


European Parliament
D G Research

WORKING PAPER

THE ENLARGEMENT PROCESS OF THE EU: CONSEQUENCES IN THE FIELD OF ENERGY (PROJECT NO EP/IV/A/2002/07/01)

Final report

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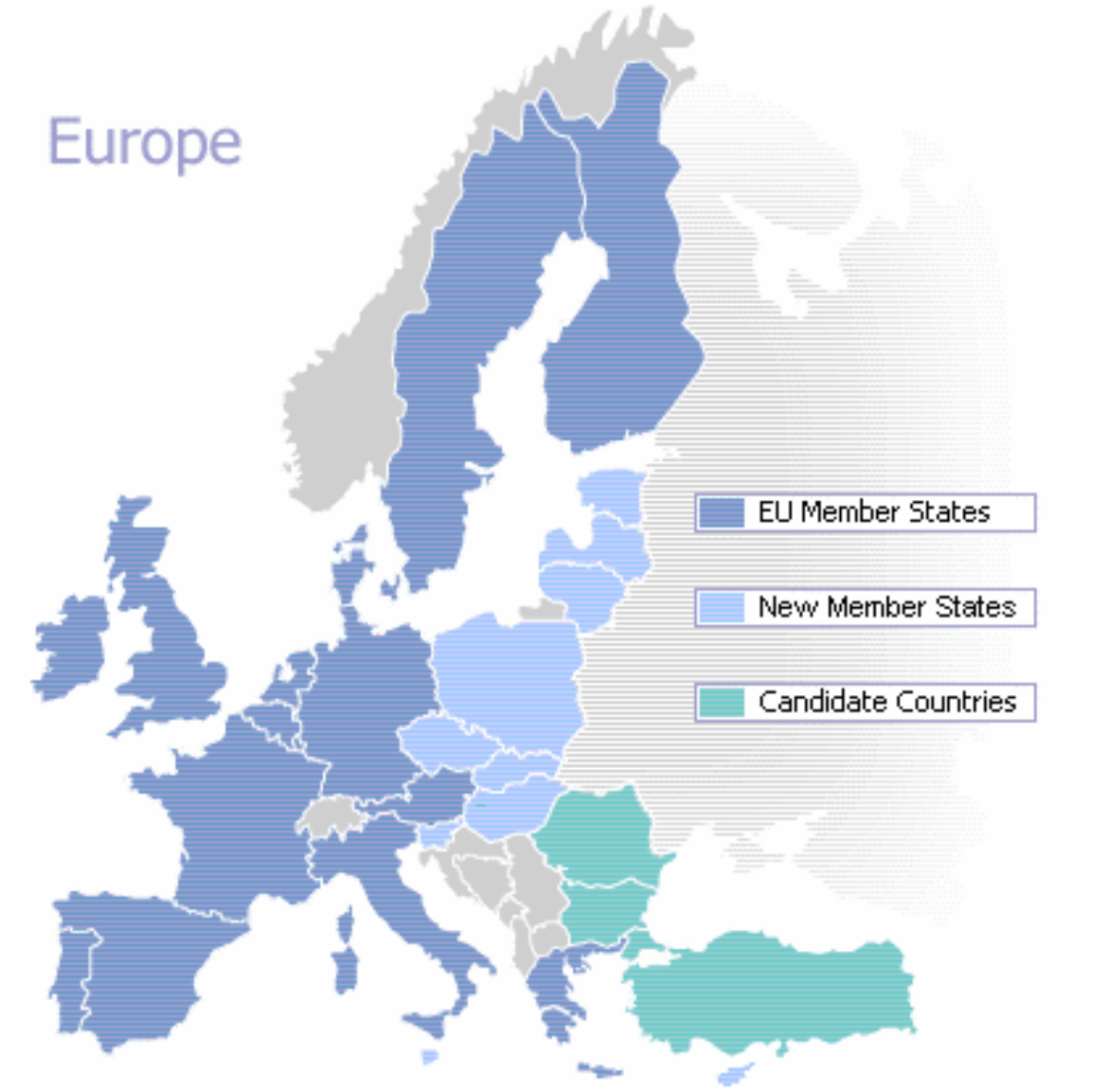
Europe
EU Member States
New Member States
Candidate Countries

1. EXECUTIVE SUMMARY

This working paper focuses onto the Enlargement Process of the EU and explores the consequences in the field of energy, in particular that of the Accession Countries (ACs). With the application of altogether 13 countries to become new members of the European Union, the largest ever enlargement of the EU has begun. The first wave of enlargement is scheduled for 1st May 2004 and comprises ten countries – Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia. Bulgaria and Romania are planning to join in 2007. Turkey's process is not advancing. Other countries in South Eastern Europe, e.g. Croatia may join the Union in the future.

For the energy-intensive EU economy, energy issues are a crucial topic in the enlargement process. The EU depends on external sources of energy is about 50% which value is likely to reach about 70% in 2030 if no countermeasures are taken. Energy policy is therefore mainly driven by three objectives: ensuring security of supply, economic efficiency and securing environmental protection. Where a basic consensus about these objectives exists, discussion on suitable measures for achieving the objectives are under process and show substantial differences between individual EU countries.

The present study aims at informing the European Parliament about the current status of enlargement process with respect to energy herewith contributing to current discussion process by highlighting consequences of the enlargement and formulating recommendations for suitable future measures.

Within the negotiation process, chapter 14 is related to energy issues, namely the adoption, implementation and enforcing of the energy *acquis*. According to this chapter candidate countries have to:

- "Decide on an overall energy policy with clear timetables for restructuring the sector;
- Prepare for the internal energy market (the gas and electricity directives; the directive on electricity produced from renewable energy sources);
- Improve energy networks in order to create a real European market;
- Prepare for crisis situations, particularly through the constitution of 90 days of oil stocks;
- Address the social, regional and environmental consequences of the restructuring of mines;
- Waste less energy and increase the use of renewable energies such as wind, hydro, solar and biomass in their energy balance;
- Ensure the safety of nuclear power plants in order that electricity is produced according to a high level of nuclear safety;
- Ensure that nuclear waste is handled in a responsible manner; and prepare for the implementation of Euratom Safeguards on nuclear materials."

Formulation of these requirements is determined by the content of the EU's energy policy (especially the energy *acquis* itself) and the typical problems resulting from the central planning in the former Eastern Block countries, which are: practically no functioning markets for energy products (e.g. artificially low prices through subsidies) leading to higher specific primary energy consumption (relative to GDP) and less energy efficiency and productivity of industrial plants; unbalanced energy-mix in respect to risk reduction; high import dependency for oil and gas on the former USSR, low efficiency and low safety standards of nuclear power plants.

Especially through the strong import dependency on the former USSR enlargement will mainly influence the future relation between the European Union and Russia. Almost 2/3 of the used natural gas in Central and Eastern Europe is imported from Russia. By adopting the policy of Kyoto objectives, the share of hard coal in the energy mix will be reduced and replaced by natural gas with consequences especially for Poland, the Czech Republic, Estonia and Bulgaria. In consequence of Kyoto Protocol, gas import dependency on Russia will further increase in these countries. The enlargement of the EU therefore reinforces EU-Russia gas trade as a new strategic chapter.

Having additionally in mind that the power plant structure mainly needs to be redeveloped, full implementation of energy *acquis* will require significant investments. In 1999 the European Bank for Reconstruction and Development EBRD estimated the necessary investments required for the energy sector to be in the range of ECU 100 – 200 billion. Despite several EU assistance programmes for enlargement, huge amounts must be realised by private investors.

However in recent years candidate countries have progressed significantly in respect to the adoption of energy *acquis*. Except for Romania and Bulgaria all countries have closed the chapter and have partially agreed to transition periods mainly in the field of building up of oil stocks. Bulgaria has provisionally closed the chapter in the second half of 2002; negotiation with Romania is still ongoing. A survey about the negotiation process for chapter 14 as well as the different transition periods is given in the following table (Table 1). The countries' progress in approximating to the energy requirements of the EU is monitored by the European Commission and is illustrated in the Annual Regular Reports on Progress toward Accession.

Table 1. Transition periods agreed at provisional closure of Energy Chapter

	BG	CY	CZ	EE	HU	LT	LV	MT	PL	RO	SI	SL
Chapter opened	2001	1999	1999	1999	1999	2001	2001	2001	1999	2002	2001	2001
Chapter closed	-	2002	2002	2002	2002	2002	2002	2002	2002	-	2002	2002
Transition periods	-	-	-	-	-	-	-	-	-	-	-	-
Build up of oil stocks	2012	2007	2005	2009	-	2009	2009	-	2008	-	2005	2008
Gas directive implementation	-	-	2004	-	-	-	-	-	-	-	-	-
Electricity directive implementation	-	-		2008	-	-	-	-	-	-	-	-

In section 4 of the report a detailed view of the energy scenario in the EU15 and in the ACs given.

The ACs are at varying degrees of applying the energy *acquis*. The Regular Report on Progress Towards Accession on 2002 highlights the following tasks as being necessary for the following countries to complete adoption prior to accession:

- **The buildup of emergency oil stocks**: Estonia, Latvia, Lithuania, Poland, Slovakia, Czech Republic, Malta, Cyprus
- **Further development of internal energy market**: Estonia, Latvia, Lithuania, Poland, Slovakia, Czech Republic, Hungary, Slovenia, Malta, Cyprus
- **Restructuring of the solid fuel sector**: Poland

- **Improvement of the energy efficiency**: Bulgaria, Latvia, Malta, Poland, Romania, Slovakia, Slovenia.
- **Promoting of renewable energy sources use**: Bulgaria, Latvia, Malta, Poland, Romania, Slovakia, Slovenia.
- **Nuclear safety improvements:** Lithuania, Slovakia, Czech Republic, Slovenia, Bulgaria, Romania, Hungary
- **Closure of nuclear power plants**: Lithuania, Slovakia, Bulgaria

Accessing the EU in the first round (2004)

Most of the EU candidate countries are in progress in line with the Oil stocks legislation. Almost all countries except Hungary and the Czech Republic had been granted a transitional period, – good example Slovenia; storages utilities will be rented from Germany oil stocks get safer by the passing of time; by 2009 all the transitional periods will end. The relatively large number of transitional periods granted could be explained by the high investment needs the Energy chapter had provisionally closed.

There is a proposal for the EP to extend the safety reserves of oil to 120 day what means more investment for the EU countries and for the AC as well – It can be supposed that the extension would cause (financial) problems primarily for the AC and secondary for the EU countries.

Accessing the EU in the second round (2007)

Only Bulgaria and Romania have inadequate oil stocks; but they have also started to adopt the necessary legislation – by the time they get into the club they will have the required stocks or they will be granted a transitional period – Energy chapter is under negotiations. No uniform EU regulations exist concerning safety reserves of natural gas. Such a regulation could raise the security of supply of the EU. Recently there has been an issue in Hungary regarding the safety reserves of natural gas, because the country has run out of reserves and limitation might be announced.

Oil

The ACs are highly dependent on oil imports from the former Soviet Union. Several oil pipelines connects the Central Eastern European countries with Russia such as Druzhba (Friendship) north line Russia-Poland towards Germany; south line Russia- Hungary-Slovakia- the Czech Republic. The Adria pipeline can be considered as an alternative for diversifying the dependency on Russian oil. It connects Croatia (sea port for oil from Tunisia and other sources), Slovenia and Hungary. - Accordingly the ACs are well connected to Russia and to each other and some links have been established to MS – the oil pipeline system could be extended to Europe.

Natural gas

The ACs are highly dependent on natural gas imports (from Russia) - exceptions are Malta and Cyprus since there is no natural gas utilisation. Most of the natural gas coming from Russia is transferred through pipelines such as Yamal: Russia-Belarus-Poland-Germany; Russia-Ukrain-Slovakia-Austria-Slovenia. Slovenia is connected to Algeria and Tunisia via Italy through a pipeline as an alternative. The pipelines connecting the CEE countries to the EU are small – both in length and capacity (e.g. Hungary-Austria, Czech-Germany) – On the other hand some project are planned in order to connect countries with each other such as the first natural gas pipeline between Hungary and Romania. The project will end in 2004 as a part of a natural gas pipeline systems connecting Turkey to Austria, through Bulgaria and Romania.

Electricity

In general the ACs are well connected to each other due to historical reasons (COMECON). Despite there are some lacks of connection to each other such as Czech Republic to Poland. The Accession Countries have some connection to the EU, such as Hungary to Austria and the Czech Republic to Germany, but further strengthening is needed. Projects such as Baltrel could ease the lack of connection to the EU countries – further extensions are needed.

Nuclear

Most of the Nuclear Power Plants in the ACs are based on Soviet technologies, which are generally not considered as safe. The new NPPs, which are under construction are based on new technologies such as Romania's new NPP is based on Canadian technology. Construction of new NPPs is in progress in Temelin, the Czech Republic, where safety changes have been made. In this ways these new NPPs meet the safeguards.

Coal

Similarly to that of the EU, the importance of coal in most of the ACs has fallen significantly since the collapse of communism, therefore sources of heating and power generation have turned to other energy bearers, namely to gas and electricity (for heating). There are exceptions such as Poland and the Czech republic where despite the decrease the importance of coal is still significant. The decrease of the heavy industry has also played an important role in the fall of the importance of coal.

Environmental challenges: renewable sources

Most of the Candidate Countries have implemented a large part of the acquis in the field of energy efficiency and RES. Though some countries could further emphasise the importance of RES in their policies, since action plans have not been carried out and money has not been allocated to the programmes (e.g. Romania and Bulgaria).

A number of ACs have implemented action plans and allocated funds for increasing the share of RES in the countries energy mix as well as it's overall energy efficiency; there are countries which set goals such as Poland to reach 7.5% of RES by 2010 and Hungary to increase the share of RES to 6% by 2010.

Political issues: liberalization processes and international cooperation

The Commission has set out in its Communication on a Wider Europe[1], the European Union has to act as a force for stability and sustainable development in the European continent. Extending the benefits of the Internal Market is part of that projection of stability to the ring of countries that surround the Union. This is a central role for the Union.

The objectives of the policy set out in this Communication is to:

– Enhance the security of energy supplies of the European continent,

– Strengthen the Internal Energy Market of the enlarged European Union,

– Support the modernization of energy systems in our partner countries,

– And facilitate the realization of major new energy infrastructure projects.

[1] Wider Europe - Neighbourhood: A New Framework for Relations with our Eastern and Southern Neighbours, Brussels, 11.3.2003 - COM(2003) 104 final

Together with the neighboring countries and our partners, the European Union can face the challenges of growing external energy dependence, the need to address infrastructure issues on a regional level, to diversify sources of energy geographically and technologically and to broaden the basis for energy trade in the Europe and its adjoining continents.

Positive effects of the liberalisation

Large monopolies lose their importance because of the possibility of entry on the market is opened for others, which at the same time also means more competition on the markets. Enhancing the penetration of RES, cost covered prices will show to the customers the actual environmental price of the energy source.

Negative effects of the liberalisation

Regional monopolies, the influence of environmentalists will decrease against the energy monopolies, therefore cooperation among the environmentalists are needed.

The second round of accession (Romania, Bulgaria)

The energy chapters are not closed yet. It can be predicted that Romania and Bulgaria will apply for transitional period in the field of liberalisation. – Lessons learnt form the first round of accession - especially in the field of liberalization - should be used for the second round (Romania, Bulgaria).

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2. ENERGY AND THE ENLARGEMENT PROCESS

With the application of altogether 13 countries to become new members of the European Union, EU largest enlargement ever is ongoing. The first wave of enlargement is scheduled for 1st May 2004 and comprises ten countries – Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia. Bulgaria and Romania are planning to join in 2007. Turkey's process is not advancing. Other countries in South Eastern Europe, e.g. Croatia may join the Union in the future.

For the energy-intensive EU economy, energy issues are a crucial topic in the enlargement process. EU depends on external sources of energy in about 50% and is likely to reach about 70% in 2030 if no countermeasures are taken[2]. Energy policy is therefore mainly driven by three objectives: ensuring security of supply, economic efficiency and securing environmental protection. Where a basic consensus about these objectives exists, discussion on suitable measures for achieving the objectives is ongoing and shows substantial differences between the individual EU countries.

This study aims at informing European Parliament about the current status of enlargement with respect to energy and contributing to current discussion process by highlighting consequences of enlargement and formulating recommendation for suitable future measures.

Within the negotiation process, chapter 14 is related to energy issues, namely the adoption, implementation and enforcing of the *energy acquis*. According to this chapter accession countries have to:

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- Ensure the safety of nuclear power plants in order that electricity is produced according to a high level of nuclear safety;
- Ensure that nuclear waste is handled in a responsible manner; and prepare for the implementation of Euratom Safeguards on nuclear materials."[3]

[2] European Union, Directorate of Energy and Transport. 2000. *Towards a European strategy for the security of energy supply: Green paper.* Brussels: European Commission

[3] European Union, Directorate of Enlargement. December 2002. *Chapter 14 – Energy* Brussels: European Commission url: http://europa.eu.int/comm/enlargement/negotiations/chapters/chap14/index.htm

Formulation of these requirements is determined by the content of EU energy policy (especially the energy *acquis* itself) and the typical problems resulting of the central planning in the Eastern Block countries are: practically no markets functioning for energy products (e.g. artificially low prices through subsidies) leading to higher specific primary energy consumption (relative to GDP) and less energy efficiency and productivity of industrial plants; unbalanced energy-mix in respect to risk reducing; high import dependency for oil and gas on the former USSR, low efficiency and low safety standards of nuclear power plants and nearly a complete indifference towards environmental issues.

Especially through the strong import dependency on the former USSR enlargement will mainly influence the future relation between European Union and Russia. Almost 2/3 of the used gas in Central and Eastern Europe is imported from Russia[4]. By adopting the policy of Kyoto objectives, the share of hard coal will be reduced and replaced by natural gas with consequences in several accession countries. Gas import dependency on Russia of those countries will obviously increase further by the adoption of Kyoto policy. EU enlargement therefore reinforces EU-Russia gas trade as a new strategic chapter.

Having additionally in mind that the power plant structure mainly needs to be redeveloped, full implementation of energy *acquis* will require significant investments. In 1999 the European Bank for Reconstruction and Development EBRD estimated the necessary investments required for the energy sector to be in the range of ECU 100 – 200 billion[5]. Despite several EU assistance programmes for enlargement, huge amount of investment must be realised by private investment.

However in recent years accession countries have progressed significantly in respect to the adoption of energy *acquis*. Almost all accession countries have closed the chapter and have partially agreed to transition periods mainly in the field of building up of oil stocks. A survey about the negotiation process for chapter 14 as well as the different transition periods is given in the following table. The countries progress in approximating to the EU energy requirements is monitored by the European Commission and illustrated in the Annual Regular Reports on Progress toward Accession.

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Gas directive implementation	-	-	2004	-	-	-	-	-	-	-	-	-
Electricity directive implementation	-	-		2008	-	-	-	-	-	-	-	-

[4] Andrei BELYI, Background paper Workshop on "Trade, Business and Investment in a Wider Europe" to in Salle XX, Palais des Nations, United Nations Office at Geneva (Switzerland) on 7 April 2003 *The enlargement impact on the EU-Russia relation in energy field* url: http://www.unece.org/trade/workshop/backgroundpapers.htm

[5] CEE Bankwatch Network Comments on the draft EBRD Energy Operation Policy, url: http://www.bankwatsch.org/publications/policy_letters/1999/ebrd11.html

3. ENERGY ISSUES: CHALLENGES OF THE ENLARGEMENT PROCESS

3.1 Energy supply

The European Community's economy is highly dependant on energy supplies from outside the Union especially on oil and gas, because of limited energy sources in the Union itself. This dependency as well as the increasing energy demand in industry, transport and the private sector can lead to uncontrolled price fluctuations and moreover could be a peril to the unions whole economy in case of a potential bottleneck in energy deliveries from the outside[2].

The European Union has reacted early on this problem and has therefore launched the 1968 oil stocks directive 68/414/EEC in which it addressed the necessity to compensate for negative effects in case of assumed bottlenecks in energy supply. This directive was amended and adjusted to the actual circumstances four times and should be repealed shortly by a new one COM (2002) 488. A package of measures was adopted to enable the Union and its Member States not only to provide for the risk itself but also to react adequately on actual energy supply bottlenecks and their impacts.

As a precaution measure, member states, according to the 1968 directive, are obliged to establish instrument to fill their stocks of crude oil and petroleum (different gasoline and kerosene types) products to at least 90 days average daily internal consumption relating to the preceding calendar year referred in the directive. Furthermore, it was stipulated that these stocks should remain stable and should not be decreased in case there is an urgent or a small local demand so that it could be refilled within a short time[6]. Fulfilling these obligations means a guarantee for every member state to have the same starting point in case of energy supply difficulties.

Further other instruments were adopted to react adequately once a shortage has occurred. As an example, the 1973 Council Directive 73/238/EEC about measures to mitigate negative effects while providing authorities with necessary powers for cutting down consumption, regulating prices and giving priority supplies. 4 years later another strategy was established setting a Community target for reduction in consumption of oil and petroleum products in Council Decision 77/706.

Because of the numerous aspects of energy supply security the Commission has launched a Green paper COM (2000) 769 "Towards a European strategy for the security of energy supply", which focused in the future regarding energy supply security and internal market. Subsequent to the Green paper a Commission proposal COM (2001) 125 was developed establishing a multiannual action programme "Intelligent Energy for Europe "combining all existing and future activities in the energy sector for the years 2003 – 2006.

[6] Council Directive 68/414/EEC imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/ or petroleum products

However the Commission has launched a new broad proposal COM (2002) 488 for a directive dealing with management in case of energy supply shortages regarding oil and gas and repealing legislation presently at force. This proposal takes into account the new requirements of the emerging internal market. As soon as the new directive comes into force, provisions of the old legislation will be obsolete. Besides various management measures stipulated in the new directive the modification most serious is the following: now supply stocks have to be increased from 90 to 120 days and a public stockholding body has to be established which holds at least 1/3 of the stock obligations of the Member States[7].

It seems that directive 68/414, which is still in force, means a case of hardship to the Accession Countries because each of the Accession Countries except Hungary has applied for a transitional period for implementing these guidelines and regulations into national law and to achieve the minimum of 90 days oil stock supply. The transition periods from establishing the directive vary from the shortest period by the end of 2005 in the case of the Czech Republic (by now, it possesses 80 days of stocks) and a maximum period until 2012 for Bulgaria. Only Hungary is in possession of oil stocks that exceed the limit of 90 days stock supply required by the European Community[8].

