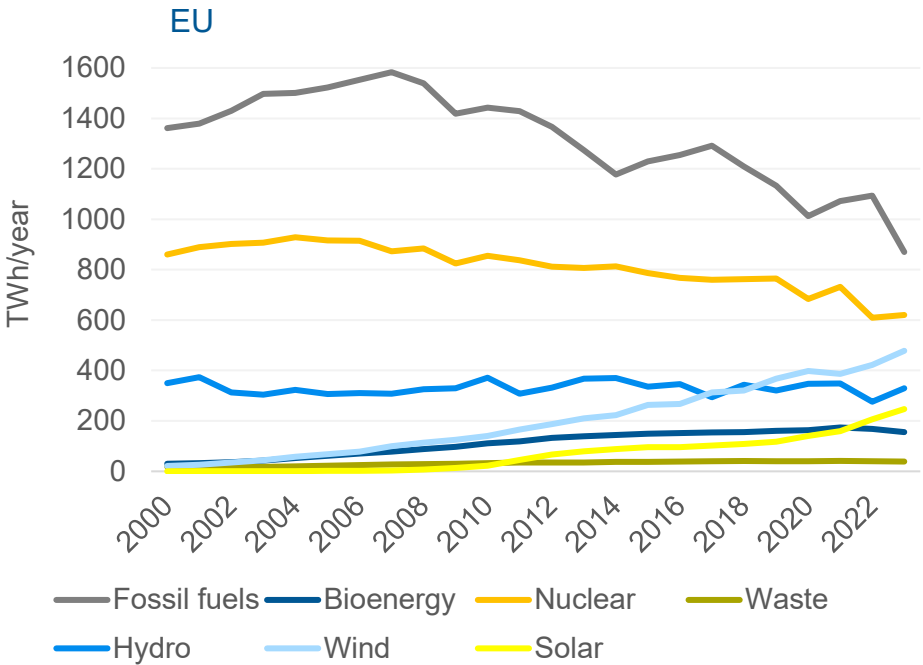


# The Devil in the Dispatch; What Hourly Modelling Uncovers in System Scenarios?

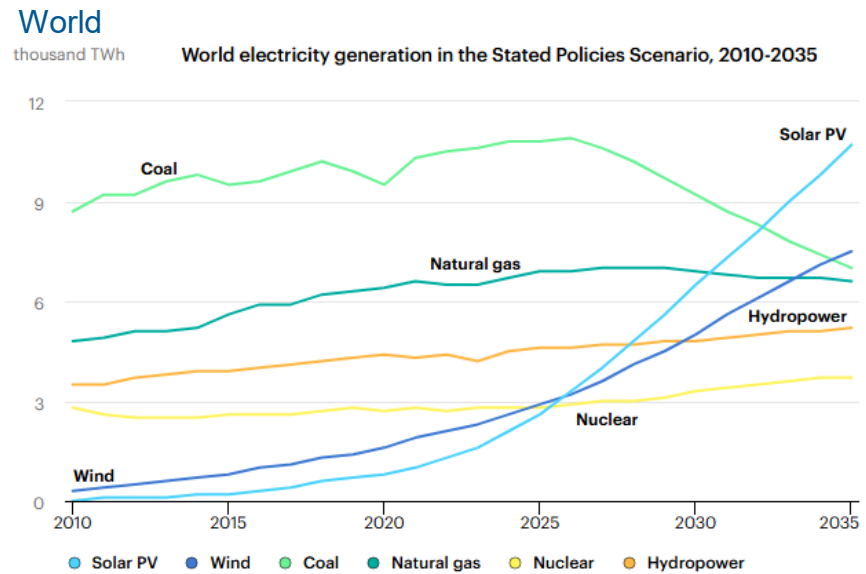
Tomi J. Lindroos, [tomi.j.lindroos@vtt.fi](mailto:tomi.j.lindroos@vtt.fi)  
Senior Researcher

