effects of energy use on environment and ecosystems

Content

The workshop

"EFFECTS OF ENERGY USE ON ENVIRONMENT AND ECOSYSTEMS"

is financed in accordance with the
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"Environmentally usage of Power"

between

Technical University of Vienna
E302 Institute for Thermodynamics and Energy Conversion
and
Austrian Science and Research Offices Ljubljana Slovenia
and Sofia Bulgaria (ASOs)

Research on Energy Use at the Institute for Thermodynamics and Energy Conversion

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Vienna University of Technology

Overview

- **Flue gas condensation**
- **Inflatable Solar Concentrator (HELIOtube)**
- **Numerical simulation of solar farms**

Situation in Austria:

Energy consumption and CO_2 production increase
➔Austrian cannot fullfill the Kyoto Protokol

Trend away from gas and oil for production of heat for detached houses in direction to alternative energy like biomass, solar energy, heat pumps …

Flue gas condensation

Detached household:

Biomass: increasse of Pellets or wood chip stoves with low power

➔Increase of efficiency with flue gas condensation

➔ Problem with fine dust (especially in inversion areas like Graz or Klagenfurt)

Flue gas condensation

- Development of a condensing boiler for Pellets and wood chip ovens
- Use of the fine dust as nucleation particle for the condensation to deposit the flue dust **Problem:** low water content of the flue gas

Heliotube

Aim of the Project

- Higher energy density → Higher efficiency of conversion to energy
- Costs reduction
  - Ligther structure
  - Cheaper structure
  - Mass producible

→ Cutting the Costs by 2/3 compared to Parabolic trough collector is realizable

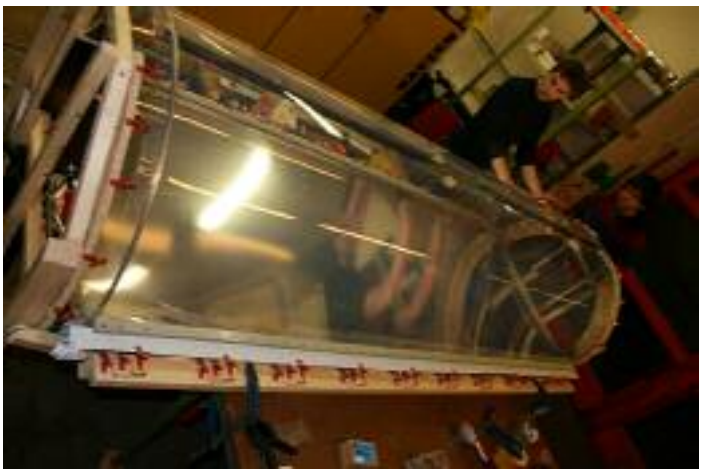
Heliotube

Status Quo

- Test Rig at Vienna University of Technology (ITE) and Vision of the Project

Heliotube

- New Model



Heliotube

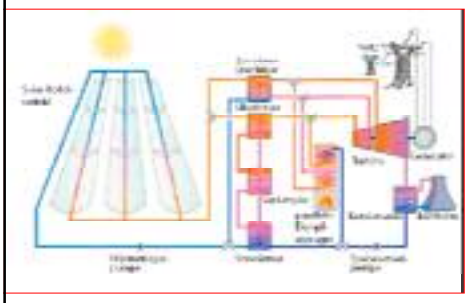
Next Steps

- **Prototype with 10 m in length and ~0.9 m in diameter**
- **Fundamental experimental set ups at ITE and Neusiedl**
- **Continuing of formfinding and modelling of the HELIOtube**

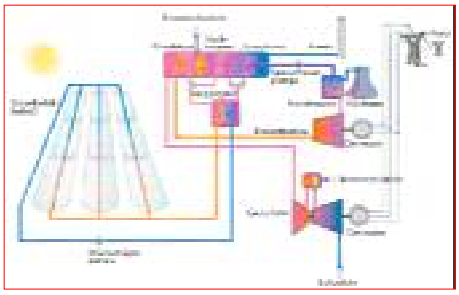
Numerical simulation of solar farms

Dynamic Simulation of heated tube networks

Solar field



SEGS - Solar Electricity Generation System



ISCCS - Integrated Solar Combined Cycle System

Overview

- **Generals about the simulation program**
- **Mathematical models**
  - **Model of the working medium**
  - **Model of the header**
- **Description of the simulated boiler**
- **Results of the dynamic simulation**

Generals about DBS

- Homogeneous two phase flow model
- Discretization of the partial differential equations was done with the aid of the finite-volume-method
- Use of SIMPLER and PISO for the pressure-velocity coupling
- To prevent checkerboard pressure fields a staggered grid is employed and for the convective term the UPWIND scheme is used.
- No pressure stage restriction
- Data administration with graph theory

Simplification assumptions for the working fluid

- One-dimensional discretization
- Constant cross section area over the control volume
- Constant physical properties in the control volume
- The velocity in the control volume is constant
- The thermal conductivity of the fluid is infinite in flow direction and zero in axial direction

Model of the working fluid

Mass balance:

$$\frac{\partial \rho}{\partial t} + \frac{\partial \rho w}{\partial x} = 0$$

Momentum balance:

$$\frac{\partial \rho w}{\partial t} + \frac{\partial \rho w w}{\partial x} = -\frac{\partial p}{\partial x} - \rho g_x + \Delta p_{fric}$$

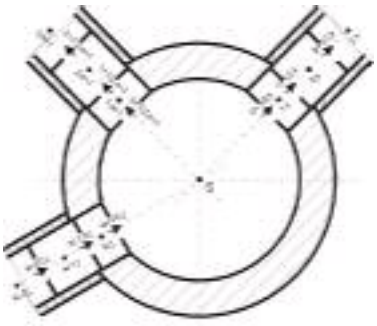
Energy balance:

$$\frac{\partial \rho h}{\partial t} + \frac{\partial \rho w h}{\partial x} = \dot{q}\frac{U}{A}$$

Simplification assumptions for the header-model

- Header can be seen as one single point
- Gravity distribution of density and pressure can be neglected
- The segregation of the fluid in the header will not occur

Model of the header



Momentum balance:

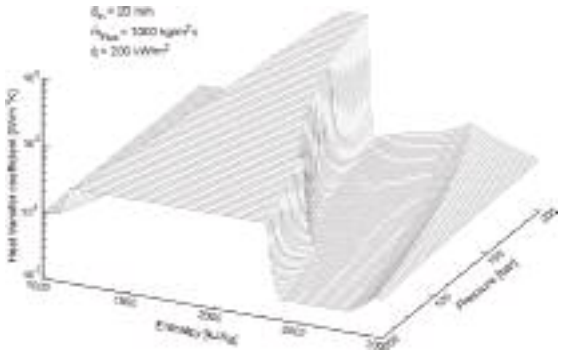
$$p_S = p_j - \frac{\varsigma_j}{2}\rho_j w_j \left|w_j\right|$$

$$p_S = p_k + \frac{\varsigma_k}{2}\rho_k w_k \left|w_k\right|$$

Mass balance: $$\frac{d}{dt}\rho_S V_S = \sum_j \rho_j w_j A_j - \sum_k \rho_k w_k A_k$$

Energy balance: $$\frac{d}{dt}\rho_S h_S V_S = \sum_j \rho_j w_j h_j A_j - \sum_k \rho_k w_k h_k A_k$$

Model for the heat transfer (subcritical region)



Single phase flow:

Gnielinski, V.: Ein neues Berechnungsverfahren für die Wärmeübertragung im Übergangsbereich zwischen laminarer und turbulenter Rohrströmung. *Forschung im Ingenieurwesen*, **61**, No. 9, pp. 240-248 (1995)

Gnielinski, V.: Neue Gleichungen für den Wärme- und den Stoffübergang in turbulent durchströmten Rohren und Kanälen. *Forschung im Ingenieurwesen*, **41**, No. 1, pp. 8-16 (1975)

Model for the heat transfer (subcritical region)

Two phase flow:

Heat transfer in the subcooled and nucleate boiling region:

Jens, W. H. and Lottes, P. A.: Analysis of Heat Transfer, Burnout, Pressure Drop and Density Data for High Pressure Water. Argonne National Laboratory, USAEC Report ANL-4627, 1951

Thom, J. R. S., Walker, W. M., Fallon, T. A. and Reising, G. F. S.: Boiling in Subcooled Water During Flow Up Heated Tubes or Annuli. In „Symp. Inst. Mech. Eng.“, London 15.-16. September 1965

Departure of nucleate boiling (DNB):

Doroshchuk, V. E., Levitan, L. L. and Lantsman, F. P.: Recommendations for Calculating Burnout in a Round Tube with Uniform Heat Release. *Teploenergetika*, **22**, No. 12, pp. 66-70 (1975)

Dryout:

Kon'kov, A. S.: Experimental Study of the Conditions under which Heat Exchange Deteriorates when a Steam-Water Mixture Flows in Heated Tubes. *Teploenergetika*, **13**, No. 12, pp. 77 (1965)

Used for horizontal or inclined tubes for DNB and Dryout.

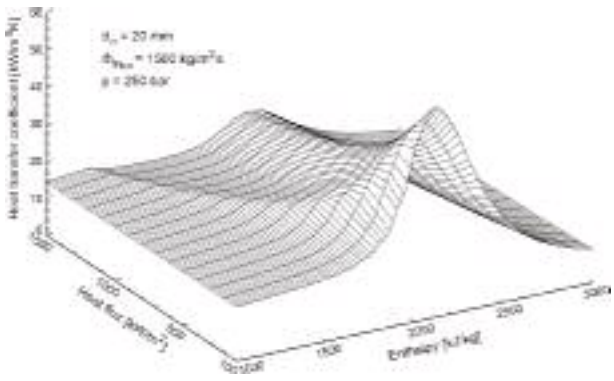
Kefer, V.: Strömungsformen und Wärmeübergang in Verdampferrohren unterschiedlicher Neigung. Dissertation, Technische Universität München1989

Post-Dryout region: (thermodynamic imbalance)

Köhler, W.: Einfluss des Benetzungszustandes der Heizfläche auf Wärmeübergang und Druckverlust in einem Verdampferrohr. Dissertation, Technische Universität München 1984

19

Model for the heat transfer (supercritical region)

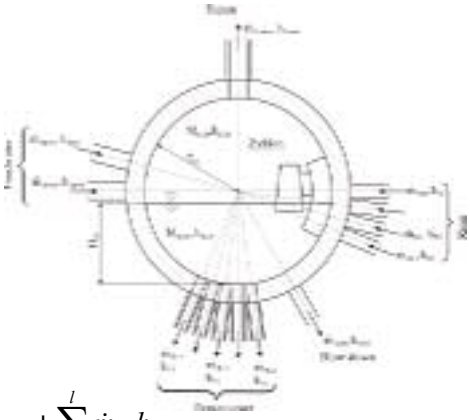


Kakac, S. and Shah, R. K. and Aung, W.: „Handbook of Single-Phase Convective Heat Transfer.” John Wiley & Sons, New York 1987

Workshop Effect of Energy Use on Environment and Ecosystem, Brasov, Romania 2009

20

Model for the drum



Mass balance:

$$\frac{\partial M_{W,Tr}}{\partial t} + \frac{\partial M_{D,Tr}}{\partial t} = \sum_{i=1}^{k} \dot{m}_{Spwi} + \sum_{i=1}^{l} \dot{m}_{Sti}$$

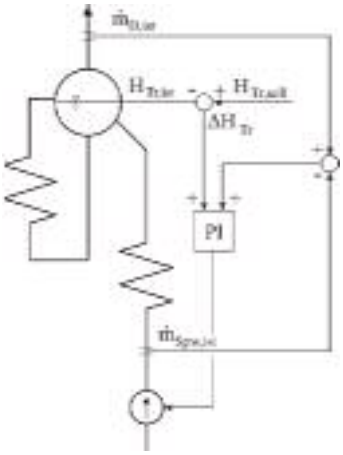
$$- \sum_{i=1}^{n} \dot{m}_{Fi} - \dot{m}_{Schl} - \dot{m}_{D,aus}$$

Energie balance:

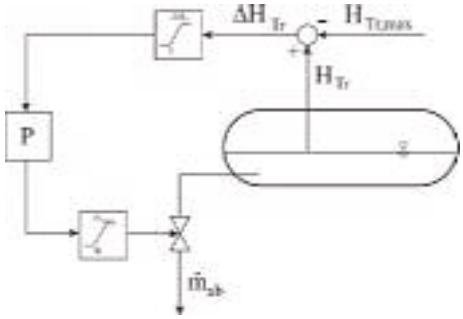
$$\frac{\partial M_{W,Tr} h_{W,Tr}}{\partial t} + \frac{\partial M_{D,Tr} h_{D,Tr}}{\partial t} = \sum_{i=1}^{k} \dot{m}_{Spwi} h_{Spwi} + \sum_{i=1}^{l} \dot{m}_{Sti} h_{Sti}$$

$$- \sum_{i=1}^{n} \dot{m}_{Fi} h_{Fi} - \dot{m}_{Schl} h_{Schl} - \dot{m}_{D,aus} h_{D,aus} + V_{Tr} \frac{\partial p_{Tr}}{\partial t}$$

Controller for the drum



Three point controller for the water level



Controller for the high water level

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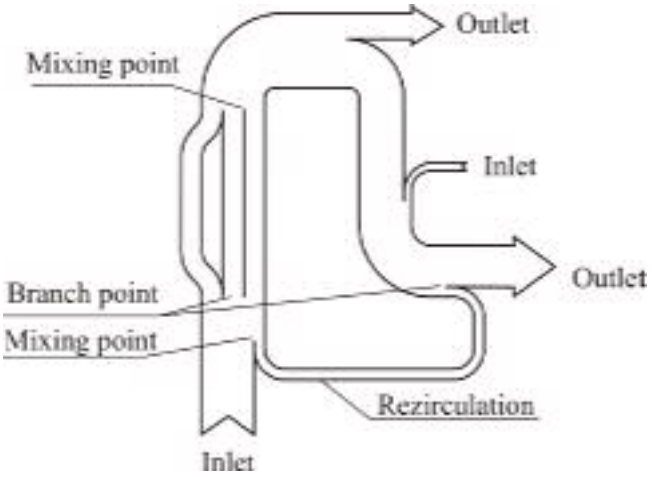
Model for the flue gas



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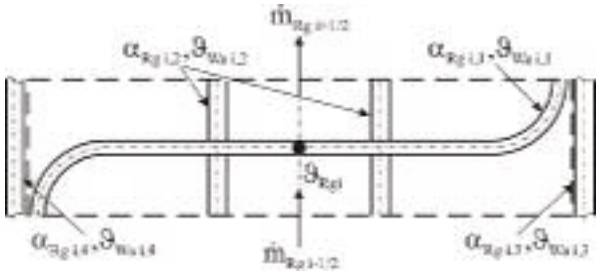
Model for the flue gas



Mass balance: solved quasi-stationary
Momentum balance: neglect
Energy balance: Solved full implicit according to the finite volume method

Future work

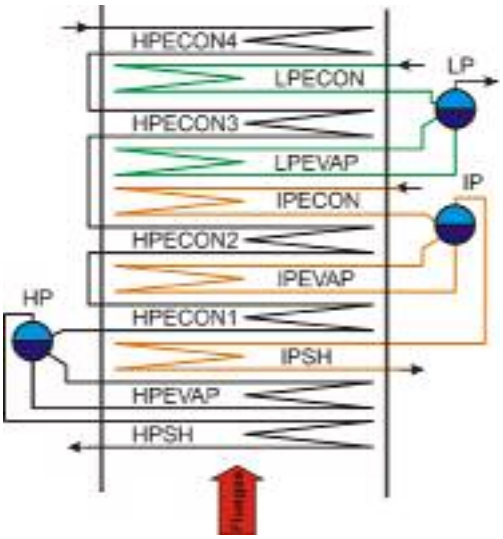
- Drift flux model (5 equation model) and 6 equation model for the two phase flow
- Expanding of the program for once-through boiler simulation
- Full implementation of the controller
- Models for the solar radiation
- Turbine modelling
- Model of the water separator
- Condensation

Design of the HRSG

System pressure at simulation start:
HP : 100 bar
IP: 32 bar
LP: 12 bar

System pressure at full load:
HP : 125 bar
IP: 30 bar
LP: 13 bar

Number of parallel tube pathes:
HPEVAP : 6
IPEVAP: 3
LPEVAP: 3



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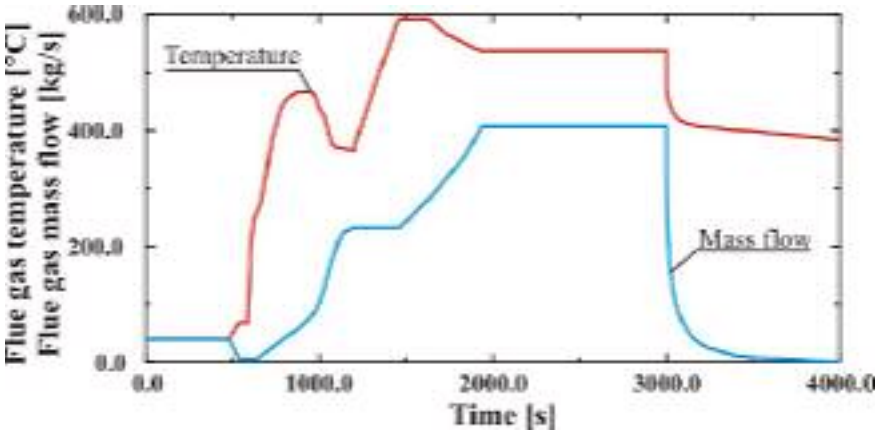
Example

Temperature and mass flow of the flue gas



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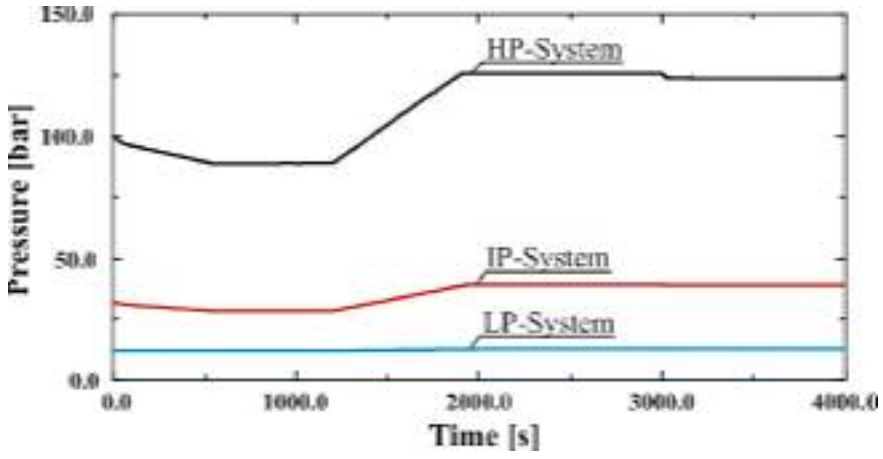
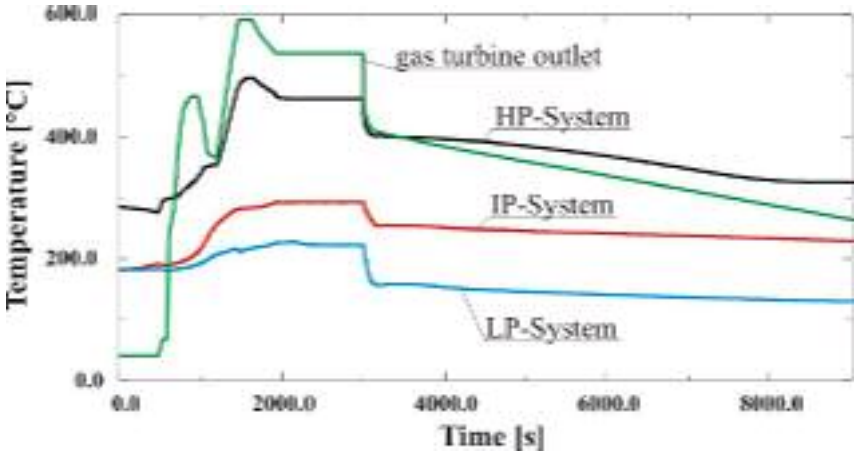
Example

Drum pressure



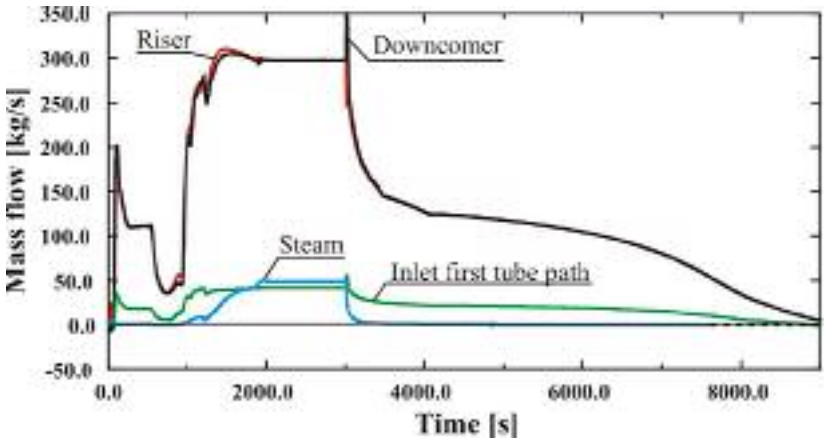
Example

Flue gas temperature



Example

Mass flow in the HPEVAP



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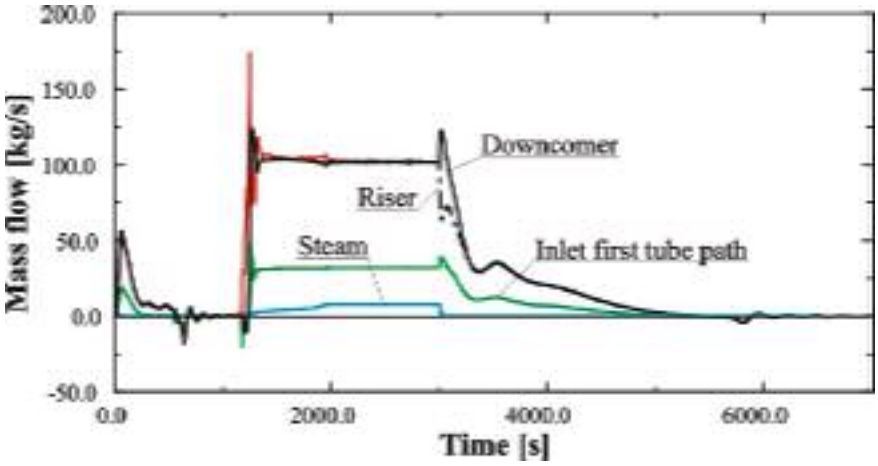
Example

Mass flow in the IPEVAP



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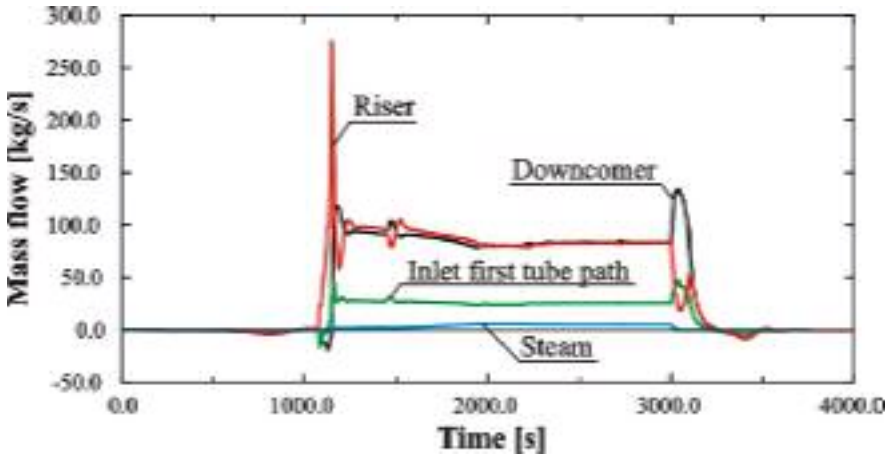
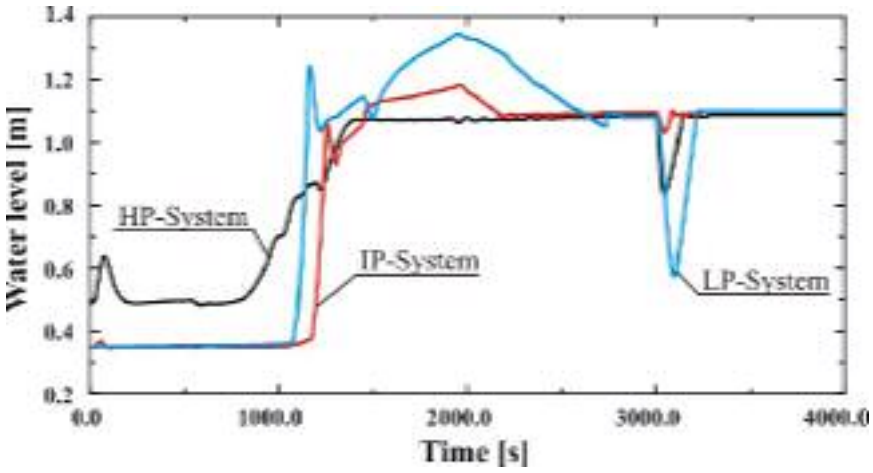
Example

Mass flow in the LPEVAP



Example



Thank you for your attention

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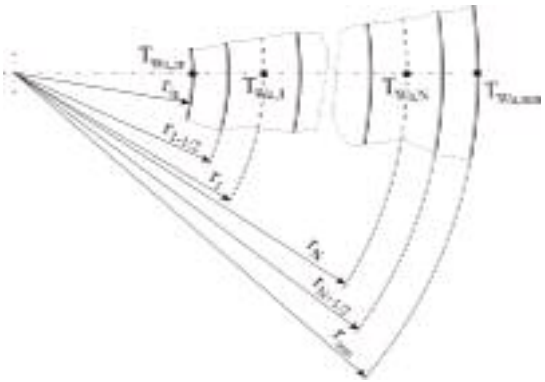
Model for the thick walls



Balance equation:

$$\frac{\partial T}{\partial t}\rho c_p = \frac{1}{r}\frac{\partial}{\partial r}\left(r\lambda\frac{\partial T}{\partial r}\right)$$

The partial differential equation is solved with the aid of the finite volume method.
The material properties are used according to Richter.

Richter, F.: Physical properties of steel as a function of the temperature.
MANNESMANN Research report, Nr. 10, 1983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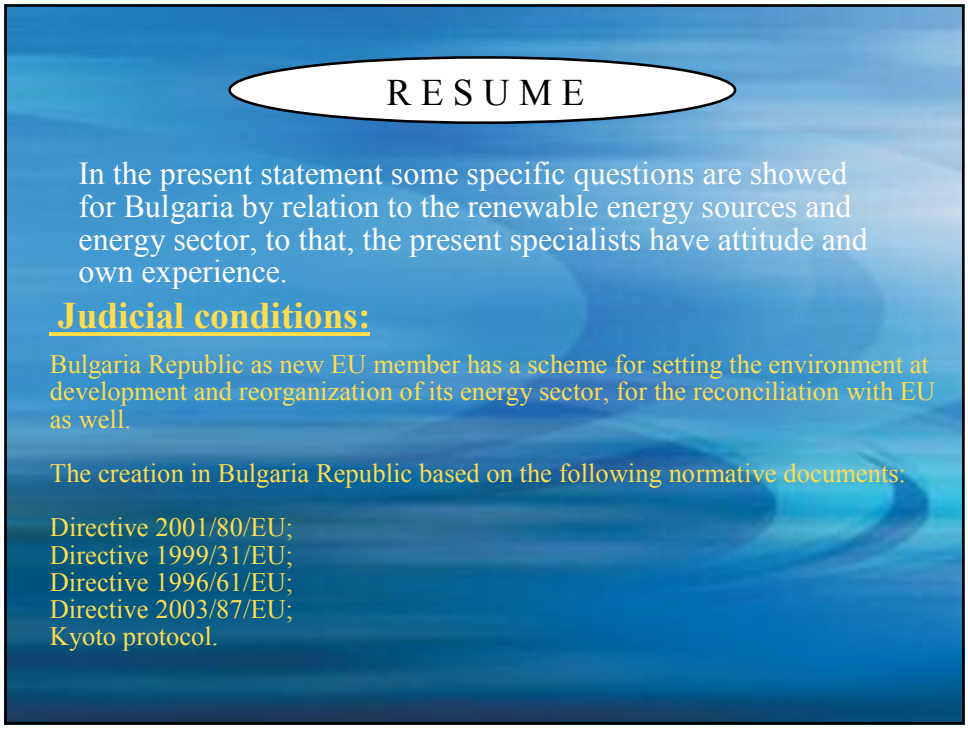

RESUME
In the present statement some specific questions are showed for Bulgaria by relation to the renewable energy sources and energy sector, to that, the present specialists have attitude and own experience.
Judicial conditions:
Bulgaria Republic as new EU member has a scheme for setting the environment at development and reorganization of its energy sector, for the reconciliation with EU as well.
The creation in Bulgaria Republic based on the following normative documents:
Directive 2001/80/EU;
Directive 1999/31/EU;
Directive 1996/61/EU;
Directive 2003/87/EU;
Kyoto protocol.

Bulgaria Republic

Specific particularities of the energy base of Bulgaria Republic

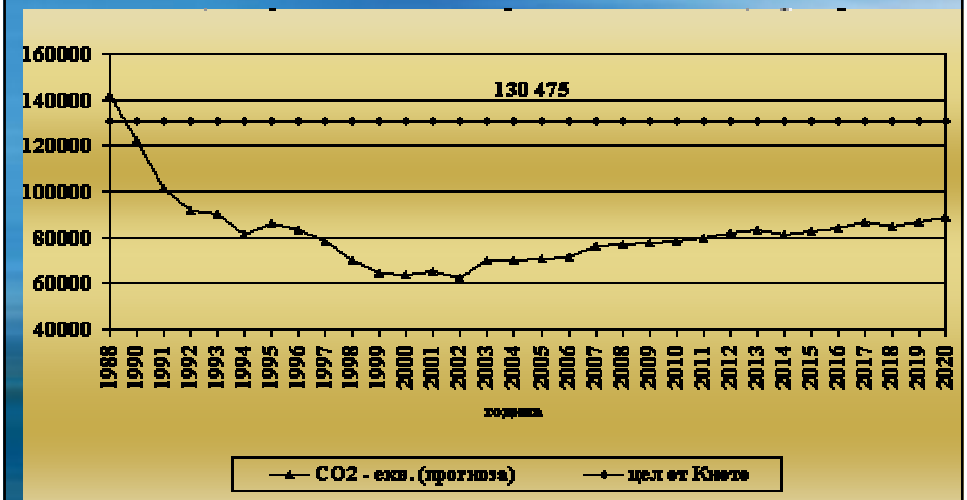
Branch	SOx	Fixed organic compounds	CH_4	NH_3	CO	NO_x
Heat power plant	735	0,85	0,80	-	3,08	61,8
Domestic polutians	17,6	25,7	17,8	-	426,6	4,3
Industry	50,7	1,43	1,1	-	61,9	18,6
Non burning productions	32,3	18,3	2,3	6,6	4,4	16,5
Fossil fuels	0,078	3,6	526,4	-	-	-
Road transport	6,5	39,3	1,2	0,03	233,3	97,5
Construction machines	34,3	6,9	0,343	0,004	17,2	42,8

A characteristic to the underlying pollutants to the environment at energy consumption thousand ton/year.

