Four things to consider for generation adequacy in a “high renewable” electricity system

IEA Electricity Security Workshop

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Decarbonization agenda will drive a significant growth in renewables – regardless of chosen policy route…

Impact assessment from “A policy framework for climate and energy in the period from 2020 up to 2030”

Note: Not exact numbers. Calculation made from numbers in the IA page 71: Total Gross Electricity Generation is presented in TWh. Generation technology in one digit shares of total.
Source: Impact Assessment accompanying the Communication “A policy framework for climate and energy in the period from 2020 up to 2030”
…as will general technology development (regardless of policy)

**Levelized electricity cost wind**

Technology developments. Supply chain & installation efficiency drive down levelized cost of electricity of renewables

Conventional thermal technology facing increasing levelized cost levels through rising CO2 prices (or cost) and decreasing operating hours
For Sweden, generation adequacy challenges will be enhanced as the nuclear fleet starts to be decommissioned.
Sweden has a challenging demand profile over the year.

Power consumption 2014 per month – Capacity from 8 → 27 GW

Sum of power consumption per month

TWh
4 important areas to address the need for flexibility

- Transmission infrastructure & integrated market
- Stronger coupling of heating and power systems
- Demand-side management
- Flexibility of hydro power
Transmission capacity and an integrated market reduces the capacity deficit

Nordic “reliable capacity” + full import

- Unlikelihood of simultaneous Nordic peaks reduces current peak from 73 to 67 GW
- Possibility to rely on interconnectors and imports reduces urgency of securing domestic capacity

*Availability according to SvKs assumptions winter 14/15: Hydro 85%, Nuclear 84%, Wind 6%, Condense 90%, Backpressure 76%.
Demand-side participation will be essential to “resolve” peak situations - extreme peaks occur only a handful of hours per year.

Much to gain from permanently reducing peak demand - and from allowing for active demand-side participation.
Stronger coupling of heating & power systems valuable from a system perspective

Flexible CHP example - Ringkøbing district heating plant (Denmark, 6 October 2014)

1. Prices not high enough for CHP to start
2. Heat demand is met by thermal storage
3. Prices >30EUR/MWh → economically viable to run gas engine in CHP to meet heat demand and obtain revenues from electricity
4. Solar fields heat water
5. Thermal storage meets demand until 23:00
6. Gas boilers heat water
7. Prices are <20EUR/MWh → electric boilers heat water

- 2 CHPs (one gas engine and a gas turbine)
- 1 electric boiler
- 4 gas boilers
- Heat storage
- Large scale solar heating field

Source: PointCarbon
Hydro power flexibility will be essential to utilize (or at least preserve)

Consumption minus wind and solar production, assuming significant RES growth (Feb 2015 vs 2050)

Net demand variability and ramp rates increase for all operational timeframes (yearly, seasonal, weekly, daily, hourly) – for system to manage, flexibility of hydro power, heat infrastructure, DSM and imports will play important roles
4 important areas to address the need for flexibility

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- Stronger coupling of heating and power systems
- Demand-side management
- Flexibility of hydro power
Thank You