New units at the Paks NPP – background of the project and human resource issues

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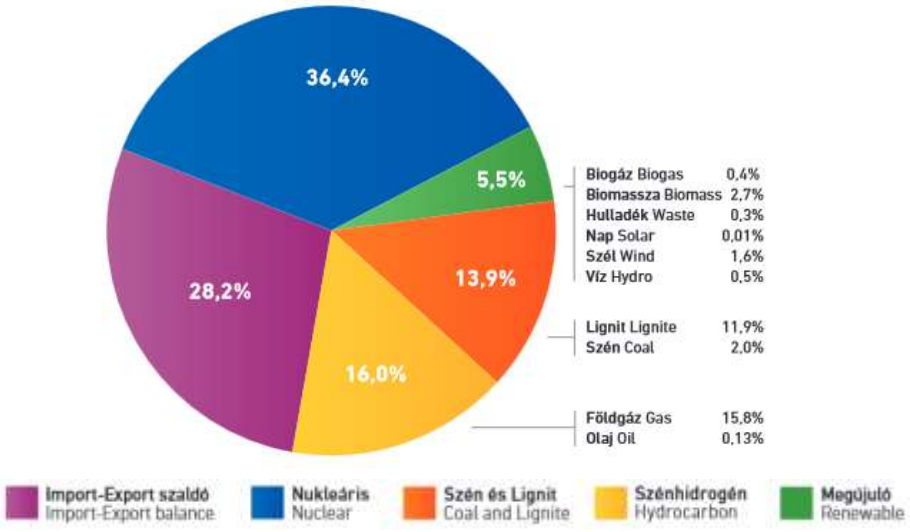
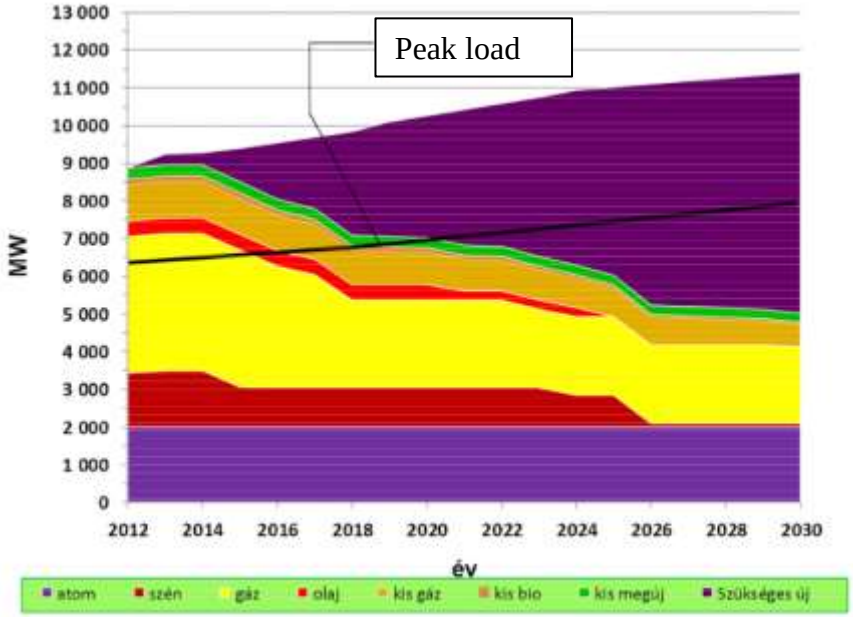
The Hungarian electricity consumption

