

Research and Co-operation between Industry and Universities in Energy and Energy Efficiency Domain

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Introduction

Research in energy domain is, probably, the most intensive.

The reasons are:

- Limited reserve of fossil fuels
- Increase of fuel price
- Deregulation of the electricity market and competition
- New regulations for air pollution.



Introduction

The research can be divided in:

- Development of energy technologies for large power plants
- Improvement of energy efficiency in energy production and energy consumption
- Alternative technologies: Distributed energy production, RES, CHP
- Technologies for protection of the environment.

This domain includes all resources at universities worldwide through:

- R&D projects
- Educations of new generations of capable researchers.



Technology for large power plant

In Serbia, there is no industry producing technology for **large power plant**.

(It is privilege of only few countries).

Possibility for research groups at universities:

- Direct cooperation with established companies in EU (Siemens, Alstom, MAN,...);
- Participation in EU research projects;
- Research centers and factories which could be opened by leading companies in Serbia in the future

It will be possible if we could offer ing. well educated in energy technologies.



Energy Efficiency Improvement

High potential – large companies for electricity production (EPS) and distribution (EMS).

The university research groups had a number of project in optimization of energy production in

- large thermal power plants (steam turbines, boilers, condenser ...)
- hydro power plant.

Also, the universities could establish very good cooperation with the process industry (chemical, steel, food, paper ...) through industrial projects:

- New energy technologies, CHP, energy efficiency ...



Alternative energy production – Small Plants and RES

The highest potential!

Reason:

- New technologies
- Relatively lower cost of research (chipper test facilities, software tools and computers capacities),
- Serbian industry is able to produce most of machines in this field,
- Support by Ministry o Science,
- Good possibilities to join to EU projects.



Research Potential at Universities in Serbia

The universities have saved a large research potential, in spite of everything.