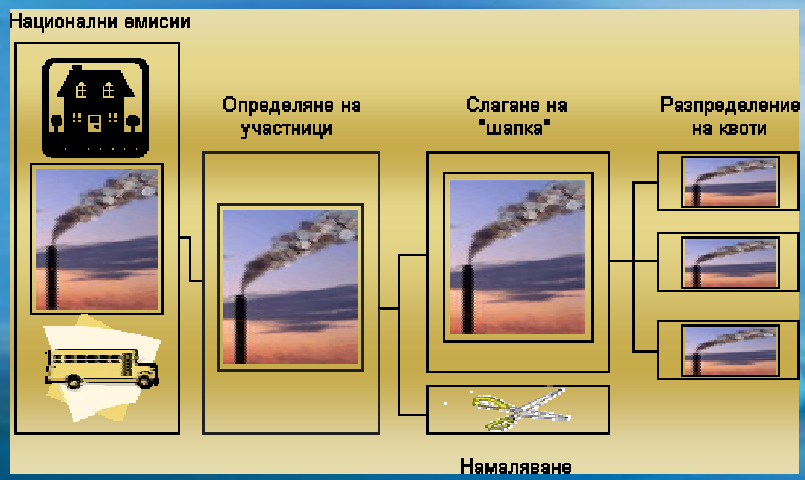
POTENTIAL OF RENEWABLE ENERGY SOURCES IN REPUBLIC OF BULGARIA

☼ - Solar energy potential
▌- Geothermal potential water
● - Water energy potential
▬ - Biomass potential

The emissions prognosis - carbon dioxide in 2020



An algorithm of allotment to the emission quotas by the biggest polluters of the environment



- National emission
- Delegating participants
- Grounding a hat
- reduction
- Allocation to quotas

Our attempt to prevent environment and the ecosystems of energy transformation

The entity of adept intervention to neutralizing the adverse impact on the environment was the heating central with turbine using the point coals.

The unacceptable high alkaline content to the water of lake (ph 11) was the main ecological topic.

The technology scheme for entrance the burning products in the water highway to the lake was developed.

Bulgarian Society for the Protection of Birds

The area of Sliven city is appropriate for windy parks building to production of electricity.

Specific noise that windmill gives adverse impact on the population to the birds - the more extra 'Golden eagle' (Aquila chrysaetos).

For the needed conditions to be justified on life of the rare sort, the zone of the placement of windmill was changed.

So the noise background at maximal frequency of top guaranteed the needed conditions to the threatened species.

ASO – Environmentally usage of power

On the Zero Emission Power Generation

February 11 2009, Brasov, Romania

Active Magnetic Bearing in Power Plants - an Application of Environmental Friendly Technology

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Contents

- Subject area of the ASO project
- Environmental and maintenance concerns of Hydroelectric Power Plant
- General characteristics of AMB
- Possibility of replacement of journal bearings with AMBs in Hydroelectric Power Plant equipped with Pelton Turbine

Subject area of the ASO project

Energy: zero emission power generation, effect of energy usage on the environment and ecosystems, comparison of the application of National Programs and Strategies of energy usage and the use of the environmentally friendly sources of energy in the five countries.

Environmental and maintenance concerns of Hydroelectric Power Plant

Hydroelectric Power Plant Vinodol with Pelton turbines for burst load of electric grid

Plant overhaul every year in the summer season → low water accumulation

3 groups × 30 MW capacity

Each group consist of a 2 Pelton turbines and a synchronous generator between them rotating with a 500 rpm

Environmental and maintenance concerns of Hydroelectric Power Plant

Each group (turbine-generator) has a separate lubrication system with about 300 l of oil for two external radial journal bearings.

The oil is cooling with a water from an accumulation lake in surrounding of the plant.

The plant can produce electric power for its own purpose in emergency situation although normally its equipment is powered by 0,4 kV from external electric system.

Environmental and maintenance concerns of Hydroelectric Power Plant

For an emergency situation there is another so called Home Turbine-Generator with a Pelton turbine rotating with 1500 rpm and total power of 400 kW

There is possibility of recontruction of this turbine-generator regarding implementation of AMBs as a pilot project.

General characteristics of AMB

1. High Reliability

With magnetic bearings there is no contact between the rotating and stationary parts, meaning there is no wear. In most cases failure modes are limited to control electronics, power electronics, and electrical windings. These components have designs lives far greater than that of conventional bearings. Magnetic bearings are the only type of bearing which is fitted with protective back-up bearings. In addition, magnetic bearings have a built-in overload protection. Magnetic bearings can signal process control equipment to stop the machine instantaneously in the case of excessive load.

Magnetic bearings are providing high reliability and long service intervals in time critical applications in semiconductor manufacturing; vacuum pumps; and natural gas pipeline compression equipment.

General characteristics of AMB

2. Clean Environments

In a magnetic bearing system, particle generation due to wear and the need for lubrication are eliminated. There is therefore no chance of contaminating a clean process with oil, grease or solid particles. Magnetic bearings offer a dry, clean and economic solution for semiconductor fabrication equipment, vacuum pumps, gas and air compressors, and various other turbomachines that require submersion in a process fluid, even under pressure.

3. Position and Vibration Control

Magnetic bearings use advanced control algorithms to influence the motion of the shaft and therefore have the inherent capability to precisely control the position of the shaft within microns and to virtually eliminate vibrations. Magnetic Bearings offer a straightforward solution to the following problems / requirements:

Vibration of the rotating part due to unbalance - controlling unbalance vibration is important in most applications, particularly turbo machinery; machine tool spindles, and vacuum pumps.

General characteristics of AMB

4. Extreme Conditions

Temperature

The magnetic bearing system, is capable of operating through an extremely wide temperature range. Revolve has applications as low as -256°C and as high as 220°C, thus allowing operation where traditional bearings will not function.

Corrosive Fluids

Magnetic bearings can operate in corrosive environments by means of canning both the stationary and rotating parts.

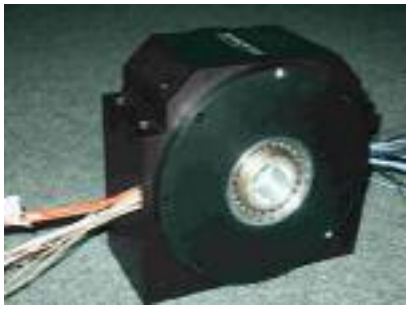
Pressure

Magnetic bearings are virtually insensitive to pressure. They can be submerged in process fluid under pressure without the need for seals, as is the case with conventional bearings. Magnetic bearings can also operate in vacuum where their operation is even more efficient due to lack of windage.

General characteristics of AMB

5. Machine Diagnostics / Smart Machines

In order to function, a magnetic bearing must determine rotor position, rotor vibration and bearing load. This information which is processed in the electronic control cabinet, can be given as an output to the OEM or end user such that there is a constant knowledge of the operating state of the machine. This allows the user to detect incipient faults, plan maintenance and optimize performance.



General characteristics of AMB

Magnetic Bearing Limitations

1. Larger Bearings

Magnetic bearings have a specific load capacity (maximum load per unit of area of application)lower than most other bearings systems. This results in bearings which may be physically larger than other similarly specified bearings.

2. Higher Complexity

The higher complexity of magnetic bearings often means the initial purchase price is higher than competing technologies. However, magnetic bearings' life cycle cost can often be less than traditional bearings. This is particularly true where the alternatives are exotic bearings.

3. Requires Electrical Power

Magnetic bearing require power to drive the control systems, sensors and electromagnets.

Possibility of replacement of journal bearings in Hydroelectric Power Plant equipped with Pelton Turbine with AMBs

Type of bearing	JOURNAL	ACTIVE MAGNETIC
Size	smaller	larger
Lubricant	oil	-
El. power	oil pump, cooling pump, sensors	power amplifiers, control electronics, sensors
Load capacity	bigger	lower (acceptable)
Initial investment	smaller	bigger
Life cycle cost	bigger	smaller

Possibility of replacement of journal bearings in Hydroelectric Power Plant equipped with Pelton Turbine with AMBs

Type of bearing	JOURNAL	ACTIVE MAGNETIC
Personnel	familiar with	unfamiliar with
Insight in the whole process	worse	better because the need for position and vibration control

NATIONAL POLICY OF WASTE MANAGEMENT IN LOCAL LEVEL IN BULGARIA

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I. Introduction

A National Program for Adoption of the Acquis (NPAA), ([2]) of the EU Legislation was adopted in the process of Bulgaria's joining to EU. During the period 1998-2005 several normative acts were developed and accepted. They enabled harmonization between Bulgarian and EU legislation in the field of hazardous wastes and harmless waste plants. Unfortunately harmonizing of the legislation is not enough for solving all problems in waste management. The harmonized legislation must be applied by local authorities and the Government. Because of that it is of great importance to invest money in increasing the administrative capacity of the local authority, in order to enable implementation of the best available EU practices.

National measures, enabling transformation of EU legislation to Bulgarian one, based on NPAA ([2]), are presented in the following table (table1):

Table 1

№	Act of the EU	Corresponding documents in Bulgarian legislation
1	Directive 75/442/EEC on wastes	Waste management Act (2003) Environmental protection Act (2002) Regulation on order and forms for supplying information about activities of waste management and order for public register of given permissions, registration documents and of closed objects and activities (2004)
2	Directive 91/689/EEC on hazardous wastes	Waste management Act (2003) Regulation on the requirements for treatment and transportation of industrial and hazardous wastes (1999) Regulation on order and forms for supplying information about activities of waste management and order for public register of given permissions, registration documents and of closed objects and activities (2004)
3	Regalement EEC/259/93 on supervision and control of transportation wastes within the boundaries of, in and out of EU	Waste management Act (2003) Instruction for requirements for treating of wastes of vehicles (2004) Ratification Act of the Basel convention for control of transnational transportation of the hazardous wastes and their treating
4	Directive 2000/76/EC on combustion of wastes	Regulation on the conditions and requirements of built end exploitation of plants for combustion and in common combustion of wastes (2004)
5	Directive 99/31/EC on the landfield of waste	Regulation on requirements, in which need responds areas where will be placed treatments to treat wastes (2004) Regulation on conditions and requirements for built end exploitation on landfills end other plants for reuse and treats of wastes (2004)
6	Directive 75/439/EEC on treatment of waste oils	Regulation on the requirements for treatment and transportation of waste oils and waste oil products (2005)
7	Directive 86/278/EEC on the order and the way of recovery of sludge from waste water treatment through its use in agriculture	Regulation on the order and the way of recovery of sludge from waste water treatment through its use in agriculture (2004)

№	Act of the EU	Corresponding documents in Bulgarian legislation
8	Directive 91/157/EEC on batteries and accumulators consists of hazardous materials	Regulation on the requirements for marketing batteries and accumulators and for treatment and transportation of spent batteries and accumulators (2005)
9	Directive 94/62/EC on packaging and packaging waste	Regulation on packaging and packaging waste (2004)
10	Directive 2000/53/EC on end of life vechicles	Regulation on the requirements for treatment of end of life vehicles (2004)
11	Resolution 2000/532/EC on introducing catalogue of wastes	Regulation on classification of the wastes
12	Directive 2002/96/EU on waste electrical and electronic equipment	Regulation on the requirements for marketing of electrical and electronic equipment and treatment and transportation of waste electrical and electronic equipment (2006)

II. Basic principles of waste management in Bulgaria

The basic principles adopted by Bulgarian Government in policy of waste management are following:

- Principle of "*hierarchy of waste management"* – the first priority is prevention of generating wastes, the second one is - reuse of products by their recycling and boosting with corresponding use of the simultaneously generated energy, and the last is the ecological treatment of waste products by boosting, without use of the attendant energy and their final disposal;
- Principles "*contaminator pays*" and "*responsibility of the producer*" – this means that each person (juridical or physical), who produces waste or producers, whose products generate waste after their use, must pay all expenses of treatment of 'their' wastes;
- Principle of using "*Best Available Techniques not Entailing Excessive Cost*" (BATNEEC) – emissions in the environment, generated by installations, should be reduced to the much possible degree and in the most possible economically effective way;
- Principle of "*independence*" – each country must establish a network of installations and treatment plants, having adequate capacity to treat entire amount of wastes, generated in its territory;
- Principle of "*nearness*" – wastes must be treated as near as possible to the place of their generation.

III. Proposed stages of realization of the National Strategy of waste management

The most important measures, concerning the obligations of the local authorities in the field of waste management and included in the National Strategy, are based on the prior principle of "*hierarchy of waste management"*. Their realization is a big challenge for the local authorities and our Government. The only possible way of treatment of solid wastes in Bulgaria, up to now, is their disposal.

Finding solution of the problems in the field of waste management is among the greatest challenges that are set in front of the local authorities. The solution must be based on the best available practices used in EU and harmonized normative acts.

The first step in solving the problems should be transformation of existing landfields in accordance to the requirements of the EU legislation.

"National Program for Reduction of the Number of Dangerous Landfields and Old Waste Pollutions" has already been created. It starts with discussing problems of solid waste

landfields. A specialized "Register of the Landfields and Old Waste Pollutions" supported by National Agency of Environment is maintained. It supplies data of more than 275 landfields. A prioritizing method is developed. It has already been verified in investigating, making inventory, valuating and categorization, based on risk evaluation of 59 of existing landfields, servicing cities, whose population is more than 20 000 people. This forms about 70 % of our country population. The conclusions of this research show that the basic part of landfields does not correspond to the requirements of the national legislation and that their disposition states their dangerous use. All investigated landfields are categorized in four groups according to their range of risk:

- I^{-st} group – the biggest range of risk – 12 landfields;
- II^{-nd} group – big range of risk – 17 lendfields;
- III^{-rd} group – middle range of risk – 28 landfields;
- IV^{-th} group – minimal range of risk – 2 landfields.

It is expected 12 landfields of the existing ones, that service cities, whose population is more than 20 000 people, to be closed till the end of 2006 (there is no published official data for 2006 yet). They are going to be as follows: 3 of them belong to the I^{-st} group, 2 – belonging to the II^{-nd} group and 7 – from the III^{-rd} group. Some measures are going to be performed for transforming of existing landfields in accordance to Bulgarian legislation and building 47 new ones in the next few years. There are at about 170 landfields in our country, servicing cities whose population is smaller than 20 000 people. Measures for closing all these landfields have to be undertaken.

A project for Technical assistance, under European program ISPA, is going on now. It aims developing projects for building seven regional landfields, which have to be financed by Cohesion fund. It is obligatory the Government and local authorities to take all appropriate steps for disposing the wastes only in registered regional landfields in the next two years.

There is a great amount of unregulated landfields in Bulgaria. 5135 unregulated landfields were identified in the period 2001 – 2005. 3554 were closed till the end of 2004 (551 – in 2002, 1677 – in 2003 and 1326 – in 2004). It is planned, till the end of 2009, simultaneously with building and putting into exploitation of the local landfields, closing of all unregulated landfields and their re-cultivation to be done.

The second step for solving the problems of local authorities is gradually developing of system for separate collecting of solid wastes, allowing their re-use ([3]).

A system for separate collecting of package wastes has been developing in Bulgaria since 2005. There are 5 associations of package producers. They sign contracts with local authorities for establishment of municipal networks for collecting package wastes. The members of these associations are 4014, according to 2005-year data. 24 of the biggest enterprises fulfill this obligation themselves. The system is financed by the package producers. They pay a fixed productive fee to the associations. The associations, themselves, organize collecting of package wastes and declare the collected quantity to the Government Institutions. Thus the second principle "*contaminator pays*" and "*responsibility of the producer*" is incarnated in practice. The producer is responsible for solving the arisen by himself problem. This system is very suitable and applicable for the local authorities in our country. Thus they are in charge of collecting and making harmless of the generated, on their territory, solid wastes. We must mark that package wastes are part of solid wastes. Thus the branch organizations of the producers co-finance the local authorities in the waste

management. The system is still in construction and is not functioning with its entire capacity yet. Part of this system is the already built installation for waste separation near the landfield of Sliven. It is possessed by one of the organizations for collecting and re-using of package wastes. There is no such a system that is a property of any local authority or of a waste collecting firm in the territory of Bulgaria yet.

The results of the activity of above mentioned organizations in the territory of Bulgaria for 2005 are: 30.80% recycled and 30.92% re-used package wastes (see fig. 1). These results exceed the planned in national legislation percentage for 2005 with about 25% - total objective percent of re-used products.

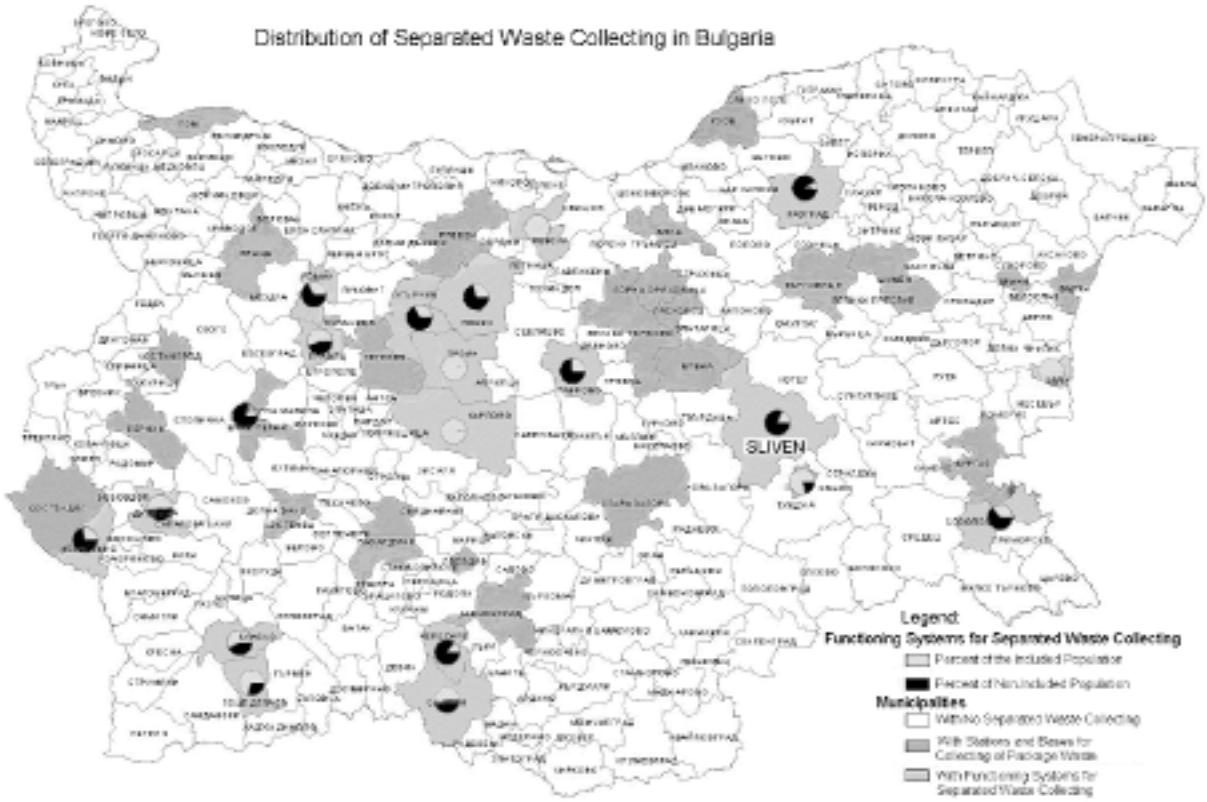

Figure 1: Scheme of the distribution of separated waste collecting in Bulgaria, ([3])

Now building of a similar system for separating of wastes of electric and electronic devices is starting. We mark that realization of this system is in a very initial level.

A 'pilot' project for collecting of hazardous everyday wastes and their separating from the total amount of waste started in Rouse and Sliven municipality in 2006, ([4]). This project is going on by the help of Dutch experts and uses Dutch experience for solving the problem. The idea is that the hazardous everyday wastes such as batteries, accumulators, neon lamps, ink or toner for printers, medicines, whose suitability term is ended, etc. ought to be separated from the total amount of waste. Movable waste collecting stations are situated in the heavily populated quarters of the cities. The collected wastes are given to the

Government Institutions for their future making harmless in a suitable for that places.

Another ambitious and perspective program for separating and re-use of harmless car wastes is in the start. There is only one, registered in Bulgaria, association of car importers that is fulfilling such kind of activity.

During 2005, the first year of functioning of the new system, the separated cars are 15 340. Their number in the third quarter of the year is 5 431 and in the forth quarter of 2005– 6724. The monitoring shows constant increase of the separated cars per quarter of year.

The total amount for 2005 of collected for treatment car wastes is 11 672,09 tones.

10 090.985 tones are taken into pieces. The quantity of re-used after dismantling car wastes is 432,12 tones. Re-used, including re-cycled, car wastes are 8 920,87 tones. 8 472. 731 tones of car wastes are only re-cycled, according to the data of National Agency of Environment

IV. CONCLUSIONS AND FUTURE STEPS IN THE WASTE MANAGEMENT OF LOCAL LEVEL IN BULGARIA

For solving the above mentioned problems and regarding the new European membership of Bulgaria, the Bulgarian Government has developed an Operating Program "Environment 2007 - 2013" ([1]), where the necessary measures and acts, that need to be performed in the next 7 years, are defined. They are formulated in priority 2, which treats the problems in waste management. The Bulgarian Government has formulated the following eight important problems, which ought to be solved and for which a financing of EU would be sought.

(1) building of systems of 23 "acceptable" local equipments/installations for making harmless of solid wastes, whose capacity will be adequate for the needs of our country in its 54-regions for waste management (for example local landfields and re-loading stations);

(2) building of "acceptable" equipment for pre-treatment , including composting, sorting and separating of wastes, simultaneously with starting work of newly built local landfields for solid wastes;

(3) building of re-cycling centers, simultaneously with starting work of newly built local landfields for solid wastes;

(4) building of installations, producing electricity using of freed, by solid waste landfields, gas emissions, especially methane;

(5) building of local equipment for re-cycling of demolished waste;

(6) under escort stopping the exploitation and closing of existing solid waste landfields, that do not correspond to the requirements of the normative acts and the contemporary technical standards. Their closing is doing to be consistent with opening of a new local equipment/installation of waste treatment;

(7) developing/examination and actualization of regional/municipal plans for waste management;

(8) support for fulfillment of investments projects in the range of the priority, including:

- necessary investigations for evaluation of technical and management needs, concerning the assets build in the range of priority;
- evaluation the necessity of education and reasonable expenses;
- supplying of education courses for the beneficiaries of the priority, considering the

increasing of their capacity for preparing and presenting projects, conducting of tenders, negotiating, accurate fulfillment and management of the approved projects as well as future adequate exploitation and support of the acquired asset;

(9) preparation of investment projects and future financial support in the range of priority 2 of the Operative Program "Environment 2007 - 2013".

Solving of the described problems is a great challenge for the Bulgarian Government as well as for the local authorities, whose obligation and right it is.

The international projects going on, with the financial support of EU, give to the local authorities and their experts a knowledge and experience, regarding the methods of solving similar problems in EU countries.

The main conclusion is that it is absolutely necessary, all local authorities to unite their efforts for solving these global problems of waste management. They ought to work hard for developing local associations for waste management and to be totally devoted to the idea of solving of the waste management problems.

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EFFECT OF ENERGY USE ON ENVIRONMENT AND ECOSYSTEMS

AN ENERGY POLICY FOR EUROPE

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AN ENERGY POLICY FOR EUROPE

1. **The Challenges**
   - 1.1. **Sustainability**
   - 1.2. **Security of supply**
   - 1.3. **Competitiveness**

2. **A Strategic Objective to guide Europe's Energy Policy**

   ►**an EU objective in international negotiations of 30% reduction in greenhouse gas emissions by developed countries by 2020 compared to 1990. In addition, 2050 global GHG emissions must be reduced by up to 50% compared to 1990, implying reductions in industrialised countries of 60-80% by 2050;** .

   ► **an EU commitment now to achieve, in any event, at least a 20% reduction of greenhouse gases by 2020 compared to 1990.**

3. The Action Plan
   - 3.1. The Internal Energy Market
   - 3.2. Solidarity between Member States and security of supply for oil, gas and electricity
   - 3.3. A long-term commitment to greenhouse gases reduction and the EU Emissions Trading System
   - 3.4. An ambitious programme of energy efficiency measures at Community, national, local and international level
   - 3.5. A longer term target for renewable energy
   - 3.6. A European Strategic Energy Technology Plan
   - 3.7. Towards a low CO2 fossil fuel future
   - 3.8. The future of nuclear
   - 3.9. An International Energy Policy that actively pursues Europe's interests
   - 3.10. Effective monitoring and reporting

4. Taking work forward

The Internal Energy Market

The Internal Market Report and Sector enquiry show the danger of discrimination and abuse when companies control energy networks as well as production or sales, protecting national markets and preventing competition.

Gradually evolving the current approach: reinforcing collaboration between national regulators by notably requiring Member States to give national regulators a Community objective, and introducing a mechanism whereby the Commission could review some decisions of national regulators which affect the Internal Energy Market

A European network of independent regulators ("ERGEG+"): Under this mechanism, the role of ERGEG will be formalised, and it would be given the task to structure binding decisions for regulators and relevant market players, such as network operators, power exchanges or generators, on certain precisely defined technical issues and mechanisms relating to cross border issues.

A new, single body at Community level would be set up.

It would in particular be granted the responsibility for adopting individual decisions for the EU electricity and gas market related to regulatory and technical issues relevant to making cross border trade work in practice

Transparency is essential to allow the market to work properly. At present, Transmission System Operators provide varying levels of information, making some markets easier than others to compete in for new entrants. Furthermore, ***some regulators require generators to be more transparent regarding generation availability than others, which can help prevent price manipulation***. Minimum requirements need to be established and to be respected by all EU companies, similar to that already adopted for telecommunications

The **Priority Interconnection Plan** sets out ***five priorities***:

- ***Identifying the most significant missing infrastructure*** up to 2013 and ensuring pan-European political support to fill the gaps.

- ***Appointing four European co-ordinators*** to pursue the four of the most important priority projects: the Power-Link between Germany, Poland and Lithuania; connections to off-shore wind power in Northern Europe; electricity interconnections between France and Spain; and the **Nabucco** pipeline, bringing gas from the Caspian to central Europe.

- ***Agreeing a maximum of 5 years*** within which planning and approval procedures must be completed for projects that are defined as being "of European interest" under ***Trans-European Energy Guidelines***.

- ***Examining the need to increase funding*** for the Energy Trans-European networks, particularly ***to facilitate the integration of renewable electricity into the grid***.

- ***Establishing a new Community mechanism and structure*** for **Transmission System Operators** (TSOs), responsible for co-ordinated network planning.

Network security

In order to increase the reliability of the EU's electricity system and prevent black-outs, recent experience has shown that ***common minimum and binding network security standards are necessary in the EU***. The new Community mechanism and structure for Transmission System Operators should also be tasked with proposing common minimum security standards. These would become binding following approval by energy regulators

Adequacy of electricity generation and gas supply capacity

During the next 25 years, Europe will need to invest ***€ 900 billion on new electricity generation***. Gas remains a fuel of choice given its high efficiency, but even gas will need ***€ 150 billion of investment on gas-fired power plant*** and ***an additional € 220 billion on gas infrastructure***. The overriding priority in terms of securing adequate new investment is a properly functioning Internal Energy Market, providing the correct investment signals. In addition, close monitoring of the demand/supply balance is also needed, to identify any potential shortfall. This will be a key role for the new **Office of the Energy Observatory**.

Energy as a public service .

Energy is essential for every European. Existing European legislation already requires the respect for Public Service Obligations. But the EU needs to go further in tackling energy poverty. The Commission will develop an **Energy Customers' Charter** with **four key goals**:

- assist in establishing schemes ***to help*** the most EU vulnerable citizens deal with increases in energy prices;
- improve the minimum level of ***information*** available to citizens to help them choose between suppliers and supply options;
- ***reduce paper work*** when customers change supplier; and
- ***protect*** customers from unfair selling practices.

Solidarity between Member States and security of supply for oil, gas and electricity

The Internal Energy Market increases the ***interdependence*** of Member States ***in energy supply*** for both electricity and gas. Even with the targets on energy efficiency and renewables, oil and gas will continue to meet over half the EU's energy needs, with import dependence high in both sectors (over 90 % for oil and some 80% for gas in 2030). Electricity generation will be heavily dependent on gas. Without a significant technology breakthrough, oil will continue to dominate transport. Therefore, security of supply of these fuels will continue to be paramount to the EU economy

The EU has effective energy relationships with traditional gas suppliers from inside the European Economic Area (EEA), notably Norway and outside, Russia and Algeria. Nevertheless, it remains important for the EU to ***promote diversity with regard to source, supplier, transport route and transport method***. In addition, ***effective mechanisms need to be put into place to ensure solidarity between Member States in the event of an energy crisis***. This is particularly important given that a number of Member States are highly or completely reliant on a single gas supplier.

A long-term commitment to greenhouse gases reduction and the EU Emissions Trading System

The EU traditionally favours the ***use of economic instruments*** to internalise external costs as the allow the market to determine how to react most efficiently and with limited costs. More particularly, in its Communication ***Limiting Climate Change to 2 C - Policy Options for the EU and the world for 2020 and beyond***, the Commission has set out how the emissions trading mechanism is and must remain a key ***mechanism for stimulating reductions in carbon emissions*** and how it could be used as a basis for international efforts to fight climate change. The Commission is reviewing the EU ETS to ensure that emissions trading reaches its full potential: this is critical to creating the incentives to stimulate changes in how Europe generates and uses its energy.

An ambitious programme of energy efficiency measures at Community, national, local and international level

For Europe's citizens, energy efficiency is the most immediate element in a ***European Energy Policy***. Improved energy efficiency has the potential to make the most decisive contribution to achieving ***sustainability, competitiveness and security of supply***.

On 19 October 2006 the Commission adopted the ***Energy Efficiency Action Plan***, containing measures that would put the EU well on the path to achieving a key goal of *reducing its global primary energy use by 20% by 2020*. *If successful*, this would mean that by 2020 *the EU would use approximately 13% less energy than today*, ***saving € 100 billion and around 780 millions tonnes of CO_2 each year***.

Key measures include:

- Accelerating ***the use of fuel efficient vehicles for transport***, making better use of public transport and ensuring that the true costs of transport are faced by consumers;
- Tougher ***standards and better labelling on appliances***;
- Rapidly ***improving the energy performance*** of the EU's ***existing buildings*** and taking the lead to make ***very low energy houses*** the norm ***for new buildings***;
- ***Coherent use of taxation*** to achieve more efficient use of energy;
- ***Improving the efficiency of heat and electricity generation***, transmission and distribution;
- A ***new international agreement on energy efficiency*** to promote a common effort.