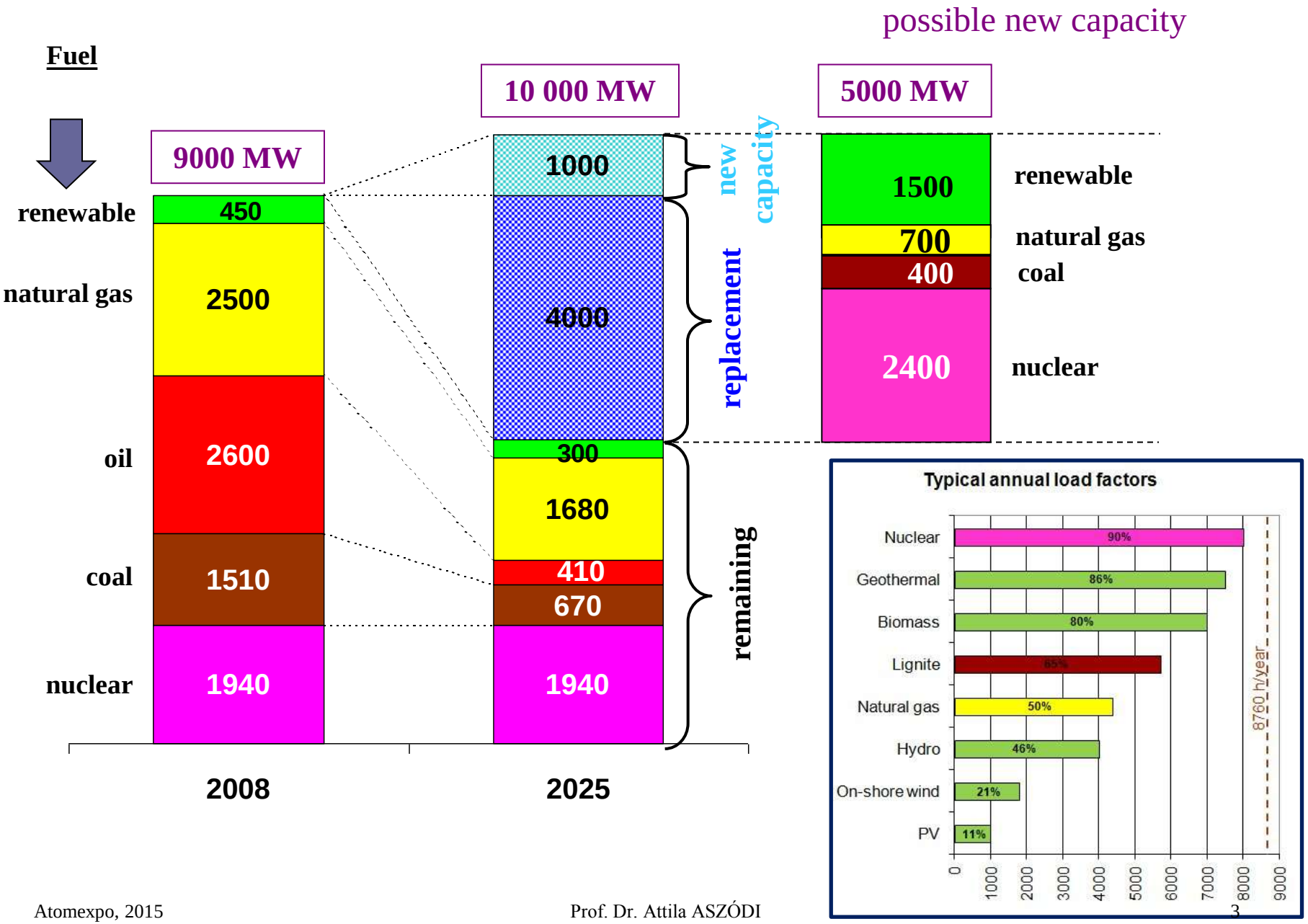
- 2013: Total gross electricity consumption: 42 189,2 GWh
  - Domestic production: 30 311,5 GWh
  - Imported electricity: 11 877,7 GWh
- Expected rate of growth: 1,3%/year (later 1%/year)
- Until 2030 roughly 7300 MW new capacity has to be built
  - Within this, 3100-6500 MW can be large PPs (eg.: nuclear), 1600 MW small PPs on renewable sources

Sources of gross electritiy consumption (MAVIR)



