

ENERGY SUSTAINABILITY: CONCEPT, SUSTAINABILITY ISSUES OF A TRANSITION COUNTRY- BULGARIA

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OUTLINE:

- ◆ **On the Concept of Sustainable Energy**
 - Introductory remarks
 - External cost of energy
- ◆ **Sustainability issues of Bulgaria**
 - Energy and energy policy status
 - Policy issues of energy sustainability
- ◆ **Conclusion**

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

Introductory remarks.

◆ Sustainable development.

We adhere to the concept that the sustainable development is such one, which satisfying the needs and the expectations of the actual generation, provides the same opportunities for the next generations too.

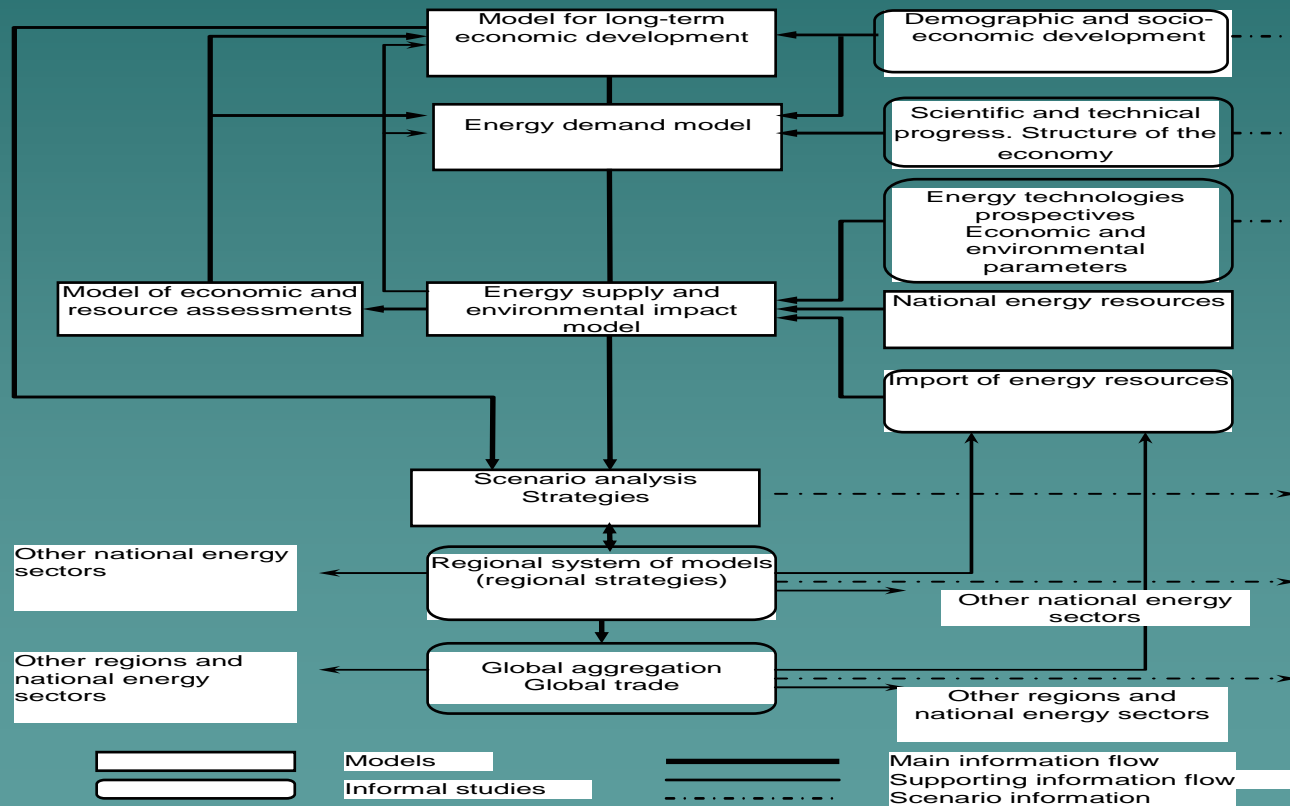
◆ Energy as a system

- Unity expressed by interchangeability of energy resources and energy carriers at all stages of their transformation and utilization;
- Strong ties with economy, environment and society (a case analysis-in part 2);
- World, regional, national and local levels of energy problems and prospects;
- Functioning and development determined by internal and external factors;
- Inertial structural evolution, requiring long-term development modeling and strategy. (A principal scheme of national strategic energy forecasting shown on Fig.1)

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

Introductory remarks.

