

# Lucky Norway. Hydropower and the benefits of climate change

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***Based on a presentation by Per Sanderud (head of the Norwegian Water Resources and Energy Directorate NVE) and a discussion with Hege Hisdal (NVE hydrologist) and Christina Beisland (NVE economist) at the 4th Nordic Conference on Climate Change Adaptation in Bergen, Norway, August 2016.***

Most people see climate change as a development that negatively affects their lives at some point in the future. There are also benefits, however, especially in Northern Europe. One of the benefits is the increase of hydropower potential for electricity production, and the country that benefits most of this is Norway. Currently 50% of Europe's reservoir capacity is concentrated in Norway. The conditions for hydropower will further improve in the north while they will deteriorate in most parts of Europe.

In the second half of this century, hydropower potential in Norway may increase up to about 15%, according to Hege Hisdal, hydrologist at the Norwegian Water Resources and Energy Directorate NVE. The increase depends on the rate of climate change, but also on processes in the water cycle that today cannot be quantified accurately enough. *'We need more*

*knowledge on especially the amount of evapotranspiration under changes in rainfall, temperature and other climate variables. This is important and partly determines what part of the precipitation flows into our reservoirs', Hege explains.*

In Norway, a distinction is made between “regulated” and “unregulated” hydropower. Regulated hydropower refers to hydropower plants with reservoirs. The electricity production is regulated by controlled outflow and the reservoir is kind of a green battery which supply can be regulated to meet electricity demand. Unregulated hydropower refers to turbines without a reservoir where river outflow is directly harnessed for electricity. Climate models indicate that climate change will result in changes in precipitation in Norway: more rainfall throughout the year and less snow accumulation in the winter. The overall effect will be that hydropower potential will spread out more evenly over the year. Unregulated hydropower potential, for instance, will increase in the winter season because river flow will increase when precipitation shifts from snow to rain. According to Christina Beisland, economist at NVE, this is positive from a business point of view: *'Demand is highest in the winter. More river flow in the winter means we can produce more electricity when the price of electricity is highest.'* She stresses that investments may be needed to exploit the benefits of climate change. Investments in turbines, for instance. The other side of the picture is that climate change is expected to lead to more extreme weather as for example more lightening. Investments to make the hydropower infrastructure more resilient may also be needed.

What about changes in the price of electricity when supply increases? According to Per Sanderud, head of the NVE, more river inflow due to more rain will not necessarily dramatically reduce the price of electricity in Norway. *'On the long-term the price of electricity by hydropower in Norway is fixed by other factors such as prices from coal and gas in Europe'*, he added.

Both adjustments of the hydropower systems and changes in reservoir management are needed in the future to exploit the benefits of climate change. The adjustments to the systems may be based on projections of climate change. Changes in reservoir management on the other hand, can be made once the impact on climate change is manifest. Hege: *'Reservoir management can change gradually in the course of time, in response to climate change. It will not become more complicated, it can just change, step by step.'*

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