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Study

Resource Efficiency Gains and Green Growth Perspectives in Romania

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- Although theenergy intensity of Romania's economy as well as its greenhouse gas emissions steadily declined over the last decade, the country still relies heavily on imports of gas, oil, and coal. Nearly all energy generating and distributing machinery has exceeded its life span and has been poorly maintained; energy saving measures could reduce primary energy consumption by as much as 35 per cent.

- In line with EU strategies, mainly EU 2020, there are several National Programmes for improving the use of renewable energy sources, energy efficiency measures and energy distribution infrastructure. However, public support for such measures is very low compared to EU average.

- The main potential for green growth and green jobs lies in bio-agriculture, renewable energies, research and development, and in waste management. But those promising developments face a number of obstacles: lack of financial resources and funding, lack of specialised staff, insufficient human resources at the institutional level responsible for formulating and implementing policies, and a lack of implementation of strategies.

Content

Introduction

Energy efficiency is not just a pretty phrase in the development vocabulary. As world leaders learned from the previous oil shortage, better use of energy can very well be a matter of survival. Whether we consider the economic perspective (as a proportion of total expenditure on energy production and consumption) or from an environmental point of view (the million tonnes of CO_2 released into the atmosphere as a by-product of energy production and waste) energy efficiency has been the focus of worldwide attention since 1974, when the OECD countries formed the International Agency for Energy. The World Energy Outlook is the primary source of energy information from a global perspective together with the World Bank Development Indicators, annual data sets that include an »Energy efficiency and dependency« entry in the Environmental section.

The current methodology for calculating a country's energy efficiency involves the use of a proxy, the energy intensity of the country's economy: that is, the ratio between GDP and total energy production. The rationale for using this mathematical equation is that the greater the amount of money spent in producing one unit of energy, the more energy intense an economy is. Lower levels of energy intensity are attributed to structural changes in the economy, use of different fuel mixes and growth of the service sector compared to the energy-intense industrial sector.

For comparative reasons, in time series spanning long periods, simple GDP is replaced by GDP at Purchasing Power Parity (PPP). Since using only GDP and total energy produced may seem an oversimplified way of looking at social and economic realities, energy efficiency can also be estimated by more descriptive indicators, such as unit energy consumption levels and the impact of different technologies used for energy savings. Subsequently, energy efficiency gains analysis focuses on a dual approach: technological improvements that are reflected in energy savings and energy efficiency gains from the shifts in structure of value added.

In reviewing Romania's energy efficiency I use GDP at 2000 PPP for the time series spanning 1999 to 2009 for general energy intensity, then compare the economic output and structure of manufacturing for the end of the time span to get a closer look at the structural shifts that have affected energy intensity. In order to establish the technological improvements that have taken place I look at energy production and use. The energy efficiency analysis of shifts in the structure of value added is reflected in my examination of the energy intensity of major economic branches from 2004 to 2008. The data suggest that the energy intensity of Romania's economy steadily declined from a value of 0.28 in 1999 to only 0.17 in 2009 (see Table 1) and that the shift in energy intensity is mostly a reflection of structural changes in the country's economy.

Since 1999, the base year for our analysis, the economy has struggled to readjust to the demands of a market economy by reducing the importance of the energy-intense industry sector. The structure of economic output and also that of manufacturing is telling. As Figure 1 illustrates, industry accounted for 32 per cent of GDP in 2000, while in 2010 it only managed 21 per cent. The change is more striking if we go back further in time. In 1991, industry accounted for 34 per cent of GDP. Manufacture has changed accordingly: food, beverages and tobacco rose remarkably, only to fall even lower than the original 26 per cent of GDP it sustained in 1990 (see Figure 2). The rise of the service sector completes the structural shifts that have changed Romania's energy intensity pattern. In 2010, the service sector increased by up to 14 per cent when compared to 2000, a trend beginning in the early 1990s (26 per cent of GDP in 1991). Energy self-sufficiency has also increased, although gas and oil are imported, especially to supplement the country's energy demands. Romania's energy relies heavily on coal and peat, even though the fuel mix for electricity has diversified by incorporating »cleaner« energy sources, such as nuclear energy and the more recent Aeolian sources (see Figure 6).

As part of the European Union, Romania has agreed to change the fuel mix for the production of electricity by incorporating RE sources. National targets are: 33 per cent for 2010, 35 per cent for 2015 and 38 per cent for 2020 of the total electricity production to be obtained from RE sources. The percentage for renewable sources in final energy consumption is set at a target of 24 per cent for Romania and by 2009 it had already reached

a level of 22.4 per cent.[1] As investments in renewable energy production are designed to grow[2] in the short to medium term, based on foreign investment in Aeolian energy production, there is reason to believe this target will be achieved by 2020.

In 2008 the most energy-intense economic activities were: manufacturing, mining and quarrying, fishing and pisciculture, and agriculture (see Figure 3). A year later, the most energy-intense sectors were: residential, industry and transport (see Figure 4). A notable distinction is that compared to 2004, residential consumption in 2009 exceeded the energy used in the industrial sector. The transport energy consumption has increased but not so much as to change its rank in the final consumption table. The Eurostat database offers an indicator of volume of freight transport relative to GDP to measure transport intensity.

The indicator takes the year 2000 as basis for comparison and it turns out the following results for Romania: since 1999, the volume of freight transport relative to GDP has constantly increased, reaching a maximum value of 174.2 in 2005, the highest in the country group analysed, and declining to 113.7 in 2009.[3]

Resource intensity, calculated as intermediate consumption per value added, for the years 2004–2008 results in the following picture: agriculture and forestry increased in resource intensity and mining and quarrying reduced in resource intensity (see Figure 5).

No energy efficiency analysis will be complete without mentioning the current impediments for energy efficiency. According to the report National Strategy for Energy Efficiency for 2007–2020, the technical condition of installations in the energy sector is characterised by low energy efficiency. About 80 per cent of thermo energetic groups in Romania have extended their working life expectancy. Installed in the 1970s and 1980s and with no additional general infrastructure maintenance, performance is as low as 30–33 per cent compared to the European average performance values of 65–70 per cent.

Central heating systems also face energy efficiency issues, as old equipment fails to generate sufficient heat and, most importantly, a large portion of the heat (in some cases between 10 and 50 per cent) is lost via transport and distribution pipelines. The decrease in industrial requirements for steam and hot water has led to unsustainable economic regimes of heat agent generation and transport, as the high costs were no longer covered by state subsidies.[4]

Combined heat and power plants and other energetic groups have a similar history of bad maintenance and overdue working age. By 2020 the rehabilitation programmes commenced in 2000 will re-technologise and modernise to 3400 MW out of the current installed power of 6450 MW.

A total of 65 per cent of all low, medium and high voltage Electricity Distribution Networks, together with transformation posts, still use equipment produced in the 1960s and have a medium intermediary consumption higher than the 7.3 average of EU countries.

Almost 70 per cent of the total length of the National System for Natural Gas Transport has exceeded its working life span; 27 per cent of recalibration and measurement stations are as much as 25 years old. The natural gas distribution networks have an elevated degree of usage and 40 per cent of pipes and connections can be considered outdated. However, the underground storage capacity has been constantly expanding and has reached about 4 billion cubic meters. The national system for crude oil transportation has a 24 billion tonnes per year capacity, which has only been used up to about 60 per cent and has been undergoing significant change since 1996's rehabilitation programmes.

Taking into consideration the changing dynamics of the energy intensity of different economic sectors and the current energy waste from energy production and transportation systems, the authors of the National Strategy for Energy Efficiency have calculated Romania's potential for energy saving as up to 35 per cent of the total primary energy resources, divided by sector as follows: 20–25 per cent for industry, 40–50 per cent for residential and 35–40 per cent for transport.

1. See: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=t2020_31

2. http://www.tpa-horwath.ro/wp-content/uploads/2011/09/Wind_Energy_Report_2011.pdf

3. See: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsien060

4. See: http://ec.europa.eu/europe2020/pdf/targets_en.pdf

If Romania is to achieve this goal it will become possible to speak of energy sustainability as energy self-sufficiency is currently at about 80 per cent. As the most energy-intense sector is the residential sector, the Romanian government has issued a programme for household rehabilitation (Government Ordinance OG 69/2010) which states that a maximum of 90 per cent of total investment in rehabilitation will be obtained by bank loans guaranteed by the government at a low interest rate.

