



# CHALLENGES AND OPPORTUNITIES FOR NEW NUCLEAR POWER PLANT CONSTRUCTION IN THE CZECH REPUBLIC AS WELL AS THE EXTENSION OF THE LIFE OF EXISTING NPPs IN ORDER TO MEET ENERGY DEMANDS

MOSCOW, OCTOBER 2016

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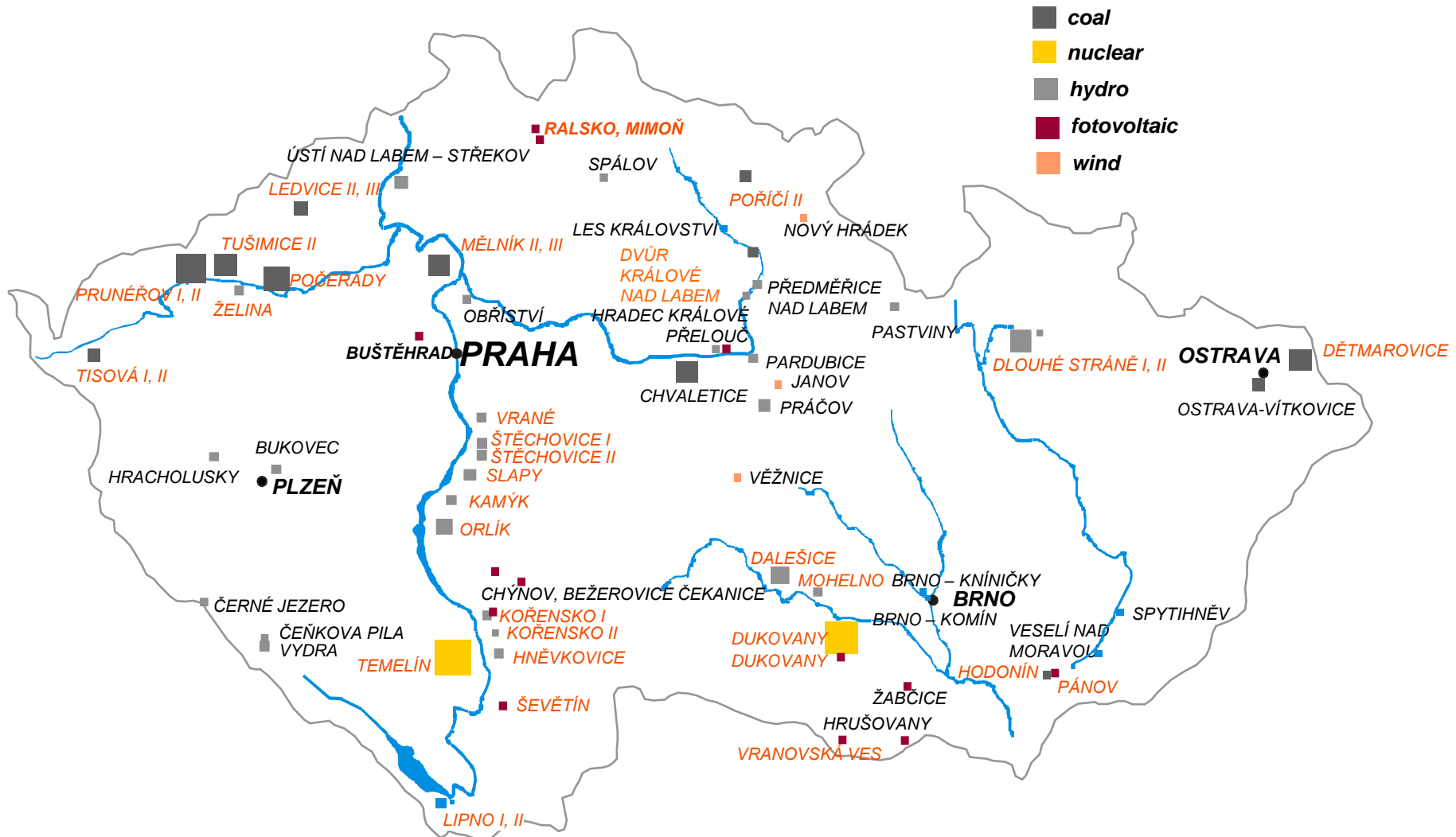
## INFORMATION ABOUT ČEZ GROUP

