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Reconstruction of the National Theatre in Prague

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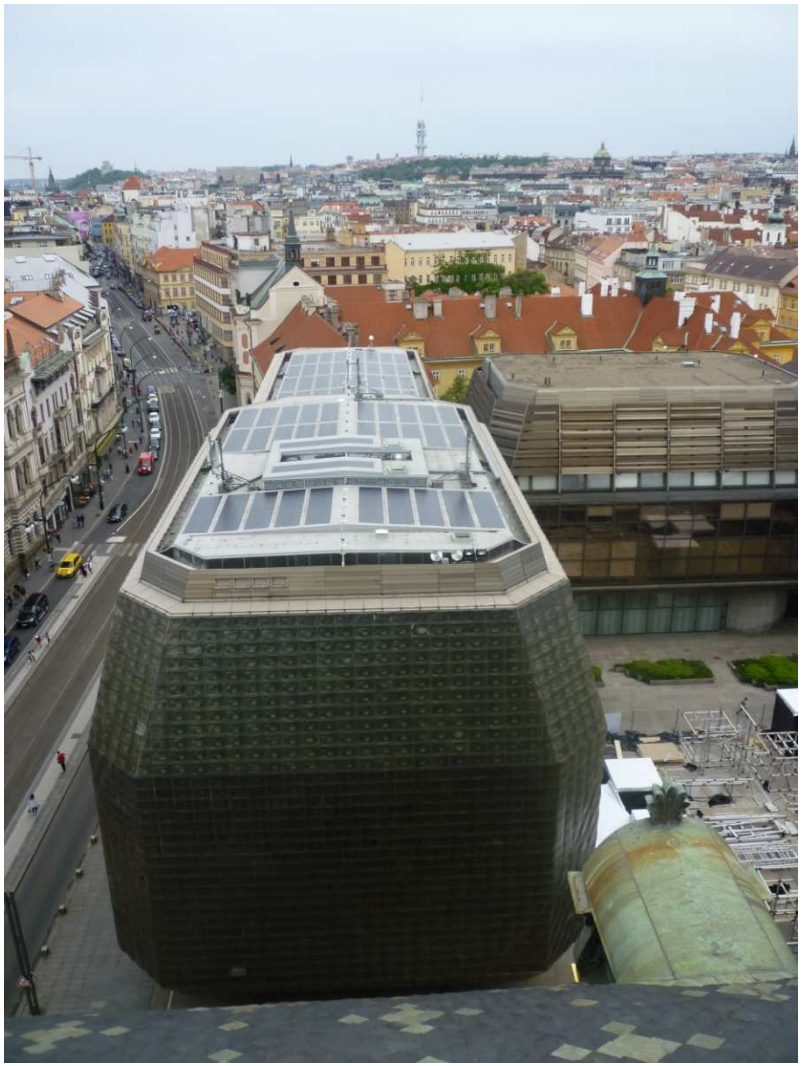
National Theatre in Prague – some facts

- One of the most important cultural institutions in the Czech Republic
- Historic building of national theatre built end of nineteenth century (opening 18 November 1883)
- General reconstruction of historic theatre between years 1977 - 1983
- At the same time new service building and new Laterna Magika theatre constructed
- New reconstruction of energy started 2007, in three stages, finished in 2009

- The complex of the national theatre now includes four buildings and multiple floors below street level

Pictures



National theatre - EPC

- Unique energy efficiency project, combination historic and modern buildings
  - Reconstruction of heating, air conditioning systems, recuperation of waste heat etc.
- The theatre was facing technical problems with the heating system, high costs and heating system was exceeding emission limits
- National theatre had not enough financial means to carry out the reconstruction, therefore EPC
- Objective was long-term decrease of costs of heating, hot water preparation, ventilation and airconditioning

National theatre - EPC

- EPC project, most complex one ever done in the Czech Republic.
- As Nat. Theatre is a public organisation, the ESCO carrying out the project was selected through public tendering
- The ESCO guaranteed that for the period of the contract all project costs would be paid exclusively from savings
- Additional savings (above the guarantee) split between ESCO and Nat. Theatre (both parties interested in maximum savings)

- Two main advantages of EPC can be seen:
- Investments paid out of savings, so no own contribution required from client
- ESCO proposed integrated solution, every measure related to the other. When using own money, it's done step by step (depending on the availability of resources)

Time table

- Preparation and tendering process 2005 / 2006
- Signing contract Nov 2006
- First phase construction (Jan-Dec 2007) ,
  - Heating & cooling system
- Second phase (Sep – Nov 2008)
  - Above standard measures, such as roof insulation, PV panels on service building
- Third phase (Sep – Nov 2009)
  - PV panels on Laterna Magika, lighting system, saving of drinking water (originally used for cooling purposes)
- From 2010 onwards – Energy management system, ICT system in framework of EU project BEST Energy

PV panels

- First installed on roof of service building
- Roof was leaking, need to lay hydro insulation on the roof. The type of hydro isolation used is integrated with PV panels. Main parameters:
  - 22.032 kWp
  - 554 m^2
  - Annual Production 18727 kWh
  - CO_2 savings – 22t
- PV is the most visible element, but CO_2 savings relatively minor
- The largest share of the energy savings was from reduced consumption of gas and hot water.

