INTEGRATION OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT INTO THE POWER PLANTS WASTE MANAGEMENTS STRATEGIES IN ROMANIA

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This paper presents a wide ranging series of propositions based on some broad ideas and logic. In Romania the largest quantities of waste produced in the last years by economical activities were made by energy power plants, deposited in open storage fields. Transition elements such as heavy metals play a central role in numerous chemical and biological processes in soil, underground water and plants.

As a result, the transition of the elements in the environment has been extensively studied, but major questions remain unsolved. At the same time different procedures for quantifying the costs and risk assessments are already applied.

The authors believes there is a need to treat the topic of sustainability both seriously and pragmatically, to embrace a much greater ambition for ecology in architecture of the olds and news waste landfills. Only knowledge of waste composition is not sufficient anymore. We will analyze the waste management strategies in Romania in balance with power plants company's strategies.

Keywords: ash and sludge deposit, risk, power plant, sustainable development.

1. Introduction

Sustainable consumption and production is the core of sustainable development, encompassing the three dimensions — economic, social and environmental. The inventory should therefore be seen in the context of the European Union's Lisbon Strategy of Economic and Social Renewal (2000) [1] and Sustainable Development Strategy (Gothenburg, 2001) [2], which provide the broad framework for promoting sustainable consumption and production in the EU.

The adoption of the EU Sustainable Development Strategy in 2001 added a third, environmental pillar to the Lisbon Strategy. The need to pursue, in a balanced way, economic growth, social improvements and environmental protection was translated into detailed objectives and actions. The European Strategy identifies six key areas: climate change, health, natural resources, poverty and exclusion, ageing and demography, land use and mobility.

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Sustainable consumption and production is a challenge and an opportunity. More efficient use of resources in order to reduce economic costs and environmental impacts offers benefits to society, environment and economy. It creates business opportunities, for innovative environmental technologies as well as for services.

At the World Summit on Sustainable Development (WSSD) in 2002, all countries committed themselves to promoting sustainable patterns of consumption and production, with developed countries taking the lead. More specific calls, countries made a commitment to promote the development of a 10-year framework of programmes on sustainable consumption and production, in support of national and regional initiatives.

One of the most serious problems of the environmental protection field, both for Romania and for the other countries, is the waste generation in large quantities and their inadequate management. The economic development achieved in the last few years, the production and consumption increase, but also the existence of out-dated facilities in the industrial field, which consume plenty of energy and materials, have determine the annual generation of large waste quantities.

2. Sustainable development related to waste management

The sustainable development of the energetic sector essentially means the meeting of the energy need at a competitive price, qualitatively and in conditions of safe supply, resources efficient using, with a limited impact on the environment. Energy production and consumption exercise great pressure on environmental, including its influence on climate change, the deterioration of natural ecosystems and built environment and the production of negative effects on human health.

The pollution coming from the energy activity (upstream and downstream of energy production placement), is responsible of pollutants' existence with a percentage of over 50% at methane and carbon monoxide emissions, 97% at sulphur dioxide emissions, 88% from nitrogen oxides emissions, 99% at carbon dioxide emissions.

Waste management **options,** as you can observe in figure 1, should be considered in the decreasing order of priorities presented below:

- **Waste prevention**– by application of "clean technologies" in waste generating activities;
- **Reduction of waste quantities** – by implementing best practices in every waste generating activity;
- **Valorization** – by reuse, material recycling and energy recovery;
- **Disposal** – by incineration and landfill.

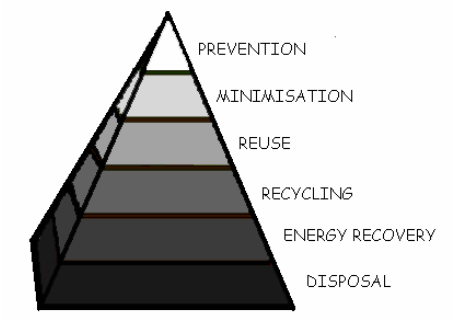

Fig 1 Waste hierarchy

Waste generation by energy production and water supply is shown in figures 2. The two sectors are presented together as data on the Gross Value Added are not available separately for each one. In general, the waste quantities of both sectors are clearly dominated by energy production waste. Waste from water supply accounts on average for about 10 % of the amount generated by energy production. The graph indicates a clearly higher relative waste generation in new Member States and Candidate Countries than in EU 15. Probable reasons are the type of energy sources used and the efficiency of energy production.

Waste arising in the old Member States ranges between 36 kg/persons and 300 kg/person. Amounts are higher in most new Member States and Candidate Countries with values up to 900 kg/ person in 2002 in Slovenia. Averages for 2002 are 281 kg/ person for the EU 25, 502 kg/person for the new Member States and 237 kg/person for the EU 15 [3].