Residential building rehabilitation will not only add to the general effort to reduce energy waste, but also help to further improve the country's carbon footprint and mitigate climate change.

Greenhouse gases generally refer to the following emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), hydro fluorocarbons (HFC), per fluorinated compounds (PFC) and sulphur hexafluoride (SF_6)

The International Energy Agency offers data on greenhouse gas emissions (other than CO_2) for the years 1990, 2000, 2005 and 2008 for Romania. All greenhouse gas emissions have declined since 1990 (see Table 3) with the exception of hydro fluorocarbons emissions, which were absent in 1990 but had risen to about 0.5 million tonnes of CO_2 equivalent in 2008. A detailed presentation is provided by Figures 7, 8 and 9. Although the general amount of GHG has decreased, energy power plants and co-generation of heat and power groups have an emission rate greater than those present in the EU and about 170 of them have been put under direct observation since 2003. If Romania does not achieve rehabilitation by 2018, in terms of environmental compliance, they will be closed down.

Data on CO_2 emissions for Romania and other countries are presented in the IEA's CO_2 Highlights, a dataset containing a time series from 1971 to 2009. From an all time high in 1988 (191.6 million tonnes) the amount of CO_2 released into the atmosphere declined to 78.4 million tonnes in 2009, a decrease of over 40 per cent (see Figure 10). As the sectoral approach in Figure 11 shows, the most polluting sectors are electricity and heat production (1632 kg/capita), transport (688 kg/capita) and manufacturing (652 kg/capita).

As an EU member, Romania has agreed to reduce the amount of CO_2 released into the atmosphere by 19 per cent by 2020, compared to the base year of 1989.[5] As the data presented indicate, Romania has not only exceeded this requirement but, if energy production and consumption do not alter significantly in the following decade, there is reason to believe that the advantages of having a low CO_2 emission rate will be economically reimbursed by trade in Green Certificates in the CO_2 market.

2. Environment

In 2010, forest accounted for 28.5 per cent of Romania's land area, slightly under the European average. Although data provided by the World Bank in the Romanian meta data set suggest that forest area has increased since the 1990 value of 27.7 per cent, current sociological findings have linked World Bank lending practices to deforestation. Shandra[6] et al. (2011) tested a dependency theory that poor countries undergoing World Bank investment and structural adjustment loan have higher rates of deforestation. The sample used includes Romania, as well as 60 other countries worldwide.

National forest evaluation reports put private ownership at over 33 per cent of forests and even though the private ownership share is lower than the 60 per cent found in the European Union, illegal felling is recorded in public forests, some under the protection of state agencies and natural parks.[7]

The World Development Indicators series provide data on *air quality* only for the capital city. The European Environment Agency expands this search by including other urban areas alongside capital cities. There are two indicators for air quality: one refers to ozone pollution and the other for general suspended particles. Ozone is a strong photochemical oxidant, which causes serious health problems and damage to the ecosystem, agricultural crops and materials. The European Environment Agency provides an indicator that shows the population weighted yearly sum of maximum daily 8-hour mean ozone concentrations above a threshold (70 micrograms

5. See: http://ec.europa.eu/europe2020/pdf/targets_en.pdf

6. John M. Shandrea, Eric Shircliff and Bruce London (2011), 'World Bank lending and deforestation: a cross-national analysis, International Sociology (2011), No. 26, pp. 292–314, Sage.

7. See: www.mmediu.ro/paduri/.../2011-11-18_management_forestier_...

of ozone per cubic meter) at the urban background stations in agglomerations. The data for Romania show that the urban population's exposure to air pollution by ozone has decreased from 6402 micrograms per cubic meter day in 2004 to 4420 micrograms per cubic meter day in 2009.[8] Particulate matter in urban areas has also dropped from 50 micrograms per cubic meter in 2003 to 30 micrograms per cubic meter in 2009.[9]

Freshwater resources in Romania amount to 179 billion cubic meters; internal flows account for 42 billion cubic meters and 170 from other countries. In Romanian Statistical publications, superficial water quality is evaluated in terms of five levels of degradation from the unmodified normal values (biological, physical, chemical, morphological) associated with the specific water type evaluated: Class 1 is very good superficial water quality and Class 5 is superficial water severely altered compared to the normal values. In 2009, according to the 2010 Romanian Statistic Yearbook, of the total length of monitored rivers (26347 km) 6784 were evaluated as being Class 1, 12341 as belonging to the Class 2, 4715 to Class 3 and the last two categories, of altered and severely altered superficial waters, comprised 2507 km (9.5 per cent). The most severe alteration was recorded for 911 km of the total. Traditional water pollution sources are the chemical and metal industries (see Figure 12).

Soil quality is affected by fertiliser consumption and by intense extraction activities. The latter will increase if energy production remains dependent on coal extraction. Figure 13 presents the use of fertilisers from 2002 to 2009.

2.1 Deep Concerns about Environmental Issues – Poor Participation in Public Environmental Debates

The ***Special Euro barometer 372***[10] on Climate Change, published in October 2011 by the European Commission, reveals that for European citizens climate change is the second biggest issue after poverty and lack of food and drinking water. Europeans view the fight against climate change as beneficial for the economic sector as it can help create new jobs; there is a favourable view of taxation by energy use level and a general expectation that Europe will have a more environmentally friendly, low carbon economy in the medium term, as well as a perception that national governments are the main actors in climate change mitigation. The two most frequently found environmentally-friendly behaviours are recycling and buying locally produced food.

In this special issue of *Eurobarometer* Romanian citizens present an interesting response pattern: a great propensity for »non-responses« and a general deviation from the established norm of participation in climate-mitigating activities. According to their own response patterns, Romanians have not personally engaged in environmental-friendly behaviours, such as recycling, with the exception of buying locally produced food and products; they disagree with the fact that by 2050 more renewable sources will be used in energy generation, they prefer not to answer questions regarding different taxation policies based on energy consumption levels; they do not expect cars to be less dependent on traditional fuels; they do not link environmental protection to the creation of jobs and a better economy; and they are reticent when expressing a point of view with regard to the increase of renewable energies.

The same »non-response« pattern can be observed in public awareness and acceptance of CO_2 capture and storage.[11] If the latter can be »explained away« by the fact that CO_2 levels in Romania are lower than those in the EU, the former seems to be the sign of a country profile. In 2008, the Green Barometer,[12] research into Romania's urban population with regard to climate change and environment awareness, produced similar results: almost 70 per cent of urban citizens declared that they possess average knowledge of climate and environmental issues.

From a typological perspective, 11 per cent were dubbed »eco-engaged«, 53 per cent were declared »eco- supporters«, while the others were considered »eco-indifferent« (8 per cent) or »eco-neutral« (28 per

8. See: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsien100

9. See: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsien110

10. See: http://ec.europa.eu/public_opinion/archives/ebs/ebs_372_en.pdf

11. See: http://ec.europa.eu/public_opinion/archives/ebs/ebs_364_en.pdf

12. See: http://terraiii.ngo.ro/date/b2d1f2f8f1bb3ec1206dd2e29da29c-ba/Barometrul_Verde.pdf

cent). Research findings confirm that the primary source for information on environmental issues for Romania's urban population is television, but this preference is not objectified in the selection of the most important environmental issues. First and foremost, urban Romanians seem to be aware of everyday impacts on the environment: traffic congestion, water pollution, lack of green spaces and air pollution (particularly in areas with a history of air pollution).

On the other hand, the NGOs that include environmental protection and interest in their activities rely mostly on advertisements in local media and the general public's propensity for volunteer work in environmental campaigns. Although representatives declare that NGOs have a say in public debates and can indeed influence policies and law making, participation in debate is reduced even for active members of NGOs. Even more controversial is the fact that NGO representatives acknowledge that communication is scarce and relationships with the mass media are frequently lacking, hence the general public awareness of environmental affairs is limited to the so-called hot topics, such as the Rosia Montana ore-mining project and Danube Delta conservation issues. As a result, active participation in environmental debates remains at the desirability stage, even if the public is aware of anthropic environmental impacts.

