NVE

Hydropower in Water Supply Schemes
SEDA study on options in Bulgaria

General conclusions on collected data

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Foto: Thomas Widerberg

Water – a major natural resource for Norway

Many large hydropower plants are built and there are options for more.

Still, - mini hydropower in water supply schemes are valued.

Photo from top left: Rune Engesæter, Sjur Bjerkli, Unn Yilmaz. All NVE

NVE did several surveys on option for hydroelectricity generation in combination with water supply schemes between 1980 and 2005

- 1980: The final report gave data on 690 schemes of total known water supply schemes 1380
  - Conclusions were that replacing pressure reduction valves in pipelines by turbines could generate less than 130 GWh
- 2004: A study comprising all Municipalities (434) and 2055 water supply plants.
  - ~770 GWh could be produced harnessing waterfalls in the catchment area between regulated lakes for water supply

NVE summary on HPP in Water Supply Schemes in Norway

- Waterfall between main reservoir and intake reservoir can be utilised
- Water fall between intake reservoir and water treatment reservoir/daily distribution reservoir can be utilised
- In large towns pressure reduction walves can be a source for hydroelectric generation
- Electro mechanical equipment: The scale factor is important for cost. Pelton 100m/500 kW (~650 Euro/kW), 200 m/3500 kW (~250 Euro/kW).
- Changing from water supply scheme to combined water supply and hydro generation scheme can introduce new demand on pipe safety. The regulation for dam safety is the same

Collected data organised by SEDA

— NVE used three documents

- Reports on sites,
- Summary report on sites,
- Data sheet on 60 options

— **As proposed from CEDA they are grouped in 5 categories:**

1) At the relief shafts of the supply pipelines
2) At pressure regulations in distribution pipelines
3) At inflow of supply pipelines into reservoirs
4) At dam water intakes
5) Increase capacity of existing HPP in water supply networks

Pernik hpp

Collected data organised by SEDA

- The output in kW is **maximum** indication based on given bar and maximum water flow. A total efficiency of 80% is used. We have understood that the given bar is the pressure that is available and not static pressure. Available pressure will vary with the flow in the pipelines.

- Most of the subjects are useful for Pelton turbines. They are flexible to flow variation. If the flow is constant Francis turbines may give higher efficiency and increased rpm, which can result in a less expensive generator

- The installation of a HPP can disturb the stability of the pipeline and this is one of many studies that needs to be taken for the schemes that looks promising.

Pernik Dam

NVE conclusions

- 14 objects have capacity over 100 kW, and two of them have output over 500 kW. The economic viability depends on the water flow. A steady waterflow all year will allow a 100 kW hydroelectric power plant to generate 850 000 kWh, which allows for 10 days maintenance each year. In that respect a 50 kW scheme could also be of interest if installation is easy and there are few extra investments needs in the waterways. These hydropower plants have very low CO2 emissions (ie:1 g CO2ekv/kWh), much better than other technologies and can reduce the purchase of grid electricity if an agreement is possible with the grid company. Otherwise selling to the grid is possible and generate income

- The key factor is the flow of water and how many hours a year its flowing on full capacity

- NVE as a public company have negotiated with three consulting companies to compete on project work with low budget. For detailed studies on a group av projects from the SEDA identified water supply schemes, the Norconsult company was preferred because they could deliver a result on short notice and had historical -, and ongoing experience in planning of hpp in water supply systems

- Norconsult will present more details and a more comprehensive study than the study done by NVE

Thank you

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