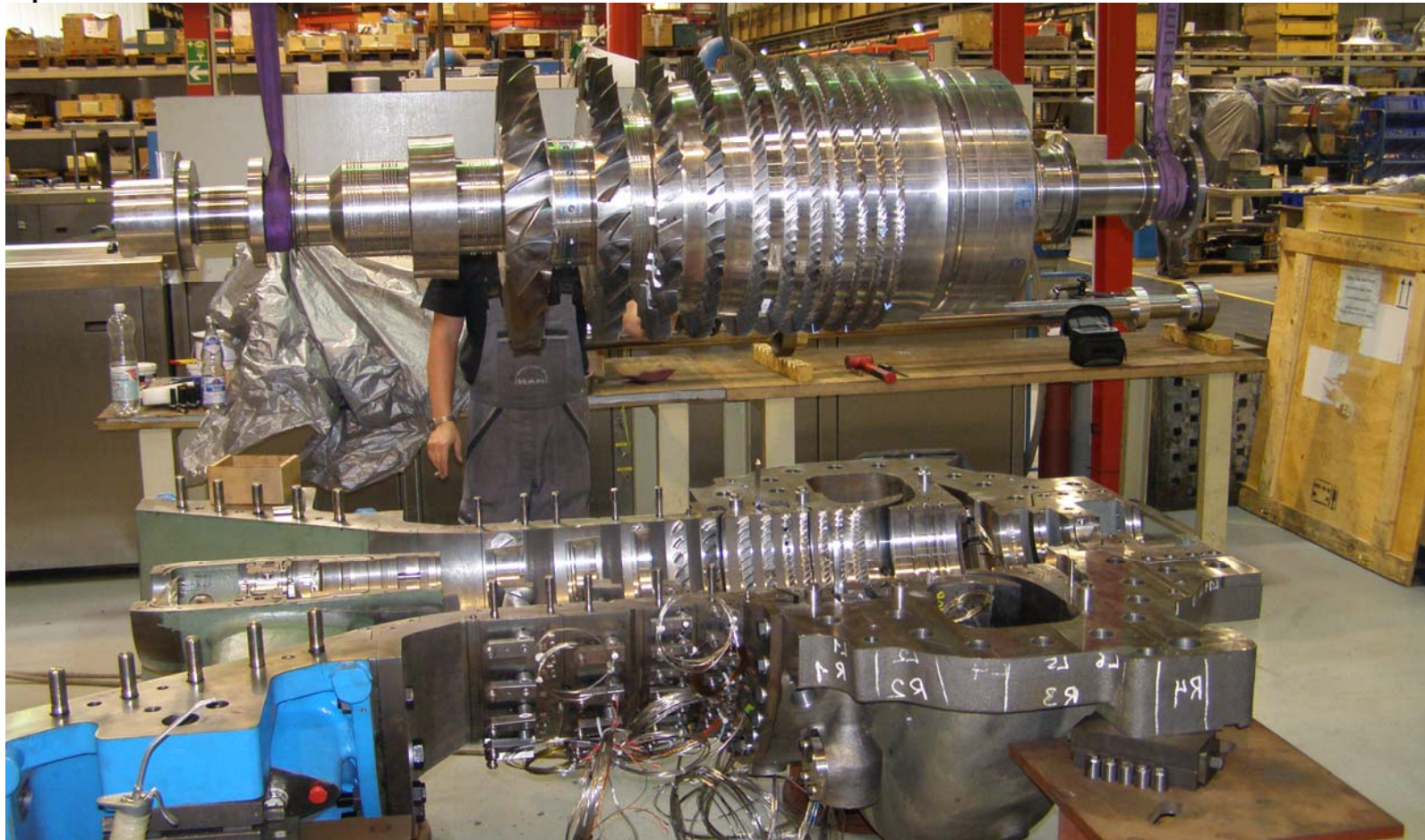
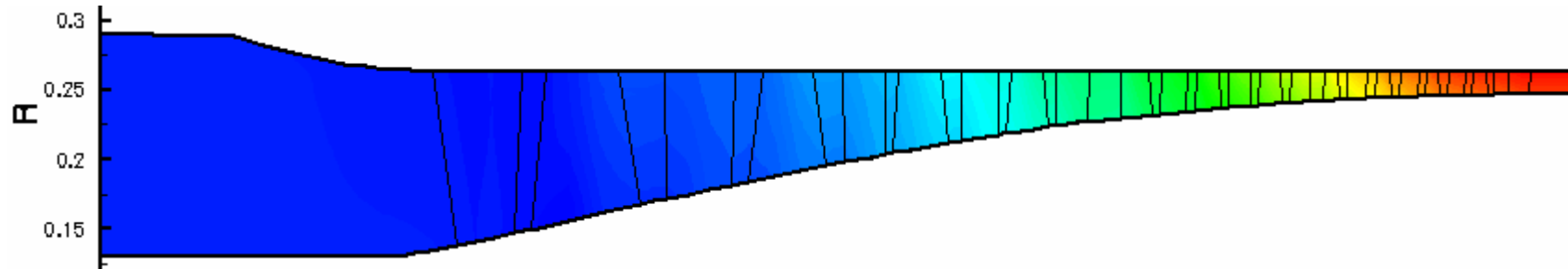
Most researchers work at universities in Belgrade, Novi Sad, Niš and Kragujevac.

Different research groups at faculties:

- Mechanical engineering
- Electrotechnic
- Mining and geology
- Agriculture

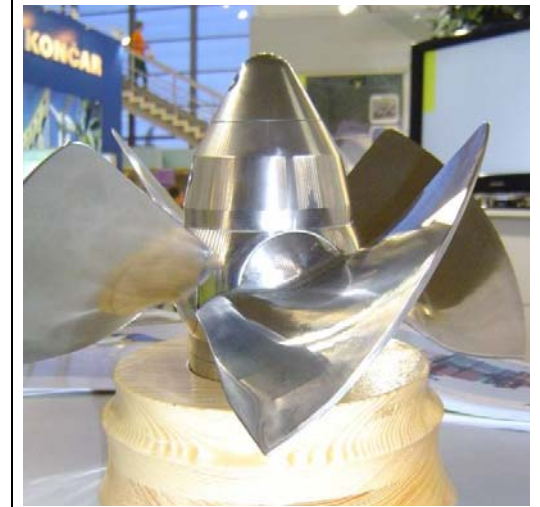
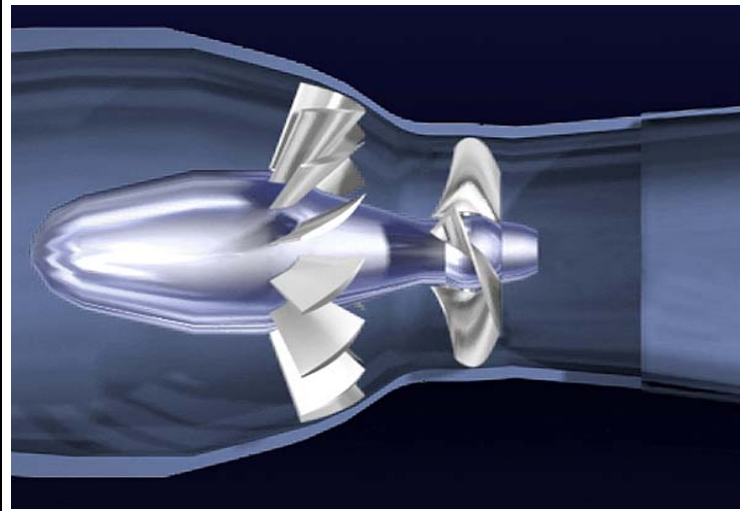
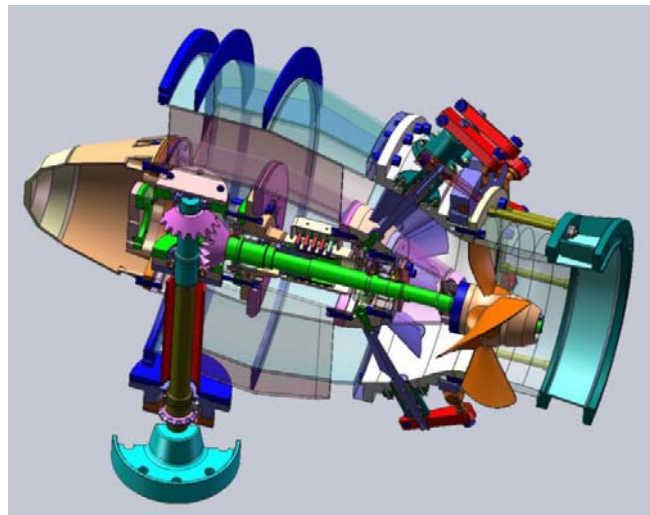