2.2 Degree of Current Technological Development

Since 1999 Romania has spent around 0.4 per cent of GDP on research and development, with a slight increase to 0.6 per cent in 2008.[13] **The number of professionals engaged in research and development has decreased constantly** over the past 15 years, reaching a low in 2008 (876.8 researchers per 1 million inhabitants).[14] The same applies to research and development technicians and technical staff. By 2007 the number of technicians had fallen fourfold since 1996, reaching an all-time low at 203.3 technicians per 1 million.[15] Theoretical knowledge, measured in journal articles published, seems to be increasing, however: in 2007, 1,252 articles were published compared to 1995. Royalties and fees increased from 3 million USD in 2002 to 193 million USD in 2009.[16] The admission of Romania into the EU correlates with an increase in high technology exports (see Figure 14).

Two decades after the fall of Communism 10 per cent of Romania's total exports in 2009 were products of high research and development intensity, compared with 3.7 per cent at the time of EU accession.[17] The number of patents submitted to both the EU Patent Office and the United States Patents and Trademarks Office is insignificant, however. As Figures 15 and 16 reveal, concrete ideas and plans for scientific improvements are as rare as the proverbial »one in a million«, or even lower.

Use of personal computers and of the internet has steadily increased. In 2008, 19 per cent of the population owned a PC, 36 per cent were internet users and almost 19 per cent of total service exports were based on information and communication technology.[18] ICT expenditure in 2010 reached 1.2 per cent of GDP and communication expenditure reached 3.6 per cent of GDP, in contrast to the EU27 figures of 2.5 per cent and 2.8 per cent of GDP, respectively (see Figure 17). E-government became available in Romania in 2007 and has continued to expand. In 2007 only 37.5 per cent of the 20 basic public services were available online, but by 2010 the percentage had risen to 60 per cent. Use of e-government is significantly higher in the enterprise sector: 41 per cent of all enterprises compared to only 7 per cent of individuals aged between 16 to 74.[19] The number of science and technology graduates has increased from 4.1 to 20 per 1,000 persons and since 2008 the figures have surpassed the EU27 average. This translates into an immense *potential for future employment in green jobs* (see Figure 18). Data from the National Statistical Institute depict the enterprise sector in Romania as being *non-innovative*: for the period 2004 to 2006, 78.9 per cent of enterprises in industry and services with more than nine employees did not develop a new or better

13. Source for data: http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS/countries/RO-EU?display=graph

14. See: http://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6/countries/RO-EU?display=graph

15. See: http://data.worldbank.org/indicator/SP.POP.TECH.RD.P6/countries/RO-EU?display=graph

16. World Development Indicators: 2011, 2007, 2007: Section 12(13) Science and Technologies : Romania.

17. See: http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS/countries/RO-EU?display=graph

18. World Development Indicators 2011: Section 5.12 The Information Age : Romania.

19. See: http://epp.eurostat.ec.europa.eu/portal/page/portal/structural_indicators/indicators/innovation_and_research

product, nor did they utilise a new or improved technological process.[20] Romania's economy has a total innovation score of 14.9, 20 per cent of which is attributed to industry and 10.3 per cent to the service sector.[21] According to the Lisbon Agenda, the distribution of financing for research and development should be: two-thirds by the private sector and one-third by public institutions. This objective has not been attained in Romania's case: since 2002 the government has been responsible for the bulk of the funding of R&D institutions (see Figure 19).

2.3 The EU and Romania's Role in Sustainable Growth

The relationship between the EU and Romania has a long history and affected sustainable growth long before the signing of the Accession Treaty in January 2007. The EU has played an important regulatory and mandatory role in legislative development and implementation in Romania. The current goals of the EU are also translated into the Romanian legal framework and are implemented via government programmes and projects.

Europe 20/20 is a set of measures that all member states are supposed to implement, at specific rates, in order for the following objectives to be achieved by 2020. These standards follow the Lisbon Agenda and have been, until recently, considered achievable. But the realities of the Eurozone crisis and the difficulties in overcoming the effects of the global crisis in certain member states have brought a little more caution to the planning of future developments. By 2020, the European Union has committed itself to achieving the following goals: 75 per cent of 20–64 year olds to be employed, 3 per cent of GDP (public and private) to be invested in research, development and innovation, reducing GHG emissions by 20–30 per cent in relation to 1990 levels, 20 per cent of energy to come from renewable sources, a 20 per cent increase in energy efficiency, reducing school dropout rates below 10 per cent, at least 40 per cent of 30–34 year olds completing tertiary education and at least 20 million fewer people in or at risk of poverty and exclusion.

20. See: http://www.insse.ro/cms/files/Anuar%20statistic/13/13%20Stiinta,%20tehnologie%20si%20inovare_ro.pdf

21. See: http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsdec340&language=en

The national targets for Romania are: 70 per cent employment rate among 20–64 year olds, 2 per cent of GDP (public and private) invested in research, development and innovation, a CO_2 emissions target of 19 per cent, 24 per cent of energy from renewable sources, a reduction of 10 Mtoe in energy, reducing school dropout rates below 11.3 per cent, 26.7 per cent of 30–34 year olds completing tertiary education and 580,000 fewer people in or at risk of poverty and exclusion. Alongside these national targets the EU has formulated a specific set of recommendations. These form the basis for the National Convergence Plan and are also integrated in the National Reform Programme.

3. Current Economic Strategy

The National Reform Programme presents the objectives identified by the EU for Romania and details how they will be achieved. The basic provisions concern total economic growth, an estimated 4–4.5 per cent increase in GDP from 2009, the reduction of inflation to 3 per cent, maintaining a prudent wage policy, continuation of structural reforms, improving exports at about 14 per cent by investing in industrial branches that produce exportable goods and steadily increasing domestic demand to 8 per cent.

With regard to improving the labour market, the Romanian government has allocated 0.039 million RON (national currency) for labour legislation and social dialogue reform, as well as for the fight against undeclared work, extending workers' active lives and promoting equality between men and women. Another pillar of employment reform is the transition from unemployment to employment.

Active measures to **improve employment** in 2012 and 2013 have the target of about 690,000 persons; a total of 793.674 RON will be allocated for these active employment measures. Funding will be provided by the European Social Fund for projects that aim at integrating the long-term unemployed. The estimates are that 59,000 participants will be included in the aforementioned projects by 2013. Other European Social Fund resources (Axis 4) will be used for a total of seven projects: Callcenter PES, Promoting Self-service Services, MedForm, RatioL3, COMPROF, CAMPION and ECOP.

Stimulating the growth of **research and development** in the public sector will have three beneficial consequences:

- increase the productivity and quality of products (technologies and services will play an important role with their contribution to the growth of competitiveness and the improvement of enterprises' positions on domestic and international markets);

- increase the volume and improve the qualitative structure of exports by increasing the share of high technology exports;

- improve the mobility of public sector research personnel, stimulate an increase in their number and improve the qualitative structure of enterprises' R&D personnel. Available funds for 2011–2013 are: RON 2.6 billion (state budget), EUR 369 million (structural funds) and RON 2.25 billion (private sector).

The commitment to fight climate change is strong, but several obstacles have been identified: lack of financial resources for developing research studies with the purpose of identifying tendencies and measures that must be conducted for diminishing GHG emissions and for adapting to climate change effects; weak sector financing for applied research on clean technologies; lack of specialised staff for dealing with climate change; insufficient human resources at institutional level responsible for formulating and implementing policies on climate change; and a lack of implementation of environmental protection strategies, for institutional and educational reasons. Measures to address these issues include: reducing GHG emissions in the energy sector, greenhouse type programmes are to be continued, curbing GHG emissions in the transport sector and reinforcing administrative capacity in order to fight climate change and promote sustainable development in Romania.

Waste management programmes are to be implemented by the end of 2012, through the approval of 28 new projects, amounting to a total of approximately EUR 840 million. These projects aim to create 30 waste management integrated systems at county/regional level; to close 1,500 non-complying rural waste stores and 150 non-complying urban waste stores, and to increase the total number of waste management integrated system beneficiaries (8 million inhabitants by 2015).

Education financing will be RON 13.235 billion in 2012 and RON 13.335 billion in 2013. Projects include: developing a National Qualifications Framework adequate for the current stage of economic development and its assimilation in the labour market, setting a selection framework based on objective criteria which will make it possible to attract skilled young people to qualifications that can promote green jobs: ICT, engineering, natural sciences, services, agriculture and creating mechanisms for the recognition of skills acquired through formal and non-formal education.

