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‘SOČA ENERGY CHARGER’: EXPERIENCE OF AVČE POWER PLANT AND FUTURE PROSPECTS

Rajko Volk, 27. 05. 2025

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History

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- The Slovenian electric power system was part of the Yugoslav system until 1991, so the structure of power generation (including location, production, and ancillary services) was aligned with the needs of the entire Yugoslav grid.
- After Slovenia gained independence in 1991, the Slovenian segment of the former Yugoslav grid faced a shortage of peak power generation capacity and lacked a Pumped-storage Hydropower Plant (PSHPP). There was also an insufficient tertiary reserve to respond to the shutdown of larger production units. Only a few gas-fired units were available, and their services were costly.

Project chronology of the first PHSPP in Slovenija - Avče

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- A feasibility study was completed in 2003.
- Construction began in September 2005.
- Commercial operation commenced in April 2010.
- The first overhaul was carried out in 2018/2019 and lasted 5.5 months.

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Economy

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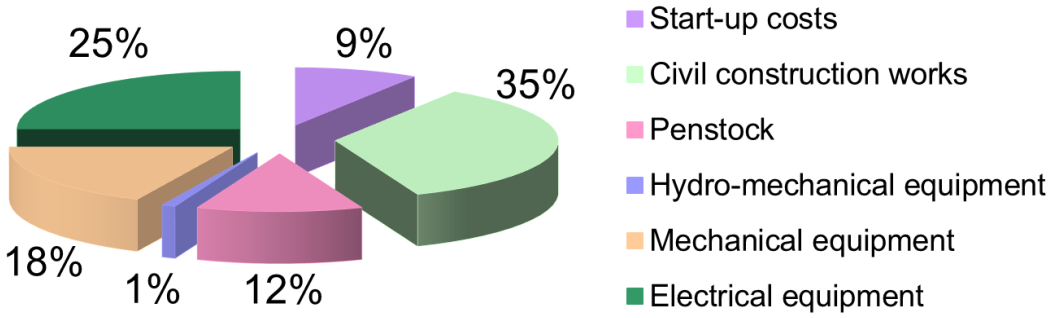
- Total project cost: EUR 126 million
- The largest portions of the project costs were attributed to:
- Civil works – 35%
- Electromechanical equipment – 43%
- Investment in the Avče Pumped-Storage Hydropower Plant (PSHPP):
- 40% covered by SENG capital
- 60% financed through loans



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Basic technical data

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- **Number of units:** 1 (with variable speed technology – DFIG)
- **Maximum gross head:** 521 m
- **Type of PSPP:** Open-loop system
- **Upper reservoir volume (usable):** 2,170,000 m³
- **Lower reservoir volume (usable):** 416,000 m³
- **Discharge (turbine mode):** 25–40 m³/s
- **Discharge (pump mode):** 21–34 m³/s
- **Power output (turbine mode):** 90–180 MW
- **Power input (pump mode):** 140–185 MW
- **Planned annual electricity production:** 426 GWh
- **Planned annual electricity consumption:** 553 GWh
- **Planned round-trip efficiency:** 77%

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Circumstances and predictions of project

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In 2003, the Slovenian and EU electricity markets were still in rapid development:

- Renewable energy sources played no significant role in the market.
- Expected revenue distribution:
  - Up to 93% from the day-ahead (spot) market
  - Up to 7% from covering deviations within the balancing group
- Planned annual operating hours (combined turbine and pump modes): up to 6,300 hours/year. Actual average today: approximately 4,500 hours/year

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Changed conditions

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Consequences of Electricity Market Development

- Introduction of **intraday trading**
- **Unbundling** of ancillary services
- Increased role of **renewables**
- Growing need for **system flexibility**

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One week of operation (10.10 – 16.10.2022)