STATE ENERGY POLICY OF THE CZECH REPUBLIC

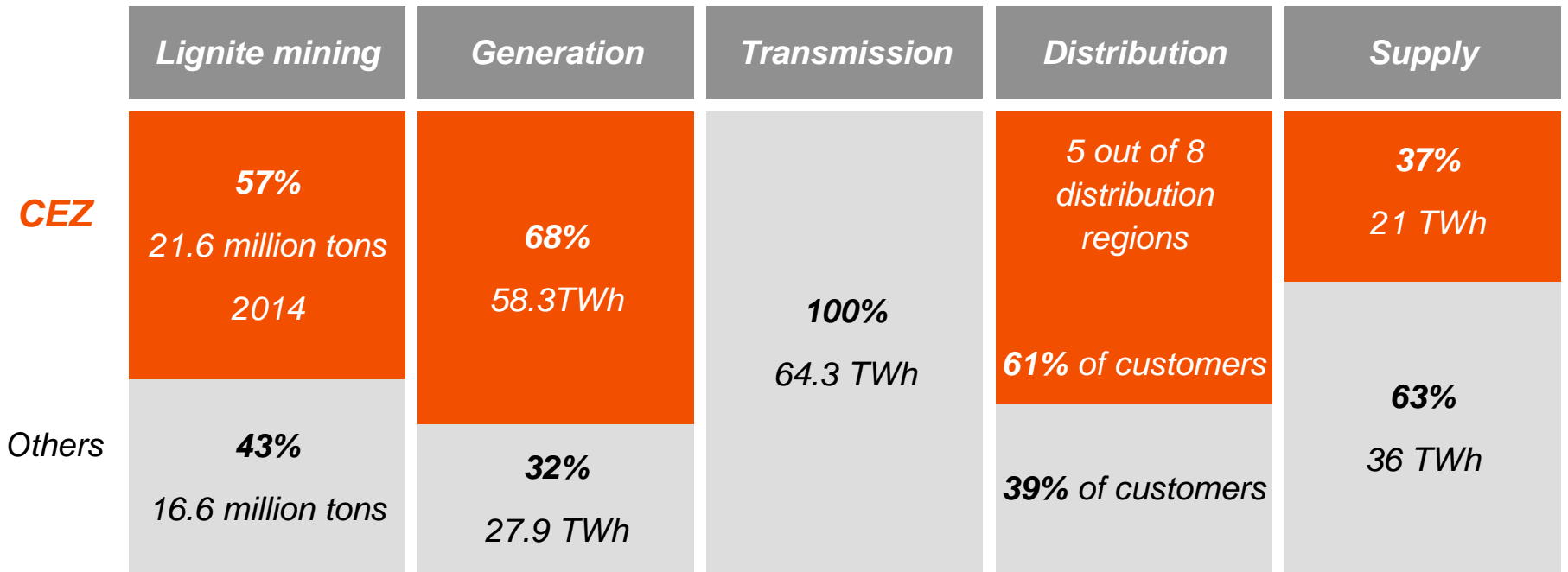
PREPARATION OF NPP TEMELIN AND DUKOVANY

LONG TERM OPERATION OF CURRENT NPP

# POWER PLANTS MAP



# CEZ IS A STRONG AND VERTICALLY INTEGRATED PLAYER IN THE CZECH ELECTRICITY MARKET



- CEZ fully owns the largest Czech mining company (SD) covering 71% of CEZ's lignite needs

- Remaining 3 coal mining companies are privately owned

- Other competitors – individual IPPs

- The Czech transmission grid is owned and operated by CEPS, 100% owned by the Czech state



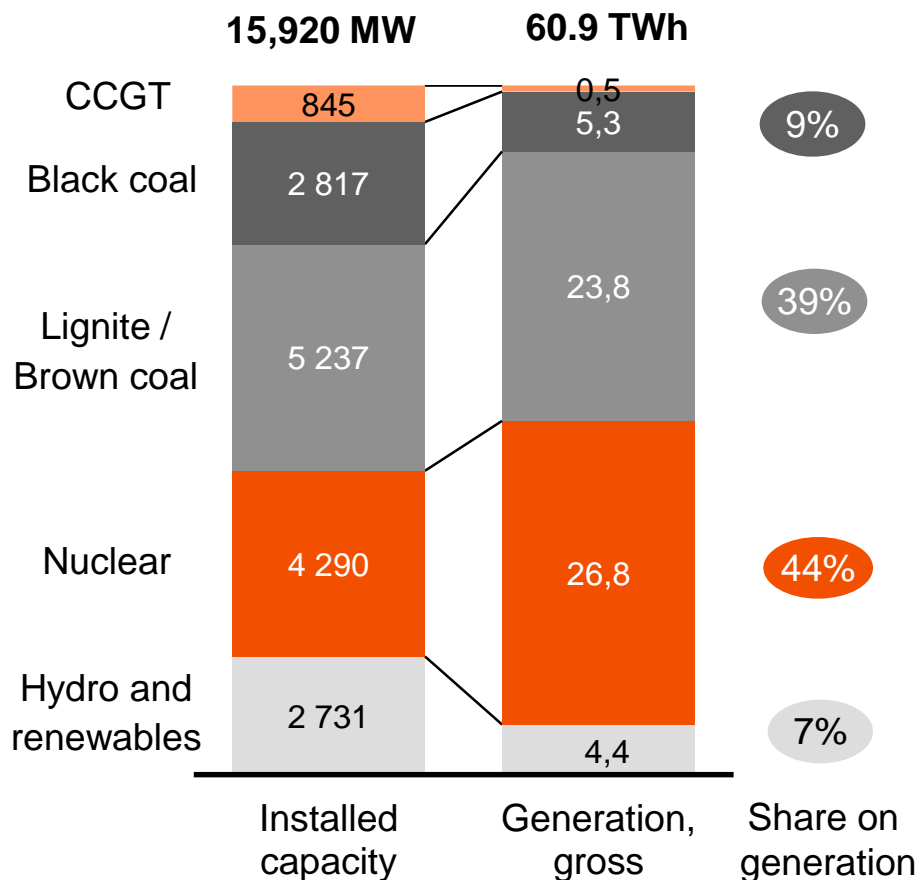
- Other competitors – E.ON, RWE/EnBW

Source: CEZ, ERU, MPO, companies' data; data for 2014 (distribution data for 2013)

# CEZ GROUP OPERATES LOW COST GENERATION FLEET, ...



## Installed capacity and generation (2015)



- **Coal power plants are using mostly lignite from CEZ's own mine**  
(67% of lignite needs sourced internally, remaining volume through long-term supply contracts)
- **Nuclear plants have very low operational costs**

