



NVE

POTENTIAL FOR FLEXIBILITY REVENUES ON DIFFERENT TIME HORIZONS IN THE SPOT MARKET

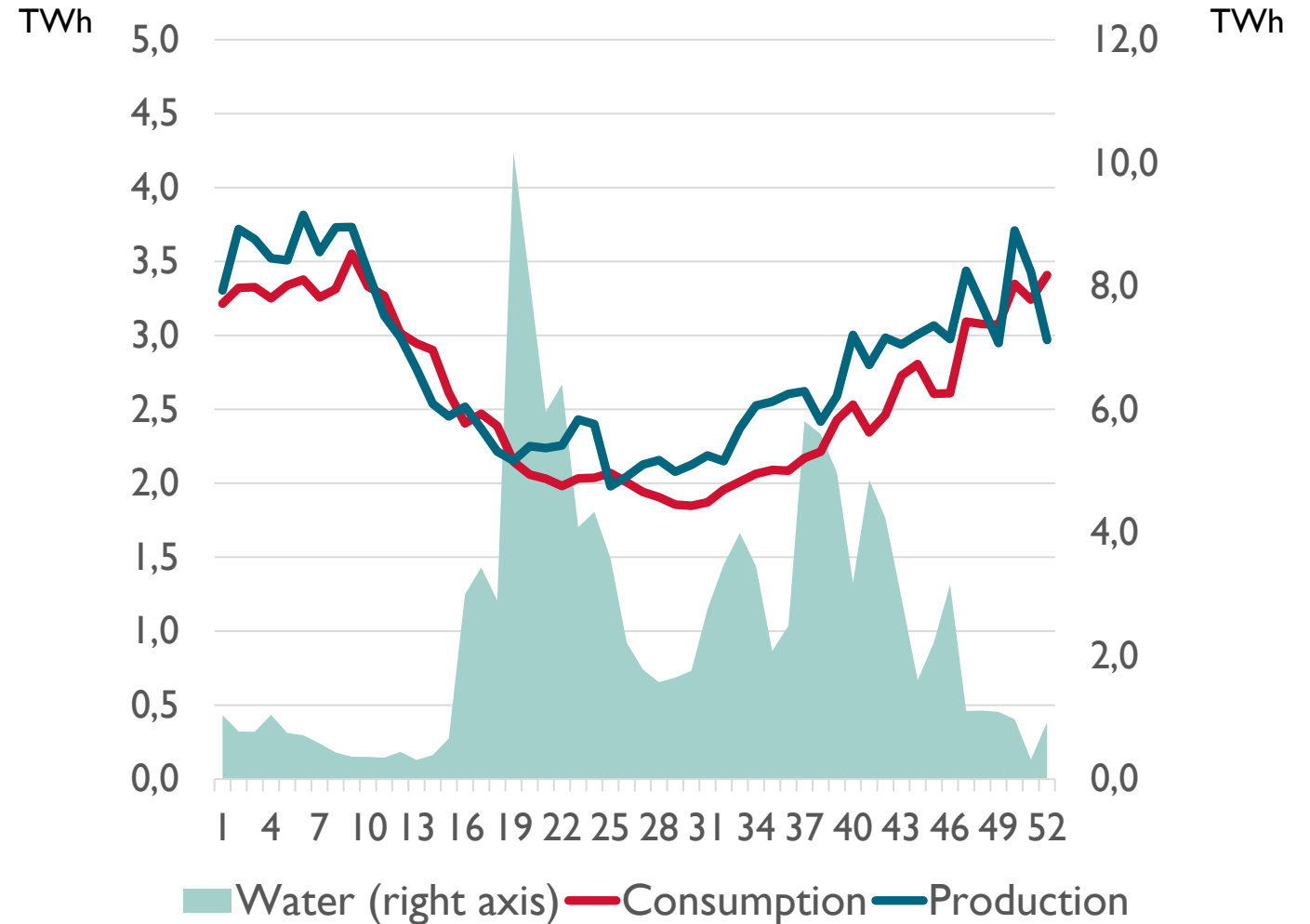
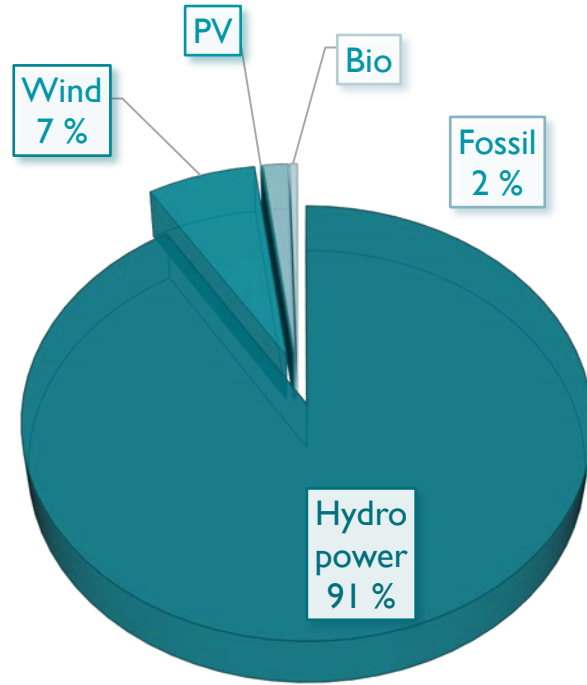
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Presentation by Fredrik Arnesen

