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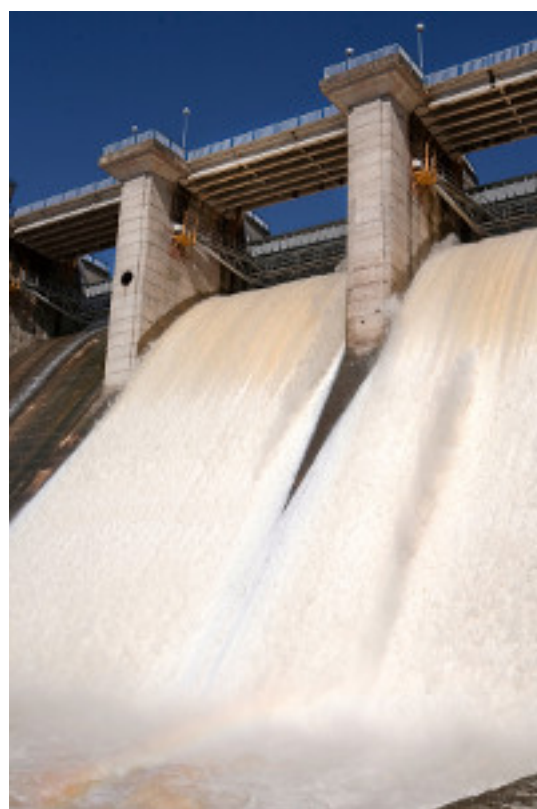
◀ Europe to experience pumped storage boom

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The increased penetration of renewables into the European energy mix will see a surge in demand in Europe for power storage solutions, particularly pumped hydro storage.

Europe's 2020 target of 20% of final energy from renewables will entail an even higher penetration of renewable energy in the electricity mix, which some estimates put at between 35 and 40%, of which intermittent renewables such as wind and solar energy will account for a large share. This share will be increased even further by the European Union's proposed 2050 greenhouse gas emission reduction targets. In order to accommodate this high level of intermittency, electricity systems will have to become more flexible, so they can balance generation and consumption. One way to introduce this flexibility into the grid is through pumped hydro storage (PHS) and some estimates suggest that more than 60 new pumped storage plants with a total capacity of about 27 GW will be built in Europe by 2020. This represents about 50% of the capacity of existing plants and reflects an investment volume of almost €26 billion.¹

Pumped storage hydroelectric plants are the most flexible and widespread means for the large-scale storage of electricity. By transferring water between two reservoirs at different elevations it is possible to supply electricity during peak demand and store excess electricity during periods of low demand. Pumped storage technology has a very good overall yield of about 80%, which means that 100 MWh of excess energy stored will enable the production of around 80 MWh of energy during the next peak in energy consumption. This storage system enables electricity to be produced rapidly. The pump turbine can go from stop mode to full power in less than 2 minutes, providing a sound complement to a gas turbine (the most flexible in the energy mix) which requires 15 minutes to reach its maximum output.



Although there are no official figures reported to Eurostat for existing pumped storage capacities in Europe, some sources² put total capacity at the beginning of 2011 at almost 45 GW, with about 170 pumped storage plants operating in Europe, over 37% of which are concentrated in Italy, Germany, France and Spain. This is due to the fact that the largest European energy industries need the largest capacities for storing electricity. Throughout Europe, the average capacity of a pumped storage plant is about 300 MW. The largest plants are in the countries that also have the most overall pumped storage capacity (the UK bucks this trend - the few pumped storage plants it has are among the largest in Europe). On average, European pumped storage plants are more than 30 years old, with two-thirds of them built between 1970 and 1990. It would seem that the conditions are ripe for the forecast boom in capacity construction.

A report on the European potential for pumped hydropower energy storage prepared in 2013 by the Joint Research Centre, the European Commission's in-house science service, assessed European PHS potential based on two topologies: one where two reservoirs already exist and are close enough to be linked (T1), and one requiring the construction of a second reservoir (T2). This assessment revealed that the theoretical potential in Europe is significant under both topologies, with potential energy storage capacity of 54 TWh under T1, of which 11 TWh is located in the EU and 37 TWh in candidate countries. Under T2, the European theoretical potential reaches 123 TWh, of which 50% lies within the EU.

However, the construction of storage facilities will bring other problems to the fore, as the stored energy still needs to be distributed. This will require an increase in the capacity of interconnectors

in Europe and new techniques to enable non-dissipative long-distance transportation of huge quantities of electricity. Therefore, a prerequisite for the forecast construction boom is the development of the grid system, as the existing grid structure is not up to the task of absorbing and transporting the necessary amount of electricity to and from its storage locations. To tap Europe's storage potential, improvements will also be required in the reservoir database which, according to the JRC report, could be expanded to include the topology of lakes. As a way of achieving this, the JRC suggests that the European Environmental Agency's European Catchments and Rivers Network System (ECRINS) database be expanded, for example by adding Norwegian reservoirs, and that its new dataset be used. Other recommendations arising from the JRC assessment include the inclusion of existing reservoirs smaller than 100 000 m³ which have hydropower exploitation above 1 MW and changing the basis on which searches for a suitable site are performed from the current 'single point' model to an 'area or polygon' model, which would require an update of the reservoir database from points to polygons. It was also suggested that it would be useful for individual countries to perform analyses of their potential storage versus population density, surface area, solar and wind resources, and projections for electricity consumption and RES generation by 2030.

The conclusions and recommendations reached based on the assessment should prove useful to agencies in charge of planning future electricity system development as well as to spatial planning authorities and to developers of hydropower schemes. If the forecasts for a boom in pumped storage prove to be accurate these recommendations are likely to be put into practice across the EU, as the European grid strives to smarten and to achieve the flexibility required to integrate the levels of renewables needed to see Europe reach its energy and climate goals for 2020 and beyond.

For more information:

<http://setis.ec.europa.eu/publications/jrc-setis-reports/assessment-of-european-potential-pumped-hydropower-energy-storage>

<http://www.hydropower.com/articles/print/volume-19/issue-3/articles/new-development/renaissance-for-pumped-storage-in-europe.html>

¹ The European Market for Pumped Storage Power Plants, Ecoprog, April 2011.

² Ecoprog



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