A longer term target for renewable energy

In 1997, the European Union started working towards ***a target of a 12% share of renewable energy*** in its overall mix ***by 2010***, a doubling of 1997 levels. Since then, renewable energy production has increased by 55%. Nevertheless the EU is set to fall short of its target. ***The share of renewable energy is unlikely to exceed 10% by 2010***. **The main reason** for the failure to reach the agreed targets for renewable energy - besides the higher costs of renewable energy sources today compared to "traditional" energy sources - ***is the lack of a coherent and effective policy framework throughout the EU and a stable long-term vision***. As a result, only a limited number of Member States have made serious progress in this area and the critical mass has not been reached to shift niche renewables production into the mainstream.

The ***challenge*** for renewables policy is to find the right balance between installing large scale renewable energy capacity today, and waiting until research lowers their cost tomorrow. Finding the right balance means taking the following **factors** into account:

- ***Using renewable energy today is generally more expensive than using hydrocarbons***, but the gap is narrowing – particularly when the costs of climate change are factored in;
- Economies of scale can reduce the costs for renewables, but this needs major investment today;
- ***Renewable energy helps to improve the EU's security of energy supply*** by increasing the share of domestically produced energy, diversifying the fuel mix and the sources of energy imports and increasing the proportion of energy from politically stable regions as well as creating new jobs in Europe;
- ***Renewable energies emit few or no greenhouse gases***, and most of them bring significant air quality benefits.

In the light of the information received during the public consultation and the impact assessment, the Commission proposes in its ***Renewable Energy Roadmap*** a binding target of **increasing the level of renewable energy in the EU's overall** mix from less than 7% today **to 20% by 2020**. Targets beyond 2020 would be assessed in the light of **technological progress**.

How do we get there?

Meeting the 20% target will require a massive growth in all three renewable energy sectors:

- ***electricity***,
- *biofuels and*
- *heating and cooling.*

But in all sectors, the policy frameworks set up in particular Member States have achieved results which show how this is possible.

A European Strategic Energy Technology Plan

Europe has ***two key objectives*** for energy technology:

- to lower the cost of clean energy and
- to put EU industry at the forefront of the rapidly growing low carbon technology sector.

To meet these objectives, the Commission present a **European Strategic Energy Technology Plan**. This Plan will need a long term vision to match the long term challenge of moving towards a low carbon energy system in a competitive manner:

–By 2020, technologies will have to make the 20% renewable target a reality by permitting a sharp increase in the share of lower cost renewables (including the roll-out of off-shore wind and 2nd generation biofuels);

–By 2030, electricity and heat will increasingly need to be produced from low carbon sources and extensive near-zero emission fossil fuel power plants with CO_2 capture and storage. Transport will need to increasingly adapt to using 2nd generation biofuels and hydrogen fuel cells;

For 2050 and beyond, the switch to low carbon in the European energy system should be completed, with an overall European energy mix that could include large shares for renewables, sustainable coal and gas, sustainable hydrogen, and, for those member states that want, Generation IV fission power and fusion energy.

Towards a low CO_2 fossil fuel future

Coal and gas account for 50% of the EU's electricity supply and are certain to ***remain an important part of our energy mix***. Long-term reserves are substantial. But coal produces roughly twice the emissions of CO_2 compared to gas. *Much cleaner coal generation and CO_2 abatement will be necessary*. Furthermore, *developing clean coal and carbon capture and storage is crucial at the international level.*

In addition to the European Strategic Energy Technology Plan, other action will be required to catalyse international research and action on CO_2 capture and storage.

To provide global leadership, the EU must provide ***a clear vision for the introduction of CO_2 capture and storage in the EU:***

- establish a favourable regulatory framework for its development,
- invest more, and more effectively, in research, as well as
- taking international action.

The EU ***Emissions Trading System*** will also need to incorporate capture and storage in the future.

As set out in its ***Sustainable Power Generation Communication***[1], the Commission in 2007 start work to:

- ***Design a mechanism to stimulate the construction and operation*** by 2015 of up to 12 large-scale demonstrations ***of sustainable fossil fuels technologies*** in commercial power generation in the EU[2].
- ***Provide a clear perspective when coal- and gas-fired plants will need to install CO_2 capture and storage***.

On the basis of existing information, the Commission believes that by 2020 all new coal-fired plants should to be fitted with CO_2 capture and storage and existing plants should then progressively follow the same approach. Whilst it is too early to reach a definite view on this, the Commission hopes to be able to make firm recommendations as soon as possible.

[1] Communication from the Commission : Sustainable Power Generation from fossil fuels: aiming at near zero emission by 2020 - COM(2006) 843.

[2] The European Technology Platform for Zero-emission fossil fuels power plant (ZEP TP) includes in the Key Recommendations of its Strategic Research Agenda (SRA) adopted in late 2006 a call for early implementation of 10-12 integrated, large-scale CCS demonstration power plants projects in Europe.

The future of nuclear

An International Energy Policy that actively pursues Europe's interests

Effective monitoring and reporting

Taking work forward

SUMMARY

A **European Energy Policy** will firmly commit the European Union (EU) to **a low consumption economy** based on **more secure**, **more competitive** and **more sustainable energy**.

Priority energy objectives involve:

- ensuring the smooth functioning of the internal market in energy;
- security of strategic supply;
- concrete reductions in greenhouse gas emissions caused by the production or consumption of energy;
- the EU's ability to speak with a single voice on the international stage.

EFFECT OF ENERGY USE ON ENVIRONMENT AND ECOSYSTEMS

IMPLEMENTATION OF EUROPEAN STANDARDS AND PRACTICES

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As in many other fields, **standards** have made, and will increasingly make, an important contribution to the energy sector:

- ► helping to enhance **the safety and efficiency of production, distribution and use** by all economic players;
- ► assuring **quality and security**;
- ► allowing for **variety control, interoperability** and
- ► **reducing waste and environmental impact**.

They contribute to market development and the acceptance of energy-efficient technologies and pave the way for the development and use of alternative renewable sources.

Standards are a **powerful tool** for:

- ► disseminating new technologies and good practices,
- ► developing global markets and
- ► supporting the harmonization of government policies on energy efficiency and renewable sources on a global scale.

The role of standards

Most technologies, including renewable energy, need to attain economies of scale if they are to advance along a learning curve and achieve cost viability. They also require that appropriate technical specifications be established and standardized in order to accelerate their deployment. ***Many energy efficiency technologies and practices are already highly cost-effective*** but are held back by additional **barriers** which include

- lack of awareness of the cost-effective savings potential,
- missing or partial information on energy efficiency performance and lack of common metrics,
- lack of consideration of system and process energy efficiency issues,
- split incentives e.g. the different economic incentives which exist between landlords who procure energy using equipment and tenants who pay the energy bill the fact that energy efficiency is often a minor determinant of capital-acquisition decisions and is bundled-in with more important decision factors.

As a result of these barriers, the procurement and operation of energy-using equipment is often overly focused on initial, rather than life-cycle cost optimization, to the detriment of its overall efficiency.

Many measures are needed to help overcome these barriers and technical, as well as management standards, underpin most of them.

In the case of energy-using products, ***standards enable an otherwise invisible product attribute, namely energy efficiency, to be measurable, comparable and reportable on a common basis***. This is an essential step for the most important barriers of low visibility and awareness to be successfully addressed.

Where ***common standards for measuring, defining, comparing, reporting and verifying energy efficiency*** are adopted, they also provide a level playing field for all market actors. Hence, wherever practicable, ***the adoption of harmonized standards is desirable***.

Harmonization of these energy performance **standards** helps to:

- **minimize** product energy performance testing and verification **costs** for increasingly globalized energy-using equipment markets,
- enable **energy performance to be compared on a common basis** across broad economic and political groupings,
- facilitate **adoption of more efficient product manufacturing**,
- **accelerate transfer of best practice** in policy settings.

Technical standards in the domain of energy efficiency need not be limited to the measurement and definition of energy performance metrics.

They can *include the means of testing, certifying and labeling energy performance* and could also include broader system and process topics such as energy management and how to monitor, identify and verify energy savings delivered via diverse applications and programmes.

Standards provide:

- ***a consistent and clear framework*** describing technologies and good practices in the fields concerned, including, *inter alia,* ***terminology***, ***classifications***, ***test methods***, ***performances*** (along with the modalities of the presentation of test results and performance levels) and ***good management practices***, and
- ***state-of-the-art knowledge*** formalized by recognized experts in the field, based on international consensus from a balance of interests reflecting the technological, economic and public interest conditions in the vast majority of the countries of the world.

Standards add value in this context by:

- **reducing uncertainty** for all the economic players, thus creating a climate favourable to public-private partnership for accelerating the development and marketing of more energy-efficient products and renewable energy sources,
- **supporting international trade of goods and services** in these fields and the development of new markets, and
- helping to significantly **improve consumer/user understanding and confidence** and thus influencing consumer/user behaviour and choices.

Examples of the use of Standards to support energy efficiency policy

A good demonstration of the role International Standards published by ISO could play can be seen in the ***energy performance of buildings***. Buildings use large amounts of energy and produce large amounts of CO_2. There are many opportunities to make savings in this sector, so practical tools are needed for the design and construction of energy-efficient buildings and the retrofit of existing buildings.

For example, ***the energy performance of buildings can be calculated using International Standard***, **ISO 13790**. *Complementing it are several other ISO standards that can be used to calculate the thermal properties of the building envelope* (walls, roof and basement) and of the individual construction materials. **These provide the reference for expressing performance in trade documents and building regulations all over the world**.
The ISO standards by which the thermal properties of building components (*U* - values) are calculated ***have been adopted as European standards and as national standards in different countries*** and are referenced in building regulations in many other countries.

Another important example concerns ***domestic appliances*** *such as household refrigerators, clothes washers and room air conditioners*. These products are major sources of domestic and tertiary sector electricity consumption. Yet, in part as a result of the existence of recognized energy performance test procedures, it has been possible for the world's major economies to develop energy labeling and energy performance standards that encourage the development of more efficient products, while preventing or discouraging the sale of less efficient ones, and thereby ***save very significant amounts of energy at low cost***.

By way of illustration, since the European Union introduced energy labeling and minimum energy performance standards for domestic refrigerators, the energy consumption of these products has improved by roughly 40% over a five-year period. .

This and similar policies applied to other household appliances in Europe *are projected to be on course to save 46 Mt of annual CO_2 emissions and more than EUR 11 billion in net consumer costs for appliances* (the sum of the purchase and energy savings costs), once the old appliance stock is replaced by the new and more efficient models.

The last example concerns **energy management** and highlights the importance of international cooperation. National energy management standards have been developed and are in use in various countries, some of which are already exploiting significant savings in energy consumption and reductions in CO_2 emissions.

Considering the developments needed in this area from a global perspective, inclusive of the needs of developing nations, the Expert Group Meeting on Industrial Energy Efficiency and Energy Management Standards organized by UNIDO on March 21-22, 2007, took the resolution listed below:

"***The EGM participants reached a consensus that the timing is favorable to move forward with the international harmonization of standards for Energy Management. Harmonization efforts within the European Union have begun under the auspices of the European Committee for Standardization (CEN).***
For these reasons, the meeting participants request that the International Organization for Standardization (ISO), as the appropriate international entity for global harmonization of standards, consider initiating development of an ISO Energy Management standard at the earliest possible opportunity."

Standard reference	Title	Citation in OJ	Directive	
CEN/TC 49 - Gas cooking appliances				
EN 30-2-1:1998	Domestic cooking appliances burning gas - Part 2-1: Rational use of energy - General	Cited in OJ: C 142 (2005-06-11), C 255 (1998-08-13), C 97 (2006-04-25)	90/396/EEC	
EN 30-2-2:1999	Domestic cooking appliances burning gas - Part 2-2: Rational use of energy - Appliances having forced-convection ovens and/or grills	Cited in OJ: C 142 (2005-06-11), C 294 (2000-10-17)	90/396/EEC	
EN 30-2-1:1998/A1:2003	Domestic cooking appliances burning gas - Part 2-1: Rational use of energy - General	Cited in OJ: C 306 (2004-12-10), C 97 (2006-04-25), C 142 (2005-06-11)	90/396/EEC	
EN 30-2-1:1998/A2:2005	Domestic cooking appliances burning gas - Part: 2-1: Rational use of energy - General	Cited in OJ: C 97 (2006-04-25)	90/396/EEC	
EN 30-2-1:1998/A1:2003/AC:2004	Domestic cooking appliances burning gas - Part 2-1: Rational use of energy - General	Cited in OJ: C 97 (2006-04-25), C 142 (2005-06-11)	90/396/EEC	

CEN/TC 89 – Thermal performance of buildings and building components				
EN ISO 13790:2004	Thermal performance of buildings – Calculation of energy use for space heating (ISO 13790:2004)	No	89/106/EEC	
EN ISO 15927-4:2005	Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 4: Hourly data for assessing the annual energy use for heating and cooling (ISO 15927-4:2005)	No	89/106/EEC	
EN ISO 13790:2008	Energy performance of buildings – Calculation of energy use for space heating and cooling (ISO 13790:2008)	No	89/106/EEC	

CEN/TC 136 - Sports, playground and other recreational facilities and equipment				
EN 958:2006	Mountaineering equipment - Energy absorbing systems for use in klettersteig (via ferrata) climbing - Safety requirements and test methods	Expected	89/686/EEC	

CEN/TC 180 - Domestic and non-domestic gas-fired air heaters and non-domestic gas-fired overhead radiant heaters				
EN 416-2:2006	Single burner gas-fired overhead radiant tube heaters for non-domestic use - Part 2: Rational use of energy	Cited in OJ: C 296 (2006-12-06)	90/396/EEC	
EN 419-2:2006	Non-domestic gas-fired overhead luminous radiant heaters - Part 2: Rational use of energy	Cited in OJ: C 296 (2006-12-06)	90/396/EEC	

CEN/TC 228 - Heating systems in buildings					
EN 15377-3:2007	Heating systems in buildings - Design of embedded water based surface heating and cooling systems - Part 3: Optimizing for use of renewable energy sources	No			

CEN/TC 371 - Project Committee - Energy Performance of Building project group				
EN 15603:2008	Energy performance of buildings - Overall energy use and definition of energy ratings	No		
1				

CEN/TC 299 - Gas-fired sorption appliances and domestic gas-fired washing and drying appliances				
EN 1458-2:1999	Domestic direct gas-fired tumble dryers of types B22D and B23D, of nominal heat input not exceeding 6kW - Part 2: Rational use of energy	Cited in OJ: C 294 (2000-10-17), C 142 (2005-06-11)	90/396 /EEC	
EN 12244-2:1998	Direct gas-fired washing machines of nominal heat input not exceeding 20 kW - Part 2: Rational use of energy	Cited in OJ: C 255 (1998-08-13), C 142 (2005-06-11)	90/396 /EEC	
EN 12752-2:1999	Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW - Part 2: Rational use of energy	Cited in OJ: C 142 (2005-06-11), C 294 (2000-10-17)	90/396 /EEC	
EN 12309-2:2000	Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW - Part 2: Rational use of energy	Cited in OJ: C 202 (2001-07-18), C 142 (2005-06-11)	90/396 /EEC	

Life Cycle Assessment (LCA) Method for Evaluation of Hydrogen Production Technologies in Slovenia

Results of interdiciplinary research project:
"SPEV - Slovenia and Transition into the Hydrogen Economy"
2006 – 2008

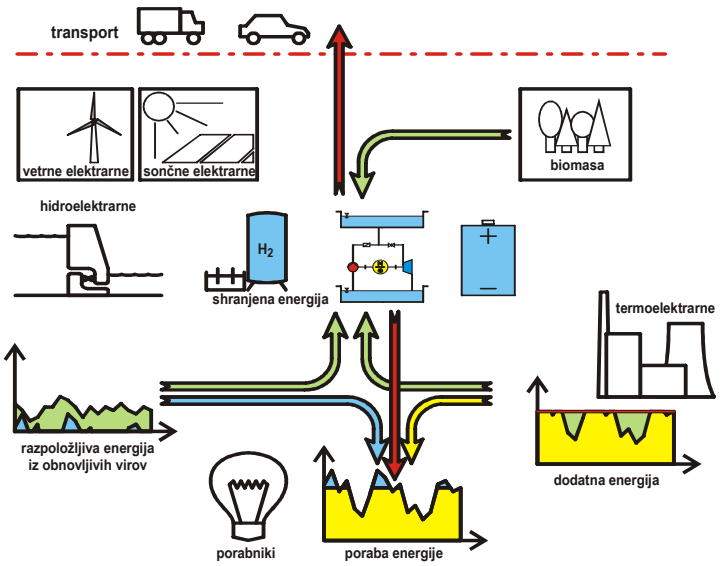
8 project partners:

- University of Ljubljana
  - **Faculty of Mechanical Engineering (Project Coordination)**
  - Faculty of Economics
- National Institute of Chemistry
- TECES, R&D Centre of Electrical Machines
- Companies Magneti, Domel, Iskra Avtoelektrika

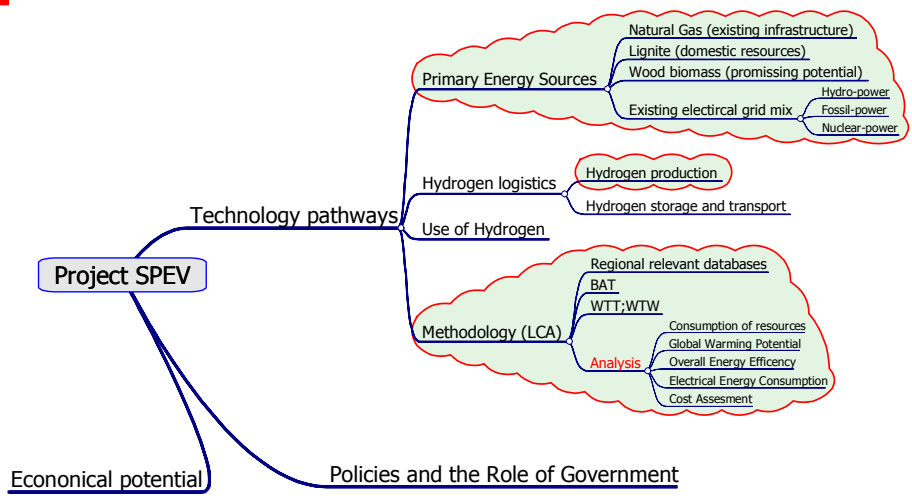
Ass.Prof.Dr. Mihael Sekavčnik

University of Ljubljana, Slovenia
Faculty for Mechanical Engineering

Idea behind?!



Layout of the project SPEV



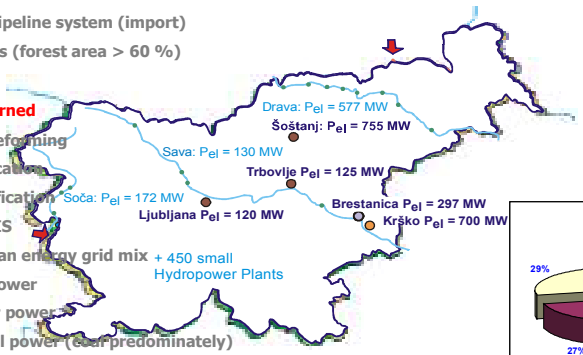
Energy Sources and Technologies of Hydrogen production

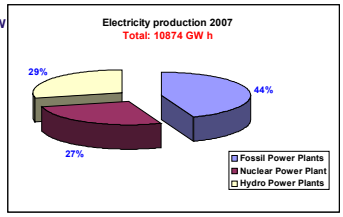
Primary energy sources concerned:

- Hydropower
- Braun coal and lignite (existing domestic production)
- Nuclear Power Plant
- Natural gas pipeline system (import)
- Wood biomass (forest area > 60 %)

Technologies concerned

- Natural gas reforming
- Lignite gasification
- Biomass gasification
- ELECTROLYSIS
  - Slovenian energy grid mix
  - Hydropower
  - Nuclear power
  - Thermal power (coal predominately)

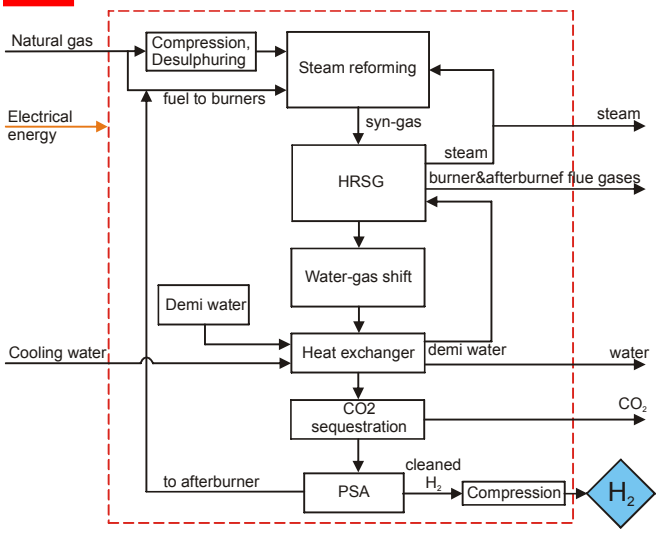




Technology pathways of hydrogen production in Slovenia

A. Natural gas steam reforming
B. Lignite gasification
C. Biomass thermal gasification
D. Biomass pyrolysis
E. Combined Pyrolysis and thermal biomass gasification
F. Eletrolysis
   - with *el. energy* from nuclear power (NPP)
   - with *el. energy* from hydro power (HPP)
   - with *el. energy* from coal fired powerplants (TPP)
   - with *el. energy* from Slovenian energy grid mix (SI-MIX)

A – Natural gas steam reforming

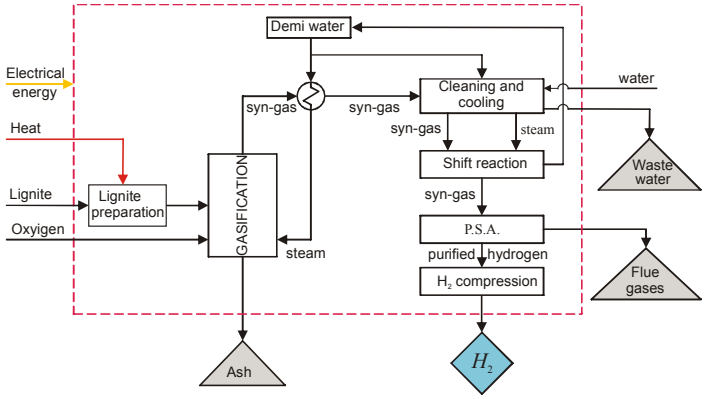


- Currently more than 50 % of hydrogen from natural gas
- Excellent ratio H:C = 4:1

PURITY of 99,99 % is reached by Pressure Swing Absorption (PSA)

COMPRESSION on 440 bar

B – Lignite gasification



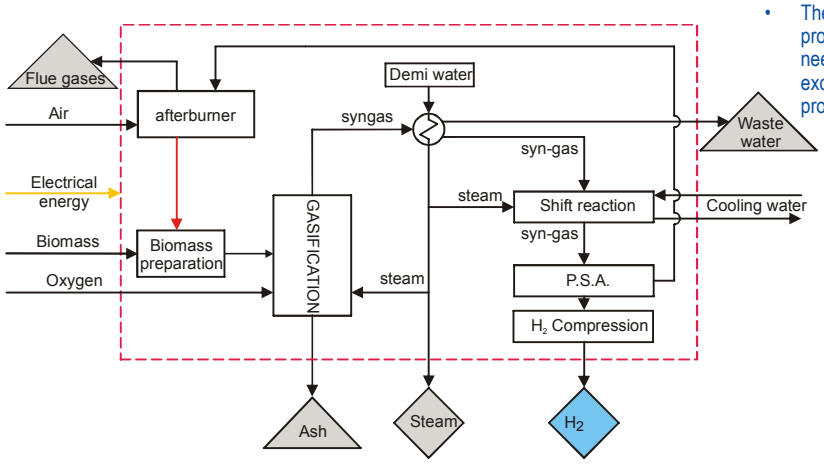
LHW = 10,5 MJ/kg

PROCESS SPECIFICATIONS

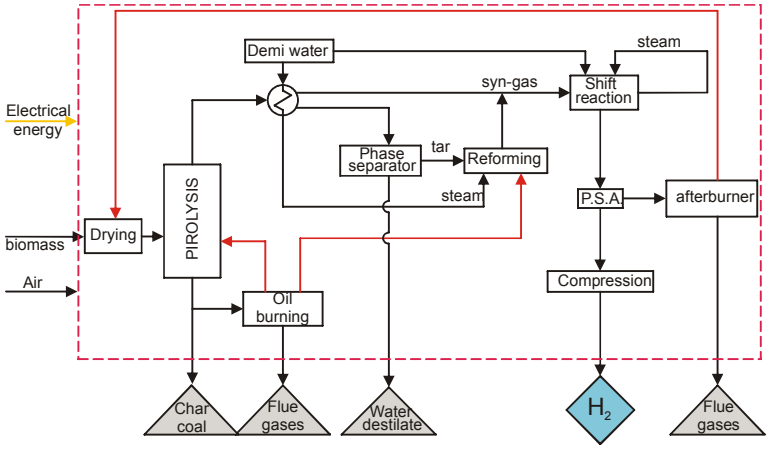
- The need of oxygen (Linde process – 260 kW h/ton$_{O2}$)
- High temperature gasification type Winkler (1300 °C, 3bar)
- Syngas composition (%$_{weight}$)
  - CO: 31,7 %
  - CO_2: 24,9 %
  - H_2O: 36,5 %
  - H_2: 2,3 %
  - other: N, SO_2, tar, dust

C – Biomass thermal gasification

- The process is similar to lignite gasification
- The amount of steam produced exceeds the needs of the process – the excess is treated like by product



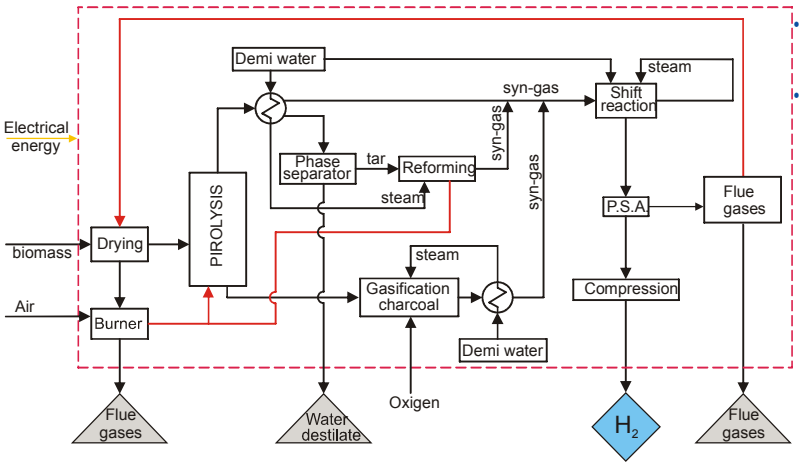
D – Biomass pyrolysis



- oxygen free reaction at high pressure and temperature
- Products:
  - syngas,
  - Pyrolysis oil
  - Charcoal

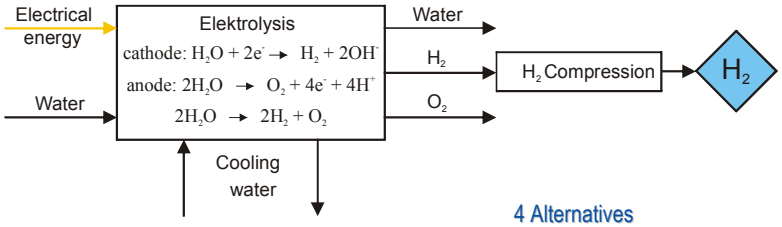
  } H_2
- Some charcoal is by-product for use in other processes

E – Combined biomass gasification: pyrolysis and thermal gasification



- Gasification of charcoal after pyrolysis
- The heat is gained by biomass combustion

F – Electrolysis



4 Alternatives

- Slovenian energy grid mix
- Hydropower
- Nuclear power
- Thermal power (coal predominately)

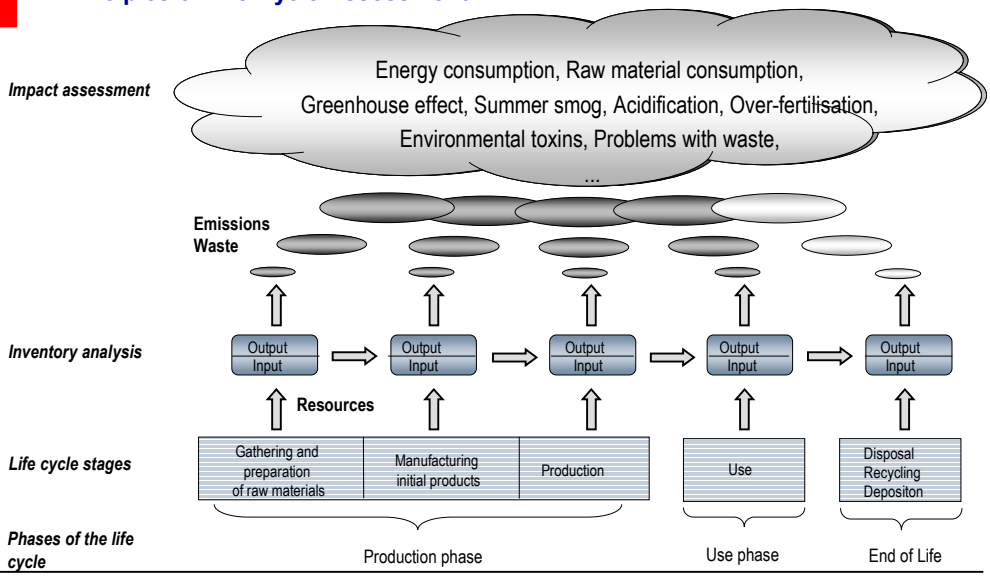
Principles of Life Cycle Assessment
What is LCA about?

LCA

▶ Definition of Life Cycle Assessment from DIN ISO 14040:

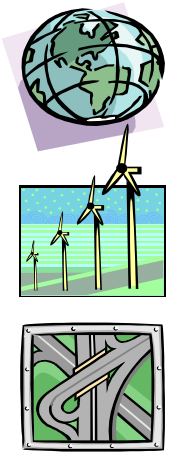
Life Cycle Assessment is the compiling and evaluation of the input and outputs and the potential environmental impacts of a product system during its lifetime.

