# The contribution of contemporary technology to the environmental protection and sustainable development

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ABSTRACT

Today Contemporary Technology is the basic factor for the environmental protection and the Sustainable Development.

Greenhouse gas emissions reduction requires measurement taking on several thematic fields in order to achieve Kyoto protocol objective, which is reduction of polluted gas emission by 5% in global level and by 8% in EU countries. Energy and Transport are the basic fields where contemporary technology is going to intervene.

The basic effort is focused on the use of environmental friendly fuels, which seems to cause big financial cost in first level. But their future broader use and evolution in technological way of their use, lead to significant prospects of achieving less financial cost.

At the same time Renewable Energy Sources use [R.E.S.] is a strategic objective towards Environmental Protection and Sustainable Development. It is certain that increased production cost in R.E.S. case, will be dealt by their broad use and positive parameters that this involves.

The present paper occupies with the systematic record and estimation of the present situation at first, and secondly with the approach and materializing of these objectives.

## 1. PREFACE

Environmental protection and sustainable development are the global aims of today. The "Rio Declaration" of the United Nations in 1992 and the Kyoto Protocol in 1997 laid the foundations for the achievement of this aim. Ten years after "Rio", in 2002, the International Conference of Johannesburg has not succeeded in giving a new prompting to this effort. The final adopted Action Plan has just maintained two basic principles of the initial Action Plan": common but differentiated responsibility and the protection principle.

Sustainable development is long-term visions for a more prosperous and fair society through a cleaner, safer and healthier environment [1].

The basic keystones towards the achievement of the sustainable development are:

- Environmental Protection
- Social Cohesion
- Financial Development

It is obvious that these keystones should coexist in a medium-long-term basis. Furthermore, the ambitious visions of the future and Actions Schemes of the present must converge to this direction. Emphasis should be placed on a small amount of major problems, which should be carefully and constantly monitored by mechanisms and indexes.

Contemporary experience leads us to the conclusion that former political choices concerning technologies in production of electricity, land uses, substructure development and financial development, have only led to threatening for environment and sustainable development consequences.

The most significant threats for environment and sustainable development, as recorded today, are the following:

- Emission of Greenhouse gases leading to the rise of global temperature causing serious problems (climate change- extreme weather conditions- consequences on the nature, health, substructures).
- Social deprivation and poverty leading to

numerous problems
- Rapid increase in transport resulting to pollution and decay of urban centers.
- Reduction of biodiversity.
- Constant increase of waste, which gets increased faster than the gross national product.

Undoubtedly, determining the priorities of environmental policies of the European Union until 2010 is extremely important for achieving sustainable development. This will be materialized through the "Sixth Action Scheme for the environment" for the period 2000 – 2010, which is the follow-up of the "Fifth Action Scheme" for the period 1992 – 2000.

Limited results in environmental protection during 1992-2000 are due to the fact that the EU Institutions expended excessively in mapping out the "European Policy" on environment and sustainable development and haven't emphasized in "materializing actions" on implementation measures and monitoring and policy mapping control. So inevitably, present decade is focusing on "materializing" and "implementation" of every "policy" that has been mapped out or is mapping out complementarily.

The attempt for controlling and reducing greenhouse gases will play a key role on Viable European Development achievement. This attempt is depended on the most significant factors of primary production and action as Energy, Industry, Transport, Urban Planning etc.

The present paper occupies with achieving Sustainable Development and Environmental Protection in the E.U. in the forthcoming decade with particular emphasis on the decisive part of the reduction of greenhouse gases and contemporary technological environmental protection growth and pollution reduction by emphasizing in producing electricity by Renewable Energy Sources.

## 2. THE EVOLUTION OF GREENHOUSE GAS EMMISIONS IN THE EU

According to W.W.F., the barbaric spoliation of earth's natural wealth during the last 30 years led the 1/3 of global natural wealth to destruction [3]. Greenhouse phenomenon is an overshadowing threat for the environment, while the optimistic side concerns the ozone hole, since reduction has been noticed regarding its growth rates and full repair expected in 2070. The EU member-states' obligations concerning the greenhouse gases reduction until 2012 are presented in Figure 1.