Regarding the nuclear energy sector, a long-term uranium supply for nuclear power plants within the Union is essential to ensure operation. Prospecting programmes have been regarded as a possibility to improve uranium supply within the territories of the Member States and supporting measures have been addressed within the 1976 Commission Regulation 2014/76 on the support of projects concerning uranium prospecting programmes.

Nevertheless, several accession countries, which operate own nuclear power plants, have agreed on closing certain types of nuclear power units or plants because of insufficient nuclear energy safety standards[3]. This approach to the nuclear energy sector means some additional burden to these states, which have to be taken into consideration by EU assistance programmes as well as in accession negotiations.

Moreover, there are technical facilities, which are destined to contribute to a secure energy supply as well as to combat climate change. In 1997 the Community has already issued a strategy to promote combined heat/power (CHP) and 5 years later the European Union has prepared a proposal for a Directive COM 2002/ 415 of the European Parliament and the Council on the promotion of cogeneration based on an useful heat demand in the internal energy market following the resolution for the creation of a framework for CHP promotion in case demand exists or is likely to increase.

In many accession countries district heating is used nation wide. Heat demand and energy saving potential is substantially high, even of most systems presently used are highly inefficient. A CHP directive could promote district heating in these countries and could also establish CHP on basis of the already existing structures and support conversion from boiler plants to CHP[9].

[7] COM (2002) 488: Proposal for a Council Directive repealing Council Directive 68/414/EEC and 98/93/ EC imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/ or petroleum products and Council Directive 73/238/EEC on measures to mitigate the effects of difficulties in the supply of crude oil and petroleum products

[8] COM (2002) 700 final: 2002 Regular Reports on Progress towards Accession

[9] COM (2002) 415: Directive of the European parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market

3.2 Coal utilization

Coal still plays an important role in the energy supply of the accession countries' economies; it is used mostly for electricity generation and heating purposes. Coal's importance in most of the accession countries has fallen significantly since the collapse of communism, and sources for heating and power generation have turned to other energy sources, namely gas and electricity (in heating).

Another source of decrease of the consumption of coal is the fall of the heavy industry in the accession countries (their power needs were high). The abovementioned facts and the fall of the export potential has led to major transitions in the region, which are the following:

- Restructuring (increase efficiency);
- Closures of inefficient mines;
- Privatisation;
- Indirect and cross subsidies
- Social issues

In terms of numbers these transitions have meant decreases in production about 40%, in manpower 50% and in mines 30% between the periods of 1990-1998[10]. Action plans have been prepared and executed but some of these problems still exist. The accession countries, mainly in Central Europe, considered as coal producers have been suffering from the same problems at a different degree, depending of the importance of coal utilisation but on the other hand the worst part of the coal industries' reconstruction is over. By around 2005 restructuring will have been finished, mainly with the help of privatisation.

The Baltic countries are in a different position; since they do not have any significant coal deposits hence they do not produce coal. This region has reduced its coal consumption, turning to more domestic sources of energy since the collapse of the Soviet Union. The Baltic countries' needs of coal are very low and they cover it with exports from Russia and Poland[11]. In case of Cyprus and Malta coal utilisation is not significant, since their consumption of coal is almost 0.

One of the main concerns of the coal producer countries in Central Europe is the accession to the European Union, more precisely the adaptation of "*acquis* communautaire" since it does not allow trade distortions. Indirect and cross subsidies are considered as trade distortions, therefore certain accession countries will have to eliminate subsidies addressed to the coal industry.

[10] World Energy Council: Restructuring and Privatising the Coal Industries in Central and Eastern Europe and the CIS

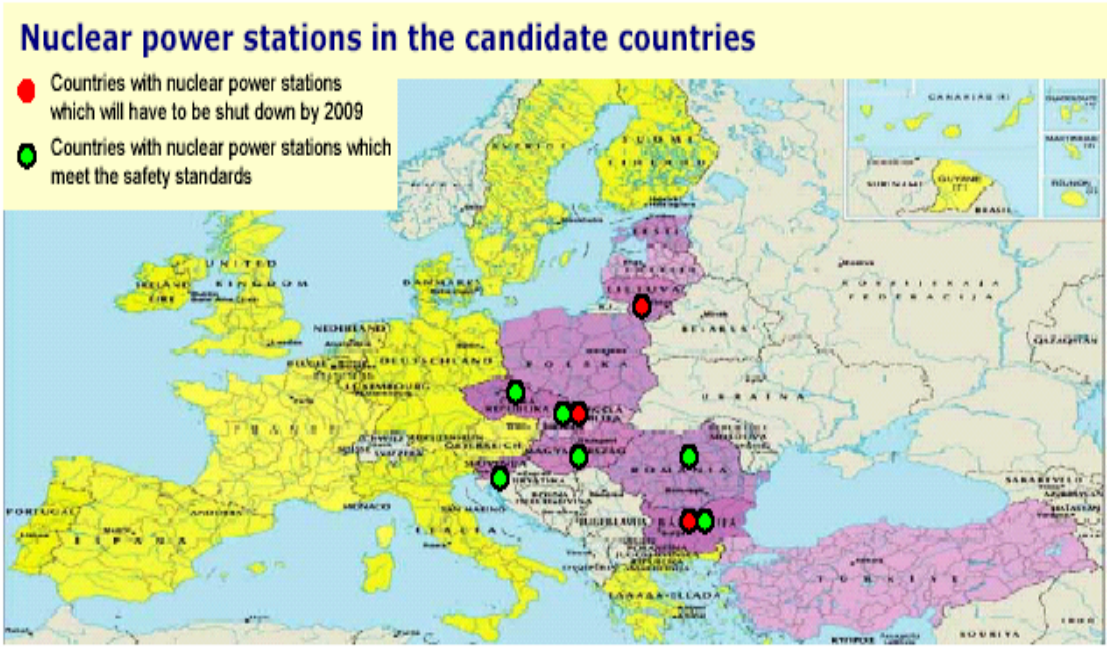
[11] http://www.eia.doe.gov/emeu/cabs/baltics.html

CO_2 emissions are closely linked to the use of coal and oil products as an energy source; more precisely 42.2% and 37.8% of the world's CO_2 emissions come from burning of oil and coal[12]. Concerning the air pollution caused through the utilisation of coal, several accession countries also produce high sulphur content coal, which is hazardous for the air. In this way its utilisation is more expensive because of the filters at the coal-based power plants, required by the Large Combustion Plants Directive. Relevant studies suggest that the proportion of coal-fired power generation capacity equipped with gas desulphurisation filters is only 40-50% by 2003.[13] Therefore in those accession countries, which face this problem, the need for finance such filters are high. Moreover further application of Clean Coal Technologies, such as district heating, briquetting and direct burning in small industrial/residential boilers and mining, could serve, as solution for the abovementioned issue.

Regarding air pollution the Kyoto protocol has to be mentioned as well. It will be discussed in chapter 5.4

3.3 Nuclear safety and alternatives

Nuclear safety has become more and more important for the European Union over the years, therefore the nuclear industry has received greater attention in the context of enlargement than ever before. Seven out of the 10 accession countries operate nuclear power plants, namely Bulgaria, Lithuania, Romania, Slovakia, Slovenia, Czech Republic and Hungary. On the other hand most of the accession countries run research reactors and/or have radioactive waste.



Source: "Towards a Community Approach to Nuclear Safety". European Commission, Directorate-General for Energy and Transport

[12] International Energy Agency: Key World Energy Statistics

[13] World Energy Council: Restructuring and Privatising the Coal Industries in Central and Eastern Europe and the CIS

As standards and safety regulation of nuclear facilities belong to the authority of national Governments, there is no uniform European safety standard[14]. In other words, it means that the accession countries do not have to adopt uniform safety standards. Based on the aforesaid it appears very unlikely that the entry of the accession countries would in practice lead to higher nuclear standards. In order to emphasis the importance of the nuclear safety the Cologne and Helsinki European Councils in 1999 requested the European Commission to address the abovementioned area. Moreover Agenda 2000 makes clear that the Commission wants to see not only closure of high-risk reactors but also an increase in nuclear safety for the second-generation reactors, which have been based on Soviet technologies. In order to fulfil this need, the commission has estimated a budgetary need of 4-5 billion Euro and has proposed 7-10 years for the implementation. As a result a number of nuclear safety programmes has been set up, which include:

- Closure before the lifetime of the NPPs. This includes eight reactors in the accession countries (for example: Bulgaria – Kosloduy 1-4 till 2006, Latvia – Ignalina 1-2 till 2009, Slovakia – Bohunice 1-2 till 2008)
- Action plans for modernizations, where the technology of the NPP allow upgrading in order to meet higher nuclear safety standards. (for example: Hungary – Paks, Czech Republic – Dukovany and Temelin)
- Monitoring of NPPs, which are based on western-technologies. (for example: Romania and Bulgaria)

In regard of lack of common nuclear standards it was announced by the EU's Vice-President Loyola de Palacio that it is time for *"common [nuclear] standards and control mechanisms, which will guarantee the application of the same criteria and methods in the whole of enlarged Europe"* This proposed common nuclear standard will be compulsory for the member states as well as for the accession countries.

Concerning closure of NPPs one of the main problems in the Candidate Countries is that the NPPs cover a large part of the electricity supply of therefore the closure of NPPs are very sensitive for the security of supply. Those NPPs, which will be closed, must be replaced by other power plants and this makes the whole closure process even more expensive for the countries.

In line with the Report on the Evaluation of Nuclear Safety in the Context of Enlargement[15], the accession courtiers are in progress but there are fields, which need further strengthening. It is stated in the report that all accession countries have safety improvements and most of them have plans to improve the legal and regulatory framework. On the other hand the report gave three general recommendations for the accession countries, with nuclear power plants:

- Completing the plant-specific safety improvement programmes
- Ensuring that the nuclear safety programmes include:
  - Safety analysis reports and related safety improvement measures
  - Safety reassessment practices
  - Emergency operation procedures
  - Feedback of experience
  - Resources of regulator
- Ensuring that the nuclear safety programmes include:

[14] http://www.eu-energy.com/EU%20Enlargement%20Watch%20-%20Nuclear.html

[15] http://europa.eu.int/comm/energy /nuclear/legislation/safety_en.htm

- Probabilistic safety assessments
- Regulatory quality management

Similarly to the abovementioned reports the experts are generally satisfied with the safety conditions of the accession countries' nuclear power plants, but on the other hand correspondingly to the report they repeatedly emphasise the need of further efforts towards higher nuclear safety[16].

3.4 Renewable sources

In 1997 the Commission published the White Paper COM 97/599 "Energy for the future: Renewable sources of energy White Paper for a strategy and action plan" following the Rio Conference and with view to the Kyoto negotiations in 1997.

Despite their economic potential renewable energies are still used in the Community in an insufficient way so that the purpose of the White Paper is to contribute to the European energy policy objectives (presented in the 1995 White Paper: An Energy Policy in for the European Union) by promoting the use of RES and establishing them within the Communities energy balances. Strategy and Action plan included in the paper are designed to achieve a RES market share in the Community of 12 % by 2010[17].

Following the White Paper the Commission issued the 1997 resolution 97/711 which underlines once more the importance of RES and reaffirms the development of a promotion strategy. With the Renewable Electricity Directive 2001/77/EC of the European Parliament and the Council the Community sets out for the future aim of establishing RES into the internal electricity market with instructions on how to achieve the target figure of a renewable electricity share of 22,1% by 2010. Further more it takes into account the Communities obligation to cut greenhouse gas emissions by 8% in 2008 –2012 with regard to the 1990 level[18].

The first progress report in 2001 on the implementation of the White Paper nevertheless showed that despite progress being made in key policy fields at local, regional and national level, the RES market share is not yet sufficient and that it is doubtful whether the target of 12% RES in 2010 will be reached unless the gross energy consumption declines and energy efficiency measures are implemented vigorously. Future and current community member states efforts should therefore concentrate on the following: Individual Member State RES strategies and objectives are as necessary as measures which call for the establishing of RES in the heating, cooling and transport sector.

Measures to improve the use of biomass for energy production have to be implemented beside conditions that encourage the production of energy crops and favour biofuel and improvements in the building sector, just to mention a few. An updated Action Plan referring to the one published in the White Paper is meant to contribute to the achievements of an overall renewable energy policy in the EU[19].

[16] OMMIKK – Energiaellatas, energiatakarekossag vilagszerte – 2001/4 p 23

[17] COM (1997) 599 final: Energy for the future: Renewable sources of energy White paper for a Community Strategy and Action Plan

[18] Directive 2001/77/EC of the European Parliament and the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market

[19] COM (2001) 69: Communication from the Commission to the Council, the European parliament, the Economic and Social Committee and the Committee of the Regions on the implementation of a Community Strategy and Action Plan on Renewable Energy Sources (1998-2000)

Although the use of biofuel is one of the objectives mentioned in the progress report, which should contribute to strengthen RES within the Community and should moreover contribute to a reduction of greenhouse gas emissions special legislation does originally belong to a different chapter of EU legislation that is the transport chapter. But because it also affects European Energy Policy, these legislative documents dealing with biofuel should be mentioned here as well. At the moment two Commission proposals COM (2001) 547 exist aiming at implementing biofuel into the transport sector and the energy market respectively.

First part of COM (2001) 547 presents not only a survey about the present situation and the potential of alternative fuel in the European Community but also lists of types of biofuel and technologies already existing on the market. The second part of this proposal refers to the implementation and promotion of biofuel so that member states eventually are obliged to ensure a 2% share of biofuel on the fuel market not later than 31 December 2005.

Although a significant number of the accession countries are in possession of large renewable energy resources of different kind, little renewable energy has been developed in most of these countries so far. [208]

3.5 Environmental issues: Kyoto protocol

The European Union has committed itself to fulfil the criteria of the Kyoto protocol. As a consequence it became necessary to adapt the Union's energy policy to the strategic objectives that had been deduced from the Kyoto commitments so far.

In the 1975 Council Resolution on energy and environment and later with the 1993 directive 93/76/EEC to limit carbon dioxide emissions by improving energy efficiency (SAVE), European legislation has been taken environmental issues into account. In 1993 a package of measures to limit carbon dioxide emissions has been defined in order to contribute to both the promotion of energy efficiency and the protection of environment. The stress has been put on Member States to establish programmes giving incentives to industry and local authorities as well as to support individuals for carrying out efficiency measures on buildings, heaters etc[21].

In the 2002 directive 2002/91/EC of the European Parliament and the Council on the energy performance of buildings energy efficiency was once more addressed to be an essential part of fulfilling the Kyoto commitments whereas controlling energy demand is important to influence the security of energy supply. Because the housing and the tertiary sector is responsible for 40% of energy consumption in the EU and is increasing considerably at present energy saving measures should focus on this issue.

The programme SAVE lead to the first important results, but an accompanying legislative instrument was essential to set precise measures for energy saving. This directive should improve energy efficiency of buildings taking into consideration the climatic circumstances and requirements regarding room climate and cost efficiency. Member States should establish minimum requirements regarding energy efficiency in buildings and these should be revised every 5 years to guarantee compliance with new standards in the building sector. The date for implementing this directive into national law is by 4. January 2006 and for accession countries it is the date of respective entrance[22].

[20] http://www.eurorex.com/viewcountry.asp?viewL3=N&countryID=24

[21] Council Directive 93/76/EEC to limit carbon dioxide emissions by improving energy efficiency

[22] Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings

Last but not least, the European Parliament and Council directive 94/63/EC about VOC emissions should be mentioned. This directive addresses energy and environmental issues and was destined for the control of volatile organic compound emissions resulting from the storage, transport and distribution of 500.000 tonnes per year in the Community without preventing measures. It was also published taking into account competitive distortions on the energy market. The directive is valid for operations, installations, vehicles and vessels used for storage, loading and transport of petrol[23].

3.6 Liberalization processes

In its 1995 White Paper COM (95) 682 "An Energy Policy for the European Union" the Commission has announced future targets for implementing a European Energy Policy which aims at achieving competitiveness, energy supply security and protection of the environment.

Liberalisation of the internal market in gas and electricity as well as liberalisation of trade, e.g. the free movement of energy products, is an important precondition for establishing a competitive European energy market. Liberalisation of the internal energy market means that fair competitive conditions for energy producers and suppliers exist, that there is free access to the existing energy networks and that market-monitoring measures are implemented. Last but not least price transparency for energy customers is another important precondition for a liberalised energy market.

The Council has adopted a series of regulations for taking these guidelines into account. In 1990 the Council has adopted the Directive 90/377/EEC for establishing a procedure to improve the transparency of gas and electricity prices to industrial end-users. Now the supplier of gas or electricity has to submit special market details (e.g. energy source used for generating electricity) to the SOEC so that the consumer is free to choose between different kinds of energy and suppliers.

The 1996 Directive 96/92/EC of the European Parliament and the Council concerning common rules for the internal market in electricity takes into account that, for the functioning of the internal electricity market, it is important to establish regulations which address electricity generation as well as transfer and distribution. Furthermore this directive manages the organisation and functioning of the electricity sector, market access criteria, methods for tendering and permissions and regulations for network operating[24].

Directive 98/30/EC of the European Parliament and the Council concerning common rules for the internal market in natural gas with reference to the 1991 Directive 91/296/EC of the Council regarding the transit of natural gas through networks constitutes a first step for the completion of the internal market in natural gas and contains corporate instructions for transfer, distribution supply and storage of gas as well as ways for granting authorisations. Moreover instructions concerning organisation and functioning of the sector and access to the market are determined.

A typical characteristic of the accession countries energy market for years has been the monopoly position of the national gas, oil and electricity companies. As a result, unbundling of branches and deregulation of energy prices were important premises for developing a competitive power market within these countries.

[23] European Parliament and Council Directive 94/63/EC on the control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations

[24] Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity

By now privatisation process of these large national companies in the accession countries is on-going and the energy market is on the opening for the benefit of the energy consumers as well as for suppliers. Implementation of the provisions of the electricity and gas directive is not easy for the accession countries. Some accession countries show limited results in the field of market opening[25].

Experiences made with member states over the years show that putting the two directives into execution can cause problems in the functioning of these markets. These experiences prompted the Commission to develop a proposal COM 2002/304 amending both directives and extending 98/30/EC. Objective of this proposal is to modify the regulations of Direct. 96/92 with regard to electricity supply and to modify Direct. 98/30 with regard to regulations that are also valid for the following products: biogas and gas from biomass and to charge these gases into the network. The proposal will also replace the existing rules: 90/547 regarding the transit of electricity through networks as well 91/296. The positive effects of the liberalisation can be summarised as the following:

- Large monopolies lose their importance because the possibility of entering the market is open for others. It also means more competition on the markets and possible decrease of energy prices.
- Enhancing the penetration of RES; cost covered price will show to the customers the actual environmental price of the utilisation of the particular energy source.

The negative effects of the liberalisation can be described as the regional monopolies; the influence of environmentalists will decrease against the energy monopolies. On the other hand it has to be mentioned that international experiences show that in some cases the liberalisation process can cause an increase in the prices[26].

Similarly to the member states the accession countries have been gradually opening their market. The grades of openness are different as well as the timing of the implementation. The first grade concerns the largest consumers.

Accession countries are basically in line with the relevant Directives and there are only two countries, namely the Czech Republic and Estonia, which have been granted a transitional period for the implementation of the gas or electricity Directive until the end of 2004 and 2008.

Romania and Bulgaria have not yet finished their energy negotiations with the EU therefore transitional period can be requested by them on certain issues – Lessons from the first round of accession should be used (such as experiences, problems, solutions) in the second round.

[25] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[26] Épitesi Piac 2003 Január-Február p 42

3.7 Transnational issues: regional markets

The market liberalisation in the fields of gas and electricity increases the possibility for establishing regional monopolies. Accordingly, liberalisation can be considered as a first step to establish a regional market.

Regional integration

Attempts have been made by various energy companies in the region to acquire regional competitors for raising their power against the western and Russian companies. The two largest oil companies in the region are Nafta Polska's PKN Orlean of Poland and MOL (Hungarian Oil and Gas Company). Although there have been attempts for *acquis*itions only few of them have achieved success. The first successful talks about this topic have been conducted in 2001 between MOL and Slovnaft, the Slovakian Oil Company, when MOL purchased 36.2% of Slovnaft[27]. Since MOL's strategic goal is to be the regional energy company there have been negotiations between INA (Croatian Oil Company) and MOL for *acquis*ition, which led MOL to be one of the owners of INA. Currently there are negotiation between MOL and Nafta Polska's PKN Orlean for strategic cooperation but the negotiations are still open[28].

Regarding regional integration, it has to be mentioned that the lack of *acquis*ition is one of the main barriers of the development of a regional market.

Pipelines and networks

Another important step in the establishment of a regional market is the good infrastructure of gas and electricity pipeline systems connecting the neighbouring countries and through them the main pipelines. Pipelines between Russia with the accession countries are sufficient and further constructions are planned.

The pipelines connecting the CEE countries to the EU are small – both in length and capacity (e.g. Hungary-Austria, Czech-Germany) – this fact is a barrier for developing a regional market[29]. Electricity networks of Lithuania are not interconnected to member states but through the framework of a planned project, called Baltic Ring, the power lines to those of Western Europe would be connected[30]. Similarly to the situation of the CEE countries the lack of connection is also a barrier of the development of a regional market.

Electricity networks in most of the accession countries are interconnected at a different capacity level. For example, Romania is strongly interconnected to Bulgaria, but with Hungary the connection capacity is weaker[31].