Aerodynamic Design of an Axial Gas Turbine Compressor



Development of a Hydraulic Turbine

Bulb Turbine



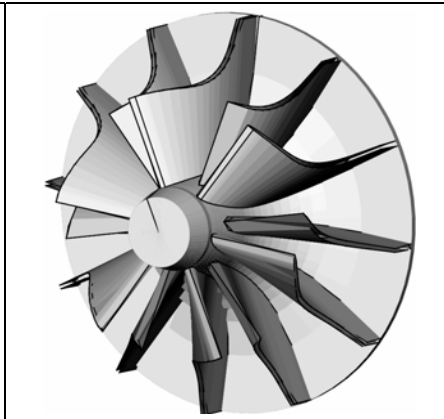
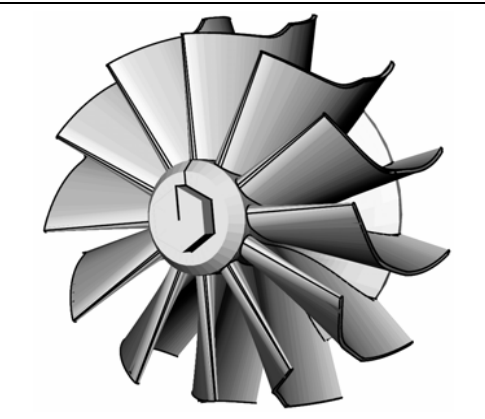
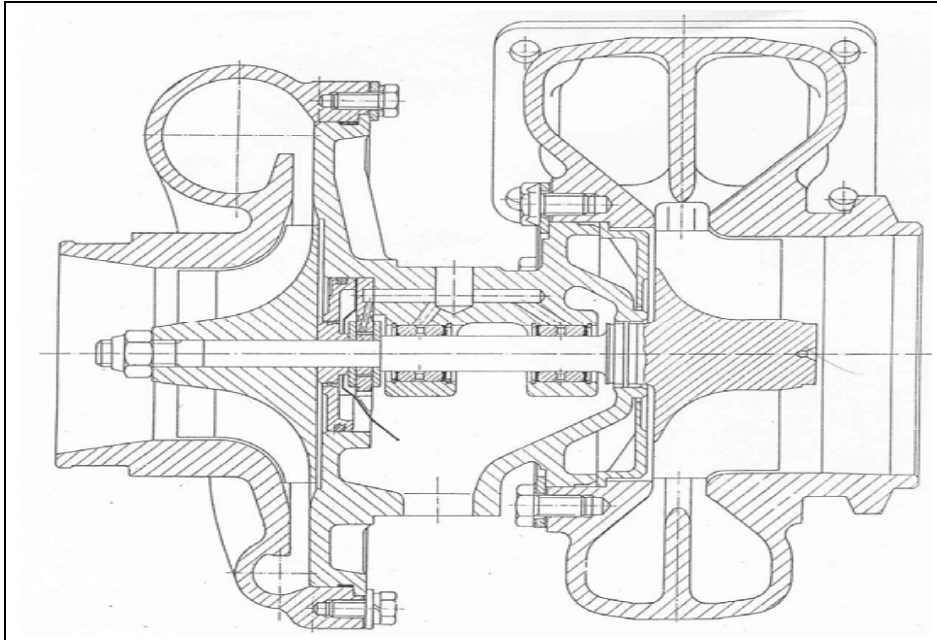
Banki Turbine