The greenhouse gases record a total reduction of 3,5% until the end of 2000 concerning the 1990's gas emissions. To this general environmental conjuncture, the reduction of forests plays unfortunately a negatively determinant role, since they are vital for the absorption of the basic greenhouse gas by 12% globally from

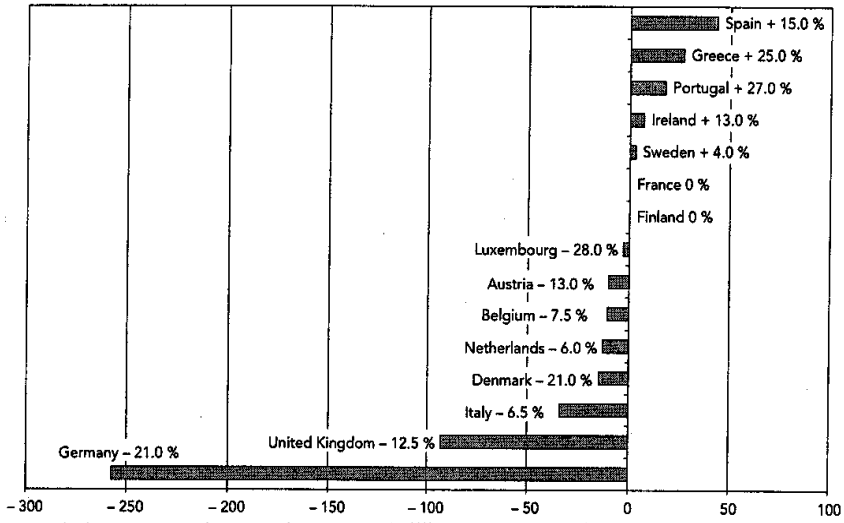

Figure 1: GHG emissions targets of E.U-15 for 2008-12(million tones CO2.-eq).

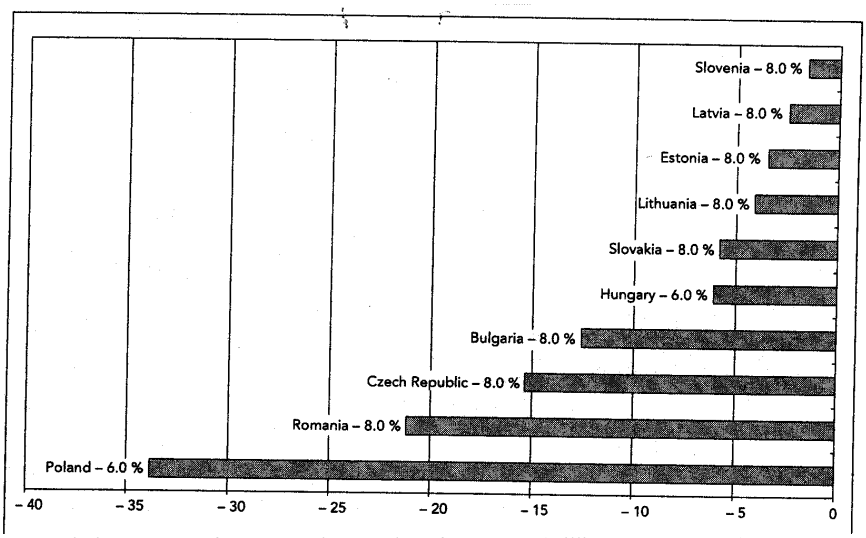


Figure 2: GHG emissions targets of new countries-members for 2008-12(million tones CO2.-eq).

