

Fulfilling national and international nuclear educational and training needs in Hungarian Higher Education

Prof. Dr. Attila ASZÓDI

*Budapest University of Technology and Economics,
Institute of Nuclear Techniques, Hungary*

E-mail: aszodi@reak.bme.hu; Web: www.reak.bme.hu

INTERNATIONAL FORUM ATOMEXPO 2014

HR ROUND TABLE

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- Hungary:
 - Population: 10 million
 - Area: 93 030 km²
 - Rank of GDP (PPP) per capita: 53rd
 - Nuclear share in electricity production: 50%
 - Nuclear share in electricity consumption: 36%

Major nuclear installations



Paks NPP (4 VVER-440 units, Σ ~2000 MWe)



Bátaapáti final disposal site (low & intermed. waste)

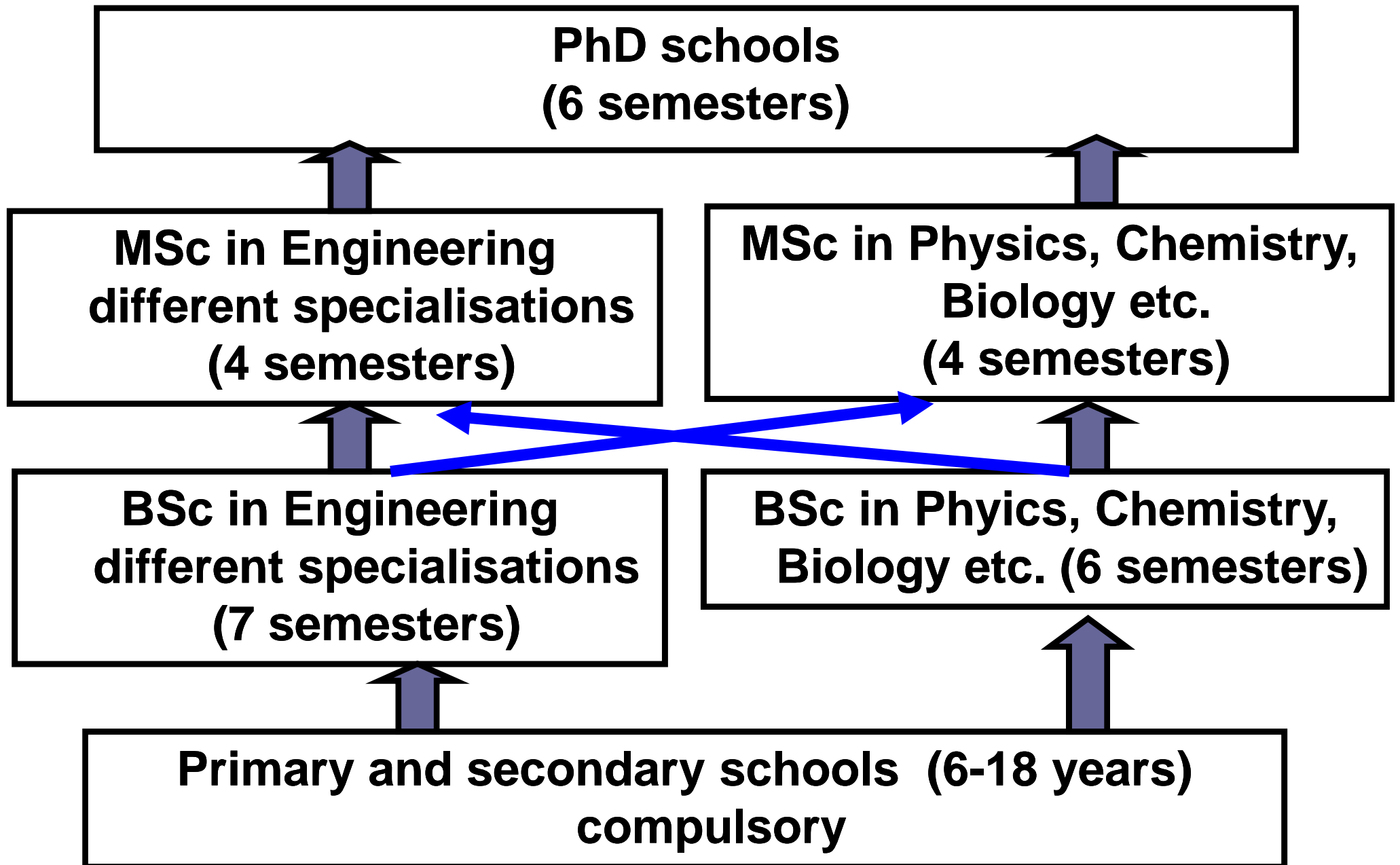


Budapest Research Reaktor (10 MW)