Fig. 1. *Principal scheme of long-term development forecasting of the energy sector in Bulgaria*



1. ON THE CONCEPT OF SUSTAINABLE ENERGY

Introductory remarks.

- ◆ **Challenges to sustainable energy development:**
 - Limited conventional energy resources;
 - Increasing energy consumption;
 - Environmental impacts of energy resources production, transport, conversions and end-use. .(Further below we present an idea on European energy externality cost studies);
 - Low energy efficiency;
 - Economic and social constraints to energy functioning and development.
- ◆ **Energy policy is a goal oriented activity to:**
 - Reliable energy supply;
 - Efficient energy transformation and end-use;
 - Environment preservation corresponding to international norms and agreements;
 - Strategically oriented energy development;
 - Socially acceptable cost and prices.

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

External cost of energy.

- ◆ **European ExternE project** [<http://www.externE.info/>]
 - **The damages assessed** - constantly enlarging list of health and environmental effects covering “Impact Category” (Human Health-mortality, Human Health-morbidity, Building Materials, Crops, Global Warming, Amenity Loses, Ecosystems), large number of Pollutant/Burden and Effects;
 - **The ExternE methodology**- impact bottom-up-approach in which environmental benefits and costs are estimated by following the pathway from source emissions via quality changes of air, soil and water to physical impacts, before being expressed in monetary benefits and costs. (Fig. 2)
 - **Applications.** ExternE methodology has been applied for a large number of European and national studies to give advice for environmental, energy and transport policies. Detailed set of data for impacts from a wide range of fossil fuels, nuclear (PWR, open and closed systems for fuel provision) and renewables;
 - **Uncertainty and Reliability.** Individual sources of uncertainty: data uncertainty, model uncertainty, uncertainty about policy and ethical choices, uncertainty about the future.

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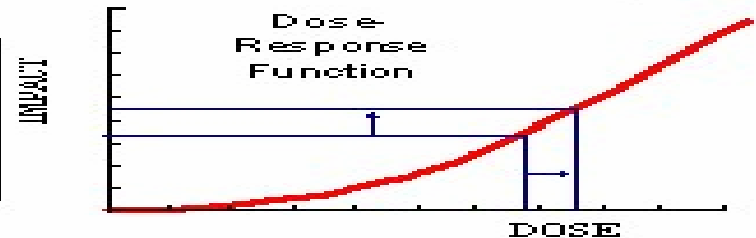
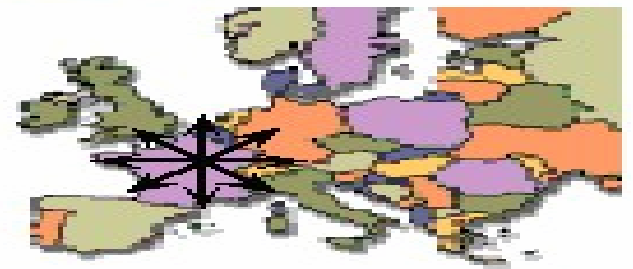
External cost of energy.

SOURCE
(specification of site and technology)
→ **emission**
(e.g., kg/yr of particulates)

DISPERSION
(e.g. atmospheric dispersion model)
→ **increase in concentration at receptor sites**
(e.g., $\mu\text{g}/\text{m}^3$ of particulates in all affected regions)

DOSE-RESPONSE FUNCTION
(or concentration-response function)
→ **impact**
(e.g., cases of asthma due to ambient concentration of particulates)

MONETARY VALUATION
→ **cost**
(e.g., cost of asthma)



French-Serbian European Summer
University, 17-24 October,
Vrnjacka Banja, Serbia

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

External cost of energy.

- ◆ **European CASES (Cost Assessment of Sustainable Energy) Project** [<http://www.feem-project.net/cases/>]
 - **Objective 1:** To compile detailed estimates of external and internal costs of energy production for different energy sources for the EU-25 Countries and some non-EU Countries (Bulgaria, Turkey, Brazil, India, China) within a coherent dynamic framework, under energy scenarios to 2030.
 - **Objective 2:** To evaluate policy options for improving the efficiency of energy use, taking account of the full cost data.
 - **Objective 3:** To disseminate research findings to energy sector producers and users and to the policy making community.
 - **Research institutions:** 21 EU and 5 non-EU research centers.