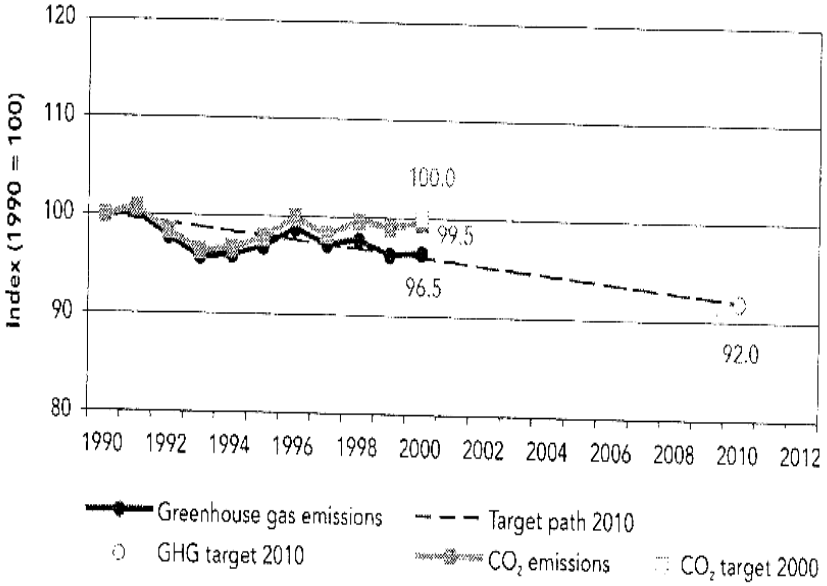


Figure 3: Reduction of greenhouse gases in E.U-15.

1970 to 2002.

The 10 new EU member states' obligations are shown in Figure 2 (accession of 9 member states is already done).

It should be noted that Kyoto Protocol will be in force after the ratification of the Treaty by 55 states, including developed countries in which at least 55% $CO_2$ is emitted in 1990 values. In practice, Russia's approval is a prerequisite for the Protocol to be in force. The 15 EU member-states had ratificated the Protocol by November 2002. Japan and 8 EU new members have also approved it.

The true evolution progress concerning the reduction of greenhouse gases in E.U. is shown in Figure 3 emphasizing in the $CO_2$ course.

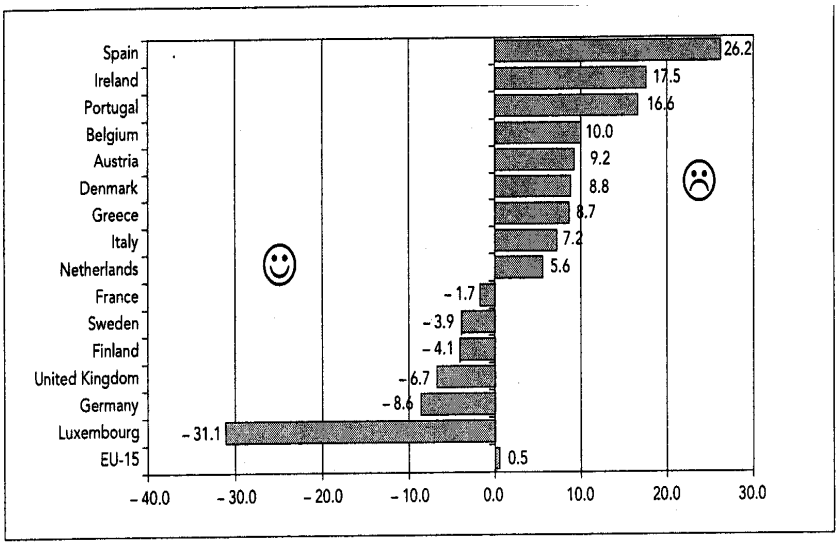


Figure 4: Distance-to-target (Kyoto Protocol burden-sharing targets) for EU States in 2000.