3.1 Industrial Sectors and Environmental Protection

Chapter 1, section 1.17 of the 2010 Romanian Statistical Annual presents investments in environmental protection. A total of 4.33 billion RON at current prices was invested in environmental protection, of which a large proportion (1.77 billion RON) was provided by unspecialised producers from the following sectors: forestry and logging (22 million RON), mining and quarrying (303 million RON), manufacturing (717 million RON), electricity, gas, steam and air conditioning production and supply (655 million RON), construction (8.2 million RON) and transport (66.3 million RON).

Investments in environmental conservation are categorised by type of investment in environmental areas: air, water, waste, soil and underground waters, natural resource protection and biodiversity preservation and other fields. One would expect, based on the specific impact of industry type, to find investments in water protection from manufacturing, air-preservation investments from transport, soil and underground waters from mining and quarrying and forestry and logging, while waste management investment to be specific to electricity production and supply. However, the data contradict the polluter-pays principle: there is a general preoccupation with air conservation (927 million RON), followed by underground water and soil (225 million RON), water (218 million RON) and waste (176 million RON). Waste and natural resource protection and biodiversity conservation are the last two categories in terms of environmental protection investment.

3.2 Quantity and Quality of Green Jobs

The authors of the UNEP Green Jobs Report suggest that, in order to find green jobs, one must look into one in the following sectors: agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, green jobs are those that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; decarbonise the economy; and minimise or altogether avoid generation of all forms of waste and pollution. In order to be green, a job must also be sustainable; that is, to provide a decent living and to protect the health and integrity of the worker. The Romanian classification of national economic activities is not organised on the basis of the divide between green and not-green jobs. Navigating the data to find the jobs that satisfy the conditions mentioned above is no easy task.

For example, while searching the manufacturing section, the entry on »manufacturing of other means of transport« might seem like a valuable candidate for green jobs integration (in other words, the manufacturing of bicycles). A more cautious approach proves that under this entry one finds the manufacturing of ships, boats and floating decks, but no bicycles. Bicycles are not even in the section »manufacturing of transport equipment«.

There is a section on »manufacturing bicycles and vehicles for invalids« far from the initial »manufacturing of means of transport«.

In the Romanian employment environment, there are four major groups, in which green jobs can be found. First, the green jobs that are already in the bioagricultural sector; second, research and development jobs; third, jobs that are to be created by the implementation of renewable resources in energy production; and finally, jobs in water supply, sewage and decontamination.

Table 3: Review of bio-agriculture in Romania.

Indicator	2006	2007	2008	2009	2010
Number of operators registered in ecological agriculture	3409	3834	4191	3228	3155
Arable land (hectares)	45605	65112	86454	110014.4	148033,5
Pastures	51200	57600	46006.5	39232.8	31579.11
Orchards and grape vines	294	954	1518	1869.4	3093.04
Spontaneous flora	38700	58728	81279	88883.4	77294.35

Source: Website of the Ministry of Agriculture.

Economic Sectors for Green Jobs

In the »2011 monitoring report of the European Union on sustainable development«, the subtheme on production patterns reports that in Romania the amount of land proposed for agri-environmental commitments is below 10 per cent compared to the EU average of 24.7 per cent. One potential sector for sustainable green growth could be agri-development.

Similarly, in the years to come in Romania, the following renewable resource energy producers will be hiring: Fântânele (CEZ, 347.5 MW), Casimcea, Topolog, Dăieni (IMA PARTNERS +Verbund, 532 MW), Tulcea (ENEL, 174 MW), Moldova and Dobrogea (PNE Wind, 200 MW), Cogealac (CEZ, 252.5 MW), Mihai Viteazu (Iberdrola, 80 MW), Constanta (ENEL, 118 MW), Cernavodă (Renovatio / EDPR, 138 MW), Galati (Renovatio / EDPR, 100 MW), Mitoc (IWE, 100 MW), Borşa (Alstrom, 56 MW), Topolog (Land Power, 168 MW) and Casimcea (Martifer, 40 MW). Renewable energy production requires constant management so employment opportunities in this sector will be abundant.

Research and development is another sector that promises green growth, specifically if we take into account the bottlenecks and impediments identified in the section on the economic strategy for climate change: lack of studies and projections on climate change and development.

Waste management is another area that will have to rise to the challenge of recycling more than 3 per cent.

3.3 Economic Obstacles to a Low Carbon Economy

The first economic obstacle to a low carbon economy is dependency on traditional fossil fuels, such as lignite. The National Strategy for Energy Efficiency provides an analysis of primary energy sources available in large quantities in the medium to long term. The results show that uranium levels are low to non-existent, oil imports are already at 30 per cent to meet domestic demand, natural gas has limited exploitation perimeters and only coal is both in large supply (up to 40 years at current extraction levels) and relatively available (large perimeters of exploitable coal fall on property already owned or to be owned by energy producing companies).

The second economic obstacle is financing energy efficiency programmes. In March 2011 the Ministry of the Economy published the estimated financial investments for rehabilitating heat and energy power plants in electricity, gas and oil and to eliminate energy waste caused by distribution losses and aging equipment that no longer complies with international regulations. A total of 20 projects concerning gas and oil worth a total of 2.1 billion EUR, and 35 projects in electricity estimated at 8.5 billion EUR[22] have already been drafted and partially implemented. The budget for household rehabilitation is estimated at about 2.2 billion RON for its second stage 2006–2015. Financial support for energy efficiency in the private sector is at a standstill: FREE (*Fondul Roman pentru Eficienta Energetica* – Romanian Fund for Energy Efficiency), the only programme outside government to provide aid to energy efficiency projects, has given financial and technical assistance in just 26 projects, well below the initial 2006 projections.

Inclusion of the banking sector in the financial schemes related to energy efficiency is at a low level. Only two projects coordinated by FREE have joint financial investment from banks, and if the economic environment does not recover from the impact of the world financial and economic crises in Romania, financial investment in energy efficiency will be limited to government agencies. Creation of new infrastructure for green jobs is another problematic domain. If Romania engages in agricultural development first it must reinstate a nationwide network of professional schools or universities with an agricultural and ecological profile. The same goes for every other domain in which green jobs can be fostered.

Last, but not least, the economic impact of the transition to a low carbon economy is another issue that demands attention. Expenditure initially on unemployment benefit, then investment in education programmes to provide qualifications and then creating new jobs to absorb the formerly unemployed.

Urgently Needed Regulations

- Green certificates for the energy sector using renewal energy
- NACE revision or disaggregation of green jobs
- Waste management plans to achieve waste reduction goals
- Financing eco-agriculture and energy efficiency programmes
- Employment for young people/or integration in tertiary education

3.4 Social, cultural and political obstacles to the creation of a low carbon economy and the creation of green jobs

Social and cultural obstacles to the creation of a low carbon economy arise from public perceptions and behaviour. As already mentioned, participation in environmental debates is low, even though there is a general awareness of environmental issues both in the world and in Romania. The most relevant social factor that can be an impediment to reducing the country's dependency on traditional fossil fuels is **the belief that economic development is not compatible with environmental conservation.** In the context of a failing economy, a high unemployment rate and lower levels of income, middle aged working Romanians tend to agree that environmental concerns must be sacrificed in order to create jobs. Green jobs – that is, jobs that produce a sustainable income and are also beneficial for the environment at large – are not visible enough nor encour-

22. See: http://www.minind.ro/

aged. Based on the ever-present case of Rosia Montana, where an international corporation wants to mine for gold ore using a cyanide-based extraction technology, the shift in the mining company's PR campaign shows the tendency to use the »business as usual« approach and the reliance on tried-and-true techniques based on the promise of a stable pay check: their new slogan is »the people at Rosia Montana just want to work«.

Recycling and waste management in general is not popular in Romania's economy, having only been introduced recently. Current national targets are set at the improbable value of 50 per cent reduction of waste by the year 2013, although in 2009 the recycled proportion was estimated at a mere 1 per cent.[23] While it can be argued that recycling industries and activities are not the ideal green jobs, in the sense that they are attributed to workers of low social status, it is worth mentioning that as energy efficiency is based on energy savings, in the same way recycling can be seen as a production-efficiency technique. As the general law on waste management was only days' old at the time this chapter was written one can only wait to see the results of political decisions for green job development.

