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**National GHG Mitigation Strategies and Energy Options in Romania**

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# **National GHG Mitigation Strategies and Energy Options in Romania**

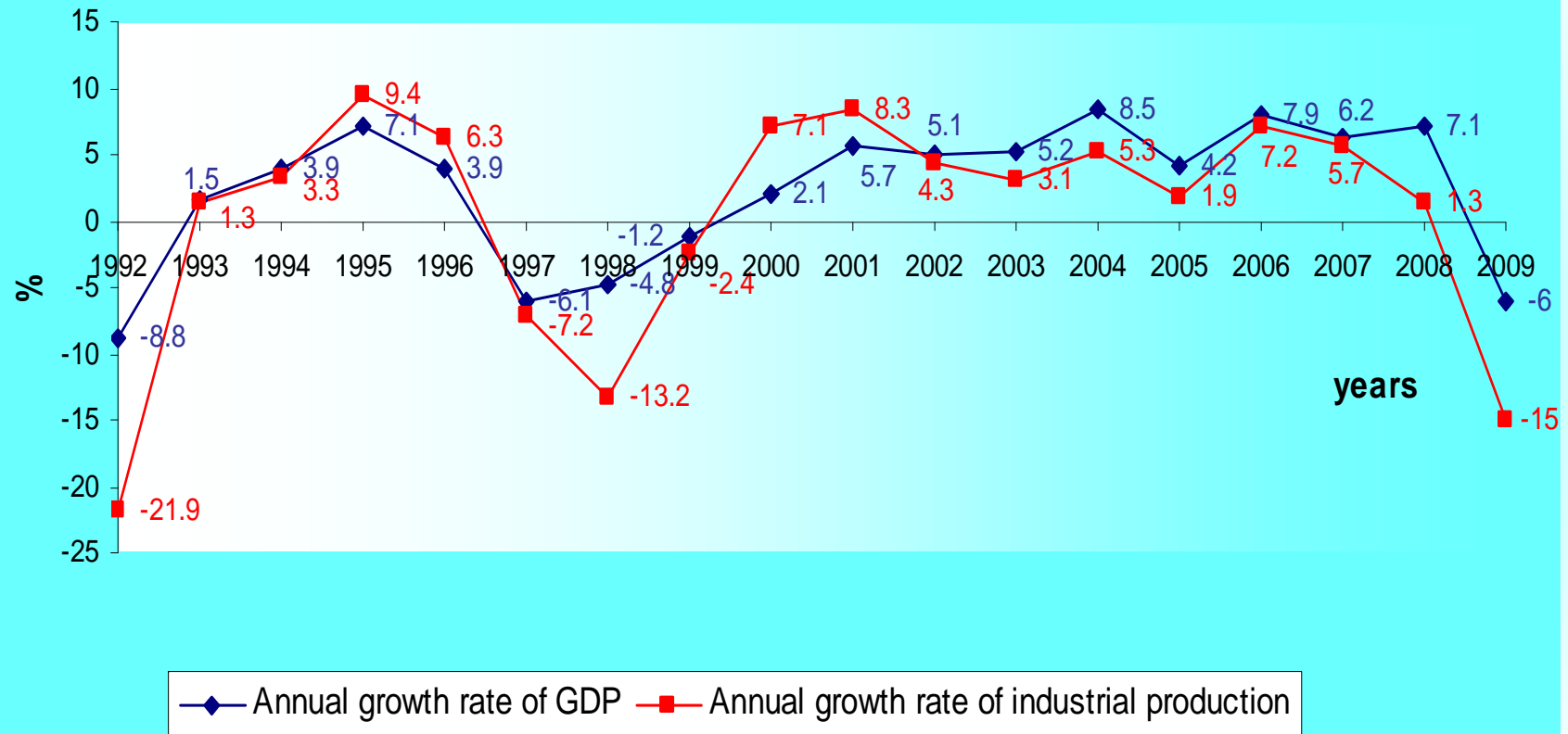
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**Alternative Response Actions to Climate Change and Energy Options  
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# 1. General Evolution

- **Romania is a country situated in South Eastern Europe with a population of 21.6 million inhabitants and an area of 238,391 km.**
- **Romania's economic evolution after 1990 has been strongly influenced by the phenomena specific to the period of transition to the market economy.**
- **The evolution of the annual growth rate of GDP and industrial production is given in Fig. 1.**

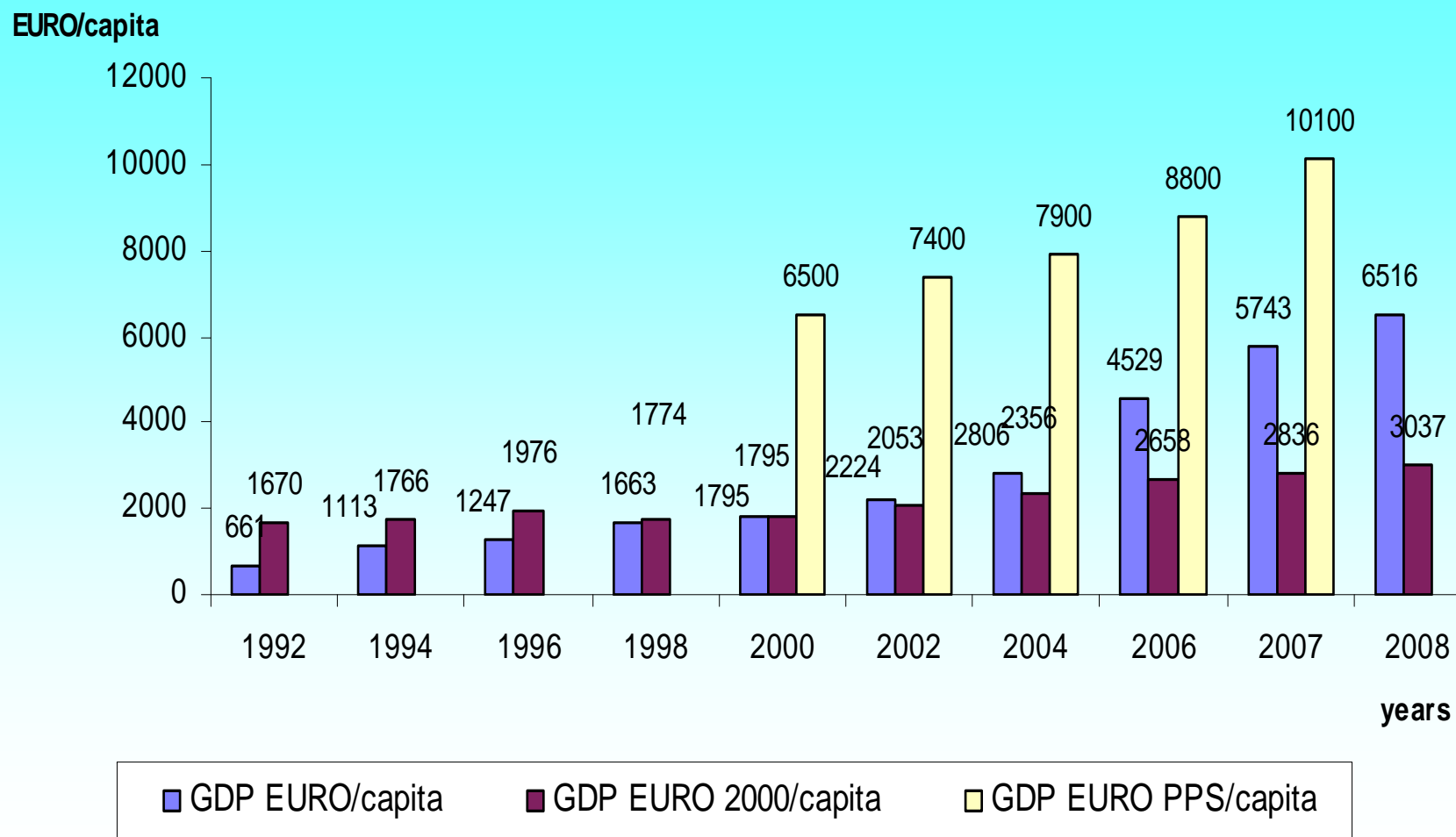
## Fig. 1 Macroeconomic indicators in Romania (1992-2009)