It should be noted that according to Kyoto Protocol, reduction is mentioned at six greenhouse gases, which are: Carbon Dioxide ($CO_2$), Methane ($CH_4$), Nitrous Oxide ($N_2O$), Hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and Sulphur Hexafluoride ($SF_6$). It should also be mentioned that $CO_2$ is the primary greenhouse gas with a percentage of 82% among the total of emissions recorded in 2000 [5], while methane ($CH_4$) and Nitrous Oxide ($N_2O$) have a percentage of 8% each. The remaining 2% is emitted by the rest fluoric gases. The deviation per each EU member-state from Kyoto's objection in 2000 concerning the 8% reduction of gas emissions starting from 1990, is presented in Figure 4.

The total EU deviation is 0,5% granted that the succeeded reduction is 3,5%. Emissions from greenhouse gases per sector are showed in Figure 5.

The two higher pollution sources are energy with 27% and transportation with 21%. Finally, the increase in emissions from greenhouse gases per sector is shown in Figure 6.

Unfortunately, there is a rapid increase in transport (19%) and there is no optimistic prospect for the future.

At this point it should be noticed that the 36% increase in fluoride gases, (HFCs, PFCs, SF6) used for refrigeration machines, air-conditions, fire-extinguishers and sprays, led Mrs Margot Valstrom, Member of the Commission in charge, in publishing a new directive on 12/8/2003 [6] on reducing specific gases methods which have high heat energy (23.900 times higher than $CO_2$ and long time duration) although they are just the 2% of greenhouse gases. Specific gases emissions are expected to reach 98 million ton in 2010 from 65 million ton in 1995 unless strict measures are taken mostly on car air conditions which are the basic emissions sources (they will reach 20 million ton in 2010 from 1,5 million ton in 1995 unless measures are taken). So, car industries are suggested

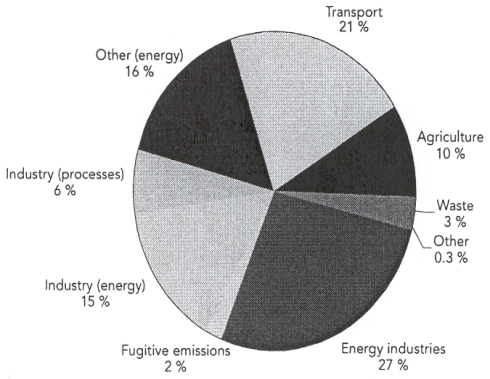


Figure 5: EU-15 Greenhouse gas emissions by sector in 2000.

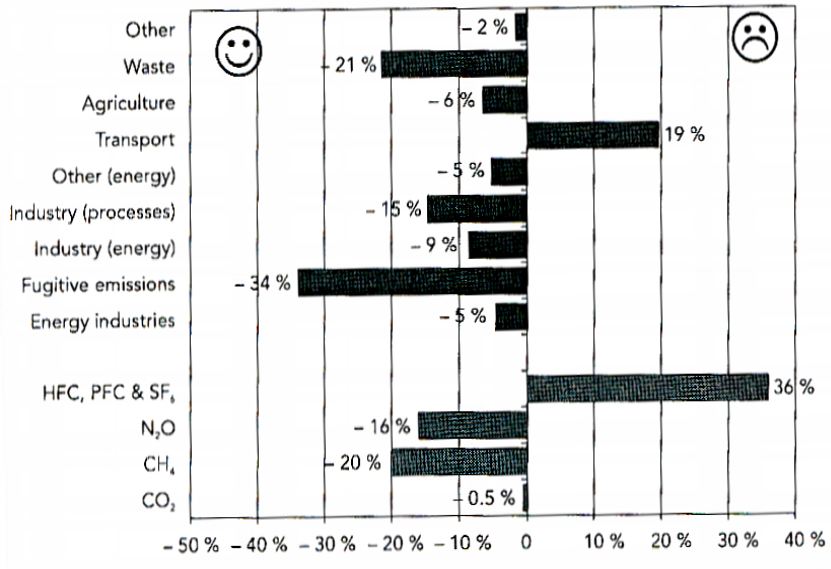


Figure 6: Change in EU-15 emissions from greenhouse gases by sector and gas 1990-2000.

by EU to stop using the specific gases and gain of course the return benefits.

