovation and Competitiveness 2014 – 2020 also addresses challenges related to energy production and consumption, which is closely tied to the development of all sectors of the economy. As one of the most energy-intensive countries which depends on the import of energy resources from European countries, Bulgaria has an energy sector characterised by a limited access to best practices, systems and models of energy efficient production. Raising the energy efficiency of enterprises and encouraging the production and use of energy from renewable sources for own consumption will be of key importance to reduce the energy intensity of the Bulgarian economy.

In relation to the above challenges, Operational Programme Innovation and Competitiveness 2014 – 2020 identifies four priority axes with respective investment priorities which relate to 5 of the key thematic objectives in support of green economy and innovation.

Box 2. RESULTS UNDER OPERATIONAL PROGRAMME COMPETITIVENESS 2007 – 2013[23]

For the period 2007 – 2013, Operational Programme Competitiveness provided grants exceeding BGN 2.306 billion given the total programme budget of BGN 2.273 billion. The total number of supported projects was over 3,100 with the largest beneficiaries among enterprises being Badeshtnost AD (8 projects with funds actually provided under them at BGN 11 million), Milko EOOD (5 projects with funds actually provided under them at BGN 10.9 million) and M+S Hidravlik AD (4 projects with funds actually provided under them at BGN 10.6 million).

Table 7. PRIORITY AXES, BUDGET, INVESTMENT PRIORITIES, RESULT INDICATORS AND CONTRIBUTION BY THEMATIC OBJECTIVES FOR OP INNOVATION AND COMPETITIVENESS 2014 – 2020

Priority axis	Budget by priority axis (% of the total programme budget)	Investment priority	General and specific programme result indicators	Thematic objective
Technological development and innovation	21.24 %	Technological development and innovation	Share of innovative enterprises; costs for innovation which are not the result of R&D	1. Strengthening research, technological development and innovation

[22] The source of the information used is Operational Programme Innovation and Competitiveness 2014 – 2020.

[23] UMIS.

TABLE 7. PRIORITY AXES, BUDGET, INVESTMENT PRIORITIES, RESULT INDICATORS AND CONTRIBUTION BY THEMATIC OBJECTIVES FOR OP INNOVATION AND COMPETITIVENESS 2014 – 2020 (CONTINUED)

Priority axis	Budget by priority axis (% of the total programme budget)	Investment priority	General and specific programme result indicators	Thematic objective
Entrepreneurship and growth capacity of SMEs	50.17 %	Access to funding in support of entrepreneurship	Number of enterprise survivals up to 2 years	3. Enhancing the competitiveness of small and medium-sized enterprises
		Growth capacity of SMEs	Volume of export of goods and services made by SMEs, increase in SME productivity	3. Enhancing the competitiveness of small and medium-sized enterprises
Energy and resource efficiency	22.35 %	Energy technology and energy efficiency	Reducing the energy intensity of the economy	4. Supporting the shift towards a low-carbon economy in all sectors
		Resource efficiency	Increasing the share of SMEs with measures for resource efficiency	6. Protecting the environment and promoting resource efficiency
Eliminating obstacles related to the security of gas supplies	3.24 %	Improving the energy efficiency and security of supplies through the development of intelligent systems for energy transmission	Achieving N – 1 Infrastructure standard	7. Promoting sustainable transport and removing bottlenecks in key network infrastructures

Source: Operational Programme Innovation and Competitiveness 2014 – 2020.

OP Environment[24]

Operational Programme Environment is the programme through which Bulgaria receives the greatest amount of funding from the European Union for investment in the environment both for the previous programming period (2007 – 2013) and for the new one (2014 – 2020). The programme supports the priorities of sustainable growth and effective use of resources as defined in the Europe 2020 strategy and aims to finance projects related to the following three key spheres of the green economy:

- Building a more competitive low-carbon economy in which resources are used in an efficient and sustainable way.
- Protecting the environment, reducing emissions and preventing the loss of biodiversity.
- Making use of Europe's leading position in the development of new environmental technologies and production methods.

[24] The source of the information used is Operational Programme Environment 2014 – 2020.

BOX 3. RESULTS UNDER OPERATIONAL PROGRAMME ENVIRONMENT 2007 – 2013[25]

According to the latest (October 2015) data, contracts for grants amounting to more than BGN 4.123 billion were concluded under Operational Programme Environment, or more than 122.79 % of the total programme funds. The payments under contracts already concluded stand at BGN 3.325 billion or more than 99.03 % of the total programme resources. 213 projects valued BGN 3.672 billion are still under-way while 225 projects have been successfully completed and used up BGN 476 million.

Bulgaria is still far from achieving the goals of the European Union by 2020 in relation to the protection of the environment. To meets its obligations, the country needs to make large-scale investments requiring funding it does not have. In view of the needs identified

[25] Information provided by the Ministry of Environment and Water.