- **The periods of economic growth have alternated with periods of recession.**
- **The first two recessions (1990-1992 and 1997-1999) were due to the economic reorganization specific to the transition to the market economy. The latest recession (2009-?) has been registered in the context of the international economic crisis.**
- **Nevertheless, the period between 2000 and 2008 was characterized by a constantly positive evolution with increase rates above the EU average.**

- **This has led to the rapid increase in the GDP per capita (fig. 2). Three measurement units have been used for GDP, namely:**
  - **EURO, utilizing the official exchange rate of the NBR;**
  - **EURO 2000;**
  - **EURO PPS (EURO at the parity of the power of purchase established by EUROSTAT).**
- **In all these instances a trend towards the increase has been noticed. The converging trend between the official exchange rate and the power of purchase is obvious. This means that there is a trend towards aligning the retail prices on the Romanian market to the average European prices.**
- **The values of the analyzed indicator are still lower than the EU 25 average values (22,700 Euro/capita).**

**Fig. 2 Evolution of GDP per capita in Romania (1992-2008)**



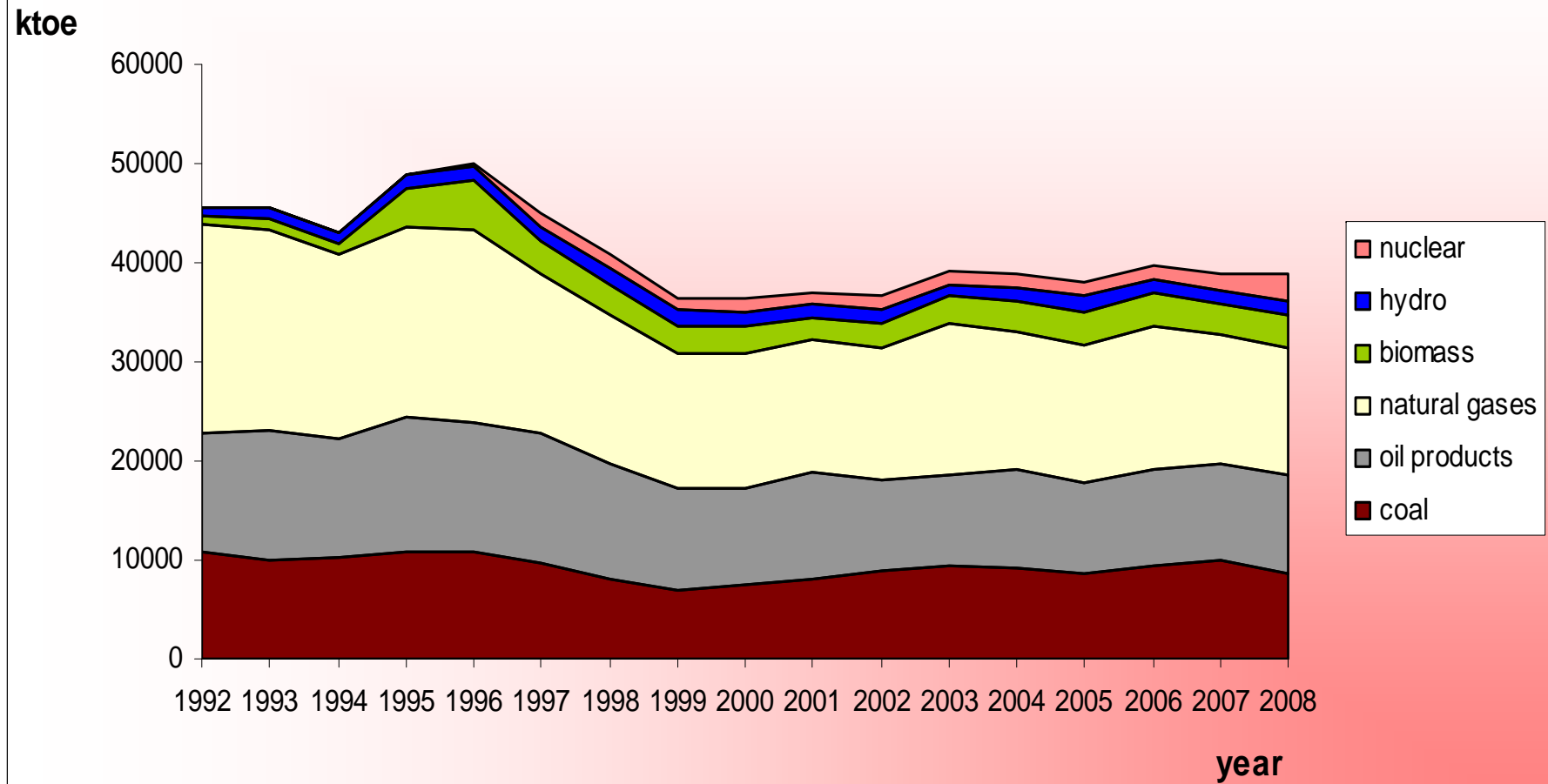
## 2 Energy consumption trends

### 2.1 Primary energy consumption (Fig. 3)

- Romanian economy restructuring has influenced the evolution of energy consumption. After a maximum value surpassing 50 mil toe was attained in 1996, the value of consumption has lately stabilized at about 40 mil toe.
- The highest share within primary energy consumption is held by natural gases. Nevertheless, this share is decreasing (from 43 % in 1996 to 37 % in 2006). The forecasts indicate a continuous decrease in natural gas consumption due to the prices on the international market. The fact that Romania depends on a single external supplier (Russia) could enhance this tendency. Consumption of oil products has decreased in a similar way.
- Lignite is the energy resource that can diminish the dependence on imports. After the measures taken for restructuring this industry between 1966 and 1999 internal lignite production stabilized and the decision-makers hardly consider a decrease in coal consumption. The EU legislation related to the allocation of the GHG emission quotas could have a major effect.
- Non-carbon energy (nuclear, hydro, wind, solar, etc) is visibly increasing and this tendency will continue to increase in the future. In 2007 the second 700 MW unit of Cernavoda NPP was put into operation. This has contributed to the increase in non- carbon energy in the structure of primary energy consumption.