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Norway's power system is dominated by Hydropower



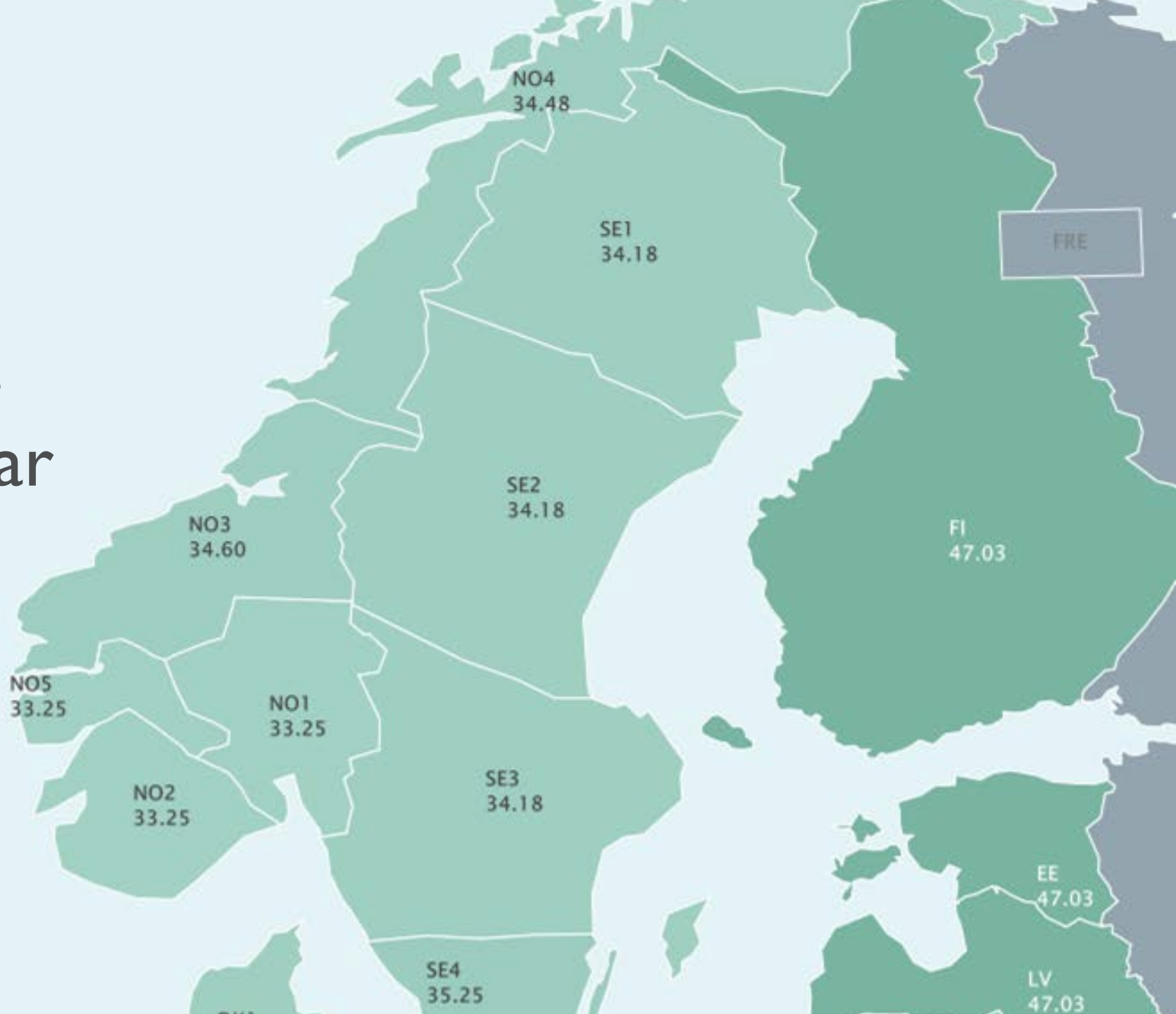
Flexibility on different time scales – IEA's divisions:

- Sub-seconds to seconds
 - Seconds to minutes
 - Minutes to hours
 - Hours to days
 - Days to months
 - Months to years
- Short term
- Medium term
- Long term



NordPool

5 bidding areas
8760 prices/year



Is hydropower more valuable?

