Central & Eastern Europe
Nuclear New Build Congress 2014

Nuclear Power in Slovenia: Current Status and Prospects

Jože Špiler

GEN ENERGIJA

2 JEK PROJEKT

Nuclear Power in Slovenia

1. GEN and Nuclear activities and facilities in Slovenija
2. Krško 2 project justification
3. Project feasibility
4. Conlusions

GEN Group's core business functions

Production



Development and Investments

Trading and Sales

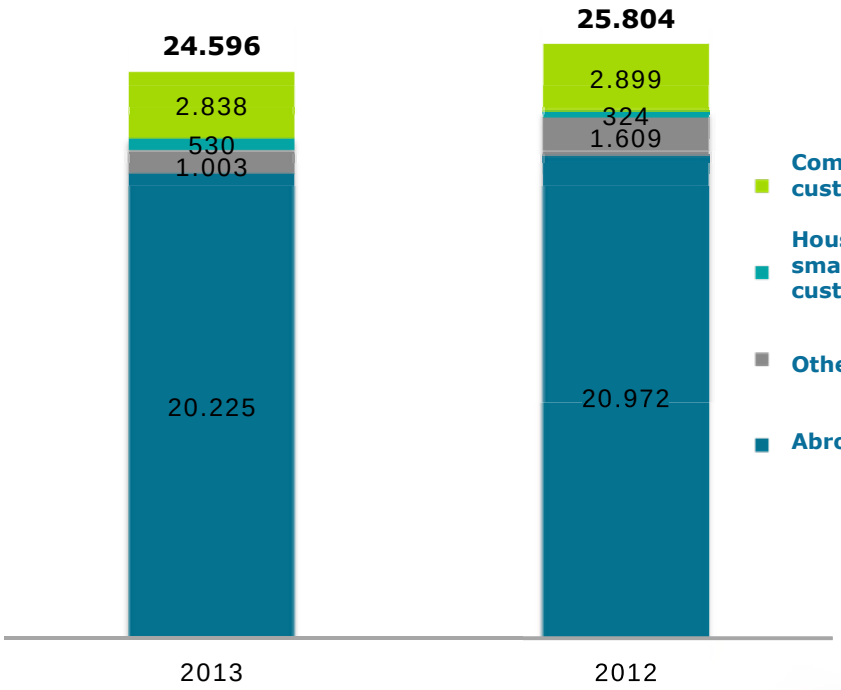


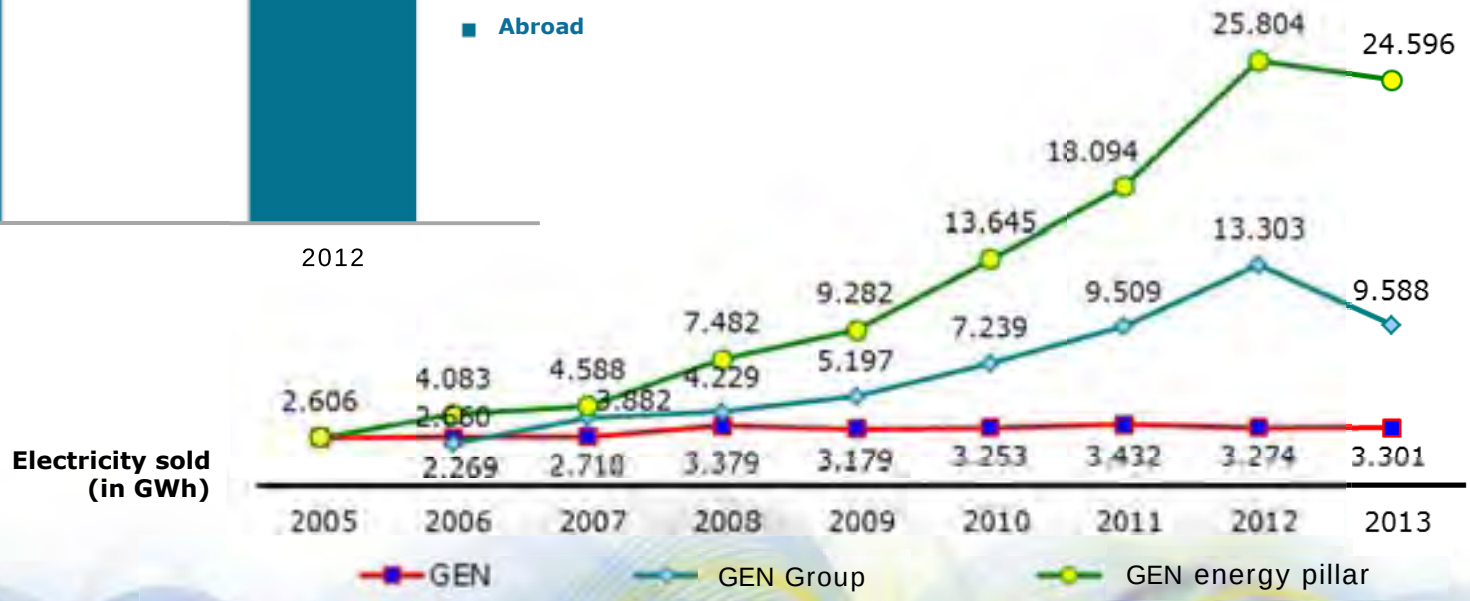

Based on sustainable energy sources

Electricity trading and sales