Application:
for Small Hydro
Power Plants



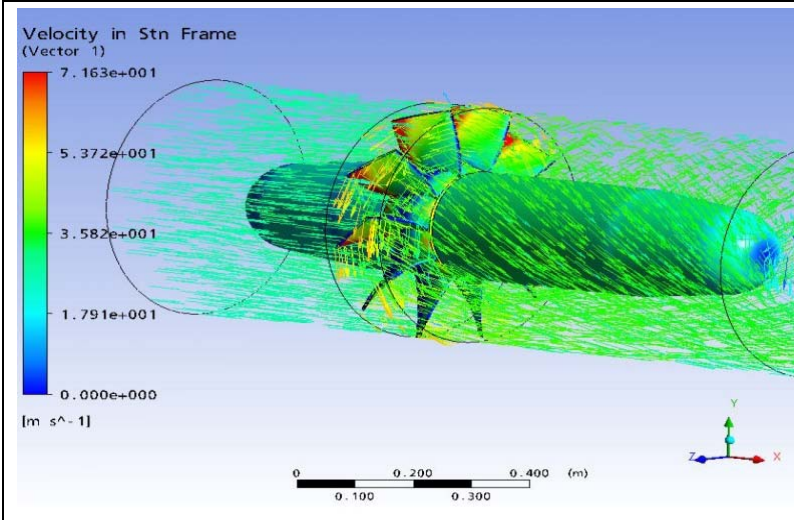
Small Gas Turbine



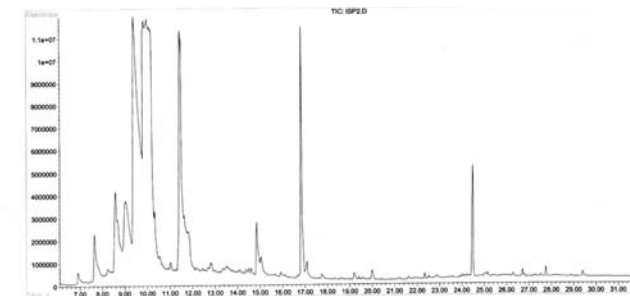
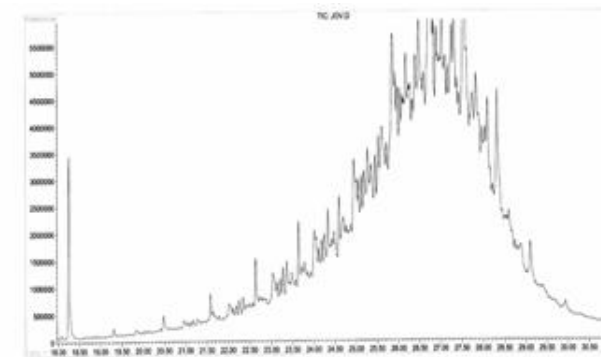
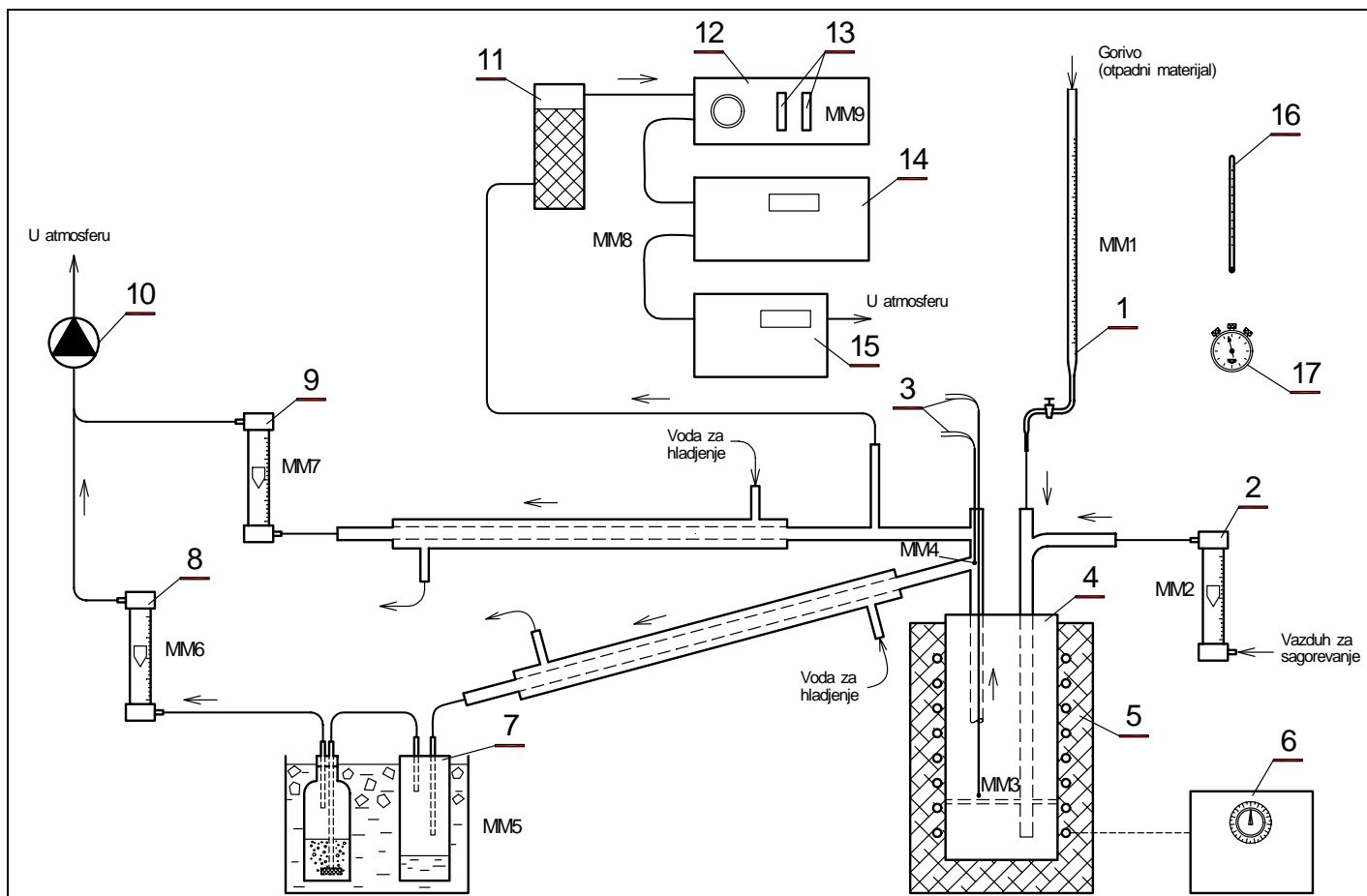
- Application:
- Distributed production
 - Fuel Cells
 - Biomass