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

External cost of energy.

- ◆ **Work Packages.** CASES consists of 13 integrated work packages (WPs):
 - **WP1** provides electricity demand and primary energy source options scenarios up to 2030 for each of the country studied (25 EU Countries, Bulgaria, Turkey, Brazil, India, China) taking into account different local conditions across countries.
 - **WP2** focuses on human health, materials and crops external costs. The deliverables are a database on life cycle emissions for electricity and heat generation technologies,
 - **WP3** updates the estimates of non-human health related environmental costs of different energy sources based on life cycle impacts for EU and non-EU countries with specific attention to 'new impacts' (acidification, eutrophication and visual intrusion);
 - **WP4** investigate private costs of generating electricity and heat by combustible renewables, focusing on heat generation technologies (oil, gas and bio-mass heating systems, heat exchanger, heat pump);
 - **WP5** estimates externalities related to energy supply insecurity for EU and other selected countries;
 - **WP6** focuses on the consistent set of national level full costs estimates for the 25 EU countries for different energy sources;

1. ON THE CONCEPT OF SUSTAINABLE ENERGY

External cost of energy.

- **WP7** focuses on the consistent set of national level full costs estimates for Bulgaria, Turkey, Brazil, India and China;
- **WP8** assess policy instruments to internalize environment related external costs in EU Member States, excluding renewables;
- **WP9** assess policy instruments to internalize environment related external costs in EU Member States, via promotion of renewables;
- **WP10** assess policy instruments to internalize externalities in non EU Member States, via promotion of renewables and consider the social and fiscal implications that these measures have, especially on poor and vulnerable groups;
- **WP11** assists WPs 8-10 by providing the guidelines for the assessment methods, including Cost-Benefit-Analysis (CBA) and Multi-Criteria Decision Analysis (MCDA);
- **WP12** is devoted to dissemination.
- **WP13** encompasses the running of the project co-ordination and management activities.

CASES is an ambitious project towards more profound knowledge on energy-environment-society interactions and internalization of externalities in the energy market and policy.

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

- ◆ Integrated economy-energy-environment indicators of some European countries and Bulgaria

Table 1. Where is Bulgaria

Indicator/Country	DK	DE	EL	FR	IT	HU	AT	BG	RO	TR
Population (million)	5.38	82.54	11.02	59.63	57.32	10.14	8.07	7.85	21.77	70.80
GDP (bln. EUR 1990)	187.3	2130.3	146.4	1549.4	1297	71.5	222.7	16.9	47.9	200
En.Cons./GDP(toe/1990 MEUR)	0.106	0.161	0.203	0.169	0.134	0.352	0.138	1.108	0.746	0.375
En. Cons./Cap(toe/inhab.)	3.680	4.164	2.695	4.384	3.029	2.485	3.804	2.385	1.642	1.059
El. Gen. /Cap(GWh/inhab.)	7291.8	6925.7	4955.5	9370.95	4961.6	3566.1	7742.3	5436.9	2523.7	1827.7
CO2Emissions/Cap(tCO2/inhab.)	9872	10293	8559	5962	7406	5388	7588	5300	4129	2764
Import Dependency, %	-41.1	60.5	70.7	50.3	86.7	58.2	66.0	74.1	25.51	67.82

Source: EU Energy and Transport in Figures, 2004 [7]