09/02/2026 VTT – beyond the obvious

# Fast increase in the share of wind and solar



Source: Eurostat



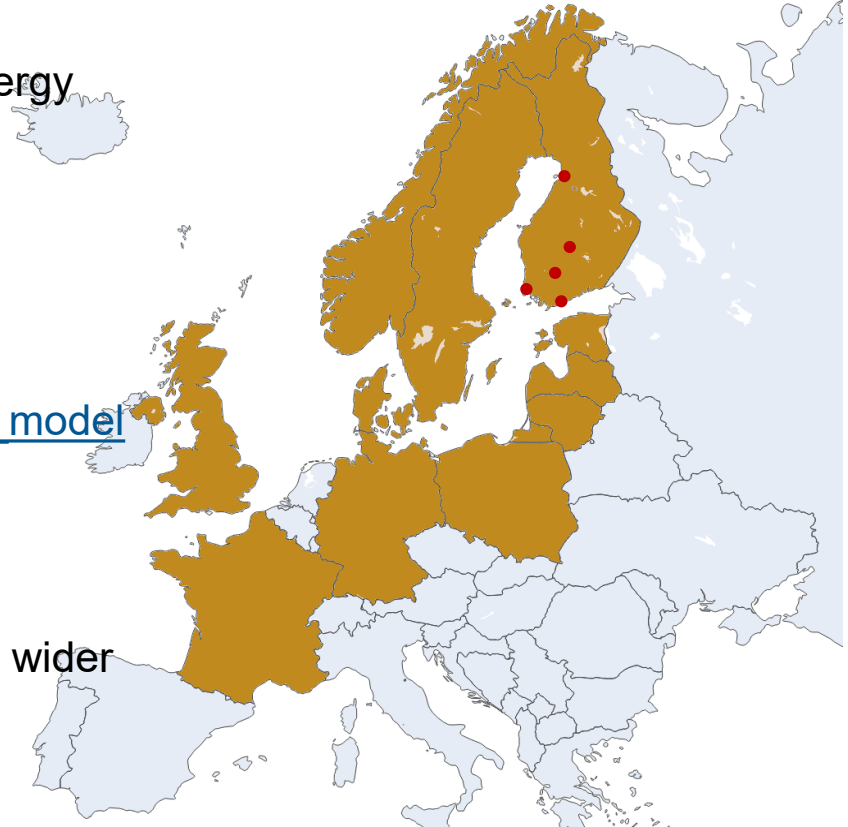
Source: IEA <https://www.iea.org/data-and-statistics/charts/world-electricity-generation-in-the-stated-policies-scenario-2010-2035>

## European / Northern European Backbone

- Modelling electricity, district heating, hydrogen
- Covers production, storages, transfers, and energy conversions
- Covers 16 countries and 7 cities in Finland
- 36 climate years (1982-2016)
- Built with Backbone modelling framework
- Open-source code and data:  
[https://github.com/vttresearch/north\\_european\\_model](https://github.com/vttresearch/north_european_model)