**Fig. 3 Primary energy consumption**

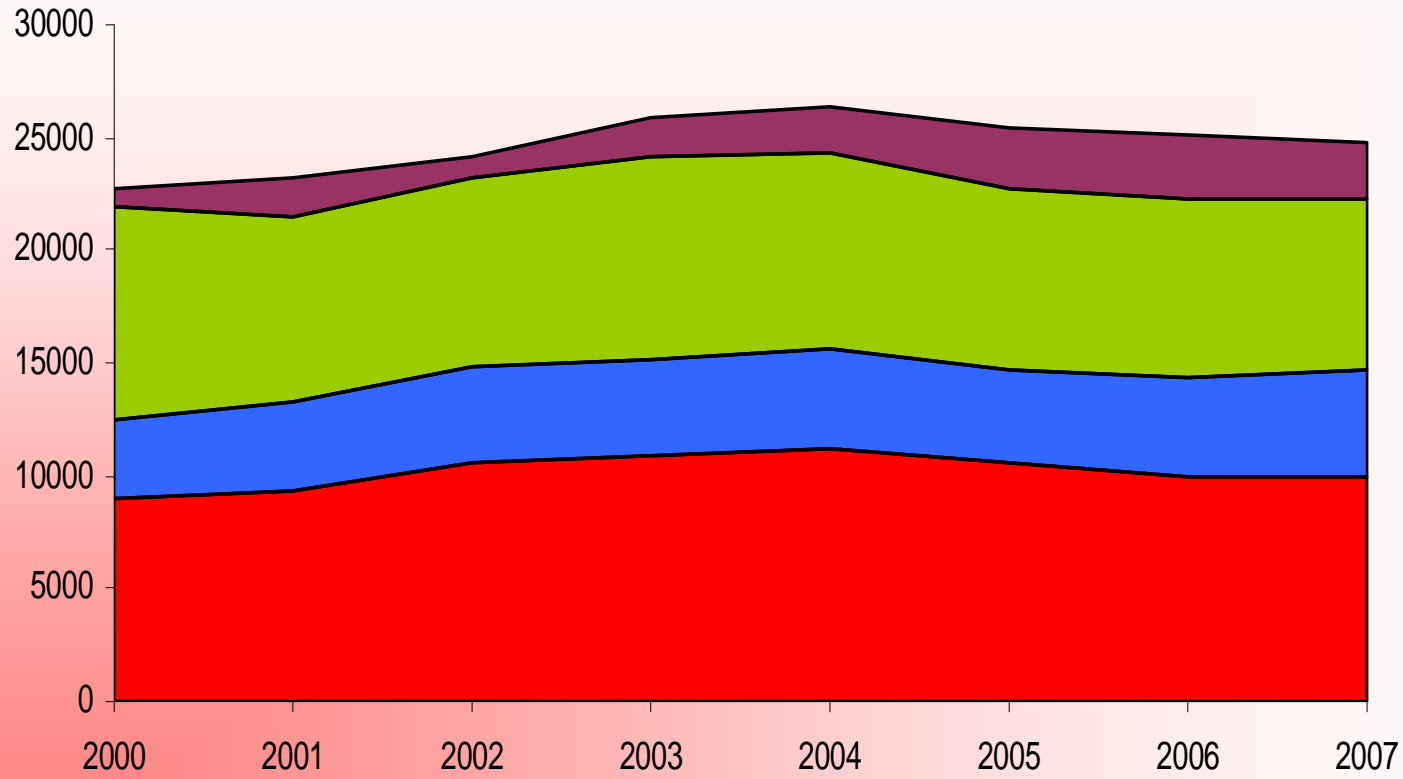


## 2.2 Final energy consumption (Fig.4)

- **The evolution of final energy consumption has been qualitatively similar to the evolution of primary energy consumption and, in fact, to the evolution of the national economy on its whole.**
- **Consumption in the industrial sector and population consumption have registered a certain decrease. Nevertheless, in the service sector, a very dynamic one, energy consumption is increasing.**