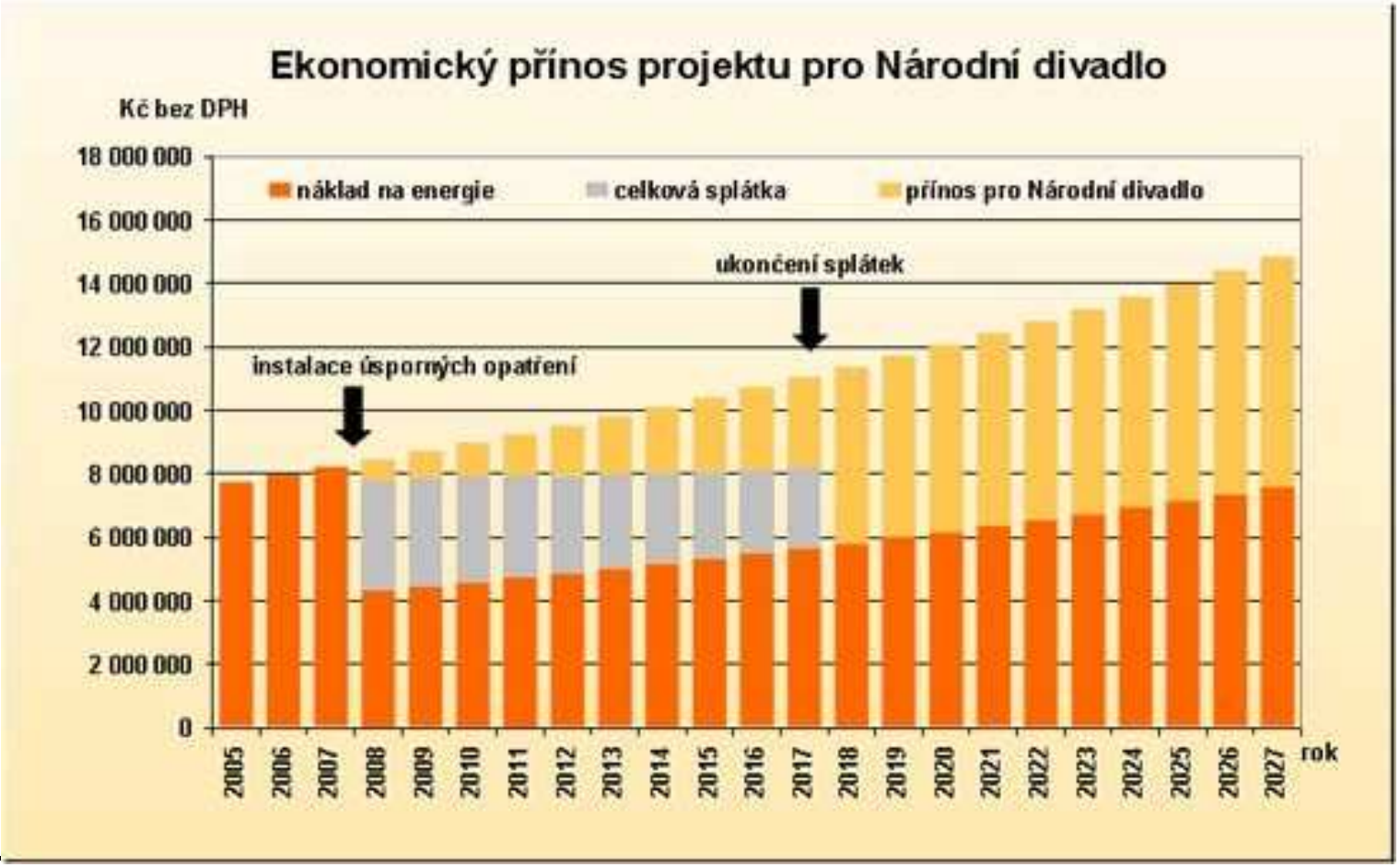
The economic benefits of the project for the National Theatre