To date, environmental protection information and opinion surveys have targeted mostly urban areas. While it is true that urban environmental issues seem more pressing than rural ones, public awareness of the environment should also be analysed and knowledge of pollution hazards disseminated. In rural areas, only 20 per cent of villages are connected to water distribution networks.[24] In 2000, only 32.7 per cent of rural households had access to treated water, whereas sanitation services and waste management are not centralised. Most importantly, since »traditional« waste areas include river banks, pollution has the capacity to travel downstream.

Social and cultural issues arise also when private land is used as a renewable energy source. Even though displacement is not unheard of in the rural environment in Romania it is worth mentioning that the population is not considered a final beneficiary. When green development companies do give a share of the profits back to local communities, more often than not the former owners do not receive their share because allocated sums go to the relevant government agency. Treating the rural population as co-beneficiaries will provide a fair distribution of resources.

One aspect that might hinder the development of green jobs is the lack of experience of green growth development. Like every other initial investment, introducing green development has its risks, and chances are that local investors and stakeholders will be reluctant to engage in project implementation. This is one of the lessons learned in the World Bank guide on financing energy efficiency.[25]

23. See: http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsien120&language=en

24. See: http://www.iccv.ro/oldiccv/romana/revista/rcalvit/pdf/cv2001.1-4.a06.pdf

25. Meyer Anke S., Taylor, Robert P Govindarajalu, Chandrasekar , Levin, Jeremy , Ward William A.

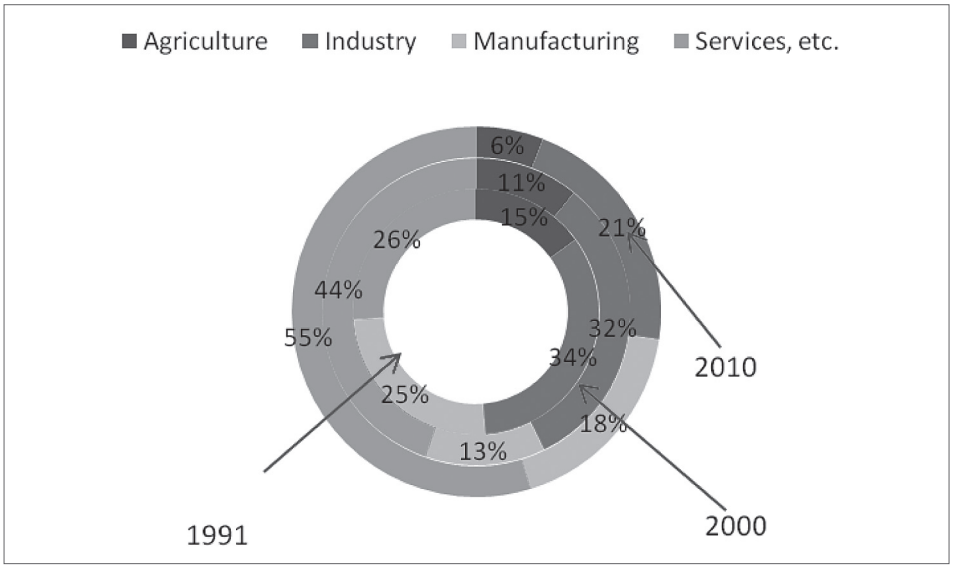
Tables and Figures

Table 1: Romania: energy efficiency gains and primary energy source self-sufficiency

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total self-sufficiency (production divided by TPES)	0.77	0.78	0.75	0.77	0.75	0.73	0.73	0.70	0.70	0.73	0.82
Coal and peat self-sufficiency	0.68	0.75	0.75	0.70	0.72	0.69	0.67	0.69	0.70	0.74	0.88
Oil self-sufficiency	0.64	0.64	0.56	0.68	0.68	0.58	0.61	0.55	0.48	0.48	0.54
Gas self-sufficiency	0.82	0.80	0.82	0.78	0.71	0.74	0.70	0.66	0.71	0.72	0.84
TPES/GDP (toe per thousand 2000 USD PPP)	0.28	0.27	0.26	0.26	0.25	0.23	0.22	0.21	0.20	0.18	0.17

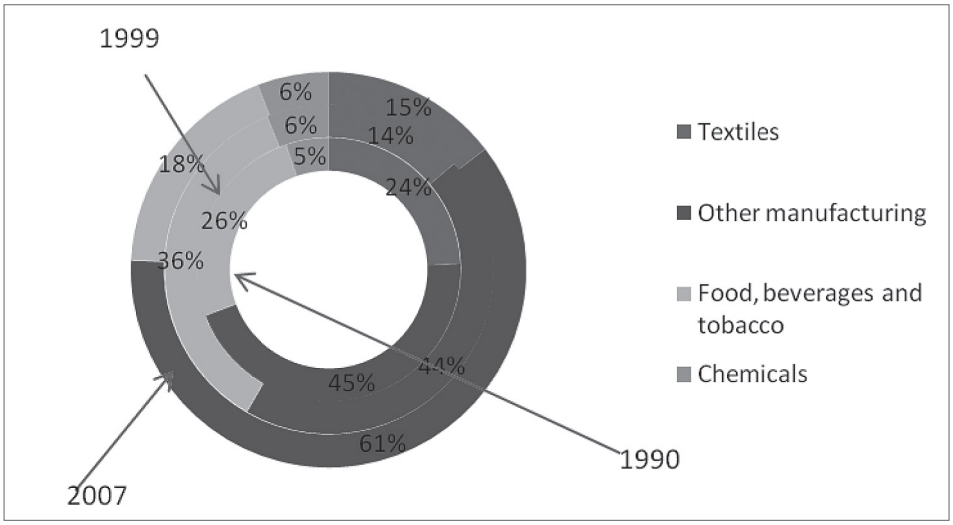
Note: In 2003, 68 per cent of the oil used in Romania for energy production was from national sources.
Source: International Energy Association.

Figure 1: Structural shifts in economic output, 1991 / 2000 / 2010



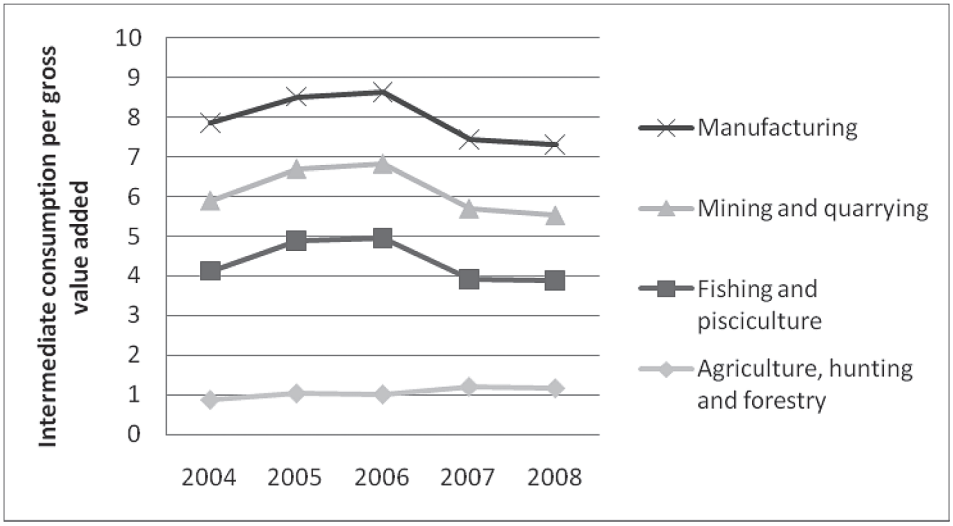
Note: In 2000, value added from agriculture accounted for 11 per cent of GDP.
Primary source: World Bank: Romania: Country metadata.

Figure 2: Structural shifts in manufacturing, 1990 / 1999 / 2007



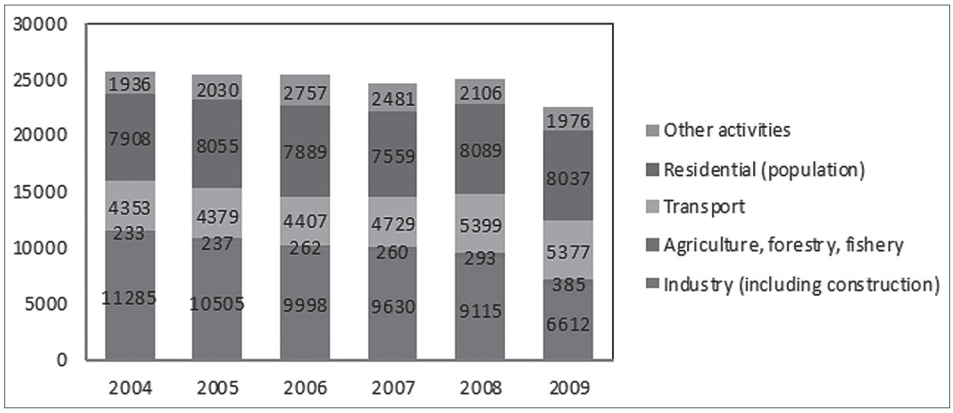
Note: In 2007, value added from textiles accounted for 15 per cent of total manufacturing value added.
Source: International Energy Association.