Reversible Fan for Air Conditioning in Tunnels



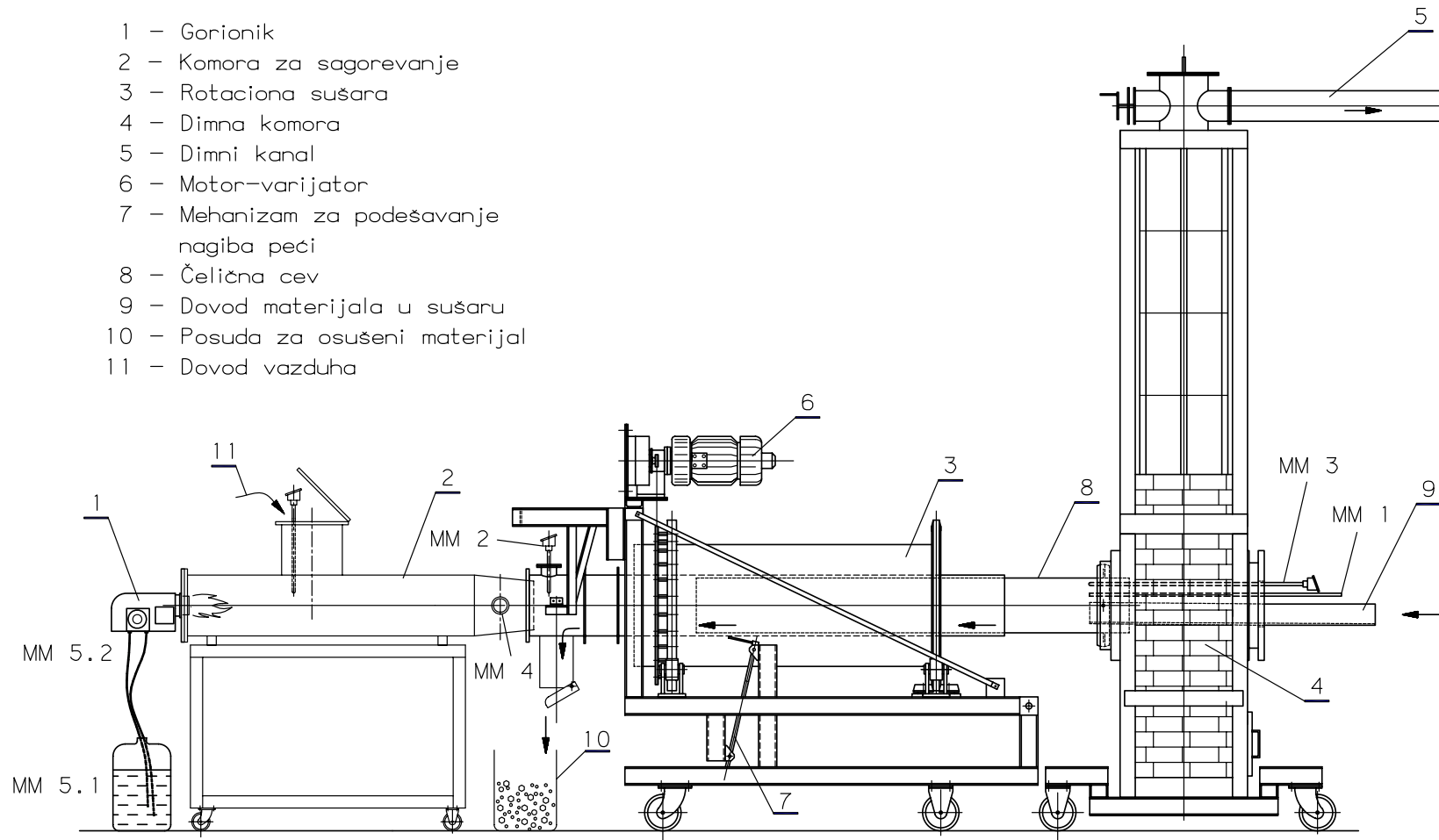
Experimental Installations for Waste Pyrolysis