The map below is the graphical presentation of the Integration of European Electricity Networks

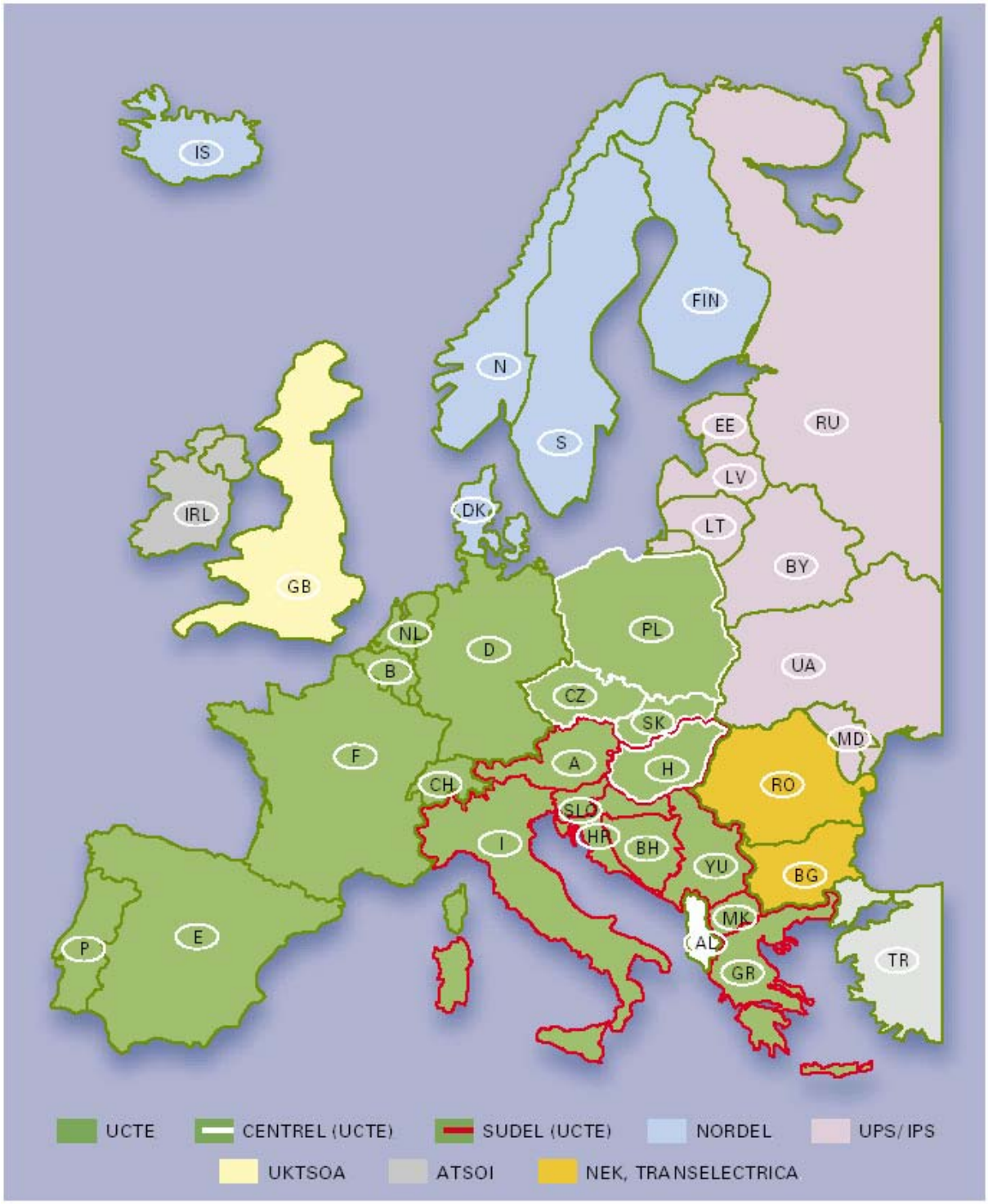
[27] http://www.eia.doe.gov/cabs/visegrad.html

[28] www.nol.hu - 13.11.2003.

[29] Mannheimer Zentrum für Europische Sozialforschung – Margarita M. Balmaceda: EU Energy Policy and Future European Energy Markets: Consequences for the Central and East European States

[30] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[31] http://fossil.energy.gov/international/romnover.html



Source: www.mvm.hu

The CENTREL electricity system, which connects the Czech Republic, Slovakia and Hungary, has been established. In 1995, the CENTREL system had been connected to the systems of Western Europe. Poland also has electricity connections with Ukraine and Belarus and both north-south and east-west connections are being expanded, as part of the EU's Trans-European Energy Network (TEN) project, with a new link to Lithuania. The four countries of the region are also members of the European electricity transmission system Union created for the Coordination of Transmission of Electricity (UCTE). UCTE coordinates the interests of transmission system operators in 20 European countries.

4. EU POLICIES TOWARDS ENERGY

4.1 Current programmes

European Union provides a couple of support programmes for the energy sector. Some of them are restricted to specific energy issues (e.g. support for trans-European energy networks). Other programmes have a broader scope like the new 6. RTD Framework, but do also affect the energy sector.

The contract of Amsterdam is the legal basis for the Programme for ***Trans-European networks*** (TEN), which is divided into the three areas transport, energy and telecommunication. The overall budget of this programme accounts for 4846 Mio. EUR in the period 2000 –2006[32] about 576 Mio. EUR only for energy projects. In frame of the energy section money should be spend to support the creation of the internal energy market and to ensure the security of supply. Therefore activities focus on the promotion of the interconnection, interoperability and development of trans-European energy networks (gas and electricity) and the access to such networks. Projects of common interest are identified by calls for proposals.

Community aid here may take one of the following forms[33]:

- Co-financing of studies;
- Subsidies of the interest on loans granted e.g. by the EIB of other public of private financial bodies;
- Contributions towards fees for guarantees for loans form the EIB or other financial institution;
- Direct grants to investments in duly justified cases;
- Risk-capital participation for investments funds.

Grant to the budget for specific research, technology and demonstration projects in specific fields of the energy sector can be achieved within the frame of the ***6 Framework programme***, especially under the thematic priority topic 6 “Sustainable development, global change and ecosystems” which comprises 2 100 Mio. EUR of the overall budget from 17 500 Mio. EUR for the period 2002-2006.

[32] Communication from the Commission to the council and the European Parliament “Financial programme” http://europa.eu.int/comm/budget/pdf/budget/financprogram/sec10130_en.pdf

[33] Call for proposals concerning projects of common interest in the field of trans-European energy networks, Call TEN Energy 2003/1 url: http://europa.eu.int/comm/energy/ten-e/call_2003_02/call_2003_2_en.pdf

Additionally accession countries get specific support by the Pre-accession financial Assistance, namely the programme ***PHARE, ISPA and SAPARD***. Within the period of 2002- 2006 the overall budget for those programmes is about 3,12 billion EUR per year (1999 prices), from which 1,56 billion EUR are related to the PHARE, 1,04 billion EUR to the ISPA and 520 Mio. EUR to the SAPARD instrument. Whereas the PHARE programme concentrates on institutions building and public administration support (e.g. key actions implementation of the *acquis communautaire*, investment to strengthen the regulatory infrastructure needed to ensure compliance with the *acquis*), ISPA and SAPARD are support instruments for investments. ISPA is related to major environmental and transport infrastructure projects and SAPARD to agricultural and rural development projects. Generally about 50% of the ISPA budget should be spend to environmental topics. If the energy sector concerns air pollution, projects may be supported by ISPA to a minor extent (priority projects concern the waste and water infrastructure). The SAPARD instruments may support energy projects in the rural areas, if the projects are in line with the regional development strategy.

In combination with the Interreg Programme the PHARE CBC programme offers other possibilities to support cross-border energy projects in co-operation with regions in member states to a minor extent.

Beside those public-funding opportunities, a number of international and European finance institutions like the World Bank, the EBRD, the EIB support loans in key actions like renewable energy, energy efficiency, district heating, waste to energy, energy production and distribution etc.[34][35]

4.2 Future support programmes

The new multi-annual programme "***Intelligent Energy for Europe***" (2003 – 2006) follows the former "Energy Framework Programme (1998 – 2002). With a total budget of 215 Mio. EUR it aims at strengthening security of supply, fighting against climate change and stimulating the competitiveness of European industry by introducing respectively continuing a couple of sub-programmes. Here are the programs:

- ALTENER programmes aims to reinforce the "renewable energies" (ALTENER);
- SAVE aims at "efficient energy";
- COOPENER redirects the existing international action: "promotion on the international level of the efficient use of energy and the use of energy supplied from renewable sources" and;
- STEER introduces a new field of action: "energy in transport"[36].

[34] European Investment Bank: http://www.eib.org/projects/loans/

[35] European Bank of Restructuring and Development http://www.ebrd.com/enviro/index.htm

[36] http://europa.eu.int/comm/energy/res/intelligent_energy/index_en.htm

By becoming a real member of the European Union accession countries will also gain access to the ***Structural and the Cohesion Funds***, which intend to narrow the gaps among the regions and member states of the European Union. For the four structural funds: European Regional Development Fund (ERDF), European Social Fund (ESF), European Agricultural Guidance and Guarantee Fund (EAGGF) and Financial Instrument for Fisheries Guidance (FIFG) planned budget for the enlarged Union (EU-25) for period 2004-2006 is about 95 billion EUR (in 1999 prices). Additionally about 15,131 EUR (in 1999 prices) will be available in frame of the cohesion fund[37].

The population fraction living in objective 1 region will be 29,5% in EU-25 compared to 22,2% in EU-15[38]. During the period 2000 – 2006 about 70% of all structural grants will be spent in objective 1 region[38] to which most of the regions in accession countries are assigned to due to their low level of GDP. Infrastructure measures will cover about 40% of the overall budget from cohesion and structural funds[38]. Building of transport infrastructure will probably receive the main share of this money (about 50%).

However supporting environmental protection is also an important aspect. About 10% of whole money from structural funds is spending to those projects. Reducing air pollution by restructuring of energy infrastructure in the accession countries is clearly an environmental topic, which may be partly financed by the structural funds even if main parts of the budget have been invested in water treatment plants yet.

Interrelated with the regional and structural development an increased engagement of the European Investment Bank (EIB) was visible during the past support periods (1989-1993 and 1994-1999). For the period 1994 – 1999 nearly 77% of all credits for regional development projects were given by the EIB. This stimulated private investments to a huge amount. For the now ongoing period 2002 – 2006 co-operation between European Commission and EIB should be further improved to increase potential benefits and synergy effects. In this respect the EIB will emphasis inter alia on support projects for the infrastructure improvement (transport and energy). By gaining access to the structural and cohesion funds, similar developments and increased co-operation with EIB can be expected for accession countries.

Further financing of structural and cohesion funds beyond 2006 is still a matter of discussion. Basing on the minimum amount of 0,45% of EU GDP yearly amount of money for regional policy is likely to increase from 30,43 billion EUR today up to 37,00 billion EUR (both figures in 1999 prices) post 2006[39]. However the level of 0,45% of EU GDP is seen to be insufficient by many parties[39] and might be increased further. This would lead to further financial pressure for the "rich" countries, which currently initiate a discussion about fundamental policy reforms of regional policy[40].

[37] Commission proposal to adopt the financial framework for enlargement: http://europa.eu.int/comm/budget/pdf/financialfrwk/ip03217/ip03217_en.pdf

[38] Second report on economic and social cohesion: http://europa.eu.int/comm/regional_policy/sources/docoffic/official/reports/contentpdf_en.htm

[39] One year before the publication of the Third Cohesion Report: some thoughts from the CPMR on the future of regional policy post 2006 http://europa.eu.int/comm/regional_policy/debate/document/futur/organ/crpm_1202_en.pdf

[40] IBO Structural Policy in the context of the enlargement of the EU http://europa.eu.int/comm/regional_policy/debate/document/futur/research/ibo_0901.pdf

5. REVIEW OF EU15 AND ACCESSION COUNTRIES ENERGY SCENARIO

5.1 Methodological notes

This chapter is based on energy data from different statistical sources, namely the International Energy Agency energy balances, fuels information and CO_2 emissions from fuel combustion.[41] The main energy unit used is the TOE (Tonne of Oil Equivalent).[42]

Primary energy sources are divided in six main types: Coal; Oil; Natural Gas; Nuclear; Hydro and Others (includes Combustible Renewables and Waste, Geothermal, Heat and Solar, Tides and Wind energies). As final energy forms, Coal, Oil, Natural Gas and Electricity are considered. Consumption is divided between the following five sectors of economy: Transformation[43]; Industry; Transport; Residential, Commerce and Public Services; and Agriculture and Others.

For reasons of comparison, the time analysis between countries spans between 1992 till 1999, since data for Slovenia, Estonia, Latvia and Lithuania, are only available from 1992 onwards.

5.2 Influence of the enlargement on major energy indicators

The enlargement of the European Union (EU15) to the 12 accession countries (AC) will bring several challenges to the EU15. This section intends to evaluate the major similarities and differences between the European Union and the EU15 with the Accession Countries (EU15+AC). For this purpose, energy data of the EU15 and the AC were aggregated and compared to the EU15 data for the period 1992-1999.

The energy evolution of the European Union and the accession countries cannot be dissociated of the different patterns of evolution of Gross Domestic Product (GDP) and Total Primary Energy Supply (TPES): despite the improvement of energy efficiency in the EU15, total energy supply continued to grow; on the other hand, in the AC energy efficiency followed the same trend, consequence of economic restructuring and other measures.

In fact, while the EU15 has increased both its Gross Domestic Production (2.0% on an average annual rate[44]) and its Primary Energy Supply (1.0% rate), from 1992 to 1999, in the Accession Countries the growth rate for GDP was 3.2% but TPES decreased 1.5% As a result, EU15 energy intensity decreased 1% while in the AC the decrease surpassed 4%.

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[41] Sources: International Energy Agency (2001), *Coal Information*, IEA Statistics, OECD/IEA , France, 2001; International Energy Agency (2001), *Oil Information*, IEA Statistics, OECD/IEA , France, 2001; International Energy Agency (2001), *Electricity Information*, IEA Statistics, OECD/IEA , France, 2001; International Energy Agency (2001), *Natural Gas Information*, IEA Statistics, OECD/IEA , France, 2001; International Energy Agency (2001), *CO2 Emissions from Fuel Combustion*, IEA Statistics, OECD/IEA , France, 2001

International Energy Agency (2002), *Energy Balances of Non-OECD Countries 1999-2000*, IEA Statistics, OECD/IEA , France, 2002

[42] The conversion factors from mass or energy units to Toe are based on the final energy concept: for fuels they are based on their Lower Heat Value; for electricity 1 MWh equals 3.6 GJ; nuclear power considers a standard efficiency of transformation from primary to final energy of 33% (as considered by the IEA); gas and coal are defined in primary energy using a combustion power set as standard.

[43] This sector represents the energy consumed during the conversion from Primary Energy to Final Energy, except for Electricity where it comprises "Distribution losses" and "Own Use" as defined in the IEA energy balances.

44 The average annual rate is calculated as the geometrical rate between 1992 and 1999 values.

In 1992, the energy intensity of the accession countries (935 Toe/million 1995 US$) was almost six times greater than the energy intensity in the EU15 (163 Toe/million 1995 US$). However, considering the energy intensity of the EU15+AC energy intensity is greater than the EU15 but only 17% more, due to the predominance of the European Union's GDP. As *Figure 5-1* shows, the distance between the EU15+AC and the EU15 annual energy intensity has converged over the past decade, especially after 1996. As its absolute value in 1999 is still higher than that of the EU15, there is a substantial potential for further energy efficiency improvements.

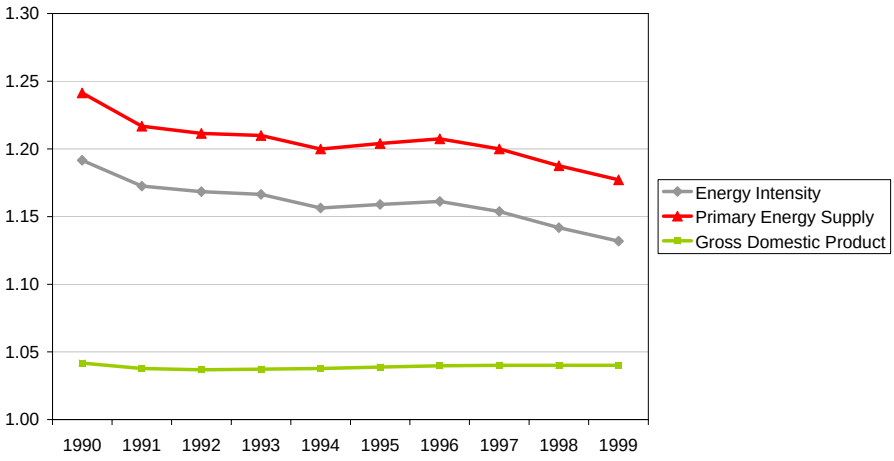

Figure 5-1. Energy Intensity, Gross Domestic Product and Primary Energy Supply Evolution: Annual ratio between the EU15+AC and the EU15.[45]

On a country by country analysis, it is generally observed that the trend of reducing the energy intensity as the GDP per capita grows is followed: countries with lower GDP per capita values exhibit bigger energy intensity reductions while countries with GDP per capita near EU15 values tend to stabilize their energy intensity (*Figure 5-2*).

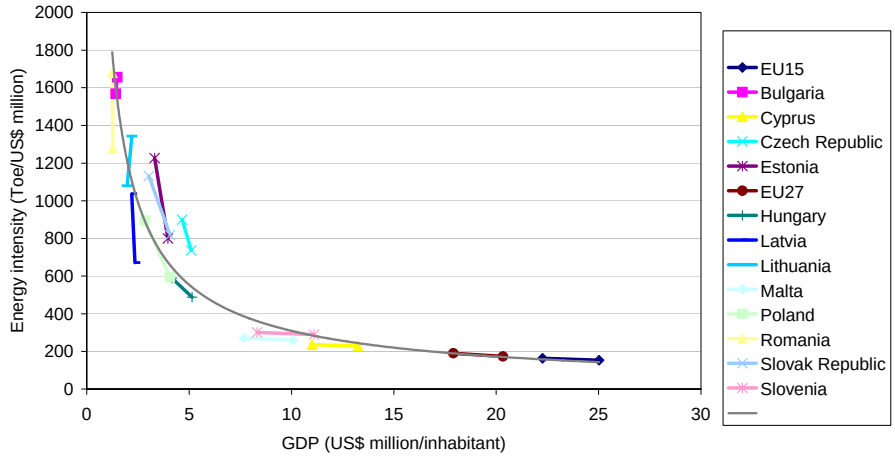

Figure 5-2. Energy Intensity versus Gross Domestic Product Evolution: EU15, AC and EU15+AC.[46]

[45] The annual ratio for year *i* is computed by the division of the property for EU15+AC in year *i* and the property for EU15 in year *i*. For GDP and Primary Energy this annual ratio is always greater than 1.

[46] Note that 1992 figures correspond to higher values on energy intensity for all countries.

In the EU15 carbon dioxide emissions due to energy consumption have been relatively stable in the period between 1992 till 1999. This is however not good news since the commitments made at the United Nations Framework Convention on Climate Change and its Kyoto Protocol stipulate an overall reduction on total greenhouse gases emissions of 8% in the period 2008-2012, taking 1990 emissions as reference.

The inclusion of the AC emissions gives a different perspective: energy CO_2 emissions have decreased since 1992 around 3.5% (see *Figure 5-3*). This can be justified by the reduction of primary energy consumption of the EU15 when including the AC (around 3%) and also by a switching from coal to other energy sources.

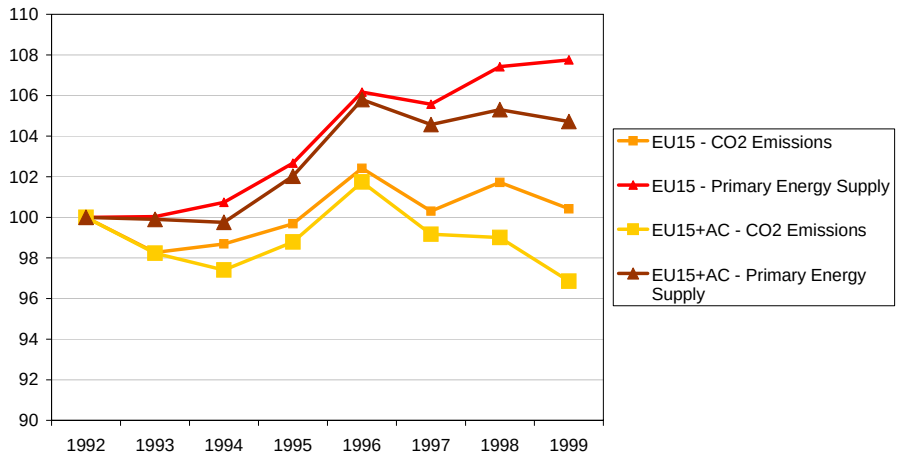

Figure 5-3. Primary Energy Supply and CO_2 Emissions Evolution (100 = 1992): EU15 and EU15+AC.

In the European Union, coal's main use (more than 80%) is in the transformation to other forms of energy. Electricity consumption is distributed between the residential, commerce and public services sector (more than 50%) and the industry sector (around 40%). As for natural gas, the consumption is similarly divided between industry, residential, commerce and public services and transformation. Transport is the main oil consumer in the EU15 (nearly 50%); the remaining consumption is balanced by industry, residential, commerce and public services and transformation sectors.

When comparing the EU15 and the AC as a whole, the distribution of energy consumption by sector presents similar trends. However some differences should be pointed. At a sectorial level, the residential, commerce and public services sector differs in the AC from the EU15 by a shift between oil and coal. The agriculture and others sector has a bigger importance in the AC energy balance. Finally it is noticeable that the transformation sector is less important in the AC for natural gas consumption.

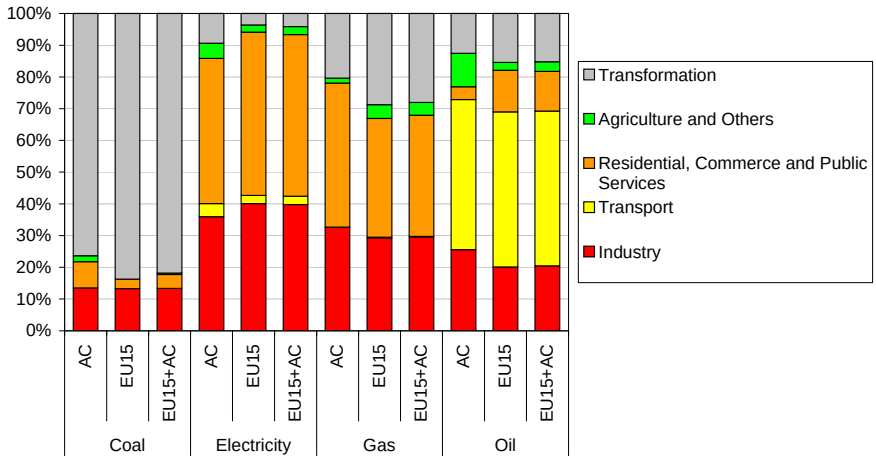

Figure 5-4. Energy Consumption Distribution by Sector and by Fuel: EU15, AC and EU15+AC, 1999 data.

