Nuclear Economics

Arguments and probability of nuclear new built

April 2014
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Government's reasons for new NPP investment case
It makes sense to support construction of new NPP in CZ because:

1. Construction of new NPP is a fiscal stimulus;
2. Demand will grow, CZ needs to remain net exporter;
3. Power prices will grow making new NPP profitable.
Contracts for difference
Contracts for difference: what are they?

In Great Britain, Contracts for difference:

• Are used to incentivize the construction of nuclear energy projects
• Are a form of state guarantee that is intended to reduce the revenue risk in large investment projects.
• Provide a price floor of GBP 92.5 per MWh (~EUR 108/MWh) for nuclear energy (For example, if a MWh sold is GBP 90 on the free market, the consumer pays the difference between the market price and the floor price)
• Are valid for 35 years from project commissioning
• Index the floor price by CPI inflation, which may be overestimate the long-term growth in electricity prices
2. Contracts for difference

If Great Britain is doing it, where is the problem?

1. **The UK ran relatively competitive process.** In the UK RWE, E.ON and Hitachi were competing with EDF on who will own the project. In the Czech Republic, CEZ’s right to be the principal was never put into question.

2. **The UK will actually needs the power.** OFGEM projected an increasing probability of blackouts due to decommissioning of old and dirty power plants in the years that follow.

3. **The UK is an island.** The United Kingdom has much less flexibility in substituting internal production with imports. The Czech Republic is in the middle of Europe and has easy access to outside supply from all neighbors.
How are CfDs different from subsidies for renewables?

- Renewable subsidies decrease over time, stimulating innovation – they are R&D grants.
- NPP subsidies provide downside guarantee. As result, NPP only gets more expensive with time.

Figure 6: Projected change in the levelized cost of energy, according to the BCG, 2010-2020

- Solar PV: -48.8%
- Wind onshore: -26.7%
- Nuclear: 20.0%
Negative learning curve of US nuclear reactors

Source: Schneider (2011), Cooper (2010)
Fiscal stimulus
3. Fiscal stimulus

Size and success of fiscal expansions

<table>
<thead>
<tr>
<th>Main Characteristics of Fiscal Expansions</th>
<th>The Composition of Fiscal Expansions</th>
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<tbody>
<tr>
<td></td>
<td>Entire population</td>
</tr>
<tr>
<td>Number of episodes</td>
<td>35</td>
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<tr>
<td>Average size</td>
<td>2.47</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.01</td>
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<tr>
<td>Highest value</td>
<td>6.73</td>
</tr>
<tr>
<td>Growth effect*</td>
<td>+0.17 (2.33)</td>
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</tbody>
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Source: Benczes (2011)
Will the subsidy be paid to the state as tax or dividends?

This argument is flawed for several reasons:

- The tax burden on businesses and households will be increased, thereby reducing aggregate demand;
- It makes economic sense for a government or a company to borrow if the proceeds of the borrowing are to be invested in ways that produce returns that equal or exceed the cost of the borrowed money;
- Only 70% of CEZ is owned by the state, so 30% of the dividends will be paid to institutional investors and could be taken out of the local economy;
- Poor accountability is an acute problem in the case of CEZ, whose management and supervisory boards are appointed by politicians. There have been numerous examples of suspected related party transactions in the last ten years under the leadership of Martin Roman and Daniel Benes.
The results are not positive for new NPP built

*Without subsidy, the cost of construction and decommissioning are impossible to recover. Project NPV is EUR (11.5 billion)*

**Temelin 3&4's capital cost and revenue in no subsidy case, EUR million**
The results are not positive for new NPP built.

CEZ will need to receive close to EUR 115 price floor to cover its cost of capital.

Temelin expansion NPV under various subsidy levels (EUR billion)

- No subsidy: -11.47
- EUR 60 subsidy for 35 years: -5.41
- EUR 108 subsidy for 35 years: -0.71
- EUR 115 subsidy for 35 years: 0.00
The taxpayer will surely lose, while CEZ will be made more vulnerable by the project by extreme capital cost.