140 TWh - hydropower production in Norway (2018)

€ 5 bn. - market value (2018)

40,4 €/MWh - obtained price for hydro power (2018)

40,0 €/MWh: - average power price (2018)

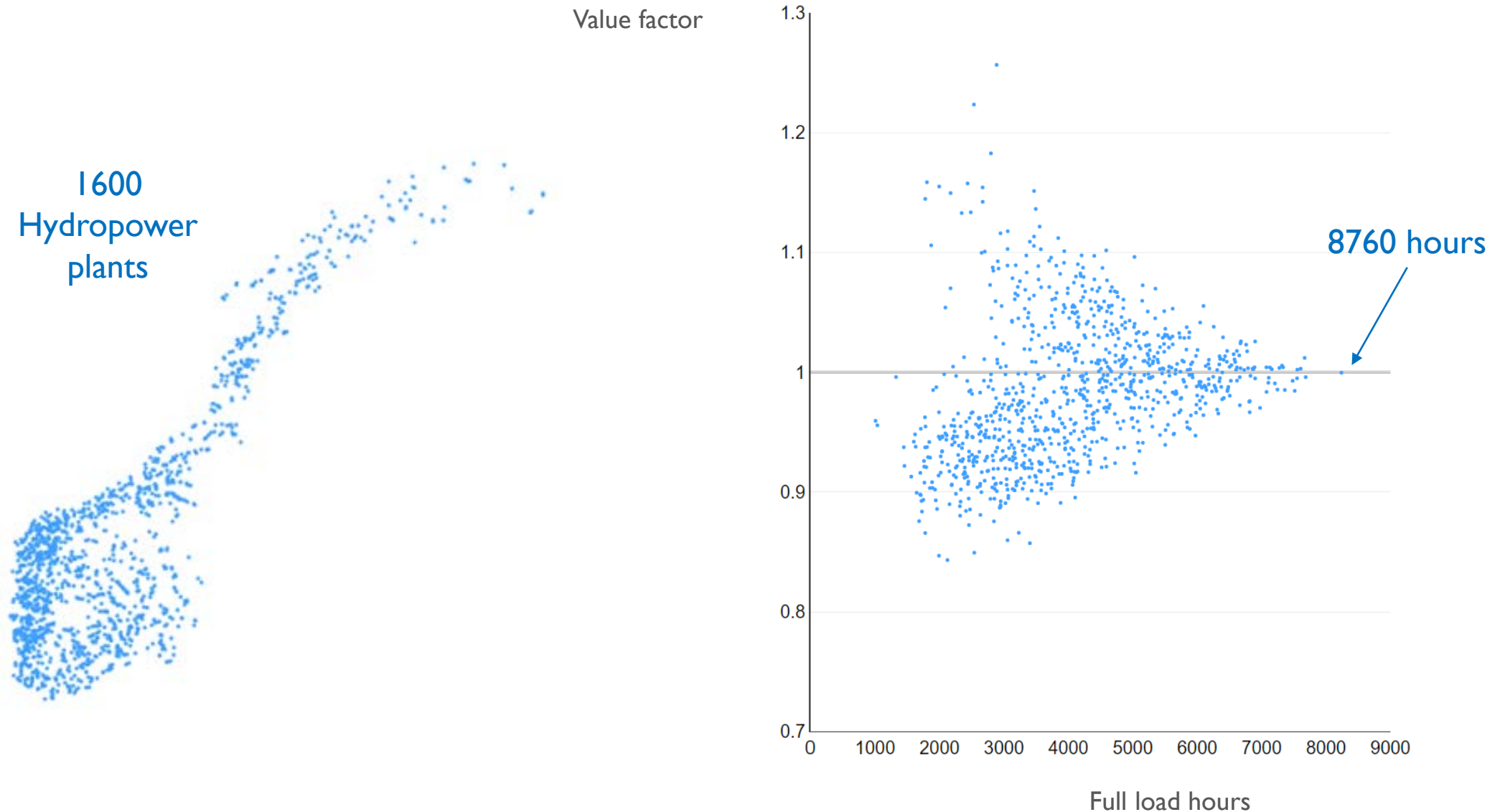
101 % value factor in 2018

Is hydropower more valuable?

