Risks in nuclear new-build projects in Europe

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minister without portfolio responsible for the Paks II. nuclear new-build project
Paks II. – a nuclear new-build project in Europe

- Paks II. – Hungary’s biggest project, also unique in Europe
- Two new nuclear units, 2x VVER-1200
- 12.5 bn EUR investment
- Separate minister responsible for the project

**Current status:**

- More than 300 licenses available
- Effective environmental and site licenses
- Construction of the first buildings started in 2019
- Current work: implementation license application documentation
  - ≈ 300 000 pages

**Diagram:**

- **A TERMELT HAZAI VILLAMOS ENERGIA MEGOSZLÁSA 2017**
  - SOURCES OF DOMESTIC ENERGY PRODUCTION 2017
  - Biogáz, Biogas: 50.0%
  - Biomass, Biomass: 25.2%
  - Nuclear & Szén Coal: 14.8%
  - Víz. Hydro: 9.9%

- **A TELJES BRUTÓ VILLAMOENERGIA-FELHASZNÁLÁS FORRASMEGOSZLÁSA 2017**
  - SOURCES OF THE TOTAL GROSS ELECTRICITY CONSUMPTION 2017
  - Biogáz, Biogas: 35.7%
  - Biomass, Biomass: 28.6%
  - Nuclear & Szén Coal: 18.0%
  - Víz. Hydro: 10.6%

**Legend:**
- Földgáz Gas & Olaj Oli: 25.0%
- Nuclear: 0.22%
- Lignite: 0.024%
- Víz. Hydro: 0.066%
- Import: 0.45%
- Szén/Ágát: 0.43%
- Nukleáris: 0.28%
- Megújulók: 0.29%
- Szénhidrogénius: 0.66%
- Import: 0.47%

**Source:** MAVIR-electricity system data 2017
The demand for electricity is growing on average in Europe

Evolution of electricity consumption in 2017

Western-Europe: Increasing electricity consumption; new needs in the future: electromobility and electrification

Eastern Europe: Further increase in electricity demand is expected (electromobility, electrification, household devices, air conditioning etc.)
Ageing conventional power plant fleet

The dispatchable power plant fleet is ageing

Penetration of non-dispatchable capacity is increasing

There are no business models for new conventional power plant capacities

Are „renewables only” the real solution?

Conventional power plants ageing - source of future import capacities is highly questionable
More and more unexpected outages in Europe

Hungarian daily production in 1st July 2019, MW

Reserve power plants are needed more and more frequently:

- 2018 H1: 1 time
- 2018 H2: 6 times
- 2019 H1: 8 times

Growing electricity demand, ageing conventional power plants and the penetration of non-dispatchable capacity bring new challenges for the electricity system.
The higher the share of vRES the higher the additional grid costs

**Technological challenges to be solved**

- Electricity storage
- System operation
- Inertia in the grid
- High ramp-rates of power plants
- Smart system management tools

The limit we can reach with intermittent renewables without endangering the electricity system is unknown

The premier of the new NEA publication was in Hungary on the 25th of January 2019

For a theoretical country

Project idea for NEA → Research for Hungary and V4 countries suggested
Low-carbon electricity generation in Europe is reached in countries with high **nuclear** and/or **hydro** share in the mix.

CO₂ emission intensity of electricity generation in 2017 (g/kWh)

- Hungarian electricity mix - 40% lower carbon intensity than the „green” Germany, the biggest consumer of coal and gas in the EU.
- Main objective: decarbonisation, not renewables – the latter is only a means besides nuclear, hydro and energy efficiency.

*From ENTSO-E data*
The investments in the energy sector are below the level required by decarbonisation and technological development.

- The investment in energy sector has a decreasing tendency.
- From 2015 the investment volume has decreased 7% in Europe. The majority of energy investments are carried out in energy efficiency.
- Energy investments are not following the pace of economic growth and the development of new technology.
- There is a need for a 45% growth of the investment volume at least.

Market doesn’t deliver the investments automatically. What guarantees can states offer to investors? – lacking optimal legisatory framework.
Ensuring the continuous supply of electricity is the responsibility of governments

Due to the diverse conditions and capabilities of EU Member States, the determination of the energy-mix is a national competence

Natural resource endowment
- Topography
- Availability of wind
- Natural waters
- Sunny hours
- Raw materials

Social conditions
- Public knowledge, experience with certain technologies, R&D and educational infrastructure
- Nuclear safety culture
- Perceived value of the environment in the society, environmental consciousness

Economic conditions
- GDP/capita,
- Affordability of energy
- Availability of funding of low-carbon resources
Long time has passed since constructing new nuclear power plants were common in Europe

There are certain risks for new nuclear power plant projects

Legislation focusses mainly on operation and maintenance, rather than construction – no tried and tested legislative framework for nuclear new-builds

Financial challenges due to market design and state aid rules

Social acceptance and public knowledge are unsatisfactory

Not in my backyard attitude

The size of the country determines the optimal size of the nuclear fleet and whether the development of an entire nuclear infrastructure is necessary (industrial supply chain, education, R&D etc.)
The legal environment of the European Union does not support the construction of new nuclear power plants

- European legislation:
  - Prevents the introduction of capacity mechanisms
  - Financing a new nuclear power plant is difficult
  - Paks II. – an annual rate of return of 7.35% for a 70-year-long project is not high enough, 7.88% is already OK
    - This is a playground for the numbers
    - While oil, gas, electricity prices keep changing daily
  - Paks II. state aid procedure took 3 years overall (formal + informal part together)
- The focus in Europe is on renewables only – this is the voters’ need
  - Politicians try to satisfy the (scientifically unfounded) public opinion
- The European Commission can intervene any time and suspend projects

Most difficult barriers of nuclear new-build are the state aid rules of the European Union.
There are international law risks of constructing new nuclear power plants

Also environmental impact assessment procedural rules involve certain risks for project schedules

The environmental impact assessment procedure carried out by the Paks II. project according to the Espoo Convention became a best practice
- Paks II. - public hearings in 7 countries, 9 locations

Despite of this, referring to Aarhus and Espoo Convention, NGOs have the right to challenge these decisions even after years - this is a risk for similar new-build projects

RES life cycle assessment? Decommissioned PV panels contain toxic waste – disposal?
Radioactive waste disposal: social acceptance is challenging – difficulty in finding sites for geological repositories

Storage of radioactive waste is not easily accepted by the public.

Location of the repository can become a political issue.
- Not in my backyard attitude
- Politically sensitive situations in the region of the repository

Hungary already operates a geological repository for low- and intermediate-level radioactive waste
Public knowledge in sciences is lacking - educating the public would be key to achieve informed decisions

There are misperceptions in the society about the various energy technologies:
- Electricity provision from PV and wind power plants is „free”
- „Renewables only” is a viable option

Lack of knowledge
- On the impact of RES on the grid,
- On the impact of RES on the balancing needs
- On the operation of nuclear power plants

Uninformed assessment of the concept of safety and risks

Paks II. Academy started its first engineering studies on 5 universities in September 2019

Nuclear new-build projects can easily become a political rather than a technical issue
Thank you for your kind attention!