# The Czech National Action Plan for Development of the Nuclear Sector in the Czech Republic and its Implementation

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MINISTRY OF INDUSTRY AND TRADE

Lenka Kovačovská
Deputy Minister
Ministry of Industry and Trade Czech Republic

# The role of nuclear energy according to strategic documents

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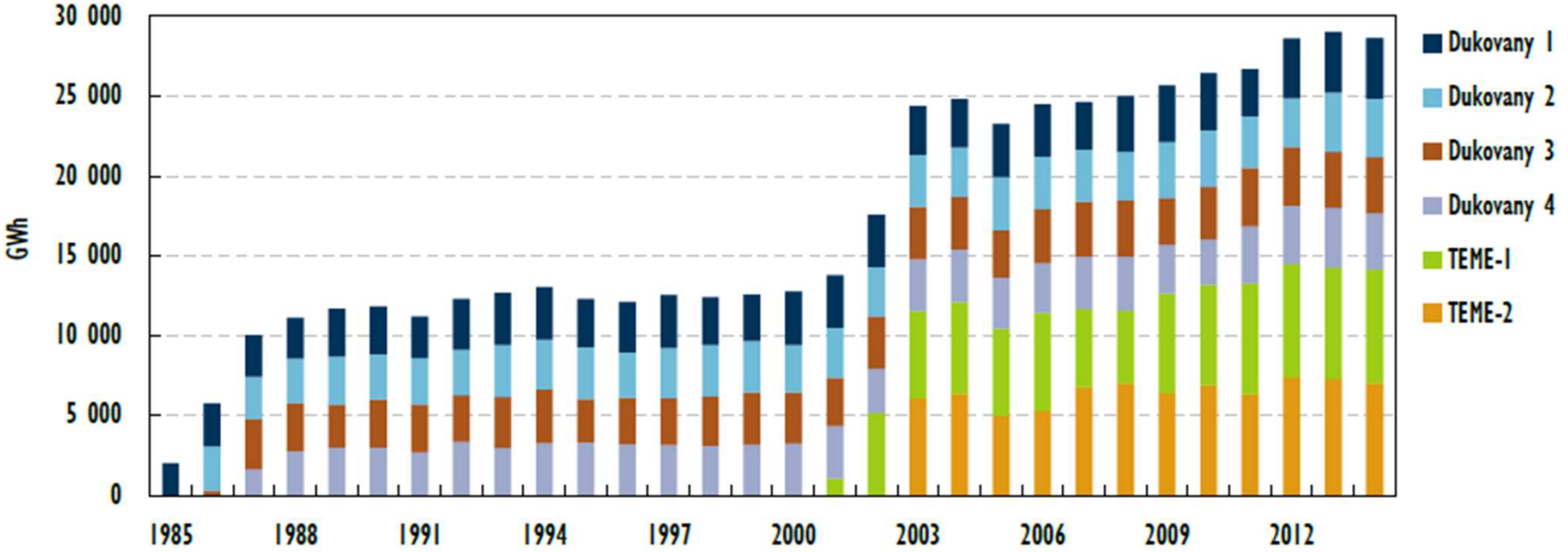
Electricity supply from six operating NPPs, 1985-2014




Note: GWh = gigawatt hours.

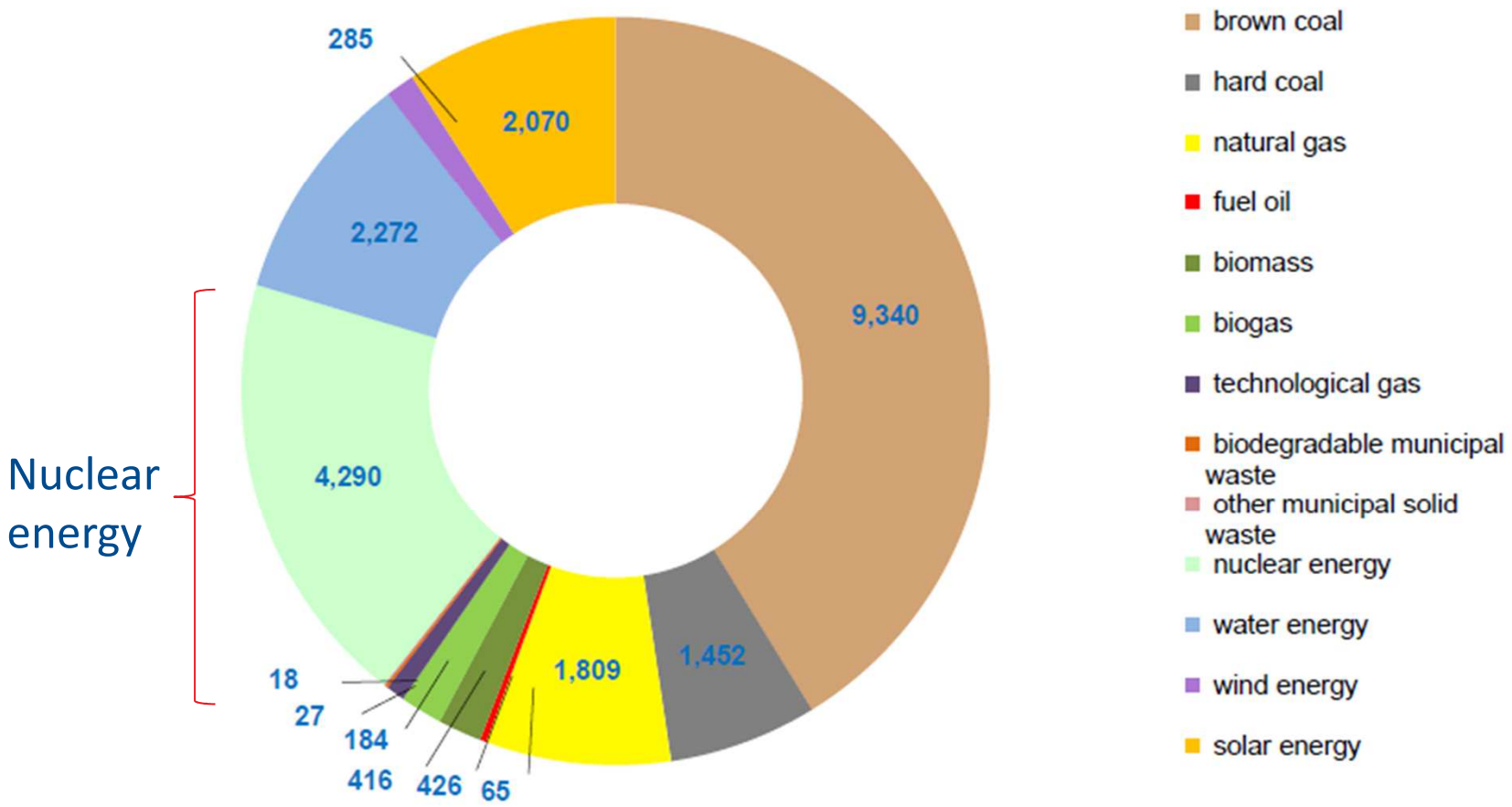
Source: IAEA (2015), *Power Reactor Information System*, IAEA, Vienna.

- The Czech Republic operates two nuclear power plants – NPP Temelín (2x1125 MW) and NPP Dukovany (4x510 MW) with total of six VVER operating units.
- NPP Dukovany is currently entering long term operation being in operation for 30 years.
- Both NPP are owned and operated by partially state owned utility ČEZ, a.s.

# Nuclear Industry Structure - overview

- There are **currently no enrichment, nuclear fuel fabrication or reprocessing facilities** in the Czech Republic.
- All the **nuclear fuel is currently supplied by TVEL fuel company** based on the long term contract. Other supplier is also possible for NPP Temelnín (for Dukovany only theoretically). NPP Temelín previously used the fuel from Westinghouse company.
- **High-level radioactive waste is currently stored in interim storage facilities** located at current NPP sites. **By 2025 the location of permanent repository should be found** with start of operation by 2065.
- There are **four near-surface repositories in the Czech Republic**, namely the Radioactive Waste Repositories Richard near Litoměřice, Bratrství near Jáchymov, Dukovany and Hostim near Beroun (that is closed).
- **Uranium mine Rožná in locality Dolní Rožínka, one of the oldest uranium mine in Europe (mining started in 1957) was closed in 2017**. Till 2016 total of 20,494 tons of uranium concentrate – ammonium diuranate has been extracted.