**Fig. 4 Final energy consumption**

**ktoe**



- Tertiary
- Household
- Transport
- Industry

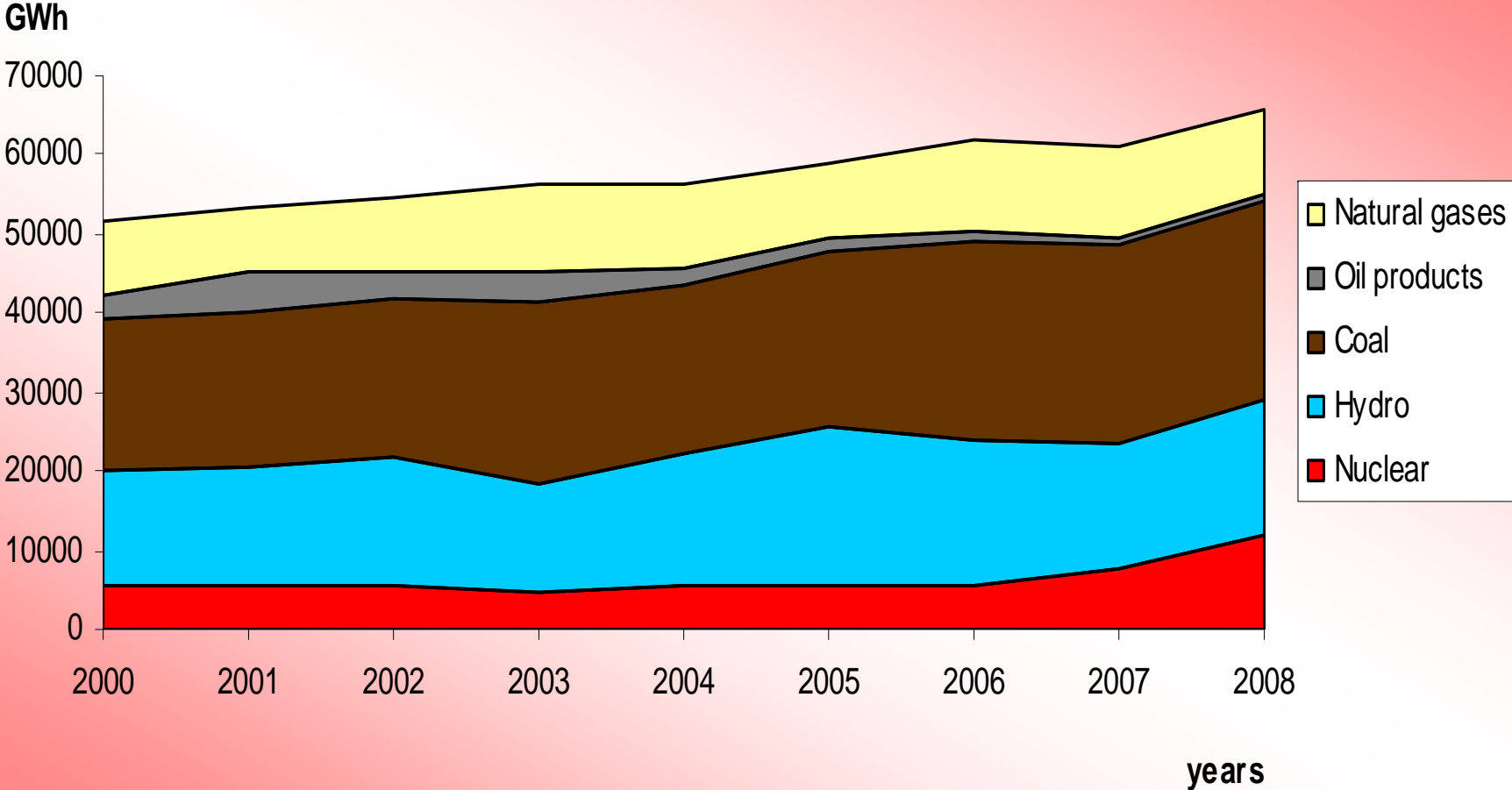
**years**

## 2.3 Electricity production (Fig. 5)

- In the last years, the value of total electricity production has continuously increased, the value in 2008 (65.7 TWh) being by 28 % higher than that registered in 2000. At the same time, significant changes have been registered in the structure of production.
- The share of non-carbon electricity (hydro and nuclear) is increasing. In 2007 the second unit of Cernavoda NPP started operating so that in 2008 the share of nuclear energy within the total electricity production amounted to 18 %. The value of the hydroelectric power production has varied from one year to another according to the weather conditions. Its share in 2008 amounted to 26 % of the total. Thus, the total non-carbon electricity production represented 44 % in 2008. Unfortunately, the production of electricity from wind, solar, etc., energy was insignificant.

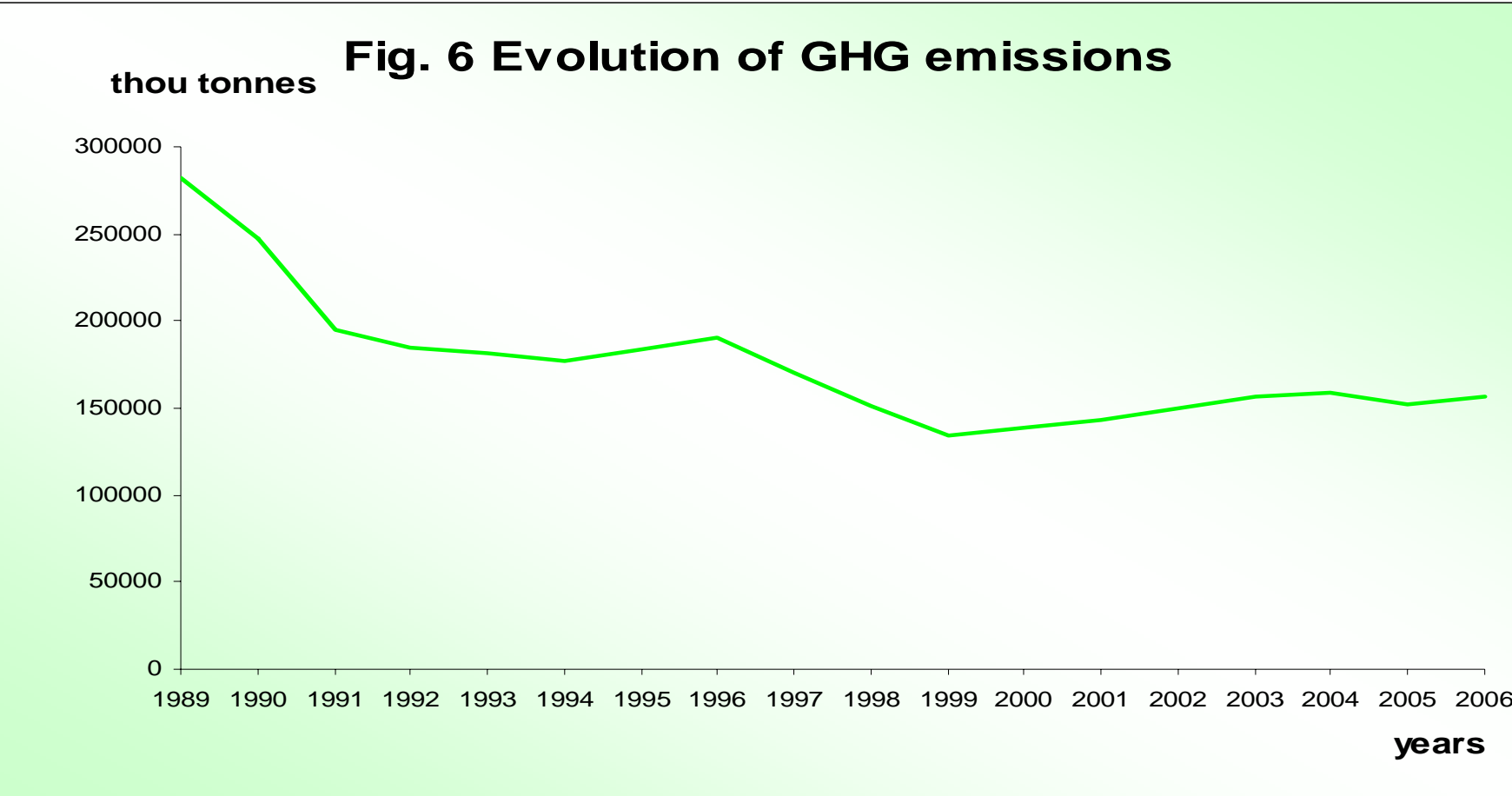
- **The share of the coal-fired plants has been practically constant in the last years. The retrofiting works carried out after 1990 have greatly improved their technical parameters and safety in operation**
- **Production of the power plants running on hydrocarbons has a continuous decreasing tendency in absolute values and as a share within total consumption. The total production has decreased from 23.2 TWh in 1996 (before the first nuclear unit was put into operation) to 8.9 TWh in 2008 (15 % of the total production).**

**Fig.5 Structure of electricity production**



### 3. The evolution of GHG emissions in Romania

Fig. 6 emphasizes the significant decrease in GHG emissions between 1989 and 1999 (from 282 thousand tonnes to 144 thousand tonnes), followed by a relatively slow increase due to the economic growth (157 thousand tonnes in 2006).