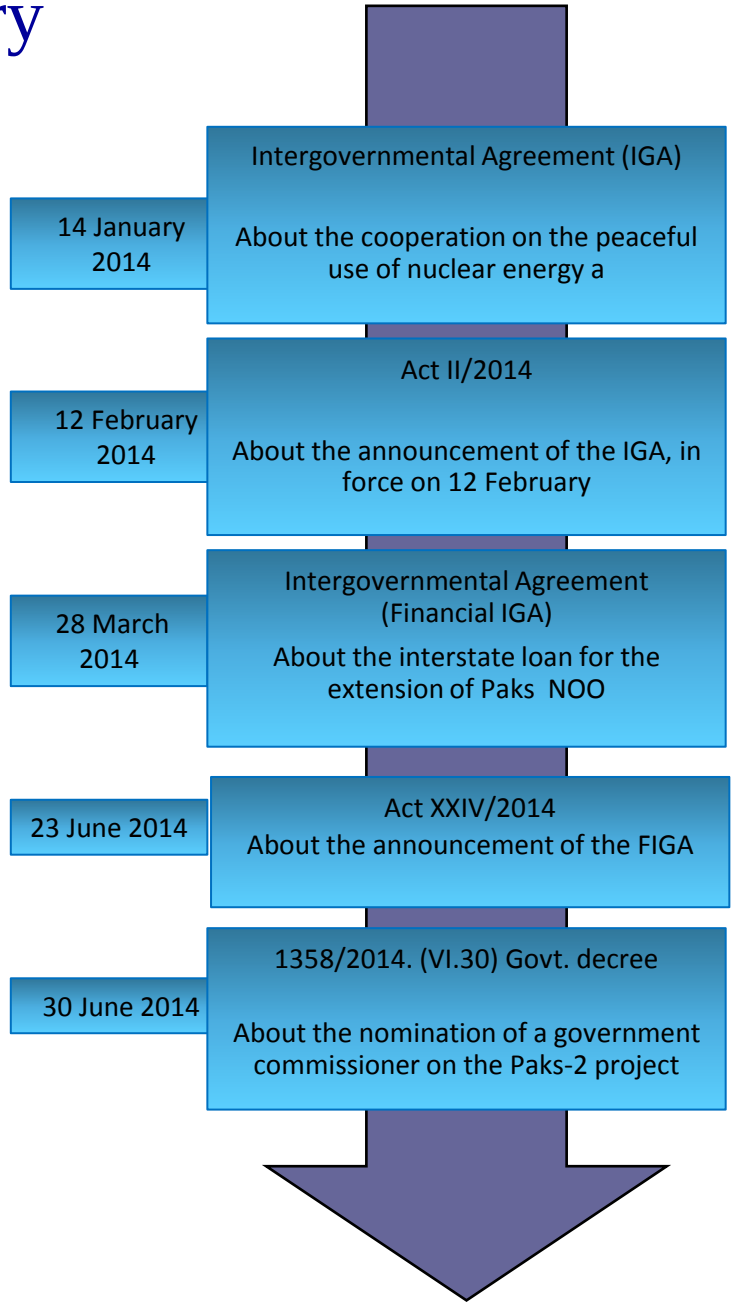


Possible capacity development



Extension of Paks NPP - preliminary

- Paks NPP: extension on the agenda since the 80's (2*1000 MW additional capacity was planned for the site)
- 2008: energy policy conception - based on supply security and climate-protection objectives, decision preparation work for new units started
- 30th March, 2009: decision-in-principle of the Hungarian Parliament
- 2012: establishment of MVM Paks II. Nuclear Power Plant Development Ltd
- January 2014: Intergovernmental agreement on the peaceful use of nuclear energy by Russia and Hungary
  - Two VVER-1200 type reactors at the Paks site
  - Russian loan for the 80% of construction costs



Hungarian-Russian intergovernmental agreement (IGA)