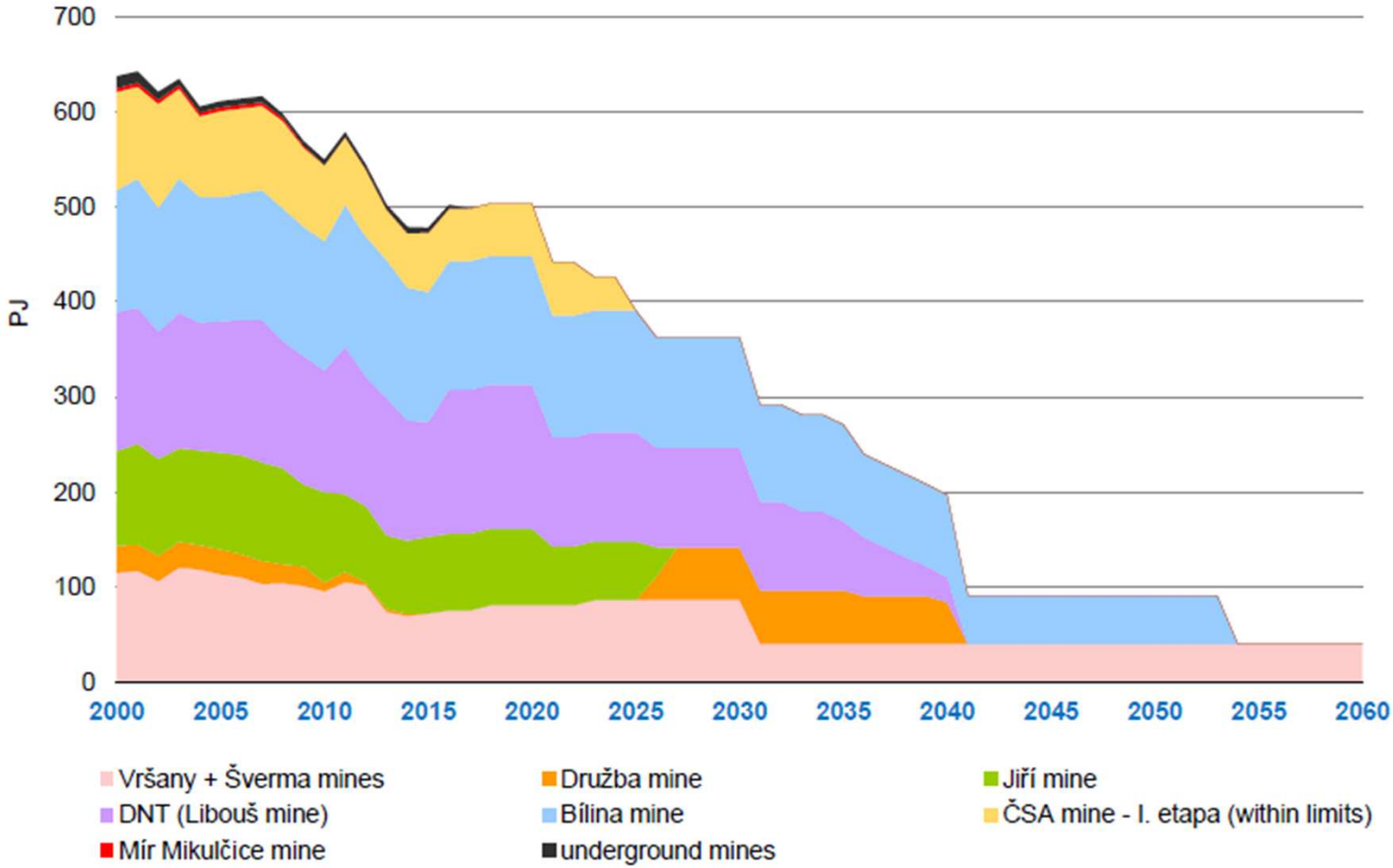
## Installed capacity in the Czech Republic – 2016 (MW)




Nuclear energy

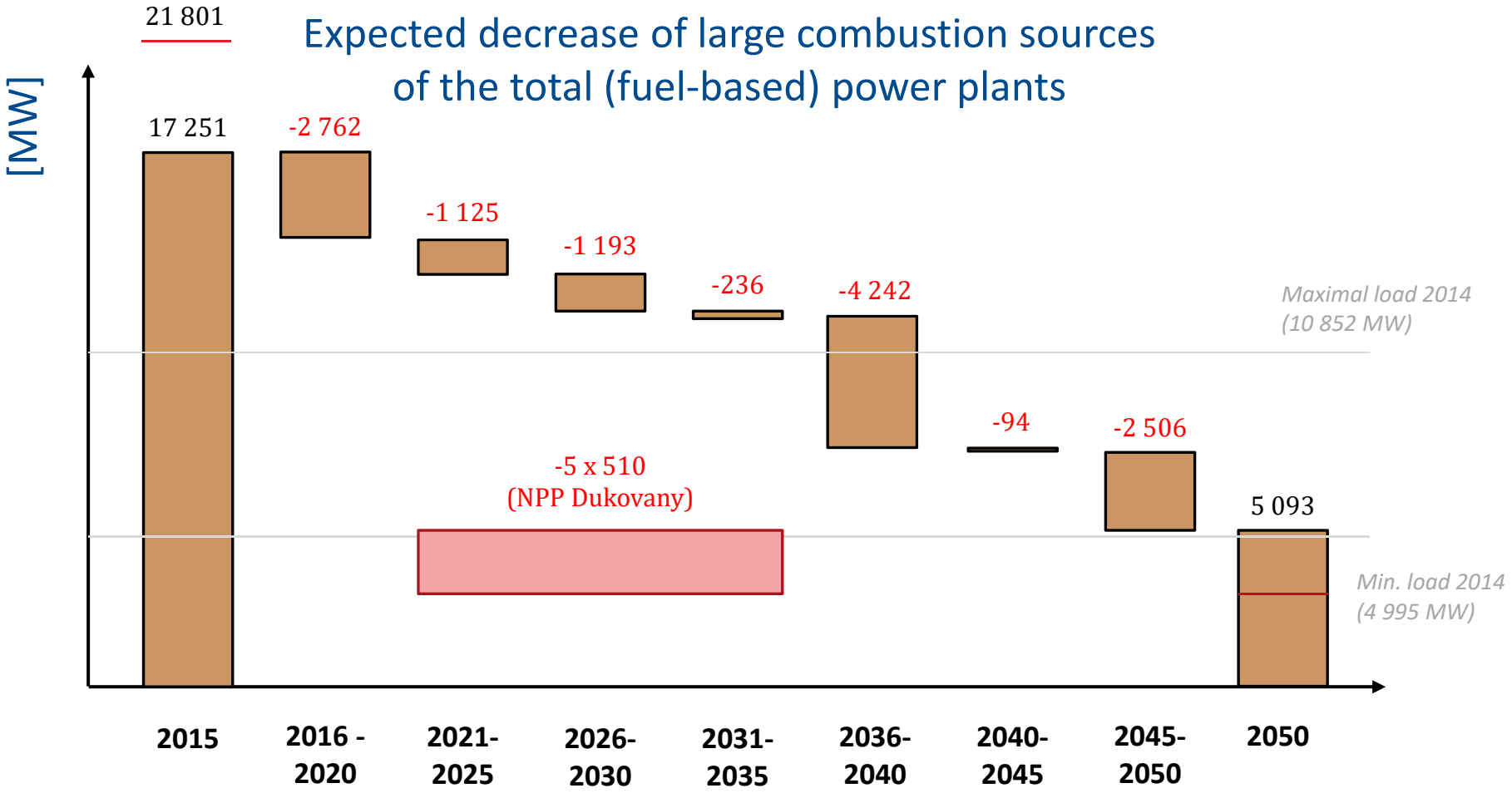
Nuclear energy plays an important role in Czech Republic´s generation portfolio; contributing to app. 35 % of annual electricity production.