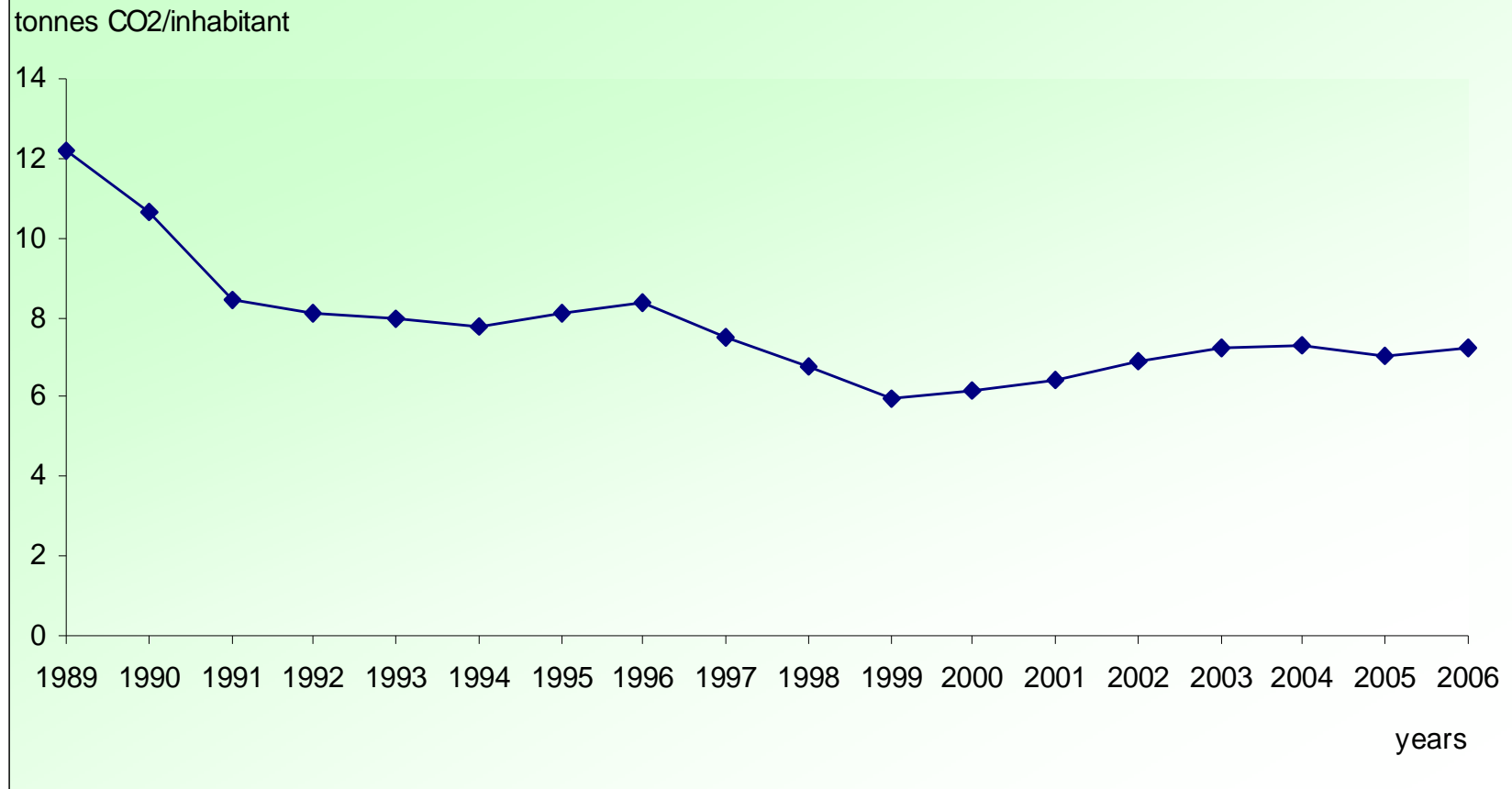
**Table 1 Evolution of GHG emission structure**

<b>Year</b>	<b>Total</b>	<b>CO2</b>	<b>CH4</b>	<b>N2O</b>	<b>% Fluorine compounds</b>
<b>1989</b>	<b>100</b>	<b>68.51</b>	<b>18.46</b>	<b>11.85</b>	<b>1.19</b>
<b>2006</b>	<b>100</b>	<b>70.85</b>	<b>18.55</b>	<b>10.20</b>	<b>0.39</b>

**The structure of GHG emissions did not change significantly during the analyzed period of time.**

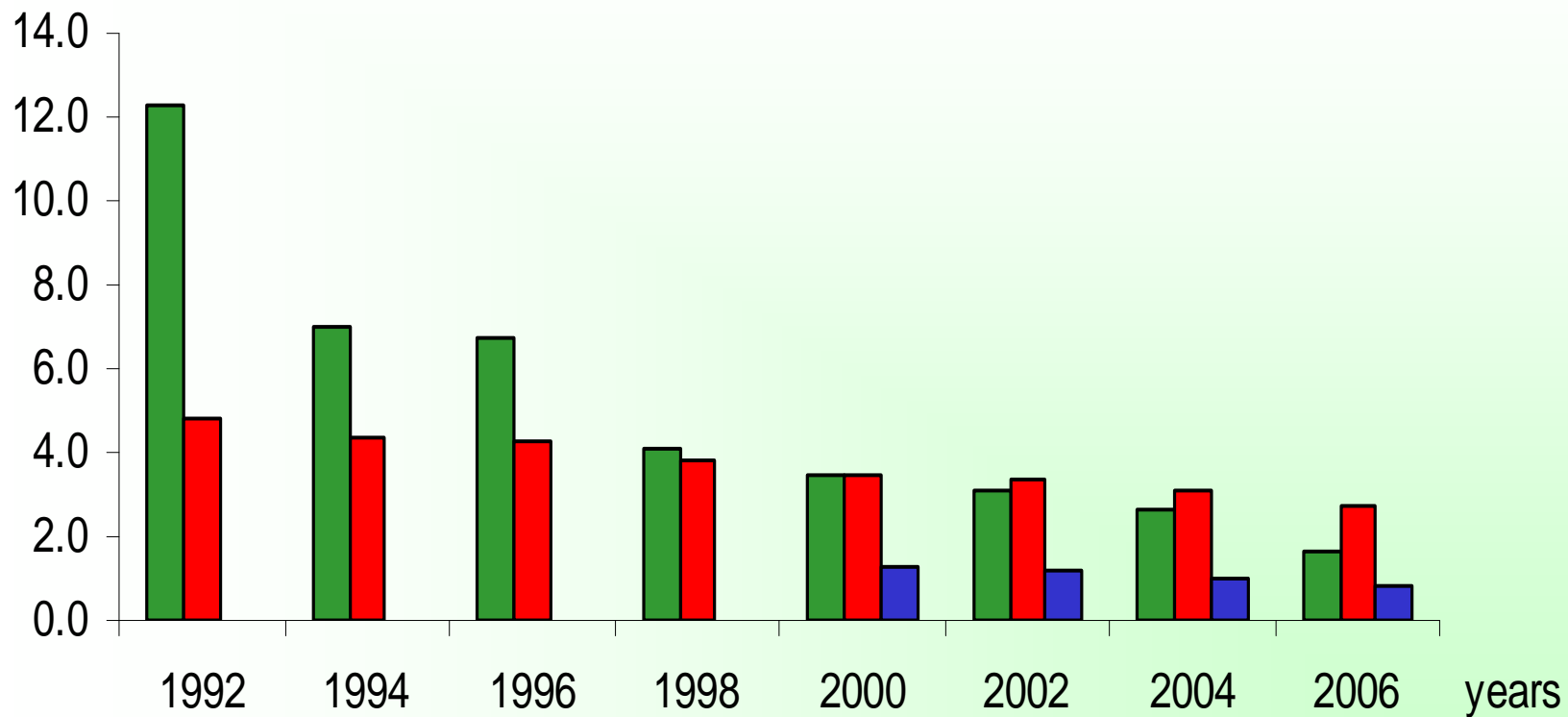


### Fig. 7 GHG emissions by inhabitant



### Fig. 8 Evolution of carbon intensity

tonnes CO2/  
thou EURO



■ tonnes/thou EURO ■ tonnes/thou EURO 2000 ■ tonnes/thou EURO PPS

The indicators concerning the CO<sub>2</sub> emissions specific to electricity production are presented in Table 2.

**Table 2 CO<sub>2</sub> specific emissions from electricity production**

<b>Year</b>	<b>Coal</b>	<b>Natural gases</b>	<b>Fuel oil</b>	<b>(g/kWh)</b>
				<b>Country Average</b>
<b>2004</b>	956	495	752	471
<b>2005</b>	1079	535	741	485
<b>2006</b>	1126	511	627	547
<b>2007</b>	1096	523	625	566
<b>2008</b>	1050	510	703	496

The data presented illustrate an increasing tendency of the specific CO<sub>2</sub> emissions. The phenomenon is alarming and it has called the attention of the working team.