In Romania in 2002, the total quantity of waste resulting from productive activities reported was 372.4 million tons – 24.5 millions tons of (hazardous and non-hazardous) production waste and 347.9 million tons of waste that do not fall under the terms of Law no. 426/2001 on the regime of waste. Most of the waste in the latter category is represented by waste generated by mining activities. The highest distribute of wastes production were reported by the power generation sector (11.7 million tons), the metallurgical industry (4.8 million tons), the food industry (1.2 million tons) and the chemical/petrochemical industry (1.1 million tons).

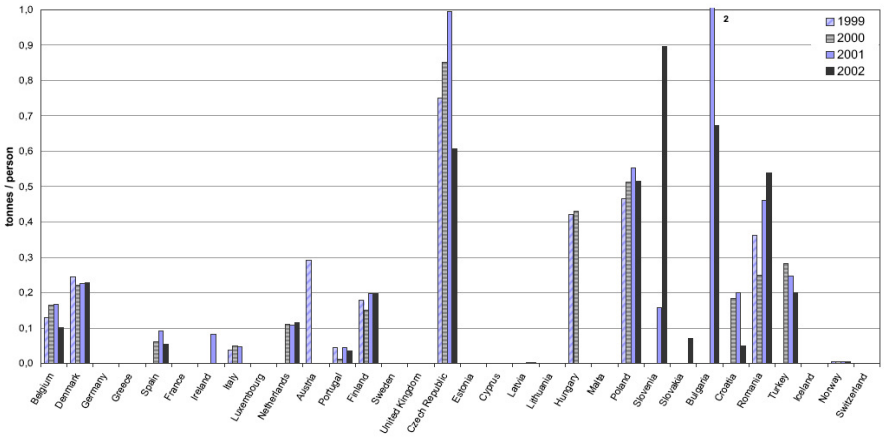

Fig 2 Waste generation by energy production and water supply 1999 - 2002

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The Romanian Waste Management Strategy indicates some specific objectives for waste from the generation of heat and power, incineration and co-incineration. In table 1 drawing out from the national waste management strategy the main objectives for this category of wastes.

Table 1

Specific Strategic Objectives for Certain Waste Flows [4]

Waste category	Sub-category	Main objective
2. Waste from the generation of heat and power, incineration and co-incineration	2.1. Slag, bottom ash, fly ash, waste gypsum from thermal power stations	2.1.1. Supporting materials and energy recovery
	2.2. Slag, bottom ash, fly ash, waste gypsum from incineration and co-incineration installations	2.2.1. Treatment before disposal in case recovery is not possible

In accordance with The Accession Treaty of Bulgaria and Romania, Annex VII Romania shall ensure a gradual reduction of liquid waste land-filled in 23 existing non- compliant facilities in accordance with the following annual maximum quantities:

— by 31 December 2006: 11 286 000 tones;
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— by 31 December 2008: 11 120 000 tones;
— by 31 December 2009: 7 753 000 tones;
— by 31 December 2010: 4 803 000 tones;
— by 31 December 2011: 3 492 000 tones;
— by 31 December 2012: 3 478 000 tones;
— by 31 December 2013: 520 000 tones.

21 waste landfills are owned by power plants and operate hydraulic transport facilities for ash and sludge and must change the operation system or to close the deposit. According to the Government Decision no. 349/2005 regarding waste storage, the existing unconfirmed deposits must complete the requirements or to be close until the beginning of 2014. The landfills owners must attain one found for the deposit closure and monitoring. According to the legal duties the owner must monitoring the deposit at least 30 years after the closure [4].

Currently work on trace element mobilization and fly-ash behavior is directed toward assessing and minimizing the risks of ash disposal practices. Benefiting operations that are facing long-term (100 year plus) responsibility for management of ash dams following their decommissioning, including management of risks of groundwater leaching both during the life of the repository and after decommissioning.

3. Power plant solid waste in Romania

The coal used in the Romanians power plants have the characteristics presented in table 2 and 3. As you can see the Ash percentage is excessive high and in the same time the heat power value has a determinate influence related to energy efficiency.

Table 2

Combustible types used in Romanian Power Plants

Combustible type		M.U.	Heat power value
Solid	Lignite	KJ/ kg	7681
	Pit coal	KJ/ kg	13.608
Liquid - Heavy Oil		KJ/ kg	38.520
Gas- natural gas		KJ/Nmc	33.700

Table 3

Composition of the combustible used in Romanian Power Plants

Content	Pit coal (%)	Lignite (%)	Heavy Oil (%)
Carbon	40,0	19,2	83,9
Hydrogen	2,.8	1,9	10,9
Ash	38	39,9	0,3
Water	9,5	27,5	0,9
Azotes	0,8	0,6	0,5
Sulphur	1,8	1,6	2,0
Oxygen	7,1	9,3	1,5

The most important power plants witch use coals in Romania are near to the extractive areas:

• Turceni, Rovinari, Isalnita, Craiova II, Govora,

• RAAN Sucursala Romag Termo.

In table 4 are presented the annual characteristics for Mintia power plant witch use coal form Jiu Valley.