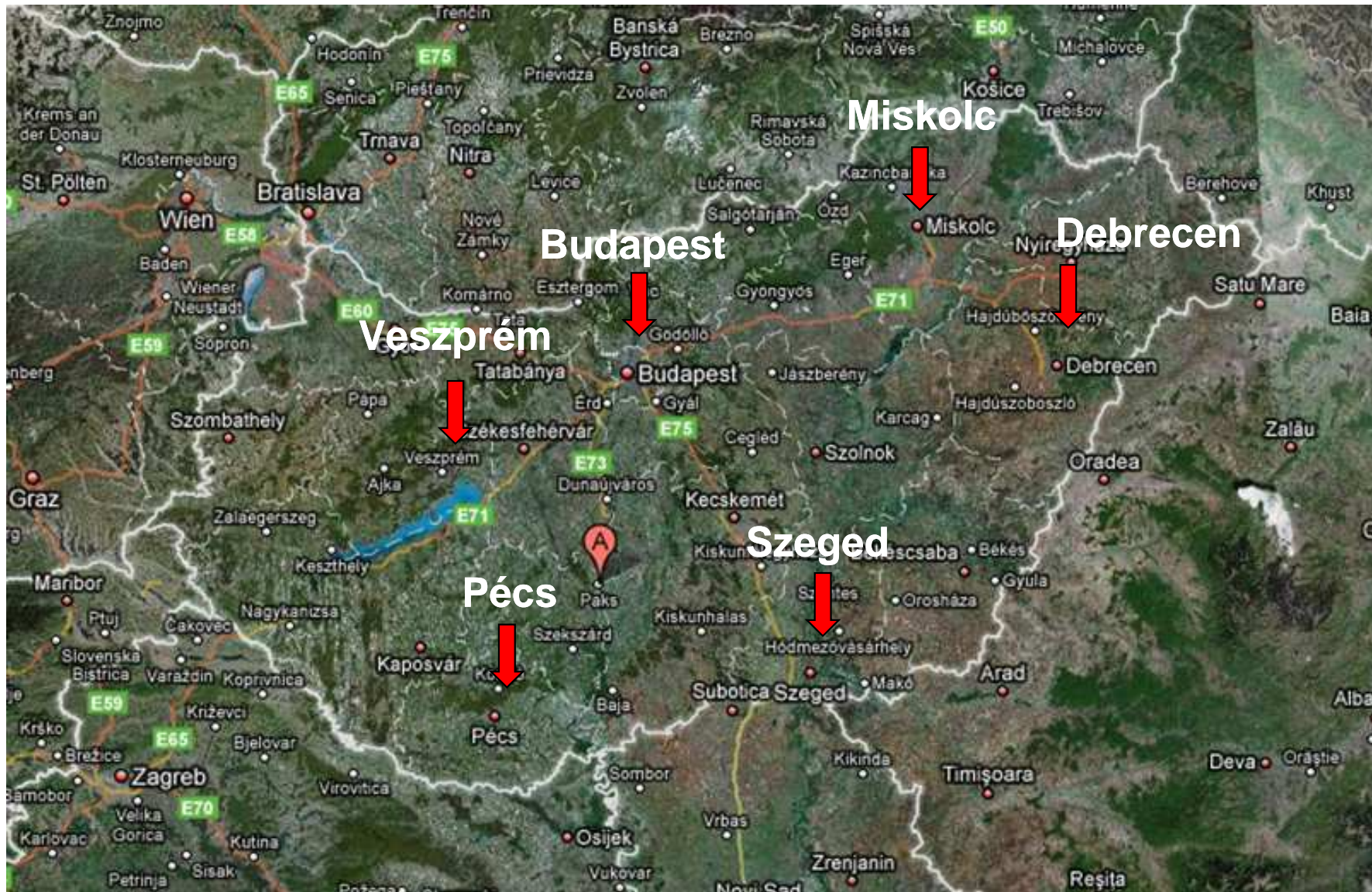


Interim Storage Facility for NPP Spent Fuel, Paks

The Hungarian education system



Cities in Hungary with universities teaching engineering and/or nuclear (physics) subjects



Budapest University of Technology and Economics (BME - www.bme.hu)

- Founded in year 1782
- 8 Faculties, 77 Departments
- 24 000 Students
- Academic staff: 1300, with scientific qualification: 700



Institute of Nuclear Techniques, BME, Hungary

Training reactor

- Location: Campus of the Budapest University of Technology and Economics (BME)
- Reactor type: pool-type reactor (Hungarian design)
- First criticality: 1971.
- Nominal Power: 100 kW
- Moderator and coolant: light water
- Horizontal and vertical irradiation channels
- Pneumatic dispatch system for the transfer of the samples into the core



Education at Training Reactor, Hungary

- Levels of courses:
 - BSc, MSc, PhD
 - Post-graduate courses
- Specialties:
 - Physics BSc and MSc with nuclear specialization
 - Energy Engineering (power engineering BSc and MSc with nuclear specialization)
 - Very active PhD school
- Measurement exercises for other universities and faculties of BME
- Different international short courses (ENEN, IAEA, EERRI, many bilateral co-operations)



