



Nuclear energy and the risk Czech view

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CAETS 2011 Mexiko City



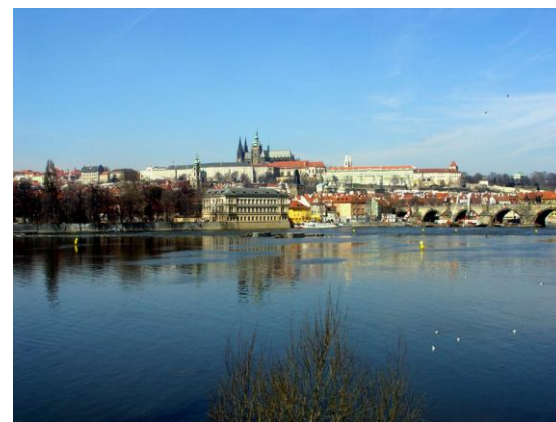
Program

- Introduction, Czech rep., EA CR, NRI, PTU
- Introduction Nuclear energy in the Czech rep
- Nuclear Energy can be safe, new view to the risk

Czech Republic Introduction

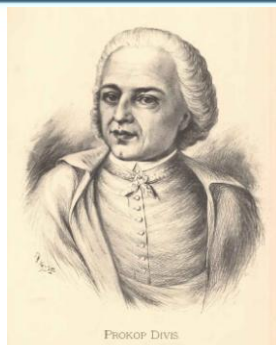


- Capital Prague
- 10,4 M. people
- Area 79 000 km²
- GDP 150 B€





Czech contribution to mankind



Prokop Diviš 1698 – 1765

Lighting rod



Johann G. Mendel

1822 - 1884

Founder of Genetics



Joseph Ressel 1793 - 1857

Ship propeller



Jaroslav Heyrovsky 1890-1967

Polarograph



Otto Wichterle 1913 - 1998

Contact lenses



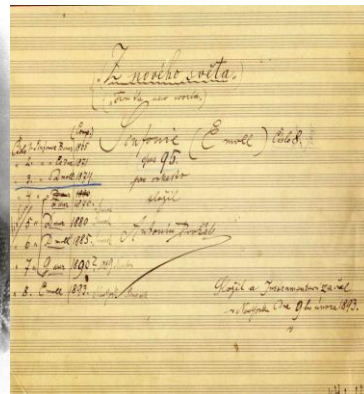
Czech contribution to mankind



Johan Amos Comenius

1592-1670

Orbis Pictus, Didactica



Antonín Dvořák

1841-1904

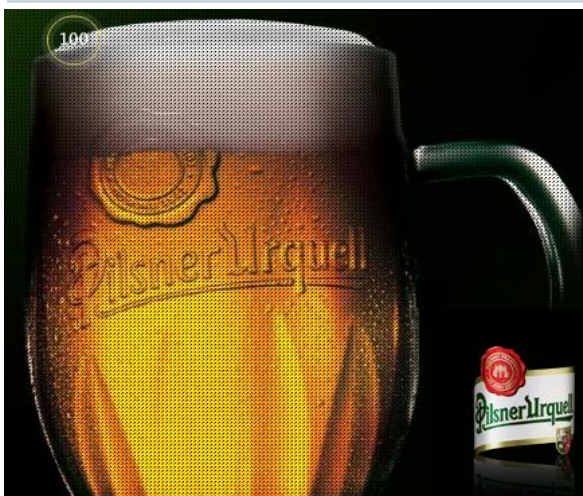
"From the New World"



Alfons Mucha

1860 – 1939

Art Nouveau design





Engineering Academy Czech Republic

CAETS and Euro CASE member

- ❑ Established 1995
- ❑ Selective non-profit organization

Structure

- ❑ Universities, Academy of Sciences of CR, top ranking companies, industry, 155 Czech and 27 foreign eminent experts