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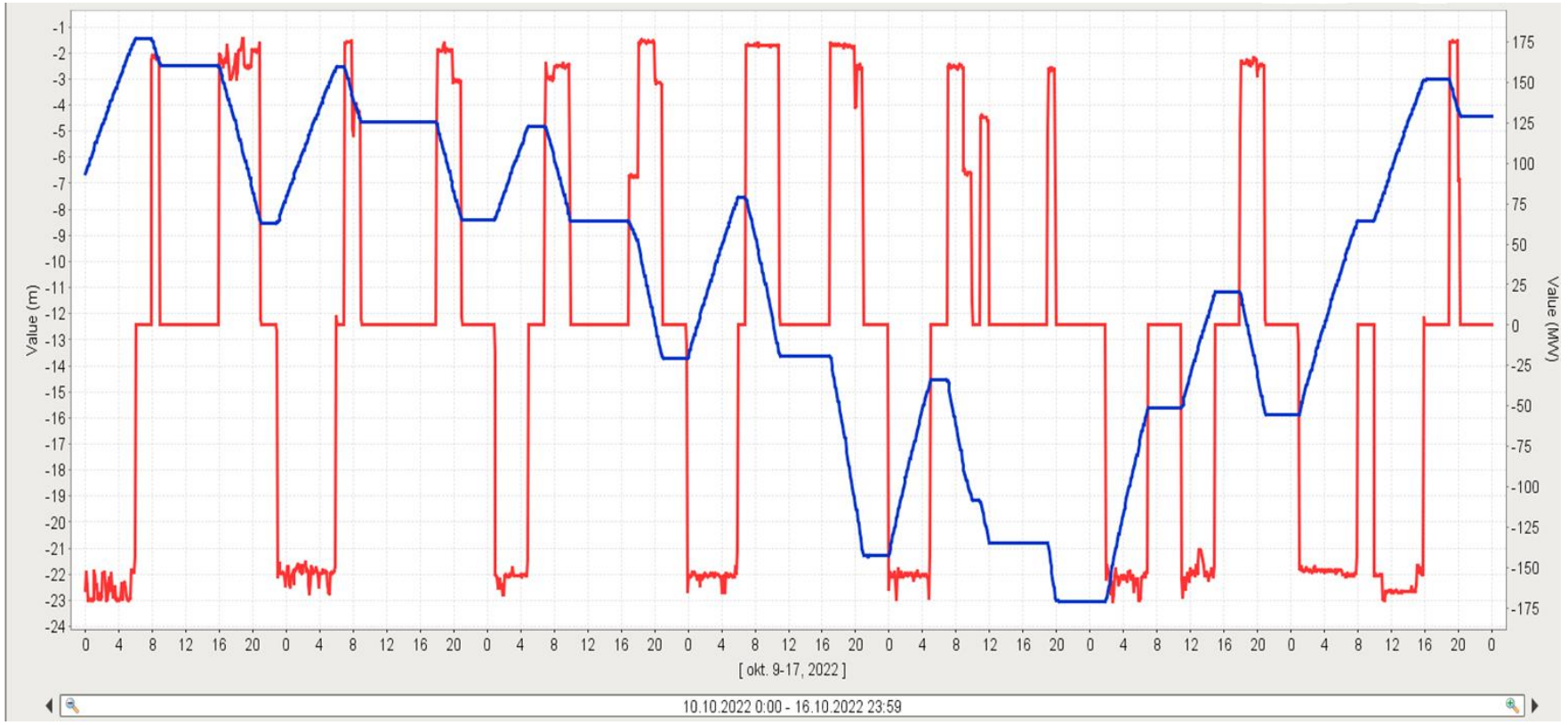

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Past response on critical events in electric power system

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- Assistance in case of synchronizing Slovenian and Italian electric grid.
- Assistance in case of transformer fault and overload of all others transmission lines in neighbour high-voltage substation.
- Deviation balancing while performance tests on other big producing unit in the system were performed.

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Conclusion

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Our Experience with Variable Speed Technology

- **Quick response** to dynamic changes in the power system
- **Soft start** of the unit – reduced mechanical and electrical stress
- **Active power regulation** also in **pumping mode**
- **Voltage regulation** for stable system operation
- **Wide reactive power range** for enhanced grid support

New PSHPP projects in Slovenija?

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PSHPP Kozjak Overview (River Drava):

- **Status:** Included in the national environmental plan, planned operation around 2030.
- **Type:** Open-loop Pumped Storage Power Plant (PSHPP).
- **Gross Head:** Approximately 700 meters.
- **Upper Basin Storage Capacity:** About 3 million cubic meters.
- **Power Capacity:** At least 400 MW for both pumping and generating.
- **Additional Notes:** Other PSHPP projects remain in the conceptual phase.

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Thank you

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