**CEZ has a long-term competitive advantage of low and relatively stable generation costs**



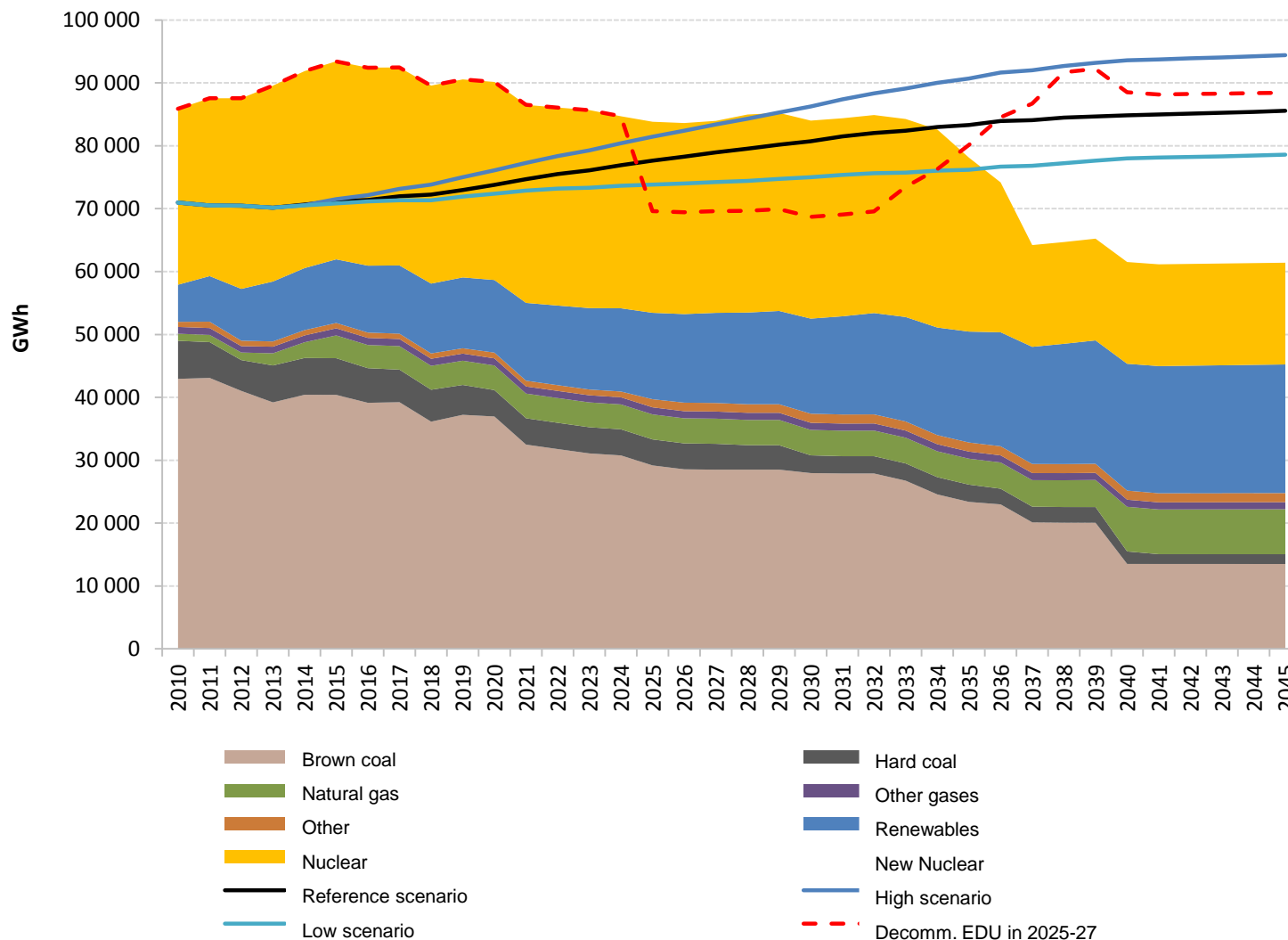
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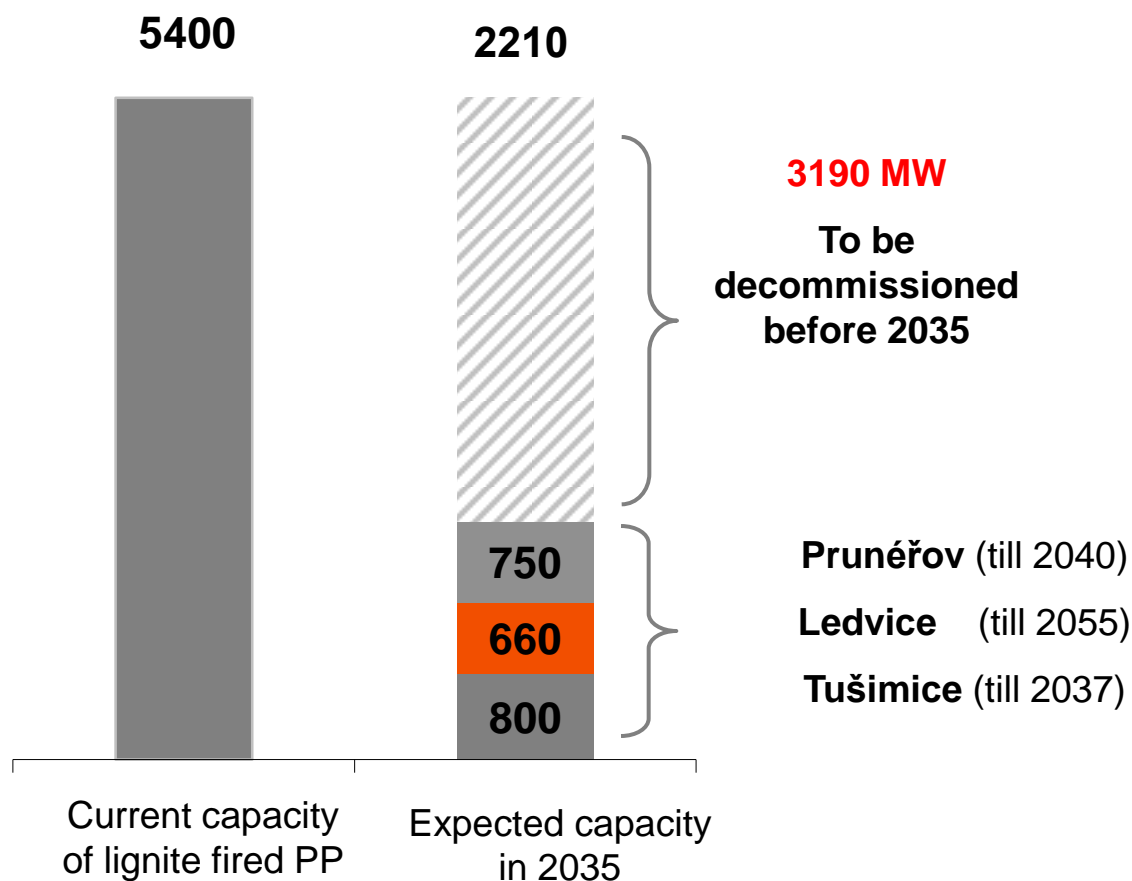
# SIGNIFICANT ENERGY DEFICIT WILL OCCUR IN 2035 (EVEN WITH EXPECTED STRONG DEVELOPMENT OF RENEWABLES)