## 3. EXPECTATIONS TOWARDS KYOTO OBJECTIVE FOR 2012

The adopted policy and the measures taken by EU member states do not allow optimistic expectations on materialization of Kyoto objective – in 2010 at EU. Although a 3,5% reduce has been achieved at the end of 2000, the present estimation is that in 2010, the final reduction in emission from greenhouse gases will be at 4,7%. [7].

Towards this outlook the 15 EU member states have taken additional measures, in order to accomplish further reduction in the emission of greenhouse gases. This policy implementation might lead 2010 to a final reduction of 12,4% in gases emission comparing to 1990 levels. In this way, Kyoto's objective will be topped by 4,4% comparing to the initial 8%. Such differences concern also the EU member states as showed in Figure 7 in which the improvement accomplished due to the additional measures is obvious.

Energy (production and use) and transport are the basic pollution sources on which the global efforts are focused**.**

### *3.1. Energy (production – use)*

Emissions from greenhouse gases by energy sector will be reduced in 2010 in E.U by 16% comparing to 1990. Additional measures taking can lead to 20% reduction.

Energy sector gases reduction at the end of 2010 due to the political steps and to the implementation of new measures in 10 EU member

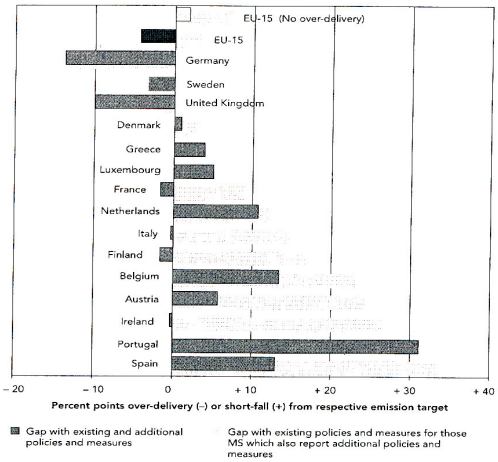


Figure 7: Relative gap (over-delivery or shortfall) between "with additional measures" projections and targets for 2010 for EU – 15 and Member States.

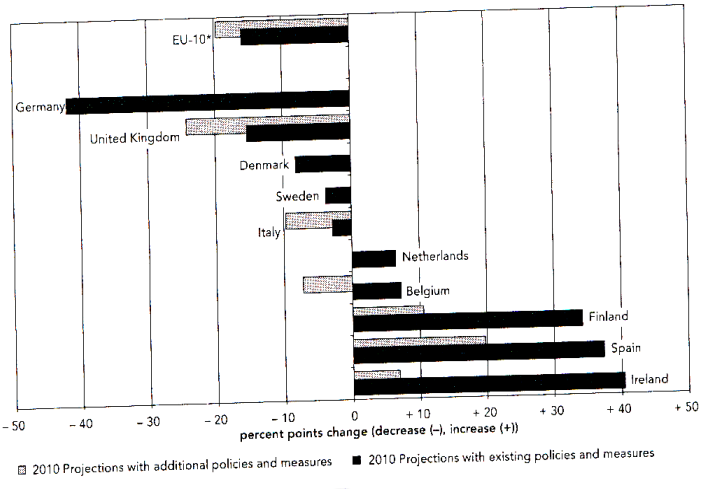


Figure 8: Greenhouse gas emission projections from energy supply and use, excluding transport (changes from 1990 to 2010).

states which have given the relevant data, .is shown in Figure 8.

Renewable Energy Sources development, $CO_2$ reduction in production of electricity and in Industry and $CO_2$ reduction in "use" implementation are the objection bases for total gases reduction by 20%.