Pilot plant for Hazardous Waste Incineration

LEGENDA

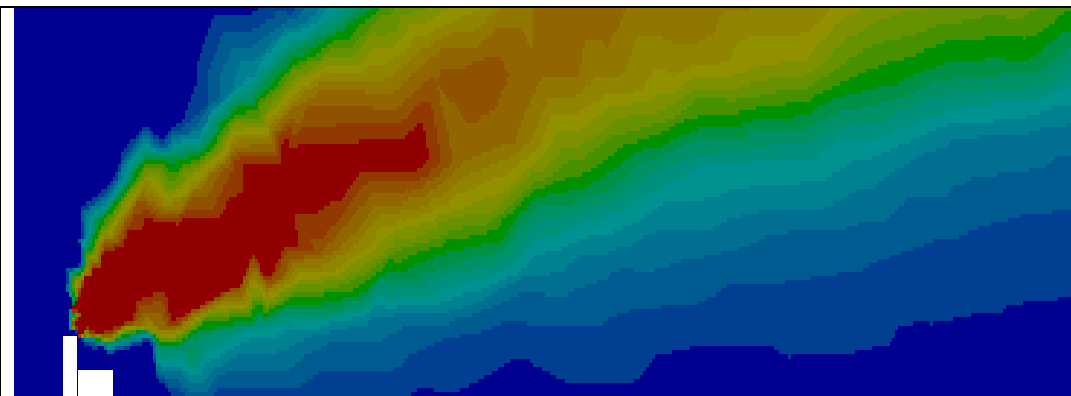
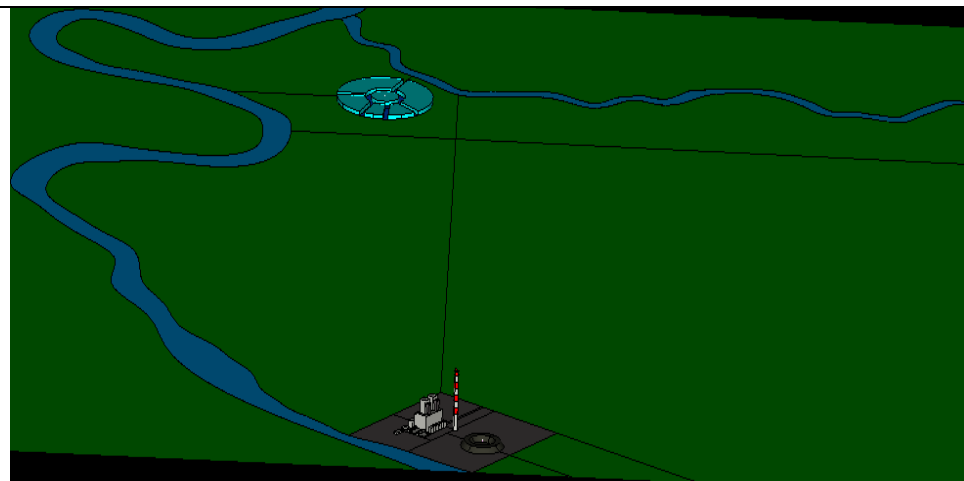
- 1 - Gorionik
- 2 - Komora za sagorevanje
- 3 - Rotaciona sušara
- 4 - Dimna komora
- 5 - Dimni kanal
- 6 - Motor-varijator
- 7 - Mehanizam za podešavanje nagiba peći
- 8 - Čelična cev
- 9 - Dovod materijala u sušaru
- 10 - Posuda za osušeni materijal
- 11 - Dovod vazduha