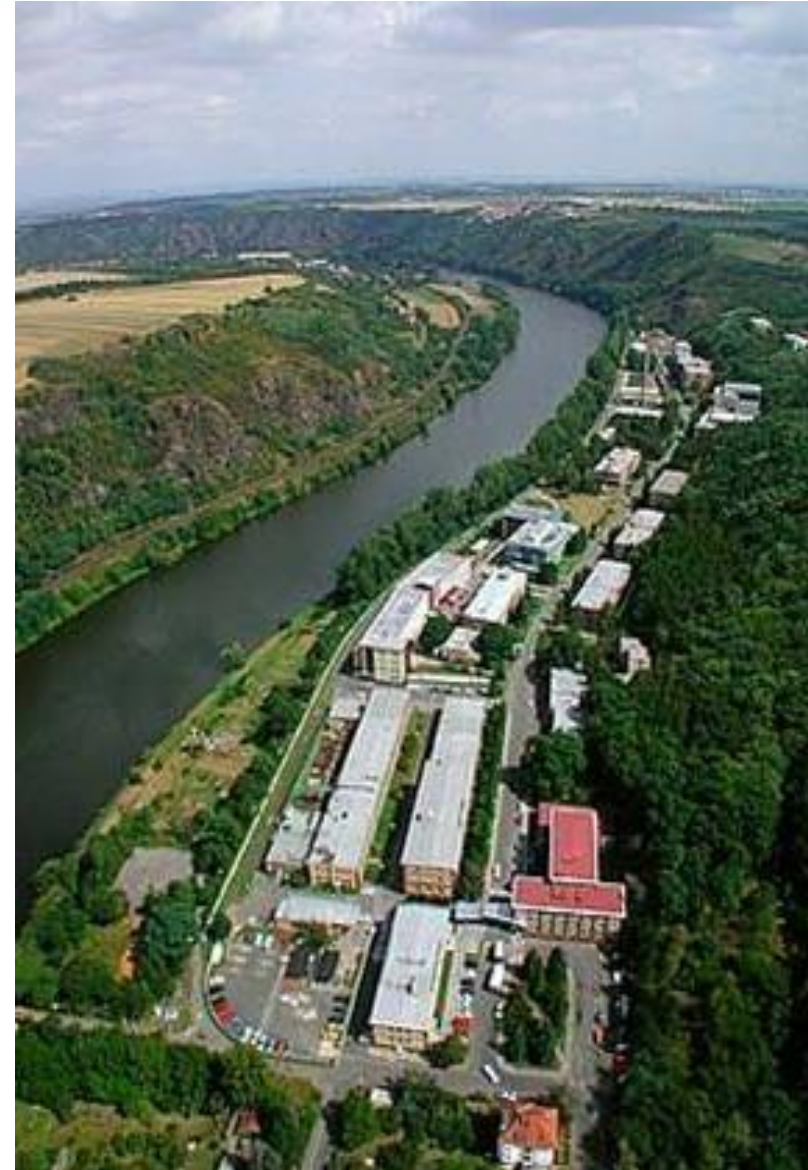
Aim

- ❑ Creating bridges between theory and practice.
- ❑ Development of technical sciences and education. Expert analyses and contacts. Involvement in significant projects. Organization of conferences and seminars. Interconnection of R&D and practice (CKTO), creation and extension of international contacts



Nuclear Research Institute Group since 1955

- 1300 experts in 7 companies offers broad range of expert advice and services to the operators of nuclear power plants in the Czech Republic and abroad
- Supports state agencies in the strategic management of power engineering and the management of radioactive wastes
- Provides independent support to the State Office for Nuclear Safety
- Facilitates development in the use of ionizing radiation and irradiation services for the basic and applied research, health-care and industrial facilities
- Carries out research and provides services aimed to dispose radioactive waste
- Provides training and education of students, technicians and scientists





Key areas

- **Material & technical engineering**
 - Integrity analysis, EQ, LTO
- **Safety**
 - Safety analysis, THD analysis, fuel and physics
- **Design**
 - Power plants, large infrastructures, engineering services
- **Fuel cycle and waste management**
- **Reactor physics**
 - Two experimental reactors
 - Material testing, irradiation services, large research infrastructures
- **TSO – Research Centre Rez**
 - Technical support of regulatory bodies
- **Radiopharmaceuticals**





