

ENVIRONMENTAL AND SAFETY REQUIREMENTS COORDINATED APPROACH FOR HIGH TECH INVESTMENT PROPOSALS' REALISATION

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Abstract: The strong industrialized world today need a new sensible approach for further development with high priority to protect and respect the nature, i.e. one rational approach coordinated with environmental and safety requirements for high tech investment proposals' realization. For the aim with the report are defined and proposed the main type of actions for practical application as a combination of legally regulated procedures concerning environmental impact assessment, prevention and control of pollution of the components, identification and application of best technological practices, assurance of operational safety of the plants and protection of the employees, public and environment, using of renewable sources and improving energy efficiency to reach the European "20-20-20" targets.

Keywords: ENVIRONMENT, SAFETY, REQUIREMENTS, INVESTMENT, REALISATION

1. Introduction

Today, when the world is a very different place for live from the past - for instance for last 500 years the world's population has increased about 15 times, and the world has been industrialized without regard for need to protect and respect nature, - as prerequisite a new sensible approach is needed, namely: Rational approach coordinated with environmental and safety requirements for high tech investment proposals' realization.

In this short report is possible to be showed only a sketch of some problems of safety and climate change, for instance in the energy sector, and the understanding for rational approach for mitigation of these problems. In particular, the approach is presented by high tech investment proposals' realization, aimed finally towards sustainable business development in the energy sector as an example, but applicable in all sectors of the economy.

For the aim, with the report below are defined and proposed the main type of actions for practical application with some examples and suggestions.

2. What is the global reality today and prerequisites for solving the problem

There are lot of examples but today only consumption of energy fuels causes about 150 million tons of CO₂ into the atmosphere every day. The whole world is affected by global warming.

It doesn't matter where are CO₂ emissions into the atmosphere, the earth's rotation and the uneven heating of the atmosphere by the sun ensure that the CO₂ is distributed randomly. That's why the UN negotiations of COP21 - 2015 Paris Climate Conference aim a legally binding and universal agreement for keeping global warming below 2°C above pre-industrial levels.

The energy consumption could be representatively presented with examples for the world, Europe and Bulgaria with several graphics:

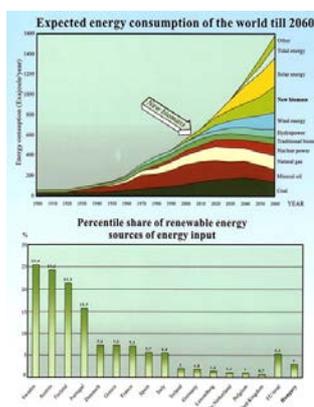


Fig.1 Global energy consumption and share of RES in EU and some countries (source: Eurostat)

The energy consumption in EU is more than 60 % on oil and gas and about 6 % on renewable energy sources (RES) – predominately biomass.

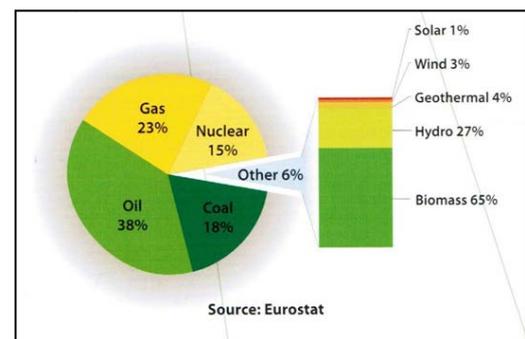


Fig.2. Shares of energy consumption in EU

The survey of the opportunities for transposition of Directive 2001/80/EC for Large Combustion Plants (LCP) in Bulgaria shows increased trend after 2000 of the energy composition [1].

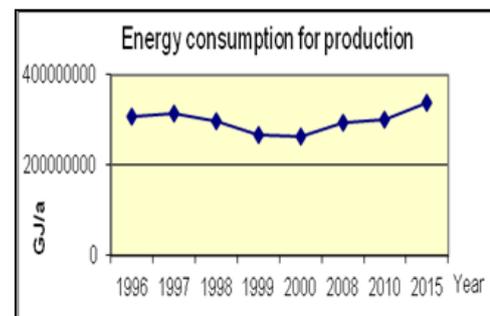


Fig.3. Trend of the energy composition in Bulgaria

The energy intensity of the economy by Gross Domestic Product (GDP) (*kg of oil equivalent per 1000 EUR*) by Eurostat' data in Europe is for EU (28 countries) ~ 142, but for Bulgaria the intensity is too big ~ 611, only Serbia has more ~ 653.