## **4. Improvement in the energy efficiency and renewable energy sources legislation**

### **4.1 Analysis of the latest EU Strategies and Directives on emission trading, RES utilization and energy efficiency increase**

**In 2007 the European Union agreed on the following overall objectives:**

- GHG reduction up to 20% by 2020, in comparison with 1990;**
- Increase in the share of RES from less than 7% in 2006, to 20% of the total RES up to 2020;**
- Increase in the share of bio-fuels within the total used fuels to at least 10% by 2020;**
- Reduction in the primary energy consumption by 20% by 2020.**

**The legislative and energy policy framework for attaining the above mentioned objectives is ensured by the directives envisaging the specific sectors: buildings, GHG trade, energy services and final users, renewable energy sources, highly efficient co-generation.**

**In April 2009, new directive were adopted (on the utilization of renewable energy and energy efficiency) and other directives have been updated (such as the GHG emission trading scheme expansion).**

### **4.1.1 An energy policy for Europe (COM (2007) 1 final)**

**The European energy policy covers three aspects:**

- Fight against climate changes;**
- Limiting EU vulnerability to hydrocarbon imports;**
- Promotion of work force employment and economic growth.**

**Further only the issues related to climate changes will be analyzed.**

- ❖ Promotion of RES has been already declared a political priority at the EU level. The Council of Europe has established that the share of RES within all the energy sources should rise to 20% by 2020. In order to attain this objective the three sectors of renewable energy sources will have to be massively developed:**
  - electricity;**
  - bio-fuels;**
  - heating and cooling systems.**

❖ **Utilization of fossil fuels with low CO2 emissions**

**There are two distinct ways to reduce CO2 emissions:**

- through the development of a modern highly efficient energy production technology with low CO2 emissions;**
- by introducing CO2 capture and storage methods**

❖ **Nuclear energy is one of the most important sources of carbon-free energy:**

- it is less vulnerable to fuel prices than the energy produced from coal and natural gases**
- it is based on available sources.**
- its costs are relatively stable.**

**The decision in favor or against utilization of nuclear energy belongs to each of the Member States.**

**Romania has chosen to continue the development of its nuclear energy sector**

❖ **Energy efficiency improvement**

**At present, energy efficiency increase is an essential component of all the sustainable development strategies. It is directly related to the environmental issue, in general, and to the issue of GHG emission reduction, in particular.**

#### **4.1.2 The Green Paper of Energy Efficiency or to do more with less (COM(2005)265 final)**

- **The meaning of the term energy efficiency is twofold:**
  - **A better utilization of energy by increasing efficiencies by means of higher performance technologies and equipment, respectively;**
  - **Change in the behavior of consumers and their orientation to lower energy consumption products/services.**
- **The document considers that the most important barrier to energy efficiency increase is the lack of information on:**
  - **Availability and costs of the new technologies and equipment;**
  - **Costs of own energy consumption.**

- **The actions should be carried at three levels:**
  - **Informing citizens on energy consumption reduction in their dwellings (efficient lighting and heating systems, etc.);**
  - **Informing industrial consumers;**
  - **Informing the energy service suppliers and experts in order to develop a functional network.**

**Education and training can play an extremely important role in the development of an energy efficiency culture.**

- **A financing model recommended by the Green Paper on energy efficiency is financing by third parties and contracting of energy services. The document considers that the energy services companies (ESCO) are still at the beginning and need support to be promoted and to gain access to financing.**
- **Public authorities, national or European ones, should play an important role in solving the market inadequacies and promoting energy efficiency. The main direct instruments that should be considered are:**
  - **The state support;**
  - **Taxation;**
  - **Public acquisitions.**



### **4.1.3 The Green Paper on the market instruments used for environmental policy purposes (COM (2007) 1 final)**

- **The EU has increasingly encouraged market instrument utilization, considering that they represent flexible and profitable means to fulfill the established objectives.**
- **The main instruments recommended by the European Union are:**
  - **Taxes and fees;**
  - **Targeted subsidies**
  - **Tradable emission certificates, etc.**
- **Market instruments do not represent a solution to all the problems. They need clear regulatory framework and are often used in combination with other type measures.**

#### **4.1.4 Directive 2006/32/EC on energy efficiency and energy services**

- **The EU Member States have pledged to reduce energy consumption by about 1% annually against the average of the last five years for which there are statistical available data in nine years (2008-2016).**
- **Each member State shall develop national energy efficiency action plans to be submitted to the European Commission. Thus:**
  - **The first NEEAP the latest by June 30, 2007;**
  - **The second NEEAP the latest by June 30, 2010;**
  - **The third NEEAP the latest by June 30, 2014.**
- **The Directive explicitly mentions that the measures included in NEEAP should be accompanied by the quantitative estimation of their effects. This estimation should be carried out both ex-ante, and ex-post.**

- According to the EU Energy Efficiency Directive provisions, on June 30, 2007 Romania submitted the European Commission the first NEEAP.
- Romania's energy saving target is given in the following table:

**Table 3 Romania's energy saving target**

*[Thousand toe]*

<b>Average in the 2001-2005 period</b>	<b>20, 840</b>
<b>The 9% target of energy savings by 2016</b>	<b>1,876*</b>
<b>The target of energy savings adopted by Romania by 2016</b>	<b>2800**</b>
<b>The intermediate target for 2010</b>	<b>940***</b>

*\* The minimum value according to the Directive 2006/32/EC*

*\*\* 13.5 % of the average consumption 2001 – 2005, 1.5 % annually, respectively*

*\*\*\* 4.5 % of the average consumption 2001 – 2005, 1.5 % annually, respectively*

#### **4.1.5 Directive 2009/28/ on the promotion of the use of energy from renewable sources**

- The Directive reiterates that by 2020 the energy share from RES should represent at least 20 % of the final gross energy consumption and establishes the overall (global) national mandatory objectives for each Member State. The objective established for Romania is of 24 % (against 17.8 % in 2005). A trend to serve as an orientation has been established, including mathematical relations for the calculation of the average share over two - year periods of time. In Romania's case the orientation trend is given in the following table:**

**Table 4**

<b>Year</b>	<b>Share (%)</b>
<b>2005</b>	<b>17.8</b>
<b>2011-2012</b>	<b>19.04</b>
<b>2013-2014</b>	<b>19.66</b>
<b>2015-2016</b>	<b>20.59</b>
<b>2017-2018</b>	<b>21.83</b>
<b>2020</b>	<b>24</b>

**The Member States should take steps to ensure that the share of energy from RES be greater or equal to the value represented by the orientation trend.**

- **In order to fulfill the established objectives, the Member States can take, among others, the following measures:**
  - **Support schemes;**
  - **Cooperation between different Member States and third countries.**
  
- **Each Member State should make sure that the share of energy from RES utilized in all types of transport in 2020 represents at least 10 % of the final energy consumption in transports in the respective state.**
  
- **Each Member State shall adopt a National Action Plan in the field of Renewable Energy (NREAP)**  
**The national plans establish:**
  - **The objectives of the respective Member State concerning the share of energy from RES to be consumed in**
    - **transport**
    - **electricity**
    - **cooling and heating in 2020;**
  - **The measures that should be adopted for attaining the respective global national objectives .**

