



GREEN TECHNOLOGIES AND CHEMISTRY

*Round table discussion: Chemistry for green technologies
Seventh National Conference on Chemistry
26–29 May 2011, Sofia, Bulgaria*

Prof. Yoncho Pelovski

*Centre of Ecology, University of Chemical Technology and Metallurgy,
Sofia, Bulgaria and
Bulgarian Chamber of the Chemical Industry*



Legal pressure on the chemical industry in EU: *Restrictions create problems and transfer productions outside Europe*

- New limits for emissions and imissions in the air, waters and soils
- New limits for emissions of green gases
- Management of the wastes is regulated on the base of often changed EU directives
- New chemical legislation and REACH implementation separately from the Global Harmonized System
- New requirements for unleaded gasoline and lower content of sulphur and other components in the fuels follow the EU policy in this area
- Very long and quite complicated procedures for EIA and getting authorization and permission for new installations
- Implementation of IPPC EU directives
- Implementation of Seveso II.



RESULTS AND TENDENCIES FOR EU CHEMICALS Market

- EU is loosing the leading producing role in the Global Economy;
- A number of productions are transferred during last decade from EU countries to other non-EU countries;
- Negative social effects: jobless and lower GDP



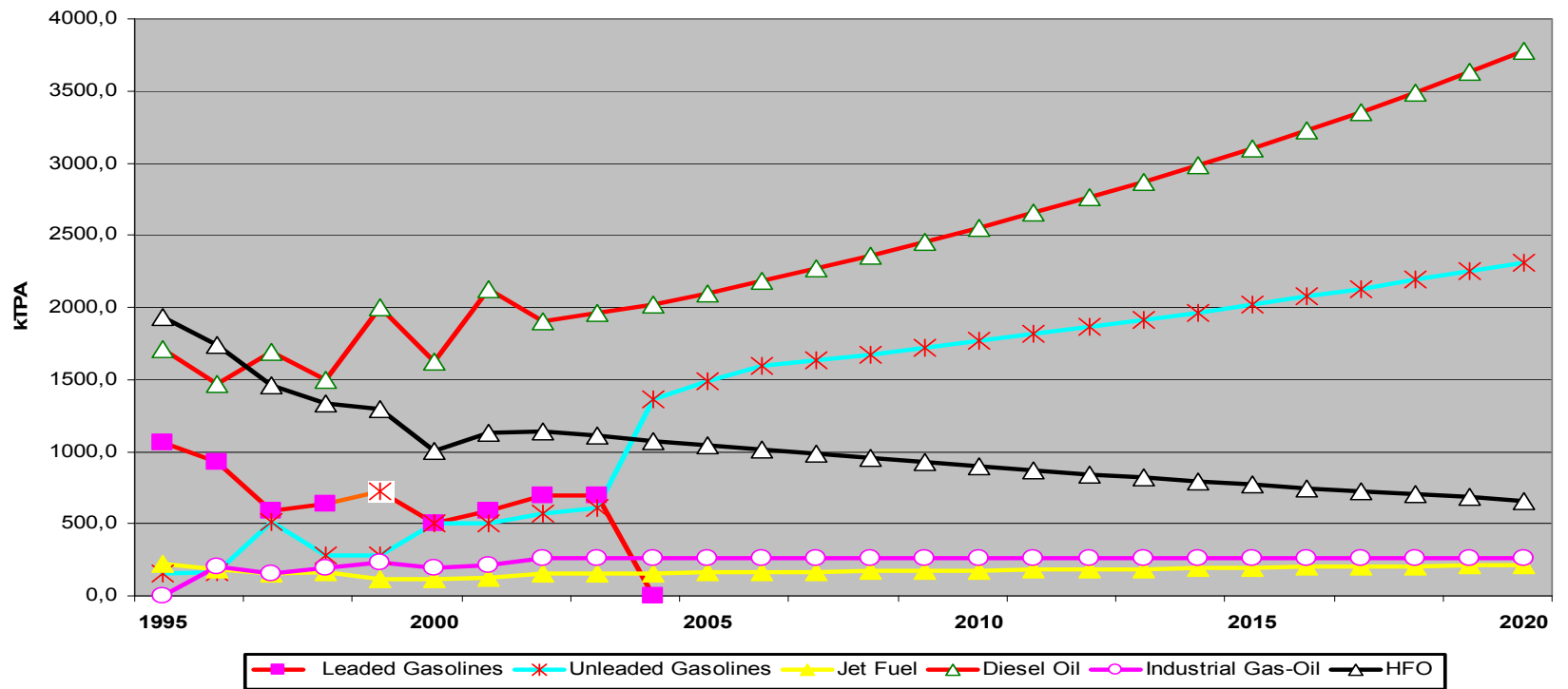
Type and capacity of chemical productions in Bulgaria

- More than 1 000 000 tonnes of soda ash
- Capacity for production of more than 1 000 000 tonnes of nitrogen fertilisers
- Capacity for more than 250 000 tonnes of superphosphate
- Capacity for more than 40 000 tonnes of hydrochloric acid
- Capacity for 30 000 tonnes of phthalic anhydride
- 100 000 tonnes of synthetic fibres
- 6 000 tonnes of artificial fibres
- 16 000 tonnes of tooth paste.