Principles of Life Cycle Assessment



Life Cycle Impact Assessment

Categories - global, regional and local



Global Criteria

- Resource depletion
- Global Warming Potential (GWP)
- Ozone Depletion Potential (ODP)

Regional Criteria

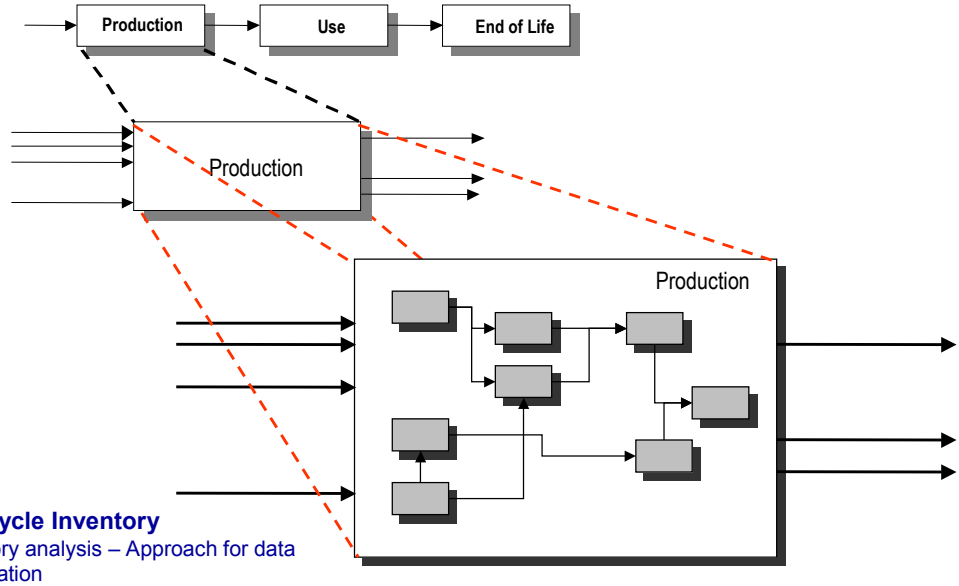
- Acidification Potential (AP)
- Land use

Local Criteria

- Human- and Eco-Toxicity Potential (HTP, ETP)
- Eutrophication Potential (EP)
- Photochemical Oxidant Creation Potential (POCP)

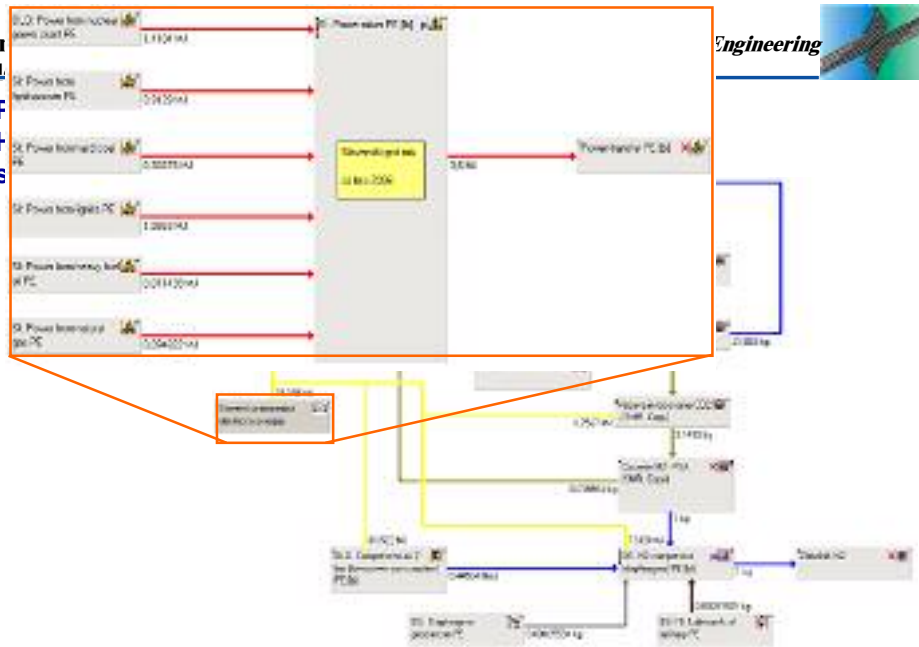
Other Criteria

- Nisance (noise, odour, landfill demand, ionising radiation)

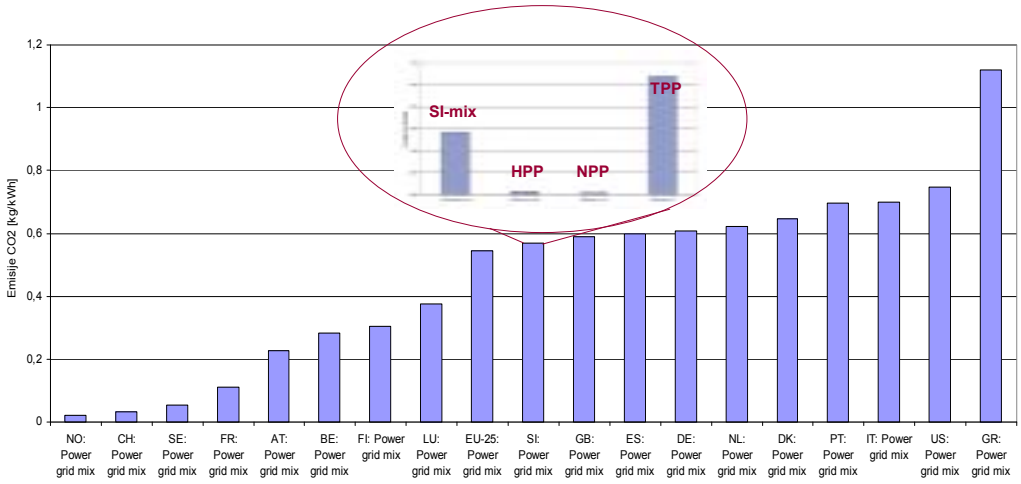


Life Cycle Inventory

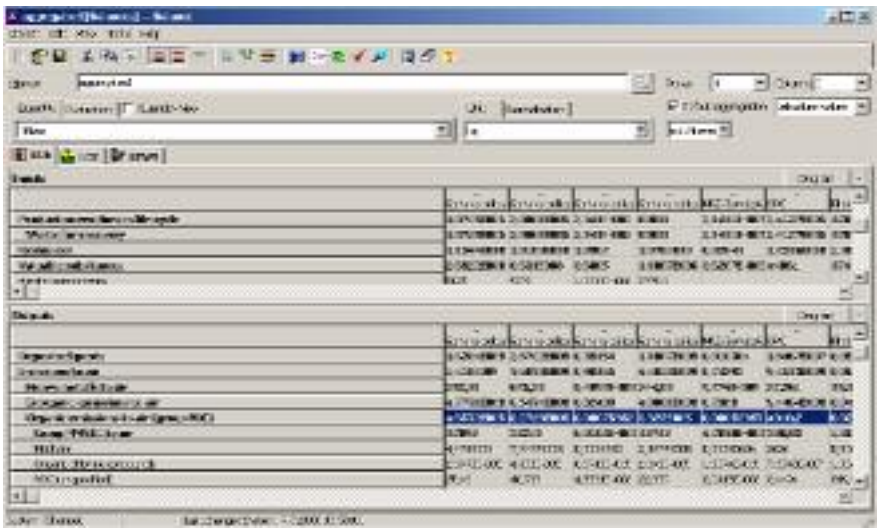
Inventory analysis – Approach for data assimilation



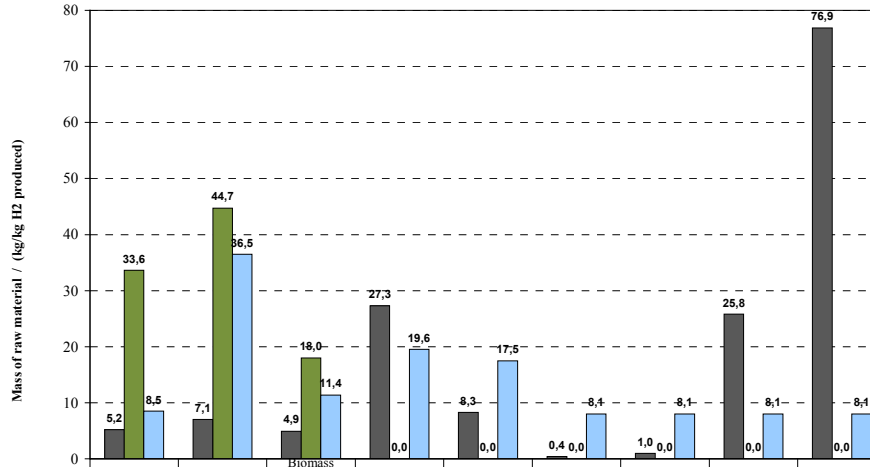
CO_2 emissions of energy grid mix EU countries and USA



Program Gabi 4
Hydrogen production balance schemes

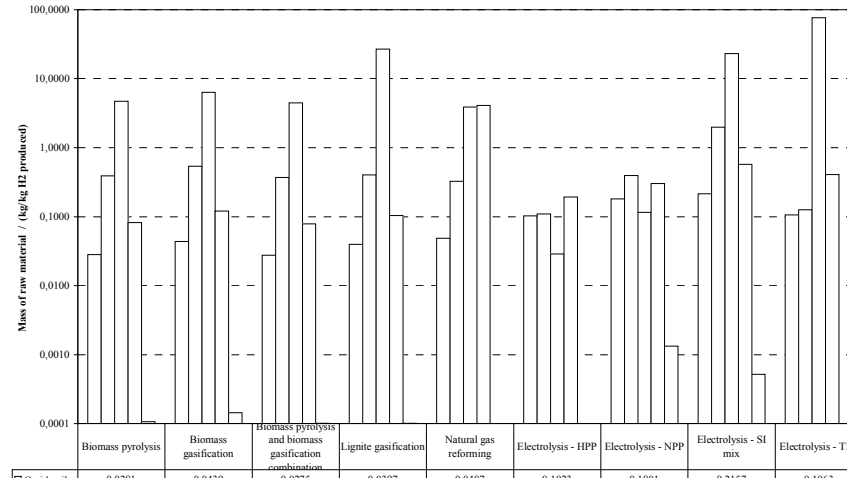


RESULTS – energy sources consumption



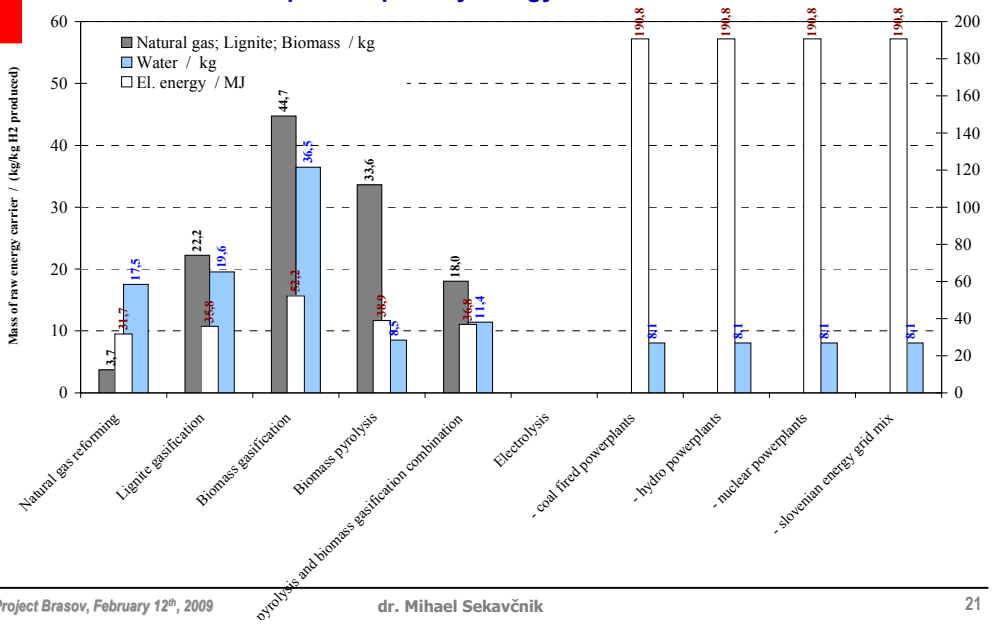
	Biomass pyrolysis	Biomass gasification	Biomass pyrolysis and biomass gasification	Lignite gasification	Natural gas reforming	Electrolysis - HPP	Electrolysis - NPP	Electrolysis - SI mix	Electrolysis TPP
Non-renewable	5,2100	7,0555	4,9316	27,2937	8,3342	0,4329	0,9927	25,8030	76,8603
Renewable	3,361E+01	4,474E+01	1,802E+01	4,478E-05	3,988E-05	1,270E-03	1,329E-03	1,289E-03	1,251E-03
Water	8,5042	36,474	11,408	19,556	17,501	8,05	8,05	8,05	8,05

RESULTS – energy sources consumption – non-renewable

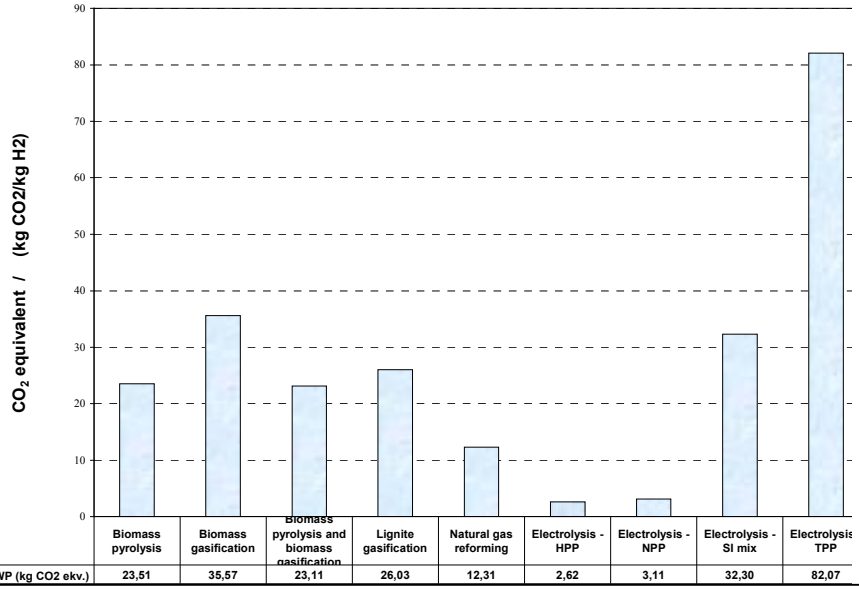


	Biomass pyrolysis	Biomass gasification	Biomass pyrolysis and biomass gasification combination	Lignite gasification	Natural gas reforming	Electrolysis - HPP	Electrolysis - NPP	Electrolysis - SI mix	Electrolysis - T
Cruide oil	0,0281	0,0439	0,0275	0,0397	0,0487	0,1023	0,1801	0,2157	0,1063
Hard coal	0,3883	0,5347	0,3688	0,4028	0,3256	0,1088	0,3958	1,9783	0,1264
Lignite	4,7116	6,3567	4,4564	26,7470	3,8586	0,0288	0,1152	23,0347	76,2187
Natural gas	0,0819	0,1200	0,0788	0,1041	4,1012	0,1929	0,3002	0,5739	0,4089
Uranium	0,0001	0,0001	0,0001	0,0001	0,0001	0,0000	0,0013	0,0005	0,0000

RESULTS – consumption of primary energy carriers

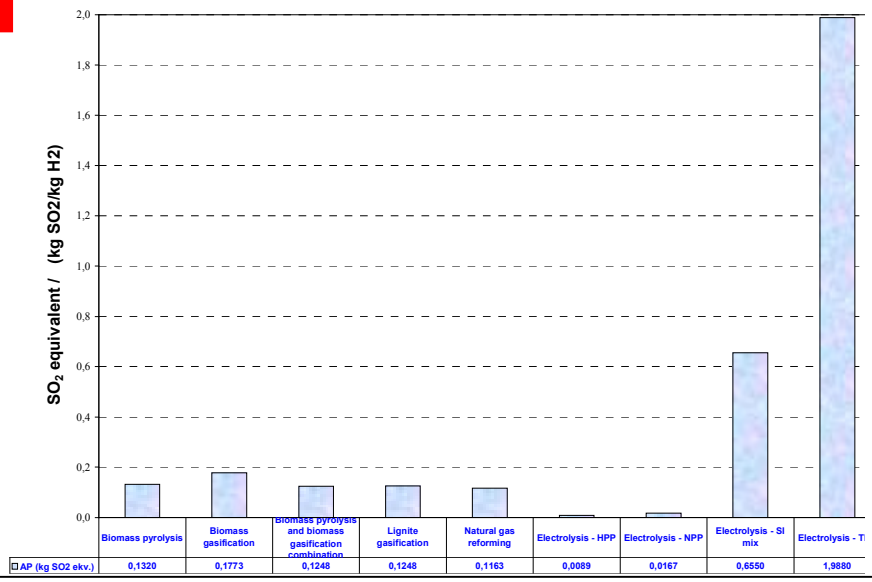


RESULTS – GWP of Hydrogen production

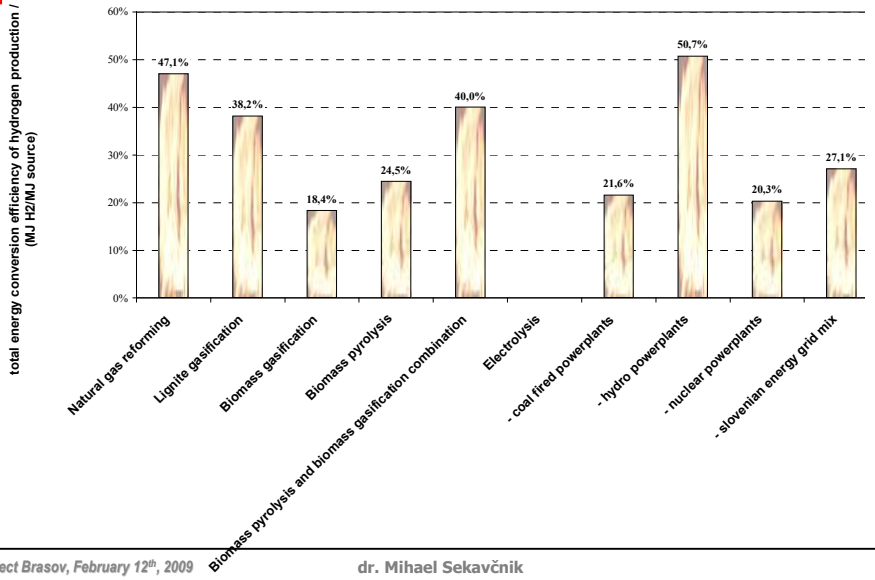


	Biomass pyrolysis	Biomass gasification	Biomass pyrolysis and biomass gasification	Lignite gasification	Natural gas reforming	Electrolysis - HPP	Electrolysis - NPP	Electrolysis - SI mix	Electrolysis TPP
GWP (kg CO2 ekv.)	23,51	35,57	23,11	26,03	12,31	2,62	3,11	32,30	82,07

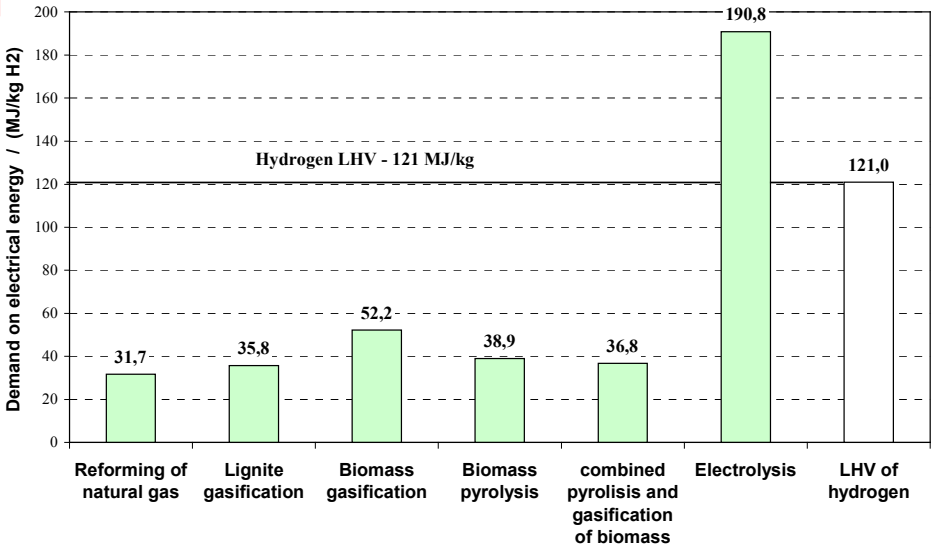
RESULTS – AP of Hydrogen production



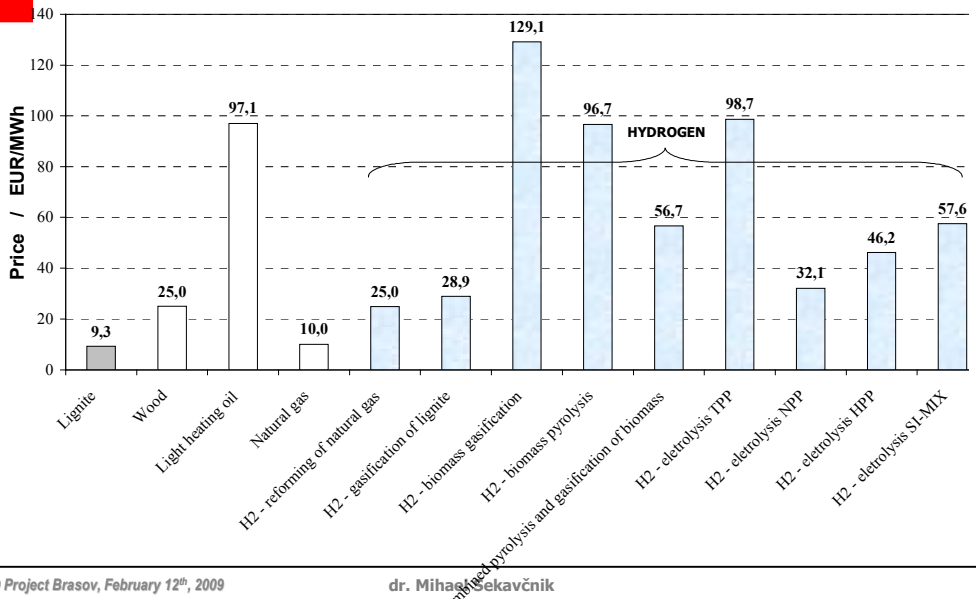
RESULTS – Total energy conversion efficiency of hydrogen production



RESULTS – Demand on electrical energy



RESULTS – Cost Assessment of Hydrogen production



University of Ljubljana
Faculty of Mechanical Engineering
Department of Heat and Power

Research, pedagogical and industrial activities

Ass.Prof.Dr. Mihael Sekavčnik

SLOVENIA IN BRIEF:

area: 20.256 km^2

population: 2 million

capital: Ljubljana (280.000 inh.)

language: Slovene

religion: RC (68 %)

climate: alpine, continental, mediterranean

EU 2004; EUR 2007

CAPITAL

LJUBLJANA UNIVERSITY CITY

University of Ljubljana

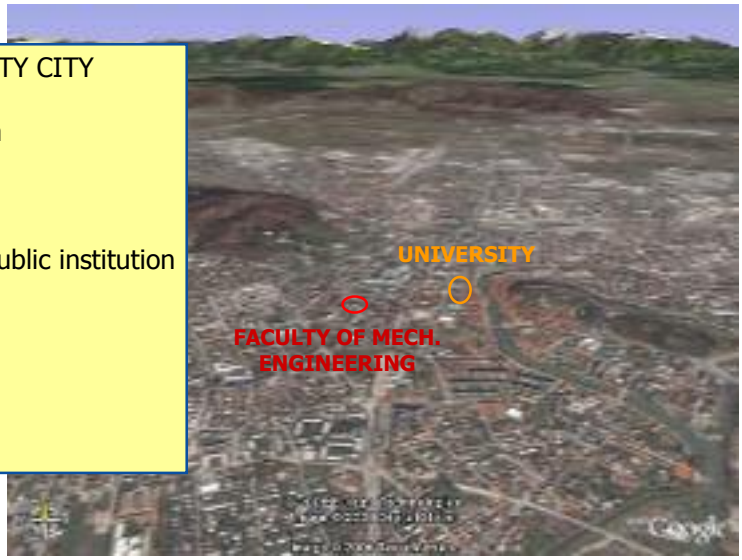
founded in 1919

status: autonomous public institution

students: 56.000

faculties: 21

academies: 3



FACULTY OF MECHANICAL ENGINEERING
DEPARTMENT OF POWER ENGINEERING
(Lehrstuhl für Energietechnik)

GENERAL ACTIVITIES

- pedagogic
- research
- professional tasks

LABORATORIES

- **Laboratory for Heat and Power (Labor für Energie- und Kraftwerkstechnik)**
- Laboratory for Hydraulic Turbomachinery
- Laboratory for Thermal Reciprocating Engines

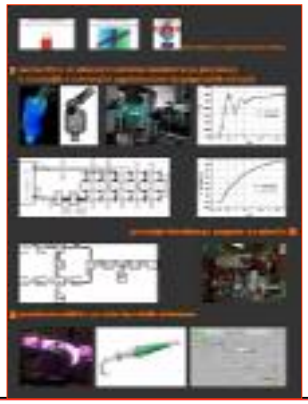
Research program: POWER ENGINEERING

Laboratory for Water and Turbine Machines — LVTS

Laboratory for Heat and Power — lte

Laboratory for Internal Combustion Engines — LTMS

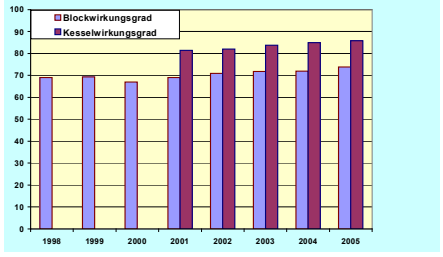
Together employed: **17** (for the period from 2004 to 2008)
COBISS - 1.01: **86**, 1.08: **77**, 2.01: **3**, 2.24: **19**, PhDs: **14**, Masters: **6**, Degrees: **114**



Classification: 1.01: research paper, 1.08: symposium paper, 2.01: publication, 2.24: patent

Effectiveness of existent power plants

The results are: continuous raising of efficiency in the Slovenian power plants, lower ecological impact and improved availability. In the recent period the entropy generation in the particular power plant's components were investigated. The exergy efficiencies of power cycles were also improved.

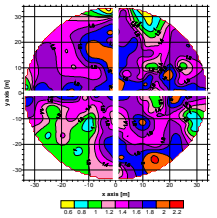


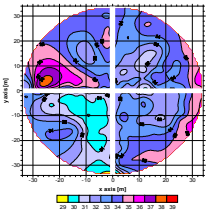
Among the applied practical results the theoretical results were used also as a complement data in European Standards in the field of Power Plant Performance Tests

Cooperation with DIN and VGB PowerTech, Germany

Cooperation with:
University of Padova, Italy,....
Industry: PP Šoštanj, PP Trbovlje, CHP Lj.

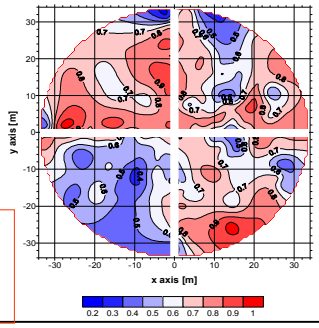
Effectiveness of existent energy sources - cooling towers



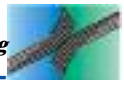


Thermodynamic properties – local inhomogeneity:
- Construction faults
- Boundary conditions
- Exploitation malfunctions

- Diagnostic method is based on measuring local parameters; velocity and temperature of the cooling air
- Modeling of transfer phenomena in natural draft cooling towers

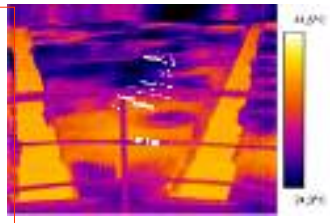


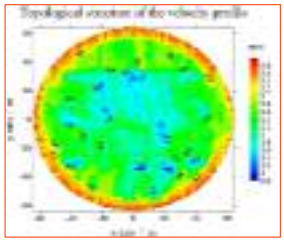
Cooperation with:
Royal University of Leuvn, NPP Tihange, Duel, Dukovani PP Šoštanj



Research activities for cooling tower diagnostic

-Evolution of “temperature field method” IR-termovision
-Complementation of the existent method with the aim of faster local disturbance location
-Method broadening to numerical simulation of transfer phenomena to achieve higher effectiveness
-Method implementation into the optimization process of the steam cycle
-Entropy generation minimization by means of cooling water redistribution



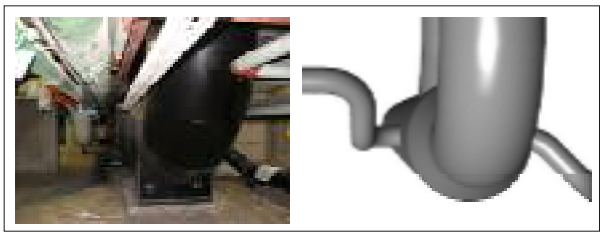


The method is ready to be applied worldwide
-Alstom
-Korea
-Russia

Hardware and numerical tools are available. The end user’s interest is big.