Against the background of economy in Europe, the energy consumption and emissions of Green House Gases (GHGs) are unevenly distributed.

In the basis of the definition of EU' "20-20-20" targets in Fig.4 and Fig.5 are shown:

- on the one hand – the needs and energy consumption but not only of the "big players" – Germany, France, UK, Italy....and of the all 28 members and other European countries,
- on the other hand their share in the GHGs production (Eurostat' data)

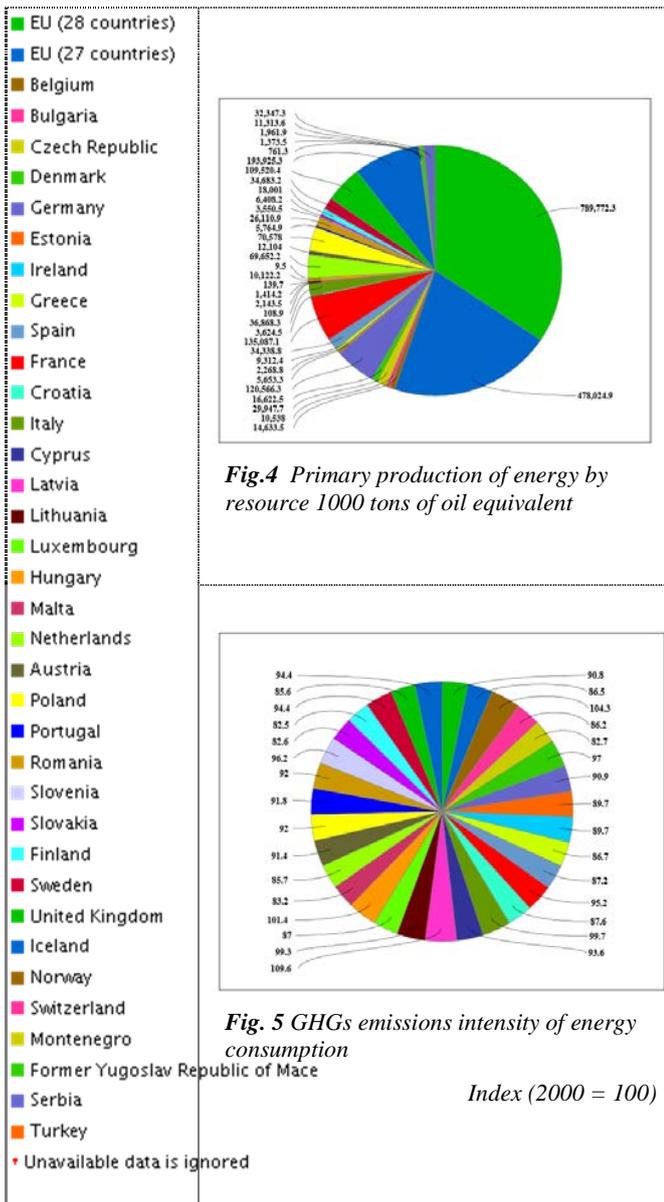


Fig. 4 Primary production of energy by resource 1000 tons of oil equivalent

Fig. 5 GHGs emissions intensity of energy consumption Index (2000 = 100)

One of the most important challenges of the European Union now in the way to the sustainable development is the climate changes, and thence the goal is to find most rationale decision of the European "20-20-20" targets.

3. Solution of the examined problem - main actions for application of environmentally and safe approach for high tech investment proposals' realization

On the backdrop of the European energy consumption reality, how could be achieved safe and environmental sound sustainable development of the investment process, especially when it comes to major projects at all in Europe, in particular in Bulgaria?

The answer of the question "HOW" could be with applying of rational environmentally and safe approach, including in global aspect for GHG' reduction and climate changes' mitigation, consist in its envelope the follow main actions:

Action-1:

Application of procedures:

- Environmental Impact Assessment (EIA) and
- Integrated Pollution Prevention and Control (IPPC), with relevant zoning and emergency planning.

Action-2:

Application of SWOT analysis as technique of the strategic management, but not ordinary and Extended SWOT analysis for identification of the influences of every project.

Action-3:

Application of ALARA Principle (As Low As Reasonably Achievable) in accordance with the relevant legislation and standards for operational safety of the investment infrastructures and protection of the employees, public and environment from hazards and harmful effects.

Action-4:

As supplement to the all activities in accordance with the European "20-20-20" targets, to be achieved 20% of the new enterprise energy consumption to come from renewable sources, and 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

For application of the above actions, the developers and investors in Bulgaria and abroad could rely for performance, research and technical support and/or consulting services of researchers and senior experts from Technical University of Sofia, in particular Safety and Environmental & Engineering Laboratory (SE&EL) at Electrical Power Department.

