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Potential for Development

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LIST OF ABBREVIATIONS

ARC Fund – Applied Research and Communications Fund
BEECIFF – Bulgarian Energy Efficiency for Competitive Industry Finance Facility
BGN – Bulgarian lev
BNB – Bulgarian National Bank
BPO – Bulgarian Patent Office
CIS – Community Innovation Survey
DG – Directorate General
EAP – Environment Action Programme
EBRD – European Bank for Reconstruction and Development
EC – European Commission
EEA – European Environment Agency
EEC – European Economic Community
EERSF – Energy Efficiency and Renewable Sources Fund
EHS – Environmentally harmful subsidies
EIF – European Investment Fund
EIP – European Innovation Partnership
EU – European Union
FDI – foreign direct investment
FEC – final energy consumption
GBIS – Green Business Innovation Survey
GDP – gross domestic product
GHG – greenhouse gas
GPP – green public procurements
ICT – information and communication technologies
IP – intellectual property
IPCC – Intergovernmental Panel on Climate Change
IPPC – integrated pollution prevention and control
IT – information technologies
KOE/TOE – kg/tonnes of oil equivalent
MEE – Ministry of Economy and Energy
NACE – Statistical Classification of Economic Activities in the European Community
NEC – National Electricity Company
NGO – non-governmental organisation
NSI – National Statistical Institute
NTEF – National Trust EcoFund
NUTS – Nomenclature of Territorial Units for Statistics
OECD – Organisation for Economic Cooperation and Development
OP – operational programme
OPC – Operational Programme Competitiveness
OPIC – Operational Programme Innovation and Competitiveness
OPRD – Operational Programme Regional Development
OPRG – Operational Programme Regions in Growth
PA – priority axis
PM – particulate matter
R&D – research and development
RTDI – research, technology development and innovation
RES – renewable energy sources
SEA – Single European Act
SEDA – Sustainable Energy Development Agency
SMEs – small and medium-sized enterprises
UMIS – Unified Information System for Management and Monitoring of EU Structural Instruments in Bulgaria

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Executive Summary

Climate change and growing economic competition are among the key challenges that the European Union and its member states are currently facing. In meeting these, innovation is a crucial factor. Realising the commercial and environmental potential of green growth by promoting green technologies is one of the main goals of the Europe 2020 strategy. The Bulgarian government has also committed itself to promoting green growth in order to meet EU targets on energy and climate. This report reviews the progress made towards greening the Bulgarian economy.

Green growth requires reducing the use of natural resources or at the very least maintaining the same level of resource consumption as economic output rises. In order to attain this, it is necessary to develop and adopt new and improved technologies and processes, methods and practices. Innovation is a crucial element in decoupling economic growth from the depletion of natural resources and environmental degradation. Green innovations are not limited to technologies, products and processes, but also encompass behaviours and attitudes.

Green innovations would allow Bulgarian businesses to capitalise on and improve their competitiveness. By producing environmentally conscious products and integrating green technologies in their production cycles, firms can upgrade their competitiveness and enter new international value added chains. The wide adoption of green innovations across economic sectors can also improve human health, reduce resource depletion and environmental degradation, as well as increase the security of energy supply. Given the low level of economic and technological development of the country compared to other EU member-states, achieving this transformation in Bulgaria would require significant social and policy innovations over a longer time horizon. The current report lays the ground for making better-informed policy decisions to achieve these ambitious goals.

European Environmental Policy Framework

The EU has one of the most comprehensive environmental legislations in the world. Since the adoption of the First Environment Action Programme in 1973 environmental policy has evolved from a scattered group of measures subordinate to the overriding objectives of market integration, to a central aspect of EU policy. At present the EU has over 500 Directives, Decisions and Regulations as a minimum common framework for the 28 member states covering nearly all aspects of the environment, as well as industry, energy, transport, fisheries, agriculture, regional development, research, innovation and external aid.

The increasing prominence of environmental policy in the Community's agenda culminated in the Europe 2020 strategy where green growth is put at the heart of the Commission's blueprint for competitiveness. Although it is assumed that high environmental standards stimulate innovation and business development, the structure and priorities of the European Commission elected in 2014 leave the impression that strengthening environmental legislation has been toned down until European economies recover from the crisis. However, the EU Commission and

Parliament have vowed to continue their drive towards ensuring higher standards for environmental protection and incentivising green behaviour in industry and society in the longer term.

With regards to decoupling economic growth and environmental degradation the resource-efficient Europe flagship initiative, one of seven under Europe 2020, has triggered the elaboration of a series of coordinated strategies and roadmaps creating a long-term policy framework up to 2050. Among them, the Roadmap for a Resource-Efficient Europe is the cornerstone of the policy efforts to transform the EU into an efficient, low-carbon economy. Its main goal is to prevent the damaging economic effect of rising and volatile resource prices and to boost eco-innovation by providing long-term predictability and incentives for businesses.

Green Growth in Bulgaria

In order to track the progress towards decoupling economic growth from resource depletion in Bulgaria, it is necessary to provide a baseline overview of the current state of green growth. This can be assessed through a number of indicators allowing a comparative analysis with the other EU member states, and particularly those from Central and Eastern Europe as they have a similar economic and technological legacy to Bulgaria.

Annual **greenhouse gas emissions** in Bulgaria have declined significantly, from 110 million tonnes in 1990 to 62 million tonnes in 2012. This has been primarily the result of the closure of the highly inefficient manufacturing sites from central planning and more recently the use of greener technologies. In 2012, 0.42 kg of CO_2 was emitted for every dollar of GDP in Bulgaria compared to the EU average of 0.23 kg of CO_2, making the country the most energy intensive member state. This can be attributed primarily to the carbon-intensive energy mix that relies to a large extent on low-grade fossil fuels but also to the technologically outdated energy infrastructure.

One of the main ways of achieving green growth is by improving **energy efficiency**. Between 1995 and 2012, Bulgaria's energy productivity (the ratio between energy consumption and GDP) almost doubled from 0.8 to 1.5, but this is still much lower than the EU average of 7. Economic growth in Bulgaria is yet to be decoupled from high levels of energy use. Low levels of energy efficiency are common in all sectors of the Bulgarian economy. Electricity generation and distribution – the most energy and emission intensive sector of the economy – suffers from large losses as a result of the technologically outdated grid and the over-reliance on electricity for heating. Furthermore, due to the low levels of energy efficiency in residential buildings, the average Bulgarian household is considered energy poor, as it spends more than 10 % of its annual income on energy products, making the drive for greening more problematic than in other EU members.

The use of **renewable energy sources** (RES) is another key element of green growth. In 2012, 17 % of all electricity consumption was generated from renewable resources, which is a significant increase compared to 9.5 % in 2004. This sudden growth has been overwhelmingly concentrated in solar and wind electricity generation, in line with the EU RES directives. Occurring, however, in a context of poor administrative and regulatory environment in Bulgaria, and recent economic stagnation, this development pushed prices up, allowing opponents to RES to associate them with rising prices and subsidised profits, with long-lasting negative effects on the industry.

Transport is the biggest producer of greenhouse gas emissions after the energy sector. The growing use of more modern and environmentally sound vehicles has not managed to offset the steady increase in motorisation in Bulgaria. The average age of the car fleet in the country for non-business use has stayed above 15 years. While the EU has reached an average of 5.1 % of use of biofuels in transport in 2012, Bulgaria is still lagging behind in this regard and has made no real progress since 2004.

Bulgarian Policies in Support of Green Industry Innovation

In Bulgaria the energy sector (energy production and retail) and energy efficiency of buildings receive a disproportionately strong policy attention compared to clean technologies and efficient final energy consumption in the industry. By delaying the introduction of across-the-board incentives for green industry behaviour, policy-makers run the risk of damaging national economic competitiveness in view of global trends and the emergence of similar policies in other countries. The few policy measures in the country related to green innovation and resource efficiency in the industry sector are relatively small in scale and have been designed and implemented primarily as a result of EU strategies and transposition of EU legislation.

Outside the energy sector, current green industry policies in Bulgaria focus primarily on increasing **resource efficiency in final energy consumption** (FEC) of large enterprises. A long-term target of 9 % FEC reduction by 2016, equivalent to 7,291 GWh annual savings, has been laid down in the National Energy Efficiency Strategy. Individual energy savings targets of 839 GWh/year (11.5 % of the national target) have been set for 297 industrial systems. The enterpris-

es mandated to achieve these targets are concentrated in food manufacturing (63), metal products (60), textiles (26), and services sectors (38, mostly water and sewage system operators). A handful of enterprises are responsible for contributing to more than half of the total required savings in industry: chemistry giant Solvay Sodi (310 GWh), Bulgarian Railway Company (58 GWh), textile manufacturer Nitex (30 GWh), transport company Somat (23 GWh), as well as pulp and paper manufacturer Svilosa (21 GWh). These enterprises have made progress primarily by introducing passive energy management measures such as retrofitting of manufacturing plants, improvements in lighting systems and technological upgrade of industrial systems. Active energy management tools such as **energy management systems** for measuring, analysing and improving energy consumption **are still a rarity**, except in the largest and most energy intensive enterprises, particularly in the utility, extraction and processing industries. At present, no legal obligations and little incentives exist for small and medium enterprises (SMEs) to improve their energy efficiency.

Public authorities in Bulgaria have in practice disregarded the voluntary instrument of **green public procurement** (GPP) as a policy tool to generate the necessary market demand for green products and services that would support investment in and wide adoption of green innovations. In 2013, the central government awarded only 29 GPP contracts amounting to around €50 million. In comparison, during the same year a total of 22,779 public procurement contracts for more than €4.1 billion were awarded by all public bodies in the country. The negligible part of public contracts awarded under green product criteria suggests that public authorities fail to use their vast purchasing power to influence the marketplace towards greater environmental consciousness. By failing to demonstrate and communicate the environmental and economic benefits of GPP, the public sector is missing the opportunity to encourage the private sector to use green criteria for its own procurement.

Funding for Green Industry Innovation

The primary sources of green industry innovation funding, for which there is publicly available information have been EU funds. Large parts of **Operational Programme Competitiveness 2007 – 2013** (OPC) have been dedicated to the greening of the Bulgarian economy. As of October 2014, close to 43.7 % of all contracted funds under OPC, or more than €511 million, have been associated with Priority Axis (PA) 2 "Increasing efficiency of enterprises and promoting supportive business environment". The majority of projects funded under this PA are related in varying degrees to increasing resource efficiency and productivity in enterprises and result in reduced environmental impact. As much as 60 % of the PA's budget has been channelled through technology upgrade procedures, which are conducive to more efficient use of resources.

The grant procedure with the most direct relation to green innovation – Investment in Green Industry – was launched in 2011 and supported 30 large enterprises with close to €40 million grant funding. It has aimed to support companies to acquire new energy efficient equipment and recycling capacities, introduce new materials, expand production and product portfolios, integrate energy management systems and invest in RES. Half of all investment projects under this procedure occurred in three industries – manufacture of basic metals, manufacture of metal and manufacture of plastic products. In addition to grant schemes, the Energy Efficiency and Green Economy Programme combined EU Structural Funds grants with commercial bank lending. As of October 2014, a total of 456 contracts in the amount of €145.8 million have been lent to SMEs for technology and energy audit investment projects in priority manufacturing sectors such as the production of chemicals, paper, plastic, rubber, machinery and equipment, electronics and motor vehicles. The co-funding rates required under EU-funded projects mobilised additional resources from businesses, which otherwise probably would not have been spent on production greening.

Operational Programme Innovation and Competitiveness (OPIC) 2014 – 2020 recognises the prominence of green growth in industry and has a PA focused on it. According to drafts of the programme a total amount of €355.7 million, or one quarter of the new OP, will be made available specifically for the transition to a low-carbon economy, resource efficiency, and environmental protection.

The available funding for SMEs in the area of green solutions and resource efficiency is complemented by three smaller scale sources – the Energy Efficiency and Renewable Sources Fund, Innovation Norway's Green Industry Innovation Programme in Bulgaria and the National Trust EcoFund. Unlike the explicit focus of OPC and OPIC on supporting enterprises, the abovementioned funds are available to a wider range of beneficiaries and only part of their resources is absorbed by the private sector.

Green Innovations in Bulgarian Businesses

The current report has assessed the state of green innovation in Bulgaria through a specialised **Green Business Innovation Survey (GBIS) 2014**. The survey provides a snapshot of current technological activities and behavioural characteristics of companies, identifies windows of opportunity for environmental technology up-take, and informs policy recommendations.

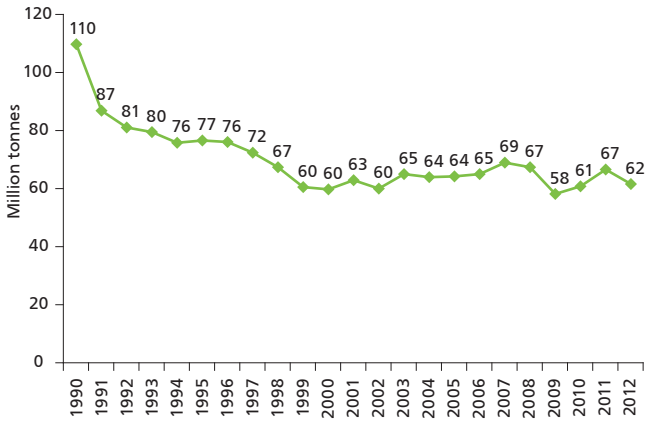
The survey revealed that **the large majority of Bulgarian enterprises fail to monitor their environmental footprint in its entirety** and ramp up any investments for greening their activities. The vast energy saving and cost reducing potential of green measures – even non-sophisticated and inexpensive ones – remain largely untapped. These missed opportunities suggest that private sector managerial capacity is low, modernisation efforts are insufficient and that weak public policies do not provide incentives in this area.

Green activities are more prevalent in larger companies, with a stronger international exposure, operating in the more heavily regulated economic sectors (e.g. mining). For 43 % of Bulgarian innovative companies economic and technical aspects (e.g. durability and reliability of new products) play a more important role in their innovation than green issues (e.g. biodegradability of used materials, avoidance of substances harmful to human health).

Close to **60 % of the Bulgarian enterprises report to have at least one environmental footprint measurement system**, allowing them to monitor and manage at least one of the following: GHG emissions; toxic chemicals; energy and/or water consumption; material use; water, soil and air contamination; waste volume. Judging by the type of the most prevalent systems, those related to the consumption of materials, energy and water and the production of waste, it can be inferred that Bulgarian companies invest in the monitoring and managing of their environmental impact when it comes to key resources directly related to profitability or to meeting statutory environmental standards.

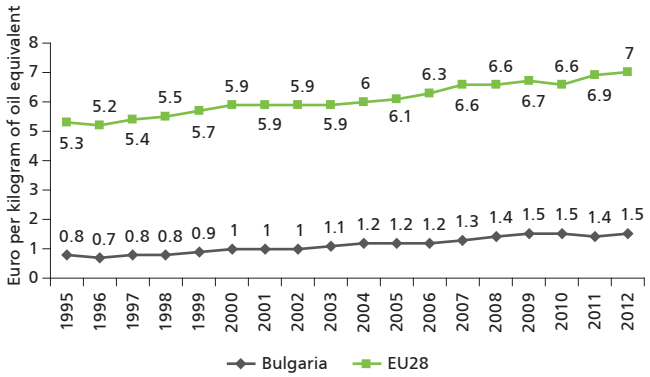
GBIS reveals that 40 % of Bulgarian companies have made efforts to increase their energy efficiency while 27 % have undertaken measures to reduce their CO_2 emissions. In terms of **preferred green measures**, the average Bulgarian enterprise opts for **less expensive and non-technological solutions** such as replacing windows, installing wall insulation and using more energy efficient appliances and lighting products. More than half of the companies which have adopted one or more energy efficiency measures report a decrease between 10 and 20 % in their electricity costs.

GREENHOUSE GAS EMISSIONS (INCLUDING INTERNATIONAL AVIATION) IN BULGARIA (1990 – 2012)



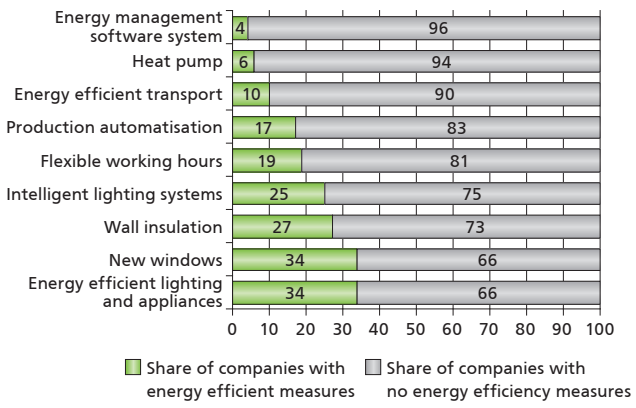
Source: European Environment Agency, 2014.

ENERGY PRODUCTIVITY IN BULGARIA AND THE EU (1995 – 2012)



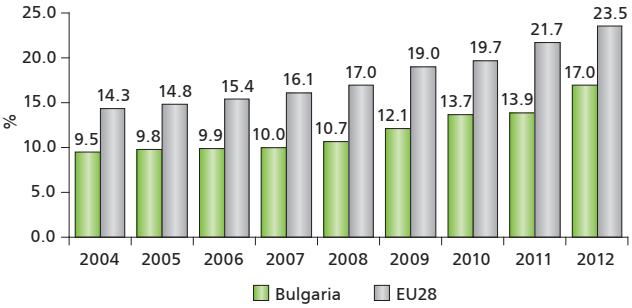
Source: Eurostat, 2014.

SHARE OF BULGARIAN COMPANIES WITH ENERGY EFFICIENCY MEASURES, BY TYPE OF MEASURE, %



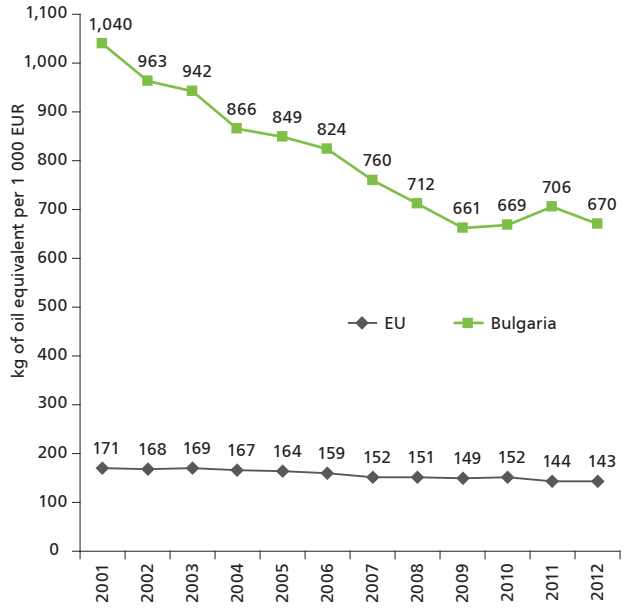
Source: ARC Fund, GBIS 2014.

SHARE OF GROSS ELECTRICITY CONSUMPTION GENERATED FROM RENEWABLE ENERGY SOURCES IN BULGARIA AND THE EU (2004 – 2012)



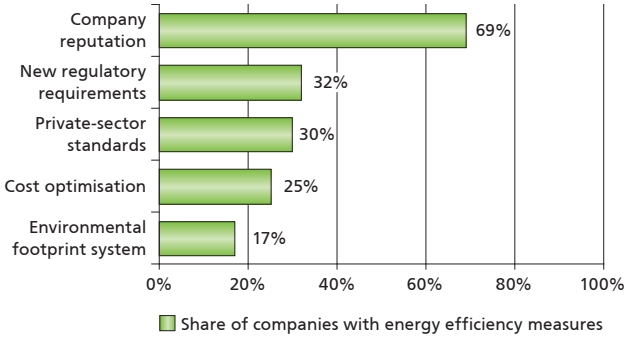
Source: Eurostat, 2014.

ENERGY INTENSITY IN BULGARIA AND EU AVERAGE (2001 – 2012)



Source: Eurostat, 2014.

MOST COMMON REASONS FOR INTRODUCING ENERGY EFFICIENCY MEASURES BY BULGARIAN COMPANIES



Source: ARC Fund, GBIS 2014.

Introduction

Addressing environmental challenges and enhancing SME competitiveness through the development and adoption of innovative technologies and processes are among the top priorities at the European Union level. Realising the growth potential of the green economy by increasing energy efficiency and developing and commercialising innovative green technologies is one of the pillars of the EU's growth strategy – Europe2020. To meet the ambitious EU targets on climate and energy, the greening of the Bulgarian economy was given high priority in a number of strategic documents. In this report ARC Fund **assesses the extent to which the political commitment and the funding made available so far have continued to green the Bulgarian economy**.

Achieving green growth for the entire economy requires that the new green technologies, processes and behaviours have a high adoption rate. This implies high **demand for green innovations**, which is difficult to ensure for a variety of reasons, applicable more in Bulgaria than in the rest of the EU. The technological innovations necessary to achieve green growth, for example by making more efficient use of natural resources or producing energy from alternative sources, are still more costly than other more energy-intensive solutions. Furthermore, the incumbent technologies and processes are dominant; green innovations require long development and adoption periods; there is still widespread uncertainty regarding their effectiveness.

Demand is more difficult to ensure in countries like Bulgaria where the population have lower disposable income and the economy is dominated by micro and small enterprises with limited finances available to invest in green technologies. While everyone will suffer from the deterioration of the environment if green innovations are not more widely adopted, **demand is unlikely to grow unless public policy is used effectively to create the right environment** for their development, coupled with financial incentives to stimulate their adoption. While in theory publicly supported introduction of green innovations will lower their prices, thus making them more affordable for both industries and individual consumers, and will create jobs, practice has shown that its mismanagement may lead to waste of precious public resources. The impact of public interventions on the greening of the economy is highly dependent on regulatory quality, on the flexibility of the product and labour markets, and other characteristics, making the management of such a transition a highly politicised and difficult issue.

While it is clear that innovations are crucial to achieving green growth, it is still difficult to **measure green innovation**. As there is no single widely accepted set of indicators or methodology to measure their development or their adoption, they are usually assessed in terms of the **number of climate control or environment related patents**. This method has three main shortcomings: not all patented technologies reach the market place; there are many more products, processes and even behavioural changes which have a positive impact on resource depletion and energy efficiency but are not be subject to patenting; even if a patented product/process reaches the market place, its impact on the environment depends largely to its adoption

rate. The other common approach to measuring green innovation is by looking at the **funding made available for green research and development activities**. While financial resources are crucial for developing the technologies themselves, their environmental impact is dependent on how widely there are adopted, which in turn relies on high demand levels and the absorption capacity of the product and labour markets, as well as widespread awareness about their benefits. Even less information is available about societal practices, such as work patterns, city planning and transport systems which make a big contribution towards green growth. **Surveys** still prevail as the most common way of gathering information about green technologies in businesses as well as environmentally conscious behaviour among the public.

This report is part of a larger **effort towards greening the Bulgarian economy** by highlighting the business opportunities that can accelerate the development and adoption of green technologies. In light of ARC Fund's long-term commitment towards boosting SME competitiveness in Bulgaria and promoting good practices, the focus of the report is on the business sector and the adoption of green innovations in SME's in particular. As the topic of green growth and its link to innovations is still relatively new to Bulgaria, policy makers, SME's and the general public are unaware of both the economic benefits of innovative green solutions and their positive impact on the environment. This report provides an overview of the wider benefits of introducing green innovations in Bulgaria in light of the most pressing economic and societal challenges faced in the country today, with the intention of spreading awareness and boosting demand for such technologies and products, as well as fostering behavioural change in businesses and the general public.

There is no readily available data that allow a straightforward identification of the progress towards the greening of the Bulgarian economy. Therefore, this report analyses **the Bulgarian economy from an energy and environment point of view**, which can serve as a baseline for future studies in this field. In particular it assesses the progress towards reducing greenhouse gas emissions, improving energy efficiency both in the business sector and in households, the proliferation of renewable energy sources, and the greening of the transport sector. The report shows what progress has been made towards decoupling economic growth and prosperity from depletion of natural resources, although without a strong indication of how much green innovations have contributed to this process. The report includes an **in-depth review of the EU and national policies that shape green growth in Bulgaria**. It concludes with the results from ARC Fund's pilot Green Business Innovation Survey, which provides an up-to-date assessment of the extent to which green innovations are being developed and used in local companies.