## Brown coal mining in the Czech Republic

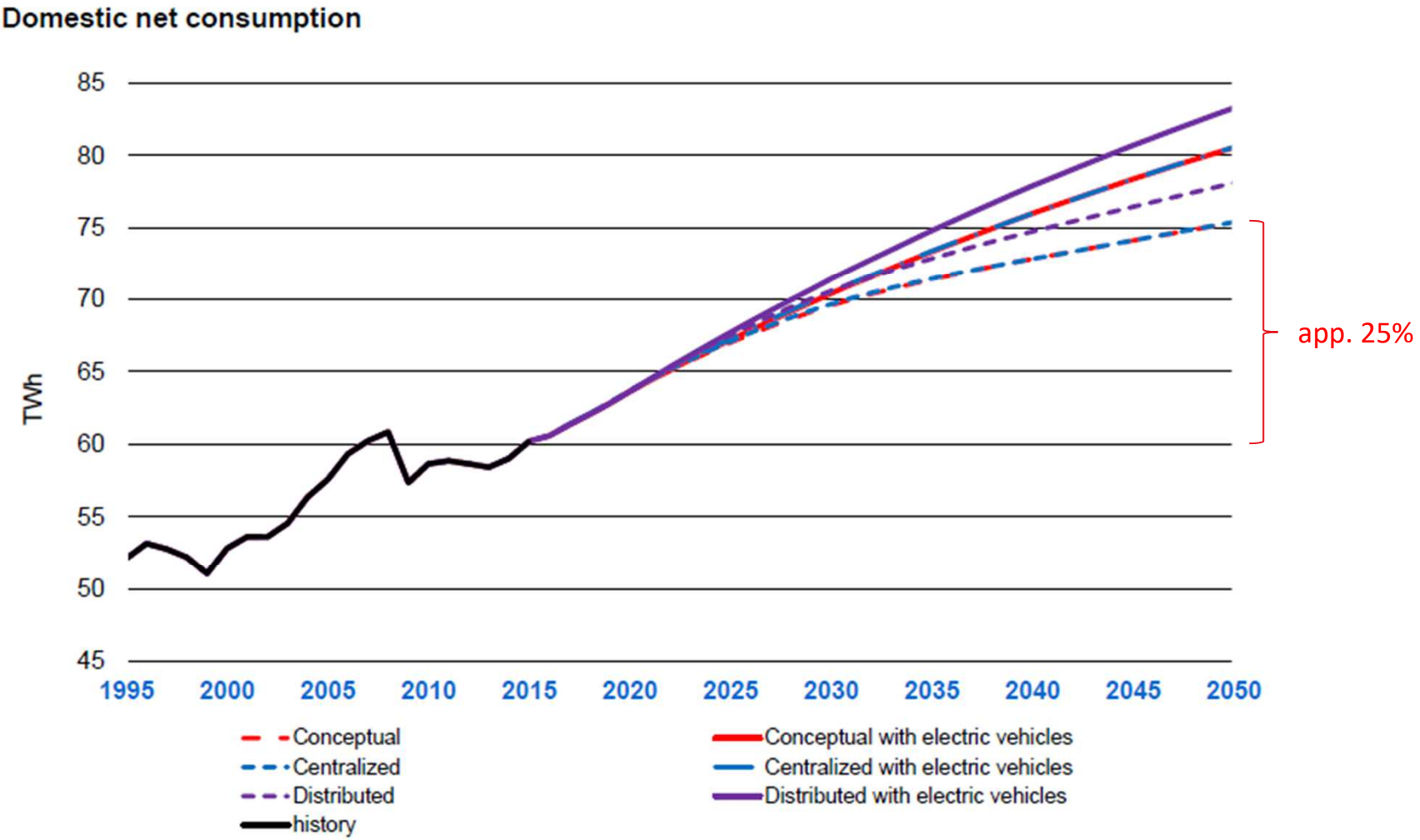



Usage of the Czech Republic´s largest primary energy source brown coal would gradually decline, however only partially due to depletion of domestic reserves.

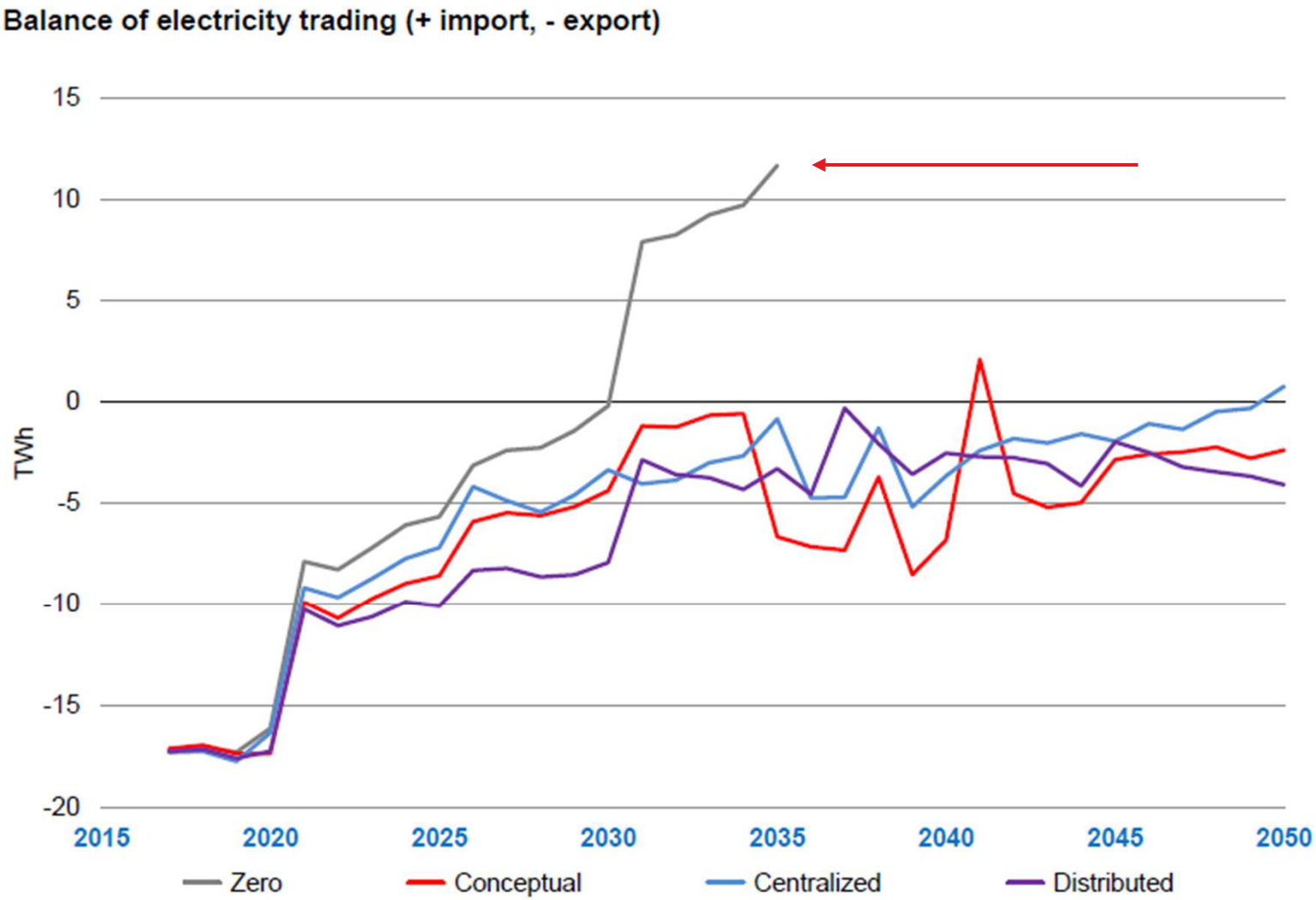
## Expected decrease of large combustion sources of the total (fuel-based) power plants