#### 4.1.6 Directive 2009/29 to improve and extend the greenhouse gas emission allowance trading scheme of the Community

- The European Council of March 2007 made a firm commitment to reduce the overall greenhouse gas emissions of the Community by at least 20 % below 1990 levels by 2020, and by 30 % provided that other developed countries commit themselves to comparable emission reductions and economically more advanced developing countries contribute adequately according to their responsibilities and respective capabilities.
- The Community –wide quantity of allowances issued each year starting in 2013 shall decrease in a linear manner beginning from the mid-point of the period from 2008 to 2012. The quantity shall decrease by a linear factor of 1.74 % compared to the average annual total quantity of allowances issued Member states in accordance with the Commission Decisions on their national allocation plans for the period from 2008 to 2012.
- From 2013 onwards, Member States shall auction all allowances which are not allocated free of charge.
- At least 50 % of the income obtained from the quota auctioning should be utilized for financing certain actions aiming at reducing GHG emissions (promotion of energy efficiency and use of RES, CO<sub>2</sub> capture and geological storage, avoiding deforestation and increasing reforestation, etc).

**4.1.7 Directive 2009/30 as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions**

**4.1.8 Directive 2009/31 on the geological storage of carbon dioxide**

## **4.2. Analysis of the Romanian strategies and legal framework**

**The main governmental institutions that are responsible for these actions are:**

- The Ministry of Economy (through its General Energy, Oil and Gases Division);**
- The Ministry of Environment;**
- The Ministry of Regional Development and Housing (for the energy efficient utilization in buildings);**
- The Romanian Agency for Energy Conservation (ARCE);**
- The Romanian Energy Regulatory Authority (ANRE)**



#### **4.2.1 The Energy Strategy of Romania in the period 2007-2020, approved through GD 1069/2007**

**The established strategic objectives are the following:**

- **Energy security**
  - **Increase in energy security by ensuring the necessary energy resources and limiting dependence on the import energy resources;**
  - **Diversification of import sources, energy sources and their transport routes;**
  - **Increase in the level of adequacy of the national electricity, natural gases and oil transport networks;**
  - **Protection of the sensitive infrastructure.**
  
- **Sustainable development**
  - **Energy efficiency increase;**
  - **Promotion of energy production from RES ;**
  - **Promotion of electricity and heat production in highly efficient cogeneration plants;**
  - **Support to the research – development activities and dissemination of the applicable results;**
  - **Reduction in the negative environmental impact of the energy sector;**
  - **Rational and efficient utilization of the primary energy resources**

- **Competitiveness**
  - **Development of competition - based electricity, natural gases, oil, uranium, green certificates, GHG emission certificate and energy service markets;**
  - **Liberalization of energy transit, ensuring the permanent and non-discriminating access of the market participants to the international transport and distribution networks and international interconnections;**
  - **Continuation of the restructuring and privatization processes in the electricity, heat and natural gas sectors;**
  - **Continuation of the restructuring process in the lignite sector aiming at increasing profitability and access to the capital market.**

- **The following measures in the energy efficiency field will be adopted:**
  - **Utilization of energy-saving financial instruments, including energy performance contracts leading to measurable energy savings;**
  - **Acquisition of equipment and technologies, especially considering energy efficiency specifications;**
  - **Acceleration of the rigorous energy auditing process carried out by industrial consumers for the la public and residential buildings, audits certified by the authorized bodies, followed by measures for reducing energy consumption.**
- **The measures considered for the promotion of RES are:**
  - **Increase in the degree of RES utilization under high economic efficiency conditions for producing electricity and heat, by means of facilities, including facilitation of access to the electrical network, in the investment phase;**
  - **Green certificate improvement with a view to attracting the private capital in the RES field investment;**
  - **Promotion of mechanisms for supporting utilization of RES for producing heat and hot water for domestic use;**
  - **Utilization of structural funds.**

## **4.2.2 National Action Plan for Energy Efficiency**

- **Industry**
  - Information campaigns;
  - Long-term voluntary agreements in different sectors of the processing industry;
  - Energy audits and efficient energy management;
  - Energy efficiency improvement by supporting financing from the Community funds.
  
- **Transport**
  - Energy consumption reduction by people and merchandise railway transport modernization;
  - Public transport quality increase so that to be preponderantly used by people instead of own cars;
  - Expansion of public transport by new route building;
  - Increase traffic and parking efficiency;
  - Provision of public means of transport for employees by the beneficiary companies;
  - Increase development of rail transport within urban transport (trams, trolleybuses);
  - Increase energy efficiency of vehicles by establishing minimum efficiency criteria;
  - Introduction of standards to support the most efficient and least polluting vehicles;
  - Utilization of gaseous and bio-fuels in the transport sector.

- **Residential (final energy consumption in buildings: heating, hot water and lighting):**
  - **Rehabilitation of the building envelope through thermal rehabilitation measures and financial support for the low-income owners for carrying out the rehabilitation works;**
  - **Increasing efficiency of the existing thermal installations;**
  - **Increasing efficiency of lighting, utilization of low consumption lamps;**
  - **Obligation to apply the provisions of the Directive and the European standards on the new buildings;**
  - **Increasing energy efficiency by supporting financing from the Community funds;**
  - **Continuing final consumer thermal energy metering;**
  - **Development of a national energy saving education programme for population, in schools and through mass-media, aiming at saving energy, protecting the environment and locally utilizing the renewable energy sources;**
  - **Stimulation of energy service company (ESCO) functioning.**

- **Public sector**
  - Efficiency increase and reduction in the public lighting consumption;
  - Efficiency increase and reduction in the water supply installation consumption;
  - Public building efficiency increase.
- **Agriculture**
  - Increase in the efficiency and utilization of bio-fuels for the agricultural machines;
  - Development of energy crops, both for producing bio-fuels, and electricity and heat through cogeneration;
  - Increase in the energy efficiency of irrigations.
- **Cogeneration**
  - Promotion of highly efficient cogeneration;
  - Identification and turning to good account of the national cogeneration potential;
  - Energy auditing of cogeneration units;
  - Rehabilitations and modernizations of the existing installations for increasing efficiency and reducing the environmental impact;
  - Building of new, highly efficient cogeneration installations.

### **4.2.3 GD 1043/2007 on the eco-design requirements for the energy- using products**

The decision translates the Directive 2005/32/EC that sets a framework establishing the eco-design requirements that apply to the energy-using products. The decision establishes the eco-design requirements the energy-using products should fulfill when they are introduced to the market and/or when they are put into operation with a view to ensuring:

- Their free circulation on the internal market;
- Sustainable development by increasing energy efficiency and environmental protection;
- Safety of energy supply.

#### **4.2.4 Ordinance 22/2008 on energy end-use efficiency and promotion of renewable energy source utilization by the end-consumers**

The ordinance translates the provisions of the Directive 2006/32/EC on the energy end-use efficiency and energy services into the Romanian legislation, envisaging the establishment of a legal framework for the development and application of the national energy efficiency policy.

**GD 409/2009 for approving the Methodological norms for the application of the Government Decision no. 22/2008**



#### **4.2.5 GD 1661/2008 on the approval of the National Program for increasing energy efficiency and utilizing renewable energy sources in the public sector over the 2009-2010 period**

The Program represents the continuation of the actions for increasing energy efficiency.