4. Results and discussion

As example and demonstration of the proposed rational approach here could be presented some results of the steps – on the first place the implementation of Action 1, for instance in the case to consider the assessment and prevention of a power plant' environmental impact and human health risk with the whole public care and responsibility now and for the next generations.

The purpose of the EIA study and report should be defined as follow:

- to study and analysis of possible reasons, sources and levels of impact and determination of potential risk for the environment and human health during construction, normal operation and possible design basis and beyond design basis accidents at the plant, and
- to define recommendations and measures to decrease the impact to the all components of the environment and to the population,
- including on this basis to be determine the risk/emergency zones and thence to be implemented the emergency planning.

The rationale for EIA is based on European and National Regulations of various countries, in particular here for Bulgaria.

So, for instance regarding a construction of a new power plant, or a new unit of existing power plant, in accordance with the European and Bulgarian legislation should be obligatory implemented EIA on the stage "Investment proposal for construction of the plant". After series of implemented projects [2], [3], [4] in this direction from our side and on the basis of our expertise could be recommended the structure of EIA, as follow:

- Introduction
- Part 1. Annotation of the Investment proposal for new plant construction.
- Part 2. Alternatives for execution of the Investment proposal.

- Part 3. Description and analysis of the environment components and factors and their interaction.
- Part 4. Analysis and assessment of hypothetical impact on the population and the environment during construction, normal operation of the new plants and emergencies.
- Part 5. Information on the methods used to prognosticate and assess the impact on the environment.
- Part 6. Description of the measures intended to prevent, decrease or stop hazardous impact on the environment, as well as a plan for execution of these measures.
- Part 7. Standpoints and opinions of the public, competent bodies on EIA, and concerned countries in transboundary context resulting from the consultations held.
- Conclusions
- Appendixes

For instance in Part 5 of EIA for the air pollution assessment applying the Tim's Simple Plume Model by the standard deviations of the plume concentration in the Y and Z directions, the air pollution dispersion could be performed as is shown in Fig 6.

Air Pollution Dispersion

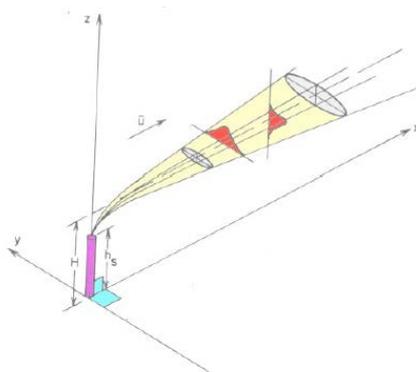


Fig 6. Spread of the plume by the air pollution dispersion [5]

As part of the Action 1, the determination of the risk/emergency zones and thence implementation of the emergency planning, in the general case for instance in the energy sector could be presented as Emergency&Risk zoning reflection in the EIA of the Investment proposal. So, this understanding should be developed in the relevant part of the EIA of each Investment Proposal in accordance with the Bulgarian and European Regulations – of course only for the cases of Investment Proposals where the EIA is obligatory. These under Article 92 of the Environmental Protection Act (EPA) from 2002 (last amendments in 2016), are e.g.: Crude-oil refineries, Thermal Power Plants (TPPs) and other combustion plants with a rated thermal input of 50 MW or more, Nuclear Power Plants (NPPs) and other nuclear reactors, enterprises for iron and steel, ferrous metal foundries with a production capacity over 20 tons/day, installations for the processing of ferrous and non-ferrous metals, enterprises for paper and cardboard, and glass with a capacity over 20 tons/day, etc.

On the one hand the Emergency Planning and Emergency Preparedness measures are stipulated in two Emergency Plans [6]:

- i. The External Emergency Plan (EEP) - Emergency Plan, which determines the emergency planning areas/zones and the actions of the competent authorities for the protection of the population, property and the environment in the event of accidents.
- ii. The Internal Emergency Plan (IEP) - Emergency Plan of the nuclear facility or the site with an ionizing radiation

source which determines the actions of the licensee or the title holder for a solution for limitation of the accident and liquidation of the consequences from it in compliance with the EEP.

On other hand bearing in mind the stages of implementation of the investment project, it was necessary to provide the emergency planning in two respective parts, as follows:

- i. Emergency planning up to the start of the operation of the plant (construction stage)
- ii. Emergency planning in relation to the operation of the plant and as protective actions during eventual accident and an emergency.