* * *

"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations".[1] Simply put, an innovation can be defined as a new idea the ultimate aim of which is to "create value from ideas" and which has a successful application in practice. In the context of the recent economic crisis, innovation has become the go-to solution for improving competitiveness, reducing costs and increasing market share and profits in businesses across the world. It is important to point out that while innovation may often be used interchangeably with research and development (R&D), it actually encompasses an entire process. It can start with R&D, but also includes sourcing, production, distribution, sales and marketing activities. Furthermore, for innovations to emerge, especially in terms of processes and methods which may not require prototypes and testing, it is not necessary to dedicate resources to specific research. In fact, innovations often arise from the work process unintentionally or by chance. It is important to bear these distinctions in mind when assessing innovations and focus on their overall output and impact, rather than only on their inputs.

While the definition of innovation is more widely accepted, the concept of green innovation is still under development and there are various definitions that are being used in this context, as well as various terminologies. In this report, the terms "green innovation" and "eco-innovation" are used interchangeably, with the idea that green innovation can be a product, process, service or method and that it should be competitive in the market by addressing consumers' demands and needs. Furthermore, green innovation should at least reduce, if not altogether eliminate, the negative effect of resource consumption on the environment compared to the available alternatives. Some definitions also suggest that an innovation can be considered green, only if its entire life cycle and its original intent are taken into account.

In order to set a broad base for this analysis, green/eco-innovation is understood as **encompassing all aspects of other innovations, but it also has two further elements:**

- **It represents innovation that results in a reduction of negative environmental impacts, irrespective of whether that effect is intended or not.**
- **The scope of green innovation may go beyond the conventional organisational boundaries of the in-**

[1] Guidelines for Collecting and Interpreting Innovation Data, Oslo Manual, OECD/Statistical Office of the European Communities, 2005, p. 46.

novating organisation and involve broader social arrangements that trigger changes in existing socio-cultural norms and institutional structures.[2]

Innovations are still not considered a priority in Bulgaria. This is the result of several factors including the lack of stable political environment and political will to promote innovations by developing a comprehensive and effective national strategy; a decrease in foreign direct investment in the last five years and limited investments from the state budget (75 % of all public investments in this field come from EU funding); lack of an institutionalised system that facilitates the transfer of innovative products and processes from an academic setting to the market. **These obstacles reduce the chances of Bulgarian businesses of capitalising on the potential of both innovations in general and green innovations in particular to improve their competitiveness and foster growth, while simultaneously decreasing environmental risks and reducing energy insecurity and energy poverty in the country.**

From the point of view of the business sector, green innovations can be very beneficial both in terms of their production and their application. On the one hand, Bulgarian businesses need to adapt their production in order to meet growing consumer demand and to business regulations for products and technologies which have a lesser environmental impact in order to be competitive on the international markets. On the other hand, each individual business can benefit significantly from the reduced financial costs which result from the adoption of technologies and processes which optimise or reduce the use of natural resources and energy, leading to lower production costs and higher profit margins.

The widespread adoption and use of green innovations also has wider societal benefits. In view of the context in Bulgaria over the last several years, when high energy prices for end consumers and lack of transparent governance in the energy sector led to social, political and economic turmoil, green innovations have the potential to address some of the main challenges that the country is faced with today. On a wider scale, updating Bulgaria's technical infrastructure with clean technologies not only in small businesses, but also in large manufacturing and power plants, as well as in the transport and services sectors, would lead to a significant reduction of environmental risks and air pollution (which is currently both an environmental and health hazard). Furthermore, green innovations can make a significant contribution towards achieving greater energy independence and higher energy efficiency, which will ultimately contribute to higher levels of energy security for the whole country. By producing innovative green products, particularly aimed at households, Bulgarian firms can also help address the widespread levels of energy poverty among the population. Domestically produced efficient appliances and retrofitting technologies can significantly reduce the share of the income that households spend on energy products, whilst making more efficient use of their spending, particularly with regards to heating.

[2] OECD, 2009, "Sustainable Manufacturing and Eco-innovation: Towards a Green Economy", Policy Brief.

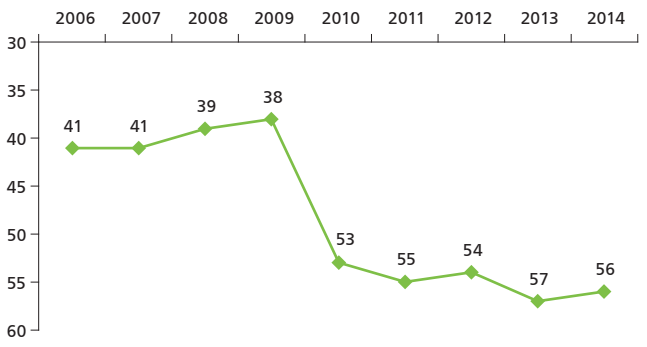
Major Green Innovation Challenges

Low Economic Competitiveness

The introduction of green technologies and the development of eco-innovations both in the system as a whole and in individual firms have a great potential for improving the overall competitiveness of the economy, as well as that of individual businesses in Bulgaria. According to the World Competitiveness Yearbook, Bulgarian competitiveness is relatively low. In 2014, Bulgaria is in 56th place out of the 60 countries included in the survey and has not made any significant improvement compared to the previous four years, indicating a state of stagnation of the domestic economy, a sign of long-term structural problems. A key element contributing to the low economic competitiveness on a national scale is the state and efficiency of the energy system. An inefficient energy system leads to higher energy prices for industrial consumers, which in turn makes local products more expensive and less competitive on the international market. Investing in the modernisation of the energy grid will reduce losses, improve efficiency and lead to lower prices.

Individual businesses can also take steps to reduce their energy costs by introducing green measures through more resource efficient production methods as well as by installing on-site energy generation technologies, making them more energy independent. The data presented in this report show that these technologies are yet to be rolled out on a large scale in domestic businesses. Bulgarian firms also have not tapped into the great potential for economic gains which could result from developing innovative green technologies and products. This is the result of a variety of factors, ranging from relatively low levels of domestic demand for such goods, lack of sufficient funding for research and development and very weak links between the business sector and research institutions and academia. Creating demand for green innovations exogenously is rather difficult and requires higher levels of awareness regarding the benefits of such goods. Given that financial resources are limited and available from a relatively small range of sources, they must be distributed more effectively. Finally, the establishment of a stronger link between businesses and research organisations can be achieved by relying on intermediary bodies – such as non-governmental organisations and technology transfer centres – which interface

Figure 1. BULGARIA'S RANKING IN THE WORLD COMPETITIVENESS YEARBOOK (OVERALL, BASIC INFRASTRUCTURE AND SCIENTIFIC INFRASTRUCTURE) (2006 – 2014)



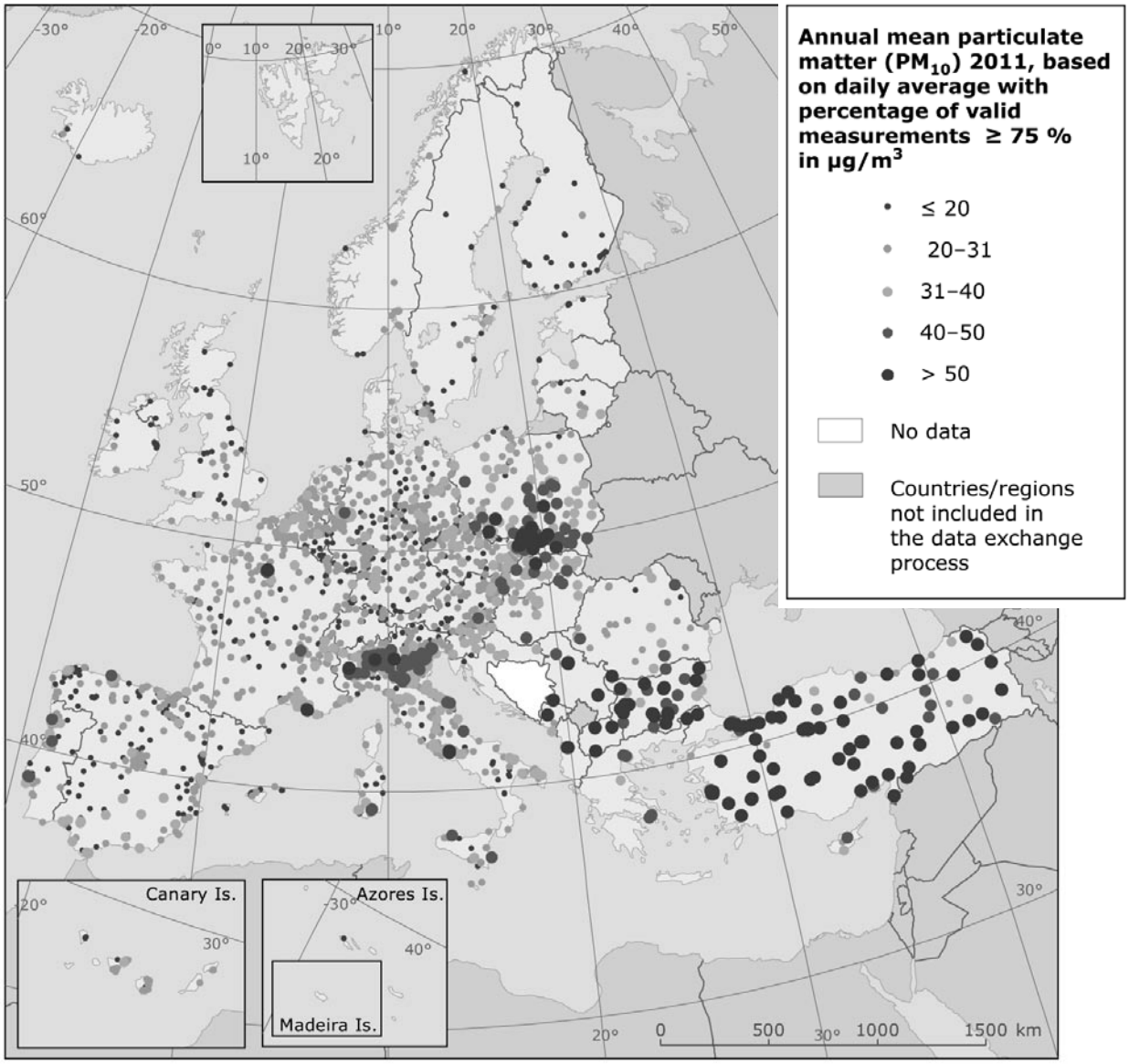
Source: World Competitiveness Yearbook, Institute for Management Development, 2014.

with both sectors and can foster partnerships that would be beneficial to both sides.

Environmental Degradation

In Bulgaria, one of the biggest environmental risks is air pollution, as **some of the highest levels of concentration of solid and liquid particulate matter in the EU have been measured in Bulgaria**. Pernik, Plovdiv, Pleven and Dobrich[3] are among the ten most polluted cities in the EU. Particulate matter derives not only from natural sources, such as sea salt, naturally suspended dust, pollen, and volcanic ash but also human activities such as fuel combustion in thermal power generation, incineration, domestic heating for households, and fuel combustion for vehicles. These particles are concentrated up to 20 meters above ground and **they have a negative effect both on human health and on the environment**. A prolonged exposure to such particles can lead to cardiovascular, respiratory and neurological diseases in both people and animals, as well as to pollution and changes in local ecosystems.[4] The high values of particulate matter in the air result from heat and power generation activities in Bulgaria and are the result of the predominant use of lignite coal, which is particularly car-

Figure 2. ANNUAL MEAN CONCENTRATIONS OF PARTICULATE MATTER (PM10) IN EUROPE BASED ON DAILY AVERAGES WITH AT LEAST 75 % OF VALID MEASUREMENTS, IN µg/m³ (2012)



Source: EEA, AirBase v.8, 2014.

[3] European Environment Agency.

[4] Air quality in Europe – 2013 report.

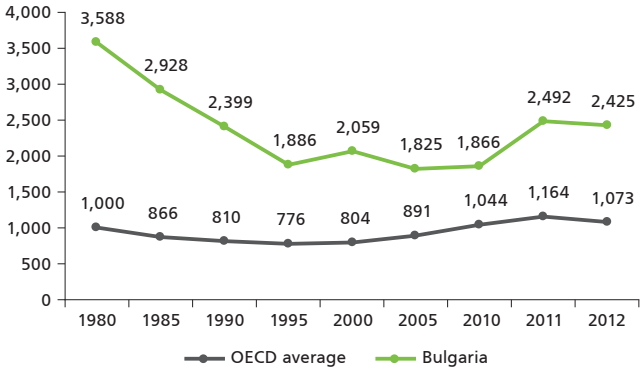
bon intensive due to its high moisture content.[5] Given that human activities related to energy generation, heating and transportation contribute significantly to air pollution, the introduction of green technologies such as electricity generation from renewable energy sources (both for mass and on-site production), the improvement in the energy efficiency in both the residential and industrial sector (thus reducing overall energy demand) and the use of hybrid or electrical vehicles has the potential to significantly reduce particulate matter concentration. The reduction of air pollution is also closely associated with the reduction of energy poverty. Close to two thirds of the Bulgarian population still uses coal and wood for heating purposes, which is both inefficient and highly polluting.

A reduction of the carbon-intensity in Bulgaria would result not only in the improvement of air quality, but also in financial gains for the country. As Bulgaria is now part of the Emissions Trading System of the EU, **the higher the number of emission quotas it has at its disposal, the bigger the profit it can make by selling them to other more carbon-intensive countries**. In 2012 the Ministry of Environment and Water registered a total profit of BGN 43,298,028,[6] while in 2013 this amounted to BGN 103,695,880 (approx. €22 mln and €53 mln, respectively).[7] The proceeds from the emissions sale are used to partially offset the losses that the National Electric Company (NEC) has incurred for purchasing power generated from renewable energy sources, but also served to cover a fiscal gap in the energy system created by company mismanagement. Part of these funds could be allocated to the development of new green technologies, which would in turn further reduce carbon emissions and generate more profits.

Energy Insecurity

According to the International Index of Energy Security Risk developed by the Institute for 21st Century Energy at the U.S. Chamber of Commerce, **Bulgaria has one of the highest energy security risks both nominally and in comparison to the average for the OECD** member states.[8] While Bulgaria's index has continued to decrease since 1980, it is still among the highest in relation to the countries included in the study, and has started to rise again since 2010. A closer look at the individual indicators which make up the index suggests that the main factors contributing to the high levels of energy insecurity in Bulgaria are the high values of energy intensity of the economy and the high levels of import dependence.

Figure 3. INTERNATIONAL INDEX OF ENERGY SECURITY RISK IN BULGARIA AND OECD AVERAGE (1980 – 2012)

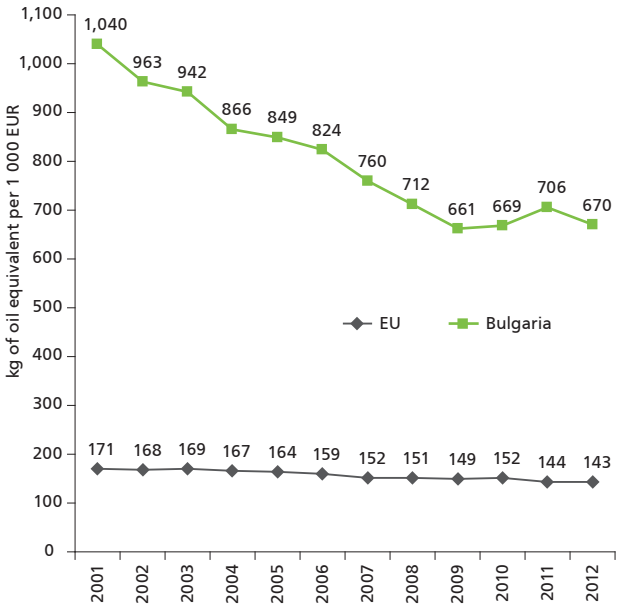


Source: Institute for 21st Century Energy, 2013.

Energy Intensity

Bulgaria suffers from a particularly high level of energy intensity in all of its dimensions, including energy expenditure intensity, carbon intensity in relation to GDP, petroleum intensity and transport energy intensity. This is partially the result of an outdated energy infrastructure and the traditionally ineffective energy consumption patterns, as well as the extensive losses during the transmission, distribution and consumption stages of the energy system. In

Figure 4. ENERGY INTENSITY IN BULGARIA AND EU AVERAGE (2001 – 2012)



Source: Eurostat, 2014.

[5] European Commission, 2010, "SMEs and the environment in the European Union".

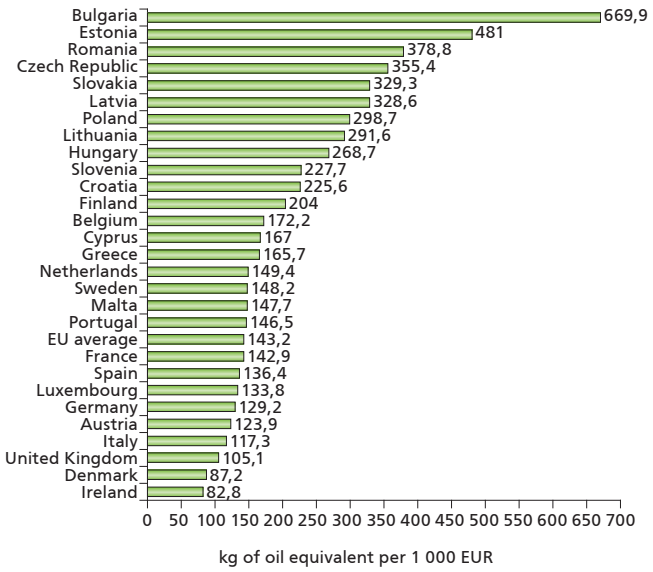
[6] Отчет за степента на изпълнение на утвърдените политики и програми на Министерството на околната среда и водите към 31.12.2012 г.

[7] Отчет за степента на изпълнение на утвърдените политики и програми на Министерството на околната среда и водите към 31.12.2013 г.

[8] International Index of Energy Security Risk developed by the Institute for 21st Century Energy at the U.S. Chamber of Commerce.

fact **over 50 % of the generated electricity is lost during the transmission and distribution stages,** in comparison to an average of 30 % across the EU.[9] This makes Bulgaria the most energy intensive economy in the EU, although the country has made big steps forward in cutting intensity almost 40 % since 2001. **Investing in the modernisation of the energy system would initially require big expenditure, but in the long run this would reduce energy losses and demand, leading to significant additional savings.**

Figure 5. ENERGY INTENSITY IN EU MEMBER STATES (2012)

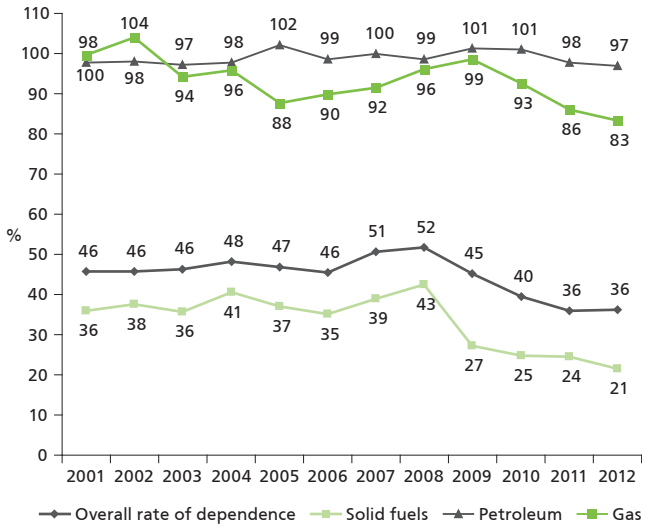


Source: Eurostat, 2014.

Energy Dependence

In order to improve Bulgaria's energy insecurity, cutting the energy intensity must be accompanied by a decrease in the country's dependence on imports of fossil fuels used for energy generation. **Lignite coal is currently the only indigenous energy sources extracted in Bulgaria**. While coal is an indigenous energy source responsible for close to 40 % of the country's primary energy supply and a significant part of the power generation capacity, it is a heavy pollutant and therefore should not be relied on for long term independence. **Bulgaria imports virtually all of its natural gas and crude oil, which makes it very vulnerable to external political and economic shocks**. If Bulgaria were to develop alternative energy sources and at the same time improve its energy efficiency, it would become more independent in meeting its energy demand. Green innovations could therefore play a key role in this process both with regard to renewable sources and energy efficient technologies and products. The acquisition, installation and rollout of such technologies require a sizeable investment, from both the public and private sector. However, the growing popularity of such technologies on a global level has already resulted in a significant reduction in their costs. In the future, Bulgaria has the potential to become a player on the rapidly growing green energy market and becoming a producer of renewable energy and energy efficiency technologies. The great advantage of green technologies is that they can spur a process of energy decentralisation, as they are not only used for mass energy production, but can also be installed in most homes, thus making individual households energy independent from the grid. If the electricity market is further liberalised, individual small power producers could sell their excess capacity back to the grid giving further incentive to invest in renewable energy expansion.

Figure 6. BULGARIA'S ENERGY DEPENDENCE BY TYPE OF FUEL (2001 – 2012)[10]



Source: Eurostat, 2014.

Energy Poverty

One of the main problems resulting from the high levels of energy intensity and dependence is widespread energy poverty. Based on the definition of energy poverty adopted in the European Parliament resolution on the Energy Roadmap 2050, energy poverty is "a situation in which over 10 % of household budgets is spent on energy."[11] By this definition **the average Bulgarian house-**

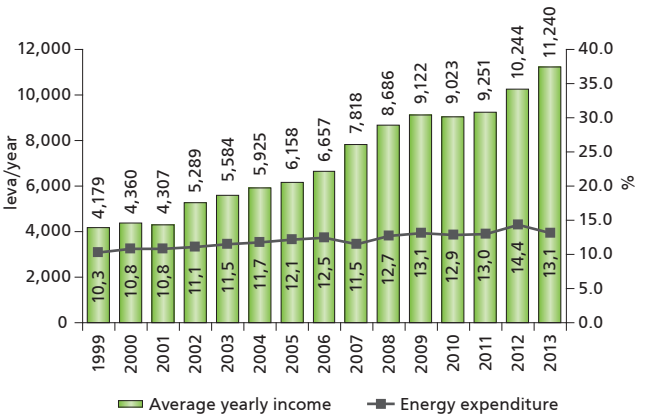
[9] Center for the Study of Democracy, 2014, "Energy Sector Governance and Energy (In)security in Bulgaria".

[10] Energy dependency shows the extent to which an economy relies upon imports in order to meet its energy needs. It is calculated as net imports divided by the sum of gross inland energy consumption plus bunkers.

[11] European Parliament resolution of 14 March 2013 on the Energy roadmap 2050, a future with energy (2012/2103(INI)).

hold has been energy poor since 1999 and the share of income spent on energy has continued to increase at a higher rate than average income. Given that energy prices are kept artificially low and any suggestion of investing in new generation capacities, modernisation of the electricity grid or energy efficient technologies that would increase power generation costs is met with great discontent by the public. In order to mitigate the increase in energy prices necessary to finance these improvements, individual households can reduce their dependence on the grid and simultaneously boost the green technology industry in Bulgaria by increasing demand for such products. By installing a variety of green technologies such as on-site electricity generation capacities (e.g. photovoltaic panels), wall insulation and energy efficient windows, low energy household appliances and smart meters, households could significantly reduce their energy consumption and expenditure. If Bulgaria succeeds in creating a green industry to produce these technologies locally, the shift towards carbon-neutral and energy independent households could also result in job creation and economic growth.

Figure 7. ENERGY POVERTY IN BULGARIA (1999 – 2013)



Source: National Statistical Institute, 2014.