5.3 Bulgaria

After a weak start of the 90's decade, where a strong reduction of the GDP reflected no energy reduction effects and maintained and even increased its **energy intensity** figures, Bulgaria has shown a sustainable decrease since 1996. Nevertheless, its figures are still far above EU15 levels (see Figure 5-2). In 2002, Bulgaria signed and ratified the **Kyoto Protocol**, compromising with an 8% decrease on **CO_2 emissions** until 2012. These emissions have decreased around 25% from 1992 to 1999.

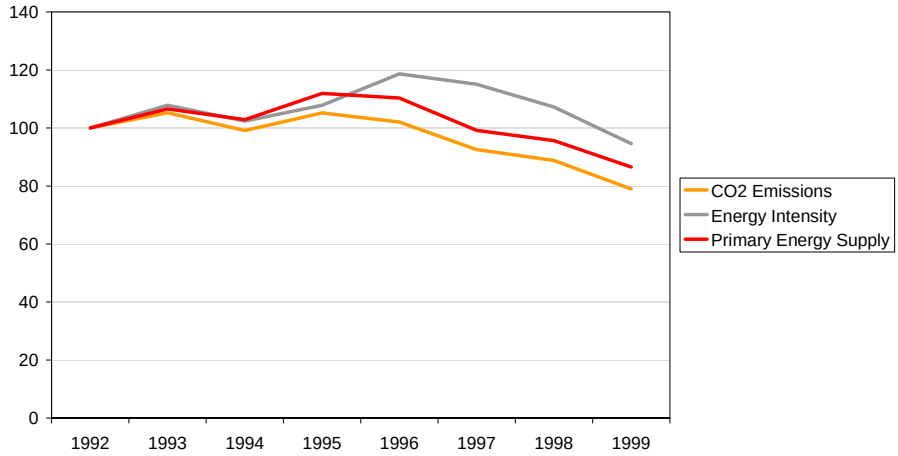

Figure 5-5. Bulgaria's Primary Energy Supply, Energy Intensity and CO_2 Emissions Evolution (100 = 1992)

Despite the reduction of the global consumption, nuclear energy has increased its production in a significant form, while coal, gas and oil use decreased their levels in the 90's. Bulgaria still relies heavily on fossil combustible facilities, representing 75% of total **primary energy supply** (see Figure 5-6).

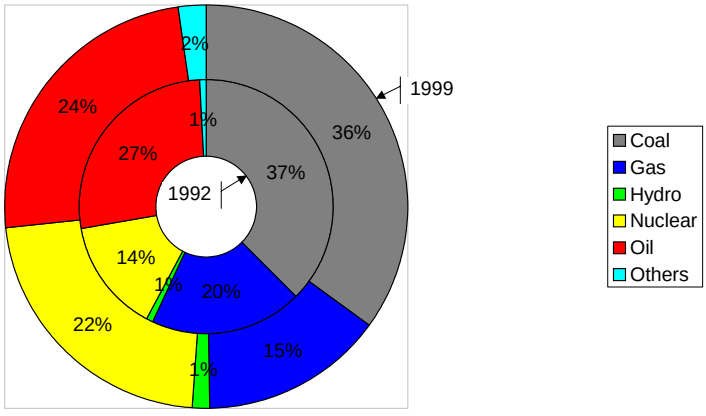

Figure 5-6. **Bulgaria's Primary Energy Supply Distribution by Fuel**

Bulgaria's sectorial consumption of energy distinguishes from the EU15 mainly in the gas consumption: the residential, commerce and public services sector is almost inexistent, being replaced by the transformation and industry sectors. Also, in oil consumption, transport and industry have equal shares, contrary to the predominance of transport in the EU15. For electricity consumption, it is noticeable the great magnitude in distribution losses and own consumption.

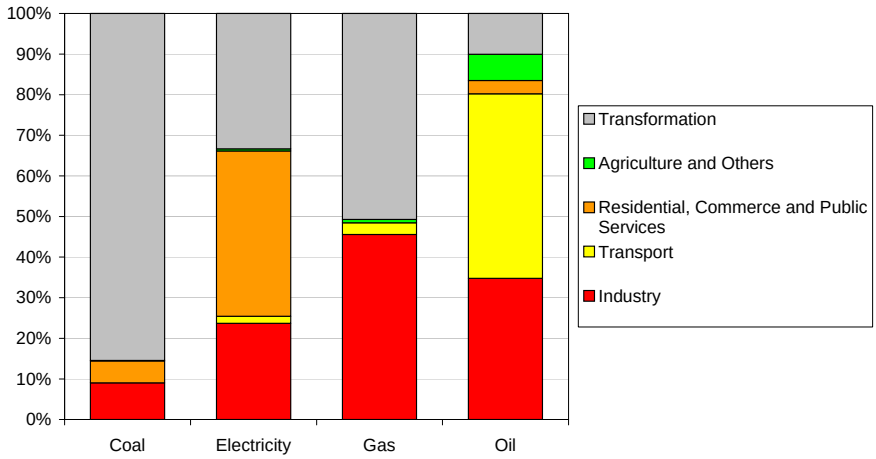

Figure 5-7. **Bulgaria's Energy Consumption Distribution by Sector and by Fuel, in 1999**

As regards security of supply Bulgaria needs urgently to adopt a framework law for alignment with the **energy *acquis***[47], given the time needed to create the necessary oil stocks. Particular attention should be given to ensuring adequate administrative capacity to manage these stocks. Market opening, access to the network and price adaptations has been introduced but a price distortion has not yet been defined. The administrative capacity and the independence of the State Energy Regulatory Commission (SERC) have improved though still need further reinforcement.

The amendments to the Energy and Energy Efficiency Law were an important legislative development but Energy efficiency remains extremely low. Price modifications should be an incentive for consumers to start investing in energy efficiency projects and initiatives, as well as for investors in the production of renewable energy, but this alone cannot address Bulgaria's problems. An active and co-ordinated policy, both on the production and end user side, has still to be defined with a view to rapidly enhancing support for energy efficiency, energy savings and the use of renewable energy sources. The Energy Efficiency Agency has no clear mandate, its management has still not been appointed following the recent change in the institutional framework, and it needs to be strengthened as part of a wide-ranging policy to promote energy efficiency.

Bulgaria has accepted all recommendations contained in the Report on Nuclear Safety in the Context of Enlargement of June 2001 although should devote further attention to: clarify the legal status of the safety analysis reports; implement as soon as possible the new Law on the Safe Use of Nuclear Energy; and give special attention to the funding of the radioactive waste storage programme.

The Status Report recommends further monitoring with regard to five recommendations, regarding the provision of adequate human and financial resources to the regulatory authority, as well as the timely completion of the plant specific safety improvement programmes, safety analysis reports and emergency operating procedures, and the implementation of the remedial programme regarding high energy pipe brakes at Kozloduy Units 5 and 6. Furthermore, the Status Report reaffirms the importance of Bulgaria's commitment on the definitive closure of Units 1 to 4 of the Kozloduy NPP at the earliest possible dates. Units 1 to 4 of the Kozloduy Nuclear Power Plant are subject to early closure commitments. They have a number of deviations from safety requirements due to their original design, not least the absence of containment.

[47] Commission of the European Communities. 2002 Regular Report on Bulgaria's Progress Towards Accession. Brussels: 2002.

In 1999, Bulgaria agreed and committed itself, in an Understanding signed with the Commission, to close down definitely Units 1 and 2 before the year 2003 and to decide, on the occasion of the updating of the energy strategy which will be completed in 2002, on the dates of the definitive closure of Units 3 and 4, which will be before the initially envisaged dates of 2008 and 2010 respectively. The European Union's understanding is that the closure of Units 3 and 4 will take place in 2006 at the latest. These closure commitments must be duly respected. It should be noted that Bulgaria has concluded a Full Scope Safeguards Agreement with the IAEA.

5.4 Cyprus

Cyprus is not far from EU15 levels concerning **energy intensity** (see Figure 5-2). Nevertheless, it has shown little evolution on the 90's decade, as no decreased was observed. Consumption accompanied the growth of the GDP of this country. Cyprus signed and ratified (1997) the Kyoto Protocol but has signed no commitments for reductions. Figures show a significant increase of 25% in CO_2 emissions due to fuel combustion since 1992, only comparable, within the AC, to the increase verified in Slovenia.

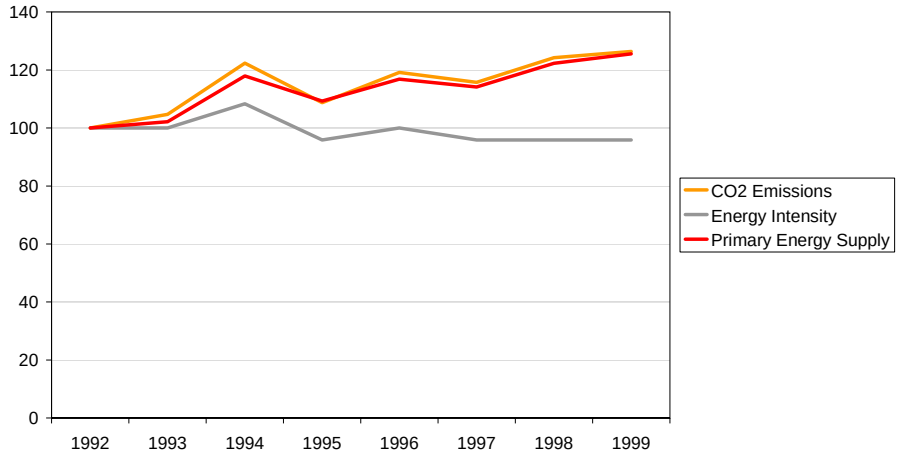

Figure 5-8. Cyprus's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Cyprus is highly dependent on oil regarding **primary energy supply** as it provides more than 95% of the primary energy. Natural gas is inexistent in the island. Cyprus started programmes in order to diversify its energy sources. In 1999 it can already be observed a growth in renewable energies (see Figure 5-9).

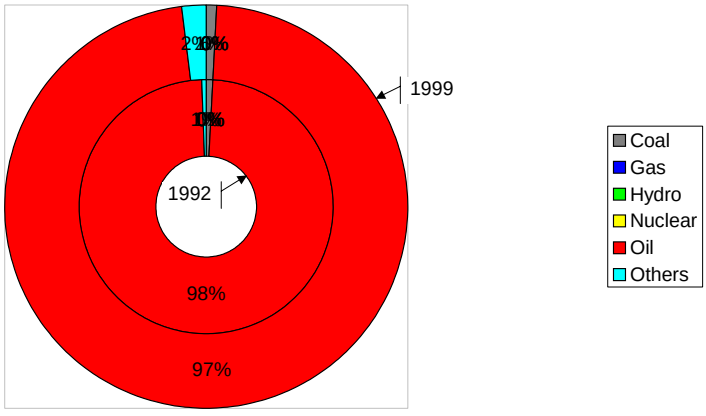

Figure 5-9. Cyprus's Primary Energy Supply Distribution by Fuel

Industry, which is of low importance in the energy balance, is the only consumer of the almost residual use of **coal** in Cyprus (see Figure 5-10). The residential, commerce and public services sector concentrates its consumption in **electricity**, representing a share of nearly 70% of its total use. **Oil**'s major consumer is electricity production, side by side with the transport sector.

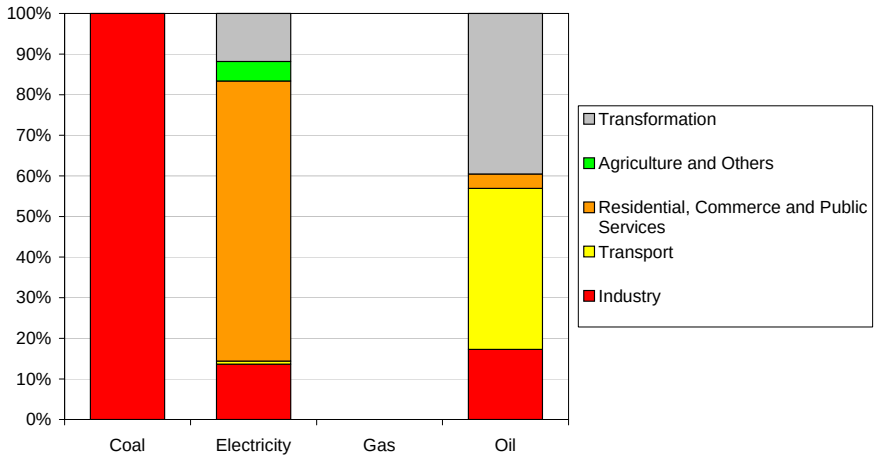

Figure 5-10. Cyprus's Energy Consumption Distribution by Sector and by Fuel, in 1999

Concerning **energy networks**, Cyprus is not connected to any other country. It has an electricity grid with 132 kV for transport and 11 kV for distribution. It has no gasoduct supplying gas[48].

The adoption of the **energy *acquis***[49] is satisfactory though requiring some efforts to fill the pretended conversion. Concerning the security of supply, due to the heavy dependency of imported oil, the issue of building up the required oil stocks in accordance with the *acquis* is of particular significance. Concerning the internal market and his competitiveness, the Electricity Authority remains the only producer and distributor of electricity, becoming difficult to eliminate the price distortions. As regard energy efficiency an Institute of Energy was established aiming to support the promotion of measures for the rational use of energy, renewable energy sources and fossil fuels. The Government has introduced a grant scheme for investments in energy conservation and for the substitution of electrical energy or conventional fuels with renewable energy sources.

[48] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[49] Commission of the European Communities. 2002 Regular Report on Cyprus's Progress Towards Accession. Brussels: 2002.

5.5 Czech Republic

Czech Republic is becoming less **energy intensive**. The combined effect of a growth on GDP and a reduction on primary energy dragged this indicator down, putting it on the way to convergence with EU15. Nevertheless, Czech Republic is still far from the average value in EU15 (see Figure 5-2). **CO_2 emissions** were reduced with a steeper decline than TPES as a result of the reduction of coal's importance and growth of natural gas consumption (see below).

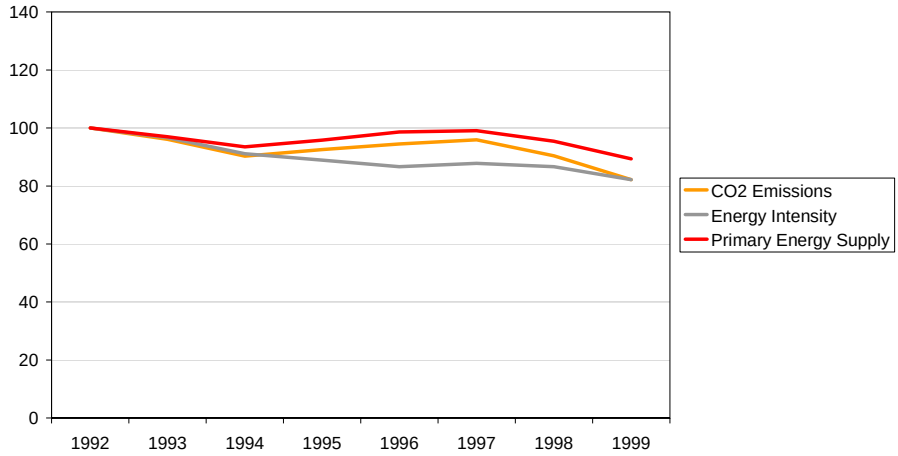

Figure 5-11. Czech Republic's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Coal was the major source of **primary energy**, in 1992, representing 60% of total primary energy supply, but natural gas showed a rapid growth, reducing coal's share. Nuclear use remained constant and with little significance. Renewable sources have little importance in Czech Republic's primary energy.

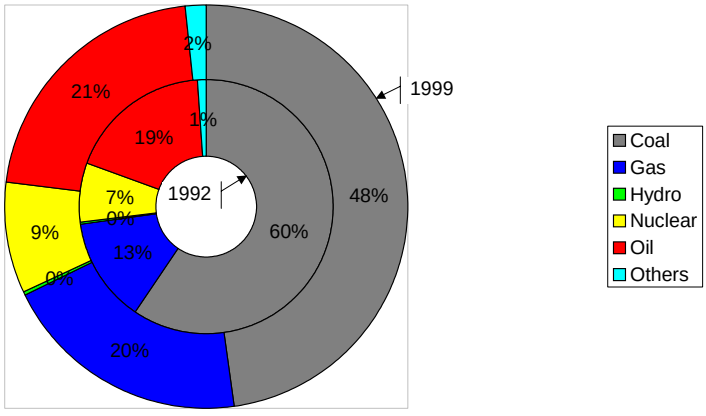

Figure 5-12. Czech Republic's Primary Energy Supply Distribution by Fuel

Energy consumption in the Czech Republic shows a similar profile to the EU15 (see Figure 5-4). Differences arise in **natural gas**, as Czech Republic consumes relatively less for transformation purposes, and in **oil** consumption, which shows a bigger influence of the industry sector and a residual use in the residential, commerce and public services sector.

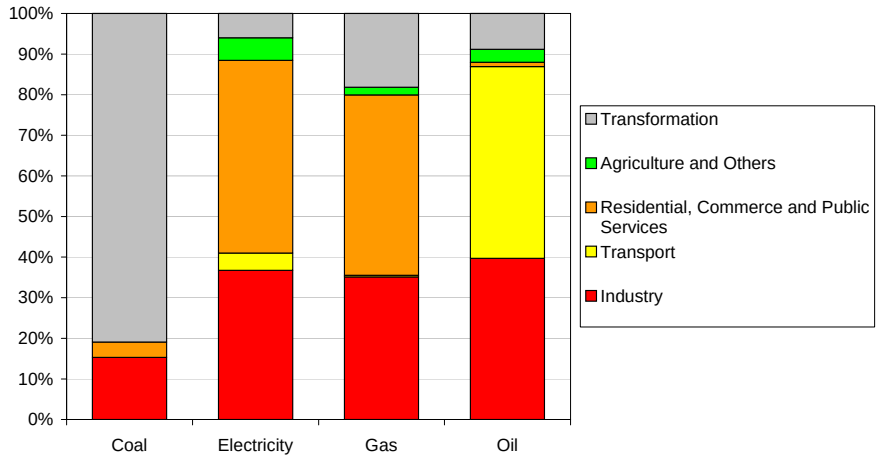

Figure 5-13. Czech Republic's Energy Consumption Distribution by Sector and by Fuel, in 1999

Concerning **energy networks**, Czech Republic is connected through major *gasoducts* to Germany, Hungary and Slovak Republic. Other neighbours (such as Poland and Austria) still lack infrastructures on gas trade. Nevertheless, existing facilities provide connections to all major points of supply of Europe's network. Electricity grid provides strong connections with Germany and Slovak Republic. Other neighbouring countries lack still reinforcement, in order to provide a concrete possibility of a regional market on this area. An oil pipeline also crosses Czech from the eastern and the southern Germany, connecting with Hungary as well[50].

Regarding the **energy *acquis*[51]**, the entry into force of the new Law on energy in January 2001 is an important step with regard to the internal energy market. It provides the legislative framework for regulating the market and covers a number of technical issues concerning the electricity and gas sectors and also the heating sector. The Czech Republic has made progress with regard to competitiveness and the internal energy market. The Law on energy provides for progressive liberalisation of the electricity market from 2002. The market should be fully opened up in 2006. Progress has been made with regard to security of supply.

The Law on strategic oil reserves adopted in November 1999 provided for the 90 days of stocks required under the *acquis* to be reached in 2005. The Czech Republic has further increased its oil reserves, bringing them to a level close to that required (80 days).. Concerning solid fuels, little progress can be reported with regard to the restructuring of the coal sector. Fuller measures are required to improve energy efficiency. The adoption of the Law on energy management is a first step in this direction. As regards energy efficiency, the Government adopted the first Annual State Support Programme for Energy Saving and the Use of Renewable Energy Sources, based on the National Programme for Economic Energy Management and Use of Renewables. With regard to nuclear energy Czech Republic is continuing work to complete the Temelin nuclear power plant and its extensive modernisation programme. Work is in progress to modernise the Dukovany power plant. However, the Czech Republic should ensure compliance with Euratom requirements and procedures, in particular with regard to Euratom safety checks.

[50] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[51] Commission of the European Communities. 2002 Regular Report on Czech Republic's Progress Towards Accession. Brussels: 2002.

5.6 Estonia

Energy intensity has decreased since 1992 (Figure 5-14), especially due to a sustained growth of the GDP, shortening significantly its distance to the EU15 (see Figure 5-2). **CO_2 emissions** have decreased around 30% since 1992, especially due to the coal dependence.

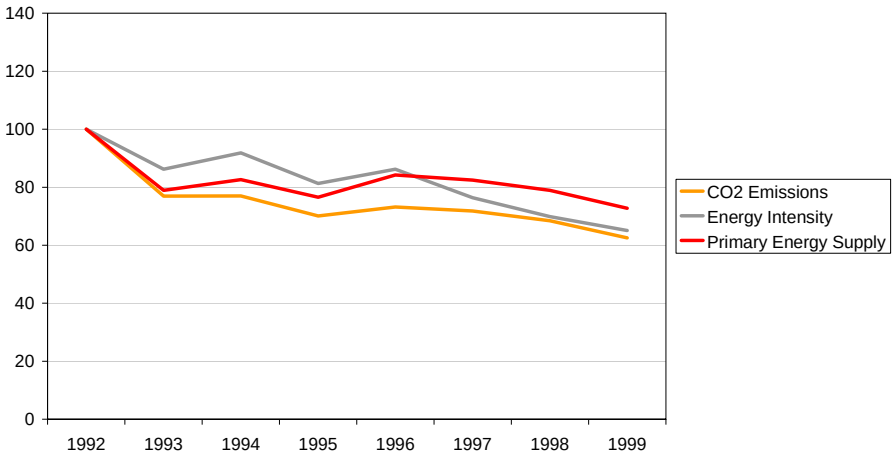

Figure 5-14. Estonia's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Despite a big reduction of coal's consumption from 1992 to 1999, Estonia's **primary energy consumption** still depends largely on **coal** (almost 60% in 1999), its main source for electricity production. **Natural gas** share in primary energy increased significantly taking the place of coal. Other sources of energy have made a noticeable increase, namely combustibles renewable and waste sources.