Figure 3: Resource intensive economic activities



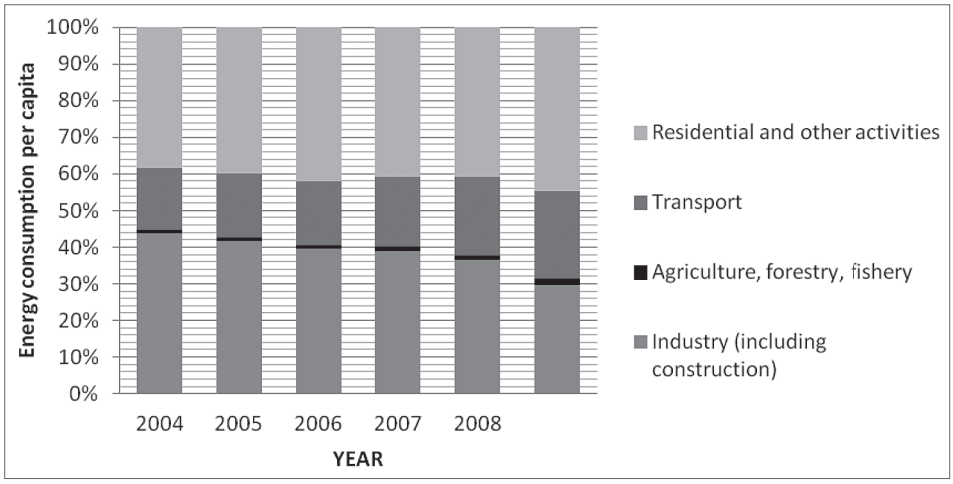
Source: National Institute for Statistics (NIS Romania).

Figure 4: Energy intensive sectors, 2004–2009



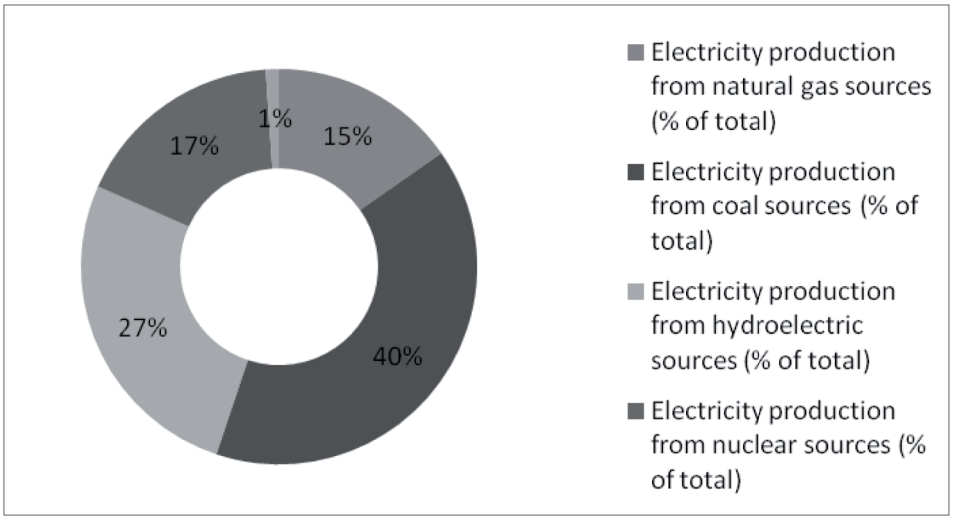
Note: Intermediate consumption per value added.
Source: NIS Romania.

Figure 5: Energy intense sectors, 2004–2009 (energy consumption per capita)



Source: NIS Romania.

Figure 6: Romania: electricity production by source, 2009

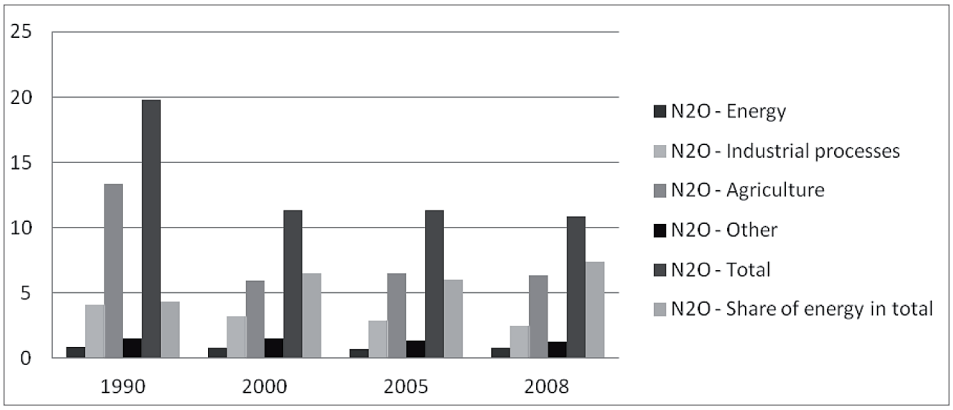


Source: World Bank: Romania metadata.

Table 3: Greenhouse gas emissions by sector

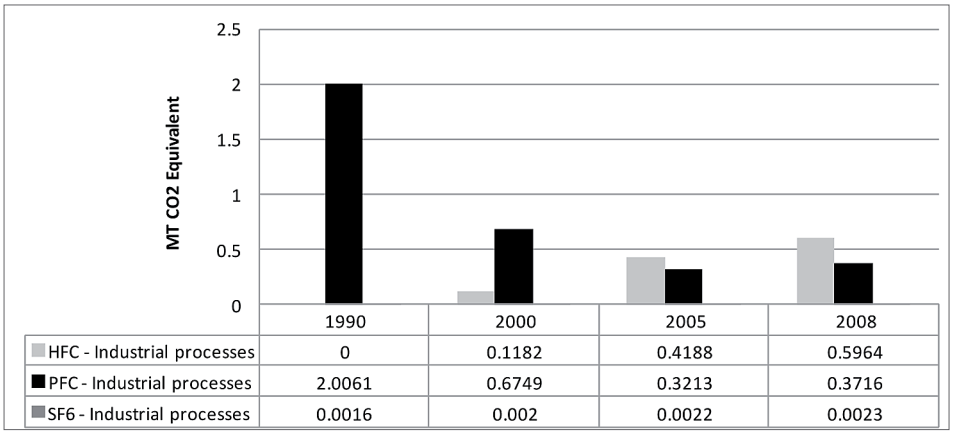
	1990	2000	2005	2008
GAS (Mt CO2 eq.)				
CH4 – Energy	18.0681	12.219	11.9424	12.4589
CH4 – Agriculture	15.6647	8.4093	8.7568	8.8347
CH4 – Waste	3.6401	4.3687	5.2193	5.4958
CH4 – Other	0.0374	0.1324	0.0369	0.0344
CH4 – Total	37.4103	25.1294	25.9554	26.8238
CH4 – Share of energy in total	48.2971	48.6243	46.0112	46.4472
N2O – Energy	0.8611	0.7353	0.6823	0.798
N2O – Industrial processes	4.0527	3.1809	2.8941	2.4638
N2O – Agriculture	13.3723	5.9612	6.4873	6.3201
N2O – Other	1.5177	1.4584	1.2977	1.2407
N2O – Total	19.8038	11.3358	11.3614	10.8226
N2O – Share of energy in total	4.3482	6.4865	6.0054	7.3735
HFC – Industrial processes	0	0.1182	0.4188	0.5964
PFC – Industrial processes	2.0061	0.6749	0.3213	0.3716
SF6 – Industrial processes	0.0016	0.002	0.0022	0.0023
Total	237.6593	130.9391	138.1733	139.8069
Share of energy in total	78.4587	76.5985	76.1486	75.9967

Figure 7: N2O emissions by source.