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

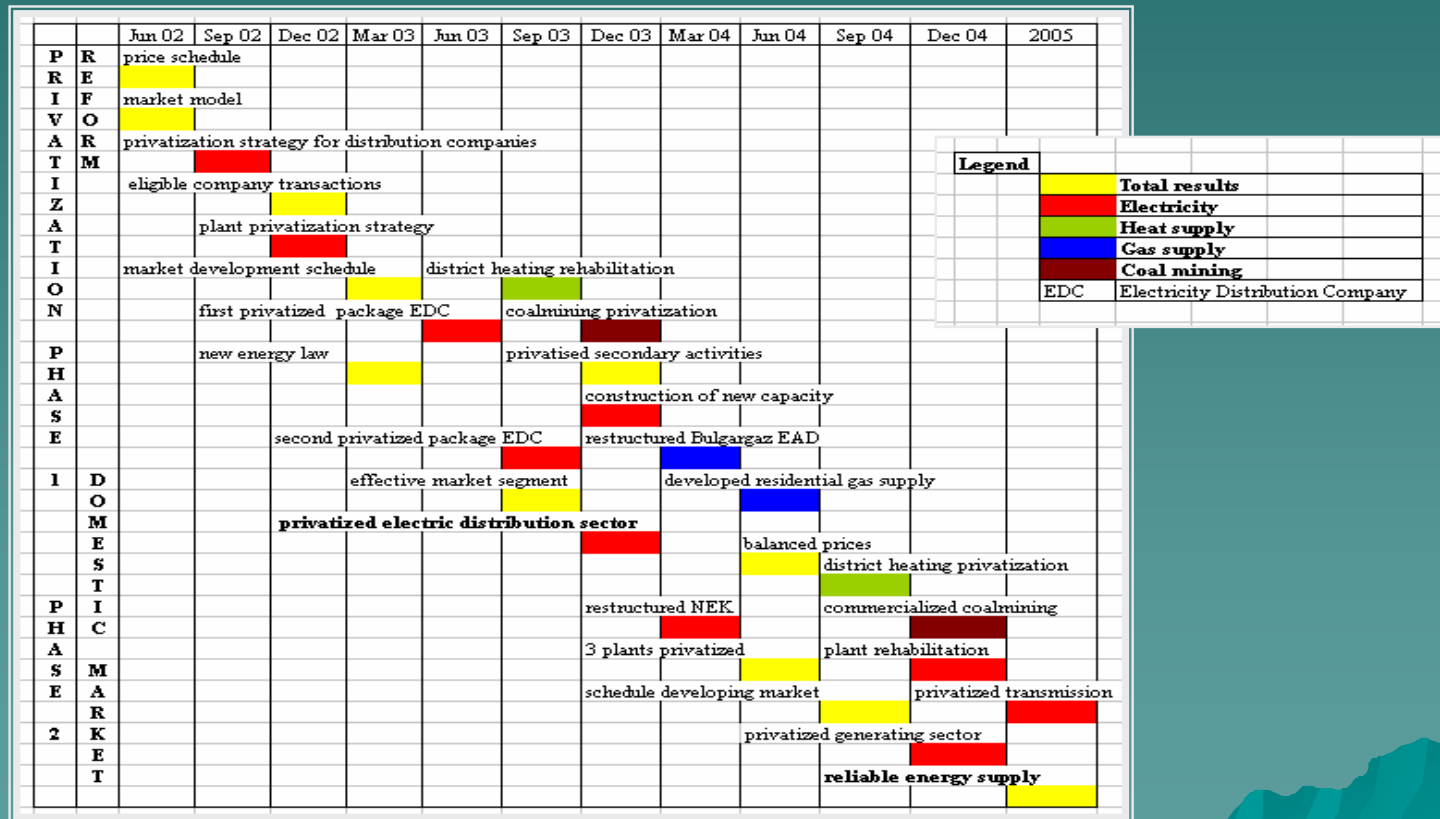
Energy and energy policy status.

- ◆ With 2153 EUR/cap Bulgaria is one of the poorest nations in Europe (EU15-24510, Austria-27596, Denmark-34814, Germany-25809, France-25984, Italy-22627, Greece-13285, Hungary-7051, Turkey-2825)
- ◆ Bulgaria is one of the most energy intensive (toe/1990 MEUR) countries (6.97, 8.03, 10.45, 8.27, 5.46, 3.15, 2.95 times more than EU15, Austria, Denmark, Italy, Greece, Hungary, Turkey correspondingly)
- ◆ With CDP/cap. times less than Italy, Greece, Hungary and Turkey Bulgaria consumes compatible or more kWh/cap than those countries
- ◆ Bulgaria is one of the most energy import depending countries in Europe

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

Energy strategy. Expected results – Fig.3



2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

◆ Energy strategy-positive results:

- Developed and acting energy regulatory body;
- Substantial price subsidies reduction;
- Introduction of regulatory rules for setting energy prices;
- Realization of the four-level stages of electricity prices increase-a serious stimuli for energy efficiency;
- Introduction of socially oriented double rate tariff for the domestic sector.