The financial support for the project co-financing has come from the state budget.

For financing the National Program between 2009 and 2010, the amounts of RON 32.9 million (Euro 8.2 million) for 2009 and RON 40 million (Euro 10 million), respectively, for 2010, have been allocated.

The National Program 2009-2010 ensures co-financing of the projects whose direct beneficiaries are the local public administration authorities relating to the following types of investment objectives:

- Rehabilitation and modernization of the district heating systems,
- Thermal rehabilitation of certain public buildings;
- Modernization of interior and exterior public lighting

The program establishes the technical and financial requirements for the fulfillment of its objectives.

#### **4.2.6 Emergency Government Decision 18/2009 on increasing the energy efficiency of the blocks of flats**

**The Ordinance establishes the works necessary for the thermal insulation of the blocks of flats designed and built between 1950 and 1990, the stages in carrying out the works, the way of financing the latter, as well as the obligations and the responsibilities of the public administration authorities and of the owners' associations.**

**Carrying out the works established through this emergency ordinance aims at increasing the energy efficiency of the blocks of flats and reducing energy consumption for heating the apartments, respectively, while ensuring and maintaining the interior thermal climate, as well as improving the urban aspect of the localities.**

**The execution of the works will be financed as follows:**

- 50% from the state budget allocations, within the funds annually approved to this goal from the budget of the Ministry of Regional Development and Dwellings;**
- 30% from the funds annually approved to this goal from the local and/or other sources legally established;**
- 20% from the repair funds of the owners' associations and/or other sources legally established.**

**The Ordinance stipulates the obligations and responsibilities of all the factors involved in applying this ordinance, as well as the monitoring and control actions.**

#### **4.2.7 Law 220 / 2008 establishing the system for the promotion of energy production from renewable energy sources (RES)**

The Law establishes the legal framework for the expansion of RES utilization and the system for the promotion of electricity production from RES.

In order to promote production of electricity from RES the system of compulsory shares combined with the green certificate trading or the “fixed price” system are applied.

The RES electricity producers and suppliers can trade the green certificates on the centralized market of green certificates, as well as on the bilateral green certificate market.

The green certificate trading is ensured by the operator of the electricity market.

## 5. Electricity production and CO2 emission forecasts

### 5.1. Electricity production forecast

**Table 5**

(TWh)

Year		2008	2010	2012	2020
<b>Electricity production for covering internal consumption</b>		62.5	66.1	69.5	85
<b>Exports</b>		3.0	4.5	5	15
<b>Electricity production</b>		65.5	70.6	74.5	100
<b>from hydro+RES</b>		18	21.7	23	32.5
<b>from nuclear plant</b>		10.8	10.8	10.8	21.6
<b>from thermal power stations</b>		36.7	38.1	40.7	45.9
<b>of which</b>	<b>coal</b>	25.7	27.1	29.7	34.9
	<b>natural gases</b>	9.5	9.5	9.5	9.5
	<b>heavy oil</b>	1.5	1.5	1.5	1.5

- **The values presented correspond to a scenario that has received political approval (the document has been approved by the Government). This scenario estimates that:**
  - **Export of electricity will substantially increase after 2015, supported by the putting into operation of the Cernavoda NPP Units 3 and 4;**
  - **Renewable Energy Sources will be promoted so that to attain the assumed targets of 33 % in 2010, 35 % in 2015 and 38 % in 2020 of the gross internal consumption (commitment made to the European Commission);**
  - **Solid fuel (lignite from internal production) utilization will be encouraged through clean technologies in order to diminish dependence on imports and solve social problems;**
  - **Production of electricity from liquid and gaseous fuels will be limited. These fuels will be primarily used in the cogeneration units supplying heat to population.**

- **Two nuclear units (Cernavoda Units 3 and 4) with an installed power of 706 MW and 600 MW, respectively, each commercially available;**
- **Retrofitting of some of the hydro power stations with an installed power of 3550 MW; development of new hydro projects the installed power of which will amount to 790 MW;**
- **Development of a pumped storage hydroelectric power station at Tarnita with an installed power of 1000 MW;**
- **Development of new thermal power units with an installed power of 3000 MW simultaneously with the taking out of operation of several units of about 2900 MW installed power.**

## 5.2. Study on the Romanian power system restructuring

The study developed four scenarios:

- The reference scenario characterized by an average increase in internal consumption, no export and investments in electricity production by observing only the economic criteria (without priorities established by the political factors);
- Nuclear scenario characterized by political priority given to the development of Cernavoda NPP Units 3 and 4 in the 2015-2016 period, followed by the development of other nuclear units;
- The wind power scenario characterized by installing 3000MW wind power by 2015.
- The hydro scenario characterized by the construction of 1230 MW installed power by 2020.

**Table 6 Forecast of the evolution of the newly installed power for the 2010-2020**

Scenario	New installed power (MW)			
	Hydro	Nuclear	Wind	Thermal
Reference	73	1,320	0	3,690
Nuclear	73	1,320	0	3,690
Wind	12	1,320	2,000	4,290
Hydro	472	1,320	0	3,090

**Table 7 Forecast of electricity production by 2020**

Scenario	Net production (TWh)	Of which			
		Hydro power stations	Nuclear power plants	Wind farms	Thermal power stations
Reference	78.2	17.1	20.2	0	40.9
Nuclear	78.2	17.1	20.2	0	40.9
Wind	78.2	16.8	20.2	5.7	35.4
Hydro	78.2	18.5	20.2	0	39.6



**Table 8 Forecast of CO<sub>2</sub> emissions for the period 2010-2020**  
(mill. tonnes CO<sub>2</sub>)

Scenario	Year		
	2010	2015	2020
Reference	31.5	31.8	31.1
Nuclear	31.5	31.8	31.1
Wind	31.7	30.8	29.6
Hydro	31.5	31.8	

## 6. Conclusions

- **Since January 1, 2007, Romania is a full Member of the EU. The euphoria characterizing the first months following integration has dissipated. The country is confronted with the necessity to fulfill all the commitments that derive from its EU membership.**
- **The EU has lately made ambitious commitments for reducing CO<sub>2</sub> emissions, utilizing RES and increasing energy efficiency. Romania is, at present, in the situation of a traveler who has to get on the train that is moving fast. The approval and implementation of the directive proposal relating to emission trading will represent a great challenge for the Romanian energy sector.**
- **The energy efficiency increase and promotion of RES represent strategic options for the GHG reduction. To achieve this, a suitable legislative framework has been developed, and the institutional framework has been improved. The National Energy Efficiency Action Plan has been developed. The development of the National Action Plan for RES Utilization is underway. The project working team has greatly contributed to these activities.**
- **The development of the nuclear energy sector represents a strategic option for Romania for ensuring security of supply and reducing GHG emissions. Cernavoda NPP Unit 2 has started operating in 2007. The works for the development of Units 3 and 4, having an installed power of 700 MW each have started. These units are scheduled to be put into operation in 2015. The development of another nuclear power plant in another location is also envisaged.**
- **Forecasts on the evolution of energy consumption and production, as well as on CO<sub>2</sub> emissions have been carried out. These forecasts are based on scenarios of a favorable evolution of economy. The actual economic crisis has strongly affected Romania, too. That is why it is considered necessary to update the forecasts.**

# Thank you!

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