The increase in electricity retailing volumes and entry into the household supply segment

Electricity sold by the GEN Group (GWh)





Nuclear Slovenia

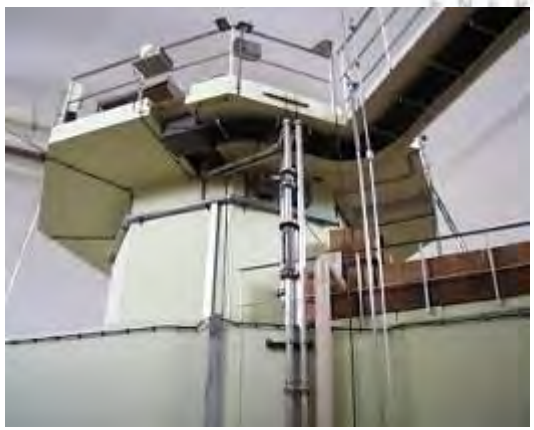
NPP Krško

Krško NPP

- Westinghouse PWR, 2 loop 700 MWe
- Commercial operation since 1983
- Ownership 50:50 Slovenia-Croatia
- Long term operation after 2043 expected
- Intensive post Fukushima improvements

Other facilities

- TRIGA research reactor
- Central Interim RW Storage
- Former Uranium Mine
- Site for Radwaste storage facility