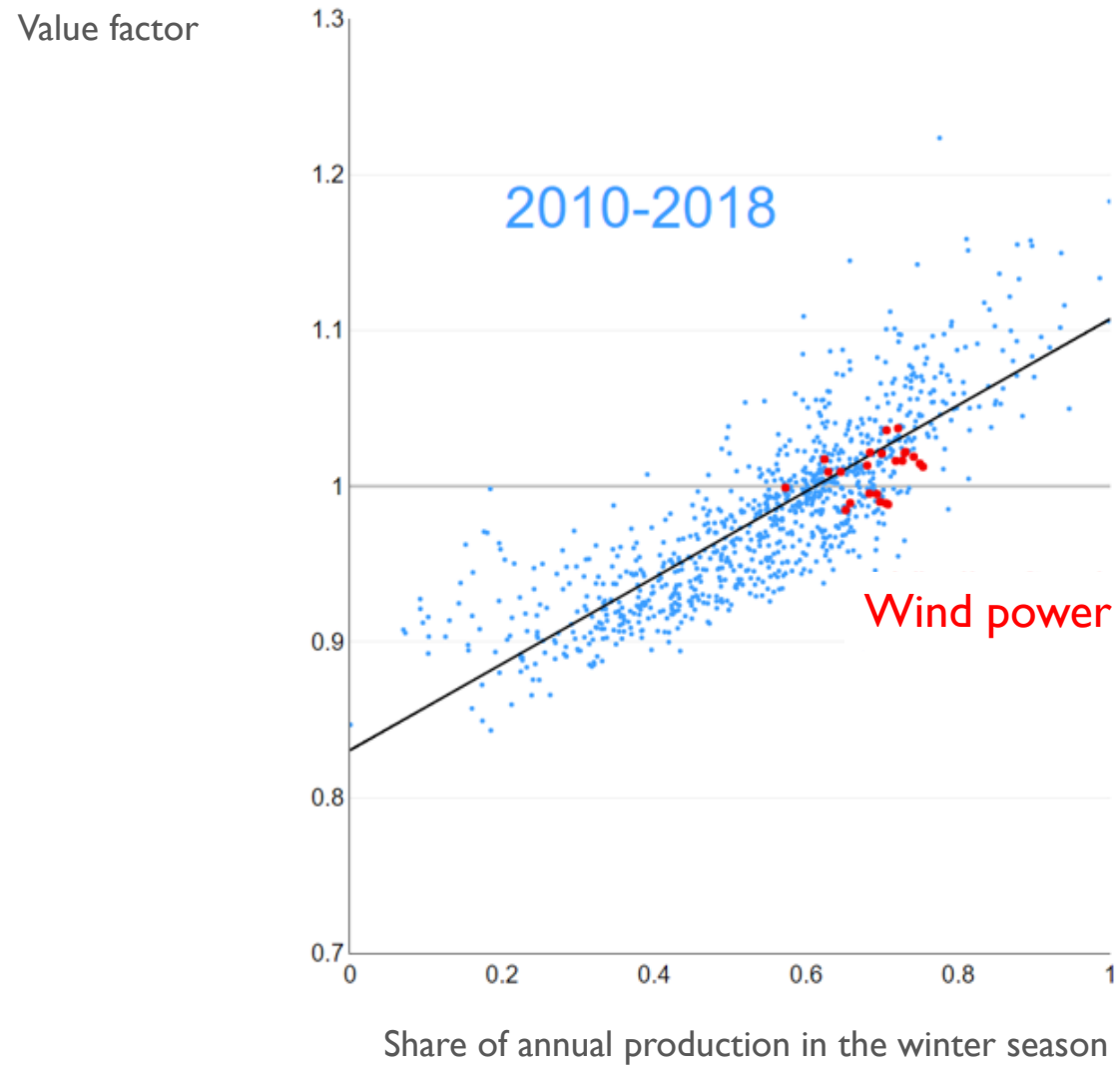
$$\textit{value factor} = \frac{\textit{market value of hydropower}}{\textit{market value of all power production}}$$

101 % value factor in 2018

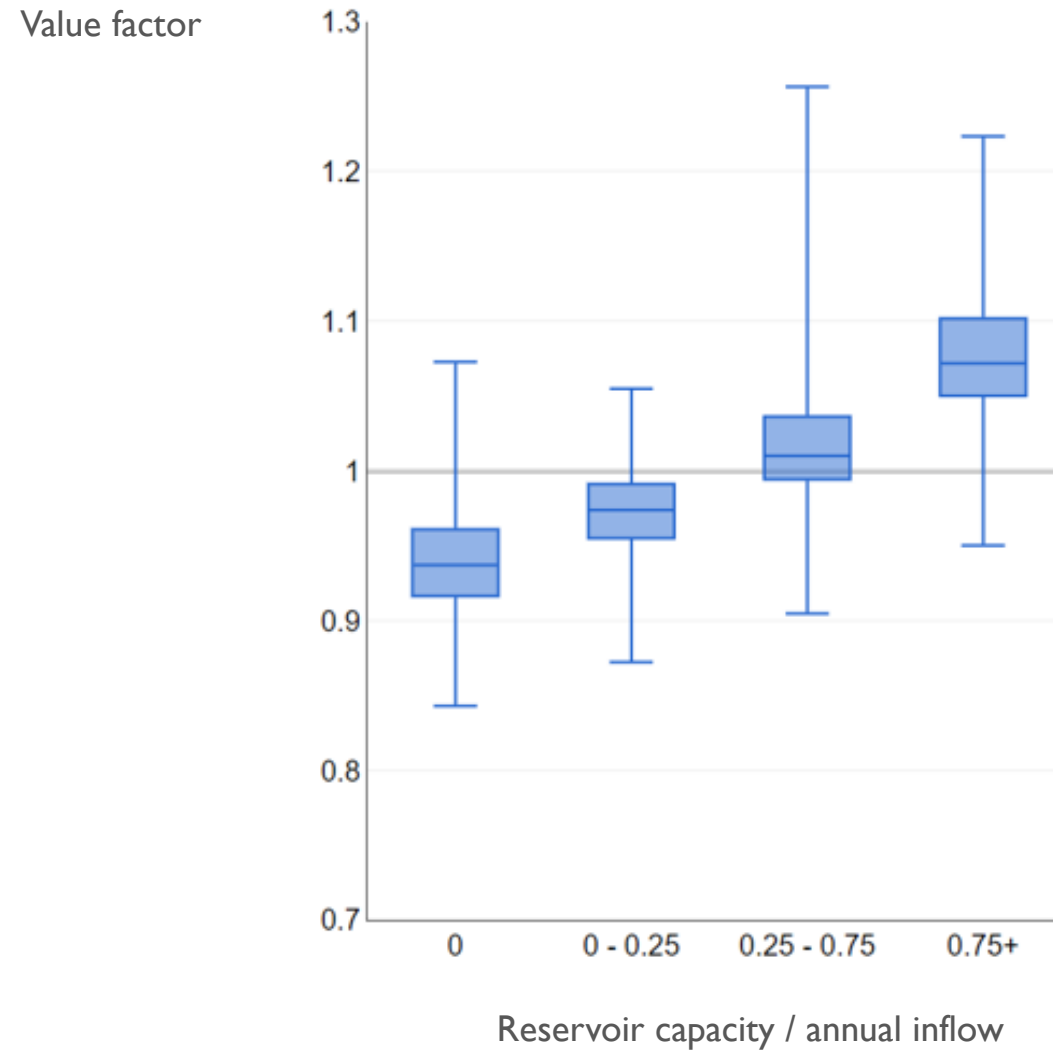
Number of full load hours is important for the value factor