### Chart 4: Czech state’s earnings from CEZ 2013-2087 assuming 70% ownership

<table>
<thead>
<tr>
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<th>Expansion with subsidy of:</th>
<th>No expansion</th>
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<tbody>
<tr>
<td></td>
<td>EUR 108/MWh</td>
<td>EUR 0/MWh</td>
</tr>
<tr>
<td>NPV of dividends received</td>
<td>109,721</td>
<td>74,201</td>
</tr>
<tr>
<td>Plus NPV of taxes received</td>
<td>116,894</td>
<td>52,918</td>
</tr>
<tr>
<td>Less NPV of subsidies paid</td>
<td>(192,148)</td>
<td>--</td>
</tr>
<tr>
<td>Net result for Czech state</td>
<td>34,467</td>
<td>127,118</td>
</tr>
</tbody>
</table>

### FCFF of CEZ under different scenarios, CZK million

- **Without Temelin**: Blue line
- **With Temelin (No subsidy)**: Light blue line
- **FCFF with Temelin (EUR 108)**: Black line

### Net debt/EBITDA for CEZ if Temelin is expanded

- **3.8x**

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3. Fiscal stimulus
Growing demand
Increase in demand?

DE 10 and 20 year CAGR
4. Growing demand

Current and future consumption and generation

- Forecasts from the newest draft of the energy strategy
- New nuclear capacity expected in 2030

Source: ERU (2013), MPO (2013)
4. Growing demand

Current and future consumption and generation

- Consumption forecasts deriving from German electricity consumption trend

Source: ERU (2013), MPO (2013)
High power price
“2012 saw dramatic growth in generation of electricity from subsidized sources and other regulatory interventions are forcing wholesale prices downward, and in some cases into negative numbers. The frequency of these phenomena is growing and the future of the wholesale market is uncertain.”

A verbatim quote from CEZ’s 2012 Annual Report, Page 103
Why electricity prices will stay low

Average electricity prices have been decreasing because of:

The growth in renewable energy sources and the German Energiewende: The renewable energy boom that many European counties are experiencing today will likely continue to keep average baseload power prices low. Over time, renewable energy subsidies will be phased out, but it is as important to consider how much more viable renewable energy production has become in the last few years. Germany is fully committed to running almost entirely on renewable energy within a few decades, and this will drive CEE power prices ever lower. According to a study by MK Online this effect is already substantial and the shift to renewable energy has only just begun;

Capacity markets: The low marginal cost and occasional variability of renewable power is causing most European countries to consider introducing a market for selling capacity availability, in addition to selling energy. Nuclear power plant will be unable to benefit from these payments because of their slow reaction time and high fixed costs. And these capacity payments will keep energy prices low;

Much supply is now offline: Even if demand does pick up in the coming decades, much of Europe’s conventional power capacity is barely producing because of low power prices. In consequence, there is a large reserve of unused capacity which can be brought online if demand recovers;

Energy efficiency: Energy efficiency is one of the three pillars of Europe’s 20/20/20 strategy and, more broadly of its energy policy in the long run. The EU’s budget for the next program period 2014-2020 is devoting more funds to energy efficiency, further reducing demand for power;

Demand response: One of many innovative technologies in the power sector, so-called demand response, will help to reduce and smooth future power demand. This will bring average prices down. By controlling the consumption of various machines and appliances, businesses and households will be able to optimize their use of energy to a much greater extent in the future, again decreasing demand and prices on the wholesale market
5. High Power Price

Merit order effect

DE, low RES, hard coal USD 80/t, carbon EUR 30/t, gas EUR 18/MWh
Merit order effect

DE, high RES, hard coal USD 80/t, carbon EUR 4/t, gas 32/MWh
5. High Power Price

Merit order effect

DE, extreme RES, hard coal USD 80/t, carbon EUR 30/t, gas EUR 18/MWh
5. High power price

Electricity wholesale price EEX
5. High power price

Czech 2003 CPI indexed vs real price
Conclusion
Probability of new NPP projects is low because:

1. British CfD scheme rejected by the European Commission in its entirety;
2. Demand likely to stay flat;
3. Power prices likely to stay low.
Thank you for your attention

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