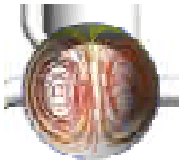
Fachliche Projekte in Kraftwerkstechnik

- **Laboratory for Heat and Power (Labor für Energie- und Kraftwerkstechnik)**
- Laboratory for Hydraulic Turbomachinery
- Laboratory for Thermal Reciprocating Engines
- Laboratory for Technical Acoustics

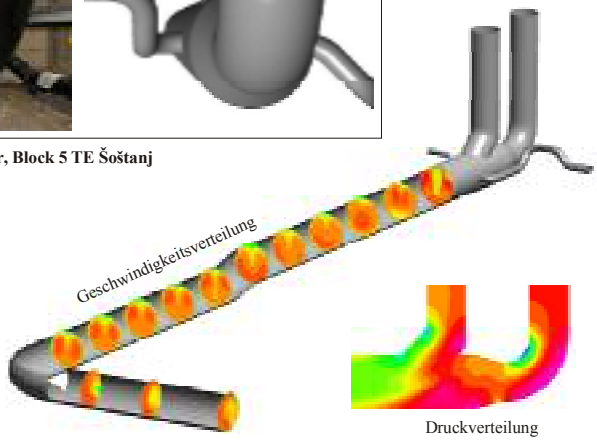


Kühlwasserrohr, Block 5 TE Šoštanj

CFD Simulation

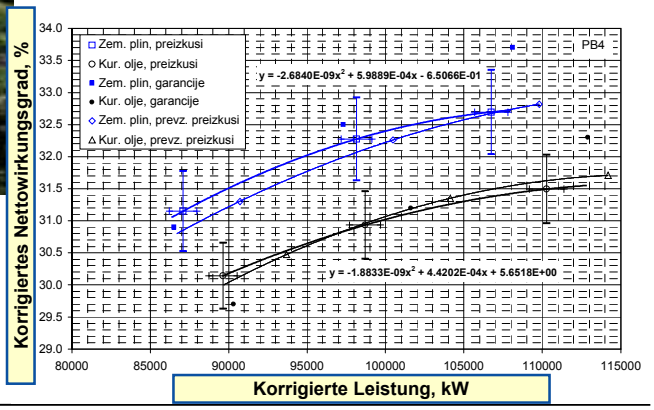


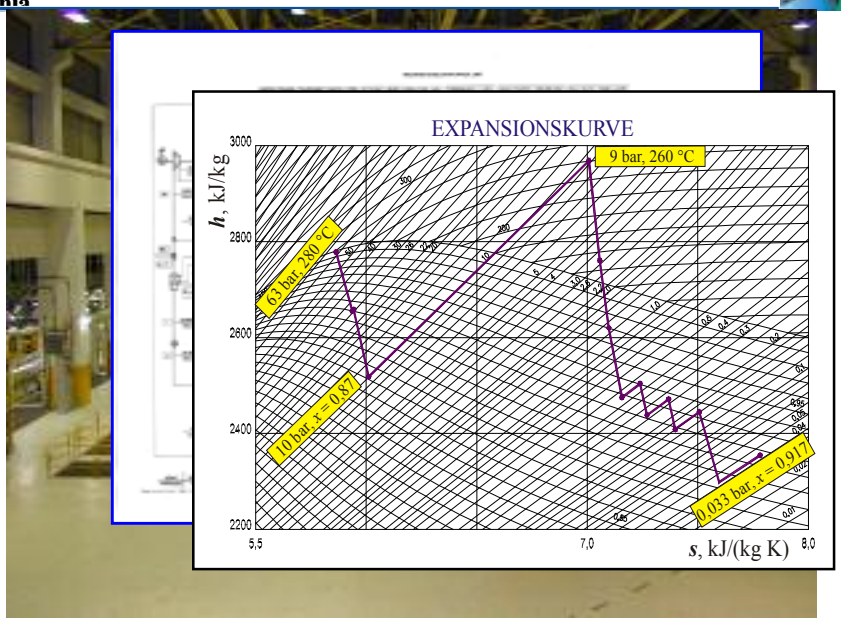
Strömungswirbellung



Druckverteilung

Gasturbinenkraftwerk Brestanica 2 x 114 MW + 3 x 23 MW



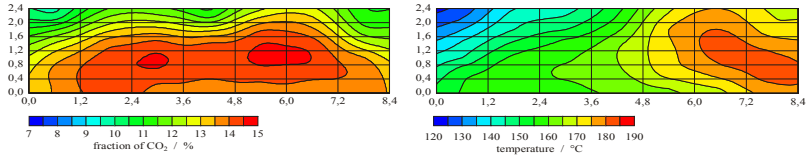


coal fired steam boiler

Efficiency? η

flue gas properties after rotary regenerative air preheater

actual conditions in flue gas channel

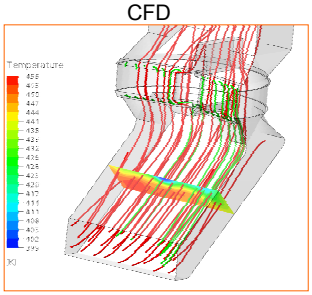


Accurate average values?

Experiment:

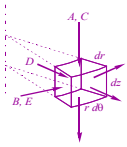
Numerical simulation:

CFD



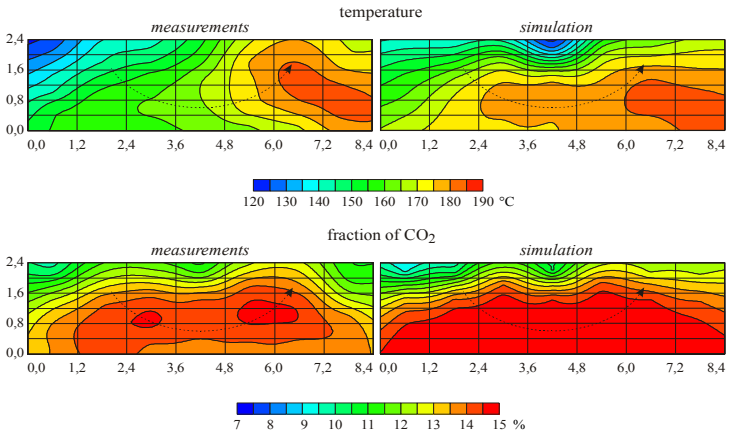
+

heat transfer model

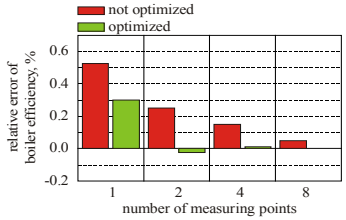


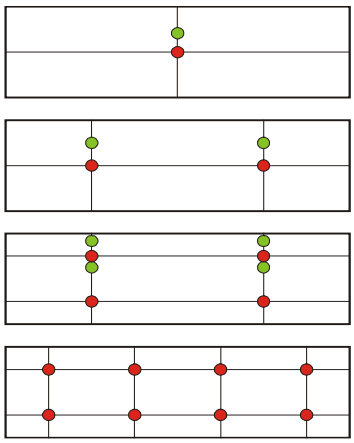
$$w_{pl}\,\rho_{pl}\,c_p\left(1-\varphi_z\right)\frac{\partial T_{pl}}{\partial z}+$$
$$+\omega\,\sigma_R\,\rho_R\,c_R\,\frac{\partial T_R}{\partial \theta}-$$
$$-\lambda\left[\varphi_z\frac{\partial^2 T_R}{\partial z^2}+\varphi_\theta\frac{1}{r^2}\frac{\partial^2 T_R}{\partial \theta^2}+\varphi_r\left(\frac{1}{r}\frac{\partial T_R}{\partial r}+\frac{\partial^2 T_R}{\partial r^2}\right)\right]=0$$

Results:

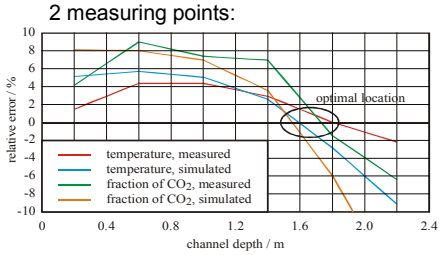


Small number of measuring points:





2 measuring points:

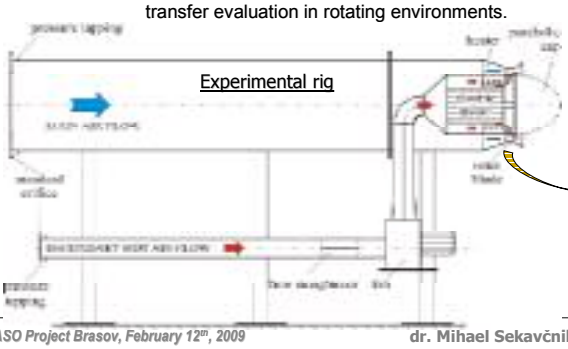


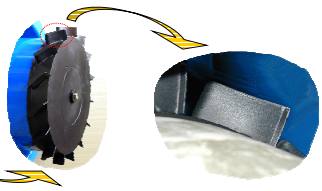
Experimental Evaluation of Heat Transfer on Rotor Blades Using Numerical and Optical Techniques

- Heat transfer study on rotating turbomachinery rotor blade.
- To simulate convective cooling in gas turbines rotor blades.

to determine

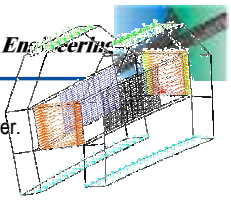
- ☑ Effect of the cooling air mass flow ratio
- ☑ Effect of varying rotational speed (Ro number) of the rotor.
- ☑ Suitability of numerical experiment to simulate conditions in gas turbines.
- ☑ Suitability of optical techniques (IR thermography, thermocromic liquid crystals) for heat transfer evaluation in rotating environments.

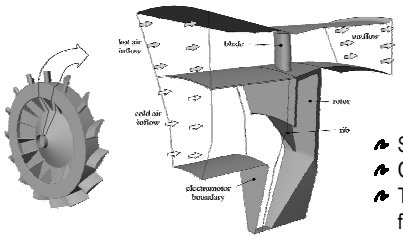


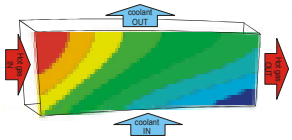


Rotor Rotor blade

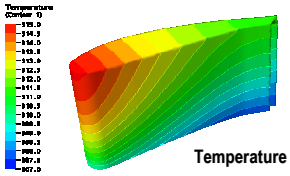
- Studing the effect and suitability of different turbulence models in the rotating environments.
- Simple geometry to eliminate additional infuences affecting shear stress in the boundary layer.
- Evaluation of heat transfer on flat rotating blade and determination of various effects.
- Comparison of results with simple empirical models.



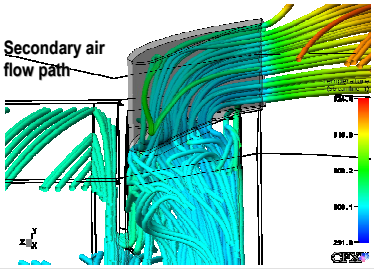




- Simulation the real conditions according to existing test rig.
- Combination of convective and conductive heat transfer.
- To get the first impression of flow conditions and heat transfer of both flows (hot, cold).



Temperature distribution on the blade

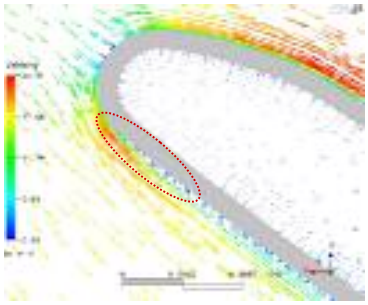


OPTICAL TECHNIQUES: Nonintrusive measurements of surface temperature distributions

CMT 384 SM IR Camera

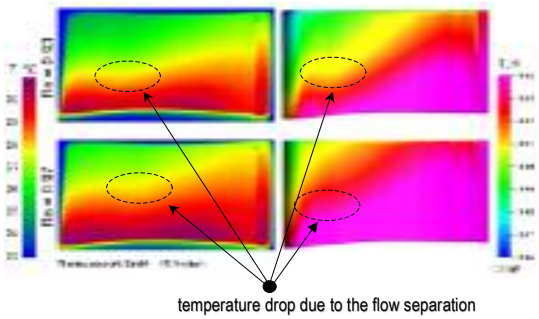
- ☑ Can be used in low and high temperature environments.
- ☑ High speed and high resolution IR Camera suitable for rotating environments.
- ☑ Relatively simple measuring procedure.

FLOW REGIME – separation zone



TEMPERATURE DISTRIBUTIONS

IR Thermography Numerical experiment

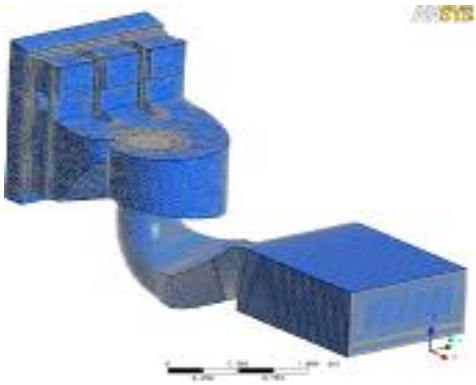


temperature drop due to the flow separation

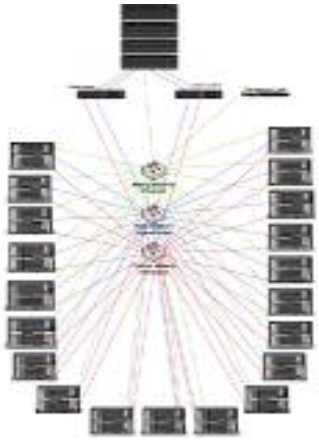
Today, Turboinštitut d.d. is one of two independent institutes in the world capable and equipped to carry out model testing in accordance with the international standards IEC 60193.

Four modern test rigs for Francis, Pump Turbine, Kaplan, Pelton and Bulb turbines are available in laboratory of Turboinštitut. Each test rig is completely independent and all four rigs are able to operate simultaneously. Test rig design and equipment allow for reliable measurements on the models, regarding various stationary and non-stationary processes in order to research turbine's energetic, cavitation and dynamic performances.

Turboinštitut is one of the leading industrial users of computational intensive methods for engineering and research applications in the middle and south-east Europe. In the past a lot of research work has been done on the experimental basis, now the computational fluid dynamics takes the leading role.



Considering research oriented future plans Turboinštitut established super-computing center with the most powerful computer in this part of Europe. Ljubljana Supercomputing Centre LSC-Adria was established with the purpose to promote computational fluid dynamics in Slovenia and the whole region of middle and south-east Europe.



Hardware

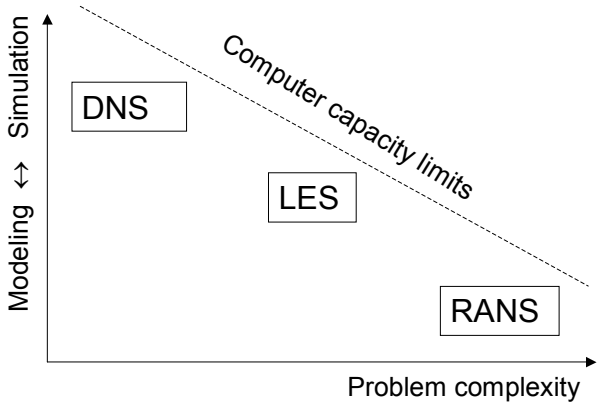
Number of proc. cores:	**2048**
RAM:	**4TB**
Hard disk:	**10TB+**
Cluster network:	**Infiniband**
Weight:	**cca 3.5t**

Software

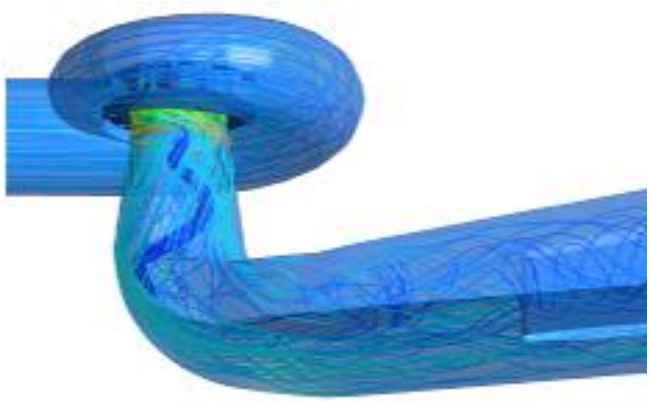
ANSYS CFX- 11, BladeModeler,
ANSYS ICEM - HEXA, TETRA, TurboGrid
ANSYS Design Space
Numeca FineTurbo
Numeca FineHexa

Today possibilities of using CFD

- analysis of the complete turbine or pump (sliding interfaces)
- turbulent flow (different turbulent models)
- multi-phase flow (free surface, cavitation)
- transient rotor stator interactions

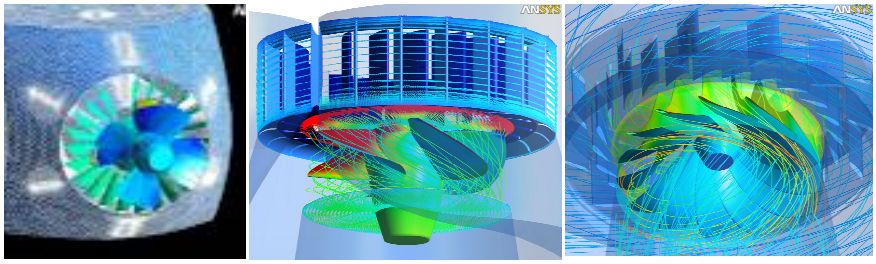


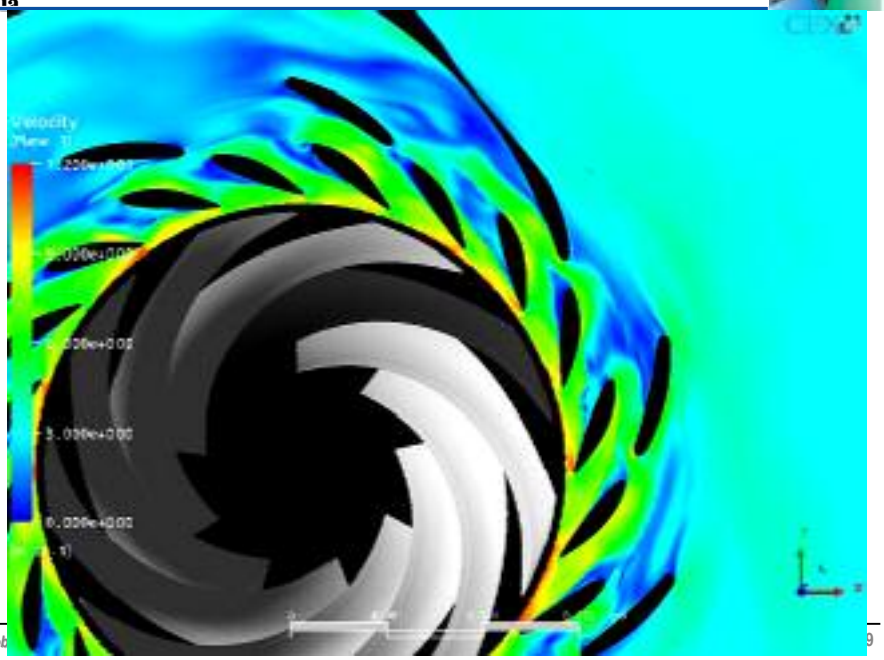
Besides work on current commercial projects in the company, LSC-Adria will be also used for research work in cooperation with Slovene and foreign universities, post-graduate study and cooperation with industrial partners.



Turboinštitut uses the CFD as every day tool in the development process of all projects for Slovene and foreign customers. Using CFD the quantity of produced models can be reduced, the time for the development can be shortened and better characteristics can be obtained.

Bulb turbine Kaplan tubine Francis turbine



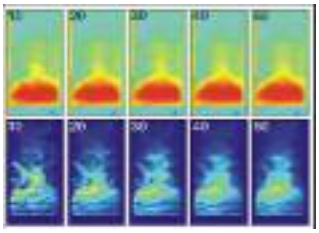


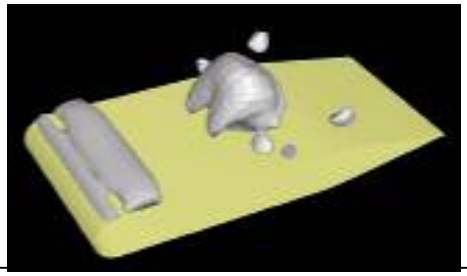
CAVITATION: Presentation of the work in the previous period

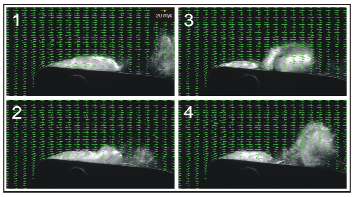
- Experimental method development for simultaneous attending cavitation structures and velocity field.
- Visualization method development for attending erosion damages on the flow tract walls.
- Numerical model development for cavitation on the isolated profile in the hydraulic machines flow tract (turbines, pumps).

Cooperation:
Technical University of Darmstadt, University of Lille, Turboinštitut, Litostroj EI, Hidria,…

2XD,2EU



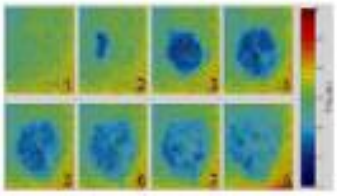




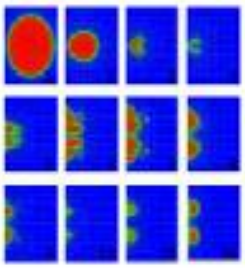
CAVITATION: Research work program for the period from 2008 to 2014

Research work directions:
- Cavitation bubble collapse model development and erosion effect predictions.
- Numerical model of the bubble collapse.
- Experimental verification with the thermovision.
- Cavitation erosion prediction model development for the hydraulic machines.

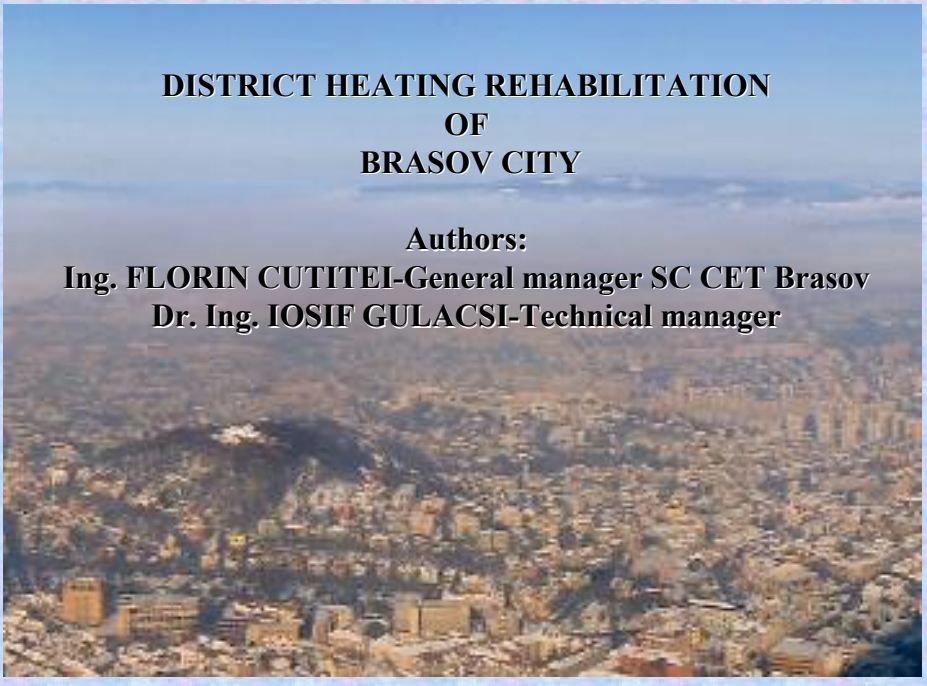
Thermocavitation experiment



Bubble collapse model



Erosion on the micro scale



DISTRICT HEATING REHABILITATION OF BRASOV CITY

Authors:
Ing. FLORIN CUTITEI-General manager SC CET Brasov
Dr. Ing. IOSIF GULACSI-Technical manager

DISTRICT HEATING SYSTEM & OPERATION

GENERAL COMPANY INFORMATIONS

- Share holders: **Municipality of Brasov**
- Employers: 828
- Registered share capital: **20,0 mil. €**
- Current electricity sale price, **day: 78 €/MWh, night: 28 €/MWh**
- Current heat producing price

(prouction & transport & distribution): **100 €/Gcal (incl.TVA)**

- Current heat sale price: **49,8 €/Gcal (incl.TVA)** (difference: subventions)
- Current fuel price: **- gas (of 8050 kcal/m³): 241 €/1000m³**
  - coal (of 1850 kcal/kg): 16,5 … 27,0 €/t (transport included)
- Current DH efficiency: **55%** (delivered heat&electricity / consumed fuel)

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

1.CUSTOMERS – HEAT & STEAM MARKET EVOLUTION

- **1990 ⇒** -79000 appartments
  - small comercial units (SCU)
  - NO METERING
  - big steam requirement in industry – Metered
- **MARKET PHENOMENS ⇒**
  - disconnection syndrome
  - industrial reorientation
- **2000 ⇒** -76200 appartments & SCU
  - 2800 disconnections
  - NO INDUSTRY !

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

1.CUSTOMERS – HEAT & STEAM MARKET EVOLUTION

- **2001 ⇒** - 73300 appartments
  - 2900 disconnections
- **2002 ⇒** - 69200 appartments & SCU
  - 4100 disconnections
- **2003 ⇒** - 64300 appartments & SCU
  - 4900 disconnections

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

1. CUSTOMERS – HEAT & STEAM MARKET EVOLUTION

- **2004 ⇒** - 53400 appartments & SCU
  - 10900 disconnections ! ! !
- **2005 ⇒** - 48700 appartments & SCU
  - 4700 disconnections
- **2007 ⇒** - 438000 appartments & SCU
  - NO INDUSTRIAL STEAM NEED

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.1. SMALL "CENTRALIZED HEATING" AREAS ("ISLANDS")

INITIAL SITUATION	ACTUAL SITUATION
Customer heat requirement [Gcal/h]	
- average . . . . . 42,0 - maximum . . . . . 57,0 (no metering)	WINTER SUMMER - average . . . . 25,0 . . . . . 5,0 - maximum . . 30,0 . . . . . 10,0 - heat & d.h.w. meters-each branch / building (CET goods) - heat allocators ~ 27 % (app. owner goods)

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.1. SMALL "CENTRALIZED HEATING" AREAS ("ISLANDS")

INITIAL SITUATION	ACTUAL SITUATION
Heat supply (network)	
- state property - network: 4 pipes ditribution system (old technology) - energy loss 35%	- municipalities public goods - network partially rehabilited – preinsulated pipes - energy loss 30%

DISTRICT HEATING SYSTEM & OPERATION

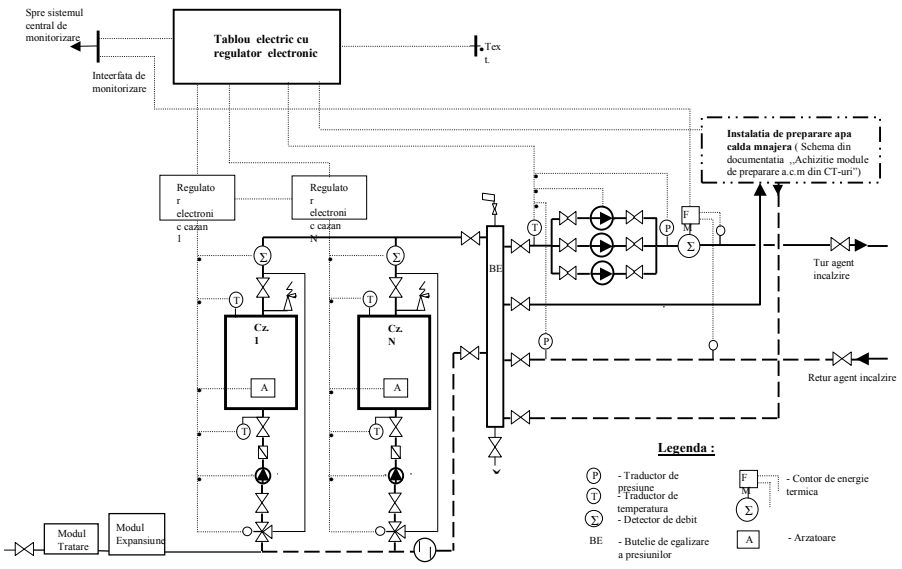
HISTORY

2. DISTRICT HEATING EVOLUTION
2.1. SMALL "CENTRALIZED HEATING" AREAS ("ISLANDS")

INITIAL SITUATION	ACTUAL SITUATION
Sources	
- state property - 21 small LBP - gasfiered warm water (90ºC) boilers (WWB); until 1 Gcal/boiler - no automation; variable flow - installed capacity: off 80 Gcal/h	- municipalities public goods - 21 modernized small LBP (2006-2007) - new gasfiered WWB - automated; variable flow pumps - installed capacity: off 60 Gcal/h

DISTRICT HEATING SYSTEM & OPERATION

MODERNIZED LBP - SCHEMATIC DIAGRAM



DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.2. SOUTH-EAST AREA (COMPACT LBP ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Customer heat requirement [Gcal/h]	
- average . . . . . 40,0 - maximum . . . . . 50,0 (no metering)	WINTER SUMMER - average . . . . 15,0 . . . . . 4,0 - maximum . . 20,0 . . . . . 5,0 - heat & d.h.w. meters (CET goods) - heat allocators ~ 30 % (app. owner goods)

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.2. SOUTH-EAST AREA (COMPACT LBP ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Heat supply (network)	
- state property - network: 4 pipes ditribution system (old technology) - energy loss 35%	- municipality public goods - network partially rehabilited – preinsulated pipes - energy loss 30%

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.2. SOUTH-EAST AREA (COMPACT LBP ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Sources	
- state property - 9 "big" LBP - gasfiered warm water (90ºC) boilers (WWB); 1 … 3 Gcal/boiler - no automation; variable flow - installed capacity: off 70 Gcal/h	- municipality public goods - 9 "big" LBP - modernized - automated - installed capacity: off 50 Gcal/h

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.3. SOUTH AREA (CTZ METROM ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Customer heat requirement [Gcal/h]	
- average . . . . . 85,0 - maximum . . . . . 115,0 - no metering	WINTER SUMMER - average . . . . 15,0 . . . . . 5,0 - maximum . . 25,0 . . . . . 8,0 - heat & d.h.w. meters (CET goods) - heat allocators ~ 30 % (app. owner goods) - horizontal app. distribution & metering (1%)

DISTRICT HEATING SYSTEM & OPERATION

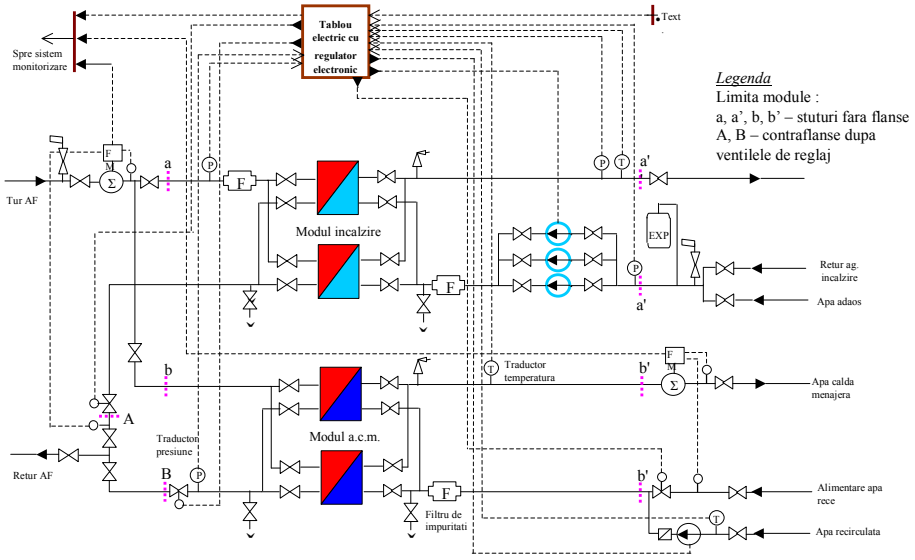
HISTORY

2. DISTRICT HEATING EVOLUTION
2.3. SOUTH AREA (CTZ METROM ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Heat supply (network)	
- state property - 2 pipes primary network (partialy underground) - 4 pipes ditrict network - old technology - 21 HES = “pipe in pipe” HE = no variable flow = no automation - energy loss 18 /35%	- municipality public goods - same situation - network partially rehabilited – preinsulated pipes - 19 HES – modernized (2005-2006) = plate HE = variable flow pumps = automation - energy loss 13/30 %