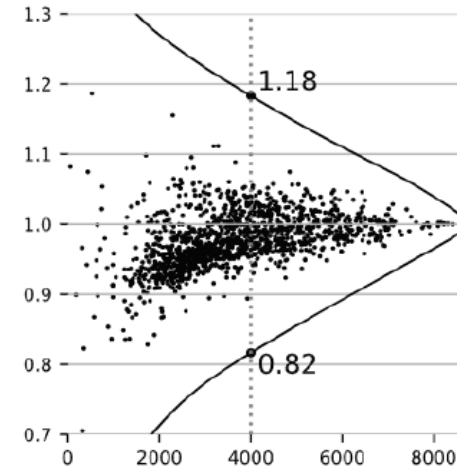
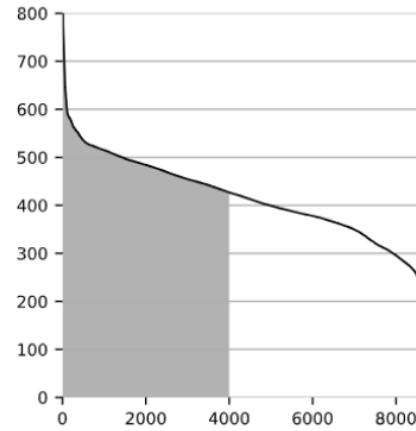
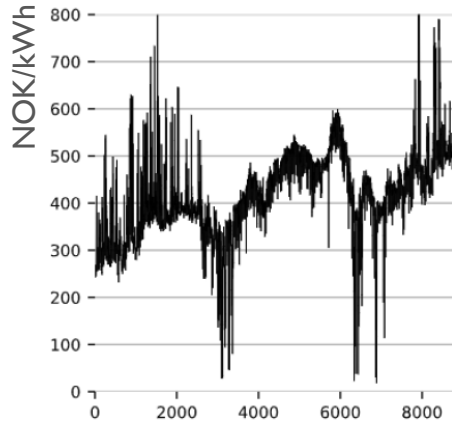
Winter production → higher value factor