*3.2 Transport*

Transport plays a critical role in gas emission globally. It's not just a coincidence that the whole contemporary technology moves towards the following directions:

- Improvement of the fuels in use as far as it concerns the gas emissions.
- Use of new ecological fuels (e.g. $H_2$).
- Other energy type use (e.g. electricity) in order to reduce the vehicle gas emissions**.**

Unfortunately several improvements (Pb-$N_2O$ etc) have been eliminated due to the rapid progress in transportation and private vehicles resulting the increase in the emission of greenhouse gases by transport for 2010 outlook, based on 10 EU member states' data – (15 members states have not given any data: Austria – Luxembourg – Portugal – France – Greece). Taking additional measures will lead to reduction of the emissions. Figure 9 shows in detail the first estimation for the above 10 EU member states.

The reduction of $CO_2$ emissions in private vehicles is the basic factor towards this direction aiming at their limitation in 120 g $CO_2$/vehicle-klm, until 2010, from being 172 g at the end of 2000.

The taken measures and the potential ones that can be taken by EU 15 member-states can be showed in Figure 10.

## 4. WIND POWER: CONTEMPORARY TECHNOLOGY IN PRODUCTION OF ELECTRICITY AND ENVIRONMENTAL PROTECTION

On May the 10th 2000, European Commission adopted a strategic goal proposal on significant increase in electricity coming from Renewable Energy Sources. [9]

Since 1997, the objective of the White Paper on R.E.S. was the doubling of R.E.S. share in E.U. energy balance from 6% to 12% until 2010. Big hydroelectric schemes are not included in this percentage.

In 2010 electricity produced by R.E.S. aims on 22,1% for the total production of electricity in E.U. including big hydroelectric schemes (>10MW).

Former percentages of produced Electricity in Greece at the end of 2000 per fuel are shown in Figure 11. [11]

Lignite is still the first by 62,79% while total

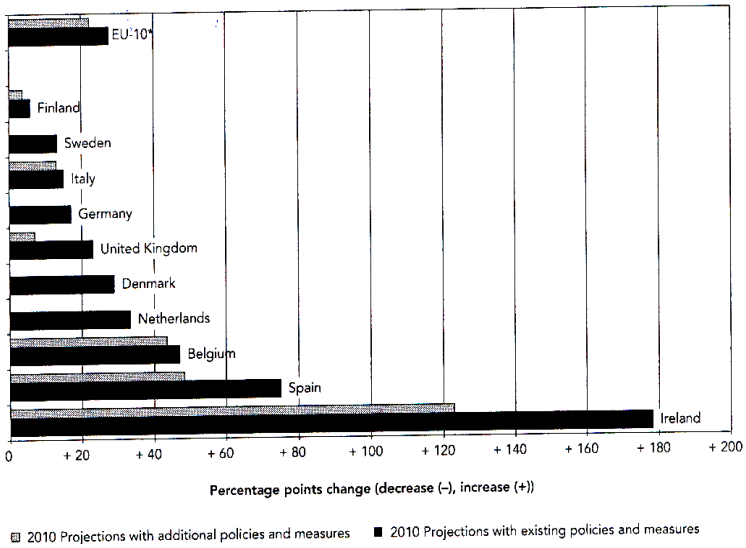


Figure 9: Greenhouse gas emission projections from transport (changes from 1990 to 2010).