Table 8. ALLOCATION BY PRIORITY AXES AND THEMATIC OBJECTIVES UNDER OPERATIONAL PROGRAMME ENVIRONMENT 2014 – 2020 (IN EUR MILLION)

Priority axis	Thematic objective	EU support	National participation	Total amount of funding
Water	6. Protecting the environment and promoting resource efficiency	1,016.9	179.4	1,196.3
Waste	6. Protecting the environment and promoting resource efficiency	244.6	43.2	287.8
Natura 2000 and biodiversity	6. Protecting the environment and promoting resource efficiency	86.2	15.2	101.4
Prevention and management of the risk of flood and landslides	5. Promoting climate change adaptation, risk prevention and management	66.7	11.8	78.5
Improving the quality of air	6. Protecting the environment and promoting resource efficiency	50.0	8.9	58.9
Total		1,464.4	258.4	1,722.8

Source: Operational Programme Environment 2014 – 2020.

and the investment opportunities, the programme funds are allocated to the following priority axes and objectives:

Priority axis 1: Water – aimed primarily at improving waste water treatment as well as the quality and management of drinking water resources in a strategic and cost-efficient way. Generally, it will support the fulfilment of Bulgaria's commitments pursuant to the Water Framework Directive.

Priority axis 2: Waste – aimed primarily at meeting the goals set in the Resource Efficiency Roadmap and the commitments related to the Community law to achieve the goal of increasing reuse and recycling to no less than 50 % of the total volume by 2020. During the new programming period, the Operational Programme will be open to businesses which will be able to benefit from grants for projects under this priority axis. There will be a focus on funding eco-innovation in the sector aimed to improve the environmental protection and resource efficiency of enterprises.

Priority axis 3: Natura 2000 and biodiversity – includes measures and activities in accordance with the National Priority Action Framework for the Natura 2000 network.

Priority axis 4: Prevention and management of the risk of flood and landslides – aimed at implementing the EC recommendation to Bulgaria to improve the prevention of floods and landslides. Municipalities will be the main beneficiary.

Priority axis 5: Improving the quality of air – addresses needs related to the quality of air by implementing adequate long-term programmes and short-term action plans in view of the sources of pollution.

OP Transport and Transport Infrastructure[26]

The main investments under Operational Programme Transport and Transport Infrastructure are envisaged in areas where implementation is well underway in order to ensure the completion of their modernisation or construction. The implementation of projects for the development of the transport system which contribute to the effective connectivity of the transport network and eliminating sections with insufficient capacity in it, the reduction in traffic jams, levels of noise and pollution, improving safety and encouraging the use of environmentally friendly types of transport will continue. The programme formulates the following priority axes:

1. Development of road infrastructure along the "core" Trans-European Transport Network with a total funding[27] of EUR 673.4 million.
2. Development of railway infrastructure along the "core" and "comprehensive" Trans-European Transport Network with a total funding of EUR 673.4 billion.
3. Improvement of intermodal transport services for passengers and freights and development of sus-

[26] The source of the information used is Operational Programme Transport and Transport Infrastructure 2014 – 2020.

[27] 27 EU support and national contributions.

tainable urban transport with a total funding of EUR 425.1 million.

4. Innovations in management and services – establishment of modern infrastructure for traffic management and transport safety improvement with a total funding of EUR 68.2 million.

Box 4. RESULTS UNDER OPERATIONAL PROGRAMME TRANSPORT FOR THE PERIOD 2007 – 2013[28]

During the past programming period, contracts for grants exceeding BGN 3.933 billion were concluded out of a total programme budget of BGN 3.918 billion. The payments under contracts already concluded amount to more than BGN 3.086 billion. An overall of 117 projects received support with the main beneficiaries being Road Infrastructure Agency (20 projects totalling BGN 1.980 billion), Metropoliten AD (4 projects totalling BGN 1.853 billion) and National Company Railway Infrastructure (30 projects totalling BGN 1.821 billion).

Table 9. ESTIMATED AMOUNT OF SUPPORT TO BE USED FOR GOALS IN RELATION TO CLIMATE CHANGE UNDER OPERATIONAL PROGRAMME TRANSPORT AND TRANSPORT INFRASTRUCTURE 2014 – 2020

Priority axis	Estimated amount of support to be used for goals in relation to climate change (in EUR million)	Share of the total funds allocated to the operational programme (%)
1	228.9	14.27 %
3	144.5	9.01 %
4	21.1	1.32 %
Total	394.5	24.60 %

Source: Operational Programme Transport and Transport Infrastructure 2014 – 2020.

Operational Programme Transport and Transport Infrastructure 2014 – 2020 aims to contribute to achieving two thematic objectives of the Partnership Agreement between Bulgaria and the European Commission: Objective 4 "Supporting the shift towards a low-carbon economy in all sectors" and Objective 7 "Promoting sustainable transport and removing bottlenecks in key network infrastructures". The programme envisages funding for specific measures with a direct impact in all four areas contributing to achieving the national goals in relation to climate change. Such measures are, for example, the increase of the share of railway transport, modernisation of the existing road infrastructure to ensure optimum speed and the reduction of the relative share of travel in personal vehicles by improving and developing urban public transport.

OP Regions in Growth[29]

Operational Programme Regions in Growth 2014 – 2020 is aimed primarily at the regional development and more specifically achieving the goals of Bulgaria's urban policy. The programme has a special focus on energy efficiency in supporting centres in peripheral areas and aims to contribute to the territorial dimension of the sector policies included in the Partnership Agreement between Bulgaria and the European Commission.

Box 5. RESULTS UNDER OPERATIONAL PROGRAMME REGIONAL DEVELOPMENT 2007 – 2013[30]

For the period 2007 – 2013, contracts for grants exceeding BGN 3.261 billion were concluded under Operational Programme Regional Development given the total programme budget of BGN 3.131 billion. The total number of supported project was 1,200 with the largest beneficiaries being Road Infrastructure Agency (59 projects totalling BGN 706.4 million), Burgas Municipality (14 projects totalling BGN 179.1 million) and the Ministry of Health (18 projects totalling BGN 167 million).