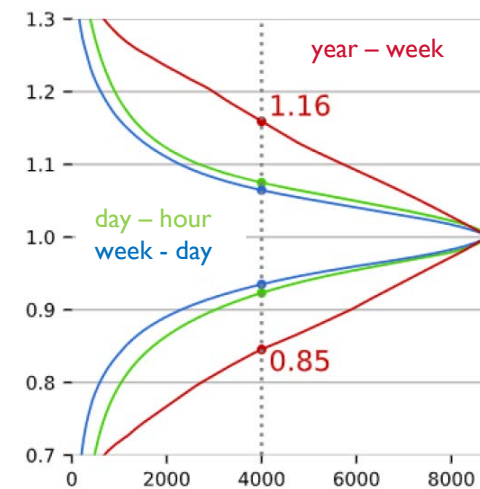
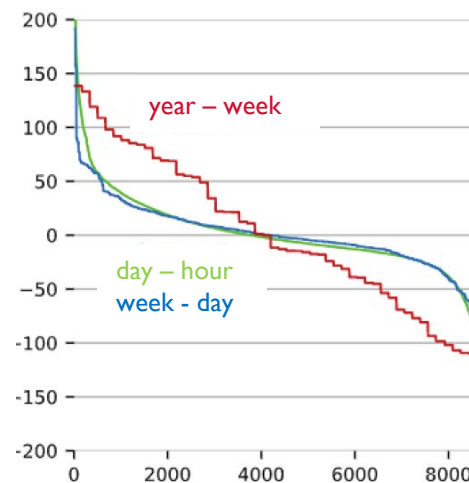
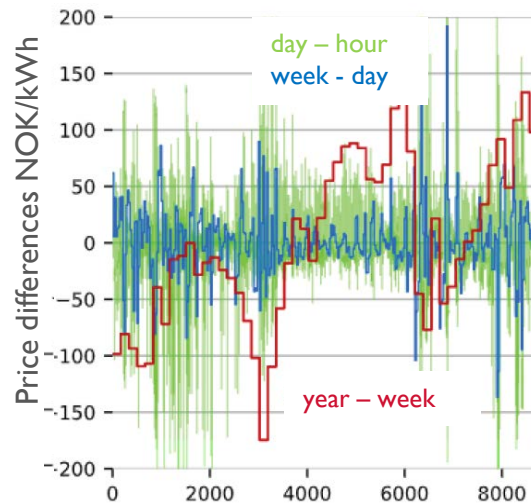
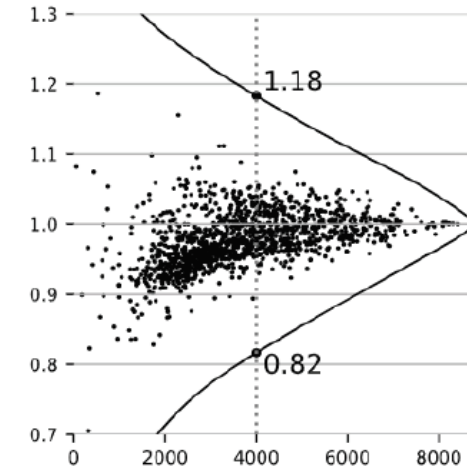
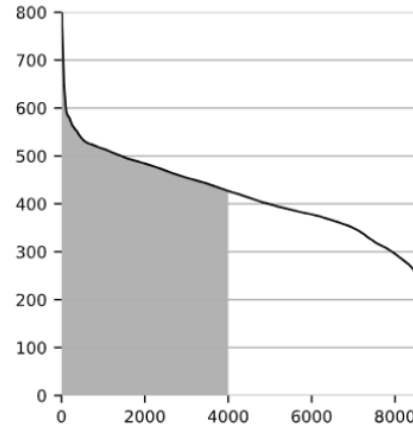
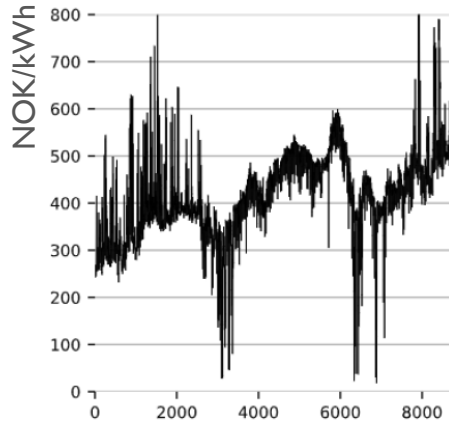
Plants that can store a high share of the annual inflow tends to achieve higher value factor