European Environmental Policy Framework

The EU has one of the most comprehensive environmental legislation in the world. The introduction of a common environmental policy is based on the assumption that high environmental standards stimulate innovation and business development. It has thus become increasingly interwoven with ongoing strategies to create and maintain a sustainable, resource efficient and low-carbon economy.

EU environmental policy has been evolving within the framework of a complex multi-level governance structure and in strong correlation to global and regional economic developments. Economic crises (e.g. 1973 oil crisis) or political events (e.g. the German reunification) have significantly affected the amount of policy attention in the area and at times also lead to periods of cooling of enthusiasm among member states to agree upon and ensure effective implementation of ambitious environmental targets. At the end of 2014, in the aftermath of the most severe economic crisis in Europe in decades, **the structure and priorities of the European Commission elected in 2014 suggest that strengthening environmental legislation has been downgraded in importance**. In contrast, reorganising Europe's energy market, diversifying energy sources and reducing energy dependency rank higher on the political agenda.

However, in the long-term the EU Commission and the European Parliament will **continue their drive towards ensuring higher standards for environmental protection and incentivising green behaviour** in industry and society. The following trends and developments, the roots of which can be traced back to the 1970s and 1980s, reinforce such expectations:

- growing public awareness and support for green policies;
- increasing understanding of the economic benefits of resource efficiency and green economy;
- growing energy security concerns;
- increasing priority of green considerations in the EU Treaties and penetration into all major policy areas;
- adoption of ambitious long-term strategies and action plans and improving; implementation of environmental legislation;
- strengthening of EU's institutional set-up in the field of environment;
- EU's world leadership in developing environmental legislation.

Evolution of EU Environmental Policies

Over the last 40 years, European environmental policy has evolved from a scattered and uncoordinated set of measures subordinate to the overriding objectives of market integration to one of the best known and central aspects of the EU. Currently, **EU's detailed system of environmental legislation provides a minimum common framework for the member states** and covers almost the whole spectrum of environmental issues and areas such as agriculture, energy, transport, fisheries, regional development, research, innovation and external aid. Environmental policy has gradually featured more and more prominently on the Community's agenda and it has been included as an important objective in the EC Treaty. With the development of EU environment framework legislation the range of available

instruments has expanded as well, currently featuring not only command and control instruments but also financial and technical ones – R&D support, eco-labelling, Community system of environmental management and auditing, etc. The mainstreaming of environmental considerations strives to ensure a more coherent and systemic approach towards environmental challenges, address trade-offs and maximise synergies.

At present, the EU has over 500 Directives, Decision and Regulations covering nearly all areas of the environment.[12] One of the most pressing challenges in front of the EU is reconciling the pursuit of the different and often competing policy goals of competitive economic growth and environmental protection. The fact that by far the largest number of open infringement proceedings brought against member states at the end of 2013 were related to the policy area of environment (334 cases or 25 % of all) leads to the crucial but largely unresolved concerns of effective implementation and policy coherence.[13]

Developments in the field of environmental legislation and policy at the European level since the 1960s offer an interesting example of how the European project has expanded from the specific economic sphere of market integration to address new social challenges. **Multiple and diverse drivers and actors have shaped the evolution of EU environmental policies**, which over the decades has been characterised by:

- economic conditions in the EU and its member states;
- social demands and support for actions in the realm of environment;
- multilevel governance and tension between the national and supranational level;
- role of non-state actors in the policy making process;
- efforts towards better implementation and increased effectiveness of legislation;
- international developments;
- pressure to address global environmental challenges.

The Seven Environment Action Programmes

The **EU environmental policy is implemented by way of the Environment Action Programmes (EAP)** which form the policy framework for individual law-making procedures. In the course of the past four decades, since the adoption of the First EAP in 1973, EU environmental policy and legislation have gradually become one of the main EU areas of intervention. The speed and scope of the evolution of EU environmental action is characterised by the European integration process and the gradual extension of EU jurisdiction in areas which fall outside the realm of the original economic mandate. Even though the EU may legislate only on the basis of explicit powers endowed by the treaties, with respect to the protection of the environment the absence of a specific legal basis in the original Treaty establishing the European Economic Community (EEC) has not prevented EU action in this field. Initially, **environmental laws were justified as removing barriers to free trade distorting competition** and had single issue focus such as radiation, vehicle emissions, chemicals, packaging and labelling.

Growing public concern about the environment and parallel international developments, including the 1972 Stockholm Declaration on the Human Environment, became cat-

Box 1. UNDERLYING PRINCIPLES OF THE ENVIRONMENT ACTION PROGRAMMES

The Environment Action Programmes (EAP) are forward-looking exercises and contain the European Commission's view concerning the objectives, principles, priorities and lines of actions of the EU. Since 1973, EAPs have been issued periodically to cover periods ranging from five to ten years and signpost significant forthcoming measures. The concrete measures to be implemented are then adopted through separate processes.

Throughout the years, **EAPs have introduced or endorsed key principles** which underpin EU environmental policy. They include:

- **subsidiarity principle** (wherever possible, action should be taken by the authority as close as possible to the people it affects);
- **precautionary principle** (decision-making should be based on the results of the scientific and risk evaluation);
- **polluter pays principle** and the **preventing pollution at source principle** (everyone who causes environmental damages, dangers and risks should avoid, reduce and combat those);
- **sustainable development principle** (the needs of present generations should be met without jeopardising the ability of futures generations to meet their own needs).

[12] Manual of European Environmental Policy, 2010.

[13] COM(2014) 612, 31st Annual Monitoring Report on the Application of EU Law for 2013.

alysts for the **adoption of the First EAP covering the period from 1973 to 1976**. This is regarded as the starting point of common EU environmental policy as it provided a broad framework of principles and objectives and was followed by the establishment of the Environment and Consumer Protection Committee (DGIII) and the Committee on the Environment in the European Parliament. The First EAP had been followed by the Second in 1977 and the Third in 1983.

During this period a series of directives were adopted on protection of natural resources, nature conservation, waste management, noise abatement and others. Environmental legislation at that stage was adopted based on a vertical and sectoral approach to environmental problems and it was mostly related to limiting pollution by introducing minimum standards. Without proper legal basis, interventions can be described as piecemeal and uncoordinated.

Table 1. OVERVIEW OF THE EVOLUTION OF EU ENVIRONMENTAL POLICIES

European Action Programmes (EAP)	General approach		First EAP (1973 – 1976)			Second EAP (1977 – 1981)		Third EAP (1982 – 1986)		Fourth EAP (1987 – 1992)		
			Avoidance of free trade distortion. General principles of EU's environment policy. Quality-oriented approach to environmental objectives.			Operationalisation of general principles. Introduction of environmental impact assessment.		Shift from the quality-oriented approach to prevention and emission reduction.		Environmental protection receives its own chapter in the Treaty – a turning point in EC environmental policy. A shift from 'trade orientation' to a 'sustainability frame'. Integrated approach. New incentives-based instruments. Impact analysis of strategic sectors.		
	Areas of activity		Quality values for water, air, soil and waste. References to agriculture, town planning and land use.			Nature protection (air, water and soil). Working environment.		Noise pollution, risk management for industrial sites, clean technology, energy production, efficient resource use, harmonisation of emissions standards, hazardous substance, product regulations, obligatory use of best available technique.		Consolidation of environmental objectives in the areas of agriculture, industry, transportation, and energy. Effective implementation of legislation. Regulation of all environmental impacts of polluting substances and sources. Public access to informa-tion. Job creation.		
Year		1972	1973	1975	1976	1977	1981	1982	1986	1987	1990	1992
Treaties Institutions		The **Declaration of Paris** marks the formal beginning of EU environmental policy.	European Parliament sets up an **Environment Committee**	Establishment of European Foundation for the Improvement of Living and Working Conditions (**Eurofound**)			Transfer of environmental responsibilities from DG Industrial Policy to the newly formed **DG Environment**		The **Single European Act** introduces an explicit legal basis for environmental legislation at the EU level		Establishment of **European Environment Agency**	

Fifth EAP – Towards Sustainability (1993 – 2000)	Sixth EAP – Our Future, Our Choice (2001 – 2012)	Seventh EAP – Living well, within the limits of our planet (2012 – 2020)
Ambitious longer term objectives and focus on a more global approach. New complex and holistic framework legislation. Combination of regulatory, market-based and voluntary instruments. Introduction of implementation reports. Decentralisation and participation.	Cautious compared to the ambitious goals of its predecessor. New governance approaches – cooperation with industry, experts and citizens. "Name, shame and fame" strategy on the implementation of regulations. Liability for environmental crimes.	A vision by 2050. Four 'enablers': better implementation, better information, more and wiser investments from public and private sources, full integration of environmental requirements into other policies such as regional policy, agriculture, fisheries, energy and transport.

Table 1. OVERVIEW OF THE EVOLUTION OF EU ENVIRONMENTAL POLICIES (CONTINUED)

Fifth EAP – Towards Sustainability (1993 – 2000)				Sixth EAP – Our Future, Our Choice (2001 – 2012)						Seventh EAP – Living well, within the limits of our planet (2012 – 2020)		
Climate change, acidification/air quality, urban environment, coastal zones, waste management, water resources, and biodiversity. Focus on five most polluting sectors – industry, energy, transport, agriculture, tourism.				Specifications by thematic strategies on key issues: clean air, soil protection, use of pesticides, marine environment, waste prevention and recycling, sustainable use of natural resources, urban environment.						Natural capital, resource-efficient, low-carbon economy (20-20-20 targets, product life cycle, circular economy, green technologies), human health. Horizontal objectives: more sustainable cities, international actions.		
1993	1994	1999	2000	2001	2003	2007	2009	2010	2012	2013		2020
Maastricht Treaty gives environmental action full EU policy status	Establishment of **European Environment Information and Observation Network**	**Amsterdam Treaty** makes environmental policy a key EU political aim			**Treaty of Nice** left the environmental legal framework almost unvaried	Establishment of **European Chemicals Agency**	**Treaty of Lisbon** moved up environmental objectives as general Union objectives	Establishment of **DG Climate**				

Source: ARC Fund, 2014.

It was only in 1987 **with the adoption of the Single European Act (SEA) that environmental protection entered with a specific title in the Treaty** (Articles 130r–130t), thus providing a legal basis for environmental legislation at the European level. The new title defined some of the guiding principles of environmental policy such as the "preventive action" principle (environmental damage should be rectified at the source) and the "polluter pays" principle. The Treaty also introduced the new idea that "Environmental protection requirements shall be a component of the Community's other policies." In the same year the Fourth EAP (1987 – 1992) came into effect and endorsed the new approach acknowledging environmental regulation as a pillar for a lasting economic and social progress. **The 1980s were a prolific period in terms of legislative output in the field of environment, seeing the adoption of over 200 legislative measures by 1987**.[14]

At the same time, with a **growing number of infringement proceedings commenced by the Commission against member states** the question about the effective implementation of environmental law came to the fore. As a result, the Commission began to explore innovative measures such as incentive-based instruments, eco-labelling, public access to environmental information, environmental impact assessments and others. From an institutional perspective, the EU was equipped with the European Environment Agency in 1990 and with the European Environment Information and Observation Network in 1994. In the early steps of EU environment policy **the European Court of Justice was also an important engine for fundamental policy change** by interpreting the often flexible legal framework.

The Treaty of Maastricht (1992) and the Treaty of Amsterdam (1997) introduced no substantial changes to the legal framework for environmental protection laid down by the Single European Act in 1987. Nonetheless, the former introduced for the first time a specific reference to environmental protection among the EU objectives, while the latter moved up the principle of environmental integration in the section outlining the general principles of EU policy. Furthermore, the Treaty of Amsterdam broadened the policy areas governed by the co-decision procedure which became the standard procedure for environmental law-making.

The Fifth EAP (1993 – 2000), titled "Towards Sustainability", integrated for the first time the environmental dimension into all major policy areas and was firmly anchored in the concept of sustainable development. It was divided into five target sectors (industry, energy, transport, agriculture and tourism) and seven themes (climate change, acidification/air quality, urban environment, coastal zones, waste management, water resources, and biodiversity) setting out objectives and actions for each of these areas. The Fifth EAP envisaged:

- adoption of new complex and holistic framework legislation;

[14] Jordan, Andrew, "The Politics of a Multi-level Environmental Governance System: European Union Environmental Policy at 25", CSERGE Working Paper, 1998.

- use of financial support mechanisms such as the LIFE programme, Structural and Cohesion Funds, as well as European Investment Bank loans;
- relocation of competence to national and regional governments;
- horizontal measures such as improving environmental statistics and public information;
- integration of different actors with various interests into institutional dialogue.

The Sixth EAP, titled "Environment 2010: Our Future, Our Choice," and the Gothenburg EU Sustainable Development Strategy (2001) reinforced the emphasis on sustainable development and environmental integration in the context of the preparation for the Eastern enlargement and the consequent increase in member states from 15 to 27. For several of its objectives no concrete policy targets and measures were set but were meant to be developed subsequently through seven Thematic Strategies covering soil protection, marine environment, pesticides, air pollution, urban environment, natural resources, and waste. The EAP proposed five priority avenues of strategic action:

- improving the implementation of existing legislation;
- integrating environmental concerns into other policies;
- working closer with the market;
- empowering people as private citizens and helping them to change behaviour;
- taking account of the environment in land use planning and management decisions.

Integrated product policy as a new aspect of environmental policy emerged on the political agenda, seeking to minimise the degradation of environment as a result of the manufacturing, use or disposal of products by looking at all phases of their life-cycle. Most prominently, however, **climate change was defined in the Sixth EAP as the "outstanding challenge of the next 10 years and beyond."** Emission reduction considerations and measures were introduced into different sectors and policy areas, including industry, transport, energy, and the construction sector. The autonomy acquired by EU climate policy and its progressive detachment from the field of environmental policy was reflected in the creation of a DG Climate in 2010.

The 7th EAP adopted on 20 November 2013 sets out a strategic framework for environmental policy making in the European Union for the period 2014 – 2020. **The new programme builds on policy initiatives in the Europe 2020 strategy, most prominently on the flagship initiatives for a resource-efficient Europe and Innovation Union**. The Programme operates against a background of many existing targets which provide a web of objectives for different policy areas. In view of the primary aim to decouple economic growth and environmental degradation the 7th EAP defines nine priority objectives and provides an overview of binding and non-binding targets set by EU environment policy.

Box 2. ASSESSMENT OF THE SIXTH EAP

In line with the provisions of the Sixth EAP the Commission submitted to the European Parliament and the Council a final assessment of the Programme in 2011. According to its results, major accomplishments in the field of environment in the period 2002 – 2012 included the extension of the Natura 2000 network to cover almost 18 % of the EU's land area, the introduction of a comprehensive chemicals policy, and policy action on climate change. The Thematic Strategies as central governance mechanisms led to:

- new legislative proposals (marine and soil);
- preparatory non-binding measures in previously uncovered areas (resources and the urban environment);
- revision of existing measures (air, waste, pesticides, marine, soil).

The varying degrees of progress towards the objectives set out in the Sixth EAP were partly explained by factors such as:

- different levels of political ambition and opportunity structures in different thematic areas;
- ineffective implementation and enforcement of EU environment legislation by member states;
- sensitivities of member states in relation to subsidiarity;
- political priorities in countries both within and outside the EU;
- changes in economic circumstances and shift in political priorities towards economic growth.

The final evaluation concluded that the Sixth EAP successfully served as a reference for member states and local authorities in defending environment policy against competing policy demands, securing appropriate funding, providing predictability for business, and adopting effective targets and timetables. Furthermore, the EAP helped map out existing commitments, identify overlaps and gaps in the coverage of EU policy and defend the environmental agenda in times of economic turbulence.

Source: ARC Fund, 2014.

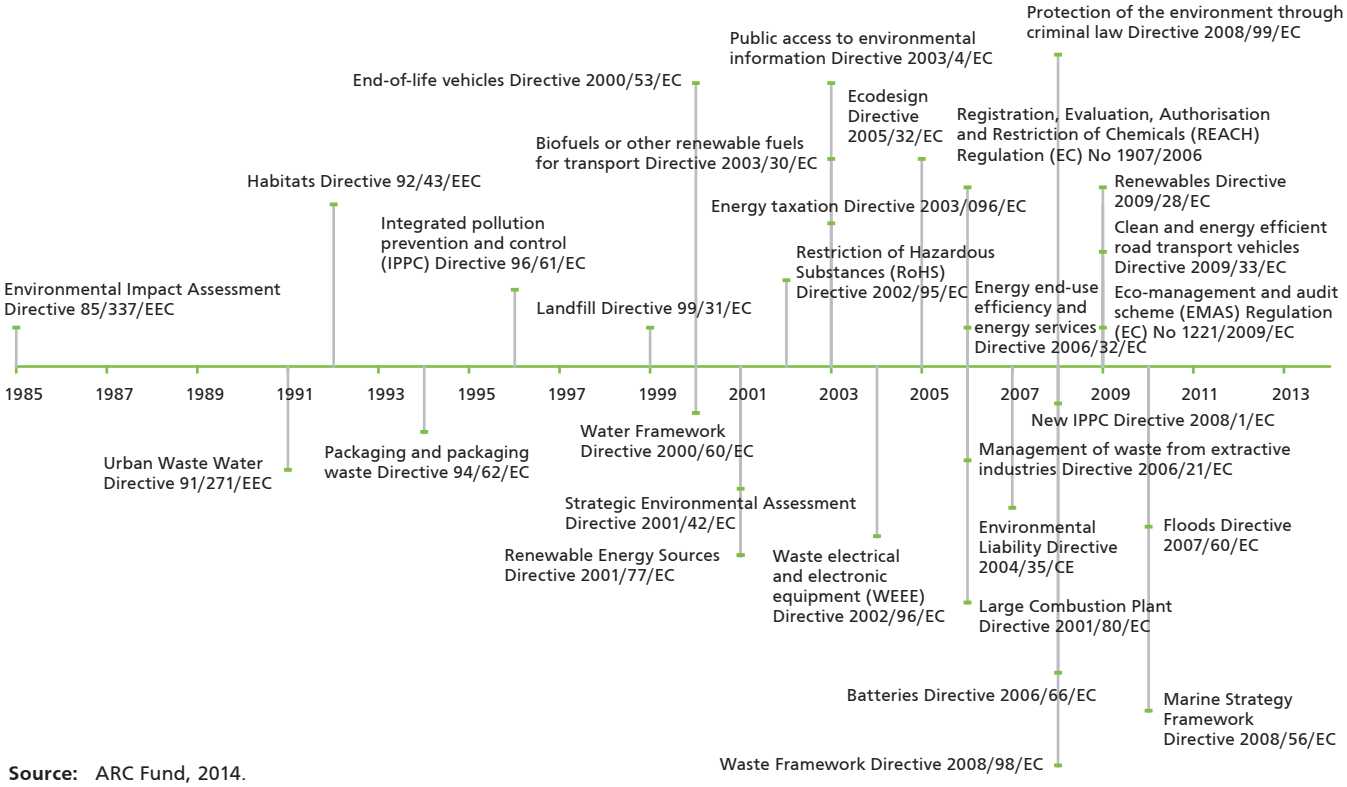
Table 2. SEVENTH EAP PRIORITY OBJECTIVES AND SELECTED INDUSTRY-RELEVANT BINDING TARGETS[15]

Target	Legal basis	Deadline
Priority 1: Protect, conserve and enhance the EU's natural capital		
Biodiversity in the marine environment is maintained	Directive 2008/56/EC	⇒ 2020
Priority hazardous substances are eliminated from surface waters in accordance with the Water Framework Directive	Directive 2008/105/EC	⇒ 2028
Priority 2: Turn the EU into a resource-efficient, green and competitive low-carbon economy		
EU-15 shall cut its aggregate greenhouse gas (GHG) emissions by 8 % compared to 1990 levels	Kyoto Protocol	⇒ 2012
Stop production of Hydrochlorofluorocarbons (a group of chemical compounds used in cooling appliances)	Regulation 1005/2009/EC	
Fleet average CO_2 emissions from new cars: 130g/km	Regulation 443/2009/EC	⇒ 2015
Fleet average CO_2 emissions from new light commercial vehicles: 175g/km	Regulation 510/2011/EU	⇒ 2017
95 g CO_2/km as average emissions for the new car fleet	Regulation 443/2009/EC	⇒ 2020
All new buildings, occupied and owned by public authorities, are nearly-0-E- buildings	Directive 2010/31/EU	⇒ 2019
All new buildings are nearly-0-E-buildings	Directive 2010/31/EU	⇒ 2020
Increase the share of renewable energy sources (RES) to 20 % of final energy consumption	Directive 2009/28/EC	⇒ 2020
Increase the share of energy from RES to 10 % of the final consumption of energy in transport	Directive 2009/28/EC	⇒ 2020
No heavy metals (Pb, Hg, Cd, hexavalent Cr, PBB and PBDE) in new electrical and electronic equipment	Directive 165/2011/EU	⇒ 2019
Separate collection for glass, plastic, metal, paper	Directive 2008/98/EC	⇒ 2015
Collection target for batteries: 45 %	Directive 2006/66/EC	⇒ 2016
Priority 3: Safeguard EU citizens from environment-related pressures and risks to health and wellbeing		
Extension of IPPC requirements to new activities	Directive 2010/75/EU	⇒ 2015
New emission limit values for existing large combustion plants and for combustion plants which co-incinerate waste	Directive 2010/75/EU	⇒ 2016
New emission limit values for selected volatile organic compounds (gases from certain solids or liquids)	Directive 2010/75/EU	⇒ 2015
Euro 6 standard for approval of light vehicles	Regulation 715/2007/EC	⇒ 2014
Euro 6 standard for registration and sale of new types of cars	Regulation 715/2007/EC	⇒ 2015
General principles of integrated pest management are implemented by all professional users	Directive 2009/128/EC	⇒ 2014
REACH restrictions concerning dibutyltin (DBT) compounds	Regulation 1907/2006/EC	⇒ 2015
Priority 4: Maximise the benefits of EU environment legislation		
Priority 5: Improve the evidence base for environmental policy		
Priority 6: Secure investment for environmental and climate policy and get the prices right		
Priority 7: Improve environmental integration and policy coherence		
Priority 8: Enhance the sustainability of EU cities		
Priority 9: Increase the EU's effectiveness in addressing regional and global environmental and climate challenges		

Source: EU Commission.

[15] Seventh EAP 2014 – 2020, Annex 3, Targets set by EU Environmental Policy.

Figure 8. EUROPEAN ENVIRONMENTAL LEGISLATION TIMELINE, 1985 – 2014



Source: ARC Fund, 2014.

Europe 2020

The Seventh EAP integrates existing environment and climate related strategies as part of a single narrative which demonstrates the linkages between them and underscores the potential for a holistic policy approach across the environment policy spectrum. The central piece of this narrative is Europe 2020, the EU's ten-year growth strategy. Launched in 2010, the strategy was developed against a background of deteriorating economic and social environment in the wake of the global financial crisis. It strives to create the conditions for a smart, sustainable and inclusive growth, which are perceived as three mutually reinforcing rather than conflicting priorities. **Europe 2020 puts innovation and green growth at the heart of its blueprint for competitiveness**. The strategy is underpinned by concrete actions at EU and national levels in order to achieve its so called headline targets by the end of 2020 in five areas: employment; research and development; climate and energy; education; social inclusion and poverty reduction. Seven flagship initiatives with specific work programmes catalyse progress in the areas identified as important levers for growth. To monitor and advance national implementation, member states are required to set own targets and adopt detailed action plans as part of their national reform programmes which are reviewed annually as part of the European Semester of economic policy coordination. The EU budget for the period 2014-2020 is closely aligned to the 2020 goals. For example, funds available for research and innovation within Horizon 2020 have been increased to €80 billion while **the amount for climate-related projects has been tripled and now accounts to 20 % of the entire budget**.

With two notable exceptions (GHG emissions and use of renewable energy), **the major drawback of Europe 2020's headline targets is that they are not set in a legally binding framework at EU level**. The non-binding political nature of the targets reflects the primary role that national governments are expected to play in the implementation of the strategy.