- Basis: cooperation agreement on nuclear energy cooperation between Hungary and the Soviet Union in 1966
- Aim of the cooperation
  - Construction of two new reactor units with a capacity of „at least 1000 MW each”
  - Cooperation concerning the existing Paks units (maintenance and modernization projects, technical consultation, decommissioning)
  - Key point of the IGA: 40% localization level (share of domestic suppliers)
  - Scientific-technical cooperation in field of: reactor technology, nuclear fuel development, basic research on peaceful use of nuclear energy, production of radioisotopes, education

Site of the new units

- In field of nuclear fuel supply, according to the IGA:
  - The Russian party supplies the first load and fuel for subsequent loads for a given period
  - Contract on spent fuel management possible (interim storage or reprocessing)
  - The spent fuel or the residual waste (in case of reprocessing) will be transferred back to Hungary

Implementation agreements

- Signed on 9. December 2014, by Paks II Nuclear Plant Development Closed Joint-Stock Company and the Russian Joint-Stock Company Nizhny Novgorod Engineering Company Atomenergoproekt
- Three implementation agreements:
  - EPC agreement
  - Operation and maintenance support contract
  - Agreement detailing nuclear fuel supply

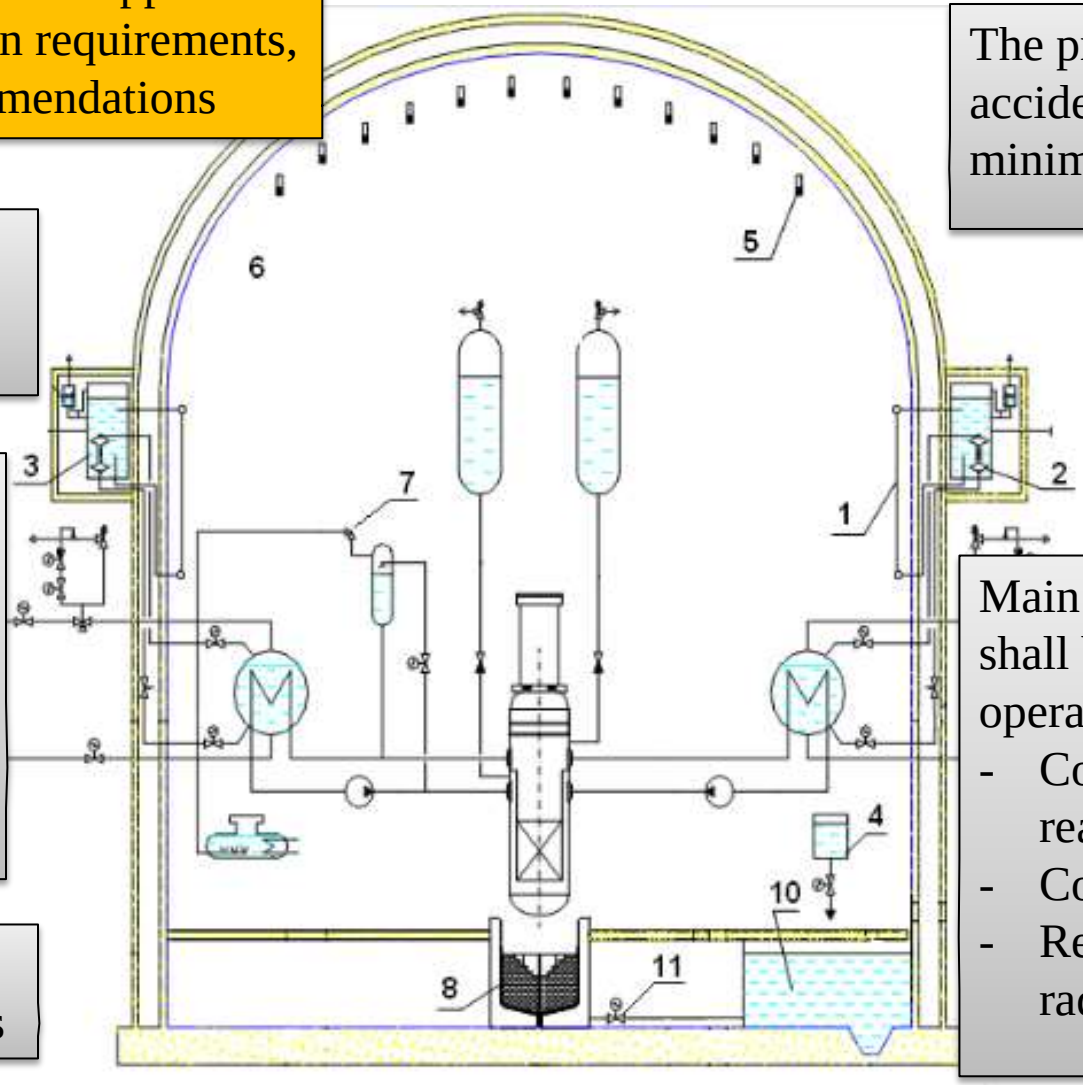
Hungarian requirements

11 600 requirements! – App.1.1. Based on Hungarian requirements, EUR, IAEA recommendations

Nuclear safety is the main priority!

The reactor has to comply with the Hungarian requirements (NBSZ) and the international standards