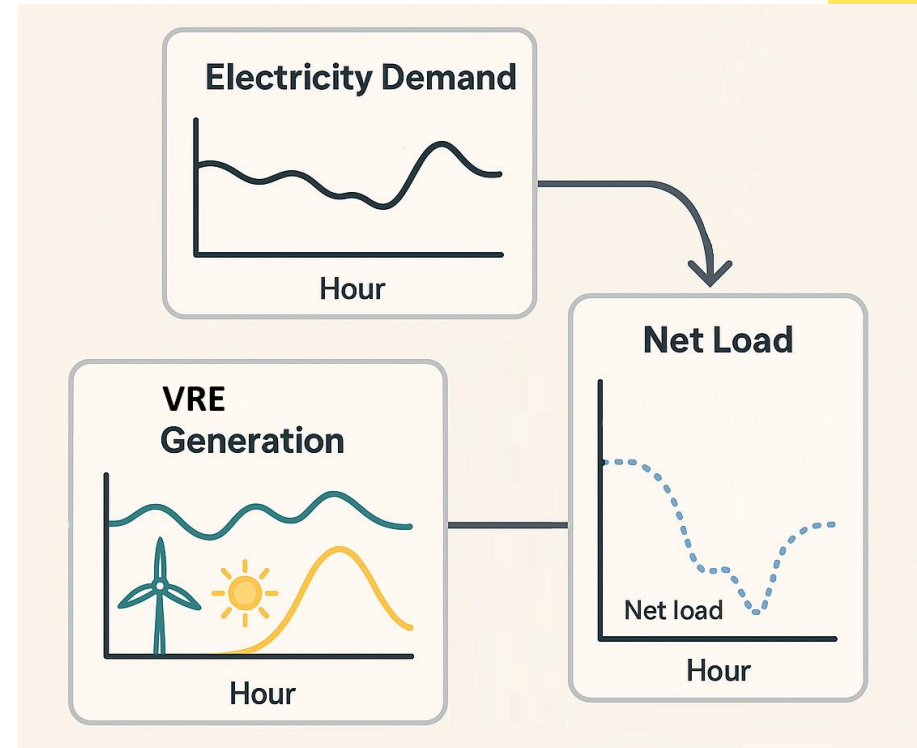
### Used to study

- Technology feasibility and market studies
- Company and city-level studies as a part of the wider system
- Climate and energy policy impact assessments



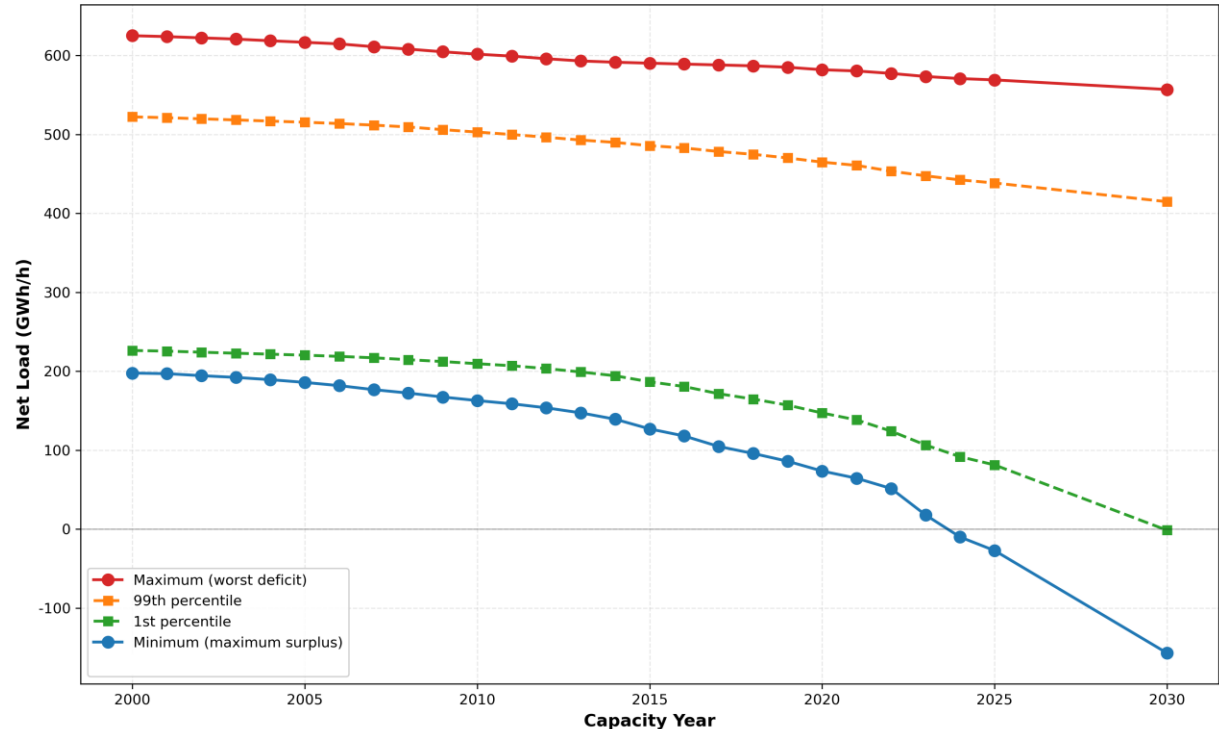
# Netload

- Net load is a key indicator when modelling dispatchable capacity
- The hourly electricity demand in the NEBB model region varies between 200...600 GW
- The VRE capacity is growing to
  - 280 GW wind + 270 GW PV in 2025
  - ~370 GW wind + 400 GW PV in 2030