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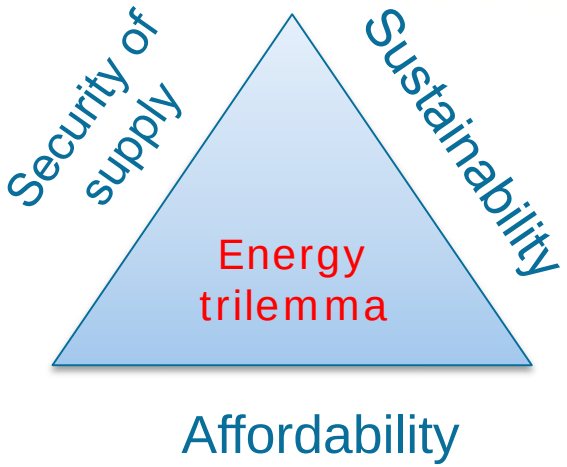
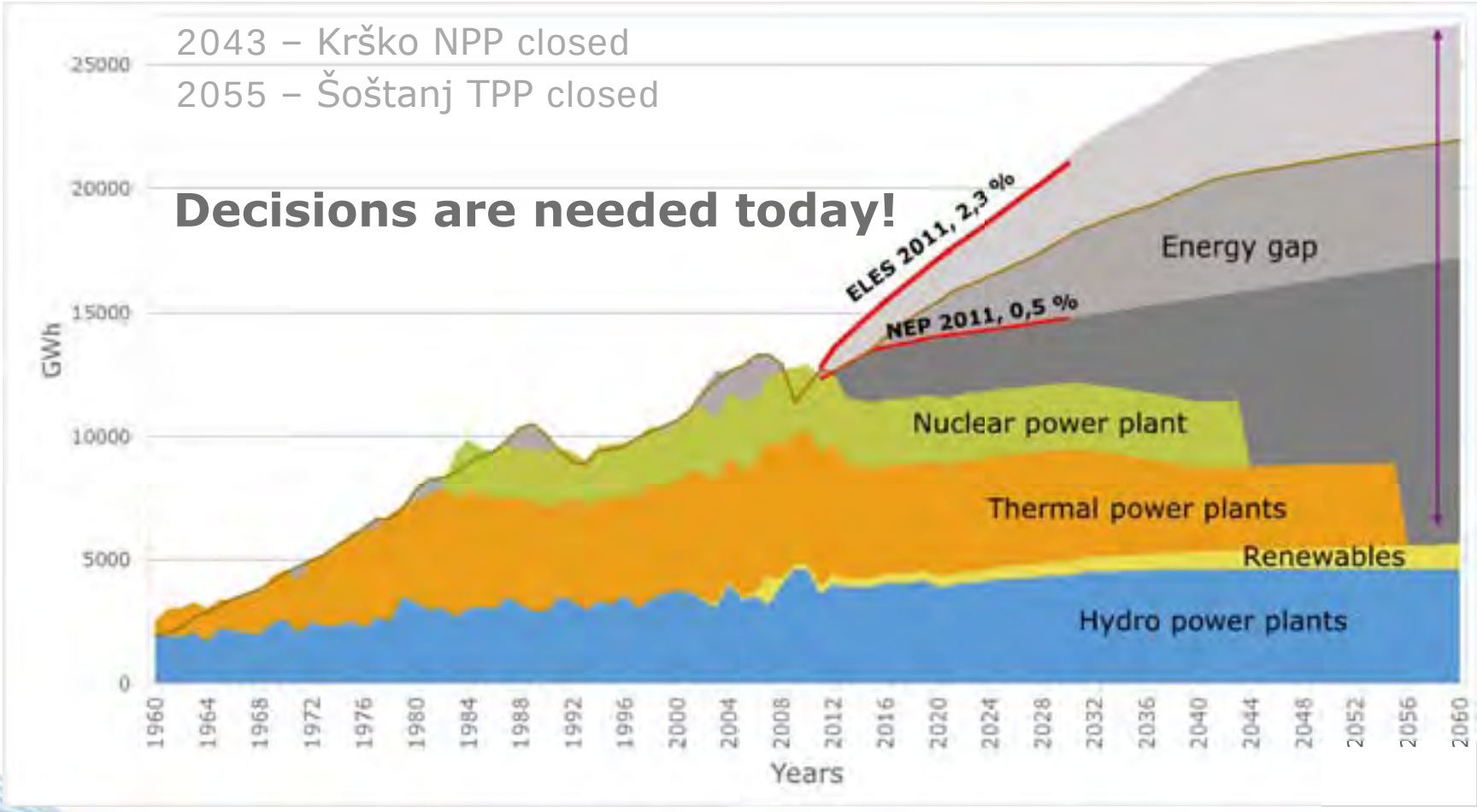
Decision levels

- **Strategic/political decision**
  - ✓ Aditional generation capacity evaluation
  - ✓ Technology selection
  - ✓ Sustainability verification
- **Regulatory decisions**
  - ✓ Site
  - ✓ Design
  - ✓ Construction
  - ✓ Operation
  - ✓ Decommissioning
- **Investment decisions after site permit**
  - ✓ Business model
  - ✓ Financial