Energy costs –

Total payment -

Benefits for the - Theatre

Costs in CZK excl. VAT



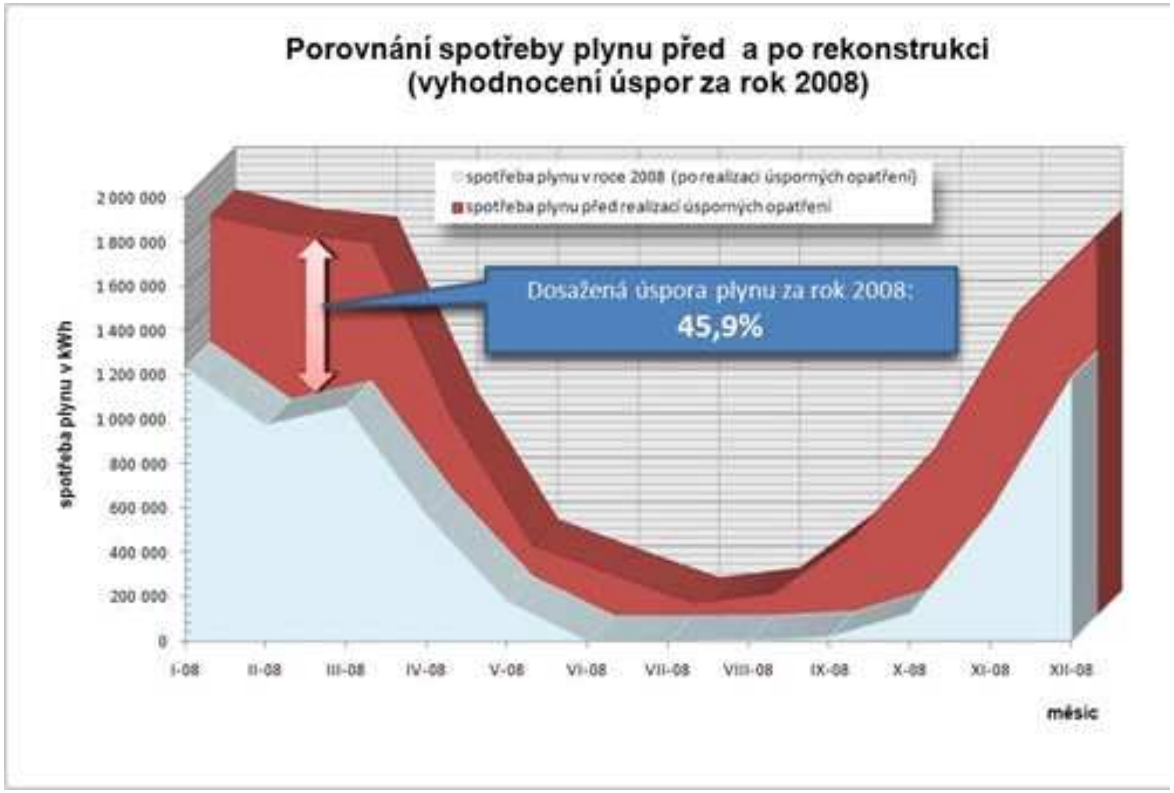
Financing

- Supplier loan + grant of ND (2.5 mln CZK) for reconstruction of roof
- Investment costs amounted 41.3 mln CZK (ex. VAT) - total costs incl. energy management, interest etc. are 66.5 mln CZK
- Guaranteed savings for 2010 – 6.8 mln CZK, every year increase 2.5% (incl. inflation)
- Repayment of loan in 10 years
- Guarantee: if savings lower than payment of Nat. Theatre, ESCO covers the difference

- Savings in 2008
  - Guaranteed 4.138 mln CZK, 22,2% savings → Realised 6.194 mln, 33,2%
  - Difference: energy price increase, more savings
- Savings in 2009
  - Guaranteed 4.562 mln CZK, 24,4% → Realised 6.574 mln CZK, 35.2%

Savings

- Savings in natural gas, red is before reconstruction, blue after (2008) – corrected for HDD
- First 6500 hours of operation → now 3000 operating hours
- Before 1.06 mln m^3 → After 540,000 m^3
- Savings due to more efficient boilers and use of waste heat



Cooling system & heat pump, using water from Vltava river

Condensing boilers Hoval 2 * 1.44 MW

Conclusions / lessons learned

Conclusion:

- EPC project in Prague was a large success, same construction now used in more similar buildings
  - Estates Theatre (2009) - 30 mln CZK investments – 4.03 mln CZK/yr guaranteed savings
  - National Opera (2010) – 33.6 mln CZK investments – 5.2 mln CZK/yr guaranteed savings
- No need to interfere with outside façade to reach substantial savings
- EPC is good option when own funds are limited, possibility to integrate measures

Specific lessons learned:

- EPC – complex scheme, some distrust had to be overcome
- Need of qualified personnel to operate new equipment
- Do not underestimate the preparatory phase, identifying energy savings

Thank you for your attention !

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