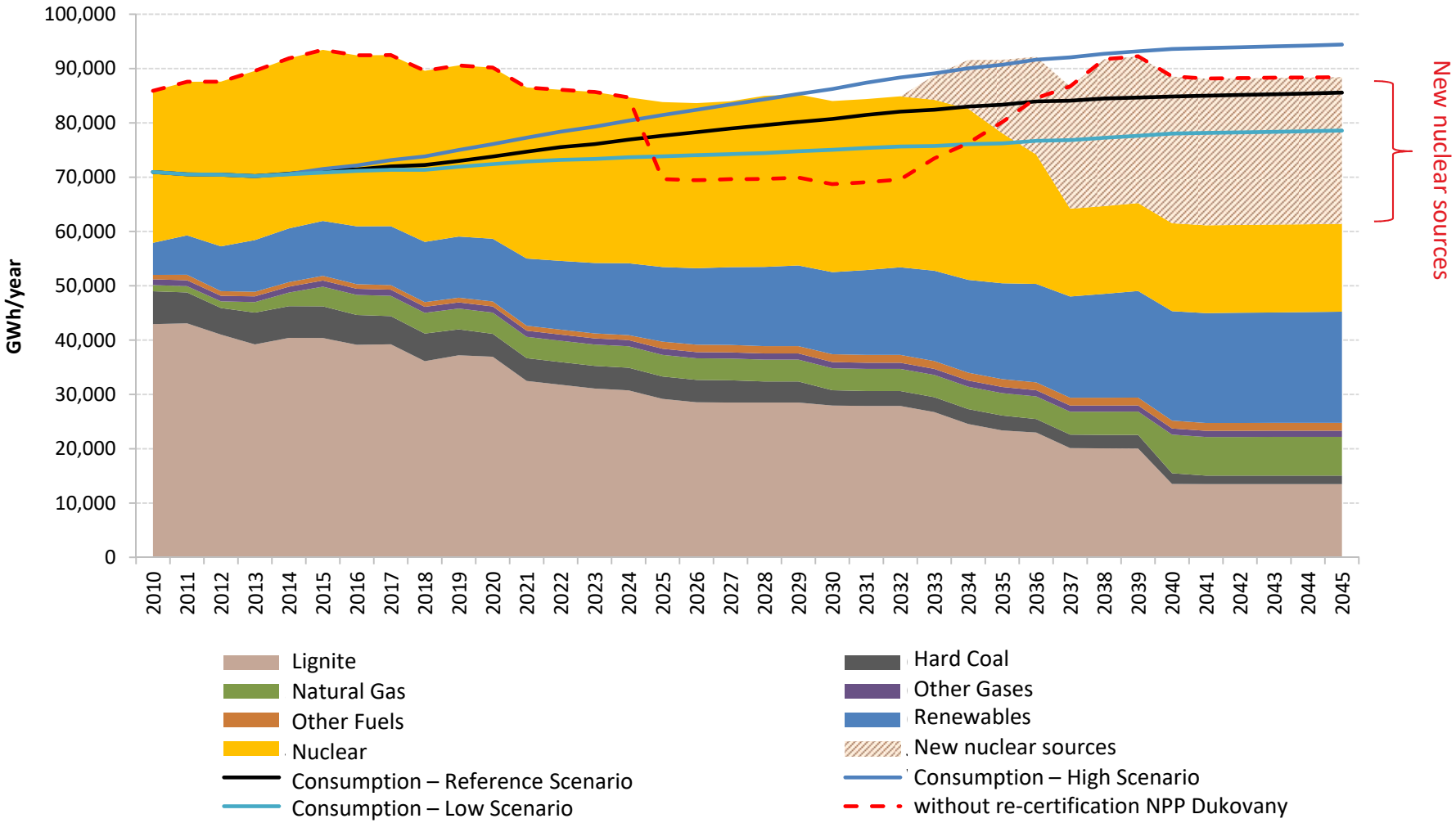

By the year 2050, essentially the entire (conventional) energy mix will be „renewed“.




According to projections domestic consumption of electricity will be further increasing due to further electrification of economy (even though unit consumption is projected to gradually decrease).




Without no new generation sources the Czech Republic can quickly loose it´s post of one of the larges European electricity exporter and „fall“ into category of new importing countries.

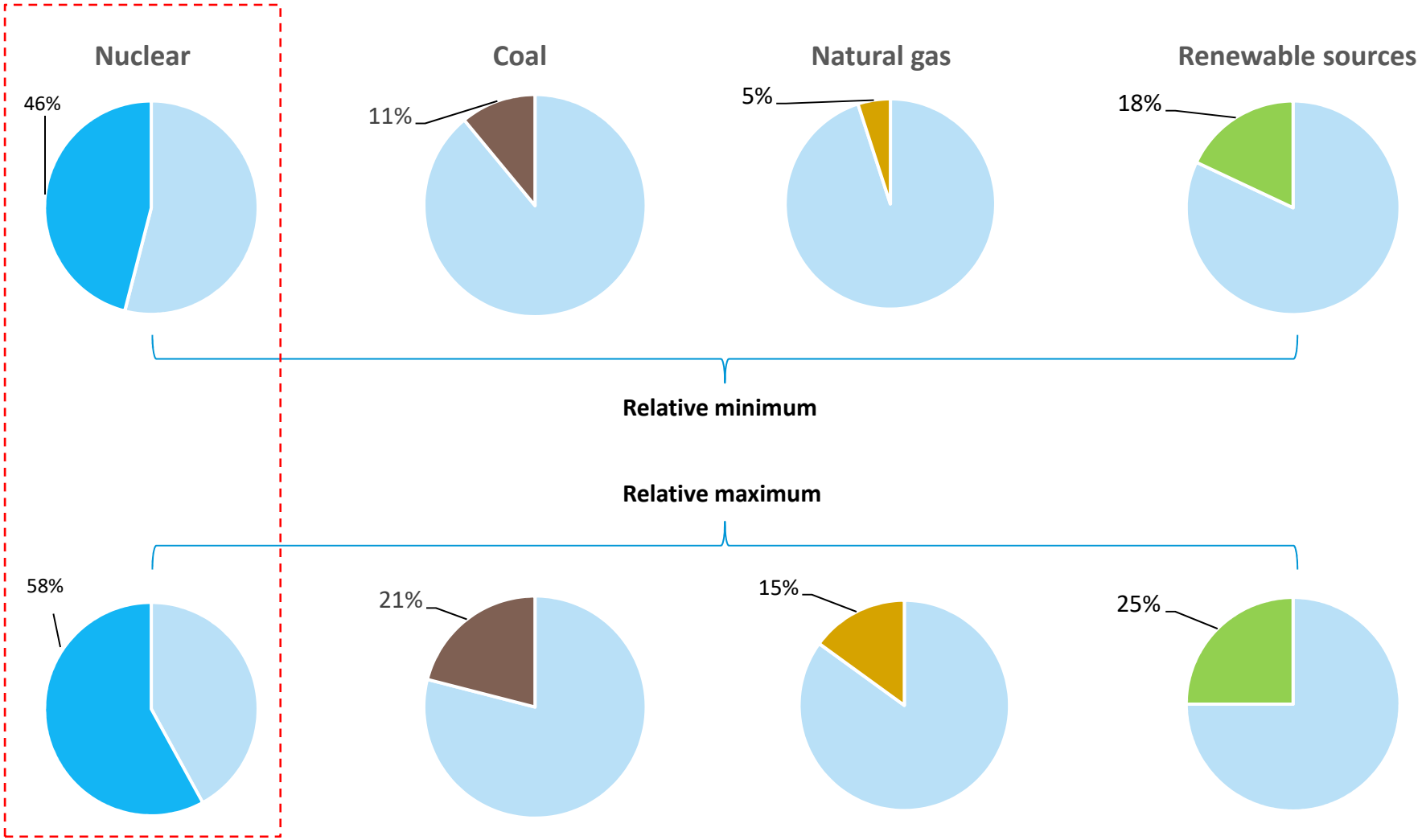



There are not many zero-emission energy sources that can replace coal in the Czech Republic at needed scale and at the same time without increasing significantly import dependency.

# Nuclear energy in context of overall energy policy (State energy policy)

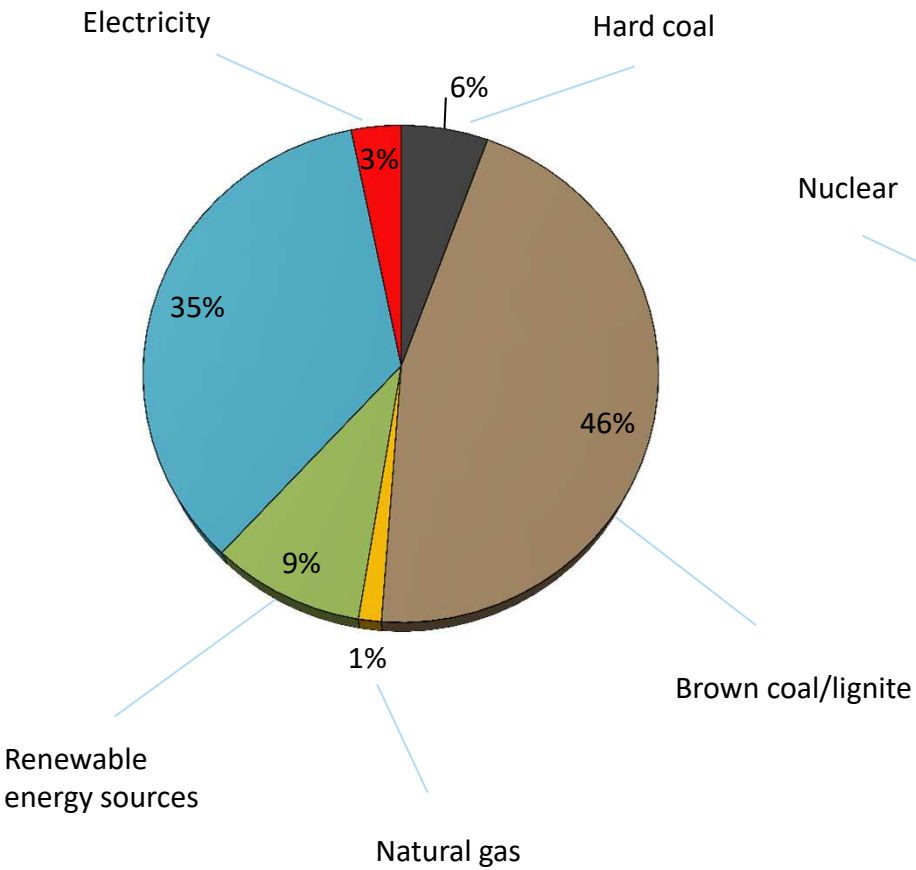
- **Strengthening the role of the nuclear energy in the energy mix of the Czech Republic,** compensation for decreasing production from thermal (coal) power plants => up to 50% share on gross electricity generation.
- **Promote and accelerate the process of negotiation, preparation and execution** of new nuclear units at existing locations **with a total capacity to 2,500 MW**, respectively, annual production of around 20 TWh in the period of 2030-2035.
- **Aim the start of operation around possible shutdown of JEDU NPP**, it means after 2035.
- Creating the conditions for extending the **operational period of JEDU NPP up to 50 (or 60) years.**
- **Ensuring the conditions for the establishment and operation of a secure and long-term repository of radioactive waste;** decide on nuclear repository location until 2025.
- **Identification and securing territorial protection for other suitable locations for potential NPPs.**