# Netload

- Capacity year = actual historical Wind/PV capacity and 2030 projection
- Calculating 36 climate years for each capacity year
- Summing all countries in the model
- Maximum net load decreases much slower than other indicators
- 1% is ~88 hours, ~3 days

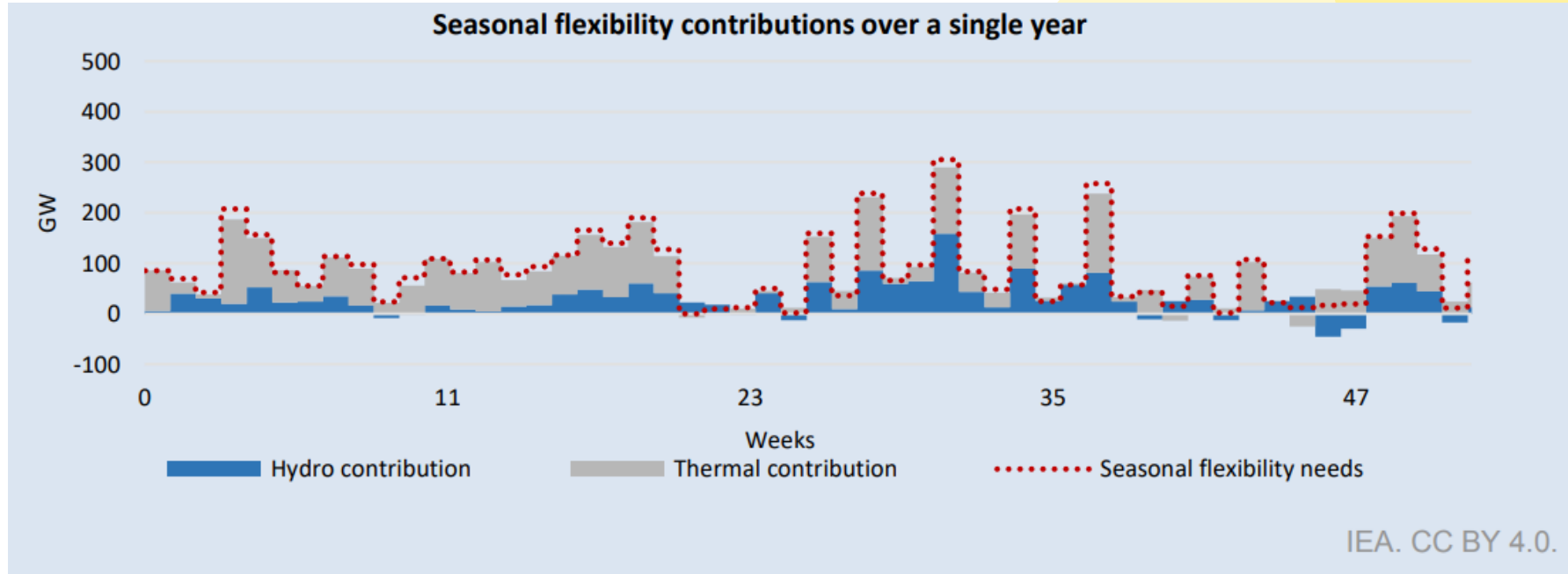


# Netload, recommendations

- Have one very short timestep to representing a very difficult netload situation (e.g. winter night with low wind), but
- keep the length/weight very low to not put too much energy and money in that timeslice.
- In addition, capacity margin should be applied
  
- Power system models typically assume also hourly constraints for
  - Minimum online firm capacity / inertia
  - Minimum upward regulation
- These are different to capacity margin and harder to move to TIMES, because their point is to guarantee a continuously stable power system, not the existence of the capacity. On the other hand, long timeslices might handle this as well.