# SIGNIFICANT PART OF LIGNITE CAPACITY WILL BE DECOMMISSIONED IN NEXT TWO DECADES



## Lignite (brown coal) capacity (MW)



- Majority of coal fired power plants will disappear from the electricity market till 2035
- Furthermore it is expected that NPP Dukovany 1-4 (2000 MW) will be decommissioned between 2035 - 37

Electricity production from power plants of approx. **7 GW** shall be replaced by new build power plants



# WHAT CAN CZECH REPUBLIC DO?

(EXCEPT OF UNREALISTIC IMPORT AND MASSIVE SAVINGS)



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- Minimal CO<sub>2</sub> emissions
- Stability of fuel supply
- Low cost of electricity



- The only fuel that is available in our region in sufficient amount
- Existing international market with black coal, import possible



- High efficiency (CCGT)
- Flexible source
- Relatively short construction period and low investment cost



- No CO<sub>2</sub> emissions
- Environmentally friendly
- Political support

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- Long construction period
- High investment
- Politically sensitive issue

- High CO<sub>2</sub> emissions
- CCS still not commercially available
- CO<sub>2</sub> price of allowances

- High gas prices
- Gas prices are unstable and difficult to predict in long term
- Total dependence on import

- Limited possibilities, strongly dependant on local conditions
- Risk for grid stability
- Expensive (depending on subsidies)

# CZECH ENERGY POLICY – CONCLUSIONS RELEVANT FOR NUCLEAR ENERGY

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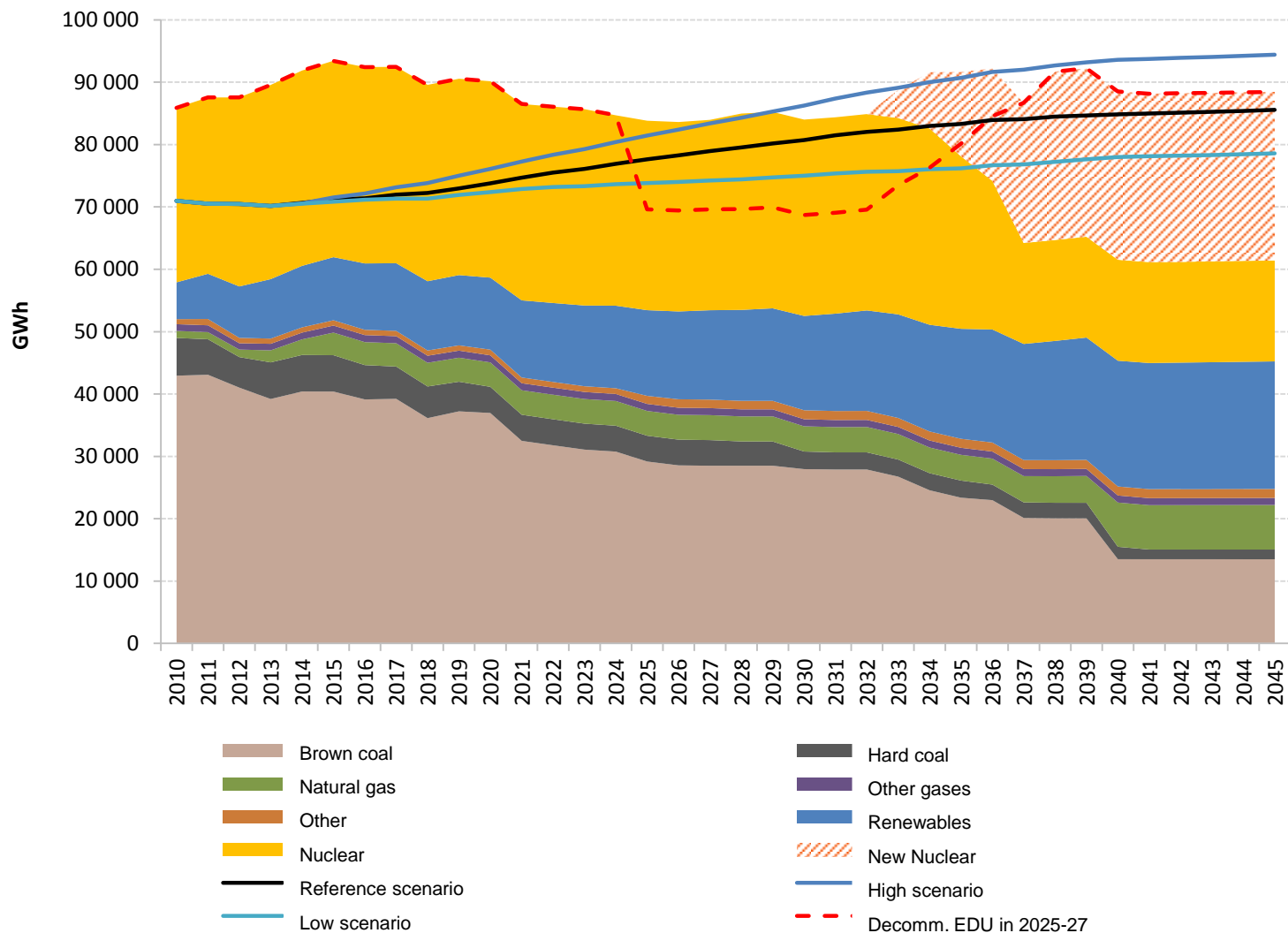
## **Czech Energy Policy** (approved in May 2015)

- Nuclear energy will reach approx. 50% share of total production of electrical energy
- Long term operation of existing NPP Dukovany (at least 50 years, it means till 2035-7)
- preparation of new nuclear units at the existing locations of nuclear power plants with a total capacity to 2 500 MW
- another unit after decommissioning of current Dukovany units
- Identification of the locality for further construction of NPP

## **Czech National Strategy to Develop NPP** (approved in June 2015)

- for elimination of licensing and permitting risks to prepare 2 new units at each site (Dukovany and Temelin) and to achieve construction permits till 2025
- to make decision how many units will be constructed at each site

ACCORDING TO STATE ENERGY POLICY THE NUCLEAR ENERGY WILL REACH  
APPROX. 50 % OF THE TOTAL ENERGY PRODUCTION IN THE CZECH REPUBLIC