# Strategic goal for power generation

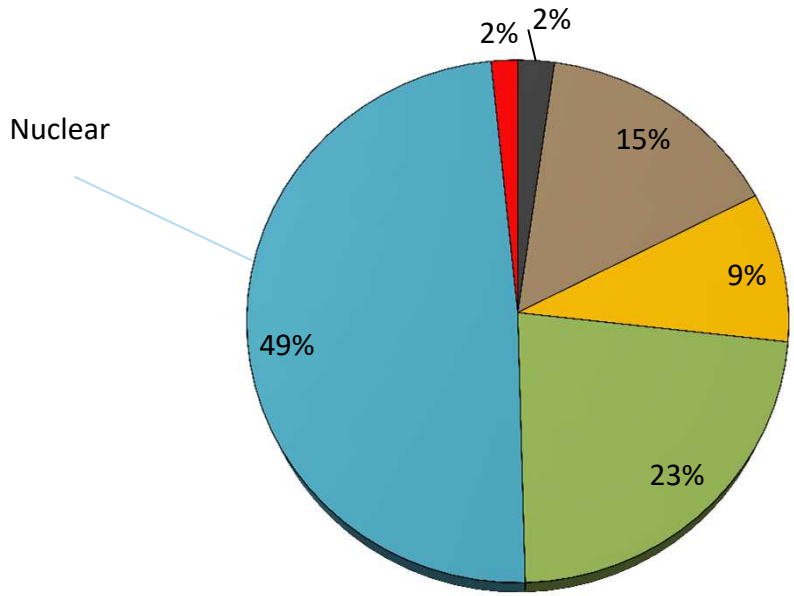


# Gross electricity production

## Current

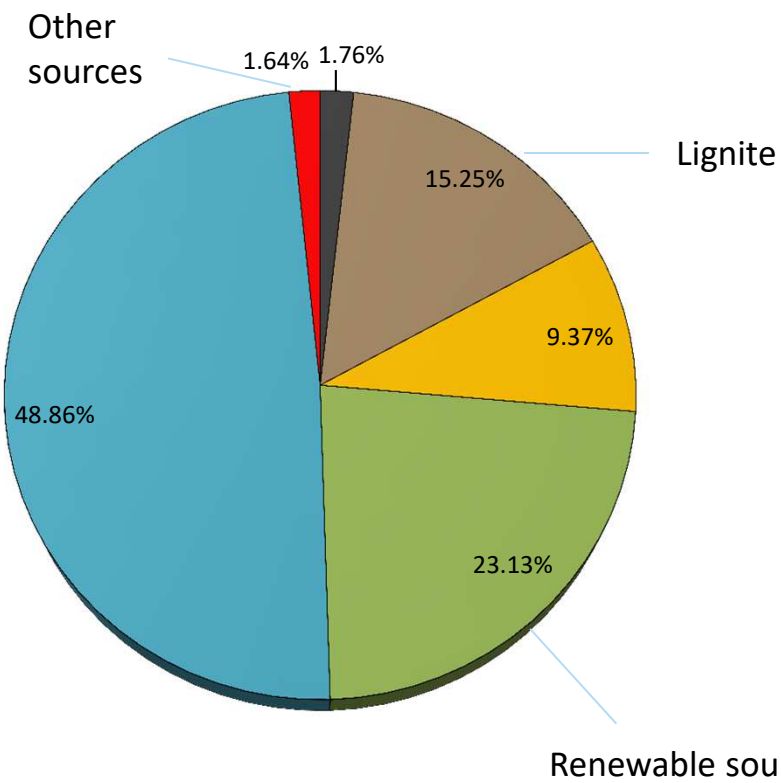



## Predicted for 2040

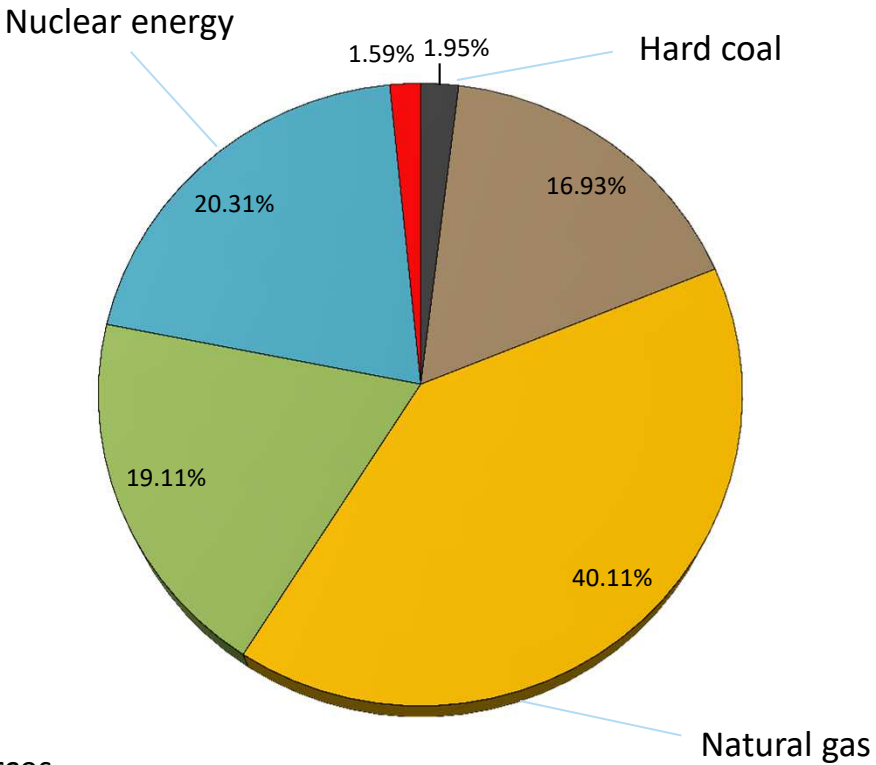


# Other possibility…

„Optimized“ scenario




„Natural gas“ scenario



# Long term role of nuclear energy sector

- **The transition to a low/zero carbon energy sector** in 2050 in the context of meeting the Czech international obligations.
  - *Communication of EU: 2050 – 80% - 95% emissions of GHG compare to 2005 (zero emission energy sector).*
- **Ensuring energy security** (ability of long-term electricity supply even in the absence of external supply sources).
  - *Creating reserves of uranium fuel for 4 or more years.*
- **Industrial production and export potential.**
  - *Nuclear energy industry and infrastructure – 15 000 people, 2 % GDP, potential to double this share.*
- **The knowledge base of the economy** (the leader of hi- tech industrial production, organizational and structural skills).
  - *High value added, with significant multiplication to other (material R&D, engineering etc.).*