Europe 2020 strategy through its resource-efficient Europe flagship initiative treats resource efficiency not only as a necessary course of action due to an increasing and unsustainable use of resources, but also as an opportunity to foster growth and competitiveness. The pursuit of the principle goal of **decoupling growth and resource use is expected to bring about a wave of innovation** aimed at reducing inputs, minimising waste, improving resource management, improving logistics and optimising production processes and management methods. There is some evidence that **stricter environmental standards and challenging targets ensure long-term predictability** and provide a major boost for eco-innovation. Analysis by the European Patent Office and United Nation's Environment Programme has shown

TABLE 3. KEY PRIORITIES, HEADLINE TARGETS AND FLAGSHIP INITIATIVES UNDER EUROPE 2020

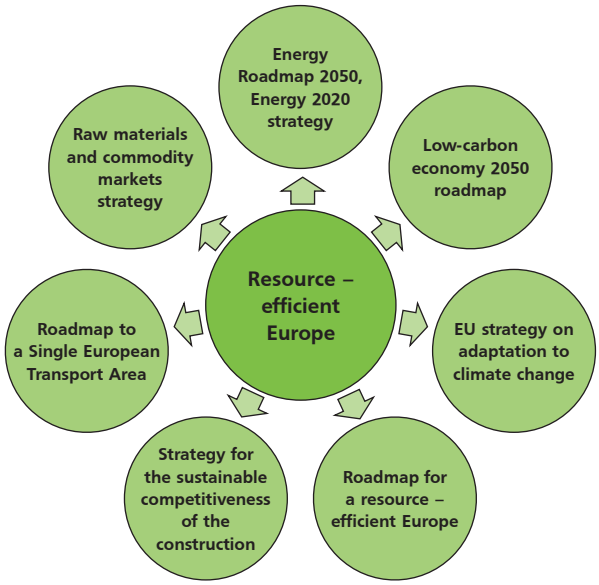
	Headline Targets	Flagship Initiatives
Smart Growth	• getting 3 % of the EU's GDP invested into research and development; • reducing school dropout rates to below 10 %, with at least 40 % of 30–34-year-olds completing tertiary education.	Innovation Union Youth on the move A digital agenda for Europe
Sustainable Growth	• limiting GHG emissions by 20 % compared to 1990 levels; • meeting 20 % of energy needs from renewables; • increasing energy efficiency by 20 %.	Resource-efficient Europe An industrial policy for the globalisation era
Inclusive Growth	• ensuring 75 % employment of 20 – 64-year-olds; • ensuring 20 million fewer people are at risk of poverty or social exclusion.	An agenda for new skills and jobs European Platform against Poverty and Social Exclusion

Source: European Commission, Europe 2020.

that after the adoption of the Kyoto Protocol in 1997 patenting rates in clean energy technologies significantly outpaced those related to fossil technologies.[16]

The resource-efficient Europe flagship initiative is expected to increase certainty for investment and innovation by creating a broad-based strategic framework for integrated policies and a long-term vision in the key policy areas of climate change, energy, transport, industry, waste and raw materials, agriculture, fisheries, biodiversity and regional development. By embedding the principle of resource efficiency into such a wide range of policies, the initiative further develops the holistic approach towards dealing with complex environmental issues. In March 2014, the Commission published a Communication assessing the progress under the Europe 2020 strategy, four years after its launch in 2010.[17] Taking account of the challenges of the financial and economic crisis, the report concludes that the EU is coming close to its targets on education, climate and energy but not on employment, research and development and poverty reduction. The analysis also revealed a mixed experience with the flagships of the Europe 2020 strategy. The review of the resource-efficient Europe initiative in particular showed that the main foreseen measures have already been initiated at EU level and **a series of coordinated strategies and roadmaps have created a long-term policy framework up to 2050**. In terms of actual implementation, a key lesson learnt is that the active engagement and participation of regions and cities which are responsible for delivering many EU policies has been crucial in pursuit of Europe 2020 objectives. The assessment also pointed out that a more comprehensive approach is needed to measure changes in the use of resources. The Resource Efficiency Scoreboard published by Eurostat with resource productivity as lead indicator (defined as the ratio of GDP to domestic material consumption) is considered as an important step in this direction.

FIGURE 9. KEY DOCUMENTS ADOPTED UNDER THE RESOURCE-EFFICIENT EUROPE FLAGSHIP INITIATIVE



Source: EU Commission.

Roadmap for a Resource-Efficient Europe

Trends show that the era of plentiful and cheap resources is over. Rising and volatile prices are having a damaging effect on the economy. Innovative and dynamic businesses have recognised the benefits of a more productive use of resources, yet many enterprises and consumers have not realised the scale of the ongoing transformations towards

[16] "Patents and Clean Energy: Bridging the Gap between Evidence and Policy", 2010.

[17] COM(2014) 130 final/2, "Taking stock of the Europe 2020 strategy for smart, sustainable and inclusive growth".

Box 3. RESOURCE EFFICIENCY VISION 2050

"By 2050 the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation. Our economy is competitive, inclusive and provides a high standard of living with much lower environmental impacts. All resources are sustainably managed, from raw materials to energy, water, air, land and soil. Climate change milestones have been reached, while biodiversity and the ecosystem services it underpins have been protected, valued and substantially restored."

Source: Roadmap to a Resource-Efficient Europe

more resource efficiency. Adopted in 2011 as part of the resource-efficient Europe flagship initiative, **the Roadmap for a Resource-Efficient Europe is the cornerstone of efforts to turn the EU into a resource-efficient, low carbon economy**. It strives to address the dual challenge of stimulating the growth needed to provide jobs and of ensuring that the quality of this growth leads to a sustainable future. The Roadmap provides a coherent and predictable action framework cutting across different policy areas and sectors and explaining how policies interrelate and build on each other. It should be seen in the context of worldwide efforts to achieve a transition towards a green economy, as for instance reflected in the OECD's Green Growth Strategy and UNEP's Green Economy report. The Roadmap aims to remove the barriers that hold back resource efficiency by:

- addressing markets, prices, taxes and subsidies that distort the real costs of resource use;
- encouraging more long-term thinking in business, finance and politics that leads to the uptake and development of sustainable practices and innovation, and cost effective regulation;
- carrying out research to fill in knowledge and skills gaps;
- dealing with international competitiveness concerns and seeking to get a consensus with international partners to move in a similar direction.

The following **industry-related measures launched since the adoption of the Roadmap deserve special attention in the context of green innovation**:[18]

- Integration of material efficiency requirements in addition to energy efficiency in **five ecodesign implementing regulations**, namely, durability requirements for vacuum cleaners, information relevant for disassembly, recycling and disposal at end-of-life for fans, water pumps, space heaters, water heaters and vacuum cleaners.
- Update of the **Methodology for the Ecodesign of Energy-related Products** to include certain material efficiency parameters (recyclability benefit rates, recycled content, lifetime, and a critical raw material index).
- Elaboration of a list of actions in the context of the **Green Action Plan for SMEs** including the establishment of a European Resource Efficiency Excellence Centre and Network of Eco-Innovation Financiers, awareness raising campaigns, promotion of green entrepreneurship through the Climate-KIC of the European Institute of Innovation and Technology, etc.
- Adoption of **green public procurement** (GPP) criteria for several new product groups, e.g. in the field of waste water treatment plants.
- Launch of a three year **Environmental Footprint pilot** phase in cooperation with volunteering industry to develop EU-wide methods to measure environmental performance of products and organisations based on the most relevant life cycle stages (extraction, production, logistics, use, end of life).
- Inclusion of resource efficiency as a **societal challenge in Horizon 2020** and launch of public-private partnerships to leverage business action:
  - **SPIRE** (Sustainable Process Industry through Resource and Energy Efficiency) – an international non-profit association formed by process industry stakeholders from 8 industry sectors (chemical, steel, engineering, minerals, non-ferrous metals, cement, ceramics, and water) established in 2012 to ensure the development of enabling technologies and best practices along all the stages of large scale existing value chain productions that will contribute to a resource efficient process industry.
  - **BIC** (Bio-based Industries Consortium) – an international non-profit association established in 2012 by European SMEs, clusters and organisations across technology, industry, agriculture and forestry as an instrument to support industrial research and innovation to deliver bio-based products.[20]
- Launch of **European Innovation Partnerships** (EIPs) for water, raw materials, and agricultural sustainability and productivity to bring together actors, pool resources and coordinate investments across the whole research and innovation chain.

[18] SWD(2014) 206, Progress Report on the Roadmap to a Resource Efficient Europe published, 2014.

[19] www.spire2030.eu

[20] biconsortium.eu

- Adoption of an **Eco-innovation Action Plan** in 2011 to expand the EU's focus from green technologies to non-technological innovative products, services and processes. Initiatives under this plan include:
  - INNEON, a network of eco-innovation financiers to extend public and private funding sources available for eco-innovation and social innovation;
  - INNOCAT, a network of public and private procurers to address the fragmentation of the demand for eco-innovative solutions in the catering sector.
- Establishment of a **European Network on Industrial Symbiosis** (EUR-ISA) in 2013, bringing together organisations responsible for up to 10 established industrial symbiosis programmes.

Table 4. COMMITMENTS OF THE EU COMMISSION AND MEMBER STATES WITHIN THE RESOURCE EFFICIENCY ROADMAP, BY LINE OF ACTION

	Sustainable consumption and production	Turning waste into a resource	Supporting research and innovation	Environmentally harmful subsidies (EHS) and taxation
The Commission	• strengthen the requirements on **green public procurement** for products with significant environmental impacts; • establish a common methodology for companies to assess, display and benchmark **environmental impacts** of products and services over their life-cycle; • set requirements under the **Ecodesign Directive** to boost the resource efficiency of products (e.g. reusability/ recoverability/ recyclability, recycled content, durability) refine eco-labelling schemes.	• **stimulate the demand** for recycled materials through economic incentives and developing end-of-waste criteria; • assess the introduction of minimum recycled material **rates**, durability and reusability **criteria** for key products; • review existing prevention, re-use, recycling, recovery and landfill diversion targets; • **align legislation** on various waste streams; • eradicate illegal **waste shipments** with a special focus on hazardous waste.	• develop **innovation partnerships** for meeting resource efficiency goals; • develop **private-public partnerships** that pool national research efforts in areas of resource efficiency (Joint Technology and Programming Initiatives); • tackle **barriers to eco-innovation;** • **focus Horizon 2020** on key resource efficiency objectives.	• promote **exchange of best practices and peer reviews** on EHS reform and market based instruments, in particular under the Market Based Instruments Forum and the Taxation Policy Group; • **improve indicators** on the use of taxes on pollution and resources; • **monitor member states' follow-up** to country-specific recommendations for phasing out of EHS.
Member states	• put in place **incentives for companies to measure, benchmark and improve** their resource efficiency, as well as exploit industrial symbiosis; • ensure that by 2020 all relevant substances of very high concern are placed on the **REACH** Candidate List.	• ensure full **implementation of the EU waste acquis** including minimum targets through their national waste prevention and management strategies.	• **focus public research funding** on key resource efficiency objectives.	• identify the most significant EHS and **prepare plans to phase them out and report** on these as part of their national reform programmes. • **shift taxation** away from labour to environmental impacts.

Source: Resource Efficiency Roadmap.

Green Growth in Bulgaria

This section aims to provide an overview of the extent to which Bulgaria is achieving economic growth, whilst reducing environmental risks, including in comparison to the other EU member states and more specifically EU15. The range of statistical indicators that are used to measure progress in this area can be divided into four broad categories:

- Carbon economy;
- Energy efficiency;
- Renewable energy sources;
- Transport.

In Bulgaria, the rate of decrease of greenhouse gas (GHG) emissions has been slowing down since 1990. Some progress has been made towards the decoupling between economic growth and high energy consumption, but the ratio between emissions and GDP remains much higher in Bulgaria than in the rest of the EU. Energy industries are by far the biggest source of emissions of greenhouse gases. The country is still heavily reliant on petroleum products and energy productivity is very low compared to the EU average. The outdated electricity system results in major losses during the distribution and transmission process. Energy efficiency in households is also relatively low especially due to the limited use of efficient retrofitted technologies. Altogether the use of renewable energy sources is growing, but this is hindering the progress towards market liberalisation due to poorly formulated regulations, which may lead to an overload of the electricity grid as a result of the sudden increase in the installed generation capacity. The transport sector is still a large producer of harmful emissions as the motorisation rate continues to grow and electric and hybrid vehicles are still very rare.

Carbon Economy

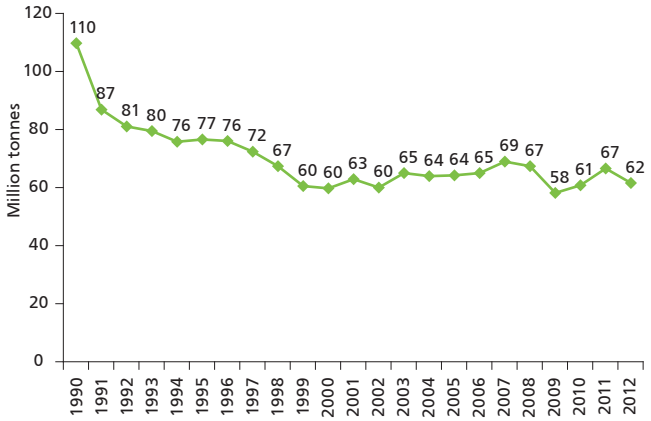
Bulgaria is aiming to shift towards a low-carbon economy in line with the main European strategies.[21] This requires a reduction in the consumption of fossil fuels, the use of new technologies which improve energy efficiency and the broad integration of renewable resources. While measuring energy consumption provides an overall indication of the state of the economy, it is not very telling of the effect of economic activities on the environment. Tracking the volume of GHG emissions over time is a very useful way of indicating progress in shifting towards a low carbon economy, which presupposes the decoupling of long-term economic growth from high energy consumption and environmental degradation.

GHG emissions in Bulgaria have experienced a significant decline since 1990, when they amounted to 110 million tonnes. The lowest level of emissions was recorded in 2009 when they reached 58 million tonnes. While this reduction in emissions is a positive sign of greener economic growth, it must be examined against the background of the overall development of the domestic economy. After 1989, the **sharp decline in emissions resulted primarily from**

[21] The key document being the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "A Roadmap for moving to a competitive low carbon economy in 2050."

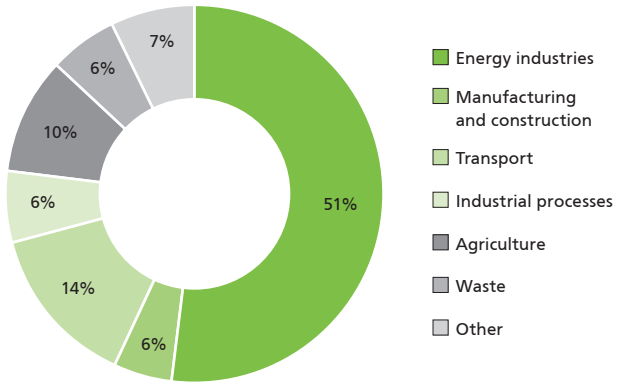
the closure of the major manufacturing sites, which can be interpreted as a sign of economic decline, rather than improvement in the efficiency of the energy system or a shift towards knowledge intensive industries. Since 2000, GHG emissions have plateaued varying between 69 million tonnes in 2007 and 58 million tonnes in 2009. The increase in the first half of the 2000s was caused by the recovery of the economy leading up to Bulgaria's accession to the EU, while the decline since 2008 was the result of the economic crisis significantly slowing down production. **Green technologies have played a small role in the overall GHG emissions trends, which are largely dependent on the overall economic situation in the country**.

Figure 10. GREENHOUSE GAS EMISSIONS (INCLUDING INTERNATIONAL AVIATION) IN BULGARIA (1990 – 2012)



Source: European Environment Agency, 2014.

Figure 11. GREENHOUSE GAS EMISSIONS BY IPCC SECTOR IN BULGARIA (2012)



Source: European Environment Agency, 2014.

Based on the Intergovernmental Panel on Climate Change classification,[22] the biggest contributor to Bulgaria's GHG emissions in 2012 was stationary or mobile energy generation using fuel combustion, including energy industries, manufacturing and construction and transport activities. Energy industries (electricity and heat generation, petroleum refining and manufacture of solid fuels) account for the biggest share of emissions – 51 % of the total in 2012, compared to 35 % in 1990. This is among the highest shares in comparison to the other EU member states. Only Malta (60 %) and Estonia (68 %) have a higher share of emissions deriving from energy production. The EU average is 30 % of total emissions and in most countries of Central and Eastern Europe energy generation accounts for less than 30 %.[23]

Manufacturing industries, construction and transport account for a further 20 % of all GHG emissions. In 1990, manufacturing and construction accounted for 18 %, which decreased to 6 % in 2012, while transportation emissions increased from 6 % to 14 % over the same period. Only 6 % of emissions derive from industrial processes (including mineral products, the chemical industry, metal production, pulp and paper and food processing), while agriculture and waste management accounted for 10 % and 6 % respectively in 2012.

The distribution of emissions among sectors is indicative of two major features of the economy. On the one hand, it is a sign that the domestic economy is shifting away from energy intensive manufacturing and towards knowledge-intensive industries, thus leaving energy industries as the biggest emitters. On the other hand, however, this could be perceived as a sign that **the energy sector is technologically outdated and relies on old and carbon-intensive resources and technologies**. In both cases the introduction of green technologies and processes would significantly contribute to the shift towards low-carbon energy generation and improved energy efficiency, which are crucial prerequisites for a tangible reduction in GHG emissions.

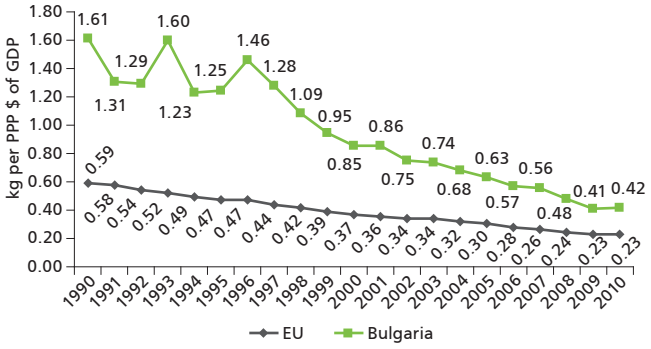
The total volume of GHG emissions should also be assessed in relation to the economic output of a country, measured in terms of GDP. This indicator is telling of both the structure of the economy as well as the domestic energy mix. Economies which are predominantly reliant on heavy industries are more energy intensive than those based on knowledge-intensive activities. Therefore economies using carbon-intensive energy resources have a higher level of energy intensity than those producing the same goods, but using low-carbon resources.

The data suggest that Bulgaria's energy intensity has decreased significantly between 1990 and 2012, going from 1.61 to 0.42 kg of CO_2 emitted for every dollar of GDP in

[22] IPCC Common Reporting Format sector classification.

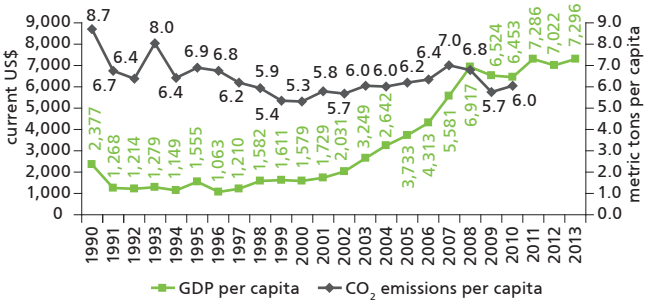
[23] European Environment Agency.

Figure 12. CO_2 emissions relative to GDP in Bulgaria and the EU (1990 – 2010)



Source: World Bank, 2014.

Figure 13. Greenhouse gas emissions per capita and GDP per capita in Bulgaria (1990 – 2013)



Source: World Bank, 2014.

purchasing power parity (PPP) produced. While this is a significant improvement, it is still almost twice as high as the average EU level of 0.23 kg per PPP $ of GDP. As most of Bulgaria's heavy industries have been shut down, **the high levels of energy intensity can be attributed primarily to the carbon-intensive energy mix that relies to a large extent on fossil fuels, and more specifically on coal and solid fuels for electricity and heating generation**. Among the EU member states in Central and Eastern Europe, Estonia is the most energy intensive country in the region with 0.67 kg per PPP $ of GDP, Poland and the Czech Republic have very similar levels of intensity (0.41 kg per PPP $ of GDP) as Bulgaria, while the other former communist states have levels of energy intensity in line with the EU average.

Box 4. Environmental expenditure in Bulgaria

As suggested in the definition of green innovations, high levels of expenditure on extensive research do not necessarily lead to the development of successful products and technologies which are widely applied thus reducing environmental damage. However, the expenditure on technologies specifically aimed at preserving and restoring the environment can give an indication of the areas of environmental damage that are being addressed. In Bulgaria, both the total expenditure and the distribution of funds for the environment kept a relatively constant trend between 2000 and 2005, when it amounted to a total of BGN 639 million (€327 mln),[24] distributed among waste, water and air facilities with 164 million, 182 million and 154 million respectively. The remaining 140 million were distributed among a variety of other areas and activities[25] of which only 8 million were spent on research and development.

In the following three years, **expenditure on environmental protection increased dramatically, reaching a total of 1.7 billion in 2008**, with 581 million for waste management, 490 million for wastewater management and 407 million for air technologies. With the start of the financial crisis spending for wastewater and air technologies decreased again reaching the levels prior to EU accession. However, overall spending on environmental protection continued to increase as a result of the growing investment in wastewater technologies.

There are some clear trends in terms of the types of technologies in which **investments have been concentrated**. Both in the case of wastewater and waste investments, they were concentrated **almost entirely on end-of-pipe (EOP) technologies**. These are installed as an additional stage of the production process in order to filter the harmful elements which would otherwise be emitted into the atmosphere. Only a small portion of the investments in these areas were dedicated to integrated technologies which reduce the amount of harmful elements produced in the first place, most likely because this is a more costly and research-intensive investment, which requires a more profound change to the production process. The only area in which investment patterns have changed is the field of air quality technologies, where since 2011 spending has been split almost evenly between EOP and integrated technologies.

[24] The Bulgarian lev is exchanged at a fixed rate of 1.95 to the euro. All other amounts in this box are in Bulgarian levs.

[25] Circulating water supply; protection and remediation of soil, groundwater and surface water; forests; protection of biodiversity and natural scenery; hunting and fishing projects; noise; research; educational activities; administration; monitoring and control equipment; environmental impact assessment.

Box 4. ENVIRONMENTAL EXPENDITURE IN BULGARIA (CONTINUED)

While R&D investment is not necessarily a prerequisite for the creation of green innovation, it is often necessary in order to create new technologies which reduce the amount of harmful emissions into the atmosphere, particularly when it comes to integrated technologies which must be adapted to each production process. In Bulgaria, **expenditure on R&D has not constituted more than 2 % of total environmental expenditure between 2000 and 2012**, with the exception of 2004 when it reached 4.57 %. In 2012, environmental R&D expenditure amounted to 6.2 million, which is equivalent to 0.37 % of the total. Another important element of environmental protection which receives very limited funding are educational activities, which have the potential of achieving a significant impact on attitudes and habits with regards to energy use particularly in households. Expenditure for this type of activity grew progressively up to 2004, after which it declined progressively reaching an all-time low of 111,000 in 2009. However, since then there has been a significant increase in funding for these activities, which peaked in 2011 and amounted to 1.8 million. As public awareness about the social impact on the environment increases, it is easier to introduce energy conservation and waste management initiatives on the demand side such as improved waste collection and energy efficiency gains.

It is also important to make note of the main sources of funding for these technologies. While public institutions, in particular municipalities, provide some funding for such technologies, **the private sector is the most active investor in the acquisition and maintenance of technologies and facilities aimed at environmental protection**. In 2012, 58 % of all expenditure on the acquisition of such technologies and facilities was provided by private entities, while the remaining funds originated from a variety of other public sources, the largest share being represented by Operational Programme Environment (13 %). The costs for the maintenance of these facilities were borne primarily by private investors (65 %) and municipalities (31 %).

