The present situation for Electricity Certificate Market in Norway/Sweden

Impacts on Norwegian Hydropower.

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Renewable energy respecting nature
Main topics

Hydropower technology for the future

Environmental design of hydropower

Impacts on birds and wildlife from wind turbines and power lines

Reconciling environmental and energy policy concerns

Norwegian Water Resources and Energy Directorate
Content

- The market in brief
  - The demand side
  - The supply side

- The impact on Norwegian renewable energy, highlighting hydropower

- Will investments come?
The Swedish-Norwegian certificate market
Investment period: 01.01.2012 - 31.12.2020

- Market based instrument
- Technology neutral scheme
- 13.2 TWh to be financed in each country within 2020; in total 26.4 TWh

- Green value of the new production shared equally between Norway and Sweden for use in EU Renewable Energy Directive
- Norwegian target in the Directive: Up from 58 to 67.5 % renewable share of energy consumption.
Possible contribution of different technologies in the two countries to reach the target of 26.4 TWh

Source: Gemensamt elcertifikatsystem med Norge, Energimyndigheten (2010)
IT is compulsory to buy the certificates for:
- All power suppliers delivering electricity to final consumers
- Consumers that purchase electricity through bilateral agreements
- Consumption of self-produced electricity

For a given share of their consumption/sales
The quota curve
THE SUPPLY SIDE
Certificate entitled production, Norway

- All new renewable electricity production where construction began after 7th of September 2009
  - Hydro power smaller than 1 MW – 1st of January 2004
- A new plant is entitled to certificates for a period of maximum 15 years
- 1 certificate per MWh
- Certificate price has typically been approx. 25 €/MWh, but must be seen together with the power market. 85 €/MWh is considered necessary to trigger investment in Wind Power on land
Global Environment - Local Environment
Status Licensing

- Licenses given last 5 years
  - Hydropower: 3.7 TWh of which 1 TWh is in operation
  - Windpower: 5.9 TWh of which ~1 TWh is in operation/under development

- Licenses given in 2012:
  - Hydropower: 145 schemes, 644 MW, ~1 700 GWh
  - Windpower: 9 wind farms, 678 MW, ~2 000 GWh

- Hydropower energy generation: ~50% small hydro, ~20% upgrading existing large hydro, 30 % new hydropower plants with capacity over 10 MW
Hydropower development in Norway

- < 10 MW
- 10-100 MW
- > 100 MW
Hydropower upgrading

- Reduced head loss and increased efficiency
- More water – hydrology related
  - Reduce loss of water
    - Increased flow capacity
    - Increased reservoir capacity
  - Increase inflow by for example diverting water from nearby catchment
- Increased head and/or reservoir capacity
- Simulation models are needed for documentation of benefits caused by increased capacity
Increase of Efficiency and Flow Capacity of Turbines

- Normal maintenance and re-establish a plant’s original technology will not be subject for Certificates.

- Accepted standards
  - Model test IEC 60193 or field measurement IEC 60041
    - Situation before and after change of technology must be documented
    - Reduction for wearing by use of simple formula or by documentation of original situation

The following simple formula may be used for wearing if the original situation can not be documented: 

$$ Y = 86.5 - 0.043 \times X $$

Y is reduced efficiency due to wearing in percent from commission or last upgrading. X is year for commission or last upgrading.
Increase of Efficiency and Flow Capacity of Turbines

- Model tests or field measurements are recommended, but a simple formula can be used as an alternative for high and low head schemes (Pelton/Francis/Kaplan)

- \[ Y = 175 - 0.087 \times X \]

  - \( Y \) is increased efficiency in percent and \( X \) is year for commission or last upgrading
  - The formula includes reduction for wearing
Hydropower over 10 MW

- ~ 8 TWh under licensing
- Highlighting upgrading
  - Need approximately 3 TWh
  - Because of completely new plants total investment
    ~3500 million €

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Developed and plans for small hydropower plants

- 1990-1994
- 1995-1999
- 2000-2004
- 2005-2009
- >2010/under construction
- Approved plants
- Under licensing
- In queue for licensing

MW
License Small Hydropower

- Approximately 860 schemes in Licensing queue. Generation capacity more than 7.5 TWh
- Target to treat all within 2017
- Need 4 TWh to be developed before end 2020
  - Means 50 schemes 2.5MW/10GWh schemes each year in 8 years
  - Total investment ~2700 Million €
New generation capacity demands increased capacity in the transmission system

- Driving forces for new transmission
  - Security of supply
  - Increased consumption
  - New generation capacity
Licensing in NVE

- Over 1500 km High Voltage
  - Ofoten–Varangerbotn (745)
  - Storheia–Trollheim (127)
  - Kollsnes–Modalen (105)
  - Rød–Bamble (35)
  - Lyse–Stølaheia (73)
  - 315 km upgrading voltage (300→420 kV)
  - 170 km cables to other countries

- Ca. 800 km Medium Voltage
- Ca. 130 affected municipalities
The TSO (Statnett) work on detailed plans

- Nytt siden NUP 2011
- Endelig konsesjon
- Spenningsoppgradering
- Bamble – Kristiansand
- Konseptbeslutning Vestre Korridor

- Nye prosjekter siden NUP 2011:
  - Lyse – Stølaheia
  - Nye stasjoner
  - Fasekompensator og transformator:
Can Norway reach new generation capacity of 13.2 TWh in the next 8 years?

- Last 5 years:
  - Construction of 5 TWh hydropower has been completed
  - 1TWh wind power has been implemented

- The next 8 years:
  - New hydro-, bio- and wind power generation capacity financed in Norway/Sweden to reach the target of 26.4 TWh
  - 50 % implemented in Norway means approximately 8 TWh new hydropower and 6 TWh new wind power constructed

- Constraints:
  - Transmission capacity
  - Engineering and construction capacity
Norway sees the highest investment volume for renewable electric energy for decades

Investment in the power system
(Mrd. NOK, 1€ ~7.5 NOK)

History

Expected

Generation

Regional- and distribution lines

High voltage transmission

Kilde: Statnett, SSB, NVE, NUP 2011, RKSUer, THEMA Consulting Group

*Investeringskostnadene for øvrige sentralnettsiere ikke med
Thank you for listening