| | Economic | | Fiscal | | Voluntary/ negotiated | | Regulatory | | Information | | Education | | Research | | Other | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Imp | Add | Imp | Add | Imp | Add | Imp | Add | Imp | Add | Imp | Add | Imp | Add | Imp | Add |
| Austria | | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓✓ | ✓ | ✓ | ✓ | ✓ | | | |
| *Belgium* | | | ✓ | ✓✓✓ | ✓✓ | ✓ | | ✓ | | | ✓✓✓ | ✓ | | | ✓✓✓ | ✓✓ |
| Denmark | | | | ✓ | | | ✓ | | ✓ | ✓ | | | | | | |
| *Finland* | ✓ | ✓✓ | ✓ | ✓ | ✓✓ | ✓ | | | ✓ | ✓✓ | ✓ | ✓✓ | | | | |
| France | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓✓ | ✓ | | | ✓ | ✓ | | | ✓✓ | ✓ |
| Germany | ✓✓ | | ✓ | | ✓✓✓ | | ✓ | | ✓ | | | | | | | |
| *Greece* | | | ✓ | | | | ✓ | | | | | | | | | |
| Ireland | | | | ✓ | | ✓ | | ✓ | | | | ✓ | | | | |
| Italy | | ✓ | | ✓ | | ✓✓ | | ✓ | | ✓ | | | | | | ✓ |
| *Luxembourg* | | | | ✓ | | | | | | | | | | | | ✓ |
| Netherlands | | | ✓ | | ✓✓ | | ✓ | | | | ✓ | | | | ✓ | |
| Portugal | | | | | | | | | | | | | | | | |
| Spain | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | | | | | |
| Sweden | | | | | ✓ | | | | | | | | ✓ | | ✓✓ | |
| UK | | | ✓ | ✓ | | ✓✓ | | | | | | | | | | |

**Notes:** Imp = implemented (existing); Add = additional.

Figure 10: Types of policies and measures by Member States for transport.

energy’s part is only 0,31%.

Electricity gets increased globally by 1-2%

The increase in Greece during the last years was 4,5% respectively. Prospect for 2010 is 3,5%.

Producing electricity by wind power promotes the basic objectives towards the following directions. [12]

- Energy dependence reduction.
- Decentralization of electricity production.
- Increase of available electrical power.
- $CO_2$ emissions reduction.
- Added value increase in national level.

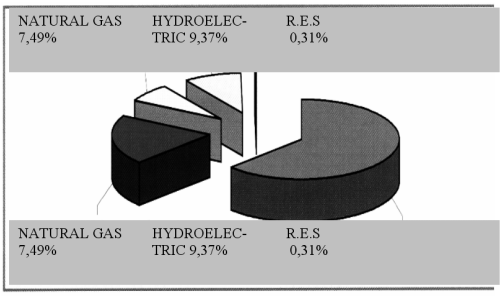


Figure 11: Electricity Production in Greece – Public Power Corporation.

- Economic activities support and employment increase in suburb.

Today, E.U. energy dependence on external sources comes to 50% for imported products. This growing tendency leads to the estimation than at 2030 the percentage will be 70% unless substantial measures are taken. According to this turn it is obvious how precarious would the E.U. position be within international economy.

At this point it should be noted that energy consumption in 2002 at E.U. was the 15% of global consumption, when demographically, E.U. is just the 6% of global population.

Under these circumstances wind power development plays a significant role both in energy balance and gases emissions reduction, especially $CO_2$.

In 2001 installed wind power was 24.000 MW, 17.319 of them were available in E.U. [13] (Figure 12)

At the end of 2002 this amount reached 31.000 MW [14], while during last year a global increase in installed power is noticed per 32% annually.

Wind power covers today 0,4% of global energy demand.

In Greece installed wind power course is shown in Figure 13. [15]

According to present data [16], installed power of R.E.S. in Greece will be 3.500 MW in 2010, 90% of which will be wind power. They will produce electricity 8.800GWh, out of a total of 76.000 GWh in Greece as it is estimated for the total production for 2010 (percentage 11,6%).

Considering that big hydroelectric schemes will produce in 2010 the same amount of electricity (today 9,27%, 7-8% in 2010 respectively) and adding the small percentage of the rest R.E.S., Greece will almost reach E.U. objection