# National Action Plan for the Development of the Nuclear Energy Sector

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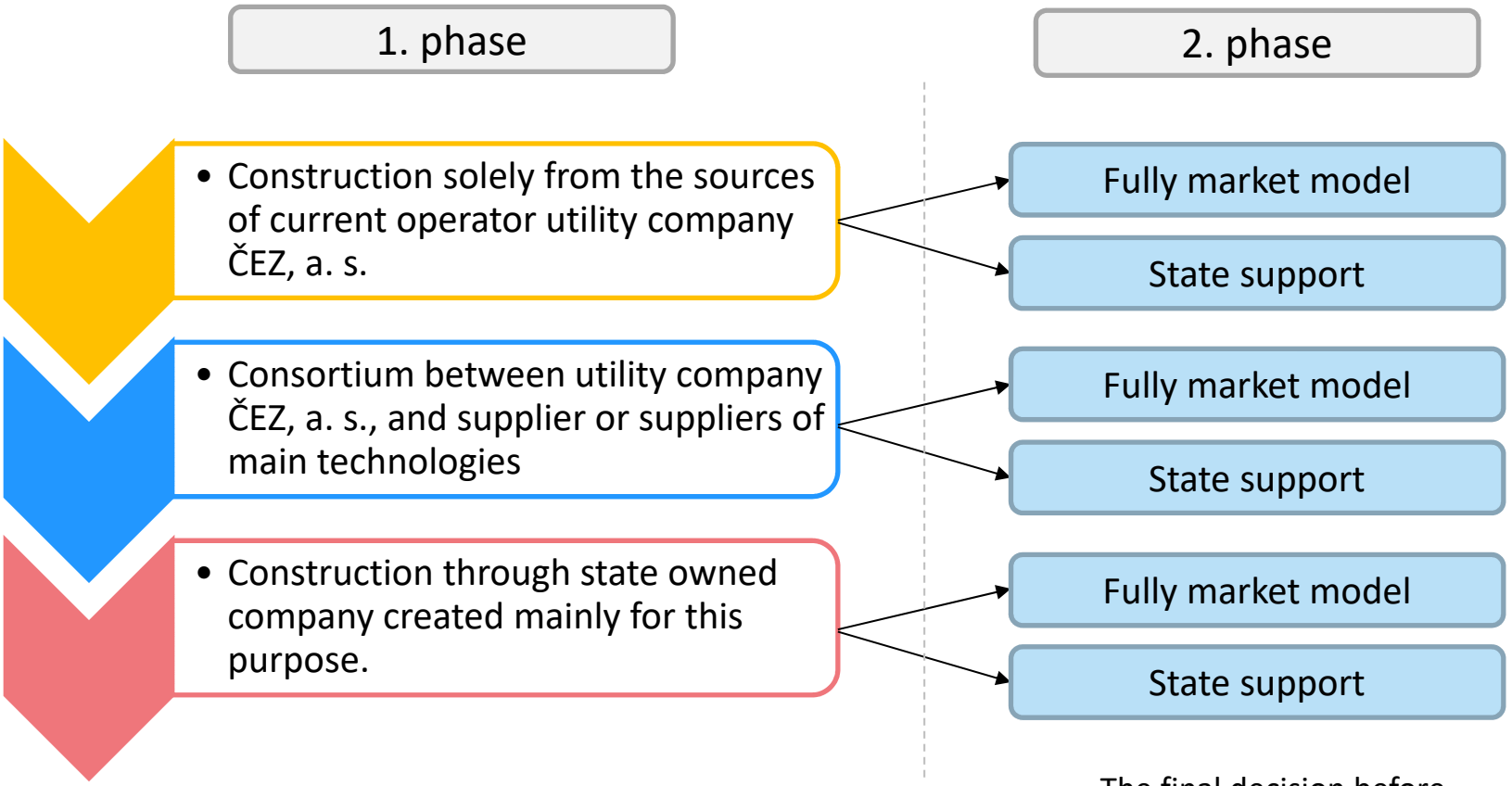
# The national action plan of nuclear energy

- NAP NE recognizes the immediate **necessity to start the preparation process for construction of new nuclear units**.
- **The priority is** to start the operation of new units **around the year 2037** in **location Dukovany** in order to sustain operation continuity and provide the replacement of decommissioned units of current NPP.
- NAP NE assumes the construction from **two to four new units** depending on installed capacity and future electricity consumption.
- **NAP NE recommend two stage approach** – in the first stage the preparation process with main goal to obtain construction permit should continue, in second stage, which is assumed around the year 2025, the construction itself should begin.
- Directly **before the second stage, there should be an evaluation**, if there is still the need for new capacities and evaluation of investment model.

# Implementation – practical steps

- Establishment of **„Standing Committee for Nuclear Energy“** – high level intergovernmental body dealing with nuclear energy development
- Establishment and initiation of the work of **three working groups under the Standing Committee**:
  - The working group focused on financing the construction, trade and investment model economy and the construction of NPP.
  - Working group on legislative and legal issues.
  - Working group on investment and technical aspects of NPP construction and operation of existing resources.
- Appointment of **government´s special envoy for nuclear energy**.
- Establishment of the new **„Unit for the Coordination of the Development of Nuclear Energy“** under the Ministry of Industry and Trade.

# Investment model

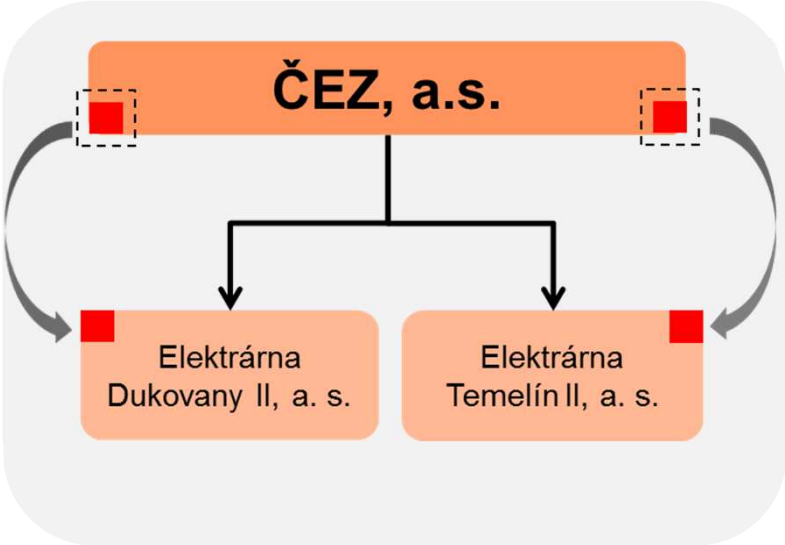



**To be decided 2017/2018**.

The final decision before issuing building permits (assumed around year 2025).

# Establishment of special companies (SPV)

- The reasons for transfer of projects into special subsidiaries:
  - Flexibility of investor model (possibility of consortium structure)
  - Enabling more options/methods for financing
  - Transparent separation of the costs of construction of new units from the operation of the existing generating facilities (separated balance sheets)



# TEMELIN Project - Current Status

- **Environmental impact assessment (EIA)**
  - Positive statement issued in 01/2013
  - Conditions to be fulfilled in site permit process
  - Validity 5 years (2018) with possibility of extension for next 5 years
  - ČEZ has applied for „verification statement“ – issued in May 2016
- **Nuclear sitting permit**
  - Positive decision issued in 10/2014 for ČEZ, a. s.
  - Company Elektrárna Temelín II has to apply for new permits
  - Conditions to be fulfilled in site permit process
- **Separate subsidiary company established**
  - Subsidiary company Elektrárna Temelín II was officially established in October 1, 2016

# Dukovany Project - Current Status

- **Environmental impact assessment (EIA)**
  - ČEZ company applied to start EIA process in July 2016
  - First phase of EIA process is currently in progress
  - Thousands of comments from neighboring countries have been received
  - The second phase will begin in July 2017
  - Positive statement is expected in 2018/2019
- **Tender documentation and safety documentation**
  - Currently being finalized
  - Tender documentation – site description part
  - Safety documentation – geological research, cooperation with existing units
  - Analysis of the experience from other projects
- **Separate subsidiary company established**
  - Subsidiary company Elektrárna Dukovany II was officially established in October 1, 2016