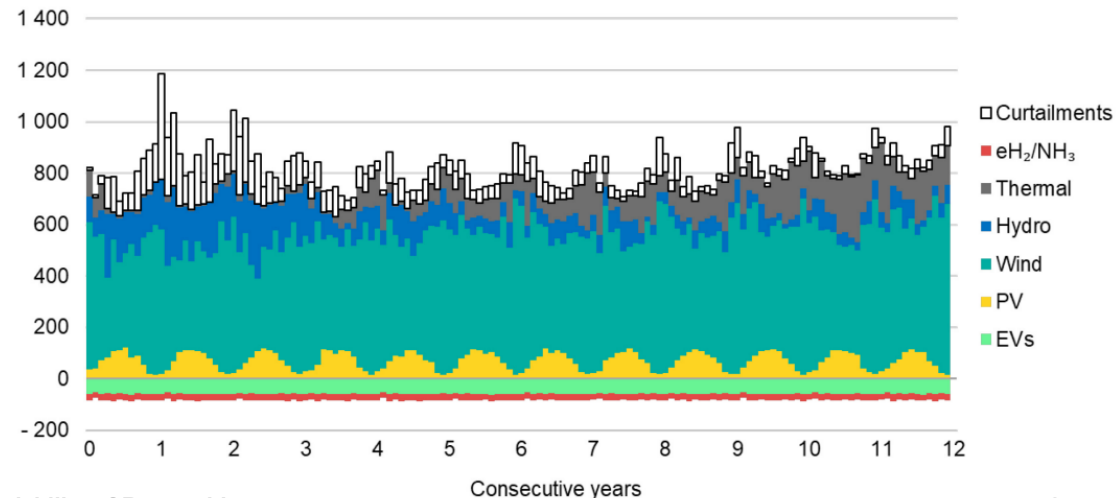
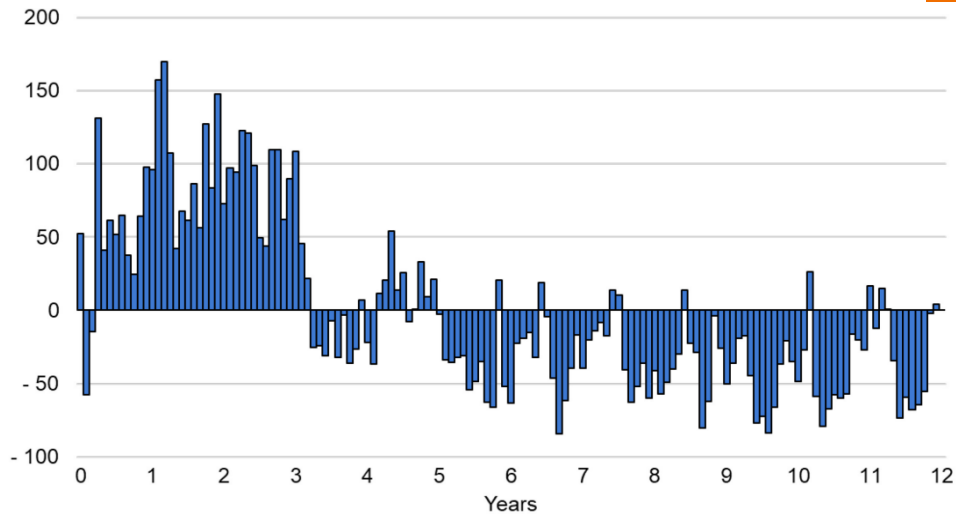
# Hydropower - short term solution, long term problem?

# Hydro power is a key flexibility provider in the current power systems



# But multiple dry years in a row can be very problematic in a high VRE scenario

- Currently we have that thermal capacity, but many long-term scenarios are phasing it out without seeing this issue.
  - > backup thermal
  - > much larger storages