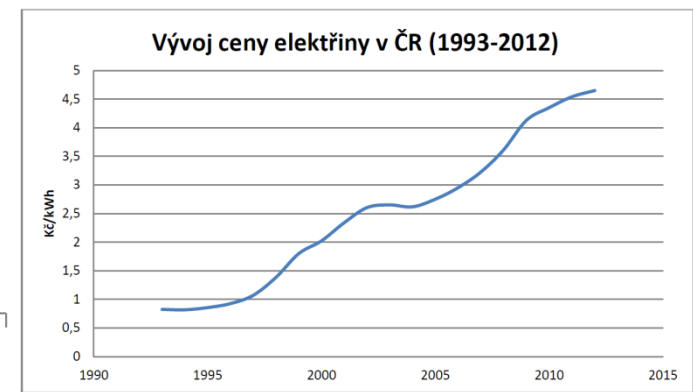
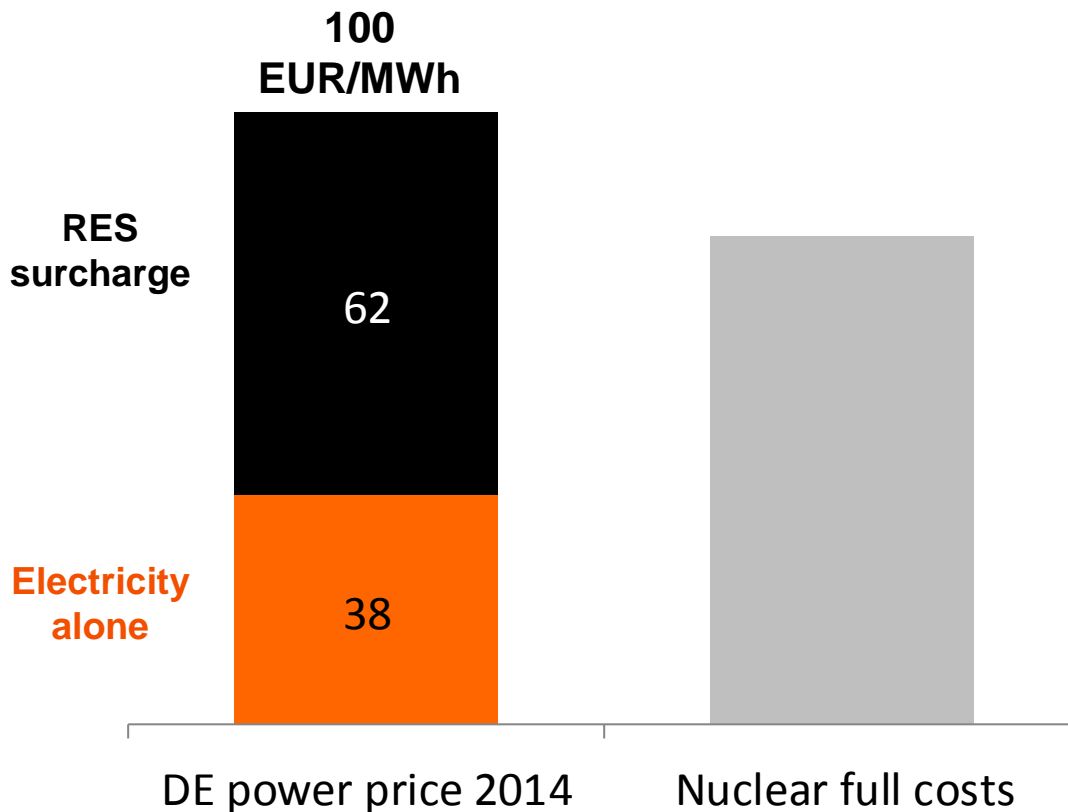


# NUCLEAR OFFERS A LOW – EMISSION, LOW COST SOLUTION FOR COUNTRIES STILL WORKING ON ECONOMIC CONVERGENCE TO EU CORE



## Electricity price in Germany compared with nuke full cost

EUR/MWh





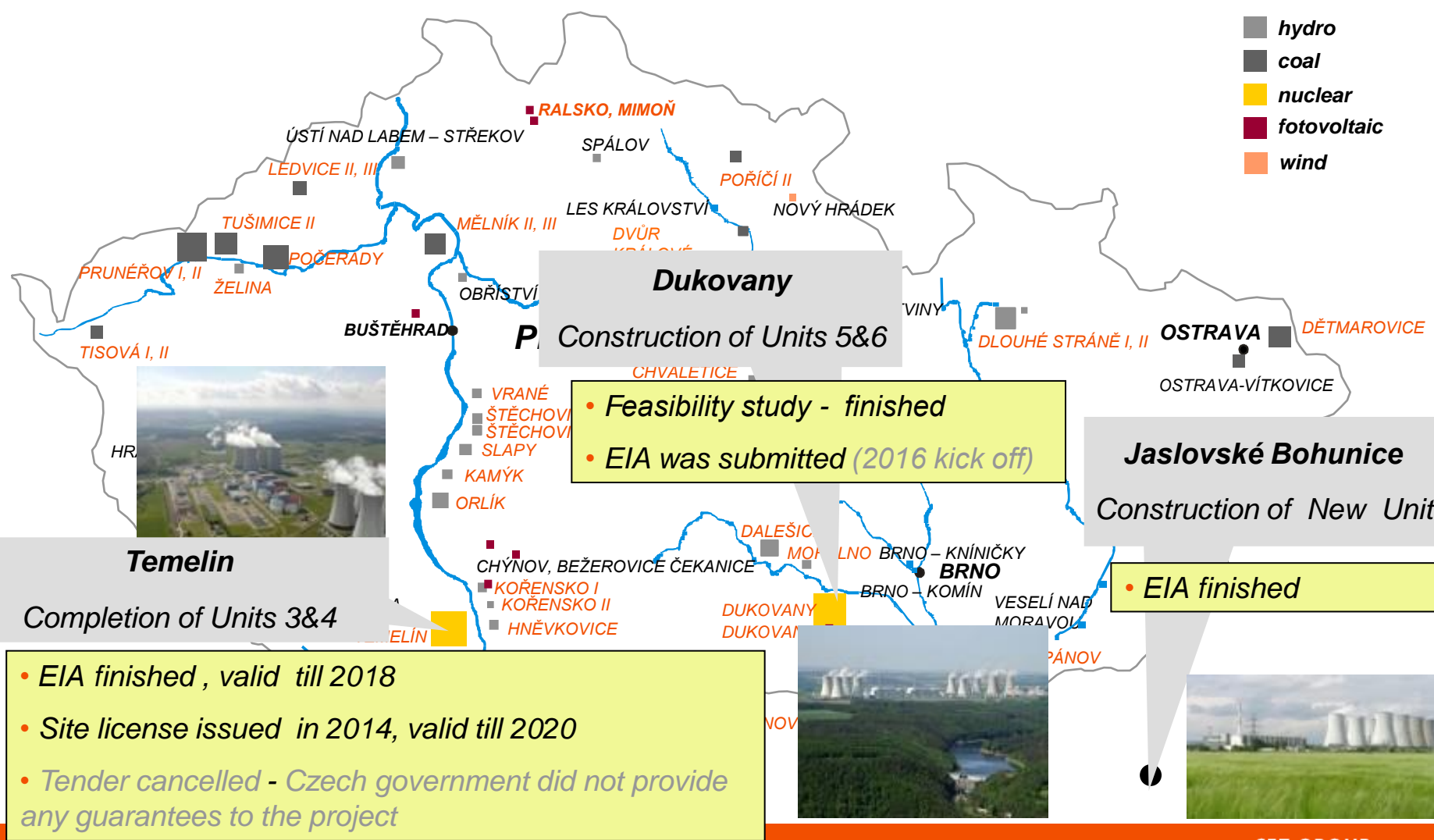
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# STATUS OF NEW BUILDS DEVELOPED BY CEZ