Figure 14. TOTAL EXPENDITURE ON TECHNOLOGIES AIMED AT PRESERVING AND RESTORING THE ENVIRONMENT BY AREA OF THE ENVIRONMENT IN BULGARIA (2000 – 2012)

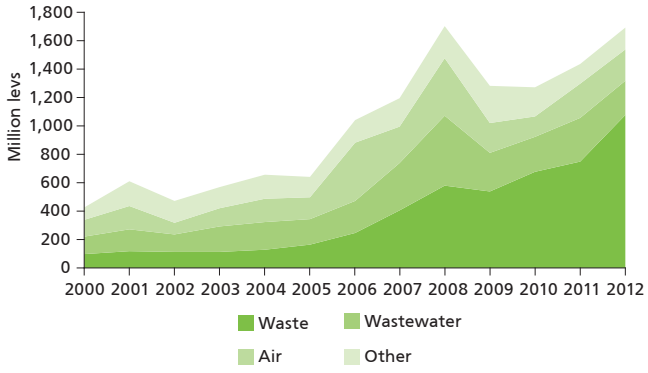
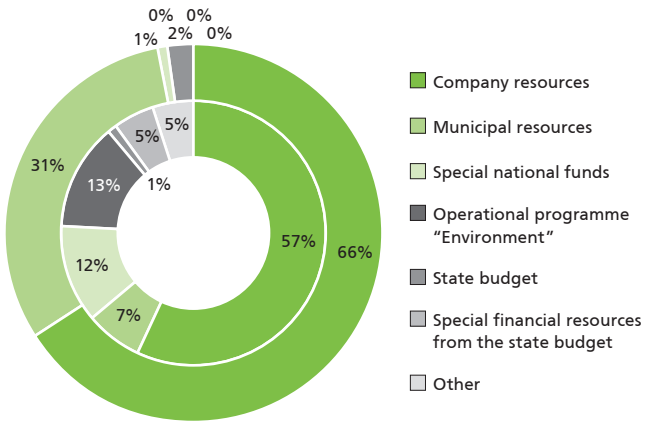


Figure 15. EXPENDITURE ON PROTECTION AND RESTORATION OF THE ENVIRONMENT BY SOURCE OF FUNDING IN BULGARIA (2012)

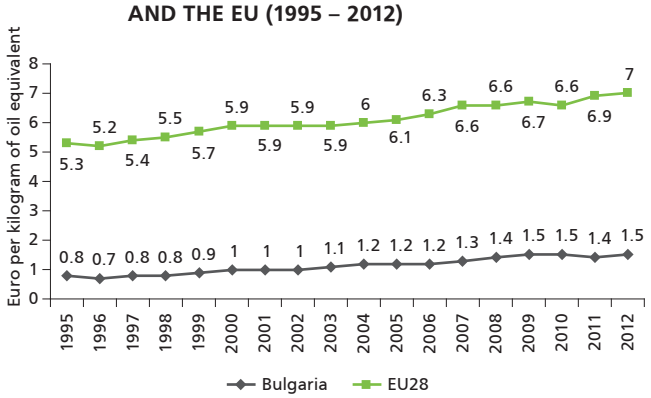


Source: National Statistical Institute, 2014.

Energy Efficiency

Energy use is key factors in the challenges Bulgaria faces with regard to environmental degradation, energy insecurity and low competitiveness. It is not only important how much energy is used and from what resources it is extracted, but also what is the final output as a result of its consumption. In order to achieve sustainable economic growth, it is important to make the most efficient use possible of energy resources. Therefore, **one of the most important types of innovative green products and technologies are those that help reduce energy consumption by improving energy efficiency**. Such technologies can be used in all sectors of the economy and contribute towards the reduction of energy product demand, thus limiting harmful emissions, improving energy security and boosting overall economic competitiveness. **The energy efficiency of the Bulgarian economy is relatively low and therefore the introduction of green technologies has the potential to produce significant energy savings.**

Figure 16. ENERGY PRODUCTIVITY IN BULGARIA AND THE EU (1995 – 2012)



Source: Eurostat, 2014.

Bulgaria's final energy consumption has decreased over time while its GDP has increased, which suggests an improvement of energy productivity as more value is added by smaller amounts of energy. In 1995, the output for every kg of oil equivalent (KOE) put into the Bulgarian economy was worth €0.8, while by 2012 this value reached €1.5. However, the EU remains significantly more energy productive, as the average level for the EU is equivalent to €7/KOE in 2012. In fact, **Bulgaria has the lowest level of energy productivity in the EU**. The other member states from Central and Eastern Europe have higher levels of energy productivity: Estonia and Romania are closer to Bulgaria with €2.1 and €2.6/KOE respectively, while Croatia is the frontrunner with €4.4/KOE.

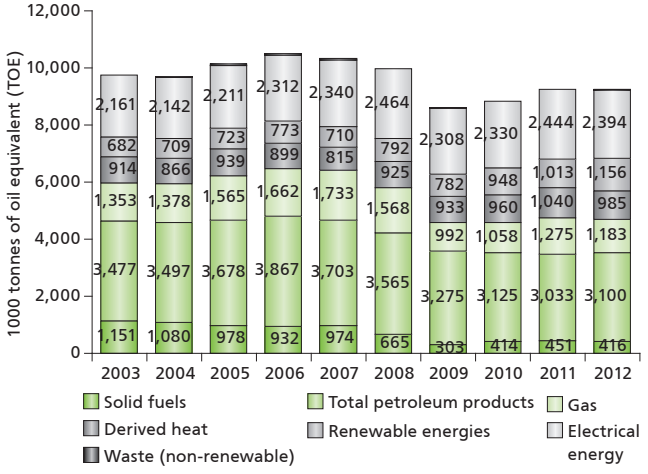
The reverse indicator to energy productivity is energy intensity, which represents the amount of energy needed to produce a given output. A high level of energy intensity is typically a sign of poor energy efficiency. Another important aspect of energy intensity is the structure of the economy in terms of the predominant sectors. For example, a knowledge-intensive and high-tech economy is likely to be less energy-intensive than one which focuses on manufacturing. Energy intensity is also affected by societal attitudes towards energy consumption, as in many cases saving resources is not considered a priority.

In 2012, the Bulgarian economy was the most energy intensive in the entire EU, with 670 KOE used to produce €1,000 of GDP. This represents a significant improvement compared to 2001, when energy intensity amounted to 1040 KOE/€1,000. The figures suggest two main conclusions about the nature of the Bulgarian economy. On the one hand, **economic growth in Bulgaria is yet to be decoupled from high levels of energy use**, which can be achieved by fostering knowledge-intensive rather than resource-intensive businesses. On the other hand, the high level of energy intensity is also the result of high levels of energy inefficiency, which means that even the production of a knowledge-intensive product requires more energy than in more efficient countries due to the outdated energy production, which causes losses in the transmission and distribution systems.

Energy consumption in Bulgaria declined drastically following the collapse of the communist regime as the majority of industrial plants were shut down. Since 2000, energy consumption has remained relatively stable, increasing gradually in the years before Bulgaria's accession to the EU as a result of the overall growth of the economy, and declining after 2008 due to the economic crisis. The biggest change between 2003 and 2012 in terms of energy products is the **reduced use of solid fuels**, which went from 1,151 thousand tonnes of oil equivalent (TOE) in 2003 to 416 thousand TOE in 2012, and the growth in renewable energy consumption, which increased from 682 thousand TOE to 1,156 thousand TOE over the same period. In terms of the distribution of energy consumption among economic sectors, the biggest shift over the period has been the significant decrease in the industrial sector. Over the period 2003 – 2007, industries consumed between 4,037 and 4,164 thousand TOE, after which consumption declined significantly reaching 2,582 thousand TOE in 2012. Energy consumption has also decreased in the agriculture and forestry sector. On the other hand, all other sectors experienced some growth in energy consumption. The biggest increase was registered in the transport and services sectors: in the transport sector it increased from 2,403 thousand TOE to 3,078 thousand TOE between 2003 and 2012, while in the services sector it grew from 763 thousand TOE to 1,002 thousand TOE over the same period.

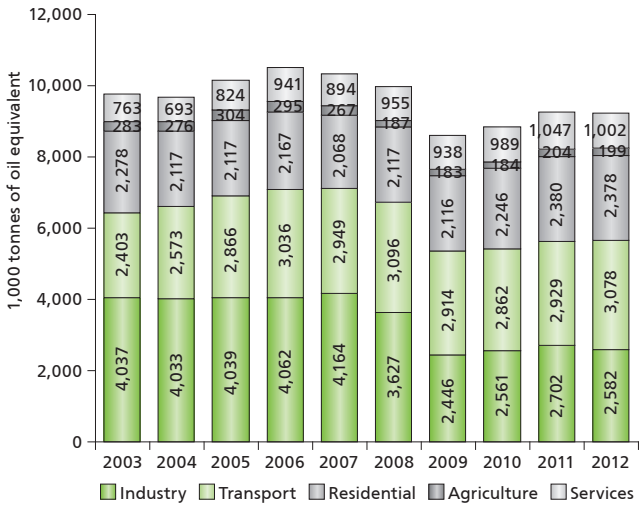
As changing energy consumption provide a good indication of the structural dynamic of the domestic economy, so the change in **the energy mix is reflective of the shift in European and national energy policy, and the growing use of renewable energy sources**.

Figure 17. FINAL ENERGY CONSUMPTION BY PRODUCT IN BULGARIA (2003 – 2012)



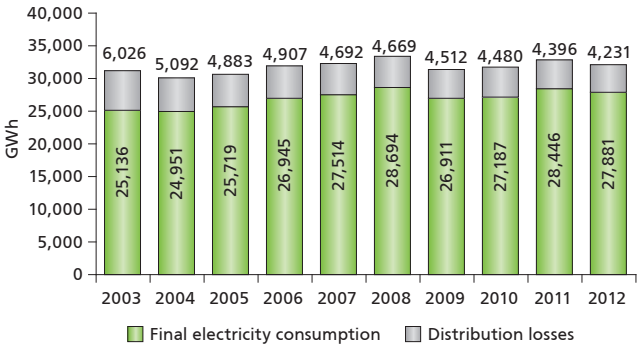
Source: Eurostat, 2014.

Figure 18. FINAL ENERGY CONSUMPTION BY SECTOR IN BULGARIA (2003 – 2012)



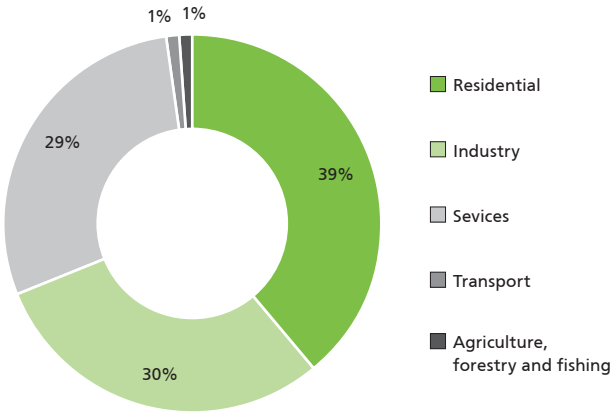
Source: Eurostat, 2014.

Figure 19. FINAL ELECTRICITY CONSUMPTION AND DISTRIBUTION LOSSES IN BULGARIA (2003 – 2012)



Source: Eurostat, 2014.

Figure 20. ELECTRICITY CONSUMPTION BY SECTOR IN BULGARIA (2012)



Source: Eurostat, 2014.

Among energy forms used in modern economies, electricity is perhaps the most telling of the entire energy system and can provide useful insight into the level of development of a country, as well as its energy efficiency. **Power generation is one of the most energy intensive processes in the Bulgarian economy** and while increased consumption can be seen as a sign of economic growth, it must also be considered in terms of the harmful emissions it produces, particularly from conventional fossil fuel power plants. Bulgaria's electricity consumption has been growing slowly since 2001 and has only suffered a slight slowdown in 2009 as a result of the economic crisis and overall decline of the economy. It is important to point out that although it is declining, **there is a large amount of electricity loss during the transmission and distribution stage, which is the result of the outdated electricity grid**. While in 2003 these losses were equal to 23 % of final consumption, by 2012 this value has decreased to 15 %. However, this is well above the EU average (7.5 % in 2012) and the rest of the former communist member states, with the exception of Romania, where distribution losses in 2012 amounted to 17 % of final consumption. This is a sign that Bulgaria is in desperate need of modernisation of its electricity grid, which can be achieved by introducing more efficient technologies. Despite the fact that customers are charged monthly for maintenance, the past 20 years have seen a continuous underfunding of the grid leading to high depreciation and frequent blackouts. Moreover, as the country introduced a preferential regime in 2007 to boost the development of projects generating energy from renewables, following the latest EU regulations and developments in the energy sector, it became clear that the aged electricity grid has no capacity to accommodate these requirements and serve the bulk of these projects.

While on the one hand consumption is going down because manufacturing industries are slowly giving way to more knowledge-intensive business and the services sector, rising standards of living and the growing use of electricity for heating have led to high levels of household electricity consumption.

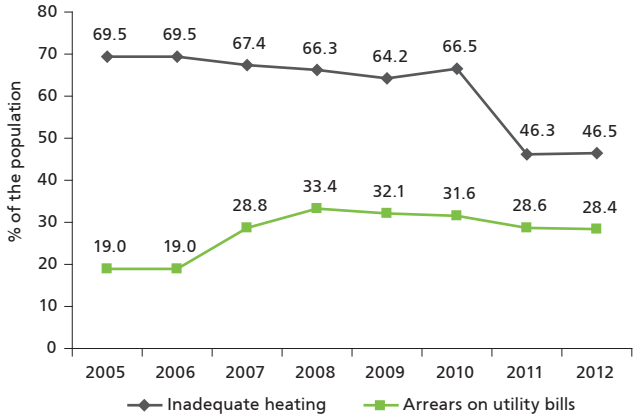
Energy Efficiency in Households and Energy Poverty

Over the past few years electricity prices have become a central topic in public debates. While nominally the lowest in the EU, they are relatively high in terms of purchasing power parity, making electricity an expensive commodity, particularly for those **Bulgarian households which spend more than 10 % of their annual income on energy and are considered energy poor. The biggest share of energy expenditure is related to heating costs**, which is another way of measuring the energy poverty of a household. This

is primarily a result of the fact that 88 % of all residential buildings in Bulgaria were built before 1990 and only 5 % were built after 2000. Thus, most residential buildings were not built in line with energy efficiency considerations and are extremely inefficient. The green technologies which can be installed or retrofitted in households by Bulgarian companies represent a big economic opportunity for local businesses which has not been fully utilised. This is mostly because families living in housing of low energy efficiency have little disposable income to invest in new technologies. At this stage, providing more public funding and simplifying administrative requirements is crucial to improving the energy efficiency of Bulgarian residential buildings.

According to the EU Statistics on Income and Living Conditions (SILC), which uses data from household surveys, in 2012 46.5 % of the respondents in Bulgaria could not keep their homes adequately heated. While this is an improvement compared to previous years, it is still significantly higher than the EU average of 10.8 %. Furthermore, 28.4 % of Bulgarians had accumulated arrears on their utility bills, compared to 9.9 % across the EU.

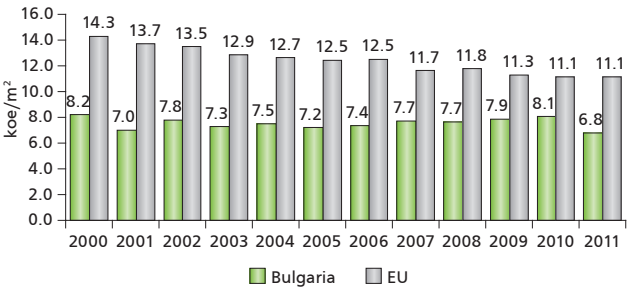
Figure 21. SHARE OF BULGARIANS UNABLE TO ADEQUATELY HEAT THEIR HOME AND HAVING ARREARS ON THEIR UTILITY BILLS (2005 – 2012)



Source: Eurostat SILC, 2013.

The average Bulgarian household uses less energy for heating purposes per m² than the average across the EU. Between 2000 and 2011 average energy consumption for heating in Bulgarian households varied between 7 and 8 KOE/m², while the average in the EU decreased progressively from 14 to 11 KOE/m² (with climatic corrections) over the same period. These trends can be attributed to several factors. On the one hand, it is likely that **Bulgarian households use less energy to heat their home due to their inability to pay for adequate heating**, rather than because their housing is more energy efficient. On the other hand, as energy efficiency improves across Europe, households use a decreasing amount of energy, but this is still higher than in Bulgaria in order to maintain a comfortable temperature.

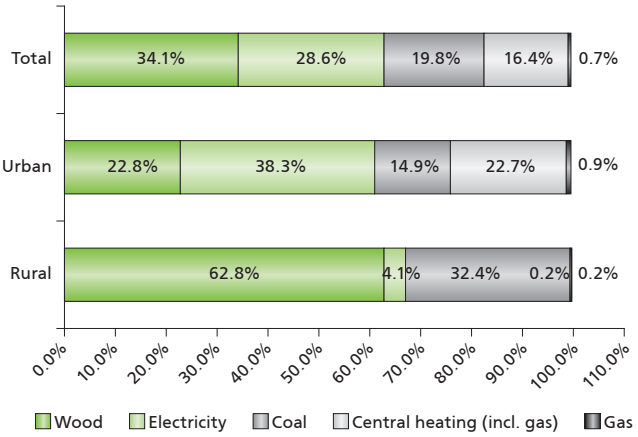
Figure 22. UNIT CONSUMPTION PER M² FOR SPACE HEATING WITH CLIMATIC CORRECTIONS IN BULGARIA AND THE EU (2000 – 2011)



Source: Odyssee database, 2014.

The state of energy poverty among Bulgarian households can also be evaluated by examining the energy mix used for heating. **The most popular heating sources are wood and electricity**, used by 31.1 % and 28.6 % of households respectively. Only 0.7 % of households use gas, which is partly the result of low penetration rate of natural gas infrastructure even in urban areas. There are considerable differences between urban and rural households. Electricity prevails in cities (38.3 % of households), which is why electricity prices are a particularly sensitive subject especially in the cold winter months. On the other hand, almost two thirds of rural dwellings use wood, which is indicative of energy poverty. Given the growing energy consumption by households and the rising electricity prices, installing technologies which reduce energy consumption has significant potential to alleviate the widespread levels of energy poverty.

Figure 23. MAIN HEATING SOURCES BY TYPE OF SETTLEMENT IN BULGARIA (2011)

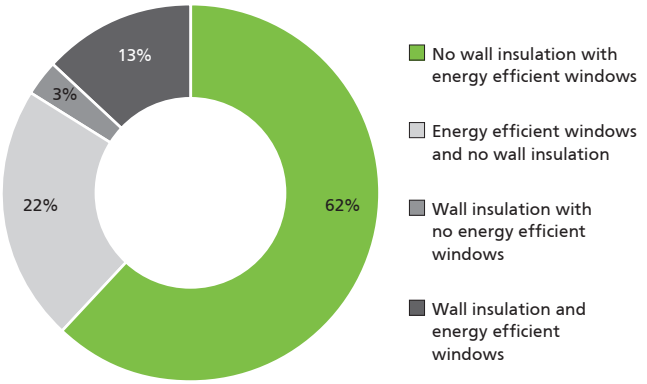


Source: National Statistical Institute, 2014.

However, **the potential of green innovations in reducing energy consumptions in Bulgarian homes remains largely**

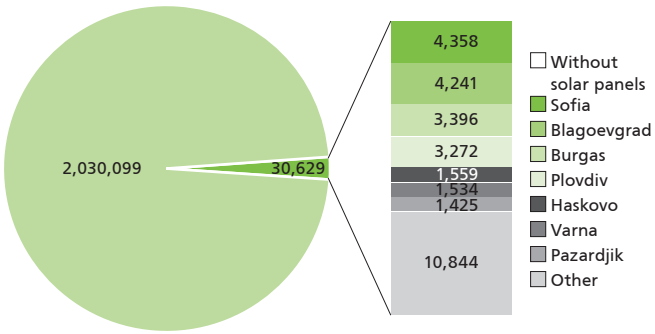
untapped. The 2011 census shows that energy saving technologies are still not very widespread. Sixty-two percent of all households have not installed any wall insulation or energy efficient windows and only 13 % have installed both. Among the two types of technologies energy efficient windows are more popular than wall insulation. Again the difference between rural and urban areas is quite stark: compared to the 17.3 % of urban homes, only 3.7 % of those in rural areas are equipped with both technologies. On-site energy production – primarily photovoltaic panels – is extremely limited despite the European Commission's estimates that in urban areas a Bulgarian home can produce on average 1,600 KWh/m² every year, amounting to 30 % of the average household electricity consumption. In fact only 1 % of Bulgarian homes, or a total of 30,629 households, have installed solar panels. These households are concentrated in the Sofia, Blagoevgrad, Plovdiv and Burgas regions, where half of the homes which use such technologies are situated. Fostering the development, production and implementation of green innovations through a favourable regulatory environment in this field, would improve the energy efficiency of households, reduce their energy consumption and increase heat comfort levels, as well as create jobs and boost economic competitiveness.

Figure 24. DWELLINGS WITH WALL INSULATION AND ENERGY EFFICIENCY WINDOWS IN BULGARIA (2011)



Source: National Statistical Institute, 2014.

Figure 25. GEOGRAPHIC DISTRIBUTION OF RESIDENTIAL BUILDINGS WITH SOLAR PANELS IN BULGARIA (2011)



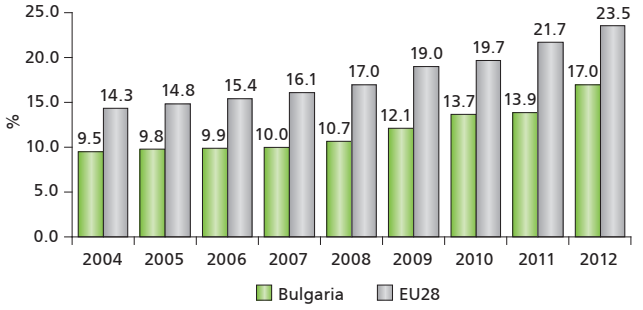
Source: National Statistical Institute, 2014.

Renewable Energy Sources

Renewable energy sources (RES) have the potential to contribute towards addressing Bulgaria's main energy challenges since they do not require the burning of fossil fuels and therefore do not lead to the emission of GHG, and they can be sourced domestically, thus reducing the dependence on energy imports, both for the economy as a whole and in households.

The share of electricity generated from renewable sources in Bulgaria reached 17 % of the total in 2012, a significant increase compared to 9.5 % in 2004. The average for the EU for 2012 amounted to 23.5 % of total electricity generation. There is significant variation among the member states from Central and Eastern Europe: Hungary (6.1 %), Poland (10.7 %), Lithuania (10.9 %) and Estonia (15.8 %) generate a smaller share of their electricity using renewable sources. On the other hand, Slovakia (20.1 %), Slovenia (31.4 %), Romania (33.6 %) and Latvia (44.9 %) use renewable sources for a much higher share of their gross electricity consumption in comparison not only to Bulgaria, but also to the EU average.

Figure 26. SHARE OF GROSS ELECTRICITY CONSUMPTION GENERATED FROM RENEWABLE ENERGY SOURCES IN BULGARIA AND THE EU (2004 – 2012)

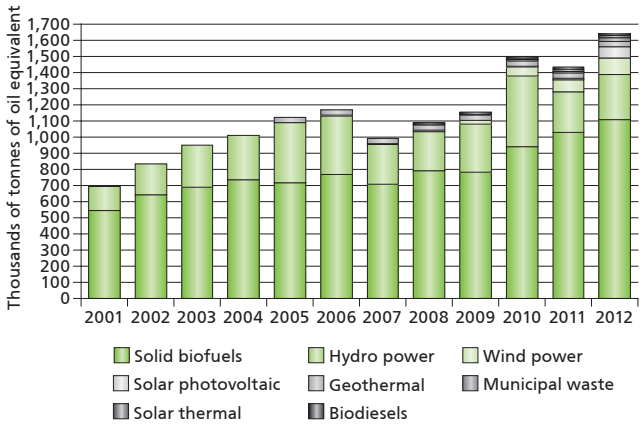


Source: Eurostat, 2014.