Source: International Energy Agency.

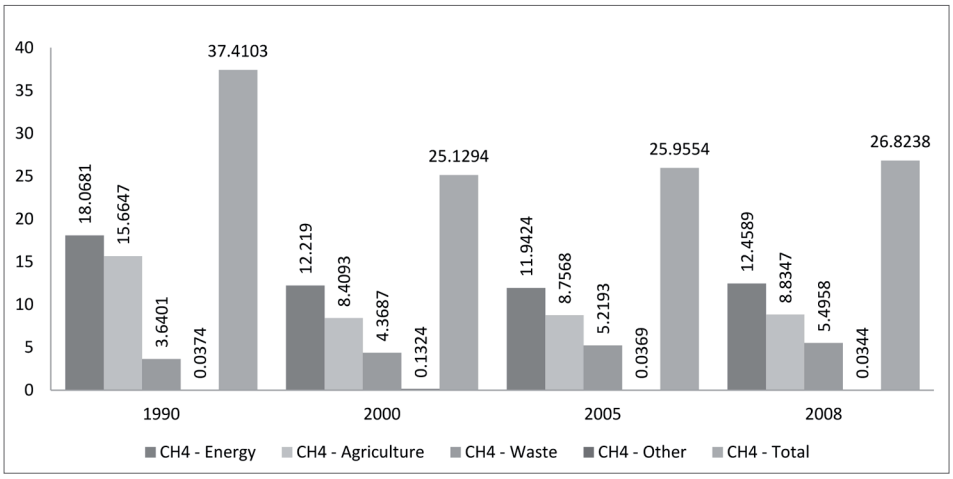
Figure 8: Other GHG emissions by source



	1990	2000	2005	2008
HFC - Industrial processes	0	0.1182	0.4188	0.5964
PFC - Industrial processes	2.0061	0.6749	0.3213	0.3716
SF6 - Industrial processes	0.0016	0.002	0.0022	0.0023

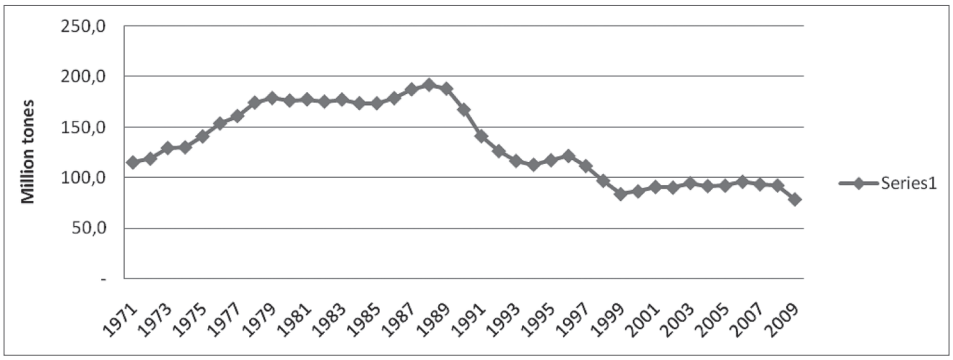
Source: International Energy Agency.

Figure 9: CH_4 emissions by source



Source: International Energy Agency.

Figure 10: CO_2 emissions, 1971–2009



Source: World Bank: Romania metadata set.

Figure 11: Sectoral approach to CO_2 emissions

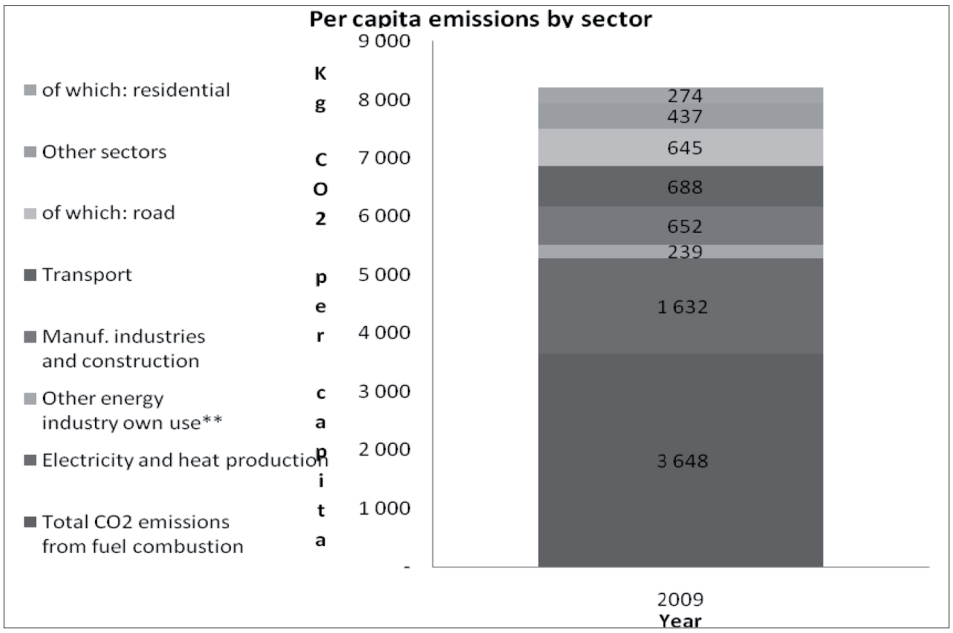
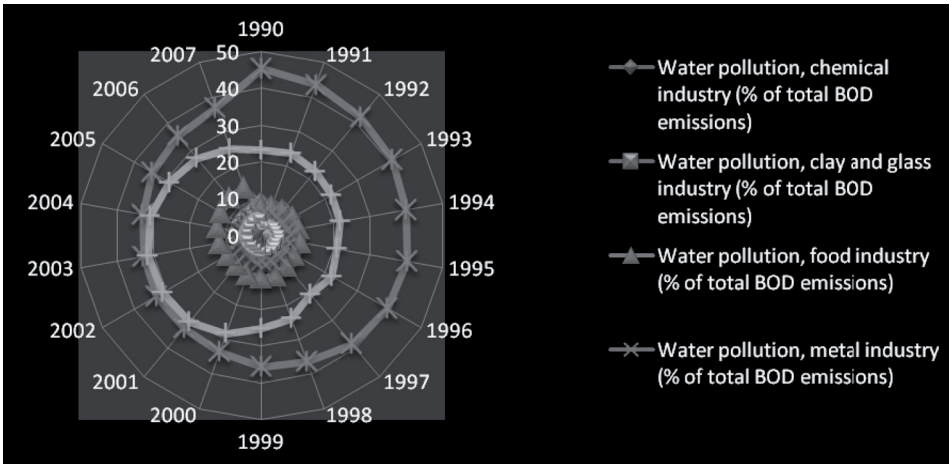
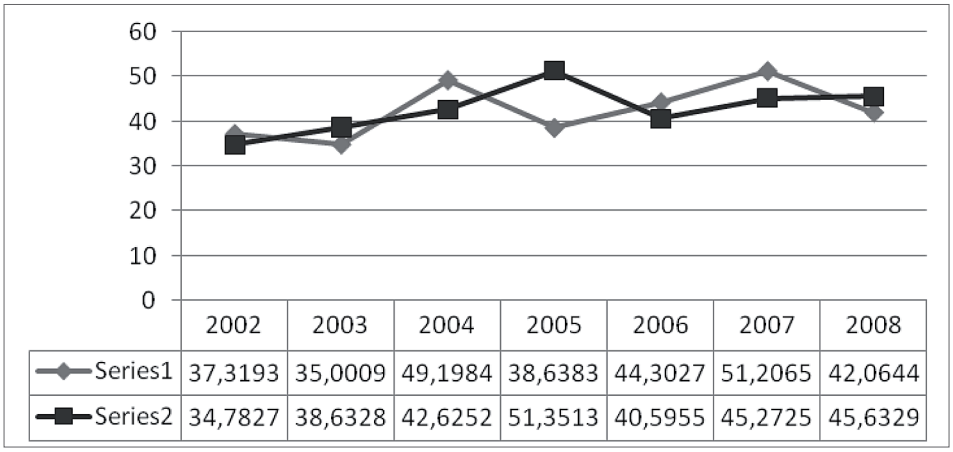


Figure 12: Sources of water pollution: chemical and metal industries (maximum values)



Source: World Bank: Romania metadata set.