Table4

Coal characteristic used at Mintia Power Plant 1993 – 2002 [5]

Combustible		**UM**	**1993**	**1994**	**1995**	**1996**	**1997**
Coal	Quantity	t	2.806.188	2.781.820	3.393.292	3.287.344	2.856.920
	Heat power value	kJ/kg (kcal/kg)	16.209 (3.871,4)	15.994 (3.820,0)	15.353 (3.667,0)	15.733 (3.757,8)	15.407 (3.680,0)
	Ash content	%	39,1	39,2	41,8	40,8	41,8
Combustible		**UM**	**1998**	**1999**	**2000**	**2001**	**2002**
Coal	Quantity	t	2.132.035	2.311.430	2.658.721	2.874.968	2.771.948
	Heat power value	kJ/kg (kcal/kg)	15.496 (3.701,1)	15.763 (3.765,0)	15.892 (3.795,8)	15.613 (3.729,0)	14.713 (3.514,3)
	Ash content	%	41,8	41,6	41,3	40,7	43,7

As a result of this amount of ash content the waste deposits absorb hundred thousand of waste every year as you can see in the figure 3. In Romania each power plant that uses coal has huge landfill because of the deposit technologies and because of the coal characteristics. For example Isalnita Power Plant own 440 ha, and the mail power plant 134 ha and the ash and sludge deposit 306 ha.

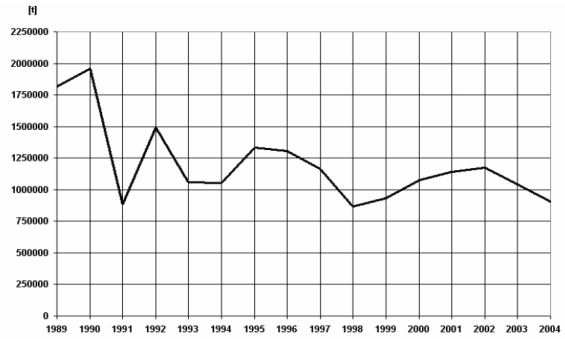

Fig 3 Ash quantity deposited at Mintia Power Plant

Tacking into account the waste hierarchy presented in the first part of the paper can be recommended several actions:

- decreasing of energy consume;
- increasing the energy efficiency into power plants;
- use of better coal with a smaller quantity of ash;
- using the solid waste as secondary row material;
- implementation of new dry deposits.

The first 3 measures are related to the prevention level, the forth one is related to the reuse level and the fifth one to the storage of the waste. It s very interesting to observe that from the beginning of the coal use into power plants was a very big interest for the first 4 measures and as you can see in the figure 4 the solid waste was sell even at the beginning of the XX century.

Fig 4 Solid waste commercialization – inter-war period

The transport necessity of the waste made the hydraulic method the most used in the past overall. The new regulations has determinate the changes. In figure 5 and 6 there are presented the wet deposit and the dry deposit. In the firs case you can see that the water pellicle isn't present to all surface and this can produce particulate dispersals and in the second one you can see one example for a dry deposit.

Fig 5 Wet ash and sludge landfill

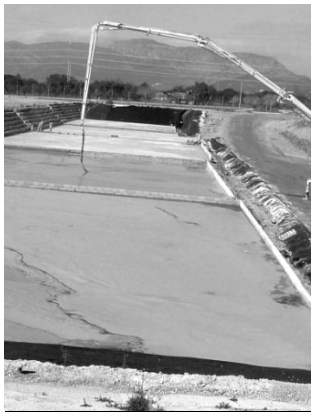

Fig 6 Dry ash and sludge landfill

4. Conclusions

Coal fired power generation has gone through several process modifications to improve efficiency, control the quality of emissions, and to improve the quality of combustion products. The variety of coal that is burned influences the chemistry of combustion products significantly. Ash and sludge result from the burning of coal under controlled conditions are non-hazardous.

The disposal cost of coal combustion by-products has escalated significantly during the last couple of decades due to significant changes in landfill design regulations. Utilization of solid waste as secondary row material can helps preserve existing licensed landfill capacity and thus reduces the demand for additional landfill sites. Continued research and marketing efforts, make possible to utilize 98% of coal combustion products in 2003 compared to only 5% in 1980. Increased commercial use of solid waste translates to additional revenues and reduced disposal costs, which in turn translates to lower electric bills for electric customers and can help sustainable development of the power sector.

REFERENCES

[1] *** COM 2000/7: **http://europa.eu.int/comm/lisbon_strategy/pdf/lisbon_en.pdf**
[2] *** COM(2001)264 final: **http://europa.eu.int/eur-lex/en/com/cnc/2001/com2001_0264en01.pdf**
[3] *** Waste generated and treated in Europe, Luxembourg: Office for Official Publications of the European Communities, 2005
[4] *** Strategia Națională de Management a Deşeurilor 2004
[5] *V. Vaida,* "Calitatea cărbunelui, factor determinant la impactul termocentralei mintia asupra mediului înconjurător", Buletinul AGIR nr.3/2006