

Effects of increased wind power generation on Mid-Norway's energy balance under climate change: A market based approach

Baptiste Francois (1,2,4), Sara Martino (3), Lena Tofte (3), Benoit Hingray (1,2), Birger Mo (3), Jean-Dominique Creutin (1,2)

(1) LTHE - Universite de Grenoble 1/CNRS, 38041 Grenoble, France, (2) LTHE - Universite de Grenoble 2/G-INP, 38041 Grenoble, France, (3) SINTEF Energy Research, P.O. Box 4761 Sluppen, NO-7465 Trondheim, Norway, (4) now at : Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Amherst, Massachusetts, USA

Thanks to its huge water storage capacity, Norway has an excess of energy generation at annual scale, although significant regional disparity exists. On average, the Mid-Norway region has an energy deficit and needs to import more electricity than it exports. We show that this energy deficit can be reduced with an increase in wind generation and transmission line capacity, even in future climate scenarios where both mean annual temperature and precipitation are changed. For the considered scenarios, the deficit observed in winter disappears, i.e. when electricity consumption and prices are high. At the annual scale, the deficit behavior depends more on future changes in precipitation. Another consequence of changes in wind production and transmission capacity is the modification of electricity exchanges with neighboring regions which are also modified both in terms of average, variability and seasonality.

Keywords: Variable renewable energy, Wind, Hydro, Energy balance, Energy market