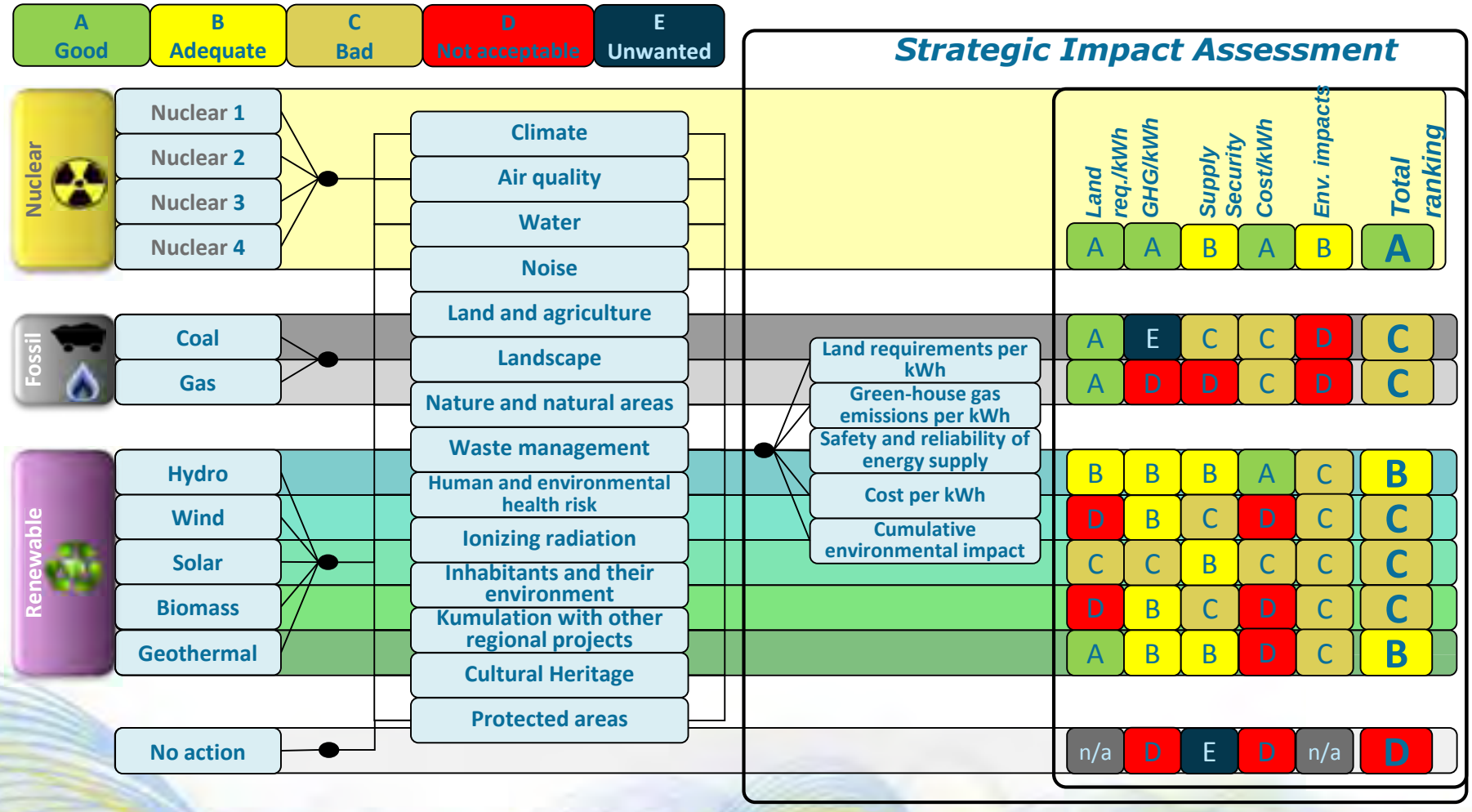
Electricity consumption & production in Slovenia 1960-2060



1 GWh = one million kWh

Technology selection model

Optimal technology selection for additional generation of electricity



Sustainable development

U.N. Report: Our Common Future – 1987

World Commission on Environment and Development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

It contains within it two key concepts:

- the concept of 'needs,
- the idea of limitations

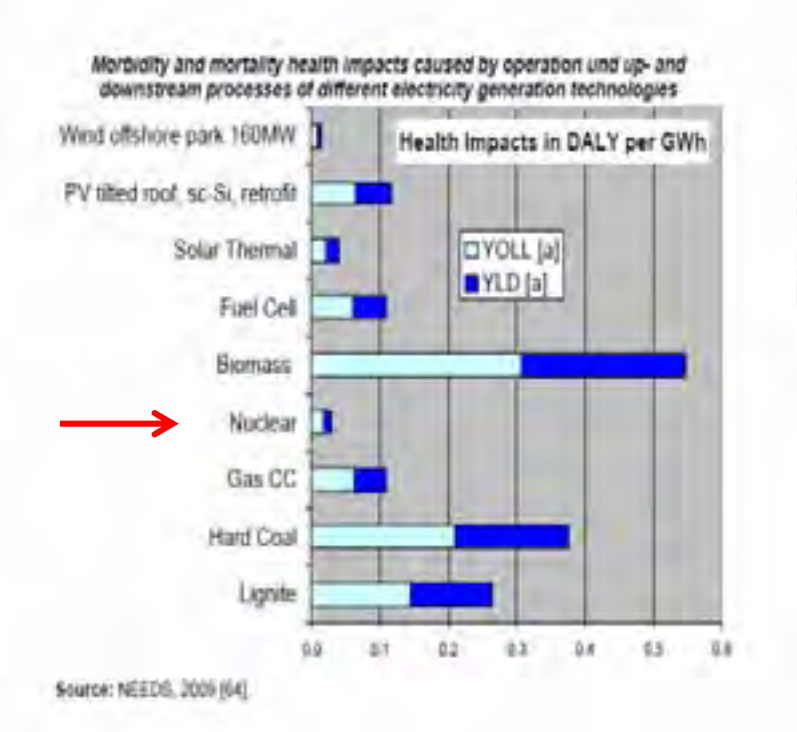
Three dimensions of sustainable development

- ✓ Social
- ✓ Environmental
- ✓ Economical

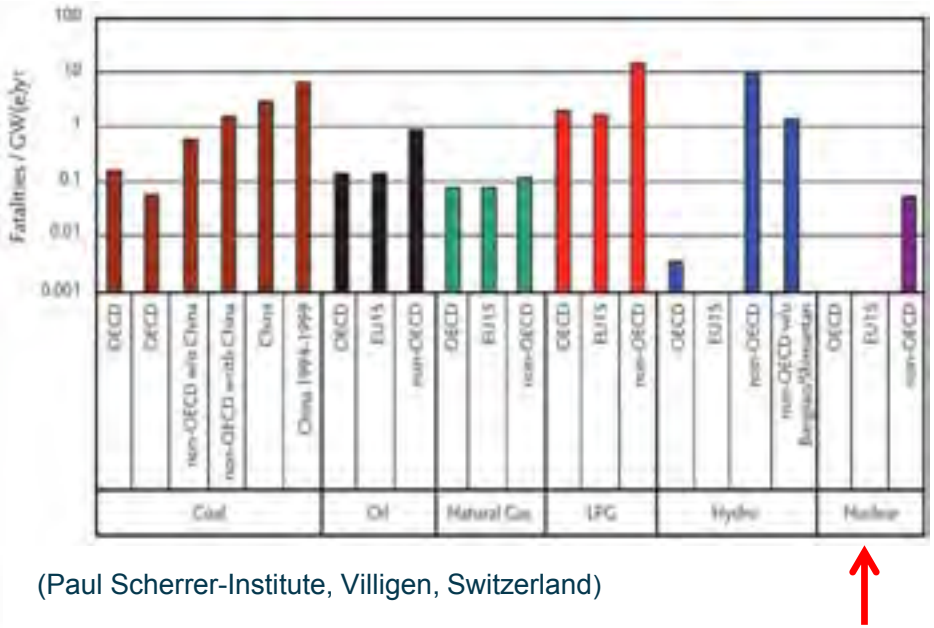
In Europe we can observe 2 trends in energy policy

- Nuclear - renewable energy mix
- Fossile - renewable energy mix and

Sustainable energy mix Nuclear + Renewable
Social dimension



(***DALY***) the ***disability-adjusted life year*** is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death.