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

- ◆ **Energy strategy-not accomplished objectives, weaknesses of the reform and the practices in the last years:**
 - The “strategy” do not outline a quantitative vision of the development and is in fact a four years plan for market reform and privatization;
 - Serious deviance from the declared investment policy to use the limited investment capacity of the state mainly for energy efficiency projects. We could not miss to indicate the not grounded considerable investment (300 mln.Euro) in units 1-4 of NPS “Kozlodui”, without defending their future, or the contract of “Maritza-East” on the principal “take or pay”, or the preparation to construct the new NPS “Belene ” with dominant state guarantee;
 - No improvement in the energy carrier policy. Bulgaria is continuing to be a country with near-zero building gasification,

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

- Insufficient transparency and doubtful expedient of the privatization in some energy sectors, in particular peace of the state sovereignty in electricity distribution at the dispose of foreign, including foreign state owners;
- The declared social protection and social guaranties fall short. The fast energy price increase, much above the four levels, became a heavy burden for the common Bulgarian citizen;
- With the exemption of the accession of the electric system to UCPE, , practically nothing has been achieved in improving regional energy infrastructure and diversification of energy resources import;
- The “strategy” does not set at all the objective of integrated energy planning in energy utilization and supply.

The energy policy of the last years is dominated by corporate interests and is against the essence of energy sustainability

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

◆ Energy efficiency policy:

- Based on National EE program till 2015. It is expected to decrease GDP primary energy intensity by 17% and final energy intensity by 8%.
- The program covers mainly the final energy use, including building insulation. The most part (99%) of energy resources pass through conversion, transportation and distribution processes not included in this program.

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Energy and energy policy status.

◆ Environmental policy:

- International agreements: convention on transborder long distance air polluted prevention and the UN Framework Convention on climate change;
- European Directives for prevention and control of air pollution, on creation of emission trade quote scheme, on RES, for limitation of carbon dioxide emission, on CHP and on biofuels or other RES in the transport;
- The long-term preservation of high radioactive waste is an unsolved problem. Two strategic approaches are possible: farther cooperation with Russia or search of a solution on international level.

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Energy and energy policy status.

National electricity system. Tables 2, 3, 4 and 5 indicates the state and the author's position on the issues.

Table 2. Potential of generated capacities

Generating capacities	Installed capacity, MW	Utilization h/yearo	Potential, TWh/year		
			by 2010 r.	by 2015 r.	by 2020 r.
NPP "Kozloduy"	2000	7000÷7500	14,0÷15,0	14,0÷15,0	14,0÷15,0
TPP "Maritsa East – 1"	670	7000	4,7	4,7	4,7
TPP "Maritsa East – 2"	1545	6500	10,0	10,0	10,0
TPP "Maritsa East – 3"	908	7000	6,3	6,3	6,3
TPP "Varna"	1260	4500÷6000	5,7÷7,6	5,7÷7,6	5,7÷7,6
TPP "Bobovdol"	630	4500÷6000	2,8÷3,8	2,8÷3,8	2,8÷3,8
	220	4500÷6000	1,0÷1,3	1,0÷1,3	1,0÷1,3
TPP "Rousse"	700		1,5÷2,0	1,5÷2,0	1,5÷2,0
Industrial TPP	1040		3,0÷3,5	3,0÷3,5	3,0÷3,5
HPP			4,1	4,6	5,0
Total			53,1÷58,3	53,6÷58,8	54,0÷59,2

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

Table 3. Expected electricity demand, TWh/year

Year	2000	2005	2010	2015	2020
Electricity demand-gross, TWh/year	36,3	36,6	39,0	42,0	45,0

Table 4. Expected maximal and minimal load in summer and winter average day

Year	2000	2005	2010	2015	2020
Maximal/minial load, MW	7300/3 100	7500/3 200	7900/3 900	8700/4 100	9100/4 300

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

Table 5. Electricity balance, TWh/year

Year		2005	2010	2015	2020
Potential, TWh/year.	With TPP "Maritsa East – 1"		48,4÷53,6	48,9÷54,1	49,3÷54,5
	Without TPP "Maritsa East – 1"		53,1÷58,2	53,6÷58,8	54,0÷59,2
electricity demand,	Minimal NEC forecast (2005)	36,6	40,0	46,0	53,3
	Maximal NEC forecast (2005)	36,6	40,5	47,7	55,3
	Author's forecast (2006)	36,6	39,0	42,0	45,0

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Energy and energy policy status.