DISTRICT HEATING SYSTEM & OPERATION

MODERNIZED HES – SCHEMATIC DIAGRAM



DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION

2.3. SOUTH AREA (CTZ METROM ZONE)

INITIAL SITUATION	ACTUAL SITUATION
Sources	
CTZ Metrom & CTZ Roman **- state property**	**CTZ Metrom** **- municipality privat good (CET share capital)**
Installed capacities	
Winter **- 1 + 1 (CTZ Metrom+CTZ Roman) gasfiered hot water boilers (HWB); 2x100 Gcal/h** **Summer** **- 1 (CTZ Roman) HWB 1x25 Gcal/h** **- no automation; no variable flow** **- no modernization**	**Winter** **1 HWB (CTZ Metrom) 1x100 Gcal/h** **Summer** **- 2 gasfiered steam boilers at CTZ Metrom, 2x10 t/h steam** **- no automation; no variable flow** **- no modernization**

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.4. NORTH-CENTRAL AREA

INITIAL SITUATION	ACTUAL SITUATION
Customer heat requirement [Gcal/h]	
	WINTER SUMMER
- average . . . . . 157,0 - maximum 180,0	- average . . . 55,0 . . . . . 10,0 - maximum . . 70,0 15,0
Technological heat requirement [Gcal/h]	
- maximum 20,0	- maximum . . 10,0 2,0
Total heat requirement [Gcal/h]	
- maximum 200,0	- maximum . . 80,0 17,0
Metering	
- no metering	- heat & d.h.w. meters (CET goods) - heat allocators ~ 23% (app. owners goods)

DISTRICT HEATING SYSTEM & OPERATION

HISTORY

2. DISTRICT HEATING EVOLUTION
2.4. NORTH-CENTRAL AREA

INITIAL SITUATION	ACTUAL SITUATION
Heat supply (network)	
- state property - 2 pipes primary network (partialy underground) - 4 pipes ditrict network - old technology - 43 HES = “pipe in pipe” HE = no variable flow = no automation - energy loss 20 / 35%	- municipality public goods - same situation - network partially rehabilited – preinsulated pipes - 43 modernized HES (2005-2006) = plane HE = variable flow pumps = automation - energy loss 16/ 30%

DISTRICT HEATING SYSTEM & OPERATION

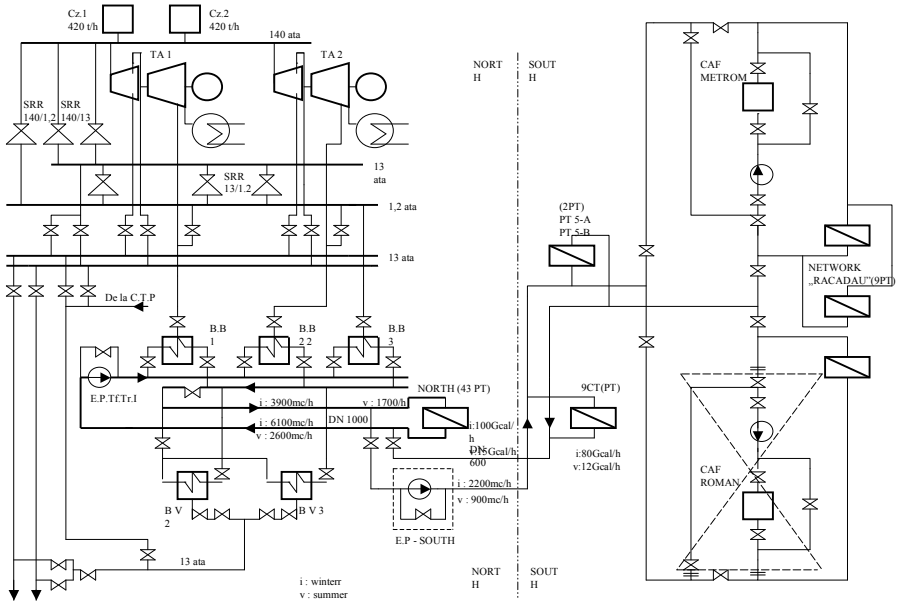
HISTORY

2. DISTRICT HEATING EVOLUTION
2.4. NORTH-CENTRAL AREA

INITIAL SITUATION	ACTUAL SITUATION
Sources – CET Brasov	
- state property	- municipality privat good (CET share capital)
Installed capacities	
Winter - 2 coalfiered (w.gas) cogeneration units (steam boiler & turbine & HE) 2 x (50.MW + 106.Gcal/h) **Summer** - 1 gasfiered HWB – at CTZ Rulmentul 1 x 100 Gcal/h	**Winter** - 1 coalfiered (w.gas) cogeneration units (steam boiler & turbine & HE) 1 x (50.MW + 106.Gcal/h) **Summer** - 2 gasfiered HWB at CET Brasov, 2 x 30 t/h steam

DISTRICT HEATING SYSTEM & OPERATION

CET COGENERATION - GENERAL DIAGRAM

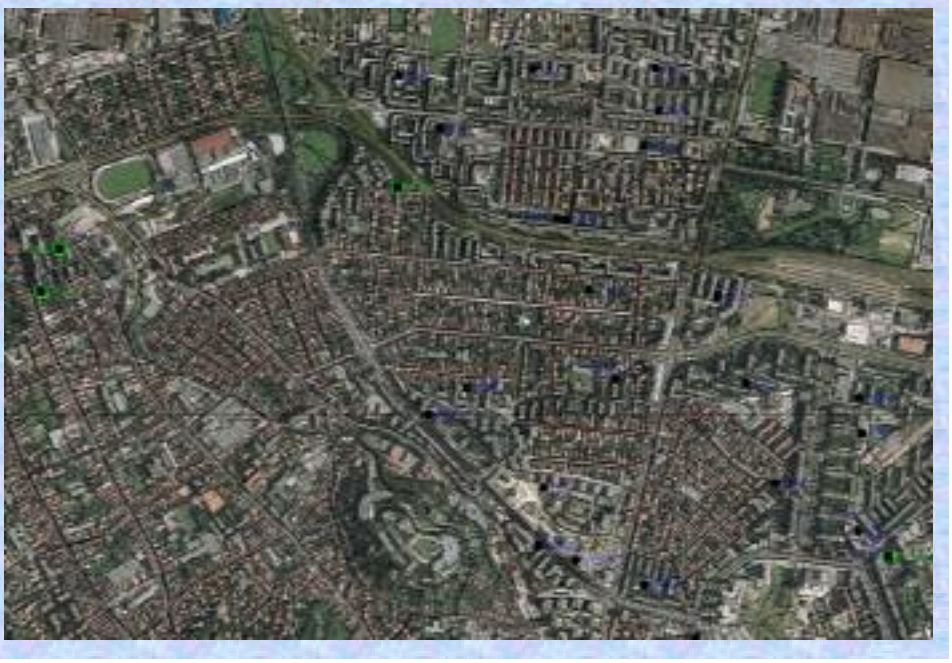


DISTRICT HEATING SYSTEM & OPERATION

HISTORY

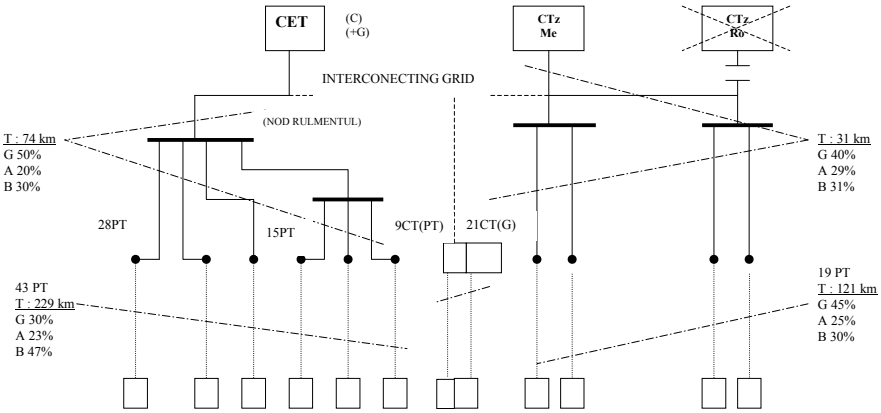
2. DISTRICT HEATING EVOLUTION
2.4. NORTH-CENTRAL AREA

INITIAL SITUATION	ACTUAL SITUATION
Technical point of view	
- old technology - 1 circulating pumps group / no variable flow - no automation - high noxes emmision - fluid (10/1) ash & cinder evacuation - old technology ash deponies	- same situation, no improvement



DISTRICT HEATING SYSTEM & OPERATION

BRASOV DH–SYSTEM, GENERAL DIAGRAM

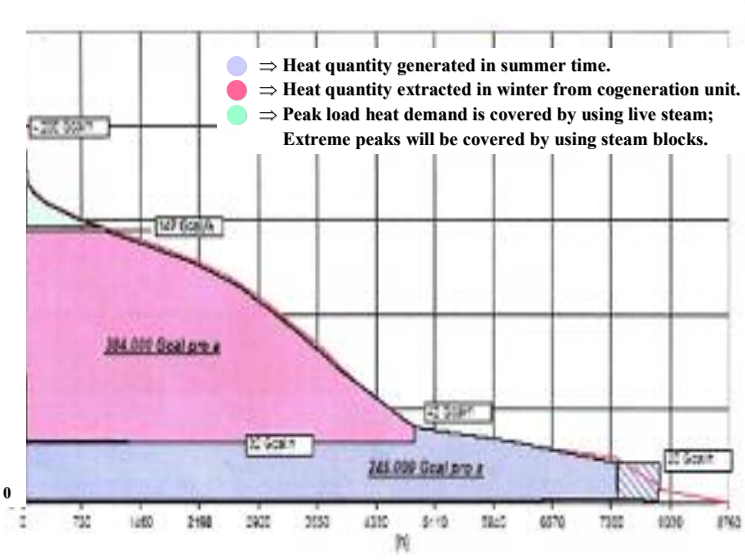


DISTRICT HEATING SYSTEM & OPERATION

HEATING LOAD VS. OPERATING HOURS

Gcal / h

SE	S	N	Total
31,5	69	150	250
25,0	55	120	200
19,0	41	90	150
12,0	28	60	100
8,0	14	30	50
0			



DISTRICT HEATING SYSTEM & OPERATION

TARGETS

1. **Extension of the horizontal appartment distribution & metering.**
2. **Rehabilitation of the primary & distribution networks ⇒ energy loss factor reducing to:**
   - **6% . . . primary network;**
   - **9% . . . distribution network;**

   } **15% . . . Total losses**
3. **Connection of the two heating systems (primary network) – NORTH & SOUTH – eliminate "one fuel type dependence".**
4. **Extention of the cogenerative heat production.**

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

1. CUSTOMERS SIDE

- **stabilization & extension of the heat market.**
- **logistical & financial support for the introduction of horizontal heat & d.h.w. distribution in appartments.**
- **financing the appartment heat metering (CET goods).**

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

A. HEAT SUPPLY

- **Partially rehabilitation of distribution network for maximum 9% heat loss**

  ⇒ Investment costs: 30,0 mil. €

- **Transport network (primary) rehabilitation for maximum 6% heat loss**

  ⇒ Investment costs: 7,0 mil. €

- **Interconnection of NORTH & SOUTH primaty networks for a maximal fuel utilisation flexibility**

  ⇒ Investment costs: 17,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

A. HEAT SUPPLY

- **Reorganizing & modernizing the CET's hot water (primary) circulating systems**
  - **efficient HE connections;**
  - **variable flow pumps (0,6KV) in 2 steps (1 upstream & 1 downstream of HE)**
  - **fiting with variable flow pumps the south network (3-rd step)**

⇒ Investment costs: 6,0 mil. €

TOTAL COSTS FOR HEAT SUPPLY REHABILITATION ⇒ 60,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

SMALL LBP

- **Finalizing of modernization & automatization process**

⇒ Investment costs: 0,9 mil. €

- **Solar collectors introducing for a partially d.h.w. preparation**

⇒ Investment costs: 0,1 mil. €

TOTAL COSTS FOR SMALL LBP ⇒ 1,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

DISTRICT HEATING - COMPACT AREAS

SCENARIO - 1

I – SOUTH-EAST

⇒

- **Cogeneration units for d.h.w. preparation – 4 x (1,0MW + 2,0 Gcal/h)**

⇒ Investment costs: 5 mil. €

TOTAL COSTS FOR SOUTH-EAST - SCENARIO 1 ⇒ 5,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

DISTRICT HEATING - COMPACT AREAS

SCENARIO - 1

II – SOUTH

- **New cogeneration power plant, delivering electricity at 10 kV**

  - **– 1 x cogeneration unit (25 MW & 20 Gcal/h)**
    = 4 gasmotors
    = 2 existing gasfiered steam boiler 2x30 t/h

    = heat exchanger (steam / hot water)
    = variable flow pumps

⇒ Investment costs: 25,0 mil. €

TOTAL COSTS FOR SOUTH - SCENARIO 1 ⇒ 25,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

DISTRICT HEATING - COMPACT AREAS

SCENARIO - 1

III– NORTH

- **A new cogeneration plant (replacement) in CET, resolving also environmenthal problems. Power evacuation: 10/110 kV;**

  - **Summer – 1 cogeneration unit -4 GM (25MW & 20 Gcal/h)**
    (gasfiered)
  - **Winter – 1 biomass fiered cogeneration unit**
    (13 MW & 40 Gcal/h)
    = 2 existing steam boiler 2x 30 t/h (at gas)

⇒ Investment costs: 65,0 mil. €

TOTAL COSTS FOR NORTH - SCENARIO 1 ⇒ 65,0 mil. €

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

DISTRICT HEATING - COMPACT AREAS

SCENARIO - 1

I. SOUTH-EAST - SCENARIO 1	**⇒ 5,0 mil. €**
II. SOUTH - SCENARIO 1	**⇒ 25,0 mil. €**
III. NORTH - SCENARIO 1	**⇒ 65,0 mil. €**
TOTAL COSTS FOR SCENARIO 1	**⇒ 95,0 mil. €**

DISTRICT HEATING SYSTEM & OPERATION

REHABILITATION SOLUTIONS

2. DISTRICT HEATING

B. SOURCES

DISTRICT HEATING - COMPACT AREAS

SCENARIO - 3

I + II + III – SOUTH-EAST & SOUTH & NORTH

- **The 9 LBP converted in HES & join them into interconnection grid (primary)**

  ⇒ Investment costs: 3,0 mil. €

- **A new cogeneration plant (replacement) in CET**
  - **1 x cogeneration unit -4 GM (25MW & 20 Gcal/h)-at gas**
  - **1 x cogeneration unit, 1 x (13 MW & 40 Gcal/h)-at biomassa**
  - **2 gas fiered hot water boiler 2x 25 Gcal/h**

  = 2 existing gas fiered steam boiler 2x30 t/h

  ⇒ Investment costs: 85,0 mil. €

TOTAL COSTS FOR SCENARIO 3	**⇒ 88,0 mil. €**

DISTRICT HEATING SYSTEM & OPERATION

OBTAINED RESULTS

- Increase of operational reliability
- Security of supply for the all network
- Increase of economic efficiency
- Environmental improvement by increase of overall efficiency
- Future-oriented solution with regard to EU requirements

BIOMASS AS BIOFUELS BIODIESEL

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Renewable Energy Sources

- Solar Energy
- Wind Power
- Water Power
- Solid Biomass
- Geothermal Energy
- Nuclear Power

Renewable Energy Sources

- RES are fundamentally different from fossil fuels, because the Sun, Earth, or Moon - 'power plants' will last for billions of years.
- They do not produce as many greenhouse gases and other pollutants as fossil fuel combustion.
- Availability:

  - Sunlight is available only during the day when the sun is well above the horizon.

  - Wind energy is typically available much less than half the time.

  - Wave energy is continuously available, although wave intensity varies by season.

Biomass

- All the organic matter, produced by *photosynthesis*.
- The source of energy in biomass is the sun, the biomass acting as a kind of *chemical energy store system.*
- Biomass is constantly undergoing a complex series of *physical* and *chemical* transformations being regenerated while giving off energy in form of heat to the atmosphere.

Categories of Biofuels

- **Solid biomass** - trees, crop residues, animal and human waste, household or industrial residues for *direct combustion* to provide heat.
- **Biogas** - obtained by *anaerobic digestion* of organic material to produce the combustible gas *methane*. Animal waste and municipal waste are two common feedstock sources for anaerobic digestion.
- **Liquid Biofuels** - obtained by subjecting organic materials to one of various chemical or physical processes to produce usable, combustible, liquid fuels.

Biofuels

- Biofuel was used since the early days of the car industry

- Examples of biofuels:
  - **Methanol**
  - **Ethanol**
  - **Butanol**
  - **Mixed Alcohols**

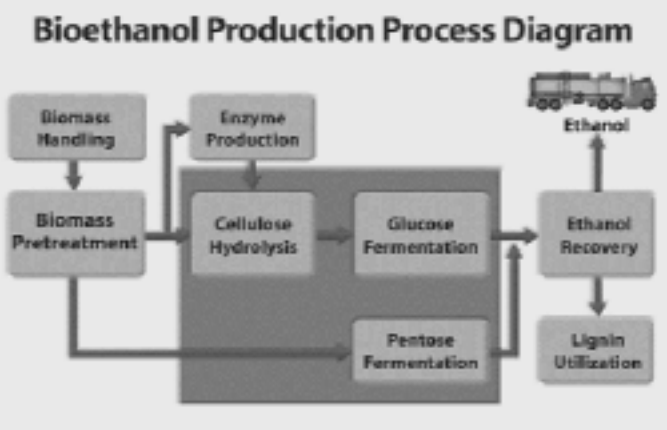
Biogas

- Biogas is produced by anaerobic digestion of organic matter with anaerobe microorganisms.
- Biogas can be produced either from biodegradable waste materials or by using energy crops fed into anaerobic digesters.
- Biogas contains methane and CO2 which can be recovered in industrial anaerobic digesters and mechanical biological treatment systems.
- Landfill gas is a less clean form of biogas, produced in landfills through naturally occurring anaerobic digestion. Is a potent greenhouse gas, if is allowed to escape into athmosfere.

Bioethanol

- Bioethanol is an alcohol made by fermenting the sugar components of biomass - mostly starch crops.
- Bioethanol can be used as fuel for cars in its pure form, but it is usually used as a gasoline additive to increase *octane number* and reduce vehicle emissions.

Bioethanol



Biologically Produced Oils

- Biologically produced oils can be used in *diesel engines*.
- Biologically produced crude oil refined into kerosene, petroleum, diesel, other fractions.

- *Type of biologically produces oils*:
- Straight vegetable oil (SVO).
- Waste vegetable oil (WVO) — waste cooking oils and greases produced by commercial kitchens.
- Biodiesel obtained by *transesterification reaction* of animal fats and vegetable oils is directly usable in petroleum diesel engines.

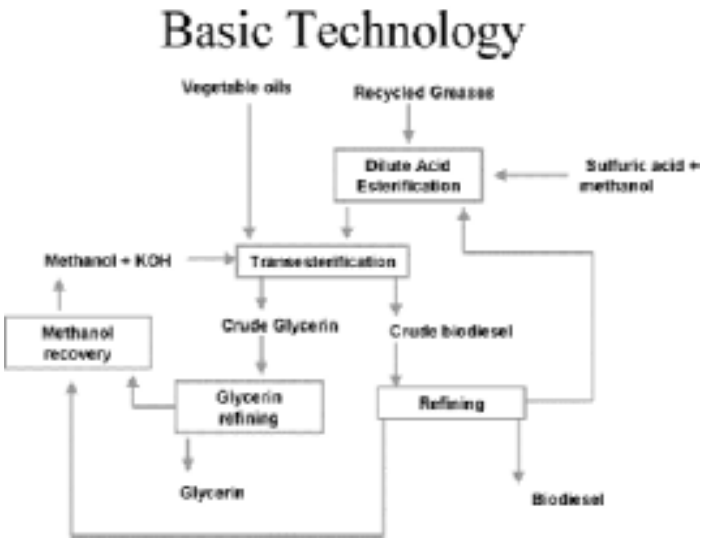
Biodiesel

- Biodiesel - mixture of *fatty acid alkyl esters* made from vegetable oils, animal fats, recycled greases.
- Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a petroleum diesel additive to reduce levels of particulates, carbon monoxide, hydrocarbons and air toxics from diesel-powered vehicles.
- Biodiesel - green fuel, does not contribute to the carbon dioxide (CO2) and produces reduced engine emissions.
- Biodiesel - non-toxic and biodegradable.
- Biodiesel - has a much higher lubricity than petroleum diesel; its use can prolong engine life.

Biodiesel

- Biodiesel - light to dark yellow liquid.
- Practically immiscible with water.
- High boiling point and low vapor pressure.
- Typical methyl esters biodiesel have a flash point of ~ 150 °C (300 °F).
- Density of ~ 0.86 g/cm³.
- Biodiesel uncontaminated with starting material can be regarded as non-toxic.

Biodiesel



BIODIESEL SYNTHESIS BY TRANSESTERIFICATION REACTION OF VEGETABLE OILS WITH METHANOL

Vegetable oils submitted to transesterification chemical reaction:

- Soybean oil
- Sunflower oil
- Maize oil

BIODIESEL SYNTHESIS BY TRANSESTERIFICATION REACTION OF VEGETABLE OILS WITH METHANOL

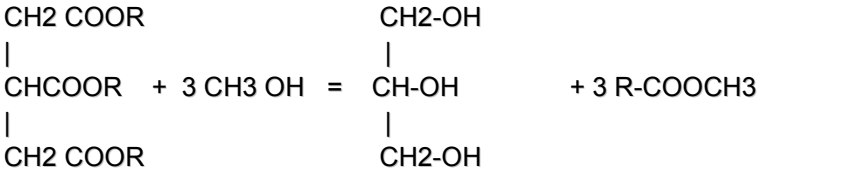
- Parametres investigated:

  - Acidity index
  - Iodine absorption number
  - Peroxide number
  - Saponification number (fourth steps of transesterification reaction) - used for monitoring the transesterification process.
  -Decreasing of saponification values in time - correlated with progressing transesterification.

BIODIESEL SYNTHESIS

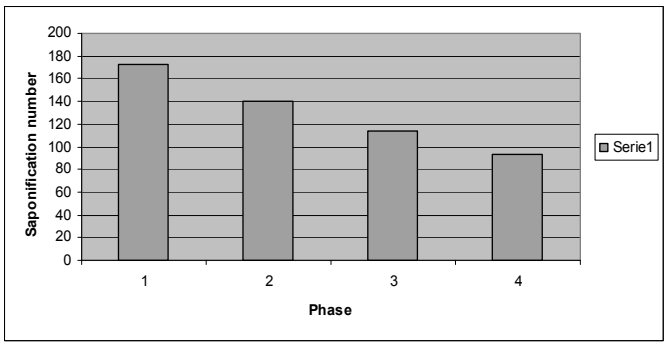
CHEMICAL REACTION

$$NaOH + 3CH_3OH = NaOCH_3 + H_2O$$



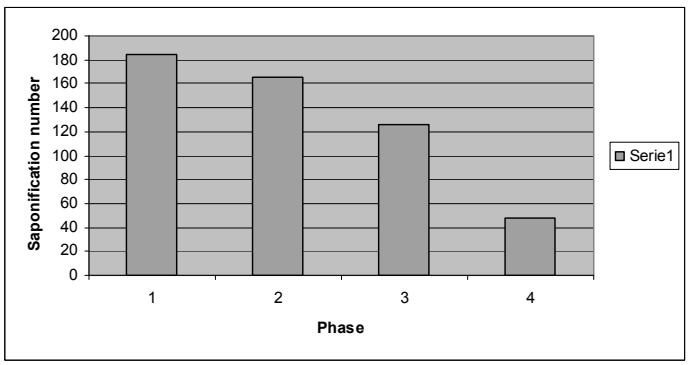
triglyceride methanol glycerine methyl esters of fatty acids (biodiesel)

MONITORING THE SYNTHESIS OF BIODIESEL BY SAPONIFICATION NUMBER



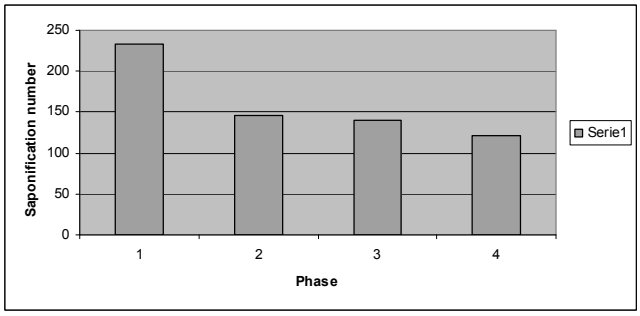
The variation of the saponification number in time for biodiesel obtained from sunflower oil

MONITORING THE SYNTHESIS OF BIODIESEL BY SAPONIFICATION NUMBER



The variation of the saponification number in time for biodiesel obtained from soybean oil

MONITORING THE SYNTHESIS OF BIODIESEL BY SAPONIFICATION NUMBER



The variation of the saponification number in time for biodiesel obtained from maize oil

CHARACTERISTICS OF THE OBTAINED BIODIESELS

Property	STAS EN 14214	Maize oil Biodiesel	Sunflower oil Biodiesel	Soybean oil Biodiesel
Density [g/cm3]	**0.8393**	**0.8604**	**0.8956**	**0.9100**
Viscosity [mm2/s]	**4-6**	**4.98**	**5.47**	**5.85**
Superficial tension [N/m]	**0.0281**	**0.0290**	**0.0298**	**0.0300**

Conclusions

The research aimed to establish simple methods, both for monitoring the synthesis of biodiesel by transesterification of oils with methanol, and characterization of oils and biodiesel obtained.
The characteristics of biodiesel obtained are comparable with those of the STAS values.
Biodiesel has distinct advantagesl:
-derivation from a renewable source, thus reducing the dependence on/and preserving petroleum;
-reduction of most exhaust emissions;
-biodegradability;
-higher flash point, safer handling and storage;
-excellent lubricity, comparing with petrodiesel. Adding biodiesel (1-2%) restores lubricity.
-Problems associated with biodiesel - higher price- can partially be offset by using less expensive feedstoks - waste oils (used frying oils).

ABMEE and Energy Efficiency at local level

Andreea Piuaru

Project Manager - ABMEE

12.02.2009

Local energy management agencies

ABMEE is a **local energy management agency (LEA)**, set-up in 2003 as a non-governmental, not-for-profit organization trough SAVE II programme of the European Commission.

What do energy agencies do?

LEAs support the introduction of good energy management practices, advocate the concept of sustainability, provide information and guidance, and offer a number of other local services based on specific local energy needs. They operate impartially on both energy demand and supply issues.

Local and regional players, whether energy producers or consumers, the public, business or equipment suppliers, can find a range of services at their LEA including:

- Information, advice and training on energy management issues
- Support for the implementation of local/regional energy plans
- Energy audits of public and private buildings
- Raising awareness on energy efficiency, renewable energy sources and transport issues
- Search for energy-management incentive funds at national and international level

LEAs in Romania

There are currently **7 working LEAs** in Romania and **2 others newly established:**

ABMEE – Brasov

HEMPS – Miercurea Ciuc

ALGEPEM – Iasi

ALEEM – Vaslui

AEEP – Bucuresti sector 1

ALEA – Alba Iulia

AMES – Sighisoara

ABMEE

Main areas of activity

- Management of European funded projects (Intelligent Energy Europe, Phare)
- Energy certification of buildings
- Energy audit
- Electro- and Thermo-energetic balance
- Organizing seminars and conferences
- Training on different topics
- Information and awareness campaigns.

Target group

- Local Authorities - assistance in defining the energy efficiency strategy and promoting energy and environment policy at local level.
- National and European entities in energy and environment field.
- Citizens – advice on energy efficiency projects.
- Private companies.

Introduction of good energy management practices

Defining the Energy Strategy for Brasov municipality

2003 – 2006 ABMEE assisted Brasov municipality in defining its Energy Strategy, adopted trough Local Council Decree 210/2007 – Brasov was among the first Romanian municipalities to have an Energy Strategy.

The importance of this strategy consists in its identifying the possibilities and means of energy efficiency increase in the sectors under the authority of the local public administration and its recommending proper programmes for their implementation.

Defining Air Quality Management Strategy in Brasov

2006 – 2007 ABMEE assisted Brasov municipality in defining its Air Quality Management Strategy in Brasov, adopted trough Local Council Decree 881/2007.

The complex reviews performed under this strategy have identified the activities to be taken into consideration by the public administration of Brasov City in air quality management.

Introduction of good energy management practices

Creation and use of Energy Management Software (EMS)

- 2003 – 2008 – ABMEE developed an online application for monitoring energy and water consumption in public buildings.
- 2003 – 2005 – 52 schools and high-schools monitored.
- 2008 – 43 public buildings under municipality's administration monitored.

Establishment of Energy Efficiency Committee within the municipality

- 2008 – ABMEE assisted the municipality in establishing an Energy Efficiency Committee within the municipality.
- The committee consists of the managers of municipality services (11 persons).
- Energy Efficiency Committee issued 4 decisions in 2008. The most important: 20% reduction of energy consumption in 43 public buildings in 2009.

Defining the Municipal Energy Programme

In 2009 ABMEE will assist Brasov municipality planning, implementing and evaluating activities to improve local energy efficiency, focusing on the overall *Process management*. The aim is at least 10% of energy, CO2 and money savings in municipal properties by 2010.

Information, advice and training on energy management issues

Training for Energy Managers

ABMEE organized 4 trainings for the Energy Managers of monitored buildings trough EMS.

Production of 2 guides for Energy Managers

Energy manager guide in educational buildings, 2005
Basic notions on efficient indoor lighting in educational buildings, 2005

Facilitating meetings with key actors in energy management

2008 - ABMEE organized a meeting between managers of municipality services and Ms. Emilia-Cerna Mladin, president of the Association of Energy Auditors for Buildings

Creation of the 1st Energy Info Point in Romania

At the Energy Info Point citizens can find free of charge, useful information and advice on energy efficiency issues, simple actions that can be implemented for reducing utilities consumption, what kind of equipment is recommended in different situations, etc. There are also brochures, guides and a whole series of other useful materials available.

Energy audits of public and private buildings

Other studies and reports

Public buildings

Energy Audit School 23
Energy Audit Grigore Moisil Highschool
Energy Audit School 8

Private buildings

Energy Audit Uranus 2
Energy Audit C-Bucuresti 82A

Opportunity studies

Public Lighting in Brasov municipality – 2 studies: 2005, 2008
District Heating in Brasov municipality, 2005

Energy Reports

Energy Report Andrei Barseanu High School
Energy Report Unirea High School
Energy Report Nicolae Titulescu High School
Energy Report School 9
Energy Report School 11

Awareness raising

Energy Efficiency Week 2005

Launching Display Campaign

Launching Energy Info Point

BISE Forum

In town without my car! 2006, 2007

Awareness raising

Air Quality Contest 2007

Municipal Intelligent Energy Days 2008

Thank you for your attention!