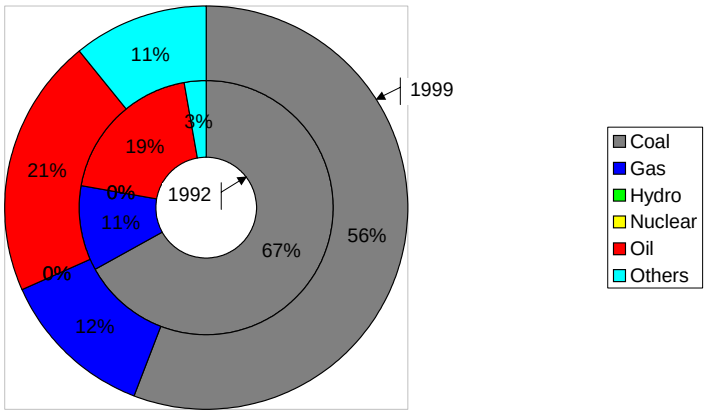

Figure 5-15. Estonia's Primary Energy Supply Distribution by Fuel

Estonian **energy** consuming structure by sector (Figure 5-16) differs from the one observed in the EU15 (see Figure 5-4). **Coal** is almost exclusively dedicated to energy transformation. **Electricity** balance shows high values of losses. **Gas** has a rather high use in the transformation sector, while the residential, commerce and public services sector, only represents 10%. The transport sector represents the highest share in **oil** consumption of all the AC and of the EU15.

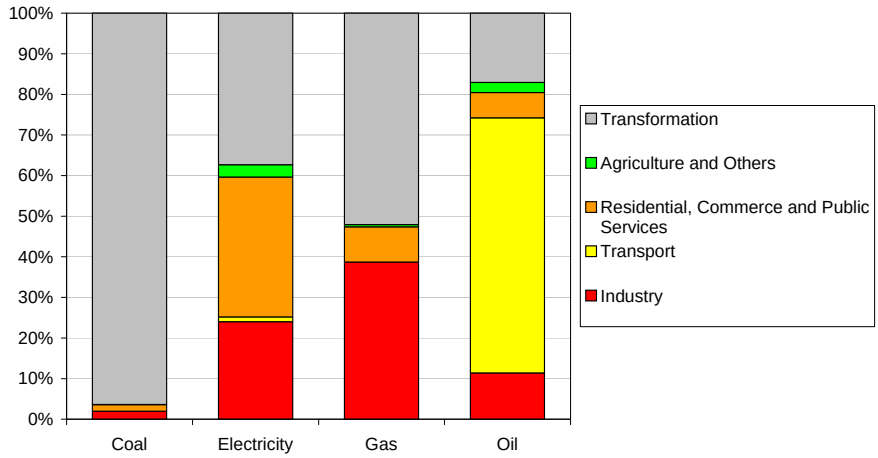

Figure 5-16. Estonia's Energy Consumption Distribution by Sector and by Fuel, in 1999

Relating **energy networks** Estonia is strongly connected to Russia both in natural gas and electricity. Gasoduct supplies almost the whole country. Estonia integrates also the Baltic pipeline system (BPS), which receives oil from other parts of the ancient Soviet Union. Furthermore, electrical connections with Latvia are available. Beside Russia and Latvia (the only land borders), no other electrical connection exists. Estonia integrates a program called BALTREL, which intends to provide connections with regional markets. A possible connection with Finland and Sweden is being discussed[52].

Estonia has made progress in adopting legislative measures in order to align itself with the **energy *acquis***[53]. The Commission believes however that considerable efforts remain necessary to accomplish the implementation of the *acquis*. Despite the efforts made by Estonia in the energy sector, it remains highly dependent on its major local fuel, oil-shale. The oil-shale question is closely connected to the security of energy supply situation. Since the 2001 report, a law on minimum fuel stocks has been adopted setting out the rules governing the constitution of oil supplies required by the *acquis* and laying down a schedule to achieve the minimum level in 2010. Estonia must speed up its efforts to reach the oil reserves equivalent to 90 days' consumption required by the *acquis*. As far as the internal energy market is concerned, restructuring of the oil-shale sector is continuing, but there are still some contradictions with respect to the opening of the market in EU law. The process of privatising the other electricity sector areas has been finalised. Further amendments to energy legislation are necessary to fully implement provisions of the internal market for electricity and gas. Estonia must continue to strive to strengthen and create administrative capacity. As regards energy efficiency the Action Plan to the Energy Conservation Target Program has been approved. This plan aims at the conservation of energy (i.e. lower consumption) in both the business sector and private households, as well as at promoting the use of environment-friendly fuels and increasing the efficiency of production, transport and distribution of energy.

[52] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[53] Commission of the European Communities. 2002 Regular Report on Estonia's Progress Towards Accession. Brussels: 2002.

5.7 Hungary

Hungary showed a constant decrease on **energy intensity**, since 1996 (see Figure 5-17). The growth of GDP in this country dragged this value down, without major changes in energy use levels. *Hungary committed to the 6% target reduction on* ***CO_2 emissions****, under the 8% of the EU as a whole.* Hungary showed little reduction on these numbers during the past decade.

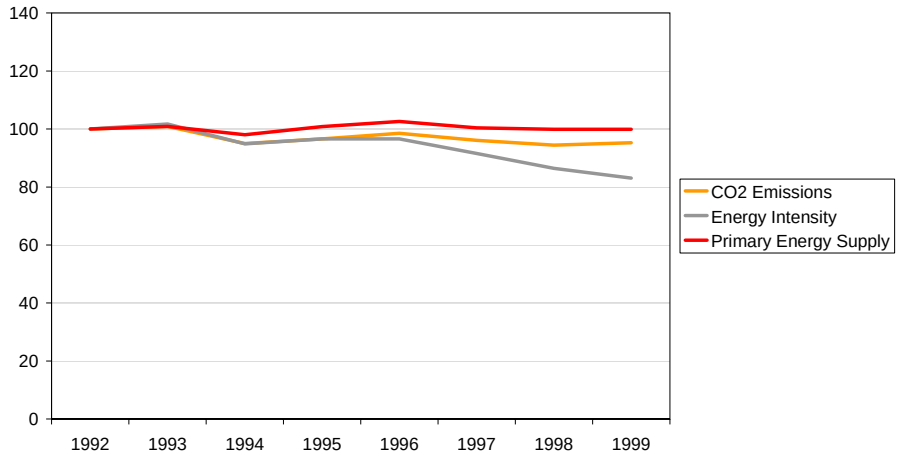

Figure 5-17. Hungary's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Gas has always been the main source of **primary energy** and has shown an increased of its share from 1992 to 1999, fact that is related with Hungary's own production of gas. On the other hand, coal and oil have decreased their shares in primary energy. Nuclear use remained constant. Hungary shows little dependency on oil when compared with the EU15. Renewable sources showed no increase (see Figure 5-18).

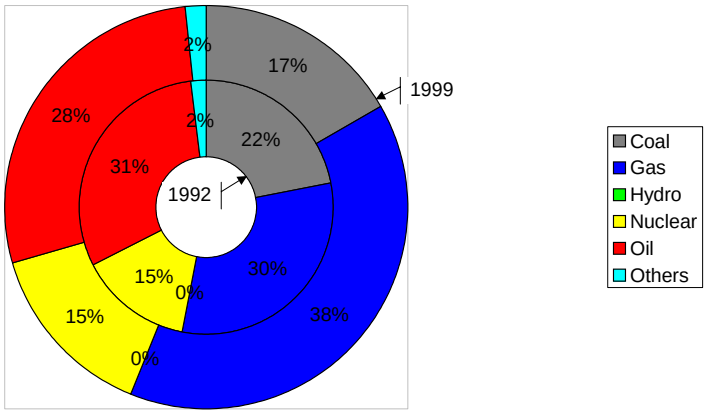

Figure 5-18. Hungary's Primary Energy Supply Distribution by Fuel

An analysis on **energy** consumption by sectors (see Figure 5-19) in Hungary shows that consumption in the residential, commerce and public services sector gains importance over industry in **electricity** and **gas** when compared with the EU15. The transport sector has a smaller impact in **oil** consumption relatively to the European Union.

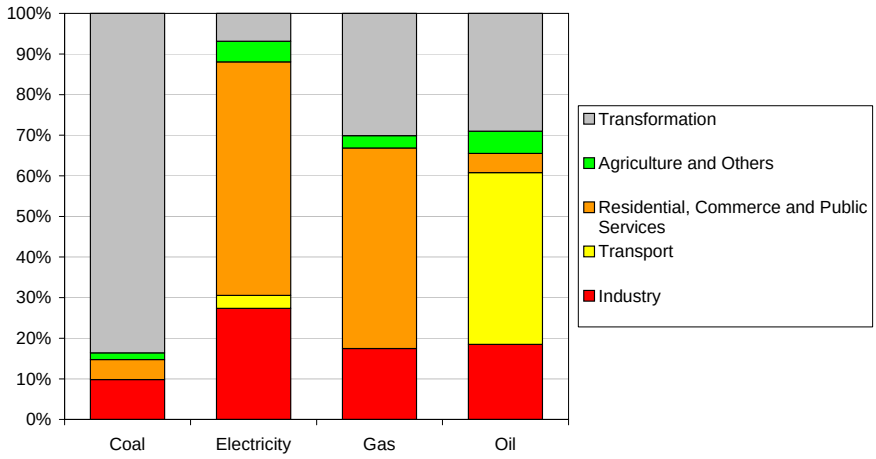

Figure 5-19. Hungary's Energy Consumption Distribution by Sector and by Fuel, in 1999

Concerning **energy networks**, Hungary is connected through major gasoducts to Austria, Czech and Slovak Republics, Former Yugoslavia Countries, Ukraine and Romania. Existing facilities provide connection to all major points of supply of Europe's network. An oil pipeline connects Hungary with these same countries. Electricity grid provides strong connections with Slovakia (mainly), Austria and Ukraine. Connection with Croatia is predicted. Serbia and Romania were also connected, but 1998 data show these lines disconnected. Most of these neighbouring countries lack still reinforcement, in order to provide a concrete possibility of a regional market on this area[54].

Overall, Hungary is making progress in implementing the **energy *acquis***[55] and is continuing to consolidate its administrative framework. Hungary has already adopted the main principles of the internal energy market but speeding up the adoption of new legislation on gas and electricity is necessary. Concerning energy market opening the Hungary Electricity Act points out to a minimum 33% of opening by 2003. As regards security of supply, stocks of crude oil and petroleum products are at the required level. As regards energy efficiency and renewable energy, it has been introduced an energy efficiency programme with the main objectives of promoting the use of renewable energy sources and improving public energy awareness. Hungary has a well developed institutional structure in the energy sector, among others, a nuclear safety body, an Energy Interest Reconciliation Council, a centre responsible for energy efficiency and an independent network manager as been established. Nevertheless, some of these need to be strengthened. Regarding nuclear issues, Hungary is a party to all major international agreements and is a member of the International Atomic Energy Agency and the OECD Atomic Energy Agency. Hungary has concluded a full-scope safeguards agreement with the IAEA. Nevertheless, steps should be taken to ensure that Hungary complies fully with Euratom requirements and procedures.

[54] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[55] Commission of the European Communities. 2002 Regular Report on Hungary's Progress Towards Accession. Brussels: 2002.

5.8 Latvia

Latvia's **energy intensity** figures evolution was very favourable during the 90's, due to a high reduction in primary energy consumption (see Figure 5-20). **CO_2 emissions** were reduced by 50% with a steeper decline than TPES in the 90's showing a favourable evolution towards Kyoto Protocol objectives.

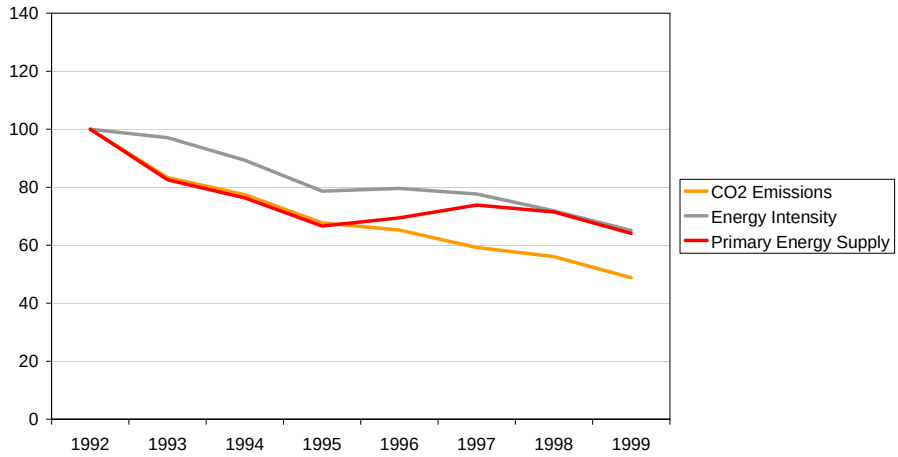

Figure 5-20. Latvia's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Contrary to other AC, Latvia's primary energy has little influence of **coal**. Gas and oil are the two major sources of energy. However renewable energies, namely combustible renewable and waste, are assuming themselves as an important source of energy (see Figure 5-21). Latvia is also the only Baltic country with significant Hydro energy explorations.

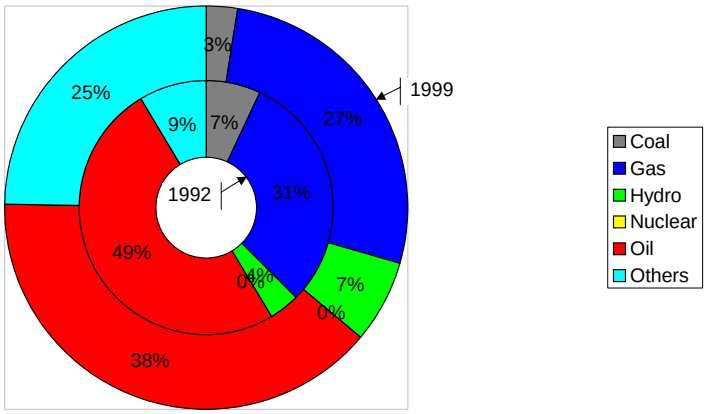

Figure 5-21. Latvia's Primary Energy Supply Distribution by Fuel

The residential, commerce and public services sector has a big share in **electricity**. The same can be observed in **coal consumption**, mainly due to the fact that coal has low importance in Latvia's energy balance. **Gas consumption** is mainly related with the transformation sector. The distribution of **oil consumption** by sector is similar to the EU15.

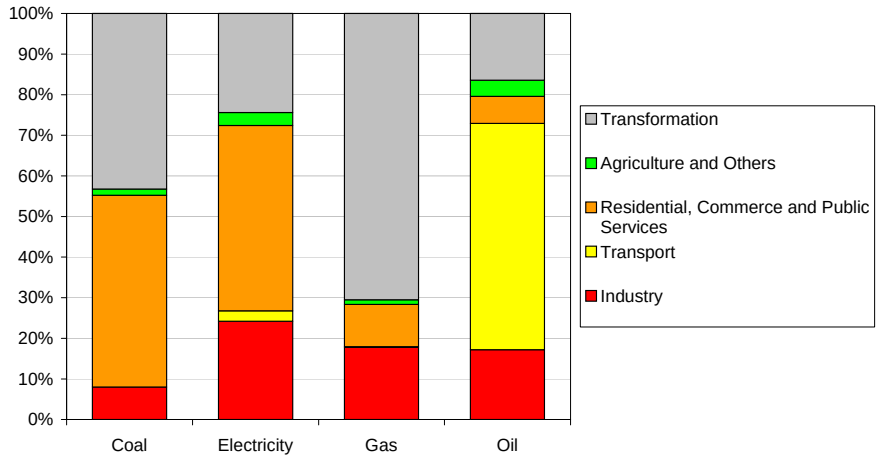

Figure 5-22. Latvia's Energy Consumption Distribution by Sector and by Fuel, in 1999

Latvia is well supplied by oil (only to Russia), **gas and electricity connections** with neighbouring Russia, Estonia and Lithuania. Further connections with north Baltic Sea neighbours (Sweden and Finland) are being studied[56].

With regard to security of supply and more particularly oil stocks, Latvian legislation and the stocks themselves do not yet comply with the **energy *acquis***[57]. In 2000 it was adopted a strategy document on the establishment of oil stocks and considered that it would need a period of 10 to 25 years to build up the required oil stocks. Regarding oil supply crisis management measures, progress has continued with the adoption of implementing legislation in 2002 defining restrictions on energy consumption. With regard to the opening of the electricity and gas markets, Latvia has made progress concerning the preparations for opening the electricity market. Nevertheless, a great many issues still need to be resolved before an internal energy market can be set up, such as restructuring and privatisation programmes, the opening of the market and the arrangements for access to the networks. Complete alignment with the two directives to eventually set up the internal electricity and gas markets is far from being achieved. The necessary institutional structure to ensure administration and regulation of the sector has been set up, but needs to be further strengthened and made more independent. In the area of energy efficiency, alignment with the *acquis* is only partial. In November 2000, the government approved the national energy efficiency strategy and in January 2001, a set of legal measures to implement this strategy. Implementing legislation was adopted in 2002 to promote the use of renewable energy sources and domestic production of heat and electricity in combined heat and power plants. As regards **nuclear energy**, Latvia has concluded a Full Scope Safeguards Agreement with the IAEA and an additional protocol.

[56] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[57] Commission of the European Communities. 2002 Regular Report on Latvia's Progress Towards Accession. Brussels: 2002.

5.9 Lithuania

Energy intensity numbers have decreased between 1992 to 1999 at the expenses of primary energy (see Figure 5-23). When compared with other Baltic states, Lithuania is the one with the highest energy intensity and is still far above EU15. **CO_2 emissions** were reduced at a higher rate than TPES.

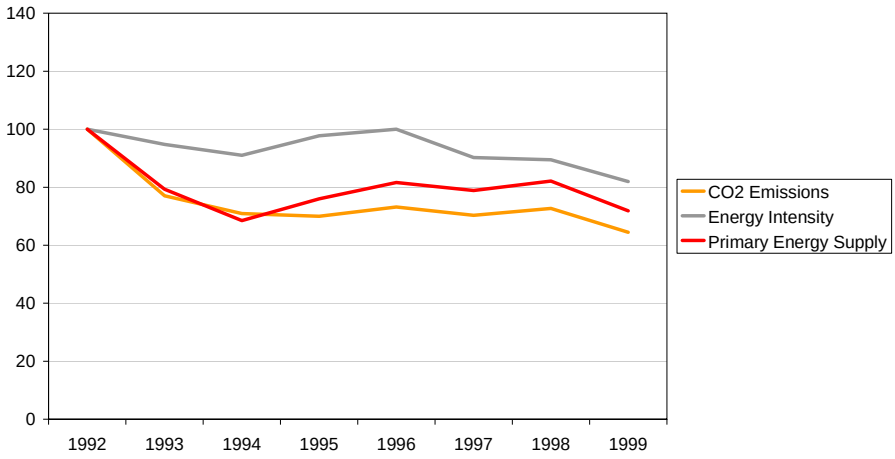

Figure 5-23. Lithuania's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Lithuania has three major sources of **primary energy**: nuclear, gas and oil. Oil is nevertheless the main source. Renewable combustible and waste energies showed an important increase in primary energy supply from 1992 to 1999. Furthermore, all other energy sources remained with the same global influence (see Figure 5-24).

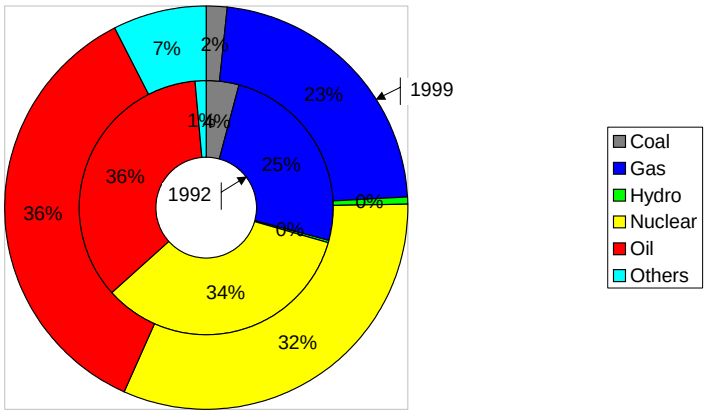

Figure 5-24. Lithuania's Primary Energy Supply Distribution by Fuel

Lithuania's energy balance sector by sector resembles Latvia's behaviour. Major differences are the important share of electricity's losses and own use and the relatively low share of industry's consumption of oil.

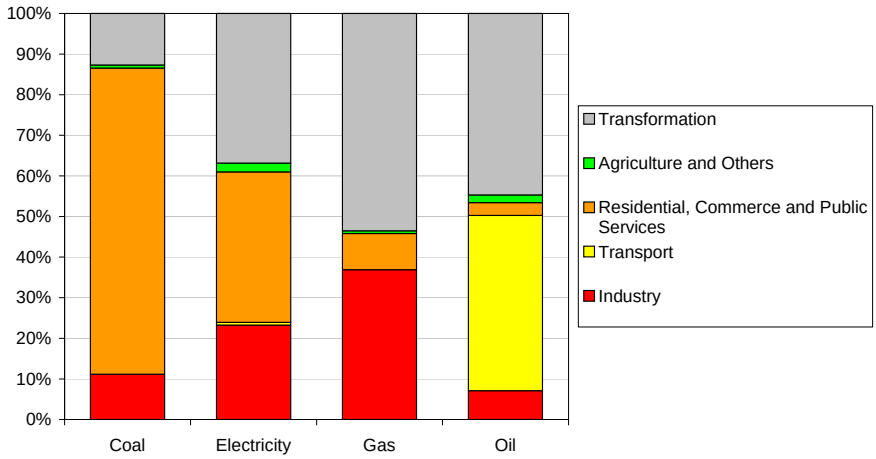

Figure 5-25. Lithuania's Energy Consumption Distribution by Sector and by Fuel, in 1999

Lithuania main **connections** are Russia orientated, towards Belarus. Lithuania has signed an agreement with Estonia, Latvia, Russia, and Belarus, which gives Lithuania the option to transmit electric power through Belarus to other markets, such as Slovakia. As mentioned above, Lithuania integrates also BALTREL, which plans to connect with Sweden and Finland. A pipeline assures oil transport responding to the exploration of offshore capacity. Gas is also connected with neighbour countries[58].