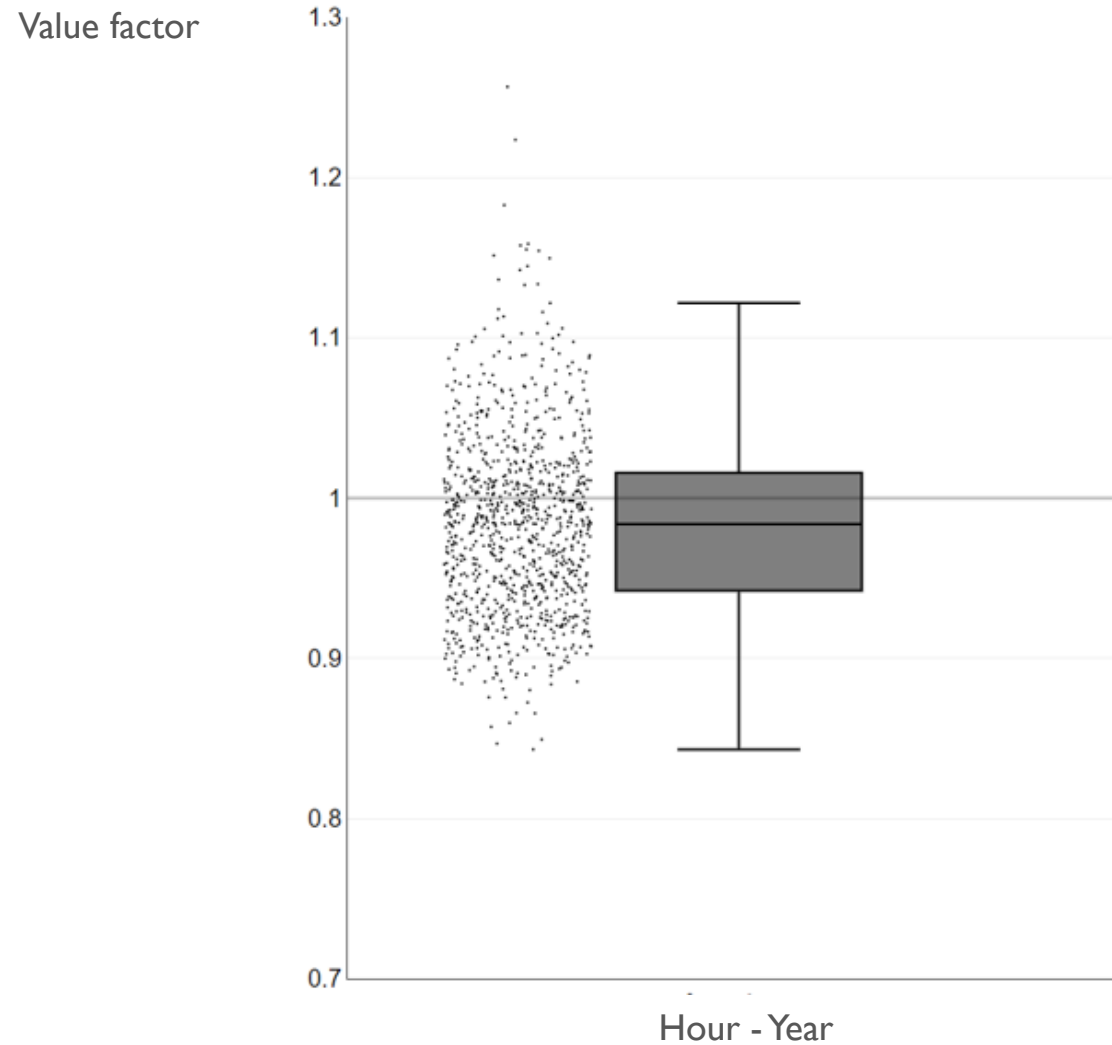
Prices determine the maximum potential value factor