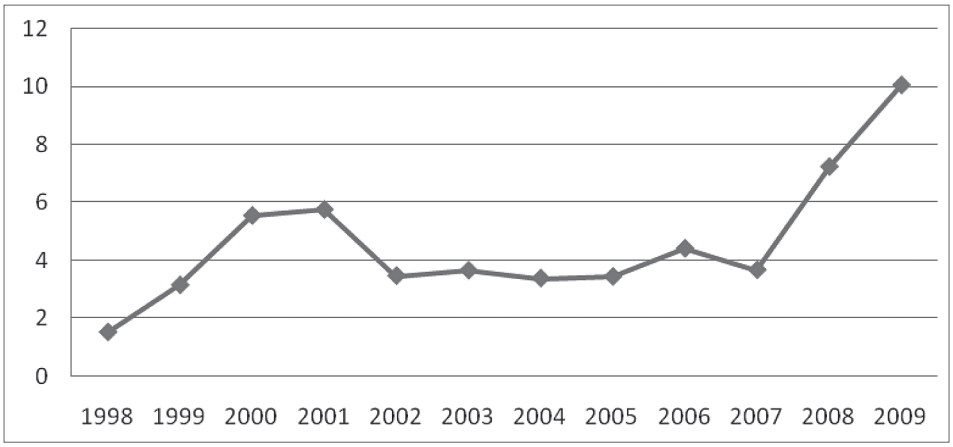
Figure 13: Fertiliser consumption, 2002–2009
Series 1: Percentage of fertilizer production
Series 2: kp per ha of arable land



	2002	2003	2004	2005	2006	2007	2008
Series1	37,3193	35,0009	49,1984	38,6383	44,3027	51,2065	42,0644
Series2	34,7827	38,6328	42,6252	51,3513	40,5955	45,2725	45,6329

Source: World Bank: Romania metadata set.

Figure 14: Impact of EU accession on hi-tech exports
(% of manufactured exports)



Source: World Bank: Romania metadata set.

Figure 15: Patent applications to the European Patent Office per million inhabitants

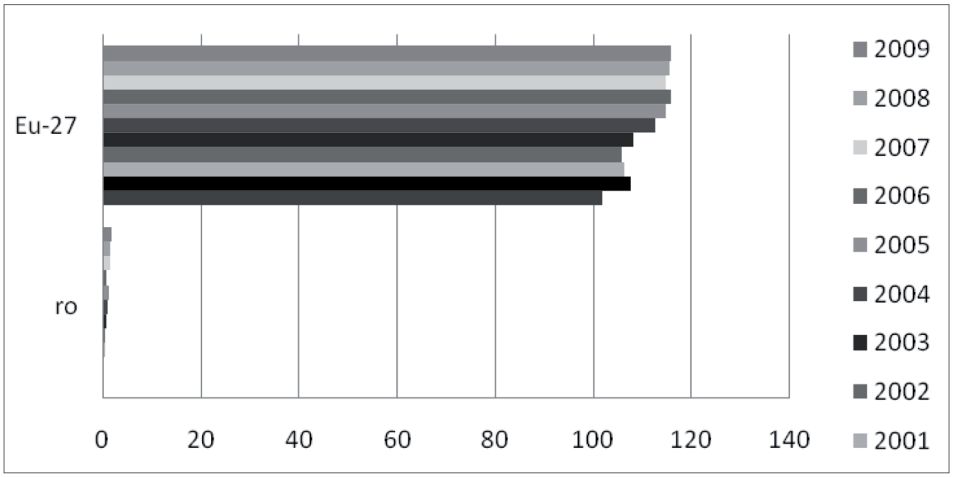
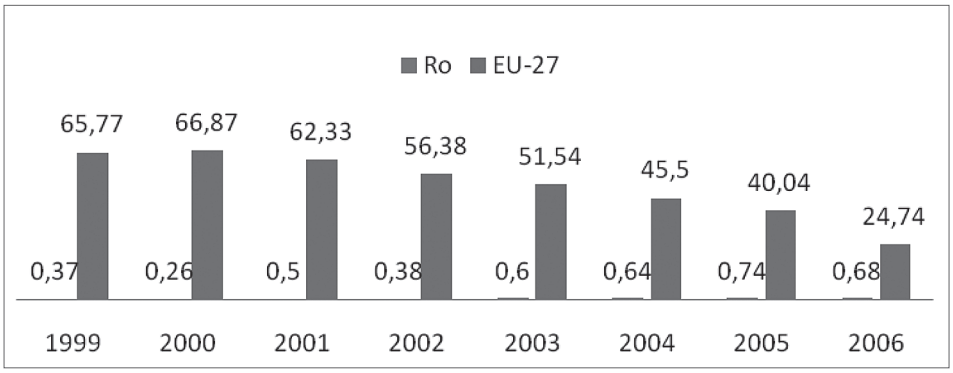
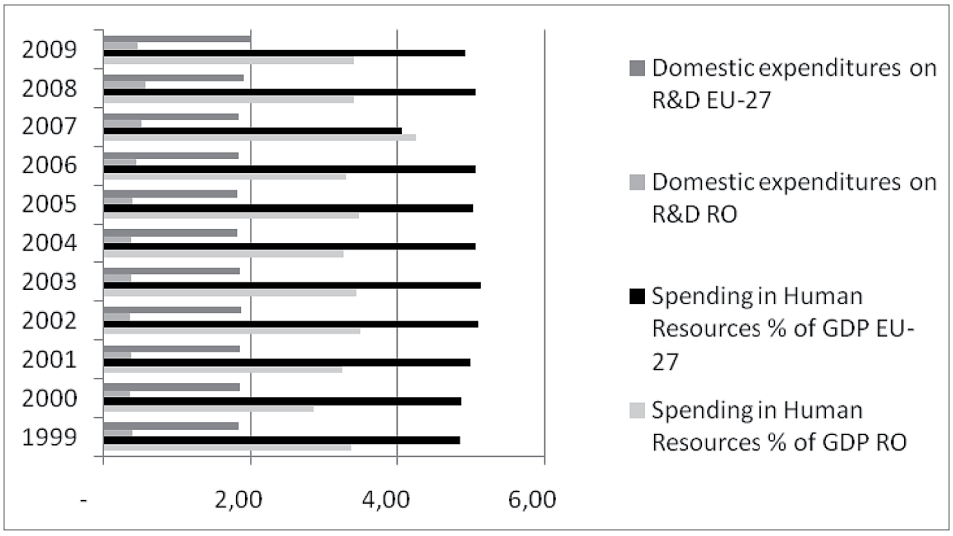


Figure 16: Patents granted by the United States Patent and Trademark Office



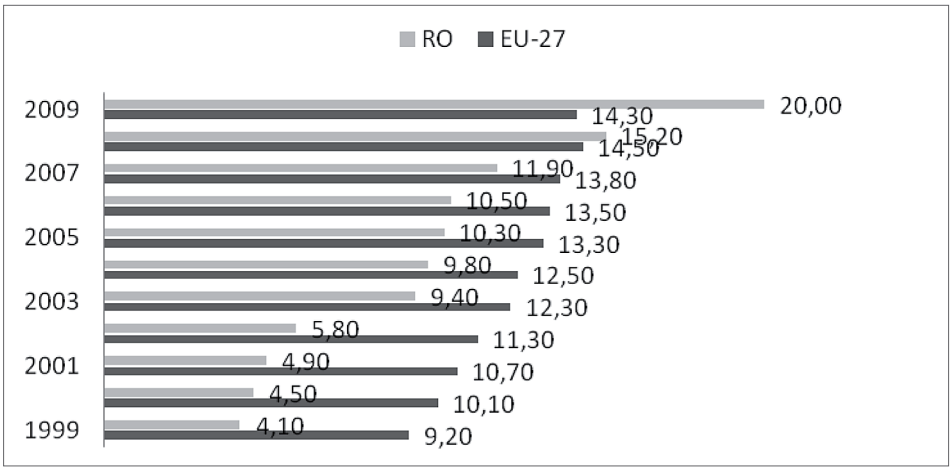
Source: EUROSTAT.

Figure 17: Human resources and R&D as a percentage of GDP



Source: EUROSTAT.

Figure 18: Science and technology graduates per 1000 persons age 20–29



Source: EUROSTAT.

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