Feedback of the Fukushima lessons

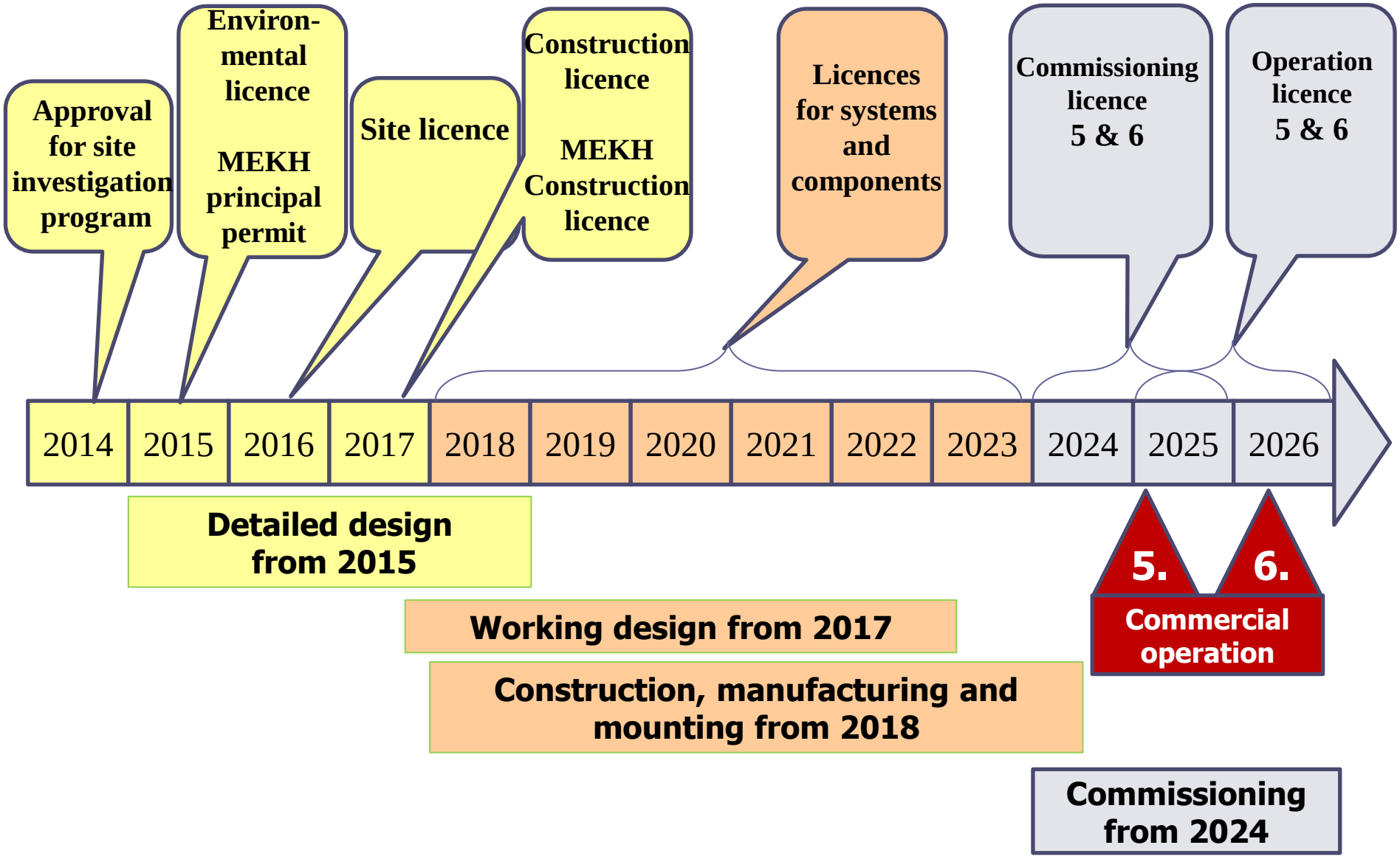


The probability of accidents shall be minimized

Main safety functions shall be met in all operational condition:

- Control of chain reaction
- Cooling of the fuel
- Retaining radioactivity

Planned milestones of the Paks-2 project



Capacity building – further tasks

- Govt. Decree 1836/2014 (December 2014)
- Among others:
  - **Professional preparation of regulatory staff, ensuring the financial and human needs of regulatory body**
  - Improvement of the Hungarian energy industrial sector – start of a supplier program
  - **Start of specific R&D programs**
  - **Development of vocational training and higher education**
  - **Establishment of a nuclear fuel investigation laboratory for Generation IV reactor fuel**