The use of renewable sources in Bulgaria has increased significantly between 2001 and 2012 going from 696.3 thousand TOE to 1,637.9 thousand TOE. **The primary renewable energy sources used in the country are solid fuels** (wood used primarily for residential heating in rural areas). Hydropower is the second most used renewable source, representing 16.9 % or 277.4 thousand TOE in 2012. Other types of renewable energy, namely solar and wind power,

have taken off since 2008 following Bulgaria's accession to the EU and the introduction of the *Renewable and Alternative Energy Sources and Biofuels Act* in 2007. Wind power is the third most popular renewable energy source, which accounted for 105 thousand TOE compared to 4 thousand TOE in 2007. Solar photovoltaic energy has experienced a similar surge growing from 0.3 thousand TOE in 2009 to 70 thousand TOE in 2012.

Figure 27. PRIMARY PRODUCTION OF RENEWABLE ENERGY BY SOURCE IN BULGARIA (2001 – 2012)

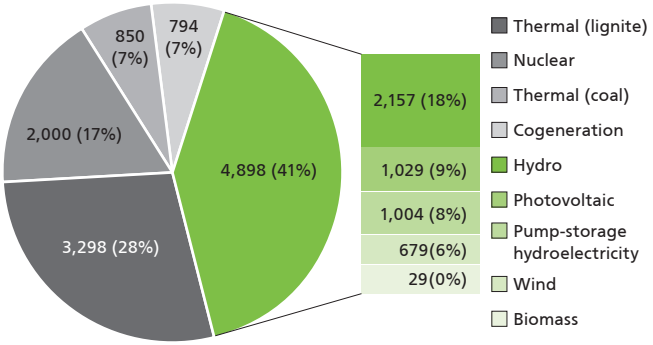


Source: Eurostat, 2014.

The environmental and economic benefits of renewable energy sources have been overshadowed by the circumstances in which their sudden growth took place over the past few years. The 2007 *Renewable and Alternative Energy Sources and Biofuels Act* guaranteed preferential prices to wind and solar energy producers, which led to a sudden and substantial growth of installed capacity. Due to the government's commitment to purchase electricity from RES consumer prices began rising, leading to widespread hostility towards these projects, which was exacerbated by the high levels of energy poverty and the economic downturn resulting from the financial crisis. Despite these issues and the overall decrease in electricity consumption, **the installed capacity of RES now exceeds the recommended amount needed to guarantee the safety of the electricity grid**, which is outdated and is not equipped with the necessary capacity to balance the increasing number of new generation facilities.

In 2013, generation capacity from RES in Bulgaria amounted to 41 % of the total, which contributes to the production of just 16.3 % of the total energy. Hydroelectric power plants represent the biggest share among renewable sources (2,157 MW), which provided most RES capacity already before the introduction of European and national legislation promoting these sources. A further 1,004 MW are provided by pump-storage hydroelectric power plants. Photovoltaic facilities had an installed capacity of 1,029 MW, while wind power plants had a total capacity of 670 MW in 2013. Biomass had a capacity of only 29 MW. The total of 4,898 MW RES installed capacity far exceeds the planned 2,070 MW which were set in the National Action Plan for Renewable Energy.

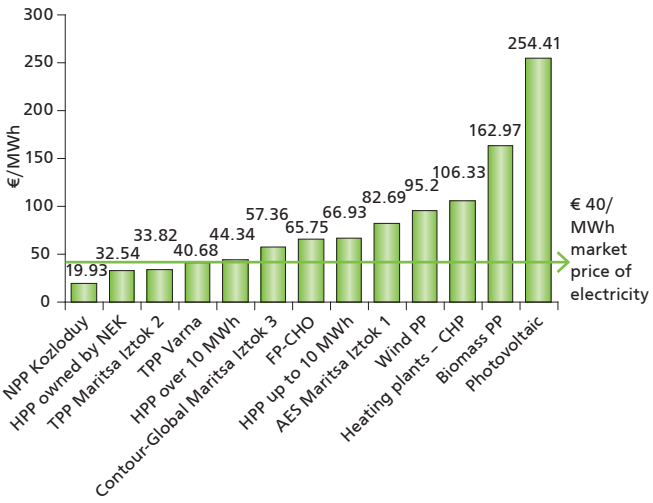
Figure 28. INSTALLED GENERATION CAPACITY IN BULGARIA, MEGAWATTS AND SHARE, (2013)



Source: State Energy and Water Regulatory Commission, 2014.

Whilst contributing to the achievement of Bulgaria's Europe 2020 goals, **the commitment to purchase electricity from renewable sources has led to the distortion of the energy market and has slowed down its liberalisation considerably**. In view of the commitments to purchase electricity not only from renewable sources but also from the two private thermoelectric power plants AES Maritsa Iztok 1 and Contour–Global Maritsa Iztok 3, the prices at which the National Electricity Company purchases electricity from most producers far exceed the free market price of 40 €/MWh.

Figure 29. ELECTRICITY PRICES ON THE REGULATED ELECTRICITY MARKET IN BULGARIA (2013)



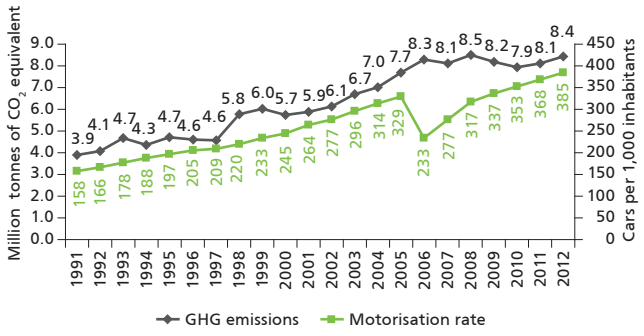
Source: State Energy and Water Regulatory Commission, 2014.

Transportation

At the EU level, **transport is the biggest producer of greenhouse gas emissions after the energy sector** and the only sector in which emissions are still growing and originate primarily from road vehicles. Bulgaria is also following in this trend, although transport only produced 14 % of total emissions in 2012. Nevertheless, GHG emissions from transport have grown from 3.9 million tonnes of CO_2 equivalent in 1991 to 8.4 million tonnes in 2012. The peak in emissions from transport was registered in 2008, when they reached 8.5 million tonnes of CO_2 equivalent. Since 2008 there has been a slight decrease in the volume of emissions, which can be attributed to the introduction of newer and more technologically advanced vehicles. This is also evident in the decrease in average CO_2 emissions per kilometre from new passenger cars, which have gone from 171.6 to 141.7 grams of CO_2 per km between 2007 and 2013.

This overall growth trend is mirrored very closely by the **steady increase in motorisation** which went from 158 to 385 cars per 1,000 people over the same period. The sudden drop in this indicator in 2006 was the result of the requirement to change licence plates in view of Bulgaria's accession to the EU, which many car owners did not do for very old vehicles, which were no longer in use. This is a relatively low motorisation rate compared to the rest of the EU member states, where Italy was the leader in 2012 with 621 cars per thousand inhabitants. However, Bulgaria has a relatively high rate in comparison to other former communist states such as Croatia (339), Slovakia (337), Latvia (305), Hungary (301) and Romania (224), which has the lowest motorisation rate in the EU in 2012 among the countries for which data are available. Given the increase in the number of cars, it is necessary to introduce a variety of measures in order to limit the rise in emissions.

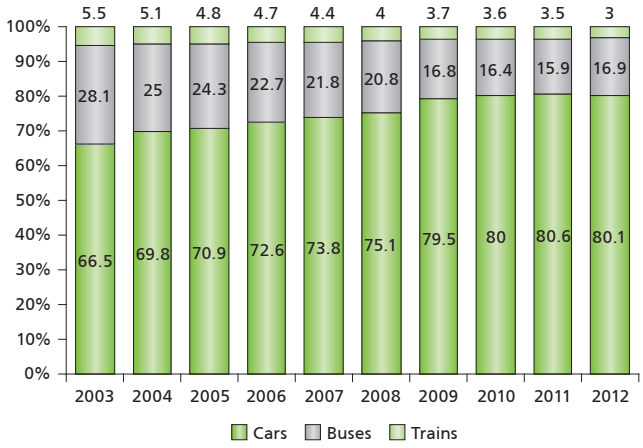
Figure 30. MOTORISATION RATE AND GHG EMISSIONS FROM TRANSPORT IN BULGARIA (1991 – 2012)



Source: Eurostat, 2014.

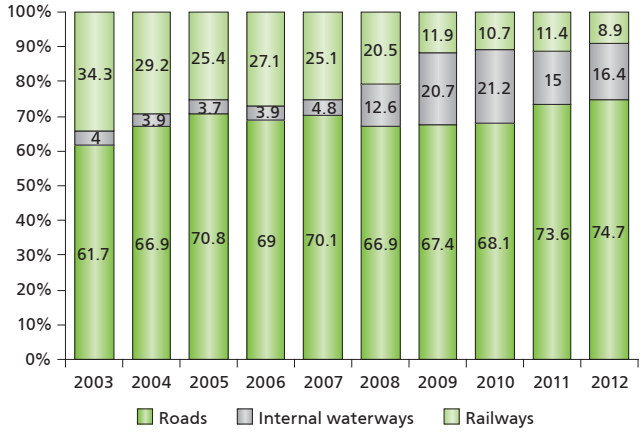
Three key elements determine the volume of GHG emissions from transport: the number of vehicles on the road; the power source they use; the technologies they are equipped with to limit the amount of CO_2 they emit. The increase in **Bulgaria's motorisation rate between 2003 and 2012 was mostly due to the growing use of personal vehicles for passenger transport** at the expense of public transport such as buses and trains. This rate of car use is slightly below the EU average (83.3 %) where this indicator varies between 67.7 % in Hungary and 91 % in Lithuania. The modal split for freight transport has also increased in the use of road vehicles, but also with regards to internal waterways at the expense of railways. This is a positive development as waterway transport requires less energy consumption per kilogram (17 % and 50 % for road and rail respectively), generates up to seven times less emissions, and causes fewer congestions and accidents than road transport.[27]

Figure 31. MODAL SPLIT OF PASSENGER TRANSPORT IN BULGARIA (2003 – 2012)



Source: Eurostat.

Figure 32. MODAL SPLIT OF FREIGHT TRANSPORT IN BULGARIA (2003 – 2012)

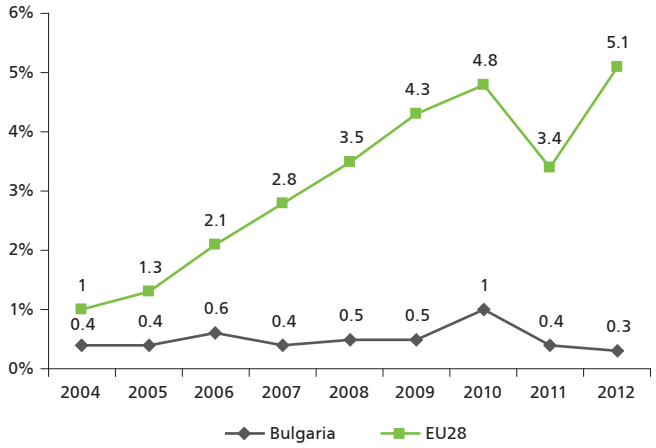


Source: Eurostat.

[27] http://ec.europa.eu/transport/modes/inland/index_en.htm

The other factor affecting the volume of emissions deriving from transport is the type of fuel used by vehicles. While the EU as a whole has been promoting the use of renewable energy sources and biofuels for transport reaching the average of 5.1 % in 2012, Bulgaria is still lagging behind in this regard and has made no real progress since 2004. After a slight increase in 2010 when 1 % of fuel consumption of transport originated from RES, this value went down to a mere 0.3 % in 2012. Cyprus is the only member state where no renewable sources are used as fuel for transportation, while the frontrunners in this regard are Germany (6.9 %), France (7.1 %, Austria (7.7 %) and Sweden (12.6 %).

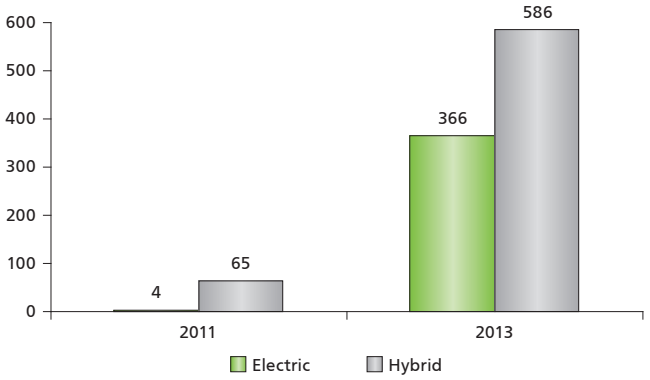
Figure 33. SHARE OF RENEWABLE ENERGY IN FUEL CONSUMPTION OF TRANSPORT IN BULGARIA AND EU (2004 – 2012)



Source: Eurostat, 2014.

The rare use of renewable energy for transport fuel is also evident when looking at the number of electric and hybrid vehicles that are currently in use in Bulgaria. **Despite policy strategies to encourage the use of such vehicles, in 2013 there were a total of 366 electric cars and 586 hybrid cars.** While these numbers are very low, they are still a significant improvement compared to 2011 when they were 4 and 65 respectively.

Figure 34. NUMBER OF ELECTRIC AND HYBRID VEHICLES IN BULGARIA



Source: Ministry of Economy and Energy, 2013.

Policies and Funding for Green Industry Innovation in Bulgaria

Resource efficiency and green innovation in industry are no passing fads. Rising resource constraints and a growing middle class around the world – the underlying sources of constantly increasing demand for raw materials and goods with the associated environmental challenges – are long-term trends that will continue shaping governmental and business strategies in the years to come.

There are significant variations in the level of development and effects of green innovation across industries and countries. For companies and countries where penetration rates are relatively low, green innovation can potentially have a dramatic impact on market dynamics. To seize the new growth opportunities and not lose competitive edge to better equipped competitors, governments and businesses need to rethink how resource-related issues shape profitability.

Government regulation determines the speed and scale at which companies adjust their strategies for more resource productivity and reduced environmental harm. Creating the necessary conditions and incentives for green growth and green innovations in industry requires a shift in institutional mind-sets and mechanisms. After decades of relatively cheap resources, secure supply and marginal environmental concerns, few private or public institutions have made resource productivity a priority. Some of the critical challenges for governments include:

- lack of understanding of the changing resource landscape and green innovation opportunities;
- fragmented institutional approach and a weak coordination among relevant ministries leading to problematic prioritisation and policy implementation;
- a complex maze of environmental regulations and a multi-level governance system responsible for the actual implementation of laws and measures.

Being a global leader in integrating environmental considerations into key policy areas, the European Union acts as a major driver for transforming the national policies of its member states. This holds true especially for countries of lower awareness and experience in the field such as Bulgaria. Not only is the design and timeline of the adopted policy targets related to green industry innovation in the country are largely determined by the mandatory transposition of EU legislative acts into national law, but financial support is also provided mainly by EU cohesion funds.

The review of national strategic priorities relevant to energy intensity and dependence reveal a **disproportionately strong attention to the energy sector** (in particular with regard to energy security and energy production, conversion and transportation) **and the energy characteristics of public and private buildings** as opposed to clean technologies, green production technologies and efficient final energy consumption (FES) in industry. This can be explained by the highly inefficient energy sector in the country, low diversification of energy imports and high savings potential from building stock retrofitting. However, **delaying the introduction of incentives for the greening of industry, policy-makers risk damaging national economic competitiveness** in view of global trends and the emergence of similar policies in other countries.

Outside the energy sector, **current green industry policies in Bulgaria focus primarily on increasing resource efficiency in FEC of large enterprises.** Adopted energy saving targets are aligned with the mandatory national target set in the *Energy Efficiency Act* as part of the binding 20/20/20 objectives of EU's 2020 climate and energy package, which Bulgaria is unlikely to achieve, at least in terms of energy efficiency. **Progress in large enterprises whose facilities fall within the provisions of the Act is largely achieved by introducing passive energy management measures** such as retrofitting of production buildings, improvements in lighting systems and technological upgrade of industrial systems. Active energy management tools such as energy management systems for measuring, analysing and improving energy consumption are still a rarity, except for the largest and most energy intensive enterprises, particularly in the utility, extraction and processing industries. **At present, no legal obligations and little incentives exist for SMEs to improve their energy efficiency**.

Bulgaria 2020

The priorities of the EU outlined in the Europe 2020 Strategy are reflected in the **National Development Programme Bulgaria 2020** and put into the context of the country's national priorities. One of its main goals is enhancing the competitiveness of the economy by ensuring a favourable environment for business, promotion of investments, application of innovative solutions and improving resource efficiency (Goal 3). Three out of the Programme's eight priorities and a number of sub-priorities are associated with reducing environmental impact and promoting green innovation. The socio-economic analysis accompanying Bulgaria 2020 highlights that a major challenge facing the country's economy is low energy efficiency which is exerting a negative impact on competitiveness. Areas of needed priority intervention include:

- outdated energy infrastructure and significant losses in energy transmission;
- outdated technological base in enterprises;
- relatively low energy prices discouraging the introduction of energy-saving technologies;
- difficult access to funding for energy-saving technologies.

Overall, the implementation of Bulgaria 2020 is projected to be financed mainly by European funds, complemented by national sources. However, **at the time of the adoption of the strategy, the sources of funding for most of the individual measures had not been established**.

National Action Plan on Energy Efficiency 2008 – 2016

Comprehensive energy efficiency policies in industry were first introduced in Bulgaria with the adoption of the *Energy Efficiency Act* in 2008 implementing the requirements of the EU Directive on energy end-use efficiency and energy services. **A long-term target of 9 % reduction in final energy consumption by 2016 (equivalent to 7,291GWh)** has been laid down in the National Energy Efficiency Strategy based on minimal values recommended in EU legislative acts and then further elaborated in the National Energy Efficiency Action Plan for the period 2008 – 2016.[28]

Table 5. BULGARIA 2020 PRIORITIES RELATED TO ENVIRONMENT AND GREEN INNOVATION

Priority 4. Development of the agricultural sector through sustainable management of natural resources
Sustainable use and management of natural resources.
Priority 7. Energy security and increasing resource efficiency
Ensuring energy security – diversification of sources and routes.
Promoting the use of energy from RES.
Increasing energy efficiency – increasing the efficiency of production, transmission and consumption of energy.
Creating an integrated internal energy market – transparent pricing, flexibility in negotiations, transmission interconnection facilities, simultaneous distribution of energy and capacity.
Increasing the efficiency of use of resources – introduction of low-carbon, energy-efficient and waste-free technologies, as well as through the recovery and recycling of a larger amount of waste.
Priority 8. Improving transport connectivity and access to markets
Limiting the negative impact of transport on the environment and the health of people – restricting the harmful emissions and pollution through intermodal transport, renovation and modernisation of the fleet.

Source: Bulgaria 2020.

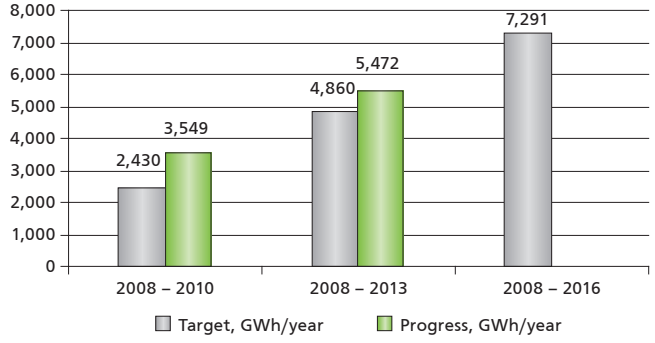
[28] The baseline value for the FEC is calculated as the average of the FEC in the period 2001 – 2005.

The plan is divided in shorter-term three-year documents which set intermediate milestones and monitor progress. **By the end of 2013, Bulgaria had overachieved its mid-term goal of 6 % FEC savings** and seems on the right track to fulfilling its commitments. The national energy savings targets are allocated as mandatory individual target among:

- owners of industrial systems with annual energy consumption exceeding 3,000MWh;
- owners of public service buildings with gross floor area exceeding 500 m^2 (after 2015 – over 250 m^2);
- retail energy sales companies.

The latter are expected to contribute as much as 5.5 times more to reducing FEC (4,644 GHh/year) compared to the owners of industrial systems (839 GWh/year). In terms of actual implementation, **the public sector (national and local authorities) has already fulfilled its 2016 target (521 GWh/year)**, while the other operators obligated by the law have achieved close to 40 % of theirs. A sectoral analysis reveals that measures implemented in industry account for only 15 % of the 5,472 GWh/year FEC savings achieved in the period 2008-2013, less than in households, transport and services. Close to one third of energy savings, or 1,743 GWh, occurred in the energy retail sector.

Figure 35. NATIONAL TARGETS AND CUMULATIVE PROGRESS IN FEC SAVINGS, GWh/year

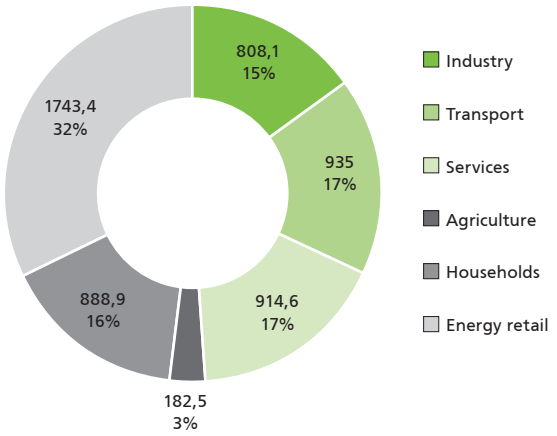


Source: Sustainable Energy Development Agency (SEDA).

The individual targets for the owners of industrial systems which have undergone an energy efficiency audit are calculated as half of the identified energy saving potential. In the absence of an audit, targets are set by the Sustainable Energy Development Agency (SEDA) in proportion to:

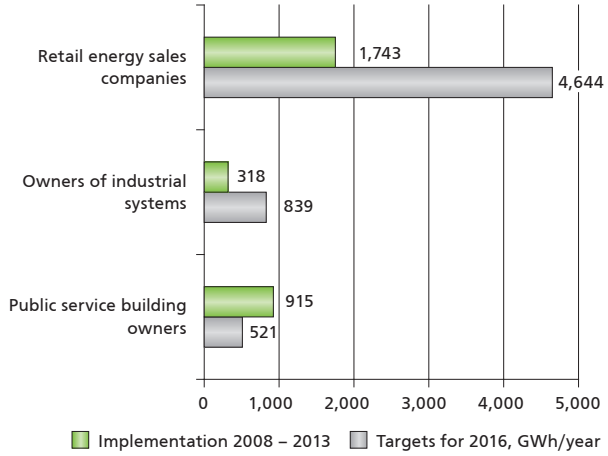
- the target for the sector;
- the weight of the industrial system consumption relative to the entire consumption of the enterprise;
- the energy intensity of the enterprise relative to EU average values, if available.

Figure 36. IMPLEMENTATION OF FEC SAVINGS BY SECTOR, 2008 – 2013, GWh/year



Source: SEDA.

Figure 37. IMPLEMENTATION OF FEC SAVINGS, BY TYPE OF OBLIGATED OPERATOR, 2008 – 2013, GWh/year



Source: SEDA.

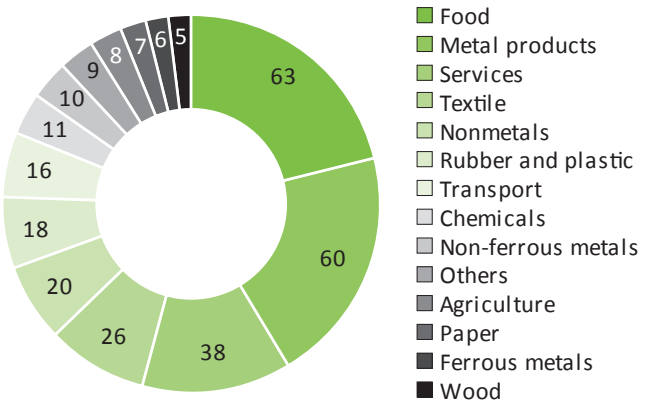
According to this methodology, **individual energy savings targets have been set for 297 industrial systems** with an annual consumption over 3 GWh. The bulk of the enterprises affected by these targets are in the manufacturing of food (63) and metal products (60), as well as in textiles (26), and nonmetals (20). The significant number of industrial systems with individual energy savings targets in the sector of services (38) is mainly due to the inclusion of water and sewage system operators in larger cities. A total of 30 enterprises, or 10 % of industrial systems owners, have to cut back energy consumption by more than 3 GWh by 2016. Five **enterprises are responsible for contributing to more than half of the total required savings in industry**: chemistry giant Solvay Sodi (310 GWh),[29] the Bulgarian

[29] According to the evaluation of the Second National Energy Efficiency Action Plan, it is foreseen that Solvay Sodi will be removed from the list of obligated companies and included into the EU Emissions Trading System.