(Paul Scherrer-Institute, Villigen, Switzerland)

- **NPP**
  - TMI, 1979, 0
  - Chernobyl, 1986, 55
  - Fukushima, 2011, 4 non radiation
- **COAL**
  - COAL, 5938 year 2005, 4746 year 2006
- **HYDRO**
  - Banqiao and Shimantan Reservoir Dam, China, 1975, 171 000
  - Sayano–Shushenskaya Dam, Russia, 2009, 75
  - Vajont, Italy, 1963, over 2000
- **OIL**
  - Jesse, pipe explosion, Nigeria 1998, 1000
- **GAS**
  - San Juanico, explosion LPG reservoir, Mexico, 1984, 600

Sustainable energy mix Nuclear + Renewable
Environmental and Economical dimension

CONTENT

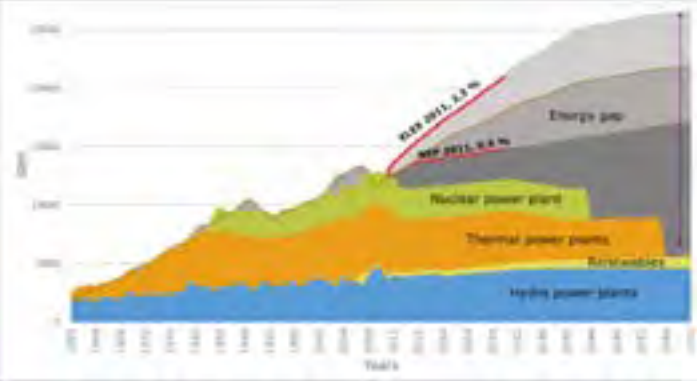
- GEN
- Project justification
- Project planning and preparation
- Future of nuclear energy and Krško2

Krško 2 Framework conditions

1. Strategic basis for the project
2. Infrastructure for nuclear energy
3. Stakeholder support
4. Acceptable technology
5. Adequate project structure
6. Economic viability and Financing

1 . Strategic basis for the project

1) Sufficient demand on electricity



2) Technical and commercial feasibility

Geology	Cooling	Grid	Logistics	Nuclear Specific

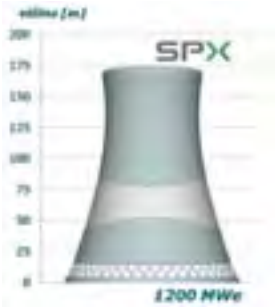
3) Socioeconomic and environmental feasibility

Land use	Socioeconomic	Environmental

Strategic basis for the project

1. Connection of smaller & larger unit

2. Circulating water cooling



3. Transport of heavy equipment

4. Construction logistic

5. District Heating

Plant layout

Upstream / West location

Downstream / East location

2. Infrastructure for nuclear energy

Design, construction, operation, fuel cycle and decommissioning of a nuclear power plant regulated and secured:

- Consolidated nuclear law and regulations with transparent structures in place and corresponding with international requirements and standards (e.g_ WENRA, IAEA).
- Predictable licensing processes – regulatory risk mitigation
- Available capacity and capability in nuclear power generation with
  - Competent regulatory body,
  - Inspectorate,
  - Specialised supplier and service compnies,
  - Human resources.
- National concept and regulation for waste management, longterm repository and decommissioning_

3. Stakeholder support

General support on the project amongst the stakeholders.

- **Public opinion is positive (in principle).**
  - On local level well above 50%
  - On national level app. 50%