The allocation of the financial resources under the Operational Programme presupposes contribution to a large number of thematic objectives, focused and coordinated territorially. Sustainable development and the transition to a green economy are prominent as more than half of the funds Bulgaria will receive from the EU for OP Regions in Growth 2014 – 2020 will be invested in projects supporting the transition to a low-carbon economy and the protection of the environment. The main beneficiaries will be municipalities, ministries and higher education institutions.

Thirty-one percent of the resources under Operational Programme Regions in Growth will be targeted at supporting the shift towards a low-carbon economy in all sectors; 22 % of the funds are allocated to measures for energy efficiency in public and residential buildings; 9 % of the funds will be invested in the development of an integrated

[28] UMIS.

[29] The source of the information used is Operational Programme Regions in Growth 2014 – 2020.

[30] UMIS.

urban transport. This allocation is the result of the main issues identified in urban territories, namely the poor condition and low energy efficiency of buildings and the continuing urbanisation process which is expected to lead to a substantial rise in urban transport and, mostly, the growing use of personal vehicles rather than public urban transport.

Another 22 % of the programme funds will support Thematic Objective 6: "Preserving and protecting the environment and promoting resource efficiency". A large percentage of the investments in this thematic field will be targeted at improving the urban environment and developing the tourism potential of the regions. The support thus provided will have a significant contribution to protecting the environment and encouraging resource efficiency. Special attention is paid to the restoration and development of zones with the potential for economic advancement whose role is to improve the ecological conditions in urban centres and also to attract investments in the regions, thus promoting sustainable growth.

The third thematic objective directly related to the development of a green economy and innovation which will be funded under the Operational Programme using 12 % of its resources is "Promoting sustainable transport and removing bottlenecks in key network infrastructures". Investment will be targeted to support roads of classes one, two and three ensuring connections and access to the TEN-T network and also opportunities for the development of the specific economic potential of the regions.

Table 10. ESTIMATED AMOUNT OF SUPPORT TO BE USED FOR GOALS IN RELATION TO CLIMATE CHANGE UNDER OPERATIONAL PROGRAMME REGIONS IN GROWTH 2014 – 2020

Priority axis	Estimated amount of support to be used for goals in relation to climate change (in EUR million)	Share of the total funds allocated to the operational programme (%)
1	339.2	25.86 %
2	89.9	6.85 %
Total	429.1	32.71 %

Source: Operational Programme Regions in Growth 2014 – 2020.

The following three priority axes envisage activities in relation to the protection of the environment and the development of a green economy:

Priority axis 1: Sustainable and integrated urban development with a total funding of EUR 840.5 million;

Priority axis 2: Support for energy efficiency in supporting centres in peripheral areas with a total funding of EUR 105.7 million;

Priority axis 7: Regional road infrastructure with a total funding of EUR 194.5 million.

Additional sources for projects for a green economy

Norwegian Financial Mechanism

A Memorandum of Understanding on the Implementation of the Norwegian Financial Mechanism between the Republic of Bulgaria and the Kingdom of Norway was signed in 2011. The main goal of the financial instrument is to reduce economic and social disparities in the European Economic Area and to strengthen the bilateral relations between Norway and Bulgaria. Under the programme, Bulgaria has access to funds for projects in priority areas for the country, including the development of renewable energy sources industry and the development of green industry innovation.

Programme BG04 Energy Efficiency and Renewable Energy

Grants under the programme amount to EUR 12.3 million for the period 2012 – 2017. The main objective of the programme is to contribute to reducing emissions of greenhouse gases and air pollutant in the long term. It will contribute to increased energy production from renewable energy sources like hydropower and biomass, and improved energy efficiency in public buildings as well as an overall increase in the knowledge and awareness of energy efficiency measures among stakeholders. The programme contains four components directly related to the outcomes defined for the programme with respective eligible beneficiaries:

- Pilot micro-electricity generation (up to 200KW) in piped water supply and irrigation gravity systems – eligible beneficiaries are state and municipal enterprises operating in the field of water supply and irrigation.
- Energy efficiency measures in public buildings and increased use of renewable energy sources for heat generation – eligible beneficiaries under this component are state and municipal organisations.
- Production of fuels for heating based on biomass – SMEs may apply under this axis.
- Training and education activities aimed at increasing capacity of state and municipal administrations in energy efficiency measures – this component is aimed at universities, training organisations and energy service companies.

The amounts of grants under the components vary from EUR 30,000 (component 4) to EUR 750,000 (component 1).

Programme BG10 Green Industry Innovation

The amount of EUR 13.7 million is envisaged under this programme for the period 2012 – 2017. It aims to provide green business opportunities within sectors such as construction, transport, and information and communication technologies. The main target group includes Bulgarian private companies; non-governmental organisations and public institutions are also eligible beneficiaries. They will gain support to develop and commercialise new and innovative environmentally-friendly technologies and processes. By creating new jobs and propelling a more sustainable economic growth, the programme will contribute to reducing social and economic disparities. Funds in the following areas will be provided under the programme:

- Development of innovative environmental technologies, products or processes.
- Increased use of remote environmental monitoring technologies to identify and respond to environmental change.
- Capacity building to increase awareness of the benefits of 'greening' business and how to put this into practice.
- Training for around 300 employees from SMEs and young entrepreneurs on the green economy.