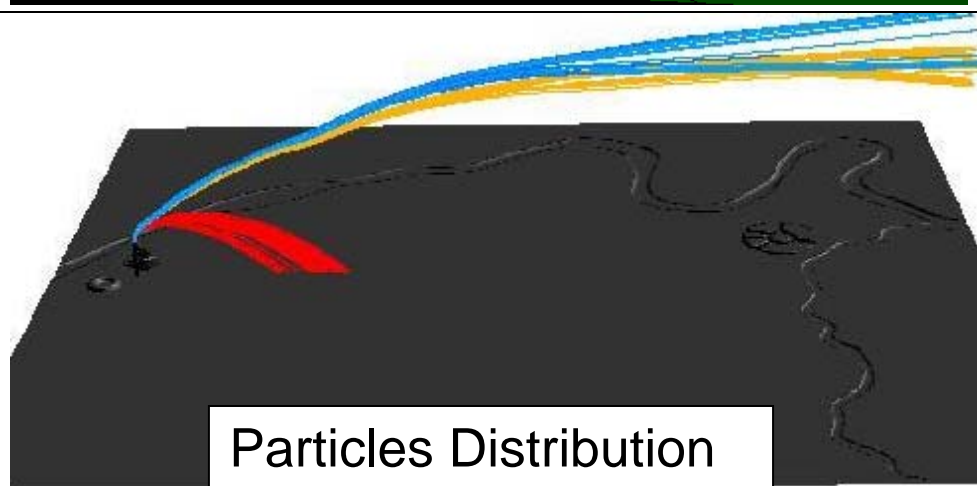
Environmental friendly technology for co-incineration hazardous wastes
Application: Energy/Paper industry/Cement plants in Serbia



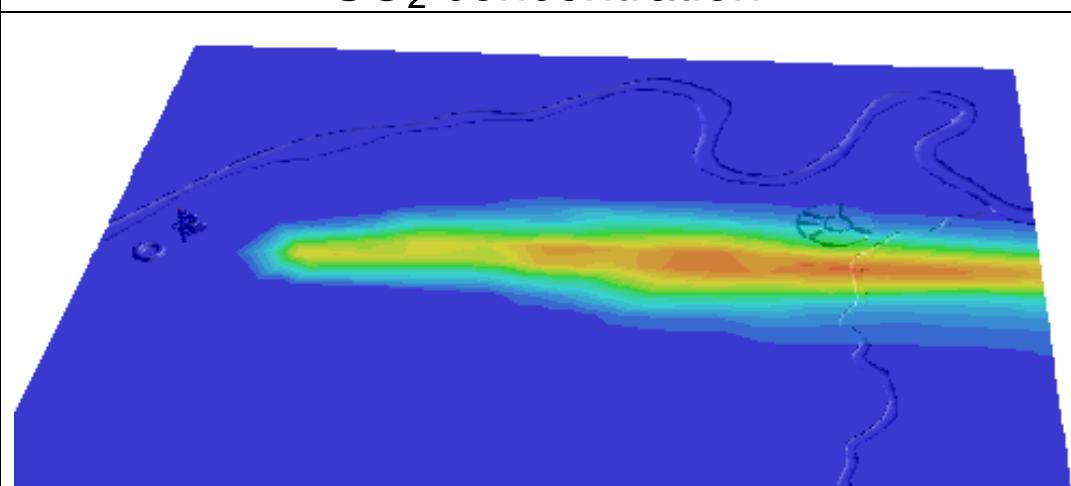
CFD Simulation of Air Pollution from Power Plants



SO₂ concentration



Particles Distribution



2x650 MW Power Plant near Belgrade



Conclusions

The need for cooperation between universities and industry in energy sector in the future will increase:

- development of new technologies
- Education.

Examples presented here shown good cooperation and level of research at universities.

It has helped to save research resources in the past.

However, steps to increase number of researchers and improve equipment should be undertaken.

We hope for participation in EU project, direct cooperation with industry in EU, as well as, further development of the relation to Serbian industry