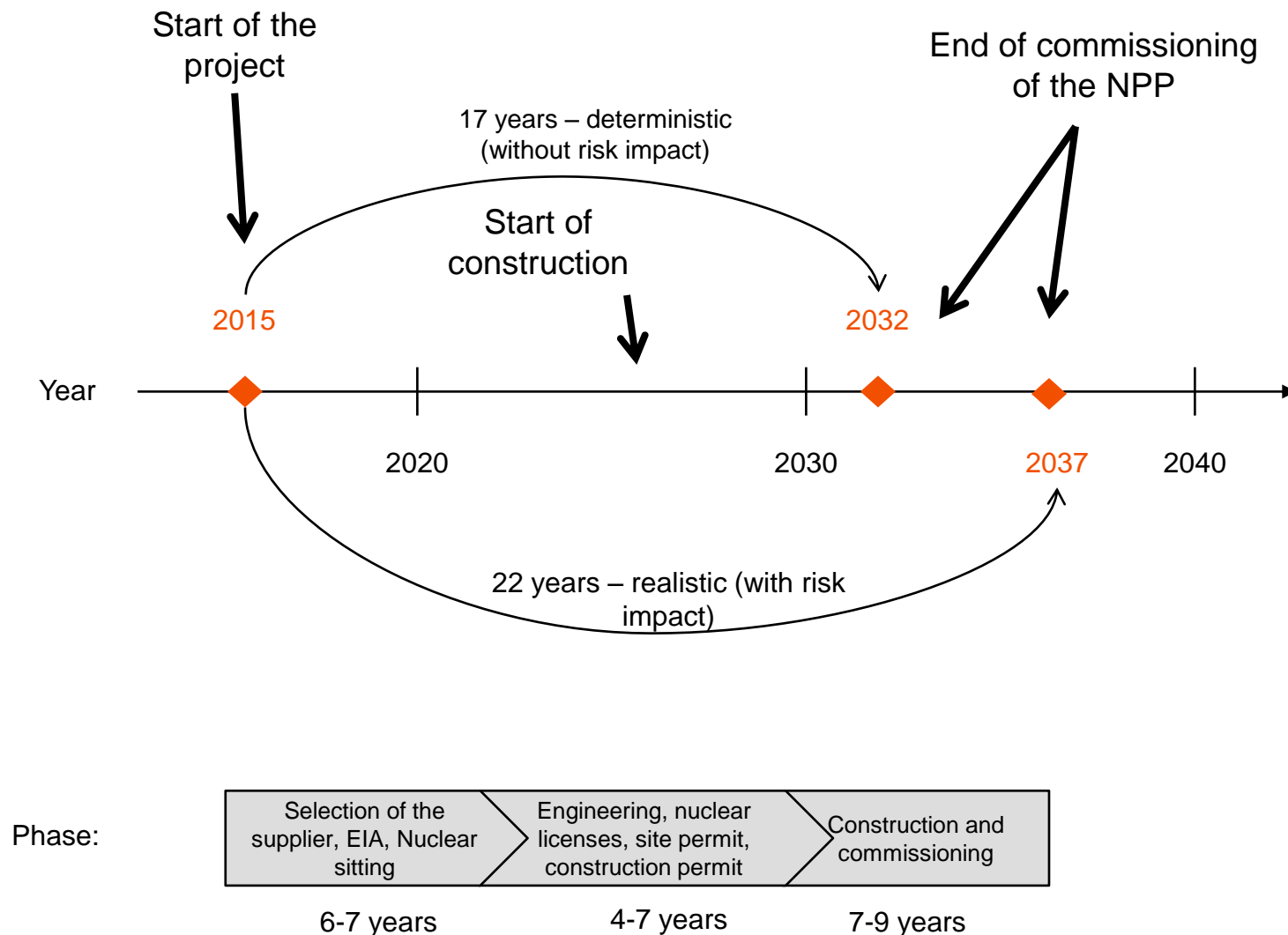
# NATIONAL ACTION PLAN DEFINES FOLLOWING APPROACH

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- **Restart preparation works on NPP Temelín project and continue on NPP Dukovany project**
  - Preparation works to be done for 2 units on each site (land, permits, licenses)
  - Current expectation is to build 1 unit on each site only
  - However with possible extension to 2 units on respective site in case of need
- **Carve out both projects into project companies** to enable future entry of the state or strategic partner
- **Start the discussion with EU** (tender approach, allowable financing models, assurance of the project feasibility)
- **Decide and approve the final investment and delivery model** in order to assure feasibility of the project .
- **Preparation of the Czech legislation modification** in order to enable acceleration of the preparation works