Railway Company (58 GWh), textile manufacturer Nitex (30 GWh), transport company Somat (23 GWh), as well as pulp and paper manufacturer Svilosa (21 GWh).[30]

The owners of industrial systems with mandatory savings targets have introduced different measures on the path to achieving them. The evaluation of the Second National Energy Efficiency Action Plan (2011 – 2013) of April 2013 revealed that while the majority of measures reported for 2012 were technological, the share of more basic improvements such as the insulation of buildings and energy efficient lighting remained large. The report pointed out that the **effective measures with shorter return on investment period are already exploited and more sophisticated, longer-term measures and activities are growing in importance**. An overall conclusion of the evaluation was that the process of decoupling of growth from energy use in industry needs to be accelerated by introducing additional financial support measures.

Figure 38. OWNERS OF INDUSTRIAL SYSTEMS WITH INDIVIDUAL ENERGY SAVINGS TARGETS (MORE THAN 3,000 MWH ANNUAL CONSUMPTION), BY SECTOR



Source: ARC Fund based on SEDA public data.

Table 6. TYPE AND NUMBER OF ENERGY SAVING MEASURES IMPLEMENTED IN INDUSTRY IN 2012

	Type of energy saving measures	Number
1	Energy efficient equipment	6
2	Change of fuel base	8
3	Energy monitoring and management	19
4	Insulation of buildings	28
5	Energy efficient lighting	40
6	Technological measures	87

Source: ARC Fund based on MEE data.

[30] SEDA list of obligated owners of industrial systems.

Green Public Procurement

In 2003, the European Commission in its Communication on Integrated Product Policy encouraged member states to draw up national action plans for greening their public procurement.[31] Although the adopted targets are not legally binding, they provide political impetus to the process of implementing and raising awareness of green public procurement (GPP). GPP is understood as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured."[32] Since GPP is largely a voluntary instrument, the extent to which public authorities use it is a good indication of their willingness to utilise their purchasing power to incentivise the development of green technologies and products by the private sector.

The National Action Plan for Green Public Procurement 2012 – 2014 adopted in 2011 introduced energy efficiency criteria for priority product groups. It also set **binding targets for the number of GPP by the central government as a share of all conducted procurement procedures**. For municipalities the application of green criteria in their procurement procedures remains optional and recommended targets are much lower. According to official data published by the Public Procurement Agency, which is entrusted with monitoring the progress under the National Action Plan for GPP, **in 2013 59 GPPs were opened and 29 awarded**. In monetary terms, awarded GPP contracts in 2013 add up to around €50 million. For comparison, in the same year a total of 22,779 public procurement contracts for more than €4.1 billion have been awarded by all public bodies in the country.[33]

Table 7. BINDING GPP TARGETS FOR CENTRAL GOVERNMENT INSTITUTIONS IN % OF THE NUMBER OF TOTAL AWARDED PROCUREMENTS

	Product group	2012	2013	2014
1	Copying and graph paper	60 %	80 %	90 %
2	Office and IT equipment	60 %	80 %	100 %
3	Office lighting	80 %	90 %	100 %
4	Air conditioning systems	90 %	95 %	100 %
5	Cleansing products	30 %	40 %	50 %
6	Conventional vehicles	98 %	96 %	94 %
7	Electric cars	2 %	4 %	6 %

Source: National Action Plan for GPP 2012 – 2014.

[31] COM (2003) 0302: Integrated Product Policy – Building on Environmental Life-Cycle Thinking.

[32] COM (2008) 400: Public procurement for a better environment.

[33] Public Procurement Agency data.

The small scale of public contracts awarded under consideration of green product criteria implies that public authorities fail to use their vast purchasing power to influence the marketplace towards greater environmental consciousness. The long-term implication for Bulgarian companies is a deteriorating competitive position as they will have less incentives to invest in environmental certification of their products and processes. By failing to demonstrate and communicate the environmental and economic benefits of GPP, **the public sector also misses the opportunity to encourage the private sector to use green criteria for its own procurement**. Based on the experience with GPP so far, the newly adopted National Strategy for the Development of the Public Procurement Sector in 2014 – 2020 emphasises that an impediment to its wider use by state authorities is the insufficiently clear definitions of product groups. To address this, the strategy envisages the elaboration of a practical handbook based on a research of best practices across countries with more experience in the field.

National Implementation of the Ecodesign Directive

An added effect of voluntary schemes – such as green public procurement – is that they reinforce the effects of mandatory requirements. A pertinent example is the Ecodesign Directive which provides consistent EU-wide rules for improving the environmental performance of:

- energy-using products (consumer goods such as boilers, computers, TVs, washing machines, light bulbs and industrial products such as transformers, industrial fans, industrial furnaces); and
- energy related products (windows, insulation material, shower heads, taps etc.).

Ecodesign requirements address only the main environmental parameters of products which have significant sales in the EU, and significant environmental impact and improvement potential. By 2020, the first Ecodesign Regulations of 13 product groups are projected to allow energy savings equivalent to more than 12 % of the electricity consumption of the EU in 2009 (compared to a 'business as usual' scenario).[34] Ecodesign requirements implemented in a cost-effective way are expected to benefit both businesses and consumers, by enhancing product quality and environmental protection. In Bulgaria, the provisions of the Directive have been transposed in national law through amendments to the *Products Technical Requirements Act*, which regulates the procedures for assessing and certifying the conformity with ecodesign requirements prior to the market launch of products under the scope of the regulation. **The impact of introduced ecodesign requirements is hard to evaluate since relevant data are not published or analysed by the State Agency for Metrological and Technical Surveillance**, the body implementing national policies in the field.

[34] "Ecodesign – Your Future", DG Enterprise and Industry, 2012, p. 5.

Funding for Green Innovation

A number of measures under the **Operational Programme Competitiveness 2007-2013** (OPC), expiring in 2015 according to the EU Commission's n+2 rule,[35] are intended to contribute to the greening of the Bulgarian economy. By October 2014, **close to 43.7 % of all contracted funds under OPC, or more than €511 million, are associated with Priority Axis (PA) 2 "Increasing efficiency of enterprises and promoting supportive business environment."**[36] The majority of projects funded under this PA are related in varying degrees to increasing resource efficiency and productivity in enterprises and result in reduced environmental impact.

As much as 60 % of the PA's budget has been channelled through technology upgrade schemes which are conducive to more efficient use of resources. In addition, the following two procedures had specific focus on energy solutions and green economy:

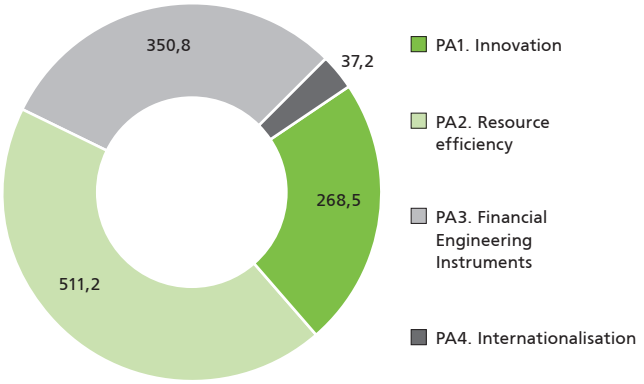
- The **Energy Efficiency and Green Economy Programme** is structured as a joint initiative between the Ministry of Economy and Energy and the European Bank for Reconstruction and Development (EBRD) aiming at the promotion of environmentally friendly, low-waste and energy-saving production technologies. The programme's duration was between June 2012 and April 2014, including several deadline extensions. The innovative feature of the programme is that it combines the EU Structural Funds grants with commercial bank lending in one process. The loan component is managed by the EBRD and provided within the framework of the Bulgarian Energy Efficiency for Competitive Industry Finance Facility (BEECIFF). Under this facility, credit lines are provided to participating local commercial banks to on-lend to SMEs for two types of investment projects – technology and energy audit driven – in priority manufacturing sectors such as production of chemicals, paper, plastic, rubber, machinery and equipment, electronics and motor vehicles. As of October 2014, **a total of 456 contracts to the amount of €145,8 million have been signed**.

[35] N+2 relates to financing rules for the annual allocation of money from the European Union's Structural and Cohesion Funds. Automatic decommitments are made if funding is not spent, or requests for payments are not made by the end of the second year after the end of the programming period in 2013.

[36] Unified Management Information System for the EU Structural Instruments in Bulgaria.

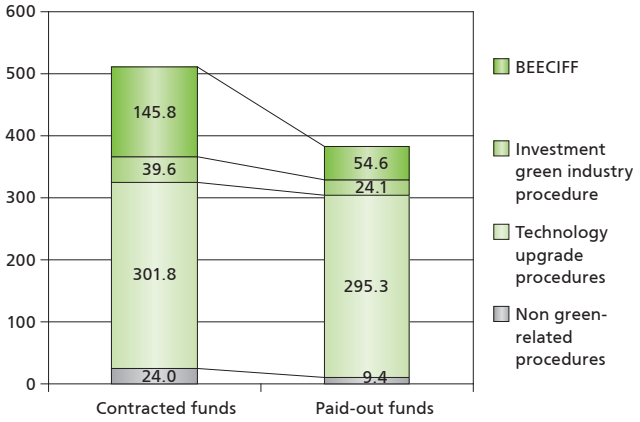
- **Investment in Green Industry procedure**, launched in 2011, supported Bulgarian enterprises in reducing their negative impact on the environment by funding projects on curbing energy consumption, manufacturing recyclable products, and using waste more effectively. Eligible candidates were only big enterprises with net sales of more than €2.5 million in 2010. **A total of 30 enterprises were supported with close to €40 million grant funding** to acquire new energy efficient equipment and recycling capacities, introduce new materials, expand production and product portfolios, integrate energy management systems and invest in RES. The 50 % co-funding rate mobilised additional €40 million from businesses, which otherwise probably would not have been spent on greening their production. Half of all investment projects occurred in three industries – manufacture of basic metals, manufacture of metal and manufacture of plastic products. The rest were implemented across sectors ranging from cement and craft pulp production over manufacture of textile, wood and furniture to manufacture of optical, hoisting and hydraulic machinery.

Figure 39. CONTRACTED FUNDS UNDER OPC 2007 – 2014, BY PA, € MILLION, OCTOBER 2014



Source: Unified Information Management System for the EU Structural Instruments in Bulgaria, 2014.

Figure 40. BREAKDOWN OF FUNDS UNDER PA2, CONTRACTED AND PAID-OUT, OPC 2007 – 2014, € MILLION, OCTOBER 2014



Source: Unified Information Management System for the EU Structural Instruments in Bulgaria, 2014.

Table 8. BENEFICIARIES UNDER THE INVESTMENT IN GREEN INDUSTRY PROCEDURE, BY ACTIVITY AND NACE DIVISION

	Company	Activity	NACE division
1	Hus	Metals	24. Manufacture of basic metals 25. Manufacture of fabricated metal products
2	Profilink	PVC profiles	
3	ZMM Sliven	Metal processing and machinery	
4	Alcomet	Aluminium products	
5	Sofia Med	Copper and zinc products	
6	KCM	Metals	
7	Aurubis Bulgaria	Production and recycling of copper	
8	Progress	Industrial iron castings	
9	Arexim Engineering	Plastic components and injection mould tools	22. Manufacture of rubber and plastic products
10	ITD	Plastic bottles, preforms and closures	
11	Herti	Plastic closures	
12	Megaport	Production and recycling of plastic packaging	
13	Extrapack	Packaging and bags	
14	Gotmar	Plastic products and tooling equipment	
15	Yuri Gagarin	Packaging and labels	
16	Plastchim-T	Packaging	

Source: ARC Fund based on SEDA data.

Table 9. INDICATIVE FINANCIAL DISTRIBUTION WITHIN OPIC 2014 – 2020, BY PA AND INVESTMENT PRIORITY, € MILLION

	Priority axis	Investment priority	EU funds	National funds	Total funds	Share in total
1	Technological development and innovation	Strengthening RTDI activities	251	44	295	20.88 %
2	Entrepreneurship and growth capacity of SMEs	Increasing competitiveness of SMEs	613	108	721	51.01 %
3	Energy and resource efficiency	Transition to low-carbon economy in all sectors	271	49	319	22.57 %
		Environmental protection and resource efficiency	31	5	37	2.59 %
4	Technical Assistance	–	35	6	41	2.95 %
	Total:		1,201	212	1,413	100 %

Source: MEE.

As of the last quarter of 2014, **no assessment can be made of the results achieved under green industry procedures financed by OPC 2007 – 2013**. By the end of 2013 most result indicators had registered no or very little progress towards the target values because at that point the bulk of funded projects was still under implementation and progress is reported only after final payments are made.[37] Thus, progress will be captured progressively with the approaching end of the period for project implementation in 2015. The built-in time lag, coupled with the delayed start of the OP in 2010 and the problematic absorption of funds by enterprises, hinder the evidence-based programming of the new OP Innovation and Competitiveness 2014 – 2020 (OPIC). It is noteworthy that the managing authority has proposed in the draft of the new OPIC a target of 52 supported companies by 2018 under the entire PA "Energy and resource efficiency" (only 10 % of the target value of 522 by 2023).[38] This low level of ambition suggests that the challenges related to **delayed launch of schemes and timely project implementation might prove hard to overcome** in the country's second programming period as well.

The successor OPIC 2014 – 2020 explicitly recognises the prominence of green growth in industry and it will be the main source of funding for the greening of the economy as envisaged by EU and national strategic documents. Reflecting the increasing environmental considerations at the EU level, its third priority axis will be dedicated entirely to improving energy and resource efficiency. According to OPIC draft of May 2014, **a total amount of €355.7 million, or one quarter of the entire programme, will be made available for the transition to a low-carbon economy, resource efficiency and environmental protection**. The two specific goals under PA3 are decreasing the energy intensity of the national economy with at least 5 % and increasing the resource efficiency of SMEs with at least 0.4 % by 2023. These targets are to be achieved by supporting enterprises to use low-carbon technologies, increase energy efficiency of production buildings, use electricity from RES, reduce and re-use waste and decrease input materials.

In the new OP there is an **increase in the number of indicators specifically related to energy and resource efficiency**. A positive development is also the newly introduced monitoring of achieved energy savings, GHG reductions, and conducted energy audits.

The available funding for SMEs in the area of green solutions and resource efficiency is complemented by **three smaller scale sources** – the Energy Efficiency and Renewable Sources Fund, Innovation Norway's Green Industry Innovation Programme in Bulgaria and the National Trust EcoFund. These funds do not have the explicit focus of OPC and OPIC on supporting Bulgarian enterprises, and only part of their resources, in some cases a minor one, is allocated to projects in the private sector. Employing different instruments and providing support under different conditions, all three funds contribute their share to greening Bulgarian enterprises.

[37] OPC Annual Implementation Report 2013 (in Bulgarian only).

[38] Draft version of OP Innovation and Competitiveness 2014 – 2020, May 2014 (in Bulgarian only).

Table 10. RESULT INDICATORS WITH TARGET VALUES UNDER OPC (PA2) AND OPIC (PA3)

Result indicators OPC 2007 – 2014, PA2	Target values		Result indicators OPIC 2014 – 2020, PA3
	2015	2023	
Number of supported enterprises introducing new technologies/products	550	400	Number of enterprises supported for energy efficiency
		405	Number of projects for energy efficiency
Number of projects for energy efficiency technologies/processes/solutions	332	100	Number of conducted energy audits
		130,000	Achieved energy savings (MWh) in supported enterprises
Installed RES capacities in supported enterprises (kWh)	33	40,000	Reduction of GHGs in supported enterprises
Number of installed co-generation facilities in supported enterprises	33	10	Number of implemented pilot and demonstration projects for material efficiency

Source: OPC Annual Implementation Report 2013 and draft version of OPIC.

Box 5. ADDITIONAL SOURCES FOR GREEN INDUSTRY PROJECTS

The Energy Efficiency and Renewable Sources Fund (EERSF) was established through the *Energy Efficiency Act* 2004 as a public-private partnership. EERSF is an independent self-sustainable commercial entity that supports the identification, development and financing of viable energy efficiency projects, resulting in substantial reduction of greenhouse gases. The initial capitalisation of EERSF was entirely with grant funds by the Global Environment Facility through the World Bank ($10 million), the government of Austria (€1.5 million), the government of Bulgaria (€1.5 million), and private Bulgarian companies, mainly financial institutions. The Fund has the combined capacity of a lending institution, a credit guarantee facility and a consulting company, providing three main categories of financial products: loans to municipalities, corporate clients and citizens, partial credit and portfolio guarantees. By the end of 2013, EERSF had financed 160 projects with more than €22 million.[39] While the majority of beneficiaries are municipalities, **50 companies have received €6.2 million** support for investments in energy efficiency in industrial processes, rehabilitation of buildings, energy management systems, and renewable energy sources.

The National Trust EcoFund (NTEF), established in 1995 through the first Debt-for-Environment Agreement between the Swiss and Bulgarian governments, has financed 100 environmental infrastructure projects for close to €12 million. The NTEF manages the funds from debt-for-nature and debt-for-environment swaps, international trade with greenhouse gas Assigned Amount Units, sale of aircraft greenhouse gas emission quotas, as well as funds mobilised from international sources including the World Bank, the Danish Environmental Protection Agency, Austrian government, and the US Agency for International Development. The majority of financed projects are related to public buildings gasification, landfills sanitation, construction of sewerage collectors, and environment restoration. **Approximately €2.5 million were provided to commercial companies** in the sectors of transport, energy, food and beverages, whereas municipalities account for the bulk of investments with €7.3 million.

Green Industry Innovation is one of the programme areas under Innovation Norway's grant assistance for the financial period 2009 – 2014. More than €110 million were budgeted for green innovation and green entrepreneurship in the eight beneficiary states of Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia. **A budget of €11 million was provided in Bulgaria**, mainly for green business development.

Source: ARC Fund, 2014.

[39] EERSF's Annual Financial Report 2013.

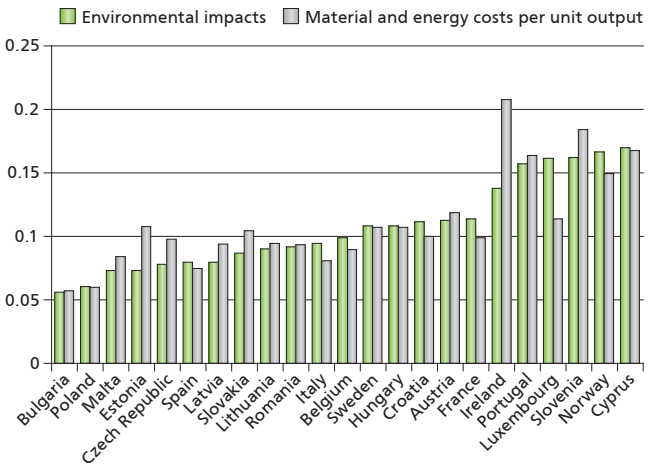
Green Innovation in Bulgarian Businesses

Community Innovation Survey

Data about the use of green innovations in businesses are very limited. The most common way of gathering information about the extent to which these technologies are integrated in the business sector is through surveys. **On the European level the Community Innovation Survey (CIS),** which is carried out every two years, **is the most comprehensive source of data in this regard.** The CIS provides extensive information on the innovative activities of enterprises, including various knowledge inputs that go into the innovation process.[40] A number of questions in the survey attempt to capture the creation and distribution of innovative products: information about in-house R&D, external R&D, acquisition of machinery, equipment and software, technology licenses, training for innovative activities, product design and market analysis. It also covers a variety of different sources of information and collaborative partners (internal, suppliers, customers, universities, etc.) as well as the ability to recognise hampering factors (funds, personnel, information, etc.). Influences on innovation inputs include public and other financial support. Outputs include the introduction of new products and processes, the share of turnover from new products, the importance of different objectives for product and process innovation on the enterprise, and the objective of organisational and marketing innovation on the enterprise.

While it provides a good overview of innovation in general, green innovations have received limited coverage in the CIS. In fact, they are only mentioned in the question regarding the purpose of creating innovation. Nevertheless the results of the survey provide a good baseline upon which to build. The **two options with an environmental**

Figure 41. CHANGE IN INNOVATIONS THAT REDUCE ENERGY COSTS AND ENVIRONMENTAL IMPACTS BETWEEN 2008 AND 2010



Source: Community Innovation Survey, Eurostat, 2010.

[40] Joseph Schumpeter identified five different kinds of innovation: "(1) The introduction of a new good... or of a new quality of a good; (2) The introduction of a new method of production... and can also exist in a new way of handling a commodity commercially; (3) The opening of a new market... whether or not this market has existed before. (4) The conquest of a new source of supply of raw materials or half-manufactured goods...; and (5) The carrying out of the new organization of any industry". Schumpeter, J. A., [1912] 1934. Theorie der wirtschaftlichen Entwicklung, Leipzig, Verlag von Duncker & Humblot. Third edition translated by R. Opie as The Theory of Economic Development, Cambridge: Harvard University Press, p. 66.

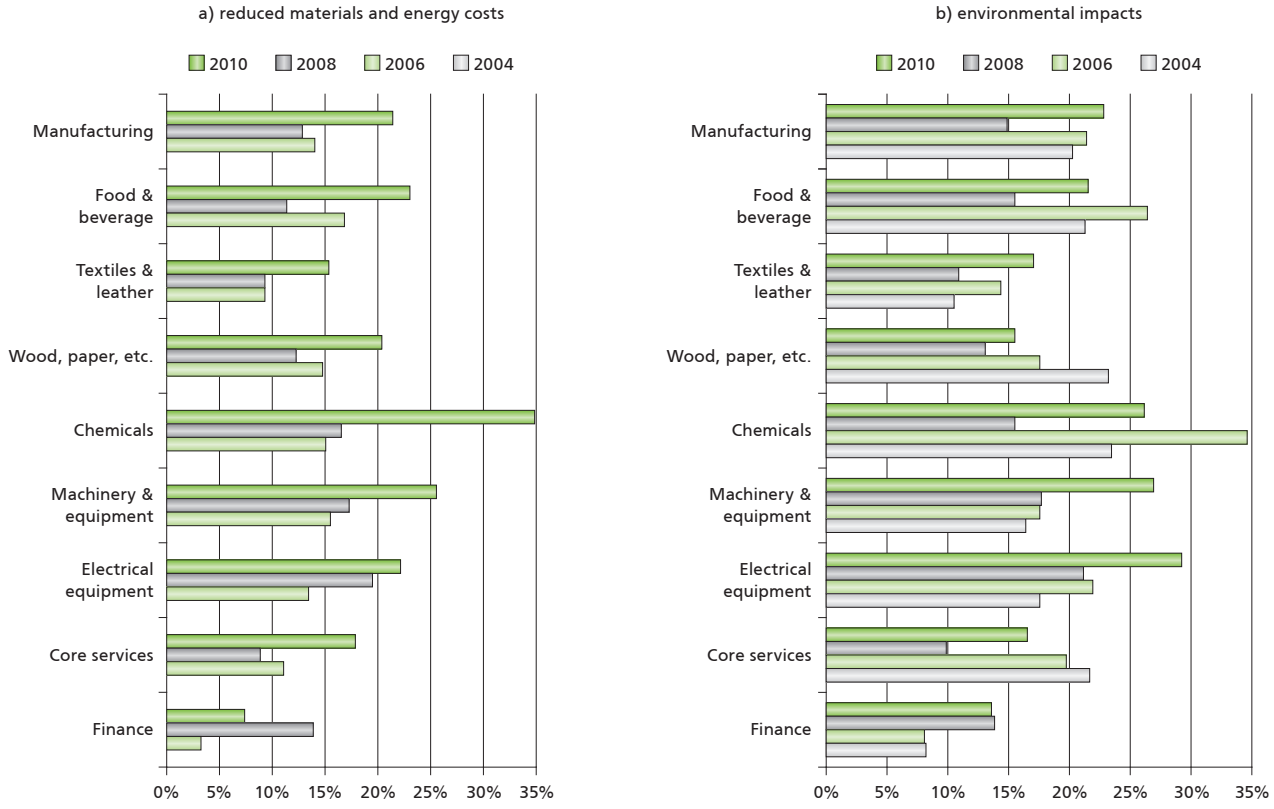
element are those concerning reduction of material and energy costs per unit of output and the reduction of environmental impact. These objectives appear as a process innovation and the lessening of environmental impact as something affecting the overall business environment. In Bulgaria, little more than 5.4 % of all enterprises in the sample have either reduced energy costs or environmental impact.