Lithuania has achieved a reasonable level of alignment with the **energy *acquis***[59], but needs to maintain its efforts, notably on the internal energy market, oil stocks and nuclear energy. Progress in the sector has been based on the national energy strategy adopted in 1999. Since the last annual report Lithuania has adopted an action plan implementing the strategy. Little progress was made on security of supply. The emergency oil stocks stand at approximately 40 days and, despite the adoption in 2001 of the Law on the State Oil Product Stocks, financial means for the necessary investments in building up those have to be available. Although plans for diversification throughout the energy sector, Lithuania remains heavily dependent on Russian energy supplies (notably oil, gas and nuclear fuels). Lithuania concluded a deal securing a second source from a Russian refinery and aiming at complementary privatisation. This should improve security of supply. With regard to the internal energy market, progress has been made, although there have been delays with restructuring and privatisation of the sector. In the electricity sector in particular, in 2000 Lithuania, Estonia and Latvia decided to create a common Baltic electricity market and establish links between the three countries. The Law on electricity adopted in 2000 provides the initial basis for alignment, preparing the opening of the market and increasing the monitoring powers of the National Control Commission for Prices and Energy. Lithuania will gradually open up the market, which should be fully open as from 2010. The Law on natural gas entered into force in 2001 and provides for opening up 80% of the market. In the area of energy efficiency and renewable energy an energy efficiency programme for 2001-2005 was adopted. In the nuclear energy sector, the Accession Partnership identifies as a short-term priority the establishment of a comprehensive, long-term energy strategy and a decommissioning plan for the Ignalina power plant in keeping with the commitments entered into under the NSA agreement. The Lithuanian government has honoured its undertaking to close Ignalina. In June 2001 the European Council adopted a report on nuclear safety recommending twelve specific measures to ensure safe operation of the Ignalina nuclear power plant until its final closure and of other nuclear installations. Measures should also be taken to ensure adequate resources for the regulatory

[58] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[59] Commission of the European Communities. 2002 Regular Report on Lithuania's Progress Towards Accession. Brussels: 13.11.2002.

authorities. It must be added that Lithuania has concluded a Full Scope Safeguards Agreement with the International Atomic Energy Agency (IAEA) and an Additional Protocol to the same Agreement.

5.10 Malta

Malta presented an evolution in **energy intensity** similar to Cyprus: 1992 and 1999 values remained similar, due to a GDP and TPES increase in the same rate. Its levels are near EU15 (see Figure 5-2). Malta has increased its **CO_2 emissions** but smother than primary energy's evolution.

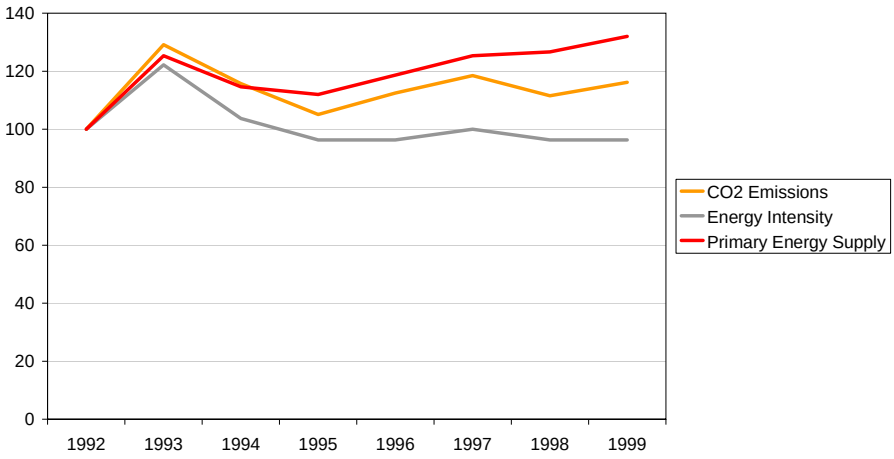

Figure 5-26. Malta's Primary Energy Supply, Energy Intensity and CO2 Emissions Evolution (100 = 1992)

Malta is, nowadays, 100% dependent on oil (see Figure 5-27). It had some coal consumption, but the power plant fuelled by coal was shut down in 1995. All of **energy supply** is imported.

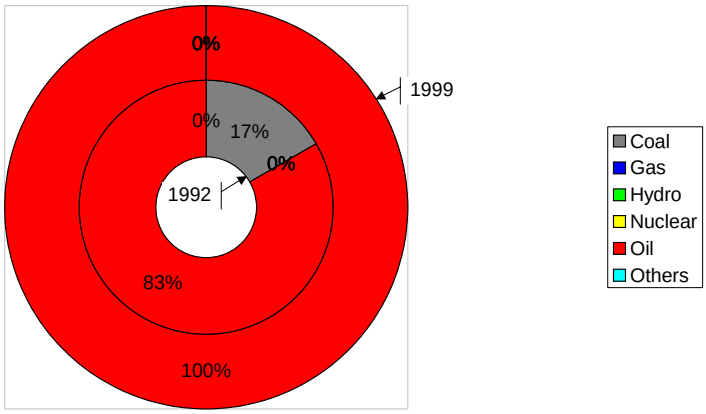

Figure 5-27. Malta's Primary Energy Supply Distribution by Fuel

Residential, commerce and public services are the principal consumers of **electricity** (see Figure 5-28), followed by industry, sector for which the consumption is basically electricity. The industry and transformation sector divide consumption in almost equal parts. **Oil** consumption is divided between the transformation and transport sectors.

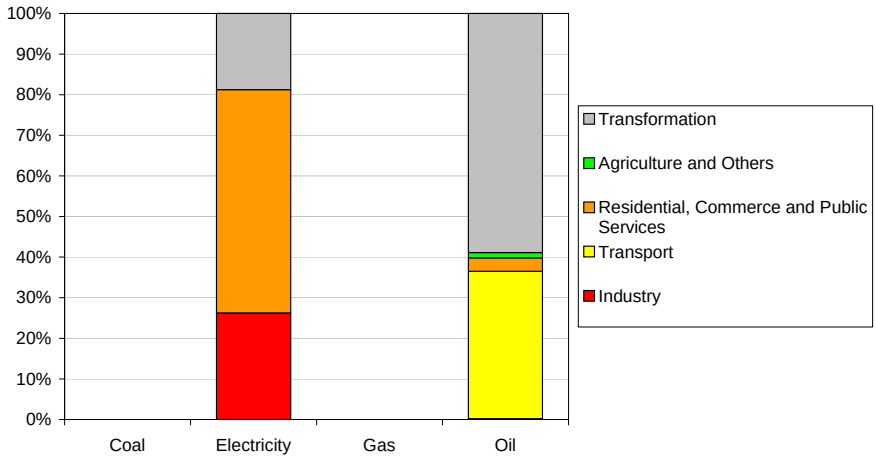

Figure 5-28. Malta's Energy Consumption Distribution by Sector and by Fuel, in 1999

Malta is not **connected** with any other countries. It supplies through a high voltage grid to Malta and Gozo[60].

Malta has achieved a relatively high level of alignment on the **energy *acquis***[61], but must continue to work towards full transposition, especially as regards security of supply and energy efficiency. Malta also still has to adopt a national energy strategy. In terms of internal energy market an important step towards compliancy with acquis was setting up of the Malta Resources Authority in 2001. Nevertheless a particular effort to implement the Authority Act, to restructure the electricity market monopoly dominated by Enemalta and to align legislation with *acquis* should be considered. There are no natural gas or solid fuel markets in Malta. As far as security of supply is concerned, in 2002 a series of regulations aiming to align its legislation with the *acquis* on oil stocks and oil supply crisis management were adopted. As regards energy efficiency alignment of legislation with the *acquis* is necessary. In 2001 it was adopted the Product Safety Act to move further into line with the *acquis*, especially as regards labelling standards and energy efficiency. The use of renewable forms of energy should be promoted: apart from tax relief (VAT) on solar power, Malta has not provided any other incentive for saving energy or using renewable energy sources. Malta should act to bring itself into line with Euratom standards and procedures, in particular safeguards. Malta has concluded a full scope safeguards agreement with the International Atomic Energy Authority (IAEA), but has not yet signed the additional protocol to the agreement.

[60] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[61] Commission of the European Communities. 2002 Regular Report on Malta's Progress Towards Accession. Brussels: 2002.

5.11 Poland

Energy intensity in Poland decreased significantly from 1992 until 1999, reflex of a massive growth of Poland's GDP, with primary energy almost unchangeable during that period. Poland is half way between the high energy intensive AC and the EU15 (see Figure 5-29). Poland signed the agreement in the reduction of 6% of its **CO_2 emissions** by 2012, but its strong dependence on coal induced little reduction on CO_2, proportional to TPES.

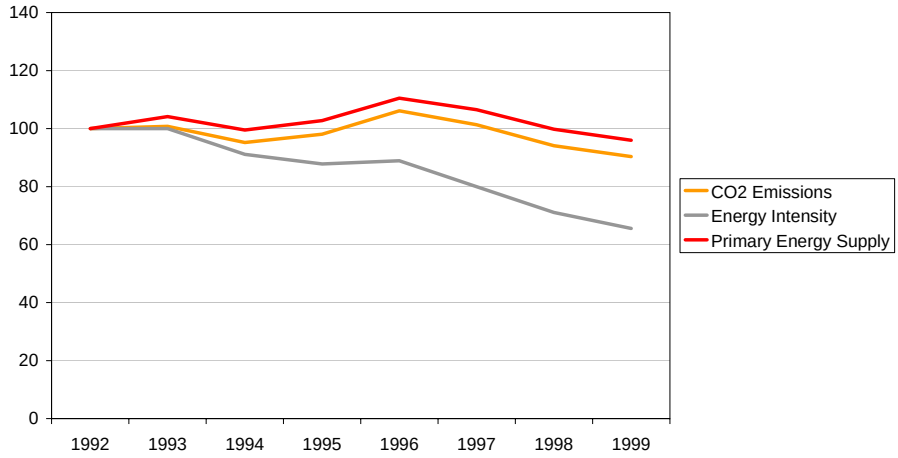

Figure 5-29. Poland's Primary Energy Supply, Energy Intensity and CO_2 Emissions Evolution (100 = 1992)

Coal is still the largest source for **primary energy** even though there has been a reduction on total primary energy consumption in the 90's. Oil increased its use strongly. Poland has no nuclear facilities. Hydropower produced an inexpressive amount of energy. Coal production in Poland guaranties internal consumption and allows also a significant exportation.

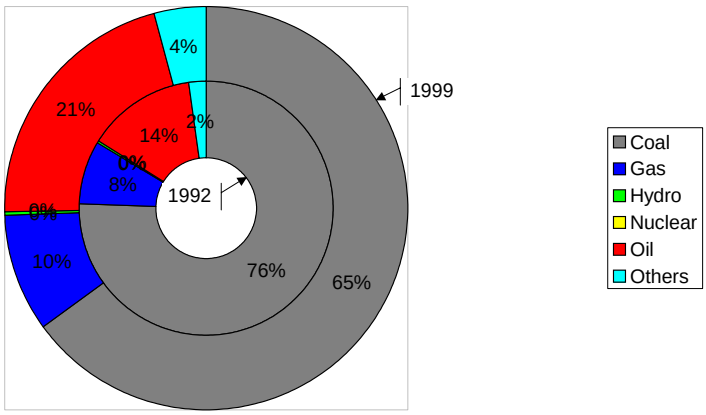

Figure 5-30. Poland's Primary Energy Supply Distribution by Fuel

Poland's energy consumption by sector is similar to the EU15 profile. The exceptions are a reduced share of **gas** for transformation and a representative consumption of **oil** for agriculture and others.

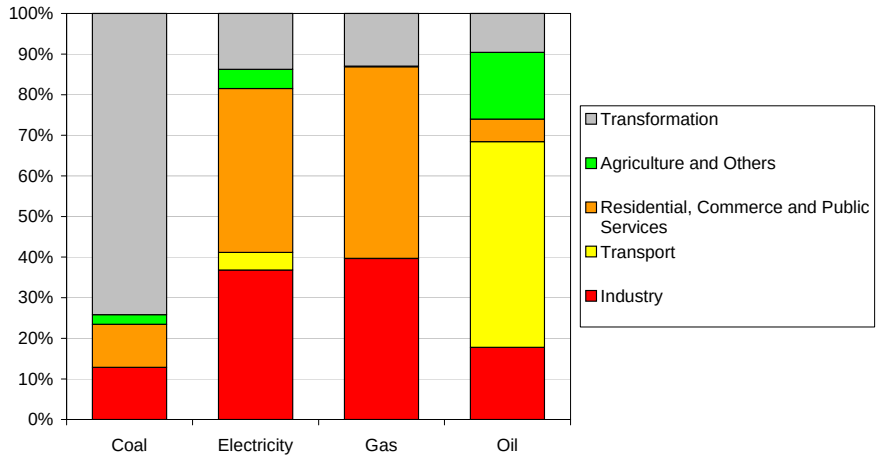

Figure 5-31. Poland's Energy Consumption Distribution by Sector and by Fuel, in 1999

Concerning **energy networks** Poland is connected through major gasoducts to all its ex-USSR neighbours (Lithuania, Ukraine and Belarus) and to Germany. Existing facilities provide connection to all major points of supply of Europe's network, but infrastructure connecting to Slovak and Czech Republic is still lacking. An oil pipeline connects to central Russia and to Germany. Internal connections between refineries and oil fields also exist. Connections to southern and western Europe are only possible through Germany or through Belarus connection to southern neighbours. Electricity grid provides strong connections with Belarus and Ukraine, from the former POKOJ system. Right now, it is strongly linked to other CENTREL countries, integrating UCPTE system[62].

Poland has reached a mid-point in aligning with the energy *acquis*[63], with progress still to be made in adopting legislation and setting up structures to implement it. Since the last report, Poland has made advances in the areas identified as significant such as the preparation of the internal energy market and securing the energy supply, including creating adequate oil stocks. The last report identified security of supply as a critical area which presented problems for Poland. The law amending the Act on national reserves entered into force in 2002. Poland has made steady progress towards the required level of 90 days. There has been some progress as regards the internal market and competitiveness, but Polish legislation is still not completely aligned with the *acquis*. In 2002, the extent to which the Polish electricity market had opened up continues to be contingent on residual long-term agreements between the Polish grid company and the electricity producers. There has been little progress in restructuring the gas sector. However, more extensive restructuring is needed, particularly to ensure that the market is opened up in accordance with objective, transparent and non-discriminatory criteria. In the solid fuel sector, the restructuring of coal mining scheduled for 1998-2002 has been implemented without delay. Problems remain, nonetheless. Preparations for privatisation must be more intensive, the necessary budget must be released and greater attention must be paid to the future role of coal in the country's energy planning. In the oil sector, privatisation entered into a delicate stage and it should continued. The level of energy efficiency is very low compared with the European Union.

[62] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[63] Commission of the European Communities. 2002 Regular Report on Poland's Progress Towards Accession. Brussels: 13.11.2002.

Poland will need to ensure compliance with Euratom requirements and procedures, particularly as regards ensuring that safety is monitored. It was signed an agreement and an additional protocol with the International Atomic Energy Agency (IAEA) and has completed the ratification of the Energy Charter Treaty. In 2002, the Government adopted several ordinances aimed at transposing the *acquis* on European efficiency requirements for household equipment and hot-water heater boilers.

5.12 Romania

Romania presents a reduction in the **energy intensity** since 1992. As GDP suffered little changes (Figure 5-2), energy intensity variations are a reflex of the reduction of primary energy supply in the country. **CO_2 emissions** have suffered an intensive reduction since 1992 following TPES tendency (see Figure 5-32).

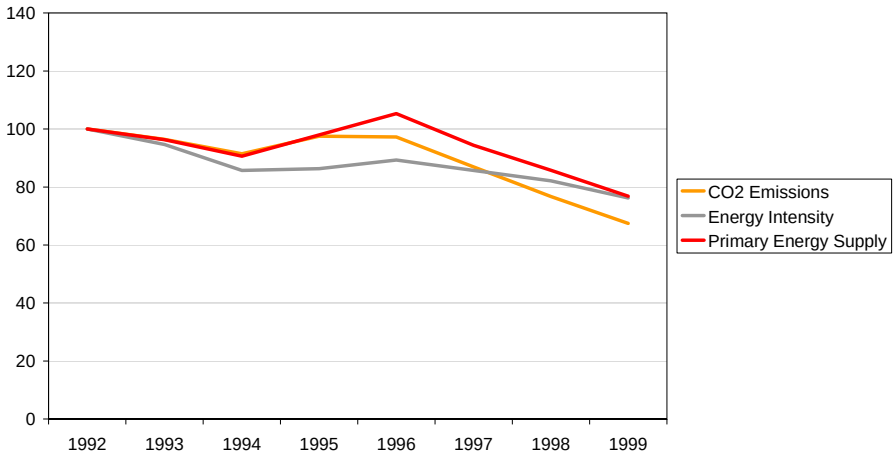

Figure 5-32. Romania's Primary Energy Supply, Energy Intensity and CO_2 Emissions Evolution (100 = 1992)

Romania produces a large amount of its **primary energy** needs (coal, oil and gas). Furthermore, Romania exports part of its production. The opening of a new nuclear power plant in 1996 provides 4% of total primary energy supply, in 1999. Coal and gas share decreased during this decade, with an increase in the other energy sources (oil, hydro and renewable combustibles and waste).

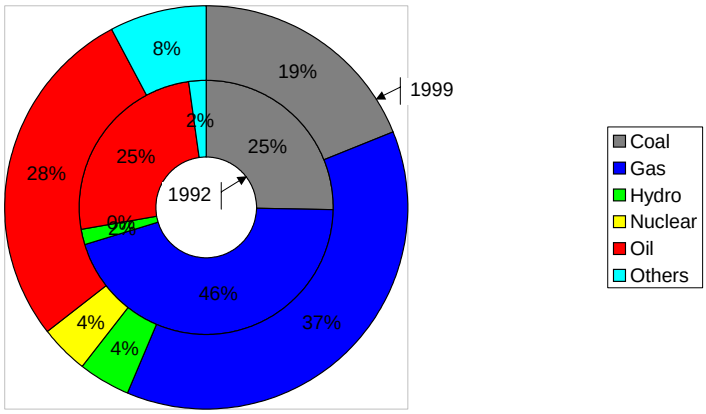

Figure 5-33. Romania's Primary Energy Supply Distribution by Fuel

Coal consumption follows the EU15 pattern. **Electricity** has a significant share of distribution losses and own use. The transformation sector is responsible for a strong share on **gas** and **oil** consumption. Transport loses importance to industry in what concerns oil consumption.

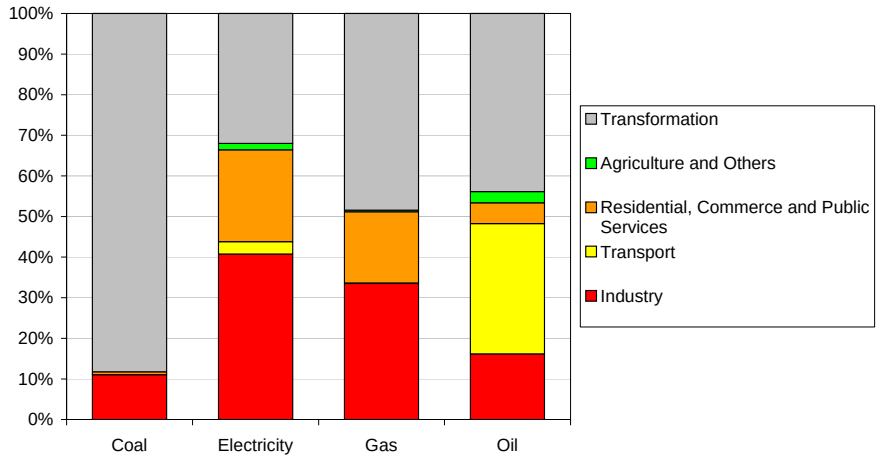

Figure 5-34. Romania's Energy Consumption Distribution by Sector and by Fuel, in 1999

Romania has large pipeline facilities, especially in the south of the country. Still, this pipeline is not connected to any foreign country. Gas pipeline is weakly connected to every north and west neighbour, while strong **connections** exist for Bulgaria and Ukraine. Strong investments are being made in natural gas infrastructures, especially in the modernization of existing facilities. Romania has a large very high voltage network (750 and 400 kV). Strong electrical connections exist with Ukraine and Bulgaria. Hungary and former Yugoslavia, at a smaller extent, are also well connected, while Moldavia is also connected at a lower voltage and a smaller capacity[64].

Romania must elaborate a clear medium-term policy for restructuring the energy sector, establish annual action plans and strictly implement these programmes to be align to the **energy *acquis***[65]. As regards security of supply, no progress has been made. The *acquis* covering security stocks and oil supply crisis management measures has still not been transposed and there is no reliable system for monitoring oil stocks. Romania has sufficient storage capacity to meet the requirements of the *acquis*, but it does not have the requisite stocks of oil products. Regarding internal energy market, in the electricity sector, market openness was increased to 33%, while gas sector was increased from 10% to 25%. As with the electricity sector, gas prices have been adjusted to reflect production costs. As far as energy efficiency and the promotion of renewable energy is concerned, little substantial progress was made in 2002.

In the field of nuclear energy, the Commission report on nuclear safety recommends seven specific measures. These include increasing the capability and resources of the regulatory authority, establishing an on-site emergency centre and carrying out fire hazard analyses. Moreover, due attention should be given to preparing for the implementation of Euratom safeguards. It should be noted that Romania has concluded a full-scope safeguards agreement and an additional protocol with the International Atomic Energy Agency (IAEA).

[64] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[65] Commission of the European Communities. 2002 Regular Report on Romania's Progress Towards Accession. Brussels: 2002.

5.13 Slovak Republic

Energy intensity in Slovakia decreased more than 25% from 1992 until 1999, despite being still far above EU15 average (see Figure 5-2). Regarding **CO_2 emissions** Slovakia's trend is of reduction and similar to TPES's.

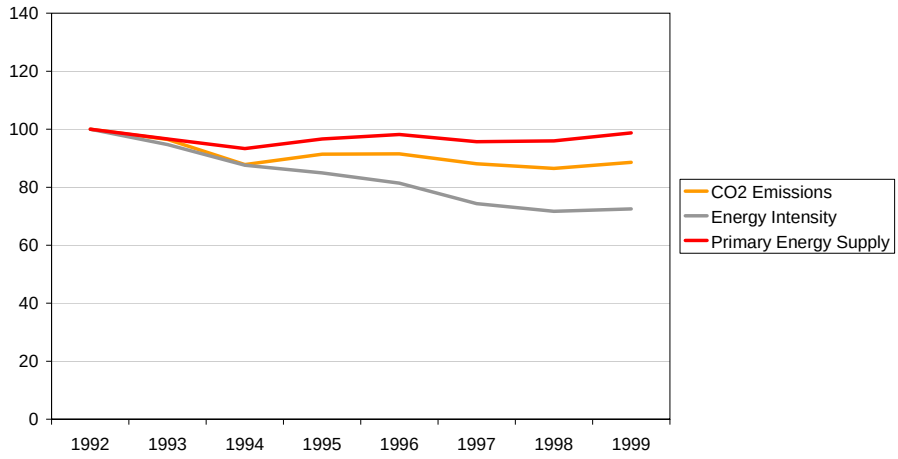

Figure 5-35. Slovak Republic's Primary Energy Supply, Energy Intensity and CO_2 Emissions Evolution (100 = 1992)

Diversified sources with equilibrium between oil, coal, nuclear and gas summarize Slovakia's **primary energy** use. Hydro augmented its position among primary energy sources, having more than doubled its production from 1992 to 1999.