# Recommended steps for construction

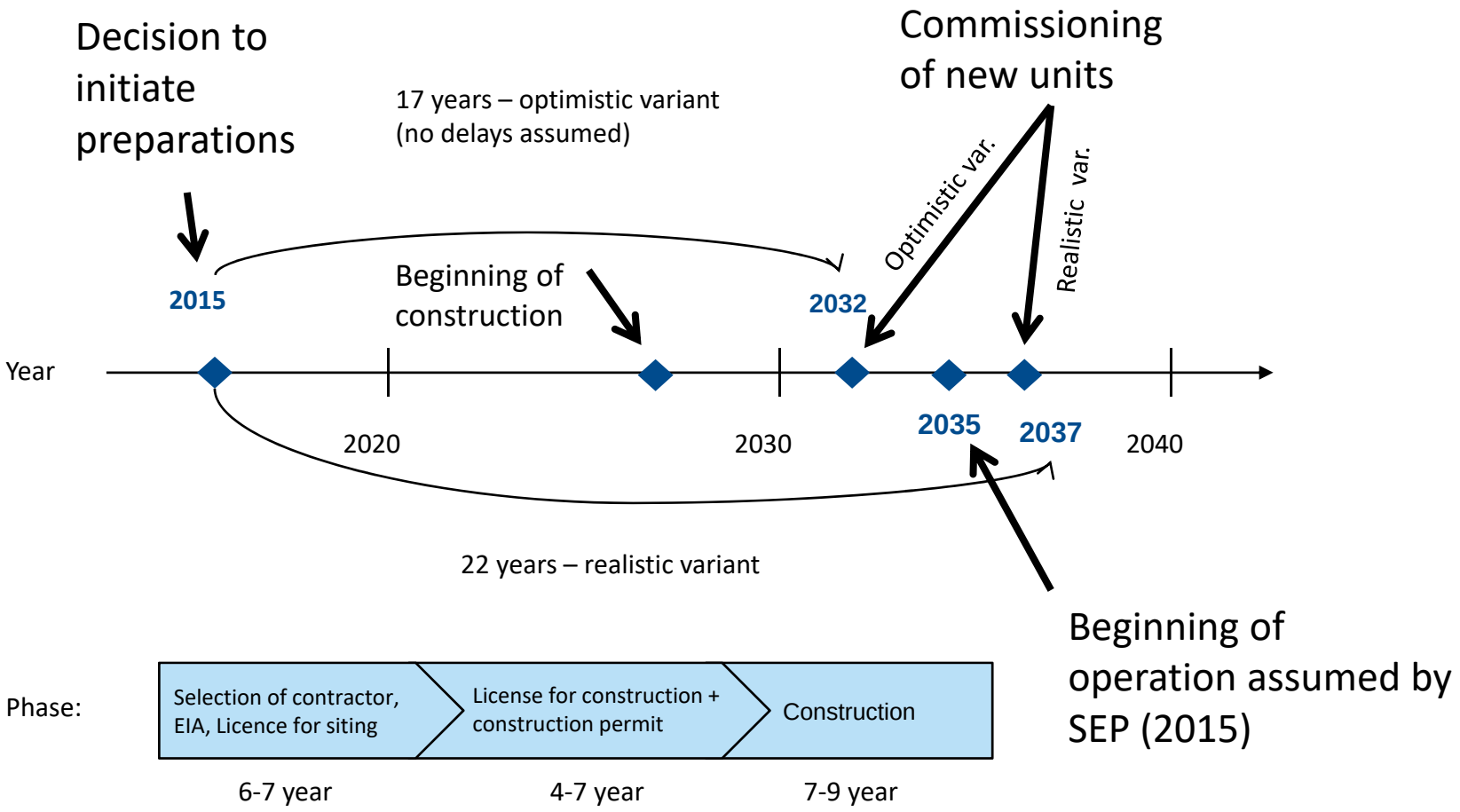
- The establishment of a special company (Special Purpose Vehicle). ✓
- Prevent irreversible steps inside the CEZ group. ✓
- Initiate contacts with strategic partners. ✓
- Initiate negotiations with the European Commission.
- Immediate continuation of the project preparation. →
- Initiate the preparation of legislative changes. ✓
- Assessing the needs of state guarantees/support.

# Recommended steps for construction

- SPV – preparation for separation to allow entrance of partner.
- Environmental Impact Assessment ( EIA) - compliance , submission.
- Preparing for supplier selection - the technical documentation.
- Permits for location - for SPV.
- Continuation of preparing the site for construction of NPP.
- The continuation of necessary land purchases.
- Continuation of activities aimed at securing the necessary permits.
- Preparation and calculations related and induced investment.

# Construction of new nuclear units

## Indicative construction schedule



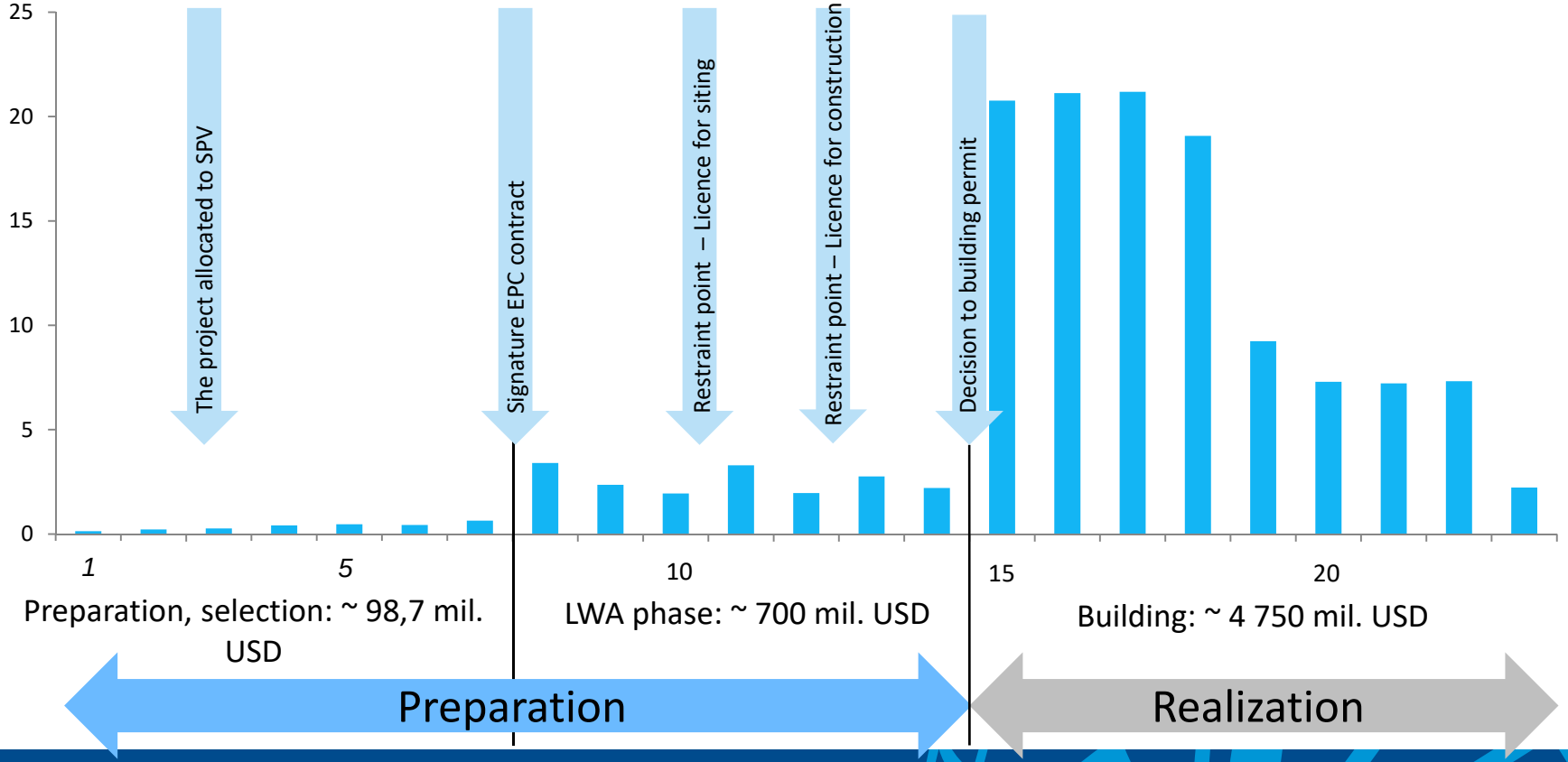
# Construction milestones

| Milestone | Years from T0 | Possible Delay | Years from T0 with delays |
|---|---|---|---|
| EIA assessment report | 5 let | | 5 |
| Permits for location (SÚJB) | 5,5 | | 6,5 |
| Supplier selection | 6,5 | + 0 - 2 years **(+ 0 years)** | 6,5 |
| Legally effective territorial decision | 8,5 | + 0,5-2 years **(+0,8 years)** | 9,3 |
| Permit for construction (SÚJB) | 9,5 | + 1-2 years **(+ 1,5 years)** | 11,8 |
| Construction permit= initiation of construction | 10,5 | + 1 year **(+ 0,5 years)** | 13,3 |
| Commissioning | **17,5** | + 1-3 years **(+ 2 years)** | **22,3** |

**Permitting process** – currently all relevant legislation is being amended, goal is to streamline all permitting obligation where applicable (avoid duplicities), allow parallel permitting and allow permitting with all possible vendors considering „the least favorable“ parameters.