# PREPARATION AND CONSTRUCTION OF THE NPP IS LONG JOURNEY AND THEREFORE SHOULD START IMMEDIATELY





# EXAMPLES OF POSSIBLE PWR VENDORS OF GENERATION III+



 <p>AP1000</p>	<p>USA</p>  <p>Westinghouse</p> <p>1200MW<sub>e</sub>*</p>	<p>Francie</p>  <p>AREVA</p> <p>1750MW<sub>e</sub>*</p>	 <p>EPR1600</p>
 <p>CAP1400</p>	<p>Čína</p>  <p>SNPTC</p> <p>1500MW<sub>e</sub>*</p>	<p>Čína</p>  <p>CGN CNNC</p> <p>1150MW<sub>e</sub>*</p>	 <p>HL1000</p>
 <p>EU1700</p>	<p>Japonsko</p>  <p>MITSUBISHI HEAVY INDUSTRIES, LTD.</p> <p>1700MW<sub>e</sub>*</p>	<p>Francie + Japonsko</p>  <p>ATMEA</p> <p>1200MW<sub>e</sub>*</p>	 <p>ATMEA1100</p>
 <p>MIR1200 VVERTOI VVER 1500</p>	<p>Rusko</p>  <p>ACB-ASF</p> <p>1200 – 1500 MW<sub>e</sub>*</p>	<p>Korea</p>  <p>KHNP</p> <p>1200 – 1455 MW<sub>e</sub>*</p>	 <p>APR+ APR1400 APR1000+</p>

\* Uveden hrubý elektrický výkon



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# DUKOVANY NPP



- In operation since 1985
- Type of reactor VVER 440 type V 213
- Installed capacity 4 x 440 MW (4 x 510 MW)
- Dukovany NPP produces about 20 % of Czech electricity
- Dukovany NPP among 13 % top NPPs world-wide based on results in operational and safety performance indicators

DUKOVANY NPP	Unit 1	Unit 2	Unit 3	Unit 4
First criticality	1985	1986	1986	1987
Design lifetime (30 year)	2015	2017	2017	2017

# TEMELIN NPP



- In operation since 2002
- Type of reactor VVER 1000 type V320
- Installed capacity 2 x 1000 MW (1055 MW)
- Temelín NPP is the largest energy source in CR
- Temelín NPP is built and designed at the highest level of safety

Temelín NPP	Unit 1	Unit 2
First criticality	2000	2002
Design lifetime (30 year)	2030	2032