The services sector appears more innovative than manufacturing industries, and relatively high-tech industries appear more innovative than relatively low-tech industries. The pattern appears broadly similar across the two objectives and across time, although there is a perceptible increase in innovativeness related to energy and the environment across manufacturing industries in the 2010 survey, but there was also a noticeable decline in overall innovativeness of Bulgarian enterprises from the 2008 survey. (There could be some ambiguity in earlier surveys). In terms of the size of the enterprise, large manufacturing firms are much more innovative than large service oriented enterprises, but the differences decreases as the size of the enterprise gets smaller. Specifically, the size of the firm does not appear to matter for the service oriented enterprises in Bulgaria, whereas it does matter for enterprises engaged in manufacturing activities.

An ad-hoc module on innovation with environmental benefits was added to the 2008 CIS, which each member state could choose to include in the standard version of the survey. The questionnaire described twelve types of environmental impacts; nine that were related to the products of the enterprise and three that were related to their use. Questions considered existing and expected environmental regulations and taxes, grants, subsidies and other financial incentives, current or expected market demand for environmental innovations and other voluntary commitments. Finally, the survey asked whether the enterprise had any procedures in place to identify or reduce its environmental impact.

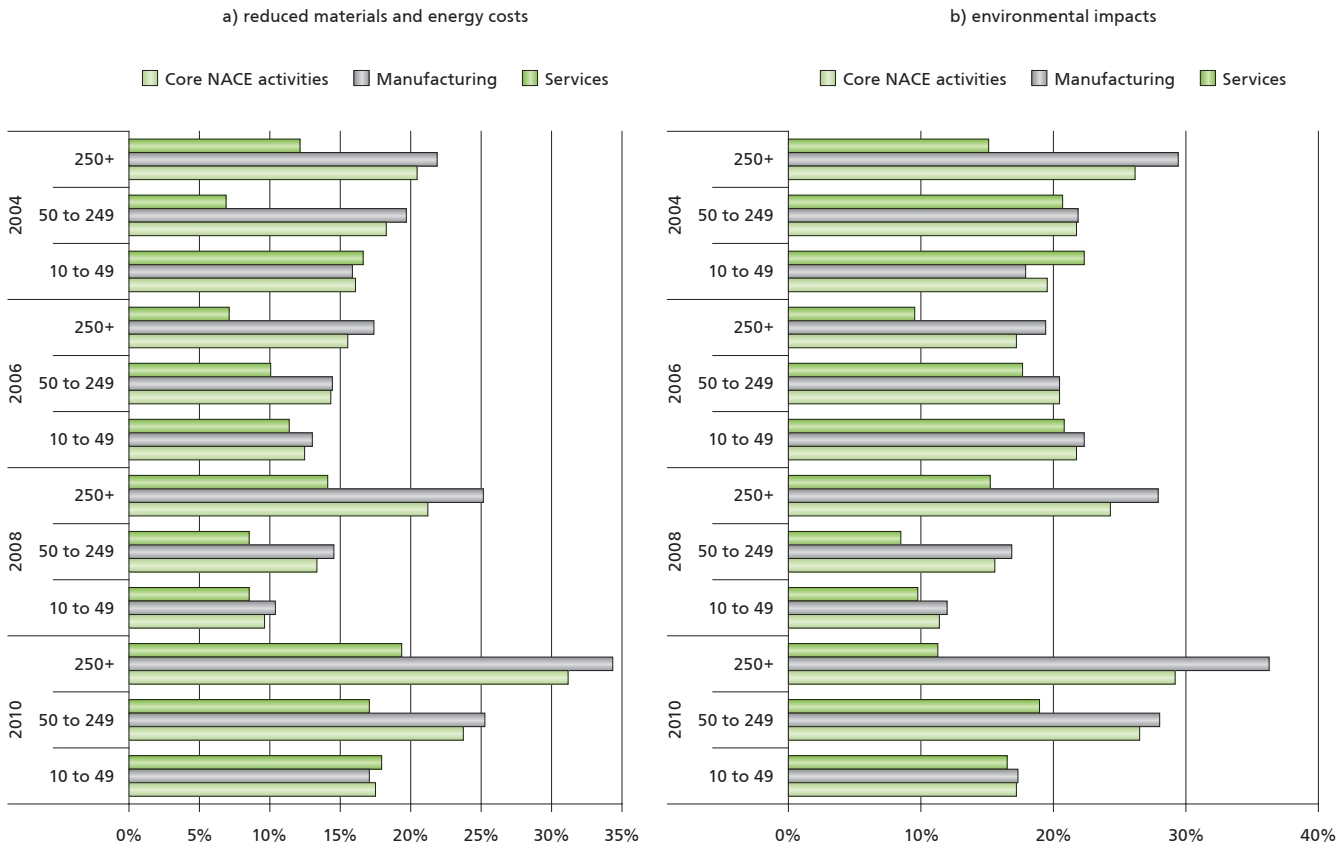
Among the countries that included the ad-hoc module, environmental issues had a relatively more important influence on product innovation compared to the motivation to introduce an environmental policy everywhere except for Hungary and Lithuania. **Bulgarian companies were least influenced by the environmental impacts and motivations for green innovation.**

Figure 42. STRUCTURAL ASPECTS OF INNOVATIVE ACTIVITIES THAT REDUCE ENERGY COSTS AND ENVIRONMENTAL IMPACTS, BY SECTOR



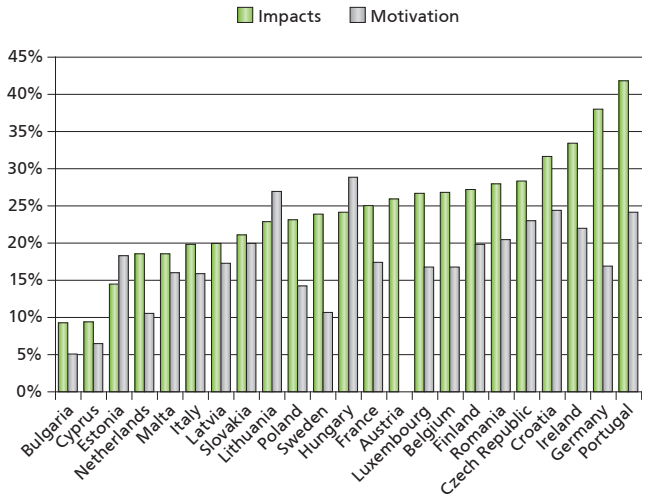
Source: Community Innovation Survey, Eurostat.

Figure 43. STRUCTURAL ASPECTS OF INNOVATIVE ACTIVITIES THAT REDUCE ENERGY COSTS AND ENVIRONMENTAL IMPACTS, BY SIZE OF ENTERPRISE



Source: Community Innovation Survey, Eurostat.

Figure 44. IMPACTS AND MOTIVATION FOR GREEN INNOVATION, 2008

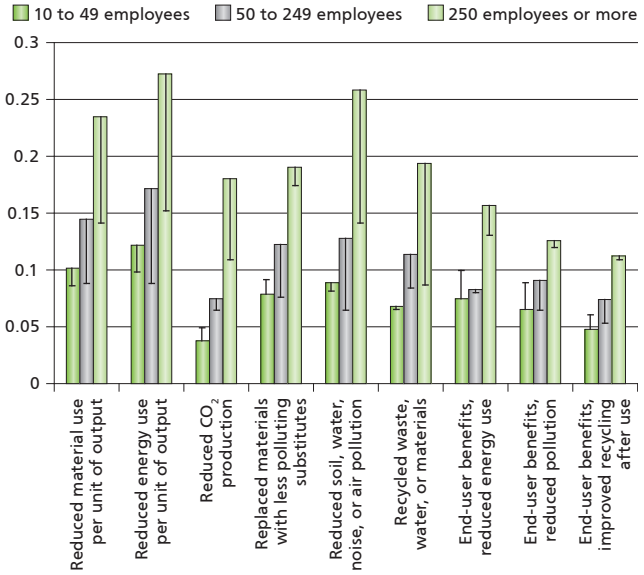


Source: Community Innovation Survey, Eurostat.

Among Bulgarian enterprises, reduced use of materials and energy per unit of output was an important factor in the innovation process, as was the reduction of soil, water, noise and air pollution. This reduction was especially significant in industry. End user benefits for energy use, reduced pollution, and improved recycling after use appeared relatively less important in industry than in the service sector. In the service sector, such green measures were more important for small than for large enterprises.

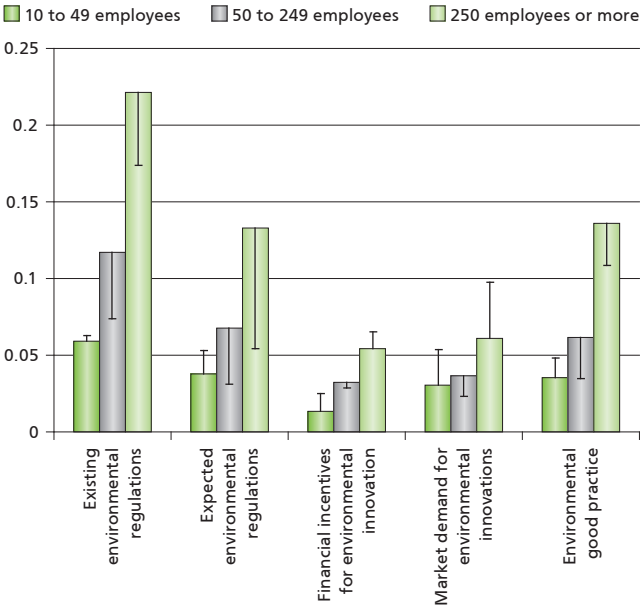
Existing environmental regulations or taxes on pollution were important for large industrial enterprises, but were of similar importance for small industrial and service enterprises. Financial incentives, including subsidies and grants, and market demand for green solutions played a relatively small role in Bulgaria. Finally, larger industrial firms are more aware of environmental good practice within their sector than small firms, but small service enterprises are more aware than industrial enterprises of similar size.

Figure 45. INNOVATIONS WITH ENVIRONMENTAL BENEFITS IN BULGARIA (SHARE OF INNOVATIVE FIRMS IN INDUSTRY AND SERVICES), CHANGE FROM 2006 TO 2008



Source: Community Innovation Survey, Eurostat.

Figure 46. MOTIVATION TO INTRODUCE AN ENVIRONMENTAL INNOVATION IN BULGARIA (SHARE OF INNOVATIVE FIRMS IN INDUSTRY AND SERVICES), CHANGE FROM 2006 TO 2008



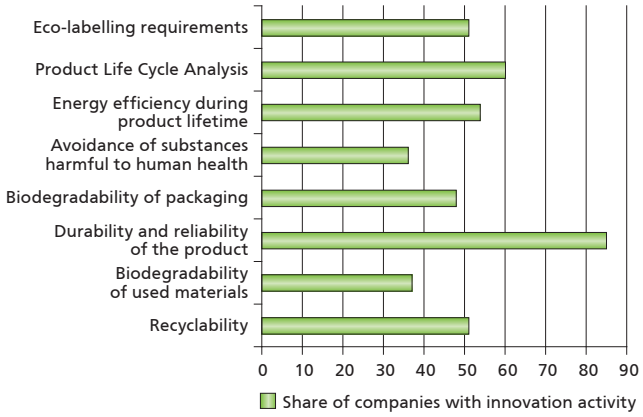
Source: Community Innovation Survey, Eurostat.

Bulgarian Green Business Innovation Survey 2014

The results of the Community Innovation Survey provide valuable insight into the use of green innovation in Bulgarian businesses. In order to obtain an even more accurate and up-to-date picture of these issues, **ARC Fund piloted the Green Business Innovation Survey in 2014.[41] It provides a snapshot of current technological activities and behavioural characteristics of companies, identifies windows of opportunity for environmental technology uptake, and informs policy recommendations**.

With regard to the level of **innovativeness** of Bulgarian companies, in 2014 43 % stated that in the last three years they have introduced a new or significantly improved product, service, or method. By far the most important **environmental considerations** for the innovation in innovative Bulgarian companies were the durability and reliability of new products. On the other side of the spectrum, the two least cited environmental considerations include biodegradability of used materials and avoidance of substances harmful to human health. These findings suggest that economic and technical aspects play a more crucial role to Bulgarian companies than green issues.

Figure 47. ENVIRONMENTAL CONSIDERATIONS IN COMPANY INNOVATION



Source: ARC Fund, 2014.

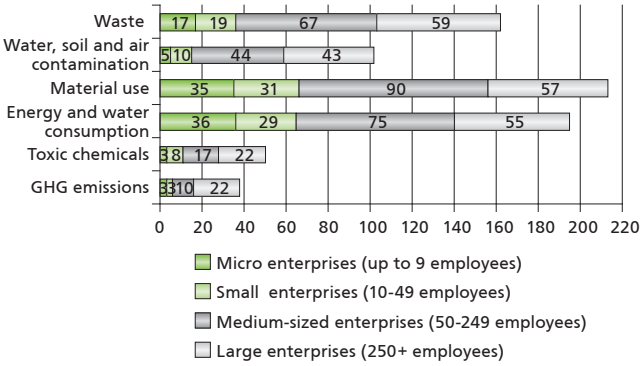
In terms of the **use of environmental footprint systems**, the findings indicate that Bulgarian companies engage in practices and invest in monitoring and managing at least one of the following:

- GHG emissions;
- Toxic chemicals;
- Energy and/or water consumption;
- Materials use;
- Water, soil and air contamination;
- Waste volume.

[41] Survey respondents include 469 enterprises, out of which 50 % are SMEs, 32 % micro enterprises and the remaining 18 % large ones. Reflecting the pronounced regional economic disparities in the country, more than one third of all respondents are located in the South-western region. Although the survey was not designed to focus on particular economic sectors, the largest group of surveyed companies were in NACE Section G "Wholesale and retail trade; repair of motor vehicles and motorcycles" – 193 (41 % of the sample), followed by NACE Section C "Manufacturing" – 145 (31 % of the sample).

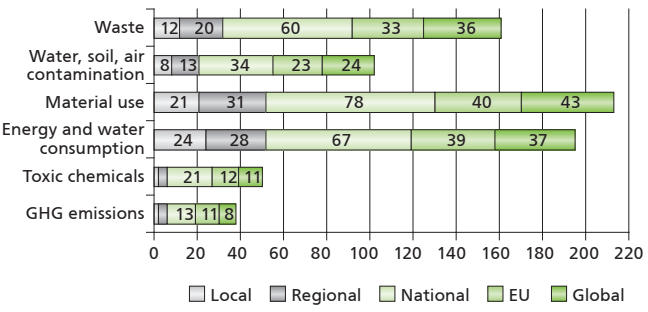
Close to 60 % of Bulgarian enterprises report to have at least one environmental footprint system. The results show significant variations by enterprise size, sector and target market. Given that managing the consumption of materials, energy and water and the production of waste are the most prevalent type of footprint systems, it can be inferred that **Bulgarian companies invest in environmental impact management mostly with respect to key resources directly related to profitability**. The low overall number of environmental footprint systems related to GHGs, toxic chemicals and water, soil and air contamination is due to their rare use by micro, small and medium enterprises. As expected, the larger the company, the more likely it is that it would monitor and manage its environmental impact. Between 25 % and 70 % of large enterprises have introduced some kind of environmental footprint system. This can be explained by regulatory requirements, economies of scale associated with large company size and resource intensity, more demanding customers or better management. The likelihood of applying environmental impact systems increases with the transition from the local to the national and to global markets. Across economic sectors **by far the highest numbers of environmental footprint systems were recorded in manufacturing** (NACE section C) and trade (NACE section G). In relative terms, however, the heavily regulated mining sector has the highest ratio of four environmental footprint systems per company.

Figure 48. NUMBER AND TYPE OF INTRODUCED ENVIRONMENTAL FOOTPRINT SYSTEMS, BY ENTERPRISE SIZE



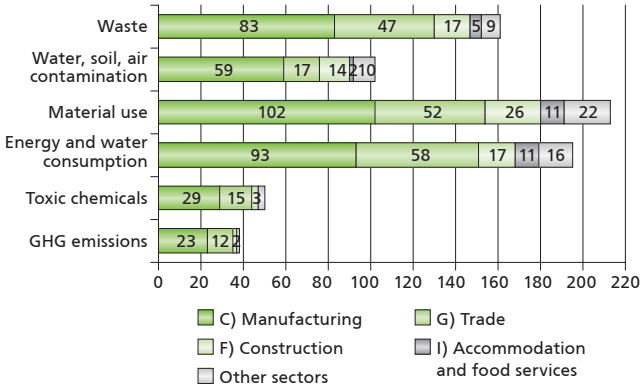
Source: ARC Fund, 2014.

Figure 49. NUMBER AND TYPE OF INTRODUCED ENVIRONMENTAL FOOTPRINT SYSTEMS, BY TARGET MARKET



Source: ARC Fund, 2014.

Figure 50. NUMBER AND TYPE OF INTRODUCED ENVIRONMENTAL FOOTPRINT SYSTEMS, BY NACE SECTOR



Source: ARC Fund, 2014.

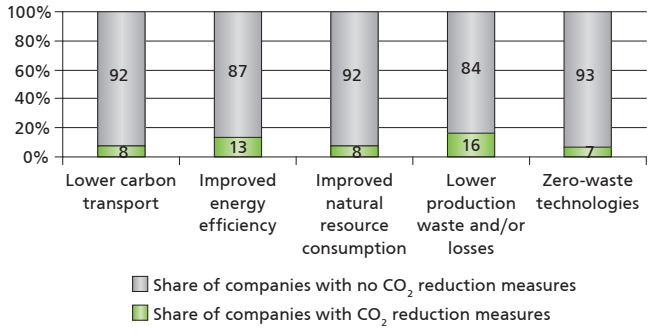
The survey results reveal that **40 % of companies have made efforts to increase their energy efficiency while only 27 % have undertaken measures to reduce their CO_2 emissions. The large majority of Bulgarian companies fail to ramp up investments in greening their activities.** Still, the prevailing form – by a wide margin – of financing green measures is using own capital. In terms of types of greening measures introduced, the average company prefers less expensive and non-technological measures such as replacing windows, putting wall insulation and using more energy efficient appliances and lighting. However, this pattern changes with increased company size: large companies employ with roughly the same frequency more sophisticated green measures such as automation, intelligent lighting systems and energy management systems.

More than half of the companies which have adopted one or more energy efficiency measures report a reduction in electricity costs of between 10 and 20 %, although only around one in ten have managed to achieve savings higher than 25 %. With regard to the most commonly cited reasons for introducing energy efficiency measures, company reputation ranks first, followed by new regulations, private sector standards and cost optimisation. Energy efficiency measures in large enterprises are much more frequently triggered by new mandatory environmental legislation and industry standards.

The extent to which companies take their environmental footprint and energy management seriously is also reflect-

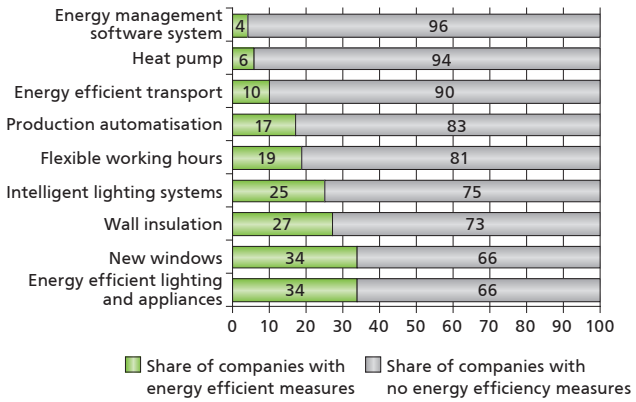
ed in the practice of conducting employee trainings on these topics. Survey data reveal that only 12 % of the Bulgarian companies carry out such trainings regularly, while another 12 % do it occasionally.

Figure 51. SHARE OF COMPANIES WITH MEASURES FOR REDUCING CO_2 EMISSIONS, BY TYPE OF MEASURE



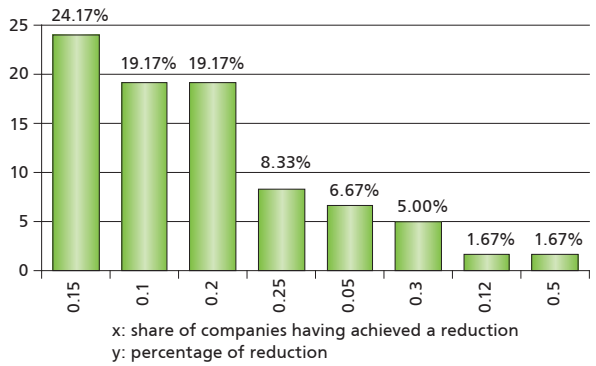
Source: ARC Fund, 2014.

Figure 52. SHARE OF COMPANIES WITH ENERGY EFFICIENCY MEASURES, BY TYPE OF MEASURE, %



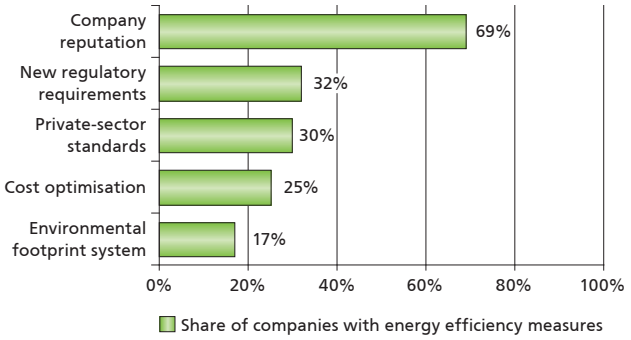
Source: ARC Fund, 2014.

Figure 53. REDUCTION IN ELECTRICITY COSTS AS A RESULT OF ENERGY EFFICIENCY MEASURES



Source: ARC Fund, 2014.

Figure 54. MOST COMMON REASONS FOR INTRODUCING ENERGY EFFICIENCY MEASURES



Source: ARC Fund, 2014.

In conclusion, the pilot Green Business Innovation Survey results confirm the hypothesis of a correlation between green awareness and activities at the company level and factors such as larger company size and stronger exposure to more competitive international markets. Some sectors are more heavily regulated in terms of harmful environmental impact by the companies, which also prompts investment in green innovations. These prove to be the main factors explaining the varying level of adoption of environmental considerations and resource efficiency by Bulgarian companies. Overall, **Bulgarian enterprises, especially micro and small ones, rarely monitor, manage and invest in reducing their environmental footprint and energy intensity**. Strictly economic factors related to their short-term performance tend to determine their strategy and activities to a much larger extent. At the same time, **the large energy saving and cost reducing potential of green measures** – even non-sophisticated and inexpensive ones – **remain untapped by the majority of Bulgarian companies**. While this missed opportunity can be partially explained by the on-going recession and the unpredictable business environment in the country, it also points to **poor managerial capacity**. Without coordinated public policies and easily accessible support mechanisms it would be unrealistic to expect the decisive shift of attention in companies required for the further greening of the Bulgarian economy.

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