Prices determine the maximum potential value factor – on different time scales

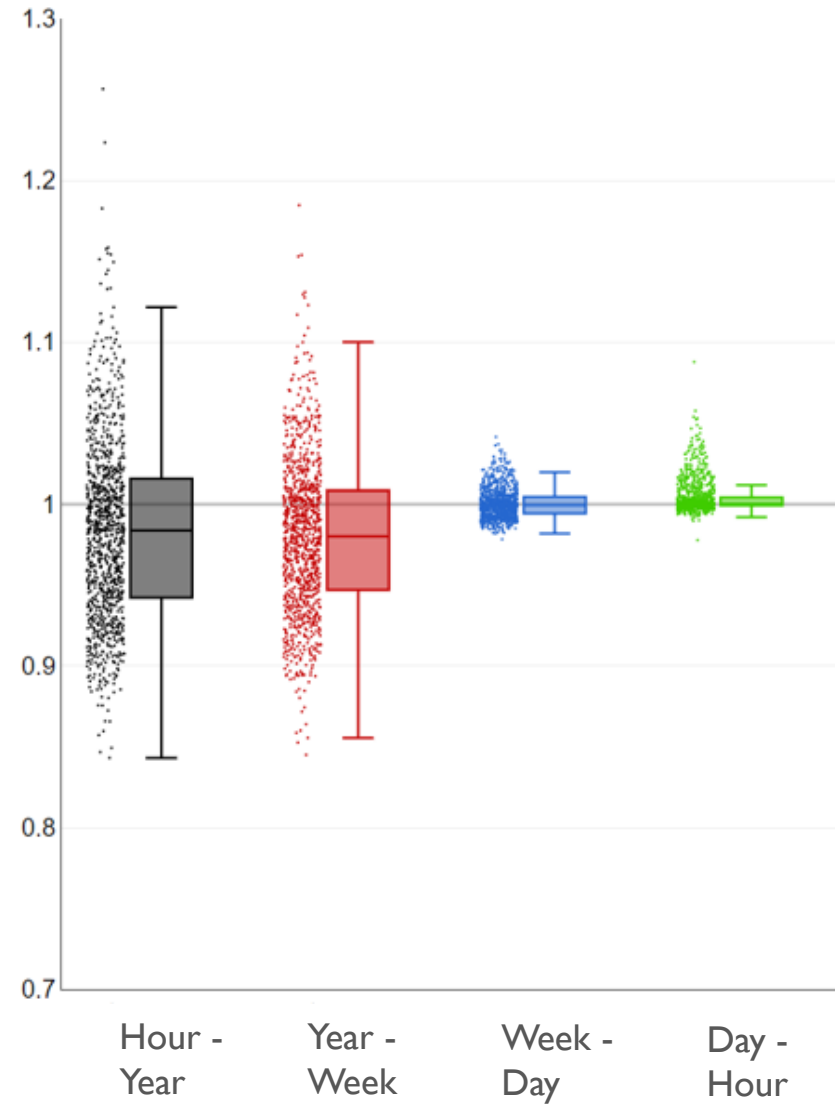


More revenue from long-term flexibility



More revenue from long-term flexibility

Value factor

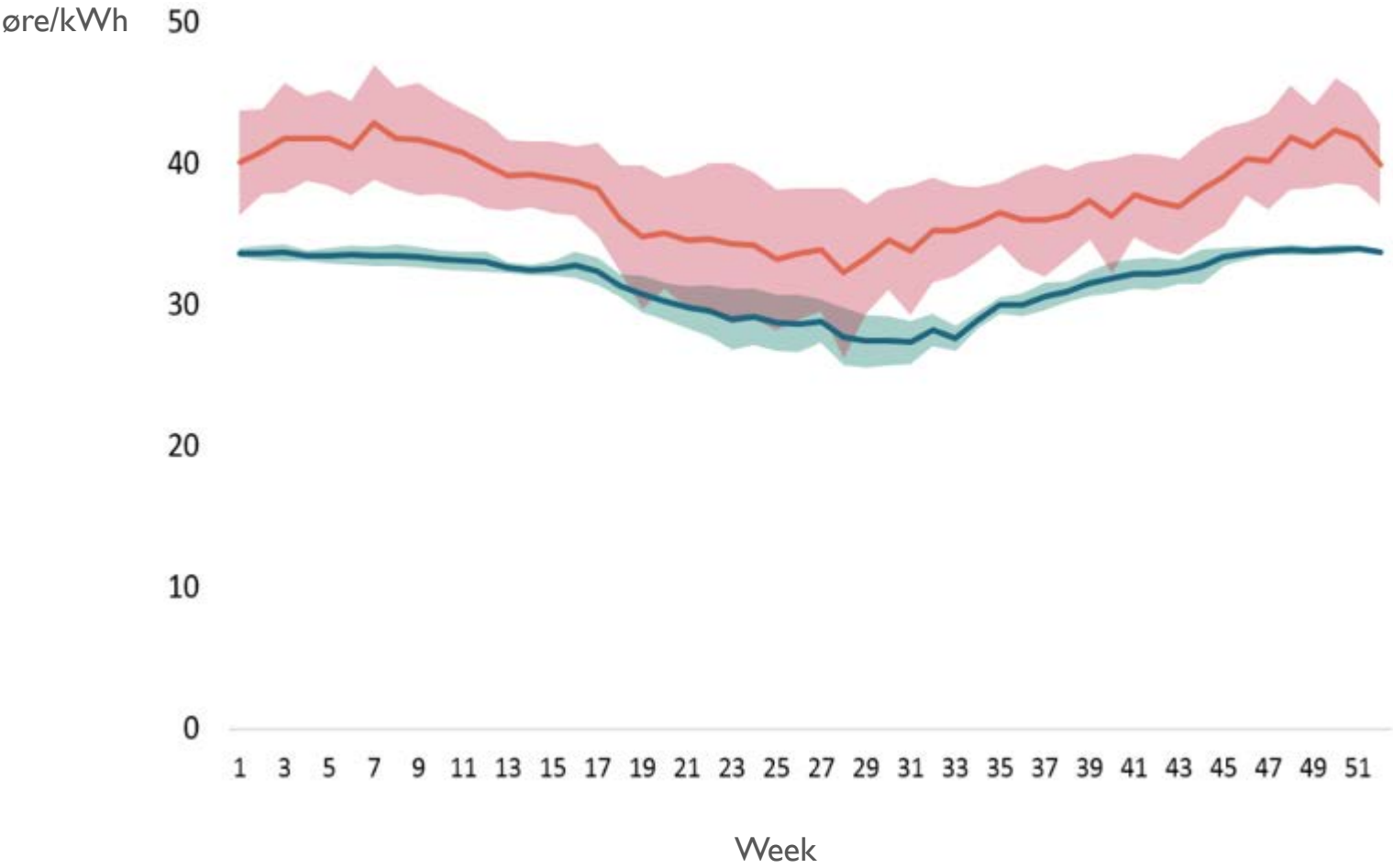


Conclusions

- Plants with higher share of regulated water tends to achieve higher value, but there are big differences.
- Power plants with high share of the production in the winter season tend to achieve higher value factor.
- Most of the value factor in the Norwegian market can be explained by the ability to hit the weeks with the highest average prices.
- Less of the value factor can be explained by the ability to exploit price differences within each week and within each day.



These conclusions can be different in the future



- Price differences
- Within the week 2018
 - Within the week 2040
 - Seasonal variation 2018
 - Seasonal variation 2040