The minimum amount of grants for individual projects is EUR 200,000 and the maximum stands at EUR 2 million.

National Trust EcoFund

The National Trust EcoFund (NTEF) was set up in October 1995. The Fund manages assets from the state budget, including under the Debt-for-Environment and the Debt-for-Nature swaps. Funds are also generated via the Assigned Amount Units international trade deal(s), the sale of greenhouse gas emissions quotas for aviation activities, as well as funds, provided on the basis of other environmental protection agreements with international, foreign and Bulgarian sources of funding targeted at the protection of the environment in Bulgaria.

Since the beginning of its work until the completion of the Debt-for-Nature swap (1995 – 2009), NTEF provided funding for 100 investment projects at more than BGN 26.5 million. As a result, the Fund mobilised more than BGN 115.1 from other, mainly international sources to implement environmental projects in Bulgaria.[31]

In addition to Debt-for-Nature, the Fund is presently running another four programmes:

- **National Green Investment Scheme (NGIS)** – set up following amendments to the Environmental Protection Act of 2010 which authorised NTEF to operate with the proceeds from the sales of AAUs. NGIS aims at including the broadest possible range of potential environmental projects in the area of energy, transport, agriculture, forestry, water and waste management, industry and other national economy sectors which result in the reduction of greenhouse gas emissions, while significantly improving the quality of the environment, and in particular reducing air, water, and soil pollution. Projects are funded under two main axes Energy Efficiency and Biomass Energy. The NGIS beneficiaries include municipalities, state institutions and companies. In 2014, it received 26 project proposals under Axis 1 to fund measures to improve the energy efficiency of public sites; 21 were approved. As of November 2015, there are no calls under the NGIS.
- **Investment Climate Programme (ICP)** – the newest NTEF programme contributing to limiting climate change. It is a continuation of a kind of NGIS as its main purpose is to encourage initiatives leading to limiting climate change. It funds projects related to increasing energy efficiency in buildings and other sites which are public state property or public municipal property. The beneficiaries under the projects include public institutions and R&D organisations.
- **The Pilot Program for Environment Restoration (PPER)** aims to mitigate the severe environmental contamination at the MDK copper smelter and refinery in Pirdop, which has been in operation since 1957. When the Belgian metallurgical group Union Miniere acquired MDK, an environmental Remediation Program was designed as part of the privatisation deal in cooperation with the World Bank.
- **The Protected Areas Fund (PAF)** was established to assist for the landscape, natural habitats and biodiversity preservation in Bulgaria`s protected areas, in accordance with the national biodiversity conservation policy through sustainable financing to complement the budget funding provided by the government and co-funding by donor projects focused on protected areas. The potential beneficiaries include protected areas, NGOs protecting biodiversity and private companies in ecotourism.

[31] NTEF, Annual Report, 2014.

Good business practices

SMEs' role in contributing towards low-carbon growth must be examined in relation to the overall business environment and the challenges that local companies face in their day-to-day operations in Bulgaria. The EC has placed great emphasis on SME support through a variety of regulatory measures and networking initiatives such as the Small Business Act,[32] the Entrepreneurship Action Plan,[33] Enterprise Europe Network,[34] and the Erasmus for Young Entrepreneurs[35] scheme. As the EC monitors SMEs across Europe, it is possible to follow their development over time.

The 2014 Small Business Act Factsheet for Bulgaria[36] identifies the main positive developments in SMEs as well as the major challenges they face. Bulgarian SMEs were greatly affected by the 2008 financial crisis. **On average SMEs had to make redundant 8 % of their staff, compared to 16 % in large enterprises, but their added value decreased by 4 % between 2008 and 2013, compared to an 8 % increase in big companies.** According to the EC, this is the result of large enterprises' ability to raise their productivity and diversify their market, while SMEs are less flexible in this regard.

[32] **Communication from the Commission to the Council, the European Parliament,** the European Economic and Social Committee and the Committee of the Regions – "Think Small First" – A "Small Business Act" for Europe {SEC(2008) 2101} {SEC(2008) 2102}.

[33] **Communication from the Commission to the European Parliament, the Council,** the European Economic and Social Committee and the Committee of the Regions Entrepreneurship 2020 Action Plan: Reigniting the Entrepreneurial Spirit in Europe (*COM/2012/0795 final*).

[34] **http://een.ec.europa.eu/**

[35] **http://www.erasmus-entrepreneurs.eu/**

[36] **European Commission, DG Enterprise and Industry,** *2014 SBA Fact Sheet: Bulgaria*, 2014.

Eurobarometer data[37] shows that the spirit of entrepreneurship in Bulgaria is very widespread as 36 % of respondents had either started a business, taken over one, or were planning to start one, the second highest rate across the EU following only Cyprus with 39 %. The positive attitude towards owning or running a company is likely the result of several administrative improvements to the business environment, such as the short and relatively simple start-up procedures, which only require 4 days and EUR 60. However, **business owners are still burdened with complex administrative red tape, slow progress in e-government rollout and lack of coordination between different authorities.**

Bulgarian SMEs still have major disadvantages that undermine their competitiveness on the EU level mainly related to **lack of access to finance, low levels of innovation and training investments, and poor environmental performance**. EC data[38] shows that local banks are still relatively risk averse as a result of the financial crisis and, although getting credits is easier than a few years ago, they are still reluctant to relax credit restrictions. Crowd funding and venture capital are also not readily available in Bulgaria, leaving SMEs with no other option but to seek financial support through government schemes. In terms of innovation, Bulgarian SMEs are not very likely to introduce or develop innovative products, processes, technologies or management strategies, which results in low patent activity from the business

[37] **European Commission,** *Flash Eurobarometer 354: Entrepreneurship in the EU and Beyond Report*, 2012.