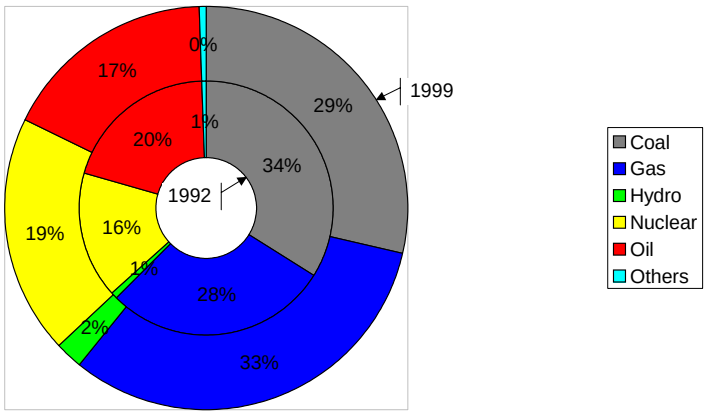

Figure 5-36. Slovak Republic's Primary Energy Supply Distribution by Fuel

Coal's consumption by sector presents a very different profile form the EU15 as transformation is only half of the consumption and agriculture and other uses are significant. **Electricity** and **gas** consumption follow a similar distribution by sector to the EU15. On the other hand, industry represents a large share of **oil** consumption.

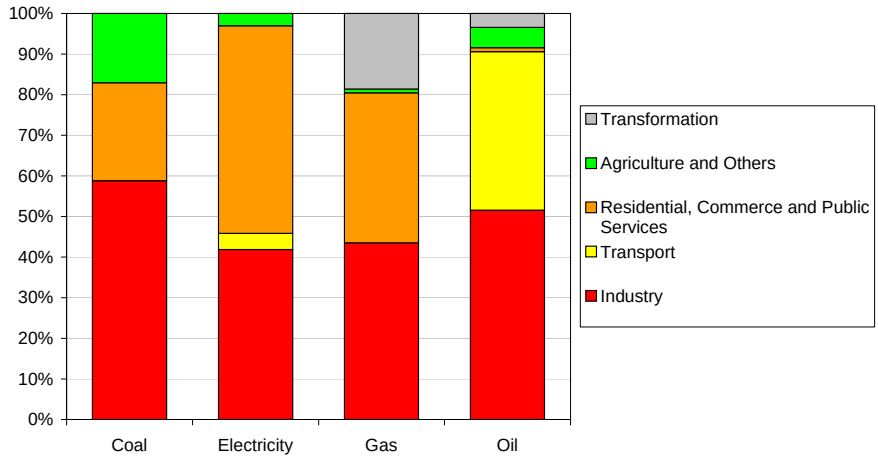

Figure 5-37. Slovak Republic's Energy Consumption Distribution by Sector and by Fuel, in 1999

Slovakia is connected through major gasoducts to Czech Republic, Hungary and Ukraine. Existing facilities provide connection to all major points of supply of Europe's **network**, but infrastructure connecting to neighbours like Austria and Poland is still lacking, so that regional markets can be a reality. An oil pipeline provides similar connection, adding Austria to the referred connected countries. Here again, connections to Poland are the most important lacuna. Electricity grid provides strong connections with all neighbours except Austria. All neighbouring countries lack still reinforcement, in order to provide a concrete possibility of a regional market on this area, integrated in the UCPTE and CENTREL network[66].

Some efforts should be done to ensure that Slovakia reaches the **energy *acquis***[67] In particular, matters such as the adjustment of monopolies (including import and export issues), access to networks, energy pricing, the establishment of mandatory oil stocks, State intervention in the solid fuels sector, energy efficiency and fuel quality standards needed to be closely monitored. A legislative framework for strategic oil reserves entered into force in 2001 and constitutes the legal basis for an increase in oil stocks. Nevertheless, efforts should continue to be made to increase reserves once one-third of the required level had been reach. With regard to the establishment of the internal energy market, Slovakia has made progress in the electricity and gas sectors and has taken additional steps to align with the *acquis*. The privatisation of the gas and electricity State enterprises is continuing. However, the preparations for the market still necessitate new measures, in particular as regards legislation and restructuring.

[66] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

[67] Commission of the European Communities. 2002 Regular Report on Slovak Republic's Progress Towards Accession. Brussels: 2002.

The measures required include the establishment of a transport network operator. The opening of the electricity market is proceeding in two stages. Following the entry into force in 2002 of the Ministry of Economy decree laying down the smallest volume of annual electricity and gas consumption for eligible customers, initial market opening of the electricity market started in 2002 with liberalisation for the largest consumers (corresponding to 31% of the market). As regards energy efficiency and renewable energy**,** the labelling of electrical household appliances entered into force in 2002. In the field of nuclear energy, Slovakia operates two nuclear power plants located at Bohuniceand Mochovce. Two of the four units at Bohunice have been classified as non-upgradeable, and must be shut down. The Government has drawn up a decommissioning plan. In the case of Mochovce, the two reactors should be upgraded and nuclear safety measures should be taken. Slovakia has made progress in this area. In November 2000 it adopted the framework procedure and timetable for the decommissioning of the two Bohunice units, which cannot be upgraded. The Slovak authorities have taken additional measures as regards nuclear safety in the other two units. The programme to improve safety compared with the Mochovce nuclear power station has been completed for half the power station, with the exception of post-accident monitoring. The EU Council adopted a report in June 2001 on nuclear safety in the context of enlargement. This report advocates seven specific measures for Slovakia which has accepted the report's recommendations.

The two V1 reactors of Bohunice Nuclear Power Plant are subject to early closure commitments. In 1999 the Slovak government decided that these are to be closed down by 2006 and 2008 respectively. These closure commitments must be respected and therefore duly included in the Accession Treaty. In addition, since the last report, Slovakia has reinforced the Slovak Nuclear Regulatory Authority and its expertise has been regarded as satisfactory by third-party bodies. It must also ensure full compliance with Euratom requirements and procedures.

5.14 Slovenia

Slovenia's **energy intensity** figures changed little during the last decade – following the EU15 pattern of combined increase of GDP and primary energy consumption – being around twice of those of the EU15 (see Figure 5-2). Slovenia **CO_2 emissions** have increased substantially and have an almost coincident evolution with TPES.

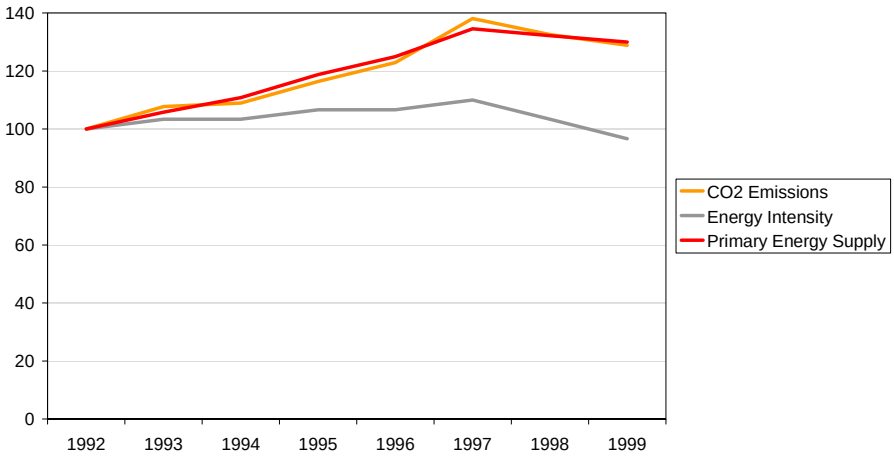

Figure 5-38. Slovenia's Primary Energy Supply, Energy Intensity and CO_2 Emissions Evolution (100 = 1992)

Primary energy in Slovenia is the country with more diverse sources of energy. It is balanced between three main sources of energy (coal, nuclear and oil) and has maintained its distribution by source, except in oil where the share has grown of importance on energy supply, while the others maintained similar levels.

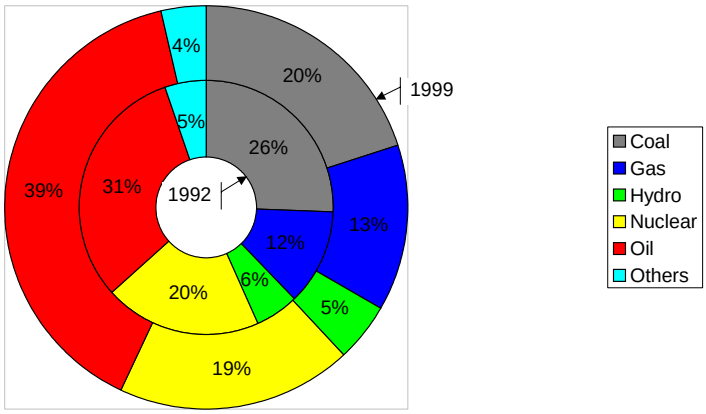

Figure 5-39. Slovenia's Primary Energy Supply Distribution by Fuel

Coal and electricity distribution by sector follow the EU15 pattern. However in gas and oil there are significant differences, due to industry's importance, namely, a particularly higher share in gas (more than 70%) and a non-significant consumption of oil; transformation sector shares in gas and oil are also smaller than in the EU15.

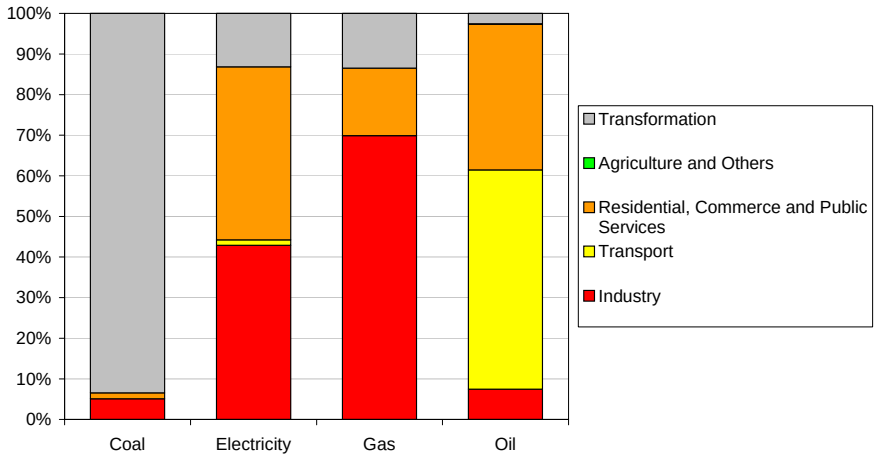

Figure 5-40. Slovenia's Energy Consumption Distribution by Sector and by Fuel, in 1999

An oil pipeline links Slovenia with Croatia and Yugoslavia. There is also an oil pipeline for refinery supply. This pipeline imports light Croatian crude to the refinery, as well as lower-quality Russian crude supplied through Hungary.

The gas transmission **network** has three connections to foreign gas pipelines – Austria in the northeast, Italy in the west, and Croatia in the south. Slovenia receives gas from storage facilities via a link from Croatia, and in turn, transports Russian gas to Croatia. Slovenia at present has no compressor stations.

The Slovene electricity network is part of the Union for the Coordination of the Production and Transmission of Electricity (UCPTE) grid. The national electricity grid consists of 110 kilovolt (kV), 220 kV, and 440 kV networks. It is connected mainly with Croatia, due to ancient Yugoslavia. Further connections exist, with Austria and Italy. Hungary connections are the weakest[68].

[68] http://eurogas.org/index2.htm; European Commission- Directorate General. Trans- European Energy Networks- Policy and Actions of the European Community. Brussels, 1997.

The Slovenia should be in a position to comply with the energy *acquis* [69]. However, matters such as the adjustment of monopolies (including import and export issues), access to networks, energy pricing, State intervention in the solid fuels sector, establishment of mandatory oil stocks, improvement of energy efficiency and fuel quality standards needed to be closely monitored. No major difficulties were foreseen with regard to compliance with Euratom provisions. Satisfactory progress has been made in the area of security of supply. Constituting oil stocks to cover 90 days' consumption has been pursued according to the government plan and currently a third of the required reserves has been accomplished. Slovenia is not equipped with sufficient infrastructure to store these reserves. Slovenia has maintained steady progress as regards energy competitiveness and the internal energy market. A number of decrees have been adopted preparatory to the opening of the energy market and concerning, *inter alia*, the setting-up of an independent regulatory authority. The internal electricity market was opened in 2001. Slovenia has continued to promote a number of initiatives, such as awarding financial incentives, to improve energy efficiency. Nevertheless, further progress must be made in this area. Where administrative capacity is concerned reinforce is priority. Regarding nuclear issue Slovenia has continued to make progress in finalising the programme to modernise the Krsko facility between 1998 and 2000. In addition, the Slovenian and Croatian Governments have signed an agreement concerning their joint ownership of this facility. Its level of nuclear safety is comparable to that of western European nuclear plants. However, additional measures must still be introduced. The Council report identifies five specific measures to guarantee the safe operation of the Krsko facility and other nuclear sites, which include, *inter alia*, seismic qualification of the facility and the adoption of a national emergency plan. Slovenia will also have to ensure that it complies fully with Euratom requirements and procedures. A Full Scope Safeguards Agreement with the International Atomic Energy Agency (IAEA) was adopted.

[69] Commission of the European Communities. 2002 Regular Report on Slovenia Progress Towards Accession. Brussels: 2002.

6 OPTIONS FOR ADDRESSING PROBLEM AREAS BEFORE AND BEYOND ACCESSION

6.1 Security of supply

In general the Accession Countries are highly dependent on energy imports. The fraction of imported goods in the energy sector of the EU27 will substantially rise up to the year 2030 (see chapter 1). Oil and gas resources within the EU27 will decrease. Due to the high subsidies coal will be no longer competitive. Besides, some member states focus on the nuclear power phase-out[70].

To overcome these obstacles a well organised and diversified energy mix is needed. Possibilities have to be implemented in order to diversify the import of Energy. Therefore, connections and capacities of the gas, oil and electricity networks of the ACs have to be sufficient. Additionally, safety reserves of petrol products should be established. According to the EU regulation 90 days of the average oil consumption have to back up in each accession country. Finally, the efficiency of the energy production, distribution and consumption should by sustainable increased.

6.1.1 Oil stocks

Most of the EU accession countries are in progress with the oil stocks construction (Table 0-1). Only Bulgaria and Romania have inadequate oil stocks; but they have also started to adopt the necessary legislation. By the time they get into the European Union they will have the required oil stocks or they will be granted a transitional period. Nevertheless, for the some accession countries besides the technical aspects especially legislative and administrative questions have to be addressed (se chapter 4). To do this almost all countries had been granted a transitional period up to the year 2005 to 2012 depending on the particular accession country.

There is a proposal for the EP to extend the safety reserves of oil to 120 days[71]. This requires even more investment for the EU countries and for the AC as well. It can be supposed that the extension would cause financial problems primarily for the AC and secondary for the EU countries. As a good example on how to solve the storage question especially in the context of necessary investment Slovenia will rent storage utilities from Germany. It should also be thought about support strategies like funded international projects to help the accession countries building up their storage capacities.

There are no EU regulations concerning safety reserves of natural gas. This regulation could raise the security of supply of the EU. Recently there has been an issue in Hungary regarding the safety reserves of natural gas, because the country has run out of reserves and limitation might be announced.

[70] Jakob Preuss; Energieversorgungssicherheit in Europa am Beispiel Gas; Berlin 08.2002; url: http://www.auswaertiges-amt.de/www/de/infoservice/download/pdf/planungsstab/energie.pdf

[71] EC; Mitteilung der Kommission an das Europäische Parlament und an den Rat - Energiebinnenmarkt: Abgestimmte Maßnahmen im Bereich der Energieversorgungssicherheit; Brüssel 2002; url: http://europa.eu.int /smartapi/cgi/sga_doc?smartapi!celexplus!prod!CELEXnumdoc&numdoc=52002DC0488&lg=DE

6.1.2 Energy Diversification

A good way to improve the security of supply is a high diversification of energy sources within the future European Union. This enables a flexible response on import shortage of particular primary energies[72].

What concerns this aspect some of the accession countries are quite well diversified, namely: Bulgaria, Czech Republic, Hungary, Latvia, Romania, Slovak Republic and Slovenia. Nevertheless, these countries are often depended on fossil fuels what causes other problems (see chapter 4). Therefore, efforts should be undertaken to increase the application of renewable energy sources (RES)[73].

Special attention should be driven towards Malta and Cyprus, which are completely not diversified and completely depended on oil dependencies (Chapter 4.4, 4.10). On the one hand side a well-structured system to handle the oil stocks is needed. On the other hand side these countries should invest in RES. Cyprus already started to build solar panels for decentralised energy supply. This strategy should be followed and additional renewable resources should be located and applied.

6.1.3 Oil dependencies

Most of the Accession Countries are highly dependent on oil imports from the former Soviet Union. Oil pipelines are connecting the Accession States with Russia such as Druzhba (Friendship) north line Russia-Poland towards Germany; south line Russia-Hungary-Slovakia-Czech Republic. These pipeline connection have sufficient capacity. Nevertheless, further constructions are planned (chapter 4). Especially Estonia, Latvia and Lithuania should pay attention to new transport lines beside the existing Russian connections. Since Romanian connections to the neighbouring states are quite poor they should build up new transport capacities.

The Adria pipeline can be considered as an alternative for diversifying the dependency on Russian oil. It connects Croatia as seaport for oil from Tunisia and other sources, Slovenia and Hungary. Some ACs are not only connected to Russia but also to each other and some links have been established to the Member States. In this context the Czech Republic, Hungary, Poland, Slovak Republic and Slovenia are well equipped.

6.1.4 Gas dependencies

Analogues to the oil sector the Accession Countries are also highly dependent on natural gas imports especially from Russia. Exceptions are Malta and Cyprus since there is no natural gas utilisation (Chapter 4.10, 4.4). Most of the natural gas coming from Russia is transferred through pipelines such as Yamal: Russia-Belarus-Poland-Germany; Russia-Ukrain-Slovakia-Austria-Slovenia.

Slovenia is connected to Algeria and Tunisia via Italy through a pipeline as an alternative. The pipelines connecting the CEE countries to the EU are small in length and capacity, e.g. Hungary-Austria and Czech-Germany. On the other hand some projects are planned in order to connect countries, e.g. the first natural gas pipeline between Hungary and Romania. The project will end in 2004 as a part of a natural gas pipeline systems connecting Turkey to Austria, through Bulgaria and Romania.

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[72] Amt für amtliche Veröffentlichungen der Europäischen Gemeinschaften; Luxemburg 2002; ISBN 92-894-1347-6

[73] BMU; Neue Energieversorgungsstruktur unter Einbeziehung der Erneuerbaren Energien; Berlin 07.2003; url: http://www.bmu.de/de/1024/js/base/

In order to improve the transport possibilities to and from the Member States and through the country especially Bulgaria, Estonia, Latvia and Lithuania should raise their efforts.

6.1.5 Electricity dependencies

In general the Accession Countries are well connected to each other due to the communism time. However, some lacks exist for the Czech Republic to Poland (chapter 4). The Accession Countries have some connection to the EU, such as Hungary to Austria and the Czech Republic to Germany but further strengthening is needed. Projects such as Baltrel could ease the lack of connection to the EU countries but further extensions are needed.

Electricity networks in most of the accession countries are interconnected with different capacities. For example, Romania is strongly interconnected to Bulgaria, but with Hungary the connection capacity is quite weak[74].

Poland also has electricity connections with Ukraine and Belarus. The north-south and the east-west connections are being expanded, as part of the EU's Trans-European Energy Network (TEN) project, with a new link to Lithuania.

However, electricity networks of Lithuania are not interconnected to Member States but through the framework of a planned project, called Baltic Ring, the power lines to those of Western Europe would be improved[75].

6.1.6 Recommendations

As described before in detail, the energy supply of the European Union concerning oil, gas and electricity demand is not secure. Therefore, the European policy should concentrate on the support on:

- the implementation of legislative and administrative measures to handle a sufficient energy storage capacity. Possibilities to include also gas storage should be discussed.
- methods for the improvement of energy diversification in some Accession Countries,
- especially increase of renewable energy as a local energy source;
- strategies for efficient energy consumption, e.g. support of local authorities responsible for inspection, certification etc.
- Innovative strategies in to increase the efficiency of the energy conversion and distribution, e.g. innovative conservation techniques.
- the construction and reconstruction of energy networks connecting the Accession Countries of the European Union.

[74] http://fossil.energy.gov/international/romnover.html

[75] Commission of the European Communities: Regular Report on the Accession Countries; chapter 14 Energy

6.2 Nuclear safety

Most of the NPPs in the ACs are based on Soviet technologies. Some of them will be closed down[76] at fixed dates in the years to come, which will reduce the nuclear risk in Europe significantly if the deadlines will be kept and adequate found and international cooperation will be provided[77]. Due to the safety programs experts of nuclear energy are generally satisfied with safety conditions of the ACs nuclear power plants. On the other hand experts repeatedly emphasise the need for further efforts towards higher nuclear safety[78]. According to the already mentioned Council Report several specific measures have been recommended to ensure the safe operation of nuclear power plants such as nuclear legislation; resources of the regulatory authority; national emergency responses and other specified technical aspects.