  - Report to the government in every 6 months

Source: IAEA

Educational infrastructure in Hungary

- Hungarian operator, maintenance and training staff for present Paks units
  - Hungary is not a newcomer country!
- Well-established educational and training system
- High-level R+D programs
  - Research reactors
  - Generation IV research programs
- Role in international education programs
- Because of the specific knowledge basis the country needs special training programs, but the basic education and training is available in Hungary!

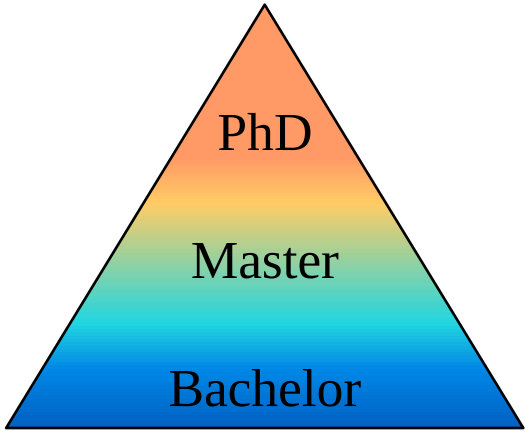
10 MWth research reactor in Budapest, MTA EK

Maintenance Performance Improvement Center, Paks NPP

100 kWth training reactor at Budapest Univeristy of Technology and Economics, BME NTI