[38] **European Commission, DG Enterprise and Industry,** *2014 SBA Fact Sheet: Bulgaria*, 2014.

sector. Moreover, only a third of local companies offer their employees any form of additional training, which significantly lowers their competitiveness in Europe.

Bulgarian SMEs also have a very poor environmental performance compared to the rest of the EU. Due to the lack of financial resources, not many companies are investing in green technologies, with the exception of resource efficiency measures, which were funded by European funds through OP Competitiveness. Similarly, **only 11 % of local companies have tapped into the eco-friendly market and offer green products to their customers.** Over 50 % of companies do not offer such products because green values are not part of the company's culture or public image, while 38 % of respondents would consider introducing eco-products if there were sufficient financial incentives. More detailed Eurobarometer data from 2013 on resource efficiency and green markets[39] show that the most common measures among companies are aimed at energy saving and resource efficiency. Almost half (45 %) of respondents indicated that these measures had reduced their production costs, while 41 % indicated that they had invested less than 1 % of their annual turnover to become more resource efficient.

Building on Europe-wide data, in 2014 ARC Fund developed the Green Business Innovation Survey,[40] which led to conclusions similar to the Eurobarometer study. The survey showed that there was a distinct correlation between the market in which a company operates and its awareness of green activities and performance. In order to succeed on the very competitive international market, companies have no choice but to improve their environmental performances. Nevertheless, the majority of Bulgarian companies have not yet taken advantage of the benefits of energy saving and cost reducing green measures. Those companies that have introduced such measures, for example environmental impact management systems, have been largely motivated by the potential of increasing their profitability as a result of reduced energy costs. This trend is most prevalent in the manufacturing and trade sectors. Typical green measures include glazing replacement, wall insulation and using more energy efficient appliances and lighting, as these require a much lower initial investment. In fact, the lack of sufficient own resources and public funding mechanisms is the main reason for Bulgarian companies' delay in introducing such measures. However, businesses which have adopted energy efficiency measures have reported a drop in their electricity bills by 10 to 20 %.

As ARC Fund's survey revealed, not many Bulgarian SMEs have done much to improve their environmental performance. However, there are companies that support low-carbon growth in a variety of ways, such as creating consumer products which have a lower environmental impact, using technologies that help reduce energy consumption and engaging their local communities to promote the benefits of green technologies and environmentally conscious consumer behaviour. Their experience shows that introducing such measures is not only beneficial to the environment, but also has positive financial implications and therefore counters the myth that green technologies are high risk investments. The following examples have been selected to showcase different types of low-carbon and green solutions that are present among Bulgaria's business sector.

Case study: Green products and technologies

Patents

One of the main ways in which SMEs contribute to low-carbon growth is through the development of green innovative technologies protected through different forms of intellectual property (IP). In the field of environmental technology, IP has been at the centre of many debates as on the one hand it is supposed to stimulate research and innovation, but on the other it hinders the widespread application of these technologies due to their higher costs resulting from IP rights. The number of intellectual property certificates granted can provide some indication of the research activity in the field of environmental technologies in a country, though it is not an entirely accurate indicator of the number of technologies developed or those put on the market.

Since 2010, patent applications in Bulgaria have experienced a slight increase and green technologies are gaining a growing share among them – in 2010 they represented 32 % while in 2014 they amounted to 39 % of the total requests. Individual inventors make up the largest share (57 %) of patent applicants for green technologies, while companies (27 %), research institutions (8 %) and joint applicants (8 %) are much fewer during the whole period. This trend is present also among applications as a whole, though companies are slightly more represented with 33 % of all applications between 2010 and 2014. Over the same period, a total of 48 patents and 85 utility model certificates for green technologies have been awarded. Probably as a result of the faster and less costly procedure, Bulgarian inventors appear to prefer utility model protection over patents. This may also infer that the technologies being protected are not entirely new, but rather improvements on existing ones, probably developed elsewhere. In terms of the types of technologies granted IP rights, **alternative energy sources prevail over the entire period, with fewer technologies aimed at energy efficiency and waste management**.

[39] **European Commission,** *Flash Eurobarometer 381: SMEs, Resource Efficiency and Green Markets Report*, 2013.

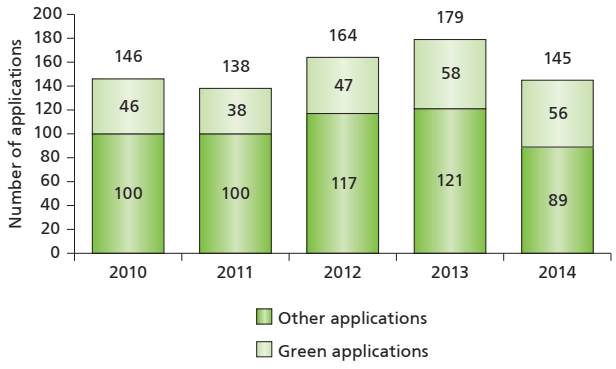
[40] **Applied Research and Communications Fund,** *Green Innovation.bg 2014: Potential for Development*, 2014.