◆ National electricity system- conclusion:

- The most actual objective till 2010 is the rehabilitation of the existing electricity production, transport and distribution capacities;
- After the rehabilitation of the existing production capacities, the construction of the replacing 670 MW “Maritza-East 1” and the utilization of a part of hydroenergy potential, the electricity demand could be satisfied till 2015-2017 with some possibility for electricity export;
- New units bigger then 400 MW, exceptionally 600 MW, are not acceptable taking care of reliability and manageability of the electric power system.

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

◆ Energy strategy for the next 20-25 years.

It is the first time for decades Bulgaria does not have a national energy strategy grounded on energy demand prospects, energy balance and technology development, investment and infrastructure policy. The working out of such strategy is possible on the base of some **initial preconditions**:

– **Drop out the extensive energy development** and the devoid of resource and economic sense myth “Bulgaria – energy island (center) of the Balkans”:

- ◆ Bulgaria imports over 74% of the energy resources and exports only electricity 5-7 TWh/year, which is 2.5-3.2 % of the final energy:

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

- ◆ The energy resources import account for 2005 is 3 bln.Euro. (An increase per rapport of 2004-62%). The profit is around 30-60 mln.Euro/year. The import expenses exceeds 50-100 times the profit.
- **Cover all energy processes and systems:** extraction, processing, energy conversions, transportation distribution and utilization should be analyzed as an unity The realization of such approach is a world practice and is a guaranty for grounded energy development , competitive energy and economy and social acceptance;
- **Combine the Bulgarian energy development with the new EU strategy,** oriented towards energy dependency decrease and development of European and South-East infrastructure, including NABUCO, Burgas-Alexandropulos and Burgas –Macedonia-Vleora projects;

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Policy issues of energy sustainability.

- Insert in the strategy the world trend and policy to **horizontally integrated** (including RES) energy supply and energy consuming systems **on local and municipal levels**.

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

- ◆ **Energy policy and liberalization of the energy market.**

The full liberalization of electricity and gas markets leads to unclear price levels, resource policy and behavior of the big “players” in Europe and neighboring regions. In these conditions of uncertainty the short-term policy should choose profit –making actions in all scenarios (“**win-win**” strategy). For Bulgaria this means much greater concentration to all energy efficiency areas, rehabilitation of existing capacities with good chances of competitiveness and full drop out of state guarantees for construction of capacities for electricity export. (A similar recommendation, put forward in UNDP and World Bank study in 2000 was neglected)

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

- ◆ **Energy prices, competitive economy and social status of the mass consumer.**

The sharp increase of electricity and heat prices and potentially of natural gas leads to serious economic and finance problems of the industry and mass consumer. The electricity price for industry (7.40 Euro/100 kWh) is above the prices of the most European countries. The prices in the building sector already reached the level of considerable part of European countries. Many factors, including the policy of the new monopolists of electricity distribution, lead to future price increase. **The price pressure could be limited by:**

- A firm and consistent policy of the State Regulation Commission. How this could be realized in full liberalization of the energy market?

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

- By already stressed necessity for redirection of energy policy from extensive development, leading to future energy prices increase, to energy efficiency, creation of alternatives for consumer and state policy to decrease energy expenses in production sphere, transport and buildings.

2. ENERGY SUSTAINABILITY ISSUES OF BULGARIA

Policy issues of energy sustainability.

- ◆ Energy policy and society.

As in many other areas, the energy policy is a possessing of limited circle of political elite. The society is far from the objectives and development alternatives, investment policy, privatization contracts...and even don't understand well its district heating bills. A lot has to be done for the transpensity in energy and the culture of society.

CONCLUSIONS

- ◆ Energy is one of the biggest and most complex systems created by the mankind. The strategy towards sustainability should be grounded on extended knowledge of its economy and environment interactions, present and long-term challenges and adequate policy mechanisms.
- ◆ The energy sustainability of Bulgaria needs vigorous reorientation of the energy policy towards essential objectives-competitive economy and well being of the society.

THANK YOU!

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