Andreea Piuaru, Project Manager ABMEE

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INFLUENTA RADONULUI ATMOSFERIC ASUPRA VIETII SI MEDIULUI

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1. Introducere

Măsurarea toxicității aerului atmosferic din punct de vedere radioactiv are o importanță deosebită datorită impactului social. Astfel, radioactivitatea induce fenomene greu controlabile pe termen lung, cum ar fi cancerul, sau modificările cromozomiale care ajung la un echilibru după foarte multe generații. Efectele produse de către dozele mici de radiații acționează în principal, la nivelul moleculei ADN care constituie o țintă de 10^6 ori mai mare decât alte molecule din organism. S-a stabilit, [3] de asemenea, că frecvența de apariție a afecțiunilor maligne creşte proporțional cu doza absorbită.

Din aceste considerente a fost realizata instrumentația capabilă să măsoare concentrația de radon şi contribuția surselor alfa radioactive atât direct prin măsurarea concentrației de radon, cât şi, indirect, prin măsurarea contaminării suprafețelor, pentru determinarea contaminării aerului.

Limita de contaminare a suprafețelor (LCS), se stabileşte în funcție de relația care există între contaminarea atmosferică şi contaminarea suprafeței.

S-a făcut, de asemenea, şi o estimare prin calcul a eficacității metodei şi a instalației de măsurare, bazată pe utilizarea unui sistem de achiziție a datelor şi a unui program de calcul specializat, care permite studierea distribuțiilor în timp şi amplitudine a impulsurilor produse de radiațiile alfa într-un detector tip camera de ionizare.

Datele preliminare indică posibilitatea măsurării activității volumice a radonului şi descendenților acestuia cu incertitudini de măsurare de 5 –6 % [19], [20].

Pentru măsurarea contaminării alfa directe a aerului se considera radonul datorită faptului ca este extrem de raspândit şi foarte periculos, mai ales prin descendenții săi. Radonul este elementul chimic din tabelul periodic avand simbolul Rn si numarul atomic 86. Radonul face parte din categoria gazelor rare. Este unul dintre cele mai grele gaze si este incolor, inodor. Radonul este un izotop radioactiv al radiului. Radonul se descopune in continuu si elibereaza radiatii. Radonul este sursa principala de radiatii ionizate la care suntem expusi. Radiatiile ionizate pot afecta celulele care formeaza tesuturile si organele noastre. Radonul este un gaz radioactiv ce provoaca cancer pulmonar si este produs de mineralele din sol, ca Uraniul si Radiul.

După cum se ştie, fig. 1, radonul provine din seria naturală a ^{238}U, din dezintegrarea ^{226}Ra, radiația alfa emisă având energia de 5.489 MeV şi un parcurs în aer de 4.13 cm.

Figura 1. Schema de dezintegrare a uraniului natural [5], [6].

Timpul de injumatatire al Radonului este de 3,8 zile.

Echilibrul între ^{226}Ra şi ^{222}Rn se stabileşte în 38 de zile. In timpul procesului de descompunere sunt eliberate pe langa radiatii alfa si radiatii beta si gamma. Particulele alfa pot parcurge distante foarte scurte si nu pot patrunde prin piele, particulele beta pot penetra insa pielea, dar nu pot patrunde in tot organismul, iar radiatiile gamma pot patrunde in tot organismul.

In figura 2 este prezentata distributia radonului in aer, apa si sol [4], [5]. Astfel radioactivitatea scoarței pamântului, în special a rocilor, este condiționată mai ales de prezența elementelor radioactive din familia uraniului ^{238}U şi ^{232}Th. Produşii gazoşi radioactivi rezultați din dezintegrarea radiului, reprezentați de izotopii ^{222}Rn şi respectiv ^{220}Rn, pătrund continuu din sol în aer. Radonul produs în rocile de suprafață pătrunde în apa, sau se degajă în atmosferă rapid, de unde se poate acumula în interiorul clădirilor pâna la concentrații periculos de mari, în special dacă clădirile sunt bine etanseizate.

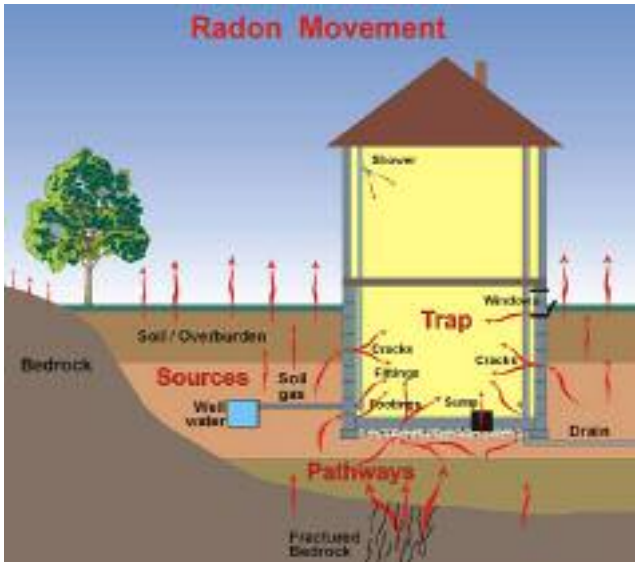

Figura 2. Distributia radonului in aer, apa, sol [6]

Concentrația radonului din locuințe, [4], [5], figura 3, depinde de totalitatea radonului produs de uraniul existent în pământul şi rocile pe care este construită locuința, de căile pe care acesta ar putea pătrunde în locuință şi de rata de schimb între aerul de afară şi cel din interior. O concentrație crescută de radon se va regăsi mai ales în subsolul caselor şi a încăperilor care sunt în contact direct cu solul.

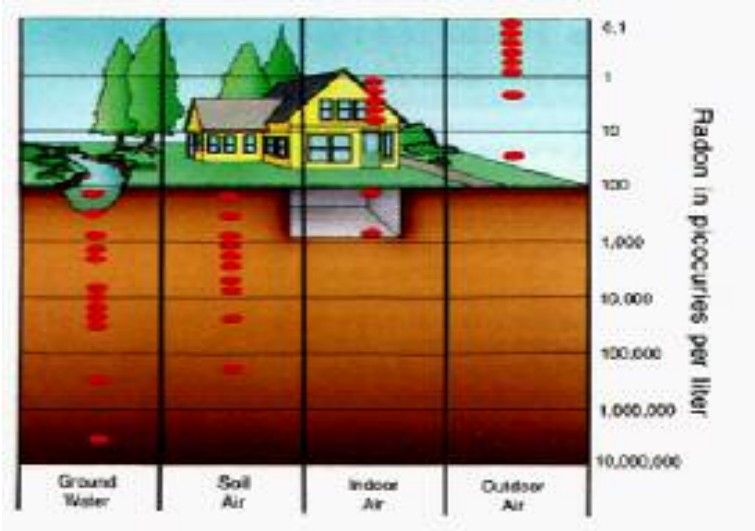

Figura 3. Nivelul concentratiei de radon in locuinte [4], [5].

Schimbul dintre aerul de afară şi cel din interior depinde de construcția locuinței, obiceiurile de ventilație ale locuitorilor şi de izolarea ferestrelor. Astfel, concentrația radonului dintr-o locuință variază foarte mult.

Unitatea de masura a concentratiei radonului din aer este picocurie pe litru, pCi/L, sau becquerels pe metru cub, Bq/m^3. Un pCi reprezinta 10^{-12} Ci si este egal cu 37 Bq/m^3.

Nivelul concentrației de radon existentă în aerul din interiorul locuințelor este estimat la 39 Bq/m^3, cu diferențe semnificative între țări, astfel că în regiunile unde locuințele sunt construite pe un sol bogat în uraniu concentrația este mai mare [8].

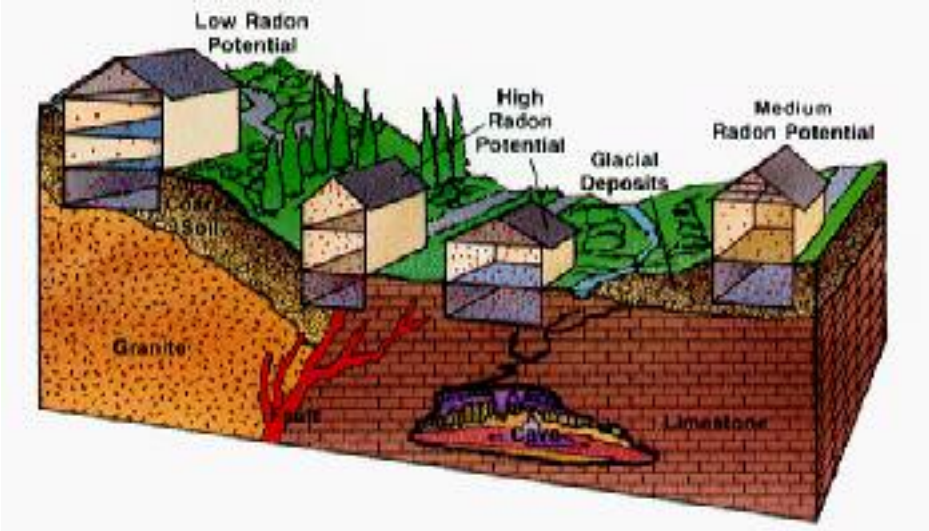

Figura 4. Concentratia de Rn in locuinte functie de amplasare

Sursa principală a existenței radonului în aerul din interiorul locuințelor este, cum am specificat şi mai sus, uraniul din sol. Alte surse sunt apa subterană şi materialele de construcție.

Prezența uraniului în sol este un indicator foarte bun al existenței radonului. În aer radonul se descompune în aşa zisii *produsi de filiatie ai radonului*, sau *descendenti*, care sunt particule solide, iar în aerul din interior ii regăsim ca şi particule fine.

Concentrația radonului şi a descendentilor acestuia depinde de cantitatea de radium din sol şi de uşurința cu care radonul poate pătrunde în pereți, iar mai apoi în aerul din interiorul locuințelor.

Emisia radonului din sol este afectată şi de schimbările ce au loc în atmosferă.

Pereții şi podeaua de la subsolul locuintelor încetinesc pătrunderea radonului în aerul din locuințe, însă aceasta este facilitată de crăpăturile din podea, izolarea proastă a pereților, etc.

Concentrația de radon existentă în aerul din interiorul locuințelor este în majoritatea cazurilor mai ridicată decât cea existentă în aerul din atmosferă. Nivelul de radon este mai ridicat în subsoluri deoarecea aceste încăperi sunt mai apropiate de sursă si sunt cel mai slab ventilate.

Radonul alături de alte gaze se ridică din sol şi rămân prinse sub clădiri. Presiunea aerului din interiorul locuințelor este mai mare decât presiunea aerului din afară, lucru care duce la pătrunderea gazelor prinse sub clădiri în interior. Odată ajuns în aerul din interiorul locuințelor radonul devine mai concentrat şi ramane acolo.

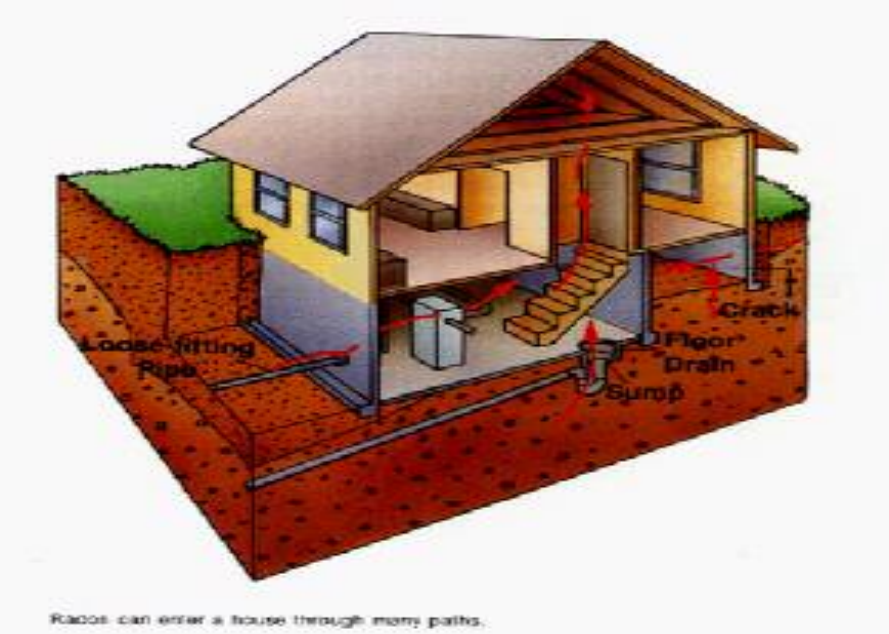

Figura 5. Circulatia radonului in locuinte [7], [8].

In figura 6 [7], se observa principalele moduri de patrundere a radonului in locuinte:
A. Fisuri in dalele de beton;
B. Spatiile neizolate dintre caramizi;
C. Pori si crapaturi in blocurile de beton;
D. Imbinarile podelei;
E. Cuva de drenaj;
F. Conducta de evacuare;
G. Imbinarile de beton;
H. Spatiul neizolat din jurul tevilor;
I. Jonctiuni intre placile de beton;
J. Materialele de constructie (caramida, betonul, piatra, etc.);
K. Apa de dus.

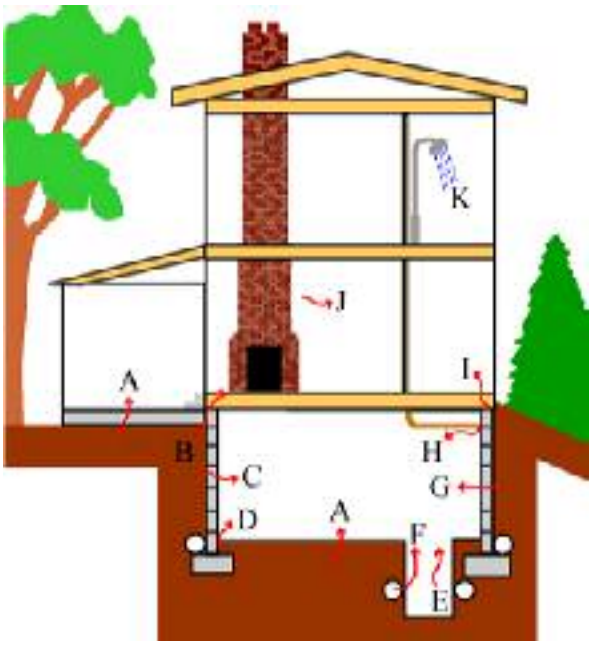

Figura 6. Moduri de patrundere a Radonului in locuinte

Nivelul de Radon existent în aerul din casă se poate reduce printr-o varietate de modalităţi dintre care amintim pe cele mai importante [7], [8]:

- Îmbunătăţirea sistemului de ventilaţie din casă şi evitarea transportării radonului din subsol în camere;
- O mai puternică ventilaţie sub podele si pardoseli;
- Instalarea unui sistem de absorbţie a radonului în subsol;
- Izolarea cat mai buna a pereţilor şi a podelei;
- Instalarea unui sistem suplimentar de ventilaţie, etc.

Se impune luarea în considerare a problemei radonului, în special în construcţia de noi locuinţe în zonele mai afectate. Îmbinarea sistemelor active de ventilatie cu sistemele pasive de temperare duce astfel la o scădere a nivelului de radon din aerul din locuinte cu peste 50%.

În tabelul 1, sunt prezentate radiaţiile alfa emise de descendenţii ^{222}Rn [16]:

Tabelul 1. Descendenţii radonului emiţători de radiaţii alfa

Radionuclidul	Energia radiaţiei (MeV)	Abundenţa relativă	Parcursul în aer (cm)	Parcursul în ţesut (10^{-3} mm)
^{218}Po	6.0025 5.1810	99.97% 0.001%	4.73 3.79	6.1 4.9
^{214}Po	7.687 6.892	99.98% 0.01%	6.86 5.82	8.86 7.52
^{210}Po	5.3045 4.5240	99.99% 0.001%	3.92 3.09	5.06 3.99

2. Consideratii generale privind concentratia de radon din aerul atmosferic

Concentraţii de ordinul $10 \div 100$ Bq/m^3 sunt de neevitat, iar materialele de construcţii provenite din rocile vulcanice pot da concentraţii de radon de peste 1500 Bq/m^3, iar cele din fosfogipsuri de circa 400 ÷ 800 Bq/m^3 [14].

Radioactivitatea aerului este dată în primul rând de prezenţa radonului care are o concentraţie medie în aerul din sol de 0.74 Bq/l, iar în atmosferă de deasupra uscatului de aproximativ 0.011 Bq/l cu o rată de producere de 0.0155 Bq ^{222}Rn/m$^2 \times$s, iar în centrele populate poate atinge valori mai mari datorită poluării şi prezenţei materialelor de construcţii. Concentraţia radonului, în medie, în casele construite din beton este de 0.185 Bq/l ceea ce este semnificativ deoarece *Agenţia de Protecţia Mediului* din SUA recomanda ca de la 0.3 Bq/l să se ia măsuri speciale privind scăderea concentraţiei de radon. *Comisia Internaţională de Radioprotecţie,* recomandă ca limita 1000 Bq/m^3, iar *Organizaţia Mondială a Sănătăţii* recomandă ca limită 100 Bq/m^3. Conform datelor publicate de *National Radiological Protection Board,* UK, la 100 Bq/m^3 riscul cancerului este crescut de 5 ori faţă de 20 Bq/m^3 [11].

Se consideră ca iradierea datorată materialelor de construcţii, în Suedia, este 109 mrad/an, iar în Polonia 56 mrad/an. Toate aceste date trebuiesc corelate cu nivelele naturale de iradiere de aproximativ 120 mrad/an, iradiere terestră externă şi 60 mrad/an iradiere internă . Nivelul de exceptare incluzând şi descendenţii radonului aflaţi în echilibru secular este de 10^{-3} Bq/kg [16].

Emisia de ^{222}Rn de la sterilul rezultat din minele de uraniu are o rata de la 0.1 la 10 Bq m^{-2} s^{-1}. Pentru locuinţe, concentraţia de 200 Bq/m^3 (*conform ICRP*) [16] este considerată nivel de acţiune, expunerea pe durata unui an la această concentraţie, presupunând un factor de staţionare de 80% (~7000 h pe an) şi un echilibru între Rn şi descendenţi de 40%, conduce la o doză efectivă de 5 mSv. Pentru locurile de muncă, nivelul de acţiune este de 1000 Bq/m^3 .

Produşii de filiaţie sunt cauza efectelor vătămătoare asupra organismului uman, radonul fiind un gaz inert spre deosebire de descendenţi care sunt activi din punct de vedere chimic.

În tabelul 2 sunt prezentate concentraţiile de radon în (Bq/m^3) în cateva ţări (*Conform UNSCEAR 2000*) [16], [13].

Tabelul 2. Concentrația medie de radon provenită din spații închise (*UNSCEAR 2000*) [16].

Țara	Concentrația de radon (Bq/m^3)	Țara	Concentrația de radon (Bq/m^3)
Suedia	108	USA	46
Finlanda	90	Norvegia	60
Italia	80	Polonia	38
Irlanda	68	Canada	34
Franta	62	Japonia	29
Germania	57	Elveția	70
Danemarca	47	Olanda	29
Anglia	20	Romania	-

3. Metode de masurare si monitorizare a radonului

Măsurările de radon se împart în două mari categorii: de termen scurt şi respectiv, de termen lung.

Măsurările de termen scurt:

1. Măsurarea descendenților fixati pe aerosoli. Aerul este trecut printr-un filtru care colectează descendenții fixați pe aerosoli. Pentru atingerea echilibrului aspirarea durează de obicei câteva ore. După aceea filtrul este pus în fața unui detector semiconductor şi se măsoară spectrometric emisiile alfa. Se poate folosi şi o metodă combinată cu măsurări intermediare.
2. Utilizarea cărbunelui vegetal. Este cea mai populară metoda utilizată în Statele Unite. Metoda constă din umplerea unei canistre cu cărbune vegetal şi prin difuzia radonului, aceasta colectează descendenții respectivi. Timpul de acumulare este de aproximativ $2 \div 7$ zile după care se măsoară radiația gamma a descendenților cu un scintilator NaI.
3. Utilizarea dispozitivelor de tip electret. Este o măsurare directă prin care o sfera încărcată la tensiune mare pierde tensiune în câmp de radiații.
4. Utilizarea dispozitivelor termoluminiscente. Dispozitivele emit lumină când sunt încălzite după expunerea în câmp de radiații, iar cantitatea de lumină este o măsură a dozei absorbite.
5. Utilizarea camerelor de ionizare. Sarcina colectată este o măsură a câmpului radioactiv. Se utilizeaza camere de ionizare de construcție specială, care să permită măsurarea curenților de ionizare foarte mici. Aceasta se realizează cu un electrod suspendat electromagnetic, sau se măsoară impulsurile de curent date de particulele alfa. Pentru obținerea rezultatelor optime se impun precauții deosebite pentru circuitul electronic de detecție.

Măsurările de termen lung:

Se utilizeaza detectori de urme. Sursele alfa prin impactul cu folii subțiri produc cratere care apoi pot fi numărate.

S-a constatat, de asemenea, că radonul reprezintă, în medie, mai mult de jumătate din radioactivitatea naturală de fond din mediul înconjurător. Această radioactivitate se datorează, în principal, ^{222}Rn sub formă gazoasă, produs de radiul natural din sol. Acest lucru reiese şi din Tabelul nr. 3.

Tabelul 3. Media anuala efectiva a dozelor pe anul 2000 provenite din surse de radiatii naturale sau artificiale (mSv). (Conform *UNSCEAR 2000*) [16].

Sursa de radiație	Doza (mSv)
Fond natural	2.4
Inhalare (in special radon)	1.2
Raze gamma terestre	0.5
Raze cosmice	0.4
Inghițire	0.3
Examinarea medicală	0.4
Testarea atmosferei	0.005
Accidentul de la Cernobîl	0.002
Puterea nucleara obtinută	0.002

Când acesta pătrunde în locuințe, în pânzele freatice, sau în apa de fântână, radonul poate să rămână în aer, în lipsa ventilației. În acest caz, radonul se descompune în alți produşi radioactivi solizi, care pot fi absorbiți în plămâni şi pot cauza cancerul pulmonar în cazul unei expuneri îndelungate. Astfel, *Agenția SUA pentru Protecția Mediului Înconjurător* (*EPA*) a estimat că, din cele 130 000 de decese cauzate anual de cancerul pulmonar, 7 000 până la 30 000 pot fi atribuite radonului din interiorul clădirilor [9], [10].

De aceea se recomandă luarea unor măsuri în cazul în care nivelul Radonului din locuințe depăşeşte activitatea volumică de 4 picocurie de radon per litru (pCi/l) de aer. Deşi descoperirile inițiale păreau să semnaleze ideea unor zone anume, mai susceptibile de poluare cu radon, în prezent se ştie că există concentrații mari de radon în multe locuri din Statele Unite [14], precum şi în multe țări europene, sau asiatice.

În ultima vreme, pe măsură ce s-a conştientizat existența radonului gazos, a apărut o cerere foarte mare de instrumente de detecție precise şi sensibile de acest gen.

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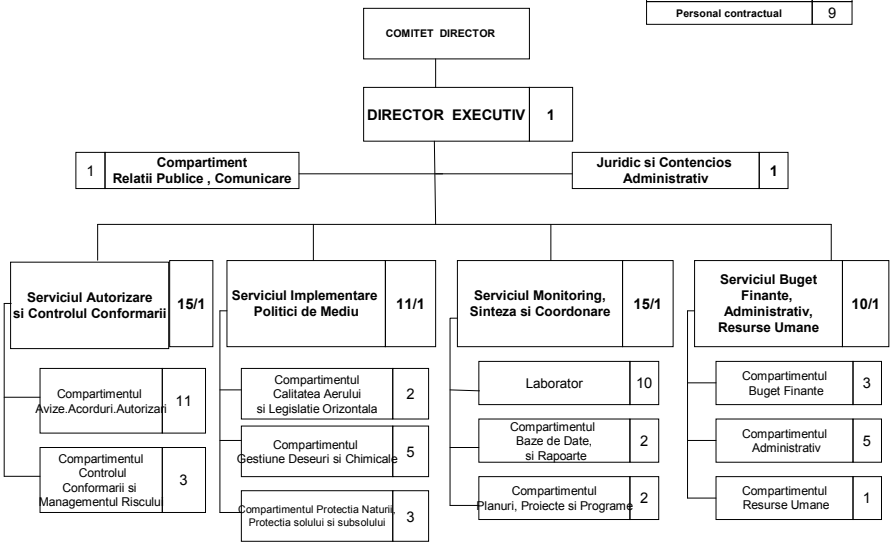
Ministerul Mediului si Dezvoltarii Durabile

AGENTIA PENTRU PROTECTIA MEDIULUI BRASOV

STRUCTURA ORGANIZATORICA

Total persoane/conducere	54/5
Functii publice	45
Personal contractual	9



SERVICIUL AUTORIZARE SI CONTROLUL CONFORMARII

S-au elaborat si emis urmatoarele categorii de documente si acte:

- autorizatii de mediu
- vize anuale
- acorduri de mediu si fise tehnice (documente care conditioneaza investitiile cu impact minor asupra mediului)
- avize de mediu pentru privatizare
- alte tipuri de avize de mediu
  - - pentru vanzari de active
  - - pentru inchideri de rampe de deseuri
  - Pentru lichidari si incetari de activitate
- decizii pentru aprobare PUD/PUZ
- documentatii analizate cu parcurgerea procedurii pentru emiterea avizului de mediu pentru PUD/PUZ (in cazul procedurilor complete, cu raport de mediu)

S-au analizat:

- studii de evaluare a impactului asupra mediului
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S-au dat consultatii privind documentatiile pentru acorduri de mediu pentru SAPARD, s-au emis adrese si Notificari SAPARD si se intocmesc indrumare si adrese pentru diferite solicitari;

Pentru mentinerea unei transparente fata de populatie, in ceea ce priveste desfasurarea unor activitati, a avut loc in prima parte a anului un numar de 49 dezbateri publice;

S-au efectuat inspectii generale de autorizare (impreuna cu Garda Nationala de Mediu) si deplasari pe teren in vederea verificarii amplasamentului pentru autorizare si a verificarii conformarii (pentru viza anuala);

S-au organizat:

- sedinte ale Comitetelor Tehnice de Avizare
- sedinte ale Comisiilor de Analiza Interna

S-a participat la:

- sedinte ale Comisiilor de Acord Unic
- S-au desfasurat etape din procedura de autorizare integrata pentru autorizatii integrate si actualizari ale autorizatiilor integrate de mediu, care au fost emise de catre Agentia Regionala pentru Protectia Mediului Sibiu;

S-au efectuat verificari la unitati privind controlul activitatilor care prezinta pericole de accidente majore in care sunt implicate substante periculoase

S-au verificat documente privind Politica de prevenire a accidentelor majore in care sunt implicate substante periculoase si s-au verificat rapoarte de securitate;

Se efectueaza diferite tipuri de lucrari si raportari, la termene sau cu caracter ocazional, solicitate de Ministerul Mediului si Dezvoltarii Durabile, de Agentia Nationala pentru Protectia Mediului, de Agentia Regionala pentru Protectia Mediului sau de Prefectura Judetului Brasov.

Compartimentul calitate aer-legislatie orizontal

- **Directiva 94/63/CE – inventarul instalatiilor aflate sub incidenta directivei privind stabilirea cerintelor tehnice pentru limitarea emisiilor de COV**
- La nivelul judetului Brasov sunt 4 depozite si 4 terminale de distributie benzina din care 3 conforme si unul cu activitatea sistata temporar.
- Din cele 74 statii de distributie benzina existente in judet,72 sunt conforme si 2 statii in curs de conformare avind perioada de tranzitie 31.12.2009
- Anual se inventariaza emisiile COV din toate statiile, depozitele,terminalele care tranziteaza benzina in vederea incadrarii in limitele impuse de legislatie.

Directiva 2003/87/CE privind emisii de gaze cu efect de sera

- La nivelul judetului Brasov sunt 10 operatori care se incadreaza in prevederile Directivei de mai sus care au primit autorizatie GES,autorizatie emisa de ARPM Sibiu.
- Conform Directivei nr.85/337/CE s-a actualizat baza de date EIA si SEA si s-a afisat pe web-site-ul Agentiei Nationale pentru Protectia Mediului

Compartimentul Gestiune Deseuri si Chimicale

- monitorizarea agentilor economici din judetul Brasov , care comercializeaza uleiuri , anvelope ,produc, importa sau comercializeaza echipamente electrice si electronice ; a celor care genereaza deseuri ; care desfasoara activitati de colectare si dezmembrare a vehiculelor scoase din uz ;
- centralizarea datelor referitoare la ambalaje si deseuri de ambalaje in conformitate cu Ord 927/2005, privind procedura de raporare a datelor referitoare la ambalaje si deseuri de ambalaje.
- participarea la lansarea programului pilot de colectare selectiva a deseurilor de ambalaje (hartie,plastic si sticla) ERACOLET avand ca initiatori Primaria Brasov, SC.URBAN SA si ECO Rom Ambalaje Romania.
- deplasari in teren impreuna cu Garda Nationala de Mediu – Comisariatul Judetean Brasov, pentru verificarea stadiului intocmirii Bilanturilor de Mediu nivel I si II pentru depozitele de deseuri menajere si industriale conform HG 349/2005 si a calendarului de inchidere a crematoriilor medicale ;precum si la agentii economici care produc, importa sau comercializeaza echipamente electrice si electronice;
- urmarirea respectarii termenelor din planurile de eliminare a PCB , pentru agentii economici din judetul Brasov ;

realizarea bazei de date a agentilor economici care produc / utilizeaza / importa substante chimice periculoase , care detin deseuri periculoase si a celor care desfasoara activitati cu substantele reglementate de OUG 89/1999 referitoare la regimul comercial si introducerea unor restrictii la utilizarea hidrocarburilor halogenate care distrug stratul de ozon, aprobata cu modificari si completari de Legea 159/2000; inventarierea cantitatilor detinute de acestia

- emiterea de aprobari pentru transportul deseurilor periculoase eliminate in judetul Brasov .
- centralizarea chestionarelor completate de agentii economici care importa anvelope uzate si a celor care detin deseuri nepericuloase.
- intocmirea de referate in vederea emiterii de către Serviciul ACC a acordului/ autorizației de mediu pentru reglementarea activităților care privesc colectarea, transportul, tratarea, valorificarea şi eliminarea deşeurilor precum şi importul, exportul şi tranzitul de deşeuri;

- deplasari in teren , impreuna cu reprezentantii Hill International , la Primariile Predeal, Bran si Prejmer , in vederea verificarii stadiului proiectelor desfasurate in cadrul Programului Phare CES 2003.
- participarea la grupul de lucru constituit in vederea revizuirii Planului Regional de Gestionare a Deseurilor pentru Regiunea 7 Centru;

Compartimentul Protectia Naturii, Protectia Solului si Subsolului

1.Continuarea implementării directivelor europene în domeniul protecţiei naturii (Directiva 92/43/CEE asupra conservării habitatelor naturale şi a speciilor sălbatice de floră şi faună şi Directiva 79/409/CEE privind protejarea păsărilor sălbatice)

- Odată cu legiferarea siturilor Natura 2000 prin Ord 776/2007 şi HG 1284/2007, în judeţul Braşov s-au declarat : 17 situri de importanţă comunitară şi 7 situri de protecţie specială avifaunistică. APM Braşov a informat primăriile care au teritorii administrative în situri despre declararea şi statutul acestora.
- S-au actualizat bazele de date privind habitatele naturale şi speciile de floră şi faună din judeţ, cu date validate, existente în baza de date online Natura 2000. Baza de date cuprinde aprox. 27 tipuri de habitate la nivelul judetului, 213 specii de pasari, dintre care 196 protejate conform legislatiei in vigoare (OUG 57/2007) si 62 specii de fauna, dintre care 39 protejate.
- Comp PNPSS a supravegheat permanent starea habitatelor şi a speciilor protejate din cadrul ariilor naturale protejate/siturilor Natura 2000.