Box 6. INTELLECTUAL PROPERTY RIGHTS IN BULGARIA

Inventors in Bulgaria have two main IP options: patents and utility models (which are not available in all countries). Patent are exclusive rights granted for a new product or process, which provide an entire new solution to a problem and is commercially viable. In order to obtain a patent, the inventor must disclose technical information about the product/process. In Bulgaria, as in most countries, patents last for 20 years and the patent holder must pay regular fees to maintain its rights. The process to obtain a patent usually lasts around two and a half years. Once the patent has been granted, its owner can commercially use the invention, sell the patent rights or allow others to use his technology.

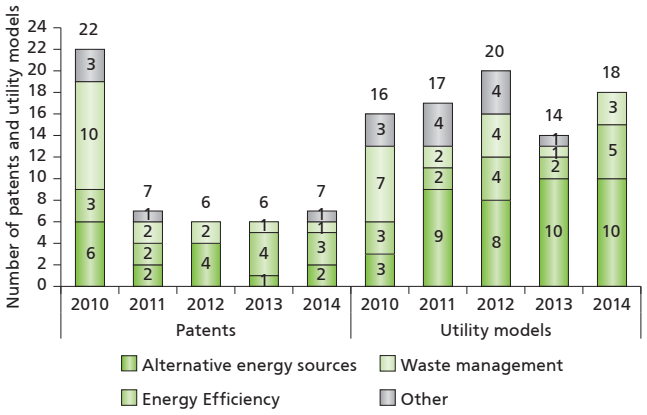
Utility models are similar to patents, but the "novelty" requirements are significantly lower and they are usually obtained for incremental innovations such as smaller improvements on existing products, often in the field of mechanical innovations, making them particularly suitable for SMEs. Furthermore, the evaluation process takes on average 9 months, fees are significantly lower to patent applications and the utility model IP is valid for 4 years, with the possibility to extend it for a further 6 years with two additional payments.

Figure 19. NUMBER OF PATENTING REQUESTS IN BULGARIA (2010 – 2014)



Source: Patent Office of the Republic of Bulgaria.

Figure 20. NUMBER OF GRANTED PATENTS AND UTILITY MODELS



Source: Patent Office of the Republic of Bulgaria.

Box 7. ENCOURAGING GREEN INNOVATIONS THROUGH INTELLECTUAL PROPERTY

In view of the growing need for low-carbon technologies, several countries, including Australia, Brazil, Canada, China, Israel, Japan, Korea, the UK and the US, have introduced measures to accelerate green patent applications to allow these technologies to reach the market as quickly as possible. It appears that the companies most likely to opt for the fast-track procedures are smaller start-ups that want to commercialise their product. Although the programmes vary, they all achieve a significant reduction in the length of the application process and have fostered knowledge exchange about green technologies.

Table 11. FAST TRACK PROGRAMMES FOR GREEN PATENT APPLICATIONS

Eligible technology	"Fast track" time saved	Average annual number of fast-track patents	% of green patents	% of total patents
United Kingdom				
All environmentally friendly inventions	0.8 years	258.7	20.91	0.90
Australia				
All environmentally friendly inventions	1.9 years	14.3	0.76	0.05

Table 11. FAST TRACK PROGRAMMES FOR GREEN PATENT APPLICATIONS (CONTINUED)

Eligible technology	"Fast track" time saved	Average annual number of fast-track patents	% of green patents	% of total patents
Republic of Korea				
Technologies funded or accredited by the Korean government, or mentioned in relevant government environmental laws	First patent office action is expected within one month of application	219.6	1.88	0.13
Japan				
Energy-saving and CO_2 reduction	First patent office action is expected within two months of application	203.7	1.48	0.06
USA				
Environmental quality, energy conservation, development of renewable energy resources, or greenhouse gas emission reduction	1.6 years	1514.1	8.22	0.36
Israel				
All environmentally friendly inventions	2.8 years	28.4	13.13	0.35
Canada				
All environmentally friendly inventions	2.5 years	44.7	1.64	0.12

Source: Antoine Dechezleprktre, *Fast-tracking Green Patent Applications: An Empirical Analysis*, International Centre for Trade and Sustainable Development, Issue paper 37, 2013.

As shown by the figures in Table 11, not many companies have taken advantage of the fast track progress. Larger businesses in particular prefer to remain in the longer application process as this allows them to delay the cost of acquiring the patent, change their list of claims during the process itself and stop competitors from copying the technology. Smaller companies on the other hand tend to benefit from the fast track schemes as they can bring their inventions to the market sooner and therefore increase their revenue, use the patent to raise private capital and take legal action against anyone copying their products. The most common technology type going through the fast track programmes varies depending on each country's priority. For example, in the US renewable energy sources, wind and solar in particular, and transport related technologies are the most prevalent, while in the UK energy saving and transport represent almost 50 % of the patents.

Ecolabels

Products that have a reduced environmental impact throughout their entire lifecycle but are not subject to IP can also contribute low-carbon growth by joining the voluntary scheme EU Ecolabel of the European Commission. The EU Regulation on **the Ecolabel**[41] **promotes products which have a high level of environmental performance according to the highest international standards, in order to facilitate consumers in their choice of products.** Companies can also use the Ecolabel as a marketing tool for their products which improves their competitiveness as a result of the growing demand for green products by consumers. The Ecolabel is available for a wide range of products in the following categories: cosmetics, hygiene products, cleaning products, clothing and textiles, paints and varnishes, electronic equipment, coverings, furniture, gardening household appliances, lubricants, paper products, accommodation.