Photo: Fehér S.

MVM Paks NPP

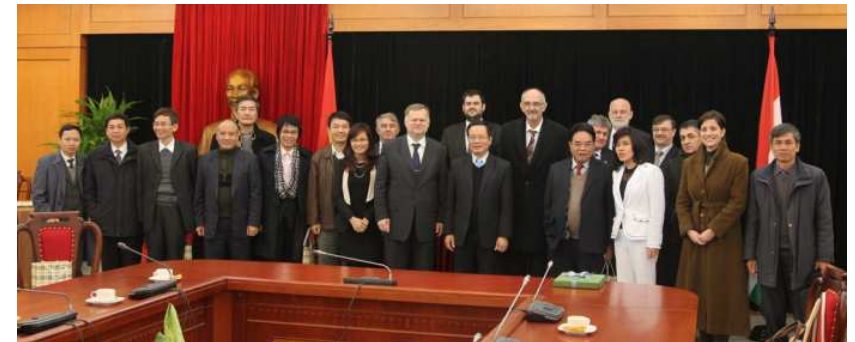
- 4 VVER-440 type units in operation since 1982 - 1987
- 46 % share in the domestic electric energy production (37% in consumption)
- Continuous upgrading of safety and production performance through innovative development
- Excellent availability and safety indicators
- Extended service time (30 → 50 years)
- Very strong scientific-educational system and associated infrastructure
- Extensive knowledge and experiences accumulated from more than 100 reactor years operation



Photo: Paks NPP

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

- Preparation
 - Coordinated at the highest diplomatic levels since 2009
 - In consonance and harmony with IAEA-frameworks
 - Several exchanges of delegations to construe a powerful training content
 - Preliminary agreements for many years in different fields
- The product
 - **HUVINETT** - Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course
 - Six-week course
 - comprehensive overview of the technical-scientific background for the construction-operation of an NPP,
 - theoretical background,
 - human resource needs and associated training programs
 - 3 weeks at BME NTI + 3 weeks in Paks NPP



HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

HUVINETT Courses at BME NTI

- 80 hours lectures
- Key topics of lectures:
 - Nuclear Fundamentals
 - Reactor physics
 - Thermal hydraulics
 - Nuclear Fuel cycle
 - Nuclear power plants
 - Nuclear Safety
 - Operation of nuclear power plants
 - Nuclear measuring method
 - Radiochemistry
 - Radiation and environmental protection



Photo: Aszódi A.

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

HUVINETT Courses at BME NTI

- 36 hours laboratory demonstrations
- Selected laboratory exercises:
 - Introduction to laboratory exercise, radiation protection and safety training
 - Measurement of scintillation and semiconductor detectors
 - Measurement of gas filled and neutron detectors
 - Reactor operation exercise
 - Determination of spatial distribution of thermal neutron flux in the core of the training reactor



Photo: Aszódi A.

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

HUVINETT Courses at BME NTI

- 36 hours laboratory demonstrations
- Selected laboratory exercises:
 - Experimental demonstration of Thermal-hydraulics of PWRs during Loss-of-Coolant Accidents on TRATEL Plexiglas mock-up
 - Radiation protection in practice
 - Demonstration of PWR primary circuit behavior on simulator
 - VVER-1000 simulator exercise



Photo: Aszódi A.

HUVINETT 2012/1, September



Final exam

Exams: detailed measurement of knowledge improvements and the end of the course



Photo: Aszódi A.

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

HUVINETT Courses at Paks NPP

- 3 weeks of practice oriented training
- Practical application of nuclear theory and knowledge
- Plant technology
- Importance of nuclear safety
- Behavioral standards and required attitude in a nuclear power plant
- Practice in real working environment
 - Maintenance Performance Improvement Center
 - Simulator
 - Labs and workshops of the plant



HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course at Paks NPP

- Training program:
 - Duration: 3 weeks, 120 hours
 - Lectures, demonstrations: 64 hours
 - Plant visit, practice, exercise: 40 hours
 - Preparation, feedback, evaluation: 16 hours
- Subjects:
 - International, national requirement of NPP operation
 - Introduction of WWER-440 technology and equipment
 - Technology development/upgrade at Paks NPP
 - Safety related issues at Paks NPP
 - Nuclear fuel management and fuel handling at Paks NPP
 - Chemistry issues at Paks NPP
 - Maintenance activities at Paks NPP
 - Radiation protection at Paks NPP
 - Emergency response System at Paks NPP
 - Severe accident management
 - Technical support activities at Paks NPP
 - HR and training system at Paks NPP
 - Exercises on the simulator and on real primary circuit equipment



Photo: Paks NPP

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course at Paks NPP



HUVINETT 2012/1, September

- The first HUVINETT course
- 40 participants from Vietnam
- Successful test of the train the trainers program



Photo: Aszódi A.

HUVINETT 2012-2013: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

- Until now 4 HUVINETT courses with 160 participants
- HUVINETT feedback and conclusion:
 - Hungary has provided
 - unique environments for learning,
 - well prepared-organized training content,
 - experienced and knowledgeable lecturers.
- **The continuation of the HUVINETT program is considered as highly beneficial for Vietnam to better face its endeavors in nuclear education and training**
 - Next course is under preparation for September 2014
 - Other short courses are planned, too



Future perspectives

- Hungarian Nuclear Education Network (HUNEN) – a new national consortium of Hungarian institutions .
- Paks NPP, the Training Reactor of TU Budapest and HUNEN is open for further cooperation, especially with those countries embarking upon their national nuclear program.
- Establishment of an international nuclear training center in Hungary is under preparation. Our objective is to support embarking countries.
- Gen3/3+ and Gen4 reactor technologies are in our focus area.