The plants producing chemicals and rubber and plastics products operate between 50 and 55% of their equipment capacity. With a relative share of 13.9% of the gross volume of production output by the manufacturing industry – chemicals, rubber and plastics items production ranks third within the manufacturing sectors in Bulgaria

FUELS

Прогноза за българския пазан на основни продукти



Consumption of fuels in Bulgaria, tonnes per year

Year/product	1995	2000	2002**	2005**	2010**	2020**
<i>Liquid HC gases</i>	63361	177211	65000	75000	80000	80000
<i>Gasoline total</i>	1064957	503983	698666	0	0	0
<i>Pb gasoline</i>	1064957	494238	683666	0	0	0
<i>RON < 98</i>						
<i>RON > 98</i>						
<i>RON 98</i>	0	9745	15000	0	0	0
<i>Unleaded gasoline</i>	157274	500966	570000	1538666	1838666	1838666
<i>RON < 95</i>	162026	167400	130000	120000	120000	120000
<i>RON 95</i>	361	333581	430000	1403666	1698666	1698666
<i>RON 98</i>	-5113	-15	10000	15000	20000	20000
Diesel HC	1037921	764654	800000	1000000	1000000	1000000
Solvents***	14096	3689	14000	15000	15000	15000
<i>Air fuel</i>	224676	115628	150000	160000	165000	170000
Light gas	-10360	112	0	0	0	0

Consumption of Fuels in Bulgaria, tones per year

Year*product*	1995	2000	2002**	2005**	2010**	2020**
Diesel fuel	1707880	1624876	1900000	2644900	2944900	2944900
Industrial light fuel	1411	191018	259300	249300	249300	249300
HFO	1936090	1004757	1144800	1144800	794800	794800
<i>S < 1% m/m</i>	<i>153339</i>	<i>16663</i>	<i>94800</i>	<i>94800</i>	<i>794800</i>	<i>794800</i>
<i>1 < S < 2% m/m</i>	<i>5000</i>	<i>1752</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
<i>2 < S < 2.8% m/m</i>	<i>-32000</i>	<i>1582</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
<i>S > 2.8% m/m</i>	<i>1809751</i>	<i>984760</i>	<i>1050000</i>	<i>1050000</i>	<i>0</i>	<i>0</i>
Oils	14481	51631	157469	157469	157469	157469
Bitumen	86472	184034	238000	248000	258000	258000
Sulphur	24093	23207	30000	45000	60000	60000

Remarks:

- * - Data supplied by the main producers of petrochemical products: *Lukoil-Neftochim-Bourgas JSC, New Plama JSC, Prista Oil JSC, Bimas JSC, Lubika JSC and the National Agency "Customs"*
- ** - Prognosis from *Lukoil-Neftochim-Bourgas JSC and New Plama JSC* ;
- *** - Only the main solvents taken into account */turpentine and acetone/*



GREEN TECHNOLOGIES: Priorities of the way to achieve sustainability

GREEN TECHNOLOGIES FOR TREATMENT OF INDUSTRIAL AND HOUSEHOLD WASTES

- MINIMIZATION OF SOLID WASTES TO THE POINT OF 0-DEPOSITION USING A SET OF TECHNOLOGIES FOR ECOLOGICAL and ECONOMICALLY FRIENDLY UTILIZATION
- RAW MATERIALS CAPACITY FOR RECYCLING OR RECOVERING THE TRADITIONAL NATURAL RESOURCES
- EFFICIENT USE AS A RENUABLE ENERGY SOURCE CAPACITY OF SOME WASTE COMPONENTS
- NEW PRODUCTS ON THE BASE OF NEW HYDROTHERMAL AND TRIBOCHEMICAL PROCESSES USING SUITABLE ADDITIVES DOR ACCELARATION OF CHEMICAL REACTIONS



GREEN TECHNOLOGIES: Priorities of the way to achieve sustainability

- **GREEN TECHNOLOGIES SUPPORTED BY:**
- **FINANCIAL RESOURCES FOR DEVELOPMENT AND IMPLEMENTATION OF NEW NON-WASTE TECHNOLOGIES**
- **FINANCIAL SUPPORT FOR IMPLEMENTATION OF BETTER PRACTICE FOR COLLECTION AND SEPARATION OF MULTYCOMPONENT SOLID WASTES**
- **NEW STANDARDS FOR PACKAGING MATERIALS SUPPORTING REUSE AND EASY RECYCLING**



MANAGEMENT OF AIR QUALITY

NEW CLEAN UP TECHNOLOGIES FOR INDUSTRIAL WASTE GASES TREATMENT:

- **NOWADAYS MOSTLY OLD TYPE CHEMICAL TECHNOLOGIES ARE STILL USED WHERE THE RESULT IS CLEANER AIR, BUT 4–6 TIMES MORE AS A MASS RELEASED WASTE WATERS OR SOLID WASTES OR BOTH (TYPICAL EXAMPLE LIME-LIMESTONE CLEAN UP INSTALATIONS FOR SULPHUR DIOXIDE REMOVAL)**
- **USING THE BEST EXAMPLES OF INNOVATIVE NEW RADIATION OR MEMBRANE OR BIOCHEMICAL PROCESSES FOR CLEAN UP SYSTEMS TO BE INTRODUCED IN THE INDUSTRY: GREEN TECHNOLOGIES WITHOUT HARMFUL EMISSIONS**
- **WIDER USE OF ANY POSSIBILITY TO ACCELARATE THE PROCESSES AND MINIMIZE EQUIPMENT SIZE AND ENERGY CONSUMPTION**

MANAGEMENT OF WATER QUALITY

ROLE OF GREEN CHEMICAL TECHNOLOGIES:

- Minimization of fresh water consumption (examples: DOW CHEMICAL IN NETHERLANDS, AGRIA IN BULGARIA, etc.
- Separation and utilization ions and particles as raw materials – as bioactive components, nitrates and phosphate anions, etc.
- Sterilization using radiation and wave clean technologies



Business initiatives: Responsible care and product stewardship

- The initiative reached this country early in 2002. Bulgarian experts received training in EU Chemical Legislation at Bulgarian Chamber of the Chemical Industry (BCCI) in March 2002
- The BCCI RC collaborators visited 27 chemical companies and they implemented R. Care
- During the last ICCA conference, held in Rome, 17–19 November 2004, Bulgaria was recognized as a member of Leadership group of this initiative



Emissions trading

- **Biomass Boiler, Svilosa JRS.** This was the first agreement for Bulgaria on the mechanism for *Joint Implementation* of the Kyoto Protocol. The World Bank as a custodian of PCF will purchase at minimum 0.5 million tonnes of reduced emissions of CO₂ for the period of 2004–2012. During preparation of the wood in the cellulose manufacture each year are deposited around 50 000 tonnes of barks. The former practice is to deposit the waste biomass. A boiler was build up for biomass burning with a capacity of 13 MW using wood waste. The Biomass Boiler partially substituted the used in HPP coals, reducing the emissions of carbon dioxide and avoiding the emissions of methane, relevant to the rotting of the deposited wood waste. The benefits are as follows:
 - Avoiding the disposal of 100 000 t/year of wood waste and utilization of the bark energy potential.
 - Reduction by 4 000 tonnes of methane emissions till 2012.
 - Reduction by 14 000 tonnes of methane emissions till 2012.
 - Reduction of the CO₂ emissions by 47 000 t/year.
 - Opening of 15 new job vacancies.
- **Agropolychim JSC** is implementing an investment program for better energy efficiency. The main objective of the program is implementation of energy-saving technologies in ammonia plant – main consumer of electric power and natural gas. Production capacity is 26 t/h and work time 330 d/y. The process improvements and new catalysts introduced give a chance to save electric power = 4 752 MW/y and natural gas = 11 675 664 Nm³/y.

Energy saving

- Energy saving program in process of implementation in Zebra JSC. Zebra JRS was certified according to ISO 9001, 14001 and is on the way to cover the requirements of OHSAS 18001.
- New high-tec installations are introduced at Lukoil-Neftochim, Plastimo JRS and Plastmasovi izdelia JRS. As a result Plastimo JRS introduced new insulation materials on the Bulgarian market
- Plastmasovi izdelia JRC is going to introduce recycling of PET bottles



Lessons learned and next step activities needed: conclusions

- The implementation of EU legislation in Bulgaria is uneasy task for the industry, including chemical industry
- The implemented projects and the developments, related to the Responsible Care initiative, demonstrate the good will and efforts made by the managers from the Bulgarian chemical industry to achieve the level required by the new legal acts in the country
- The technological improvements adopted at the refineries, related to the production of lead-free petrol are a good precondition for the improvement in the quality and environmental adequacy of motor fuels, reflected in the requirements of Directive 98/70/EC on the quality of petrol and diesel fuels and the respective amendment – Directive 93/12/EEC



Exchange of experience and granting of support in the following directions will mostly welcome:

- **Investigations and expert analyses of the best applicable technologies and practices related to the implementation of new environmentally cleaner alternative;**
- **Analyses of the profit and expenses as well as the economic mechanisms for ensuring the investment process and access to the best available practices;**
- **Improvements of the products quality control, including import-export control from outside EU market;**
- **Improvement of the control on the emissions, especially particulate emissions and minimization of wastes;**
- **Management of chemicals and replacement of specific hazardous products with less or no hazardous need international co-operation and support from the authorities;**
- **Development of Responsible Care initiative, including product stewardship, as an integrated publicly recognized management system need exchange of experience and support from the authorities and public.**