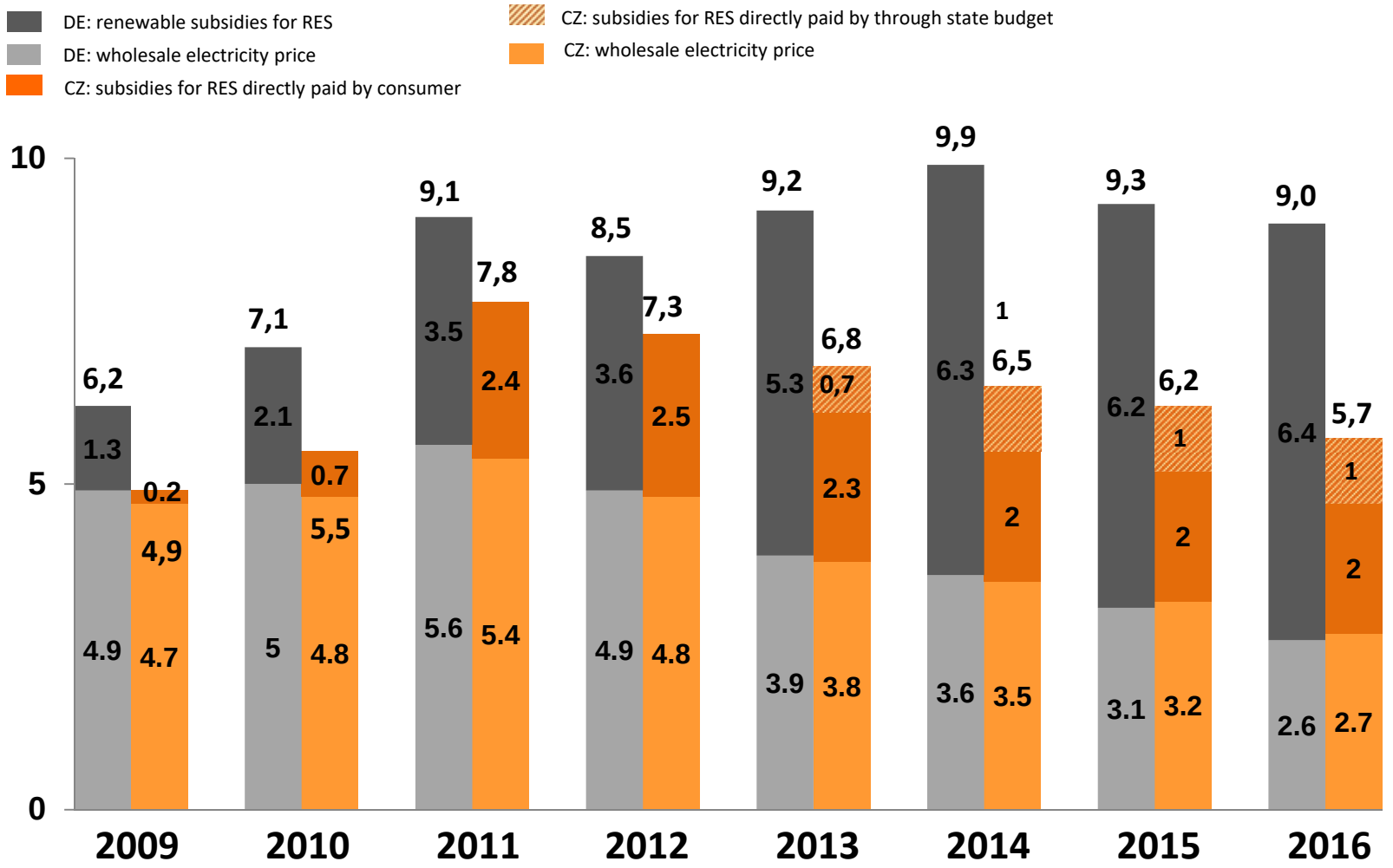
# Indicative cash-flow decomposition of one unit (1200 MW)

Assumption of overnight capital investment in prices of 2014 – 4200 EUR/kW (app. 4500 USD/kw)

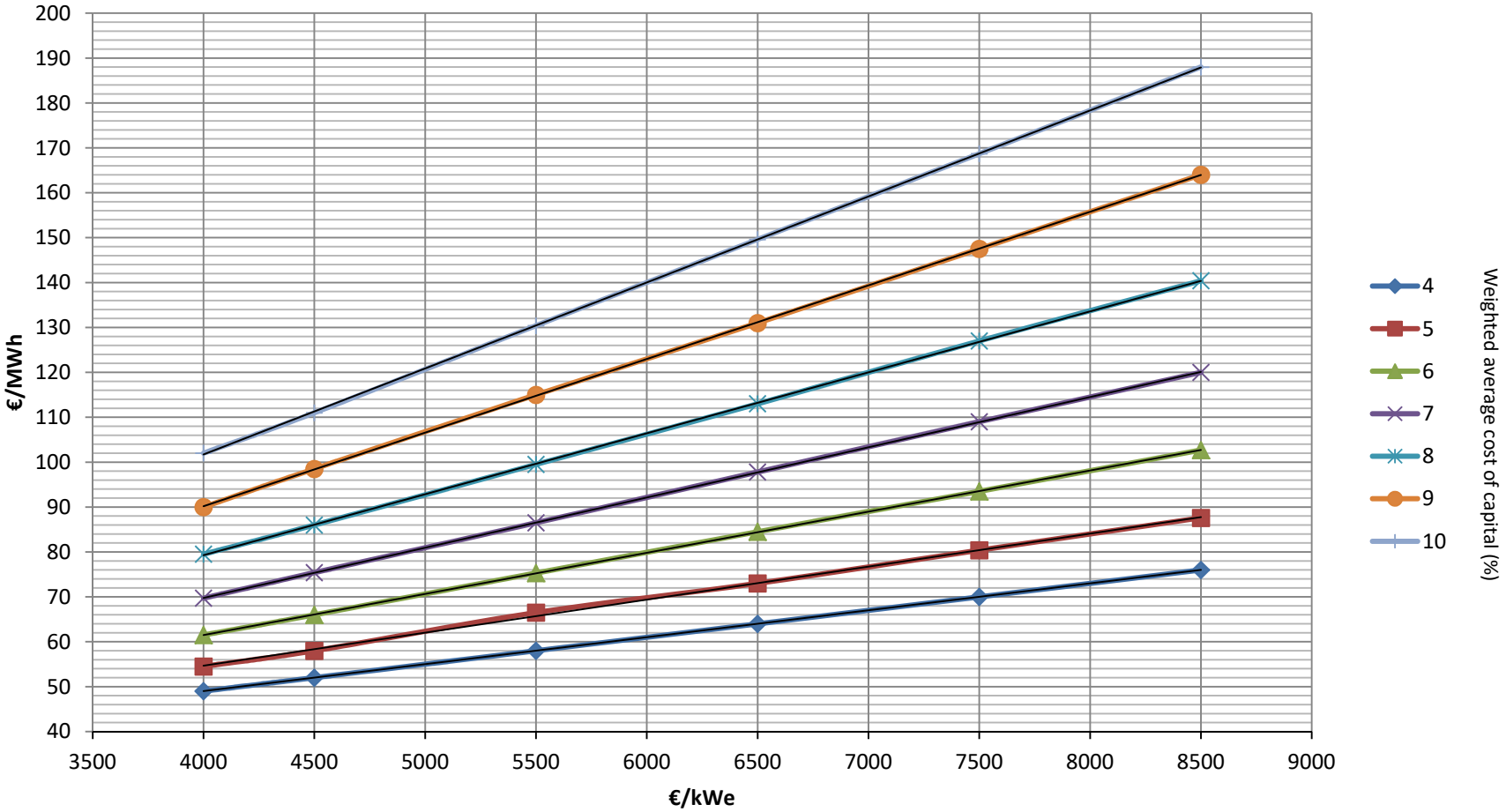


# Development of price of electricity and subsidies for RES

**Development of price of electricity and renewable subsidies CZ, DE** (Eurocent/kWh)



## Relation of „strike price“ on capital costs and WACC




With optimal choice of investment model and state involvement (not necessarily through direct funding) the „strike price“ can by significantly influenced (reduced).

# Involvement of local companies

- In the reaction of strategic documents **Czech Power Industry Alliance** (CPIA) was founded.
- CPIA a is an alliance of Czech companies with long term experience in power sector and mainly (but not only) in nuclear sector.
- The aim is to maximize share of local companies in new build, but also engage in other countries to sustain the know how.


# Potential vendors

| Vendor | Country of origin | Type | Ins. capacity |
|---|---|---|---|
| Westinghouse | USA | AP 1000 | 1200 MW |
| Rosatom | Russia | MIR<br>TOI | 1200 MW<br>1250 MW |
| Kepco /KHNP | Korea | APR 1400<br>APR 1000+ | 1400 MW<br>1100 MW |
| Areva | France | EPR 1700 | 1700 MW |
| Atmea | France/ Japanese | Atmea 1100 | 1100 MW |
| CGN | China | HPR 1000 | 1150 MW |

- In second half of 2016 potential vendors were asked to respond to „request for information“; six companies responded to this request and sent information packages.
- During January and February 2017 the Czech republic hosted consultation meetings with potential vendors. The propose of this meetings were to clarify the responses and to obtain sufficient information for the start of permitting procedure (mainly EIA).
- During February and March 2017 all the addition information were analyzed, these information will be further used for identification of the most optimal delivery and investment model by the government.

# Road ahead…

- Decision on the most **optimal method for transparent and non-discriminatory way of selecting vendor/vendors** for a new-build in accordance with Czech and European legislation.
- Decision on the most **optimal investment model**.
- Decision on the most **optimal financing model** and possible direct or indirect involvement of the state.

# Thank you for your attention

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Lenka Kovačovská
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