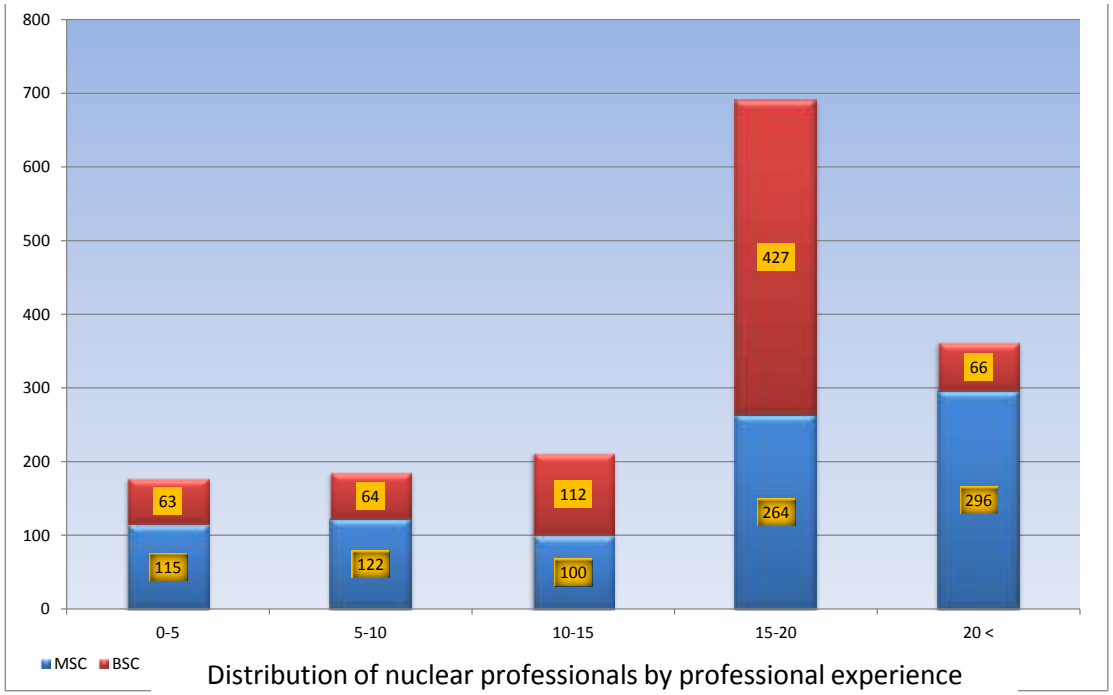
Educational infrastructure in Hungary

- Hungary is part of the Bologna education system (European Higher Education Area)
  - Bachelor's degree (180-240 ECTS)
  - Master's degree (90-120 ECTS)
  - Doctoral degree
- Science and technology universities can take part in nuclear education
  - 4 relevant universities in Budapest, 5 more in the country
  - Most important: Budapest University of Technology and Economics (BME):
    - education of engineers and scientists
    - Energy engineering BSc, MSc and PhD education available in nuclear field!