Table 2. Ranking of NPPs in ACC and MS by risk (first 12)

Ranking of NPPs in ACC and MS by risk (first 12)		
No.	**Name of NPP**	**Country**
1	Kozloduy 1-4	Bulgaria
2	Ignalina	Lithuania
3	Calder Hall	GB
4	Bohunice 1-2	Slovakia
5	Chapelcross	GB
6	Bradwell	GB
7	Hinkley Point	GB
8	Dungeness	GB
9	Sizewell A	GB
10	Oldbury	GB
11	Kozloduy 5-6	Bulgaria
12	Wylfa	GB

Source: Österreichisches Ökologie Institute für angewandte Umweltforschung

[76] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[77] Österreichische Ökologie Institut für angewandte Unweltforschung: Safety of Nuclear Power Plants in West- and Eastern Europe

[78] OMMIKK – Energiaellatas, energiatakarekossag vilagszerte – 2001/4 p 23

The study on the Safety of Nuclear Power Plants in Western and Eastern Europe ranks the NPPs across Europe by using 6 criterions such as reactor type, age, safety systems and design basis, physical properties, site criteria, maintenance and financial aspects. According to the study of the Österreichisches Ökologie Institute für angewandte Umweltforschung – Safety of Nuclear Power Plants in Western and Eastern Europe it can be extracted form the above table that the risky NPPs in ACs will be closed in the future and deadlines have been allocated to each of them. Therefore the negotiations and the allocation of money seem to be successful. These NPP-closures will significantly reduce the nuclear risk across the continent as well as in the world. On the other hand it is also very important to mention that the above table includes a considerably number of risky NPPs functioning in the Great Britain. The reason behind is that these English Magnox NPPs are aging. Furthermore according to the abovementioned study Britain intends to extend the lifetime of these NPPs from 40 years up to 60, which would increase the nuclear risk in Europe.

The accession of 10 countries to the European Union raises the key question of how safe NPPs should be in these countries when entering the EU. Contrary to other fields nuclear safety does not fall under the Community Acquis, since standards and safety regulations of nuclear facilities belong to the authority of national Governments, therefore there is no uniform Western European safety standard. It also means that there are no Western European safety standards to which new members have to adopt. Due to this situation, it seems very unlikely that the entry of ACs into the EU would in practice lead to higher nuclear safety standards. As a result it was announced that common nuclear standards and controls would be implemented. Moreover these nuclear standards and controls would create more equal market conditions for the NPP operators in the member states as well as in the ACs, which is becoming increasingly important due to the electricity market opening.

It was also stated by the Commission that *'to avoid any difference of treatment between the current Member States and the new Member States, the legal regime will need to be operational on the date of the enlargement of the Union, i.e. 1st January 2004'*[79]. This announcement indicates that the deadline suggested for the 'nuclear package', namely the date of the enlargement of the EU is not realistic or necessary and by stating such unachievable timetable the Commission will undermine the 'nuclear package' legislation[80].

Regarding the communication of NPPs to the public, Temelin in the Czech Republic can be mentioned as an example since it has caused protests and negotiations among the neighbouring countries especially in Austria.

New issues have appeared in the world concerning safety of NPPs, due to the unpredictable weather conditions. Because of the low level of water of the Danube the Romanian NPP (Chernavoda) had to stop its operations at 25.08.2003. Since the NPP could not get enough cool water from the river for cooling down the reactors in order to avoid overheating.

As already mentioned earlier one of the main problems of NPP-closure is the high share of NPPs in the energy production. This fact leads to modernisation and extension of their lifetime. Closures need to be well planed in advance in order to avoid electricity shortage; therefore building of new power plants or importing electricity is needed. Moreover the replacement of the old NPPs could increase the price of electricity generation since generally NPPs produce the cheapest electricity.

[79] http://www.euenergy.com/Nuclear%20package.html

[80] http://www.euenergy.com/EU%20Enlargement%20Watch%20-%20Nuclear.html

6.2.1 Recommendations

- More attention has to be paid to the NPPs not only in the ACs but in the member states as well, such as in Great Britain since those reactors are aging and some countries intends to extend these NPPs' lifetime. Funds and action plants should be provided in order to increase higher nuclear safety in Europe.
- Further efforts are needed form the ACs towards higher nuclear safety
- More attention should be paid for communication and trans-border cooperation in order to minimise the public resistance and protests against new NPPs.
- Since the unpredictable weather-related problems can be expected to appear from time to time in the ACs as well as in member states they should be adequately addressed.
- Closures of NPPs in the ACs need close attention to avoid electricity shortage. In addition replacement of old NPPs could increase electricity prices and needs heavy investments, which could increase public resistance as well. Therefore probably more funds could be allocated for NPP closures.

6.3 Coal Utilization

In general coal still plays an important role in the energy supply of the accession countries' and member states' economies. Similarly to the accession countries the EU's coal industry has been in serious decline between 1980-1999 – decrease from 278 million Mt to 102 million Mt – 63% in the EU[81].

This situation in the accession countries shows differences as well as similarities with the member states. The reduction of coal production, closure of mines, social issues and air pollution (for details please turn to chapter 2.2) are similar, but these problems originate from different (historical) sources and affect the – still in transition - economies of the Candidate Countries more painfully. Especially those countries have been hit badly by the effects of reduction of coal production, which are large coal producers such as Poland (9th among the major coal producers[82]) and the Czech Republic. Although the "worst is over" for coal producer countries in the region projections for 2010 show that production will decline by 20% in the accession countries but the speed of reduction will differ by country to country.

One of the main concerns of the coal producer countries in Central Europe is the accession to the European Union, more precisely the adaptation of "acquis communautaire" since it does not allow trade distortions[83]. Indirect and cross subsidies are considered as trade distortions, therefore certain accession countries will have to eliminate subsidies addressed to the coal industry.

[81] http://www.coalage.com/ar/coal_european_coal_industry/ - Ellen Ewart: The European coal industry: Hard times for hard coal

[82] http://www.eia.doe.gov/cabs/visegrad.html

[83] Trade distortions are considered as actions taken by the Governments in order to provide advantage for certain industries, firms. Examples: direct or indirect state subsidies, legislation, etc.

Significant number of coal producers among the accession countries mine brown coal, the utilisation of which generates hazardous air pollution. According to the Large Combustion Plants Directive (2001/80/EC) these coal-based power plants have to be equipped with desulphurisation filters in order to reduce their hazardous air-pollution. Relevant studies suggest that the proportion of coal-fired power generation capacity equipped with gas desulphurisation filters is only 40-50% by 2003[84] in the region. Therefore in those accession countries, which are faced with this problem, the need for financing such filters are high.

Unlikely to the EU countries there are accession countries, which use considerably amount of coal products for house heating in coal-boilers such as in Poland and Bulgaria. Although these coal-boilers are small in size due to their significant number they generate major hazardous air pollution and are barriers against higher energy efficiency.

Close cooperation is needed between the accession countries and member states in order to fasten knowledge and best practise exchange. Clean Coal Technologies can provide solutions for the problems of the coal industry in both regions. Encouraging is needed in the development of the Clean Coal Technologies in order to accelerate their promotion and to carry out more and even better solutions. The CARNOT program is a good example for it, since in December 1998 the Council of the European Union approved a multi-annual programme of technological actions promoting the clean and efficient use of solid fuels.

6.3.1 Recommendations

- Flue gas desulphurisation is only applied to 40-50% of coal-fired power generation capacity by 2003, and there is a great need to be financed. Therefore further enhancement of flue gas desulphurisation is needed.
- Air-pollution caused by small coal-based boilers below 50 MW should be addressed
- In order to join the EU, the accession countries must adopt the "acquis communautaire", which does not allow trade distortions (indirect and cross subsidies)
- Investments are needed for completing the reconstruction as well as for cleaning up ecological hazards (recultivation)
- Enhanced cooperation is needed in the field of Clean Coal Technologies

[84] World Energy Council: Restructuring and Privatising the Coal Industries in Central and Eastern Europe and the CIS

6.4 Environmental challenges: renewable sources and Kyoto protocol

Some ACs should emphasise more the importance of RES in their policies. Although these countries have started to implement the necessary legislations, action plans have not been fully carried out and funds have not been allocated to the appropriate programmes such as in the case of Romania and Bulgaria[85]. Most of the ACs has implemented a large part of the *acquis* in the field of energy efficiency and RES.

On the other hand a number of ACs have implemented action plans and allocated funds for increasing the share of RES in the countries' energy mix as well as it's overall energy efficiency; there are countries which set goals such as Poland reaching 7,5% of RES by 2010, Hungary aims to increase the share of RES to 6% by 2010.

Table 3. Shares of Renewables in TEPS for 2000

Share of Renewables in TPES (%)			
Country	**TPES (Mtoe)**	**A**	**B**
Bulgaria	18,8	4,3	1,2
Cyprus	2,4	1,9	1,5
Czech Rep.	40,4	1,9	0,4
Estonia	4,5	11,1	0
Hungary	24,8	1,6	0,1
Latvia	3,7	29	6,6
Lithuania	7,1	9,2	0,5
Malta	0,8	0	0
Poland	90	4,7	0,2
Romania	36,3	11,4	3,5
Slovak Rep.	17,5	2,8	2,3
Slovenia	6,5	12	5

A: Share of total renewables in TPES

B: Shares of renewables excluding combustible renewables and waste in TPES

Source: International Energy Agency: Renewables in Global Energy Supply 2002

[85] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

As it can be extracted from the above table the share of RES in the ACs is generally under the EU -average. Moreover, a very important difference between the ACs and the member states is that in the accession courtiers the share of combustible renewables and waste is very high in the RES. One of the reasons behind it is that in some of the ACs, especially in the Baltic region and in Romania, wood combustion is still commonly used for residential heating. In general the abovementioned numbers also indicate that other RE technologies, such as the utilisation of geothermal sources, wind-power and sun-collectors are not widely used in the ACs due to their high investment costs. Probably the only exception is hydropower in some ACs.

On the other hand, for example Romania has a great potential to utilise its alternative sources, namely their rivers for electricity generation, but currently the contribution of hydropower to the country's energy-mix is relatively small[86]. Furthermore there are potentials for utilising renewables in the ACs: Hungary, for example, has high potentials in the field of geothermal energy usage. Another good example is Poland especially at the southern part of it, where is has a large potential of biomass-based energy generation.

The Kyoto protocol has been ratified, accepted or already approved by all ACs[87], however these countries can apply a certain level of flexibility in the operation of the protocol and have therefore declared different base years than the commonly applied year: 1990. Accordingly, the base years are as the following: Bulgaria 1988, Hungary average 1985-87, Poland 1988, Romania 1989 and Slovenia 1986. Contrary to the member states the ACs are in different situation concerning the Kyoto protocol hence there has been a decrease in greenhouse gas emission since the end of communist era. Energy consumption of the abovementioned countries have fallen significantly since a number of coal-based power plants have been closed as well as the importance of heavy industry has been reduced. In line with that most ACs seems to fulfil the requirements of the Kyoto protocol[88], the only exception is Slovenia, which will need emission cuts to accomplish its commitments.

6.4.1 Recommendations

- Maintain pressure on ACs to budget sufficient resource for strengthening the positions of RES as well as to keep the deadline of the national action plans.
- Provide more budgetary and technological resources in order to encourage non-combustible RES, such as hydropower, photovoltaic, wind-power, etc. It is very important in order to meet with the requirements of the White Paper as well as of the Kyoto protocol. Additionally encouragement of combustible RES is of utmost importance as well since combustible RES comes mainly from households, which use old technologies.
- Enhance international cooperation in the field of RES.

[86] http://www.fossil.energy.gov/international/romnover.html

[87] http://www.unfccc.int/resource/kpstats.pdf

[88] European Environment Agency: Greenhous gas emisson trends in Europe, 1999-2000

6.5 Political issues: Liberalization processes

The goal of the actual Member States of the European Union is to reach a proportion of open energy markets of at least 34 % until the year 2005. Also the Accession Countries have to put a lot of effort into their liberalisation process. Especially, the rehabilitation and creation of the necessary infrastructure is a hardly accessible goal. On the one hand side the energy infrastructure of the Accession Countries is still far below the standards of the European Union. On the other hand side the financing funds are scarcely limited both in the respective countries and in Brussels. The actual investment demand of the 12 European Union accessions is predicted to over 500 billion Euro. The energy and the corresponding environmental sector are forecasted to 180 billion Euro[89]. This investment in the context of the European energy market is mainly needed to construct and reconstract the regional energy supply systems. Some Accession countries already have efficient transport capacities others still lack of sufficient network systems (see chapter 4 and 5.1).

Actually, investments of approximately 100 billion Euro, essentially by pilot credits of international development banks are faced to this sum. These investments cannot take over this task for an unlimited period. Thus large areas of central and Eastern Europe remain infrastructure European Union regions of "second class", and there is the danger of a durable economic gradient between old and new European Union countries.

Only Estonia has been granted transitional period for the implementation of the Electricity Directive[90] until the end of 2008. Most Accession Countries are basically in line with the relevant Directives[91]. Some of the Accession Countries have already opened a part of their electricity market. This number varies between 20-50% (see chapter 4).

What concerns the electricity liberalisation process in the accession countries; these reform steps were not yet completely converted. So far Poland, Hungary show the best results. In these countries there are independent power producers, even if their market share is still very small. But still work has to be done on the introduction of proper legal conditions. Additionally, strategies should be implemented to overcome price distortions and cross-subsidies. One of the main problems of the electricity market opening is that some of the CEE countries have long-term agreements between the grid owners and the electricity producers. In this way the capacity of the grids and power plants are contracted for long-term and the access of them for others is hard.

In Slovakia, Czech Republic, Bulgaria, Romania and the Baltic states still no considerable progress has been obtained in order to liberate the electricity market. In most countries the electricity economy is still dominated by integrated monopolies. Likewise the majority of the enterprises continue to be in national hand[92].

[89] DIW Berlin; "Forcierung der Marktwirtschaft wichtiger als Finanzspritzen"; url: http://www.uni-protokolle.de/nachrichten/id/6071/

[90] Directive 96/92/EC of the European Parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity

[91] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[92] DIW Berlin; "Stromwirtschaft in Mittel- und Osteuropa: Mehr Wettbewerb im Vorfeld des EU-Beitritts erforderlich"; DIW-Wochenbericht 48/00; url: http://www.diw.de/deutsch/publikationen/wochenberichte/docs/00-48-2.html

Currently the energy chapters are not closed[93]. Therefore, it can be predicted that Romania and Bulgaria will apply for transitional period in the field of liberalisation. Lessons learnt form the first round of accession, especially in the field of liberalisation should be used for the second round.

Only the Czech Republic has been granted transitional period for the implementation of the gas Directive until the end of 2004. The other Candidate Countries are basically in line with the relevant Directives[94].

The market is already opened between 20-50% in the rest of the accession countries. Estonia has opened 70% of its gas market. Cyprus does not use gas on its territory but it has to adopt the necessary legislation as well[95].

International experiences show that the prices can be increased as well as decreased by the liberalisation. – This can cause social resistance in case of increasing. Transition from prices set by the authorities to prices set by the market can cause disappointment to the investors since the market prices are determined by the market conditions. It is most important for the investors that the prices should ensure the profit and the money for development[96].

6.5.1 Recommendations

In view of the concretising European Union entry of the accession countries the privatisation and liberalisation of the electricity sector should be accelerated. Special attention must be paid to the adjustment of the price structure. A further opening for foreign investors can help to cover the high investment demand for the electricity economy. Also the trading of CO^2-certificates could help. Additionally, following strategies should be supported [97]:

- the transformation of the former state enterprises in corporations and their privatisation;
- the implementation of independent control authorities;
- cross-border cooperation of economic organisations and enterprises;
- the EU27 should try to work against price cartels in the gas or oil sector.
- similarly to the situation of the CEE countries the lack of connection is also a barrier of the development of a regional market. Special attention should be drawn on the investment in efficient transport systems
- consistent criteria for the handling of European energy reserves should be set up, in order to be prepared in crisis periods and to prevent market distortions.
- a diversification of energy sources and energy supplying countries has to achieved in order to prevent dependencies to individual actors and routes for the energy transport.
  - the pipelines connecting the CEE countries to the EU are small in length and capacity (e.g. Hungary-Austria, Czech-Germany). These Connections should be extended. This fact is a barrier for developing a regional market[98]

[93] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[94] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[95] Commission of the European Communities: Regular Report on the Candidate Countries; chapter 14 Energy

[96] Épitesi Piac 2003 Január-Február p 42

[97] Norbert Glante, MEP "EU enlargement and energy policy -the view of the European Parliament"; EUROHEAT & POWER, unichal 30th congress in Gdynia, 7 and 8 June 2001; http://www.glante.de/download/euroheat.pdf

[98] Mannheimer Zentrum für Europische Sozialforschung – Margarita M. Balmaceda: EU Energy Policy and Future European Energy Markets: Consequences for the Central and East European States

6.6 Energy efficiency

The main problems of the Eastern European energy industry are their poor energy efficiency. In this sector the discrepancies to Western Europe are highly visible. An increase of the energy efficiency is thus one of the central tasks and challenges. An increase of the efficiency is a consequence and a goal of the liberalisation. However, these goals are not available with a zero tariff. They do not only require high investments, but involve also the loss of many jobs. Therefore, especially in changing periods, this energy policy causes high social costs.

Actually, the average energy efficiency of the member states is 0.3 kWh/US$ per gross domestic product. The average energy efficiency of the accession countries is approximately 1.37 kWh/US$ [99]. A main reason of this are the still low energy prices because of social and political interests.

Although, the energy intensity decreased in several Accession Countries it is still far behind the EU 15. Only Lithuania, Slovenia and Cyprus have energy intensity factors comparable to the Member States. Mainly this is due to the fact that the energy consumption within the Accession Countries is still at a very high level (see Figure 4.2). No efforts have been undertaken to reduce this consumption. Some countries implemented organisations in order to supervise the energy efficiency on especially the consumption side. This is a promising approach but also the conversion and the distribution of energy should be regarded. In this context the low efficient coal transformation techniques should be substituted by innovative gas conversion techniques or even better the support of renewable energy sources. However, to follow this way a lot of investment will be necessary.

Some Accession Countries already have a significant amount on renewable energy. Mainly Hydro and Biomass are used for energy supply purposes. These countries are Estonia and Latvia (see chapter 4.6, 4.8). Not only because of diversification but also to improve their energy efficiency Malta and Cyprus should try to apply RES (see chapter 4.4, 4.10). Cyprus already started this process by building up solar panels as decentralised energy resource.

[99] Sector I: Agriculture; Sector II: Industry and Energy; Sector III: Commerce and public services; Sector IV: Transport

6.6.1 Recommendations

To reduce the dependence of the future European Union from energy import the energy efficiency has to be sustainable improved. Besides less energy consumption this also supports the efforts of the EU to meet the Kyoto commitments. The following points can help to increase the energy efficiency within the Accession Countries:

- The support of privatization and liberalization processes;
- Increase of the energy prices for electricity, gas and oil;
- A solid legal and institutional framework for the energy sector;
- Introduction and support of the application of renewable energy sources;
- Strengthen the position of authorities and institutions for the supervision, certification etc. of efficient energy use. E.g. low losses for transport, less energy consumption, optimal energy conversion at the consumers;
- Economical and social differences between the Member States and the Accession Countries have to be taken into account in order to prevent an unbalanced European Union;
- Since an increase of the energy efficiency is a long lasting process, which needs high investments, the necessary actions have to be supported by European and national subsidies. This can be done for example analogues to the structural funds [100];
- Support of a fuel switch from coal and oil to gas.

[100] E.g. WWF European Policy Office; Structural Funds In an Enlarged EU Learning from the past - Looking to the future; May 2003

7 ABBREVIATIONS AND TERMS USED

AC - Accession Countries

BG - Belgium

BMU - Bundesministerium Für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Environmental Ministry)

CEE - Central and Eastern Europe

CEEC - Central and Eastern European Countries

CHP - Combined Heat/Power

CY - Cyprus

CZ - Czech Republic

EAGGF - European Agricultural Guidance and Guarantee Fund

EBRD - European Bank for Reconstruction and Development

EE - Estonia

EIB - European Investment Bank

EU - European Union

EU15- Ireland, United Kingdom, France, Portugal, Spain, Italy, Greece, Austria, Belgium, Luxembourg, Germany, Netherlands, Denmark, Sweden, Finland

EU27 - Ireland, United Kingdom, France, Portugal, Spain, Italy, Greece, Austria, Belgium, Luxembourg, Germany, Netherlands, Denmark, Sweden, Finland, Bulgaria, Cyprus, Czech Republic, Hungary, Estonia, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, Slovenia

ERDF - European Regional Development Fund

ESF - European Social Fund

FIFG - Financial Instrument for Fisheries Guidance

GB - Great Britain

GDP - Gross Domestic Product

GJ – Giga Joule

GWh - Giga Watt hour

HU - Hungary

IEA - International Energy Agency

INA - Croatian Oil Company

ISPA - Instrument for Structural Policies for Pre-Accession

LT - Lithuania

LV - Latvia

MOL - Hungarian Oil and Gas Company

MT - Malta

MS - Member States

MWh – Mega Watt hour

NPPs - Nuclear Power Plants

NSA - Nuclear Safety Account

OCDE - Organization for Economic Co-operation and Development

PHARE - Poland and Hungary Assistance to Restructure the Economy

PL - Poland

RES - Renewable Energy Sources

RES-E- Renewable Energy Sources- Electricity

RO - Romania

SAPARD - Special Accession Programme for Agriculture and Rural Development

SI - Slovenia

SL - Slovak Republic

Slovnaft - Slovakian Oil Company

TEN - Trans-European networks

TPES – Total Primary Energy Supply

TWh – Tera Watt hour

TOE - Ton of Oil Equivalent

UCTE – Union for the Coordination of Transmission of Electricity

UK - United Kingdom

USSR - Union of Soviet Socialist Republics

CO2 – Carbon Dioxide

NOx – Nitrogen Oxides

SOx – Sulphur Oxides

VOC - Volatile Organic Compounds

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Council Decision

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- Council Directive 93/76/EEC of 13 September 1993 to limit carbon dioxide emissions by improving energy efficiency (SAVE). *Official Journal L 237, 22/09/1993 P. 0028 - 0030*

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11 ANNEX I

Gas Pipelines, Crude Oil Pipelines and Electricity Grid Maps

SUMMARY

The following maps provide the existing and the proposed networks connections in Europe, Middle East and North Africa, concerning:

- Gas Pipelines;
- Crude Oil Pipelines;
- Electricity Grids.

These maps were extracted from:

http://europa.eu.int/comm/energy/ten-e/maps/gas_map.pdf

http://europa.eu.int/comm/energy/ten-e/maps/oil_map.pdf

http://europa.eu.int/comm/energy/ten-e/maps/electricity_map.pdf

The data was collected in 2003.

CONTENT

Map 1: Gas pipeline

Map 2: Crude- Oil pipeline

Map 3: Electricity Grid

Map 1: Gas pipeline

Map 2: Crude- Oil pipeline

Map 3: Electricity Grid