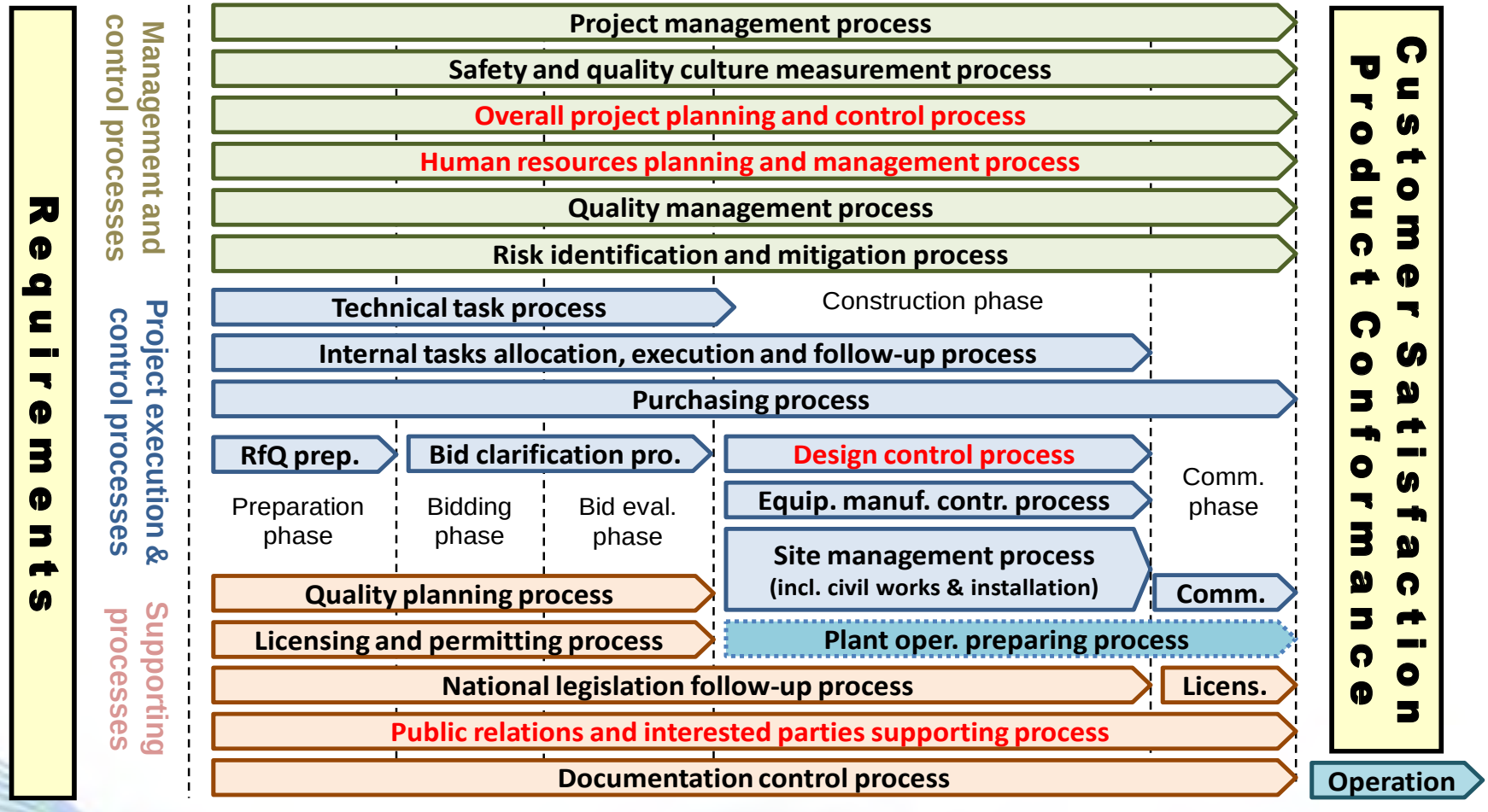
- **Major points of critique will be addressed and clearly be disabled on a national and international level by means of**
  - Mitigation of external hazards
  - Acceptable technology - GEN III

4. Acceptable technology

- **"GEN III"- designs fulfilling at least the European Utility Requirements**

- **EUR set requirements that:**
  - achieve the safety level required by EUR group
  - meet the expectations (EC Council Directive, ENSREG, WENRA)
  - meet the internationally agreed requirements, e.g. MDEP
  - are consistent with the IAEA Safety Standards

5. Adequate project structure
JEK 2 Project Process Map



6. Economic viability and Financing

Preliminary investment study

When the plant starts operating in 2025, cost for shareholders will be less than EUR 50/MWh (5 cents/kWh), including all:

- production costs,
- depreciation,
- finance costs and
- waste management

Building cost is estimated at EUR 5-6 billion EUR.