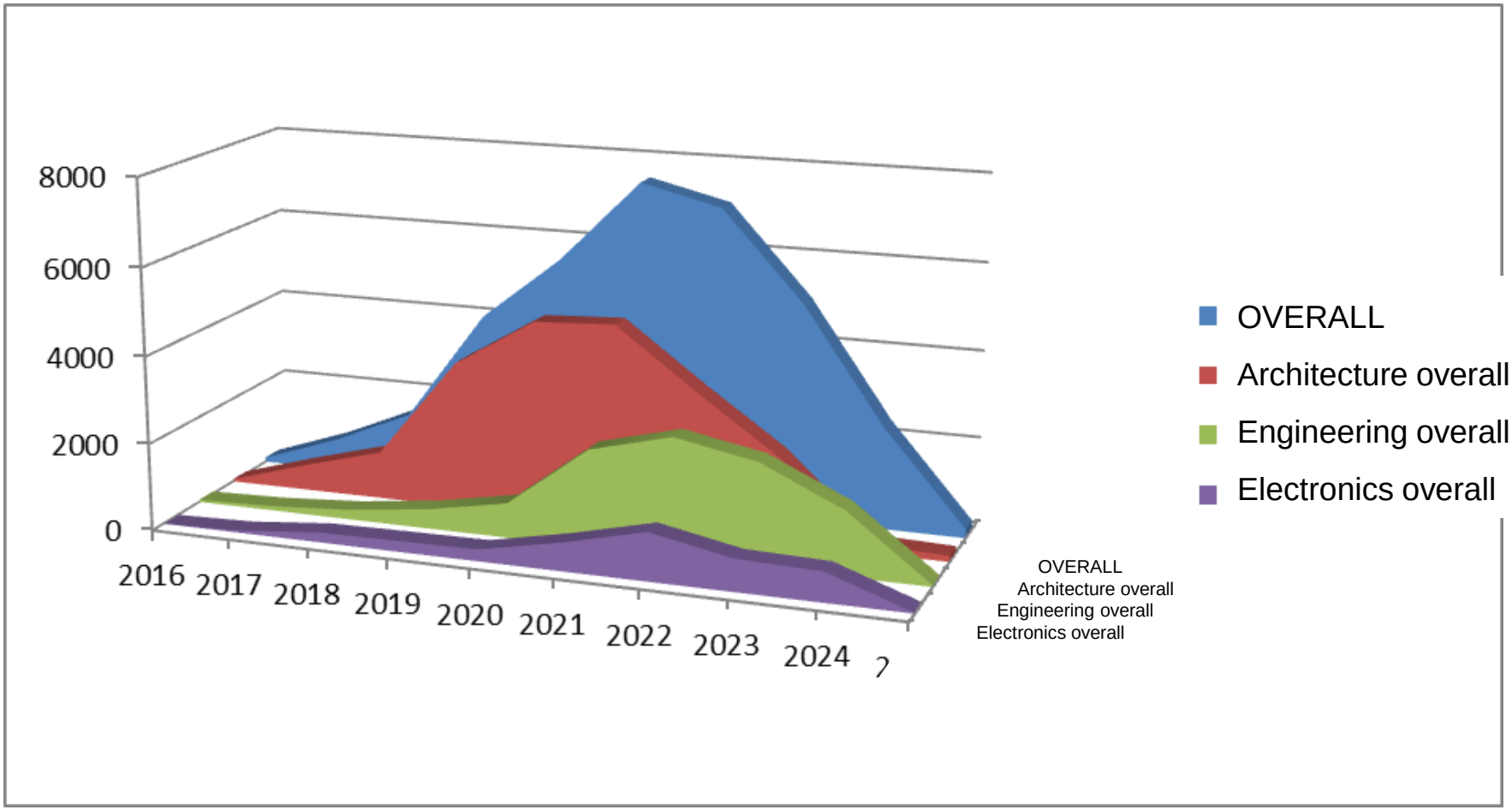
Hungarian nuclear competence

- Survey in 2013 by ERBE company for 101 companies, universities, research centers, authorities
- Highest education, age, specific professional experience, language knowledge of staff
- Classification of 1642 professional
  - MSc degree: 55.4%
  - BSc degree: 16.1%
  - Average age: 44.2 years



Distribution of nuclear professionals by professional experience (year) (Source: ERBE)

Human resource needs for the construction



HUVINETT 2012-2014: Hungarian-Vietnamese Nuclear Energy „Train the Trainers” Course

- Until now 5 HUVINETT courses with 200 participants
- HUVINETT feedback and conclusion:
  - Hungary has provided
    - unique environments for learning,
    - well prepared-organized training content,
    - experienced and knowledgeable lecturers.
- **The HUVINETT program is considered as highly beneficial for Vietnam to better face its endeavors in nuclear education and training**
  - Other short courses are in progress, too

Hungarian education plans for the new construction

- Complex education program by the Hungarian government
  - General educational action plan – for supplying the necessary workforce for the elongated operation of present Paks, for the construction and operation of new Paks units, for the staff of technical support organizations (TSOs)
    - Financial support for educational institutes participating in the program
    - Establishment of a domestic fellowship program to make the nuclear and other connecting education for the students and to help the expert after-growth on a long term
  - In order to reach the 40% localization level (aimed in the Intergovernmental Agreement);
  - To help the domestic companies preparing for the new construction;
  - Involving the regional secondary schools, vocational schools;
  - Independent educational program for the preparation of the authority staff

Hungarian education plans for the new construction

- **The basic education infrastructure is available in Hungary!**
- For the specific education the Hungarian intention is to send a team of instructors into Russia (train-the-trainers concept)
  - They would be able to train the staff of Paks2 in Hungary
- Hungary is open for other possible educational cooperation for the necessary specific education
- For Hungary the main goal is the further development of the domestic R&D infrastructure and maintenance of this R&D for a long term