Czech Higher Education

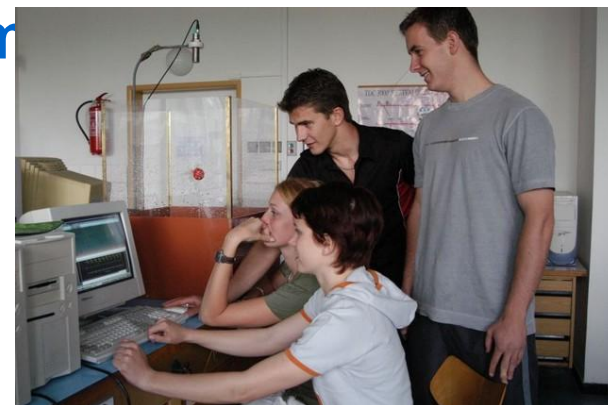
for 10.000.000 inhabitants:

- 26 Public schools
- 42 Private schools
- 2 Military schools

expected number of students 350.000

The Czech Republic

- accepts the Bologna process,
- prepares a reform of tertiary education
- reform of research and development





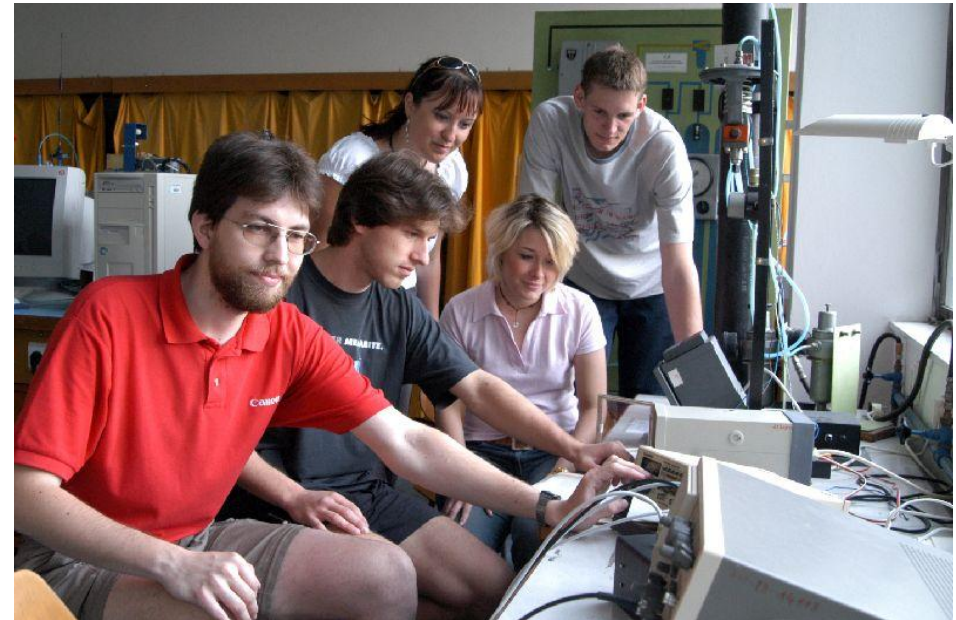
Czech Technical University Prague

The Oldest Civil Technical University in Central Europe
Established 1707

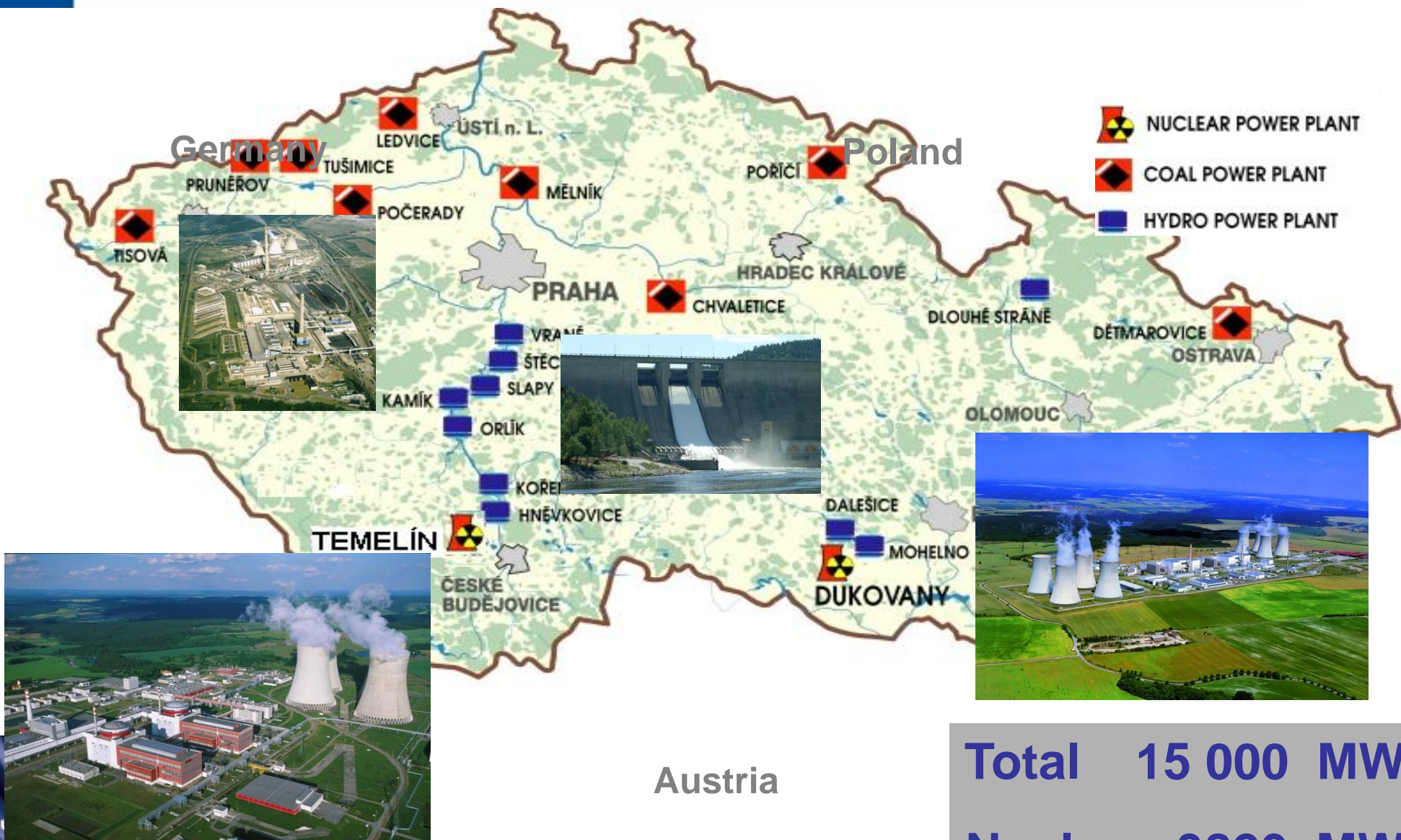
Nuclear Research Institute Rez



- ☐ 23 000 Students
- ☐ 150 Professors
- ☐ 350 Associate Professors
- ☐ 860 Lecturers