2. Asigurarea custodiei pentru ariile naturale protejate

- Din ariile protejate din judetul Brasov, 11 sunt date in custodie, in vederea unei mai bune gestionari a capitalului natural de care acestea dispun.
- Acestea sunt: "Poienile cu narcise de la Dumbrava Vadului", "Pădurea şi mlaştinile eutrofe de la Prejmer", "Dealul Cetăţii Lempeş" – custode Direcţia Silvică Braşov; "Peştera Comana"- custode Clubul Speologic Silex, "Cheile Dopca" – custode Asociaţia Ecologică Mileniul III, "Complexului Piscicol Dumbravita" – custozi SOR filiala Brasov si SC Doripesco SA; "Punctul Fosilifer Carhaga", "Punctul Fosilifer Ormenis" si "Coloanele de bazalt de la Racos"- custozi Asociatia pt Integrare Sociala si Protectia Mediului "Feed-Back" şi "Punctul Fosilifer Purcareni"- custode o persoană fizică
- Ultima arie protejata data in custodie in anul 2007 Asociaţiei Judeţene a Pescarilor Sportivi Braşov este "Aria de protecţie specială avifaunistică Rotbav".

3.Realizarea Planului de control privind ariile naturale protejate

- In ariile naturale protejate au fost efectuate un numar de controale pentru verificarea punerii in aplicare a responsabilitatilor autoritatilor implicate in Protectia Naturii, astfel:

- Dintre acestea, s-au efectuat :
  - controale privind supravegherea starii de conservare a populatiilor si habitatelor din ariile naturale protejate si posibilele situri ale retelei Natura 2000.
  - controale privind verificarea modului de respectare a obligatiilor asumate de administratorii parcurilor nationale, naturale si a custozilor rezervatiilor naturale.

4. Organizarea si participarea la campanii de informare si de constientizare a publicului in domeniul protectiei mediului

- Cu ocazia Zilei Mondiale a Zonelor Umede, s-au întocmit materiale împreună cu Societatea Ornitologică Română – Sucursala Braşov pentru publicarea în revista Info mediu şi revista locală Ecologistul Român.
- S-a organizat la Şcoala Generală nr.19 din Braşov o acţiune ecologică – un concurs cu premii având ca temă SOS Salvaţi Natura – Ziua Mondială a Zonelor Umede. S-au întocmit postere şi pliante cu situl Ramsar – "Complexul Piscicol Dumbrăviţa" dedicat acestei zile.
- La Grupul Şcolar Industrial Zărneşti în cadrul proiectului – "Didactica durabilităţii aplicată în turism", APM Braşov a avut o prezentare privind ariile protejate din judeţul Braşov. Au fost detaliate aspecte legate de protejarea şi conservarea biodiversităţii în ariile protejate: Complexul Piscicol Dumbrăviţa, Poienile cu narcise de la Dumbrava Vadului şi Complexul Geologic Racoşul de Jos. S-au distribuit materiale publicitare – mape şi fluturaşi.
- Cu ocazia Zilei Mondiale a Mediului din 5 iunie 2007 la Şinca Nouă, a avut loc un simpozion cu tema: "Satul Românesc, sat european, sat ecologic". APM Braşov a prezentat date privind schimbările climatice expunând problema topirii gheţarilor.
- O altă activitate de popularizare a ariilor protejate în care s-a implicat APM Braşov a constat în deplasarea la Plaiul Foii - în Parcul Naţional Piatra Craiului cu un grup de studenţi de la Universitatea Politehnică Laussane. S-au prezentat date privind capitalul natural al Parcului Naţional Piatra Craiului.

SERVICIUL MONITORING, SINTEZA SI COORDONARE

Activitatea	Numar de analize	
	Planificat 2007	Realizat 2007
Supravegherea calitatii aerului	**230**	**431**
Expertize asupra calitatii solului si vegetatiei	**307**	**307**
Monitorizarea zonelor contaminate	**87**	**87**
Determinarea zgomotului urban	**516**	**522**

- **Supravegherea calităţii aerului**
  - Se analizează poluanţii gazoşi (NO_2, SO_2, NH_3), pulberile în suspensie şi pulberile sedimentabile.
  - Laboratorul APM Brasov preleveaza probe de poluanţi gazoşi din urmatoarele puncte:Laborator APM, SC Tamiv SA, Str. Iuliu Maniu, pulberi în suspensie Laborator APM, SC Tamiv SA şi pulberi sedimentabile din zone unde îşi desfăşoară activitatea agenţi economici care produc materiale de construcţii (zona Prescon, zona Prefa, zona Hoghiz, etc.)

- **Staţiile de monitorizare a calităţii aerului**
  - Au fost amplasate **6 staţii de monitorizare a calităţii aerului**: 1 staţie de fond urban (pe str. Castanilor),1 staţie de fond suburban (Sânpetru), 2 staţii de trafic (Calea Bucureşti, Bdul Gării), 1 staţie de fond industrial (Bdul Vlahuţă) , 1 staţie EMEP (Fundata), 1 panou exterior şi 1 panou interior.
  - Staţiile monitorizează următorii **indicatori**: CO, SO_2, NO_X, O_3, COV, PM10 şi parametrii meteo.
  - **Scopul** amplasării staţiilor de monitorizare este evaluarea calităţii aerului şi informarea publicului.

- **Expertize asupra calitatii solului**

Factorul de mediu sol se analizează din 23 de puncte de recoltare din judeţul Braşov, acestea fiind grupate pe zone, după cum urmează: Braşov, Codlea, Făgăraş, Hoghiz, Feldioara, Victoria 1 (5 puncte aflate în incinta societăţii "Purolite"), Victoria 2 (6 puncte aflate în exteriorul societăţii şi în alte puncte din localitate).

Solul se recoltează în perioada martie – noiembrie a fiecarui an. Indicatorii analizaţi sunt: umiditate, pH, carbon organic, humus, azotul din ionul amoniu, azotul din ionul azotat, sulful din ionul sulfat, carbonaţi, bicarbonaţi, cloruri, conductivitate electrică, reziduu fix şi metale grele (Cu, Zn ,Mn, Cd, Ni, Pb).

- **Monitorizarea solului din zona haldelor de deşeuri**

Solul din zona haldelor de deseuri se analizează in 4 zone de depozitare a deseurilor din judeţul Braşov: Codlea, Râşnov, Triaj, Zizin.

Solul se recoltează lunar, indicatorii analizaţi sunt: umiditate, pH, carbon organic, humus, azotul din ionul amoniu, azotul din ionul azotat, sulful din ionul sulfat, carbonaţi, bicarbonaţi, cloruri, conductivitate electrică , reziduu fix şi metale grele (Cu, Zn ,Mn, Cd, Ni, Pb).

- **Determinarea zgomotului urban**

  Se efectuează măsurători ale nivelului de zgomot produs de traficul rutier în 46 de puncte.

  Măsurătorile se efectuează lunar în principalele intersecţii şi pe arterele cu trafic intens şi trafic greu, în zone în care există instituţii publice şi în zone de recreere, de pe teritoriul judeţului.

- **Supravegherea radioactivitatii mediului**

  Masuratorile beta globale efectuate la Statie au aratat ca activitatea factorilor de mediu monitorizati in Municipiul Brasov (aer, apa potabila, apa bruta , sol, vegetatie) se incadreaza in limitele admise, nedepasind nivelurile de notificare operationale stabilite la nivel national.

  In zona de interes din judet, Feldioara – Rotbav, s-au prelevat probe lunare de apa de suprafata (Raul Olt) si de adancime (fantani la Rotbav), care s-au incadrat de asemeni in limitele admise.

  De asemeni, probele de sol si vegetatie, prelevate din aceste zone,si din jurul Sucursalei Feldioara a CNU se incadreaza in media pe tara, activitatea beta globala fiind de acelasi ordin de marime cu cea a probelor recoltate in Brasov.

Compartimentul Planuri, Proiecte si Programe

- Monitorizarea şi raportarea semestrială a implementării Planului Local de Acţiune pentru Mediu Braşov 2007-2013 cu implicarea factorilor responsabili ;
- Monitorizarea şi raportarea lunară şi trimestrială a stadiului realizării măsurilor din “Planul de măsuri prioritare privind integrarea europeană pentru anul 2007” - Capitolului 22 – Mediu:
  – măsurile din plan au fost realizate

- Identificarea şi transmiterea către ANPM a unui numar de fişe cu propuneri de proiecte de mediu în vederea reactualizării portofoliului de proiecte din cadrul Planului Național de Acțiune pentru Protecția Mediului;
- Eliberarea unui număr de de referate pentru susținerea proiectelor depuse la AFM;
- Colaborare la întocmirea cererii de finanțare pentru propunerea de proiect "Managementul biodiversității şi dezvoltarea durabilă în sit-ul Natura 2000 Dumbrăvița-Rotbav-Măgura Codlei" , beneficiar APM Braşov, depusă la ARPM Sibiu în vederea obținerii finanțării pe Axa 4 - POS Mediu.
- Elaborarea materialului necesar pentru realizarea CD-ului "România în Mediul European"- în limbile română şi engleză .

- APM Braşov colaborează cu ABMEE Braşov exprimîndu-si unele puncte de vedere cum sunt:
- Crearea cadrului organizatoric adecvat pentru selectarea solutiilor tehnice propuse în proiectele de mediu
- Indrumarea agenților economici sau a primariilor care au nevoie de astfel de proiecte

Corelarea Planului Municipal Energetic al Braşovului cu prevederile Agendei 21 şi cu Planul Local de Protecţie a Mediului şi includerea unor prevederi referitoare la:

-obţinerea energiei electrice prin prelucrarea deşeurilor

-utilizarea energiei eoliene şi a căderilor de apă

-efectuarea de cercetări privind obţinerea şi stocarea hidrogenului

APM Braşov a participat la pilotarea şi omologarea unui proces tehnologic vizînd distrugerea deseurilor epurarea gazelor si valorificarea energiei

Asigurarea accesului publicului la informatiile de interes public

- Legea 544/2001 privind liberul acces la informatia de interes public,
- HG nr. 878/2005 privind accesul publicului la informatia privind mediul
- informaţii difuzate din oficiu
- informaţii difuzate la cerere
- puncte de informare-documentare – avizier, pagina web

- articole presa
- aparitii radio-TV
- actualizarea buletinului informativ, conform art.5 din Legea 544/2001 si afisarea lui pe pagina web a APM.
- **Raspunsul in termen la sesizarile venite din judet si la solicitarile primite cu privire la transmiterea de date si informatii**

Educarea publicului in domeniul protectiei mediului

- Organizarea de activitati educative cu ocazia Zilei Mediului din 5 iunie, la unitățile de învățământ din municipiul şi județul Brasov: Colegiul pentru Agricultură şi Industrie Alimentara Prejmer, Scoala Generală nr.2 Brasov, Scoala Generală nr.3 Brasov, Liceul Grigore Antipa, Colegiul de Stiinte ale Naturii "Emil Racovita" Brasov, Scoala Generala nr.2 Codlea si Liceul Industrial Codlea - s-au prezentat materiale Power Point cu tema "Schimbarile climatice"
- Ziua de 5 iunie a fost declarata Ziua Portilor Deschise la APM.
- S-au tipărit si distribuit materiale informative: afise, pliante, fluturaşi
- Alte evenimente de mediu (Ziua Mondiala a Apei, Ziua Pamantului, Ziua Internationala a Protectiei Stratului de Ozon) au fost mediatizate prin articole in presa, tiparire de pliante, afise, fluturasi si distribuirea lor.
- S-a incheiat un protocol de colaborare cu Colegiul pentru Agricultură şi Industrie Alimentara Prejmer.

Obiective ale APM Brasov

- Coordonarea, îndrumarea si monitorizarea, la nivel județean, a implementării de catre agenții economici a legislației de mediu, privind Directivele europene referitoare la limitarea emisiilor anumitor poluanți din instalatiile mari de ardere (L.C.P.), reducerea emisiilor de compuşi organici volatili in anumite activități si instalații (C.O.V.) si la controlul asupra pericolelor de accidente majore în care sunt implicate substanțe periculoase (SEVESO II).
- Colaborarea cu autoritățile locale, in scopul aplicării legislației de mediu, în vederea autorizării proiectelor/planurilor urbanistice generale, zonale si de detaliu.
- Emiterea de autorizatii pentru emisii gaze cu efect de sera pentru operatorii noi care se vor inacadra in prevederile HG 780/ 2006.
- Monitorizarea **lunara** la nivel judetean a stadiului conformarii instalatiilor care au obtinut perioada de tranzitie la prevederile Directivei 94/63/CE privind controlul emisiilor de compusi organici volatili rezultati din depozitarea carburantuilor si distributia acestora de la terminale la statiile de benzina si a costurilor efectuate in vederea conformarii.

- Monitorizarea prin **calculul anual** a emisiilor COV in atmosfera de la statiile de distributie carburanti, depozite, terminale (pentru benzina) din judetul Brasov

- Stabilirea proiectelor prioritare din judeţ în domeniul gestiunii deşeurilor pe baza criteriilor stabilite de către autoritatea publică centrală pentru protecţia mediului şi de politicile regionale ;

- Urmărirea stadiului de îndeplinire a obiectivelor prevăzute în Strategia naţională pentru gestionarea deşeurilor şi a realizării proiectelor prioritare identificate în cadrul Planurilor judeţene si a celui regional de gestiune a deşeurilor; acordarea sprijinului Agenţiei Regionale de Protecţie a Mediului în realizarea activităţii menţionate mai sus

- Cercetarea statistica privind gestiunea deseurilor, pentru generatorii de deseuri, realizata in conformitate cu Regulamentul nr.2150/2002/EC;

- Furnizarea Agenţiei Regionale de Protecţie a Mediului, Agenţiei Naţionale pentru Protecţie a Mediului şi autorităţii publice centrale pentru protecţia mediului informaţiilor din baza de date a Agenţiei de Protecţie a Mediului privind gestiunea deşeurilor şi a substanţelor chimice periculoase, în formatul solicitat.

- Monitorizarea agentilor economici care au ca obiect de activitate gestionarea substanţelor chimice periculoase şi a aplicarii Regulamentelui Parlamentului European si al Consiliului (CE), nr.304/2003, privind exportul si importul de produse chimice periculoase, a Regulamentului Parlamentului European si al Consiliului(CE) nr.2037/2000, privind substantele care epuizeaza stratul de ozon şi înregistrarea evoluţiei acestora în baza de date a Agenţiei de Protecţie a Mediului;

- Furnizarea Agenţiei Regionale de Protecţie a Mediului, Agenţiei Naţionale pentru Protecţie a Mediului şi autorităţii publice centrale pentru protecţia mediului informaţiilor din baza de date a Agenţiei de Protecţie a Mediului privind gestiunea deşeurilor şi a substanţelor chimice periculoase, în formatul solicitat.
- Continuarea implementarii prevederilor legislatiei specifice asupra conservarii habitatelor si speciilor de flora si fauna salbatica
- Cresterea gradului de constientizare ecologica
- - Popularizarea, mediatizarea, ariilor protejate la nivelul judetului
- - Educarea in spirit ecologic a noilor generaţii
- - Atragerea de noi custozi pentru ariile protejate neluate in custodie
- Realizarea Planului de control privind ariile naturale protejate
- - Controlul starii de conservare a habitatelor si speciilor de interes comunitar din siturile Natura 2000
- - Controlul starii ariilor protejate
- - Controlul indeplinirii obligatiilor asumate de administratorii si custozii ariilor naturale protejate

- Crearea unei baze de date privind Protectia Solului si Subsolului
- - Baze de date privind alunecarile de teren la nivelul judetului Brasov
- - Baze de date privind zonele rebilitate/reconstruite ecologic.
- Actiuni privind organismele modificate genetic
- - Actualizare registru public al locatiilor pt introducerea deliberata in mediu, pt testare a plantelor modificate genetic.
- - Baze de date privind soiurile de plante modificate genetic aprobate si omologate.
- Monitorizarea automată, în scopul evaluării calităţii aerului în aglomerarea Braşov şi transmiterea datelor on-line către panoul exterior şi interior, pentru informarea publicului;
- Gestionarea calitaţii aerului prin monitorizarea continuă în puncte fixe şi întocmirea planurilor de gestionare a calităţii aerului;
- Monitorizarea calităţii solului, a zgomotului, a radioactivităţii mediului şi monitorizarea semiautomată a calităţii aerului pentru actualizarea continuă a bazei de date;
- Se vor desfasura in continuare programele ***standard*** si ***special*** de supraveghere stabilite in colaborare cu Laboratorul de Radioactivitate al ANPM.In functie de metodologia stabilita, masuratorile se vor completa si diversifica .
- ***Staţia automată de monitorizare a dozei gamma şi a parametrilor meteo*** face parte din Reţeaua Naţională de Supraveghere a Radioactivităţii Mediului şi realizeaza supravegherea radioactivităţii in zonele urbane aglomerate, obiectivul principal fiind detectarea oricăror creşteri cu semnificaţie radiologică a nivelelor de radioactivitate din mediu, precum, şi acţiunea de avertizare – alarmare .
- Statia automata s-a montat in vecinatatea sediului APM si este in curs de testare. In cursul anului 2008 va incepe transmiterea on line a datelor

- Monitorizarea masurilor din Planul de măsuri prioritare pentru integrare europeana pentru anul 2008, la nivelul judeţului Brasov;
- Monitorizarea implementarii Planului Local de Acţiune pentru Protecţia Mediului pentru judeţul Braşov (PLAM), elaborat în anul 2004 în cadrul proiectului „Asistenţă tehnică pentru Întărirea Inspectoratelor Locale de Protecţie a Mediului şi înfiinţarea Inspectoratelor Regionale de Protecţie a Mediului", finanţat prin Programul Phare „Implementarea Acquis-ului de Mediu", plan revizuit in anul 2006 si depus spre aprobare la Consiliul Judeţean Brasov; raportarea semestriala a stadiului implementării;
- Participare la monitorizarea implementarii Agendei 21 locale si judetene;
- Implementarea proiectului propus de APM Braşov pe Axa 4 - POS Mediu, în cazul obţinerii finanţării;
- Informarea factorilor interesati cu privire la posibilitatile de finantare a investitiilor de mediu prin fondurile post-aderare: Fondul European de Dezvoltare Regionala si Fondul de Coeziune, care finanteaza masurile din Programul Operational Sectorial de Mediu; identificarea altor programe de finantare si a potentialilor beneficiari si informarea acestora;
- - Monitorizarea stadiului implementării proiectelor de mediu din judeţul Braşov
- Mediatizarea legislatiei de mediu si conştientizarea populaţiei în privinţa acţiunilor de protectie a mediului.
- - Implicarea altor unitati de invatamant din municipiul si judetul Brasov in procesul de educare in domeniul protectiei mediului , prin incheierea protocoalelor de colaborare si intensificarea actiunilor ecologice
- Colaborarea cu Universitatea Transilvania la cunoasterea calitatii factorilor de mediu afectati de procesele termice utilizate la obtinerea energiei.

Environmentally Friendly Heating Radiant Systems

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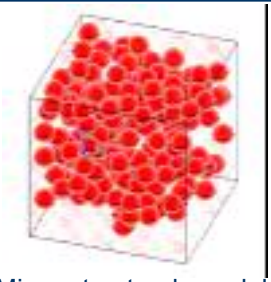
Slides

- Introduction
- Some 3-D Models of PMCs with conductive filler
- Description of Heating Radiant Systems
- The Heating Principle
- Industrial Applications
- Domestic Applications
- Conclusions

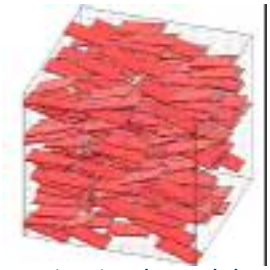
Introduction

- The electric conduction through organic PMCs with powders and/or conductive fillers is described by the percolation theory.
- This conduction is accomplished through proximity.
- The conductive phase finds itself at micro level as a conglomerate of conductive micro-zones.

Some 3-D Models of PMCs with conductive filler



- Micro-structural model of a PMC with conductive spheric particles as filler [Bin Su, 2006]



- Micro-structural model of a PMC with conductive undeformed flakes as filler [Hooker, 1964]

Description of Heating Radiant Systems

- New generation of heating radiant systems are composed from the following parts:
  - Frame;
  - Front side;
  - Heating resistive element made from advanced composite materials;
  - Thermal insulator;
  - Rear side;
  - Thermostat;
  - Supports – 4 pieces;
  - Power cable.

The Heating Principle

1. The electric energy is transformed in thermal energy produced by the heating resistive element.
2. This transfers the heat to the environment through thermal radiation (thermal waves), the heating principle is similar to the sun.
3. The heat transfer does not accomplish through air, but through walls-, objects from surroundings and through the human body heating.
4. The air heats due to the objects- and wall heating and not due to the heat taking over by the air streams on the heating plate surface.

Industrial Applications

- Heating of shelters for telecommunications

Domestic Applications

Conclusions

- With the help of the heat conductive layers made from advanced composite materials, a more clean heat is obtained, more advantageous and spends more energy.
- Despite convection, at the heat radiation, the energy transfer does not accomplish through air, but through electromagnetic waves, namely the air between the heat bearer and its receiver does not heat.

Conclusions

- The complexity of these heating radiant systems results from the researches to find some constructive solutions that lead to the conformity with IGEF (International Society for Elektrosmog-Research) stipulations, regarding the electronic smog.
- These products are also complex through their manufacturing technology of the composite resistive element: moulding at a well established pressure and temperature of the resistive stack in the hot mould press as well as the homogenization process of the powders in the matrix of the composite material.
- Know-how incorporated from the field of materials science (advanced composite materials), physics (the concept of thermal radiation through heat waves, radiation spectrum, etc.), thermodynamics and thermotechnics.

INTERNAL COMBUSTION ENGINES MathCAD PROGRAMS STEPS FOR ENERGY SAVING

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1. INTRODUCTION

The modern civilization needs the development of transport of persons and goods. On highways and roads , on railways, or on sees and rivers moves a huge number of trucks, cars and buses, Diesel locomotives or ships and boats.

All these vehicles and their internal combustion engines are important fuel and energy consumers.They also are important pollution factors.

In order to improve the performance and fuel consumption of internal combustion engines thermal cycles of them must be represented by computer programs.

2. KINEMATICAL ALGORITHM FOR CRANK – ROD SYSTEM

In the papers [1], [2], [3] and [4] Tofan and Ulea presents some results obtained using FORTRAN programs.

In order to describe the kinematical characteristics of the crank-rod system a MathCAD programs was developed.

It calculates: angular speed ω_1 and acceleration ε_1 of the road, piston speed vp, acceleration ap and displacements, as volum variation. Some elements of MathCAD programs are shown below.

$$\theta := 2\cdot\pi\cdot N^{-1} \qquad I := 3 \qquad (r \quad L \quad \lambda) := \begin{pmatrix} 1 & 3 & \frac{r}{L} \end{pmatrix} \qquad j := 0 \,..\, 2 \qquad \beta(q) := \operatorname{asin}(-\lambda\cdot s(q)) \qquad r^{\langle 1\rangle} := \mathbf{e}(I\cdot\theta)\cdot r$$

$$\beta_I := \operatorname{asin}(-\lambda\cdot s(I\cdot\theta)) \qquad r^{\langle 2\rangle} := r^{\langle 1\rangle} + \mathbf{e}(\beta_I)\cdot L \qquad r2^{\langle i\rangle} := \mathbf{e}(\beta(i\cdot\theta)) + \lambda\cdot\mathbf{e}(i\cdot\theta)$$

$$A(i) := \operatorname{extins}\left(L\cdot\mathbf{t}(\beta(i\cdot\theta)), -E^{\langle 0\rangle}\right) \qquad B(i) := -r\cdot\mathbf{t}(i\cdot\theta)\cdot\omega \qquad Vb^{\langle i\rangle} := A(i)^{-1}\cdot B(i)$$

$$C(i) := \operatorname{extins}(r\cdot\mathbf{e}(i\cdot\theta), L\cdot\mathbf{e}(\beta(i\cdot\theta)))\cdot\left[\omega^2 \quad \left(Vb_{0,i}\right)^2\right]^T \qquad Ab^{\langle i\rangle} := A(i)^{-1}\cdot C(i)$$

In figures 1 and 2 are presented the rod-crank system speeds and accelerations.

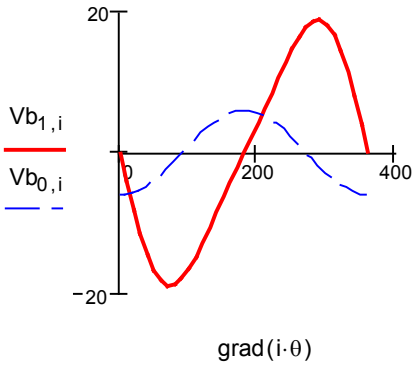


Fig. 1 Vb = {ω_1 vp}

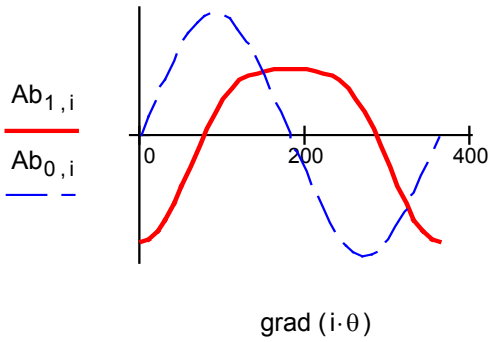


Fig. 2 Ab = {ε_1 ap}

3. THERMAL CYCLE PHASES

Using variable politropical coefficients compression and relaxation processes are described. A compression evolution for a Diesel engine is represented in figure 3.

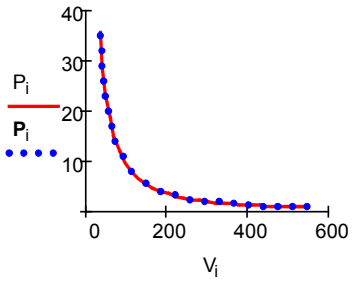


Fig. 3

3.1 Ignition Aproximation by Laplace-Vibe Kinetic Laws

The Vibe's law [1],[5], defines the oxidized fuel fraction *f(t,m)* till the time *t*, as aplication on product of the interval [0 1] x [0 1], where *m* is the kinetic exponent and *C* the finishing factor of oxidation:

$$f(t,m) = 1 - e^{-C \cdot t^{m+1}}$$

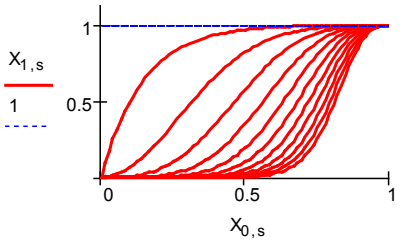


Fig. 4 Vibe's Laws

In figure 4 are presented kinetic Vibe's laws for different kinetic exponent *m* and finishing factor of oxidation *C*.

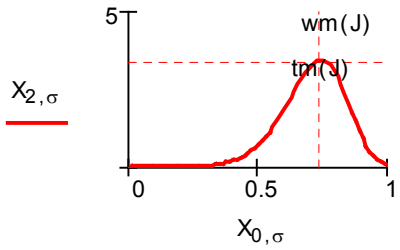


Fig 6

In figure 6 is presented an oxidation speed with the delay *tm* J:.=6. Elements of MathCAD program are shown below.

$$J := 6 \quad \sigma := k_{J,0} .. k_{J,N} \quad Ex(m) := \frac{m}{C\cdot(m+1)} \quad tm(m) := Ex(m)^{\frac{1}{(m+1)}} \quad W^{\langle kw_{j,0}\rangle} := (0 \quad 0)^T$$

$$W^{\langle kw_{j,1}\rangle} := (tm(j) \quad 0)^T \quad wm(m) := C\cdot Ex(m)^{\frac{m}{(m+1)}}\cdot(m+1)\cdot\exp(-C\cdot Ex(m)) \quad sw := 0 .. kw_{M,3}$$

$$W^{\langle kw_{j,2}\rangle} := (tm(j) \quad wm(j))^T \quad W^{\langle kw_{j,3}\rangle} := (0 \quad wm(j))^T \quad Wm^{\langle j\rangle} := (tm(j) \quad wm(j))^T \quad jj := 1 .. M$$

$$Ws^{\langle j\rangle} := \left(tm\left(\frac{j}{p}\right) \quad wm\left(\frac{j}{p}\right)\right)^T \quad Ws^{\langle jj+M\rangle} := Wm^{\langle jj\rangle} \quad jw := 0 .. M\cdot 2$$

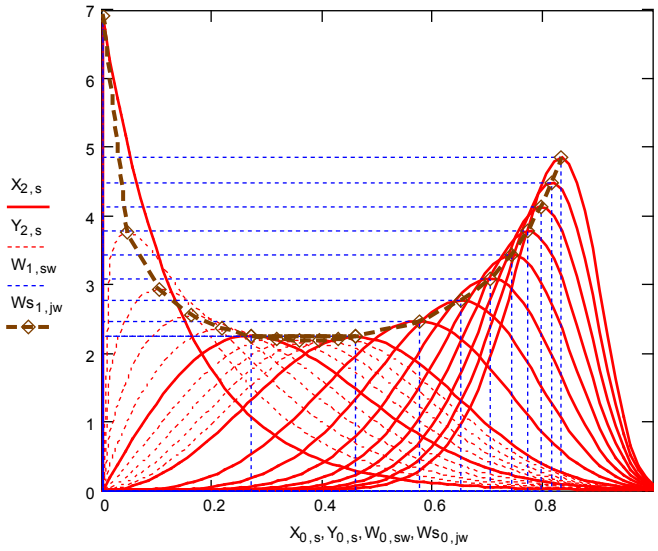
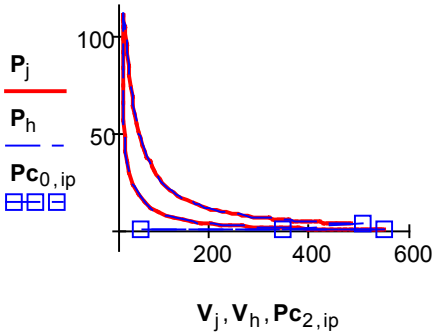


Fig. 7

Figure 7 presents ignition speeds for differents kinetic exponents *m*.
This law permits to describe better the injetion and ignition of fuel.

4. PRESURE VOLUME DIAGRAMS

Using MathCAD program in figure 8 is presented presure volume variation for a



Diesel Engine.

This permit to calculate the fuel consumption and to optimize the energy saving. The transient processes of Diesel engine starting were considered in paper [6].

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