Obtaining an Ecolabel has many advantages. From the point of view of SMEs the label facilitates market entry in all member states as it is recognised across Europe and it increases the likelihood of gaining distribution contracts with large retailers, which have increasingly high environ-

[41] Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel.

Table 12. ECOLABEL FEES IN BULGARIA[42]

	Application/ Renewal fee (BGN)	Extension/ Modification fee (BGN)	Annual fee (BGN)	Maximum annual fee (BGN)*
Large enterprises	600	480	500	48,900
Small and medium enterprises	480	360	375	36,700
Micro enterprises	480	360	300	36,700

* Maximum annual fees can be very high for companies that have a large number of products.

Source: Ministry of Environment and Water, Bulgaria, 2015.

mental requirements for the products they sell. The Ecolabel also adds value by making it easier for companies to win green public procurement contracts and showcasing corporate social responsibility to their customers. For consumers, the Ecolabel makes recognising and purchasing green products easier and they have the guarantee of high that the certification is based on an assessment performed by independent, qualified scientists.

The first EU requirements for ecolabelling were introduced in 1992, while Regulation (EC) No 66/2010 was introduced in 2009. As of September 2015, there were a total of 44,711 products and services comprised by 2,031 licences across the EU. Both licences and products/services are distributed very unevenly geographically and in terms of the product categories, possibly due to lack of information and promotion of the scheme. Over 30 % of licences are in the category of tourist accommodation services, followed by cleaning products (13 %), indoor paints and varnishes (8 %) and tissue paper (6.6 %). In terms of products and services, hard coverings represent the biggest share (32 %), followed again by indoor paints and varnishes (13 %) and tissue paper (13 %). The distribution of ecolabelled products across member states is very uneven. Over 27 % of all licences are held by France, 17 % in Italy, 12 % in Germany and 9 % in Spain. The distribution of the products themselves is even more skewed with almost half of all products and services originating from Italy (43 %), followed by France (14 %), Spain (6.6 %) and Finland (5.8 %).

The Ministry of Environment and Water is Bulgaria's national authority responsible for the Ecolabel scheme. The Ministry is supporting the initiative by setting relatively low fees compared to other member states and further reducing annual fees by 25 % for the first three companies awarded the Ecolabel. However, there have been no publicity campaigns to promote the environmental and economic benefits of Ecolabels in Bulgaria, and as a result there are currently only two companies whose products have been certified under this scheme, suggesting that the authorities should take more concrete action to promote the certificate.

Bulgaria's first Ecolabel

Despite the low financial costs of obtaining the Ecolabel, currently the Belovo Paper Mill is the first of only two Bulgarian companies to have obtained the certificate. It is the biggest paper tissue producer in Bulgaria, with over 100 years of experience. Its products, popularly known under the brand "Belana", range from tissue, MG paper, wrapping paper, greaseproof paper and fluting. After initially gaining the Ecolabel for three of its products in 2013, it has since extended its certified range to nine products. As part of its environmental strategy, the company also holds an ISO 14001 standard. The strategy also includes provisions for assessing the environmental impact of company's activities, technological update for a more environmentally friendly production process, implementation of environment management programs aimed at limiting pollution and measures aimed at informing and encouraging staff members to be more environmentally conscious.

The process to obtain an Ecolabel certificate in Bulgaria requires companies to submit their application to the Ministry of Environment and Water, alongside with specific studies demonstrating that the product is compliant with the relevant assessment criteria for its category and that its suppliers also fulfil environmental standards. The initial process to obtain the ecolabel took approximately 6 months. The Ecolabel means that throughout the entire production process, Belovo Paper Mill discharges less toxic or eutrophic substances into waters, has a lower energy consumption and related emissions to air, has decreased environmental damage related to the use of hazardous chemicals, uses sustainable fibres and applies sustainable

[42] **Application/Renewal and Extension/Modification fees are reduced by 30 % for** applicants registered under European Eco-management and Audit Scheme or by 15 % for applicants certified under ISO 14001 (reductions are not cumulative). Extension/Modification fees are reduced by 20 % for products awarded with other Ecolabel type I according to ISO 14024.

management principles in order to safeguard forests. The Ecolabel certifies that the company's production cycle is environmentally friendly, creating more business opportunities with large multinational companies such as Nestle and McDonald's, which have high ecological requirements for their suppliers.[43]

Case study: Production process and renewable energy

Established in 1999, Valiyan OOD[44] specializes in luxury wood processing and carpentry services, using digitally controlled machines and automated processes. It is one of the biggest and most reputable Bulgarian manufacturers of interior furniture and equipment, with 70 % of its production being directed at exports. Despite its growing success on the Bulgarian and European markets, Valiyan was also affected by the financial crisis, sharing most of the challenges faced by other Bulgarian SMEs.

The company had limited financial resources to update its production process and develop innovative solutions. Outdated equipment caused poor working conditions due to high levels of fine particulate matter and a heavy workload. Furthermore, since the beginning of the crisis, domestic demand for furniture dropped and large international retailers entered the Bulgarian market, driving the company to seek ways of sustaining high quality production with competitive prices, in order to maintain its market share. To boost its competitiveness Valiyan decided to invest in a number of machines that would reduce its production costs and environmental impact by increasing resource efficiency, achieving waste-free production, increasing manufacturing capacity and production volumes, enhancing its product portfolio and creating new workplaces. The company has obtained the support of the two major programmes funding green technological upgrades: OP Competitiveness and the Norwegian Financial Mechanism.