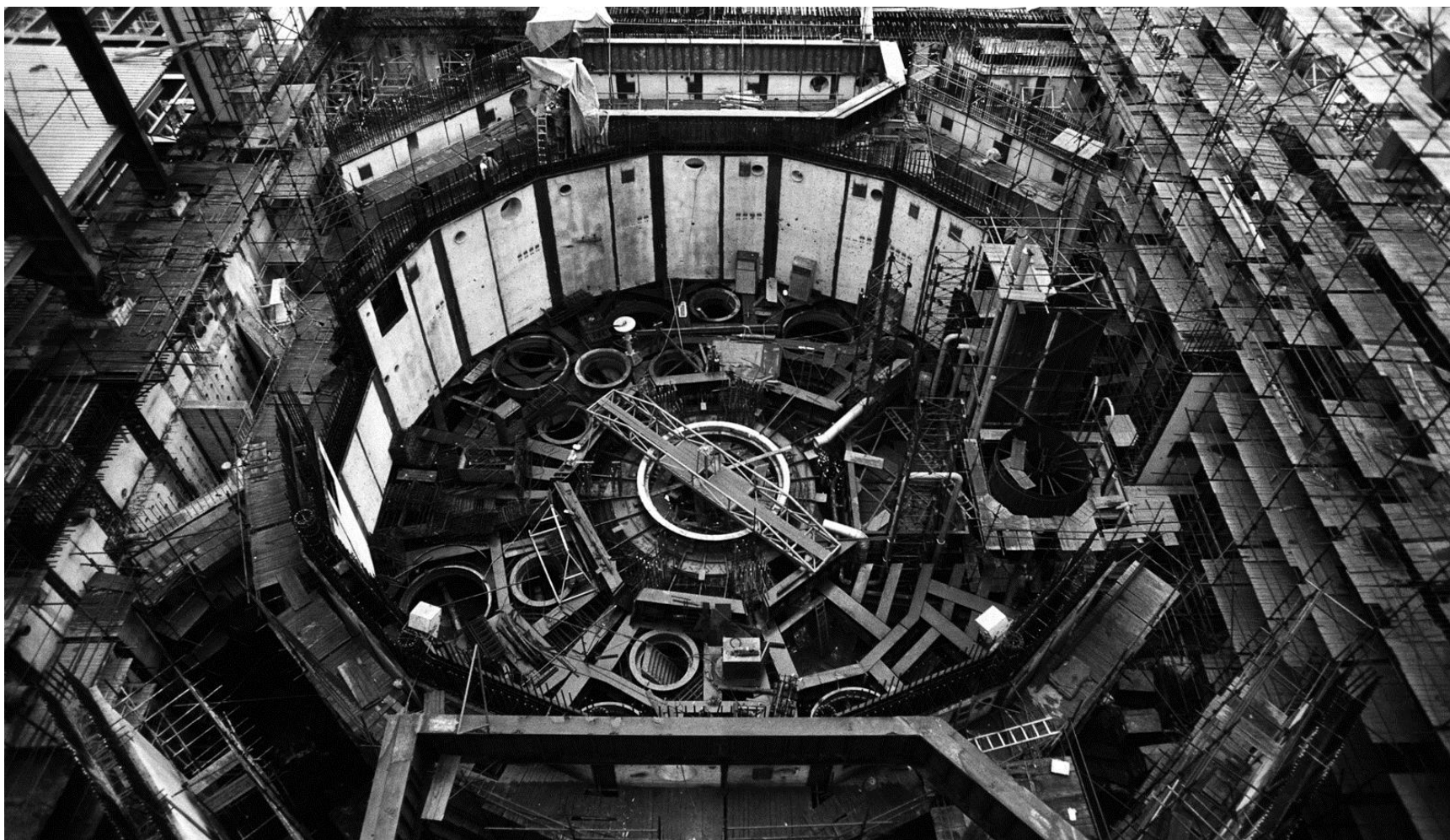


# 1980 – DUKOVANY COOLING TOWER UNIT 1

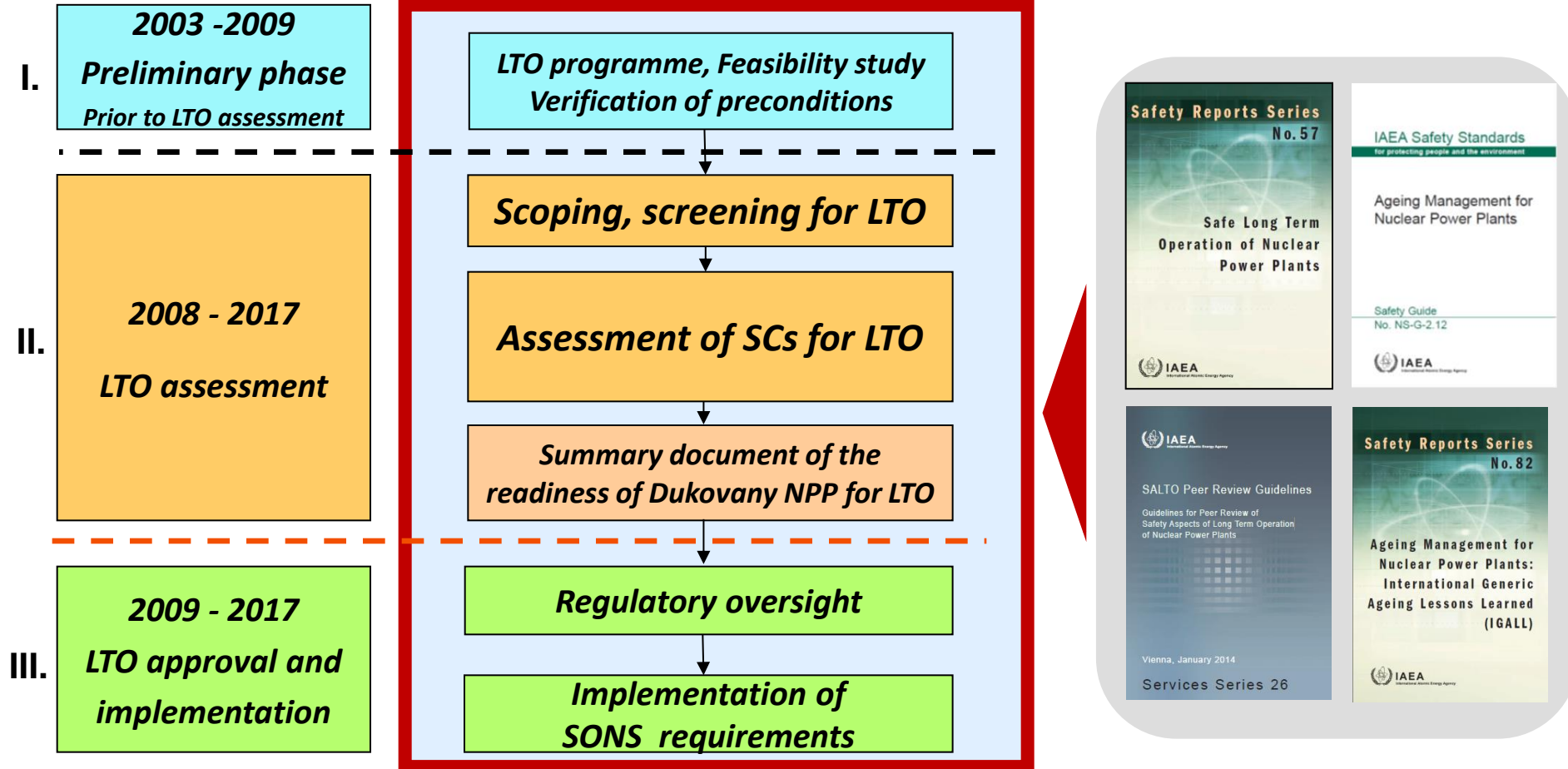




# 1982 DUKOVANY UNIT 1 REACTOR PIT



# LTO PROGRAMME PREPARATION AT DUKOVANY NPP ACCORDING TO IAEA



**PART OF LTO PREPARATION IS IMPLEMENTATION OF CORRECTIVE MEASURES - SONS requirements from previous Permit, measures from PSR etc.**

# LTO PROGRAMME PREPARATION AT DUKOVANY NPP



- LTO preparation is based on the requirements of the Atomic Act, the Nuclear Safety Regulation and the best international practices
- Technical - Economic Study of Dukovany NPP LTO demonstrates technical feasibility and economic profitability of Dukovany NPP LTO with perspective for up to 60 years of operation, but legal requirements (nuclear safety etc.) are changing continuously
- International verification of LTO preparation - SALTO Peer Review missions IAEA and IGALL Programme
- New Operational Permit for Unit 1 was issued on 30. 3. 2016 for an indefinite period (with many conditions)
- Unit 2, January 2017, Request for LTO to continue operating beyond July 10, 2017
- Unit 3 and 4, July 2017, Request for LTO to continue operating beyond December 2017





# LTO PROGRAMME PREPARATION AT TEMELIN NPP



- Temelin NPP is significantly younger than Dukovany NPP
- Unit 1 was put to Operation in 2000 (Unit 2 in 2002)
- design lifetime is 30 years (2030 for Unit 1, 2032 for Unit 2 )
- main activities have been launched for LTO sufficiently in advance
- using the experiences from LTO Programme at Dukovany NPP
  - preparation of Technical - Economic Feasibility study (2015 – 2018)
  - Ageing management programs were implemented at the same time for both NPPs
  - evaluation of Ageing management programs and evidence of Time-Limited Aging Analyses (2016-2018)
  - using the experiences from IGALL and SALTO PR missions





**THANK YOU**



**FOR YOUR ATTENTION**