The IPPC procedure in the Action 1 have to be implemented for the plants in operation in accordance with Directive 2010/75/EU of the European Parliament and the Council on industrial emissions (the Industrial Emissions Directive or IED) - the main EU instrument regulating pollutant emissions from industrial installations. The IED aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of Best Available Techniques (BAT) in the mayor existing plants.

In the Action 2 the list of SWOT issues should be defined in screening, for instance with the matrix at Fig.7 and their exemplary descriptions below.

Extended SWOT analysis		Internal environment	
		Pluses (S)	Minuses (W)
Ex -environment	Opportunities (O)	S-O strategies: Opportunities for pluses realizations	W-O strategies: Weaknesses destruction for creating of new opportunities
	Dangers (T)	S-T strategies: Using of pluses for weaknesses elimination	W-T strategies: Creating of strategies which not allow activation of the weaknesses from the dangers

Fig.7. Matrix of SWOT issues

S – strengths (pluses): competent human resources, experience in common research, extensive range of expertise, fixed financing from the budget and additional funds from the projects, high qualified human for safety assessment, experience in EU project, expertise with EU projects in other fields of science, well fitted laboratories and software for performing of analysis and assessments;

W – weaknesses (minuses): not enough qualified human resources in the field, direct applicability of results, inadequate human resources management, research is concentrated in the fields, which are partly financed by national sources, Bulgaria can't afford to develop large research programs.

O - opportunities: Financing from national project to cover the studies on innovations, systems and materials, participation in technical meetings, participation at EU Funds, participation in EU calls and international projects, involvement of young researchers in the projects, where it is possible co-operation with neighboring countries.

T – threats (dangers): insufficient number of students of relevant engineering programs at the universities and learners/trainees in training centers, reduction of funding at the universities, research institutions and training centers, only applicative research, confined opportunities for young specialists in the field, no strategy on national level to define the priorities in development of innovations and research, lower interest for knowledge.

These SWOT issues are more appropriate for national level, but could be modified for the conditions of the relevant investment proposal also.

In the Action 3 applies ALARA Principle. This acronym is formed from the phrase "As Low as Reasonably Achievable." The phrase refers mainly to a principle of keeping radiation doses and releases of radioactive materials to the environment as low as can be achieved, based on technologic and economic considerations.

Although that, the more than merely best practice, ALARA which is predicated on legal dose limits for regulatory compliance, this principle could and should be applied as a requirement for all safety programs.

The application of ALARA Principle have to be for operational safety of the investment infrastructures and protection of the employees, public and environment from hazards and harmful effects. In all of the cases ALARA have to be in accordance with the relevant legislation and standards. For instance for investments in the nuclear energy sector leading standards are the nuclear safety & security and safeguards standards of the International Atomic Energy Agency (IAEA), general presented in Fig. 8 in three series:

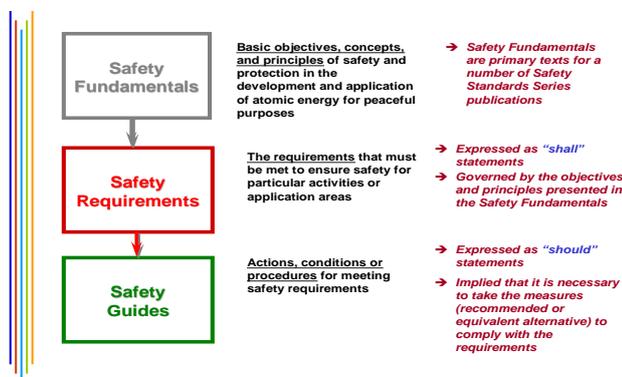


Fig. 8. Series of IAEA safety standards

The aim of the Action 4 is to be defined a model of the targets of the Investment in the new enterprise, in harmony and compliance with the European "20-20-20" targets to be met by 2020, namely:

- A reduction GHGs emissions of at least 20% below 1990 levels.
- 20% of EU energy consumption to come from renewable resources.
- A 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

The European "20-20-20" targets should be consider as good practice and to be applied in each Investment in a new enterprise in Bulgaria and everywhere in the world [7] [8], especially concerning the energy consumption to come from renewable sources, and appropriate measures for improving of the energy efficiency.

5. Conclusion

These actions presented above could be considered and accepted from investors and companies on one hand, and also from authorities and municipalities on other hand, in Bulgaria and other countries, not only as reasonable recommendations. These should be taken together with relevant effective measures and activities for possible contribution for global warming' mitigation and achieve of safe and environmentally sound sustainable development of the investment process and the whole economics.

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