Within the framework of the projects, Valiyan has introduced new technologies that cover a large part of its production process, including cutting, grinding, shaping and polishing individual components, painting and varnishing furniture and packaging finished products. As these machines are automated, the company expects productivity levels to rise significantly by up to 4 times, and workload to be reduced. Furthermore, the automation of many processes reduces production times, wasted material and the reliance on external contractors in cases of large orders with short deadlines. The new machines will also expand the range of products that the company can offer its clients as they are much more flexible in terms of the size and type of materials used.

The majority of the old machinery used by Valiyan was installed between 2006 and 2008. The new generation of technical equipment is much more energy efficient, which will lead to energy savings ranging from 10 % to 60 % per unit. This will cut down production costs and also make the company more energy independent and less vulnerable to changes in electricity prices. The new machines also have a smaller environmental impact than the current technology used. Their lower energy consumption leads to up to 60 % less CO_2 emissions compared to the existing technologies and they are also fitted with much more effective filters that absorb fine particles. This is expected to improve the working conditions in the company and reduce its impact on the outside environment. Despite the automation of many production processes, the new machines will lead to the creation of 6 additional workplaces in the company and all relevant staff members will receive training to work with the new technologies. With the increased production capacity and Valiyan's growing customer base, the company expects to hire up to 30 more workers in the upcoming months.

As the installation of all machines has not been completed, it is difficult to estimate the overall financial savings resulting from the project, or the reduced environmental footprint of the company. However, Valiyan estimates that it will increase its production capacity by over 30 %, while production costs will drop by 15 %. On average, the company offers prices that are about 5-8 % lower than the competition on the international market, which is expected to yield an average 22 % annual increase of sales revenue, including a significant rise in exports and grow its national market share from 0.40 % to 0.64 %.

Case study: Cooperation with local authorities

Introducing green products and processes is not the only way in which Bulgarian SMEs can help the environment. Many companies, primarily larger ones, have organised individual and joint awareness raising campaigns on this topic. In recent years, Bulgarian small and medium enterprises have also launched ecological initiatives, such as the system for separate collection of hazardous household waste, run by BalBok Engineering Co.

Since 1990, Balbok has worked in the field of collection and treatment, including transport, repackaging, reuse and disposal of different types of hazardous waste. Based

[43] *Capital.bg*, „Първа българска компания с европейска екомаркировка", 10.02. 2013 г.

[44] OOD stands for the Bulgarian acronym of Limited Liability Company.

on the company's experience, corporate strategy and commitment to environmental protection, in 2011 BalBok developed the system on its own initiative and approached Sofia Municipality to collaborate on implementing this sustainable and environmentally friendly mechanism to collect hazardous household waste.

As stipulated by Art. 19 of the Waste Management Act, each municipality is responsible for organising the separate collection of hazardous household waste, which is paid for by citizens through their annual garbage tax. Given the relatively small volume of hazardous waste generated by households, Bulgarian municipalities do not provide separate containers for these substances. As households do not have access to facilities for the safe handover of hazardous materials, they often keep them in their home or throw them away together with the rest of their garbage, which can lead to several health and environmental hazards.

BalBok's solution is a new system centred on a mobile station (a specially equipped minivan), where citizens can hand over their hazardous waste to company experts, who are trained to handle such substances. The mobile station has a predefined schedule and it periodically visits different neighbourhoods in the participating towns. The collected waste is directly transported to one of the company's specialised sites for further treatment. All costs related to the system are covered by the municipality's garbage tax and do not require additional public financing. The system allows for the separate collection of hazardous household waste such as mercury, varnishes, paints, household cleaners and chemicals, contaminated packaging and older drugs, whose composition and properties pose a risk to human health and the environment.

The system guarantees the separation of hazardous and non-hazardous waste, which significantly reduces the risk of health hazards due to accidents and disruptions during the collection and disposal of solid waste, and further facilitates the separate collection and recovery of recyclable materials such as paper, metal, glass and plastic. The system also allows the company to sort waste systematically based on the substance type and code under the statutory waste classification, and collect data, which can be directly integrated into the official waste statistics.

The first pilot project was implemented by Sofia Municipality from the beginning of 2012. By 2014, the system had already been introduced in Plovdiv, Shumen and Sliven. Since the beginning of 2015 Veliko Tarnovo, Radomir, Sredets and Levski have also joined the initiative. The total number of citizens who have access to the service is over two million. The track record and growth of the initiative over the past four years is testament to its social value and sustainability. More than 1,500 households have benefitted from the system and over eight tonnes of hazardous waste has been collected, with a steady increase in both indicators, a sign of growing awareness and commitment towards environmental protection from citizens.

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The Applied Research and Communications Fund is a Bulgarian research non-profit organization, registered in public benefit, established in 1991. Its mission is to support the development of innovation and the knowledge economy in Bulgaria through:

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- research and analyses of development trends and policy options for supporting innovation as well as information and communication technologies;
- public-private partnerships among businesses, public institutions, the academic community and civil society for addressing specific issues of ICT and innovation based competitiveness.

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