Power Generation in the Czech Republic



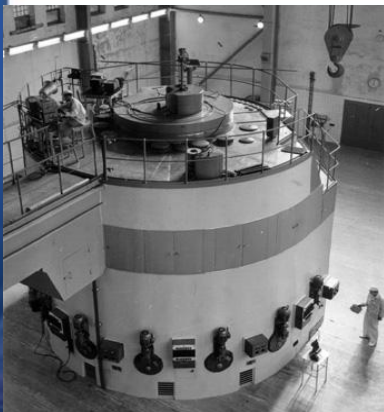
Total 15 000 MW
Nuclear 3820 MW

Austria



Nuclear experiences in the Czech Republic

Nuclear Research Institute Řež



Since 1955 UJV Řež, experimental and school reactors
NPP Dukovany, Temelín





Nuclear energy can be safe

- ❑ Risk or Safety that is the question
- ❑ Looking back to the nuclear history of the mankind we can see after 14 500 reactor years some severe accident
- ❑ Risk is the level of dangerous that process/ processes will not go correctly. Risk is probability that process will collapsed
- ❑ We could know the level of unavailability of every part of the process
- ❑ As managers we have to know the risk level and maintain the risk, we must decrease the risk
- ❑ Risk is complementary to safety- low risk high safety
- ❑ We increase the safety
- ❑ Risk or Safety - what expression is better I pass it to PR people



Nuclear Energy can be safe some severe accident and theirs root cause

- ❑ Nuclear power generation is a special case
- ❑ Probability of the failure is very small but results are catastrophically (large area, long time)
- ❑ Example of few severe accident during the nuclear history
 - Windscale – technical reason, human error
 - Three Mile Island – technical reason, human error
 - Chernobyl - human error
 - Tokaimura – technical failure + human error
 - Paks – human error
 - Etc, etc

 - Fukushima - **nature**



Nuclear Energy can be safe some major risks before March 11. (1)

- Construction period – design mistakes results longer term, higher costs,
- Operation period - equipment failure, human error results to shut down the unit and lose of the market position
- Long term operation (60 years) - keep knowledge continuity within few generations
- Security issues
- Radioactive waste
- Spent fuel and reprocessing



Nuclear Energy can be safe

New risks after March 11. (2)

- ❑ Fukushima accident was problem of the nature - externals
- ❑ Bigger tsunami then designed one
- ❑ Lesson learned - **we must take in a count higher influence of the nature then we have done until now**
- ❑ New level of the risks
- ❑ Probability of severe accident (recommended value) for new units gen 3 **CDF 10^{-6} až 10^{-7} = 1 per million year**
- ❑ We must take in a count the same level of probability of the externals
- ❑ E.g.
 - Probability of airplane crash $5 * 10^{-7}$ /year
 - Probability of the meteorite hit $1 * 10^{-8}$ /year
 - Compare with other risks - car crash $1,7 * 10^{-1}$ sport injury $3,6 * 10^{-4}$ (skiing) $-1,7 * 10^{-3}$ (cycling), light hit $3,5 * 10^{-6}$
- ❑ We must study the history back and made some evaluation for, tornado, hurricane, storm, flooding, extreme thermal condition, etc etc for hundred /thousand year to the history



New look to the risk

- ❑ **Stress test** – checking of the design running plant – some plant could not fulfill criteria of acceptability, will be modernize or shut down
- ❑ **New build** – new or stronger criteria for new unit gen 3. Changes in EUR – time delay and increasing the cost
- ❑ **Long term operation** - life time extension of existing nuclear units should be difficult and less optimistic
- ❑ **Fast political decision** – Germany, Switzerland, Italy shut down all NPP.

And the possible scenario:

- **Bad signal to young generation,**
- Reduction of students in nuclear science
- Lack of the workers and experts for nuclear operation, maintenance, technical support and engineering organization even the date for shut down is 2020, young people decided now



Risk and prevention

- In my opinion the most dangerous risk is wrong, fast political decision
- What we can do against it?
 - Explain, convince, encourage
 - On all level
 - Communicate, communicate, communicate



Resume

- Introduction, Czech rep., EA CR, NRI, PTU
- Introduction Nuclear energy in the Czech rep
- Nuclear Energy can be safe but we have new view to the risk after March 11
- There are risks of – increase the costs, delay in New Build, problem in life time extension and mainly lack of the new generation of nuclear experts....
- There is the risk of bad political decision
- Only the way of the prevention of such a bad decision is communication, communication, communication