A proposed high-level financing model

- Equity resources: 35 %
- Financial resources 65%:
  - Credit loan: 35 %,
  - Bonds: 30%

Status of key studies

Completed:

- ✓ Project justification
- ✓ Project feasability
- ✓ Conceptual Design for the new NPP,
- ✓ Strategic Environmental Impact Assessment
- ✓ Pre-Investment Study of the new NPP

In preparation:

- ✓ Site Safety Analysis Report
- ✓ Environmental Impact Report
- ✓ Business and financial model

Target schedule of the Krško 2 project

Preparation	Development	Construction	Operation
2008 Strategic EIA	2016 Vendor information package	2021 Construction of the plant begins	2026 Electricity production begins
2010 Preinvestment study	2016 Site permit application	Operating Licence	60 years of operation
2014 Site characterization	2018 Shareholders agreement Biding process initiation	Fuel loading	Waste disposal
2015 Strategic/political decision	2020 Construction licence Preparatory work at the site starts		Decomissioning

2008-2015 | 2016-2020 | 2020-2025 | 2026-

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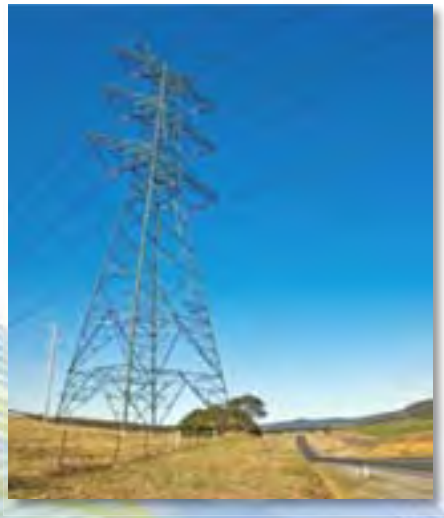
Krško 2 – future activities

- Project is still in early planning and preparation phase
- Strategic/political decision making process is expected in next year(s)
- Challenges are known and managable:
  (safety, financing, radioactive wastes, public acceptability…)
- National policy can help in solving those challenges
- Environmental, social and energy benefits are significant and justify the effort



Conclusions

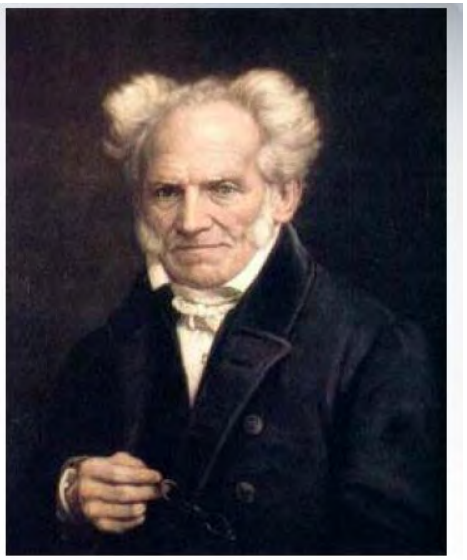
- Policy makers face critical choices in reconciling energy, environmental & economic objectives
- Changing outlook for energy production & use may redefine energy pricing, economic competiveness & geopolitical balances
- Shifting away from or towards nuclear can have significant implications for a country's energy security, electricity prices & climate change objectives
- In a resource constrained world, nuclear can be an attractive option for Slovenija

Future of nuclear energy and Krško2

Arthur Schopenhauer

„All truth passes through three stages"

- First, it is ridicules.
- Second, it is violently opposed.
- Third, it is accepted as being self-evident.



UN Rio Declaration 1992

Principle 3 of the UN Rio Declaration states
Emission-free technologies, such as nuclear energy, are essential to global sustainable development

IEA 2013 - World has stalled on clean energy

The world's governments are failing on almost every level to clean up their energy systems and must intervene to support nuclear power

G7 2014 Energy security

Energy ministers of the G7 have called for diversification of the national and global energy mix and said they will promote the use of low carbon technologies including nuclear