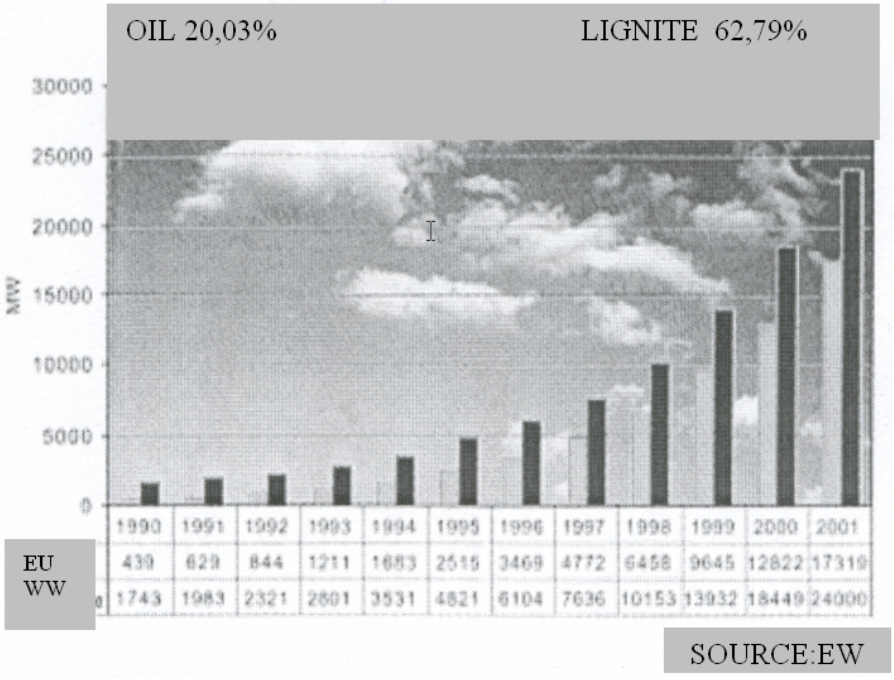


Figure 12: Installed Wind Power Globaly (MW).

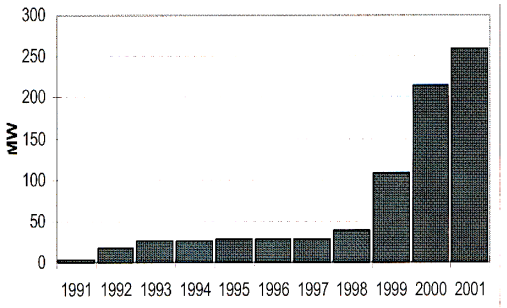


Figure 13: Wind Power Evolution in Greece.

for 2010 that means 22,1% production from R.E.S. and big hydroelectric schemes.

## 5. CONCLUSIONS

It's a common belief today that Contemporary Technology, Sustainable Development and Environmental Protection are a common objective, common action course, and complementary policies and measures implementation. During the last two decades focusing has been made on environmental problems due to predatory use of the environment, while in the last decade global European and National policies have been mapped out without being materialized.

Materialization of these policies will be made during 2000-2010 since the negative consequences in not taking measures are so obvious as the positive results after specific measures implementation in international and national level.

Towards this direction, contemporary technology evolution will play the main part, and will give the first but not last priority to transport and production of electricity.

It is obvious that emission of greenhouse gases evolution will play a key role on environmental protection evolution, on climate changes, on Sustainable Development. Unfortunately, since Kyoto Protocol has not yet been into force the evolution is negative at this point.

Substantial activation of E.U.–25 in drastic reduction of $CO_2$ in energy (production – use) and in the vital sector of transport is an auspicious prospect. It is a fact that global scientific community efforts have been focused on transport as far as it concerns the direction of new ecological fuel implementation (e.g. H2) and the improvement of the fuels in use. It's also a fact that rapid progress in transport and in private vehicles is opposed to this serious effort.

Therefore same emphasis should be given on the technological evolution in this sector as on transport management sector in order to eliminate every vehicle use.

Eventually, emphasis on I.E. is a vital priority since it is the "cleaner solution" as far as it concerns energy. Present high cost will surely be depressed after their wide use and the evolution of technology. Therefore we can hope that during the following period until 2010 the negative course of environment will be changed and Sustainable development by using technological evolution will be reached.

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