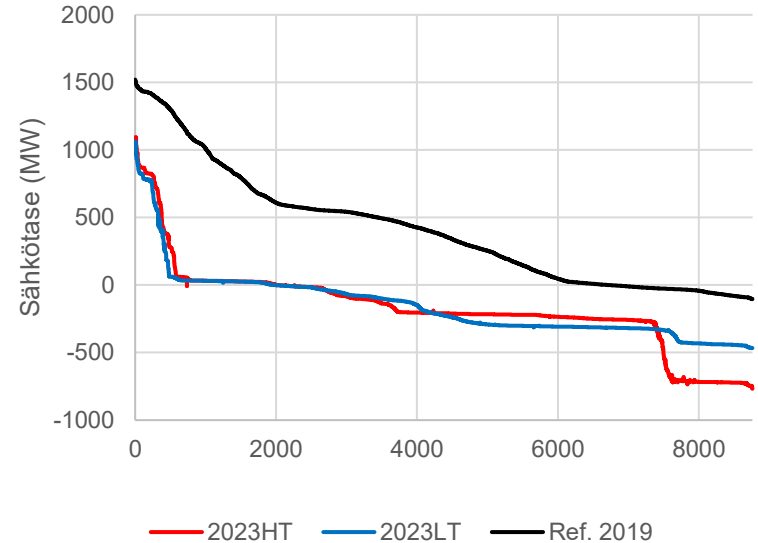


# Regional issues creating constraints on low carbon transition

# Finnish cities are turning from net producers to net consumers

Figure shows the modelled electricity net generation of Helsinki in 2019 reference year and in two 2030 scenarios

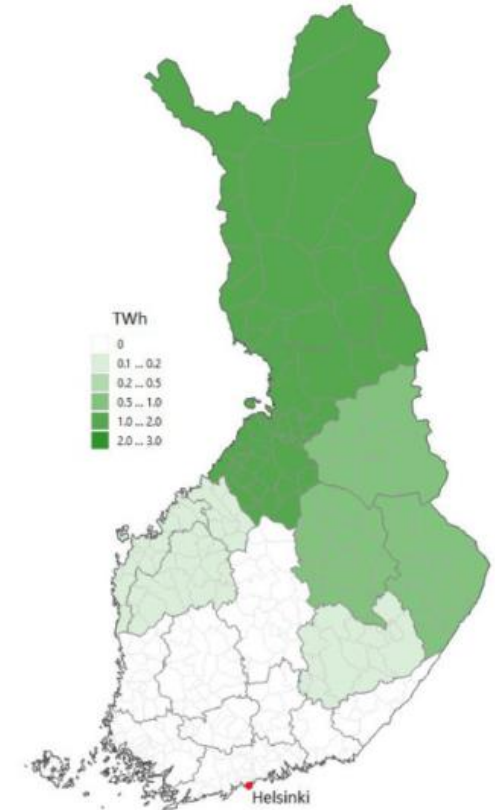
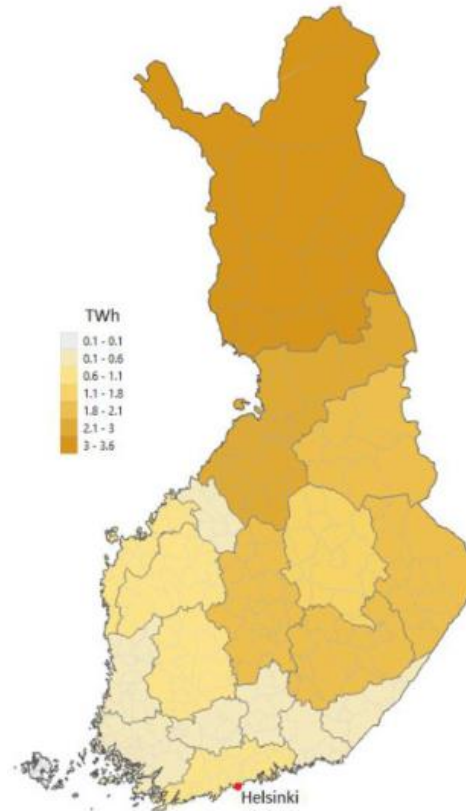
Hiltunen, Pauli and Lindroos, Tomi J. and Rämä, Miika, Electrification of District Heating: The Impact of Electricity Price Volatility and Distribution Temperatures on the Optimal Capacity Mix. Available at SSRN: <https://ssrn.com/abstract=5185397>



# National limit on biomass simplifies too much

- Finland is a large country full of forests, but the largest demand is in South under 10% of the Finnish land area.
- There is not enough sustainable biomass within reasonable transport distance.

Tomi J. Lindroos, Elina Mäki, Kati Koponen, Ilkka Hannula, Juha Kiviluoma, Jyrki Raitila; Replacing fossil fuels with bioenergy in district heating – Comparison of technology options; Energy, Volume 231, 2021, 120799, ISSN 0360-5442; <https://doi.org/10.1016/j.energy.2021.120799>.

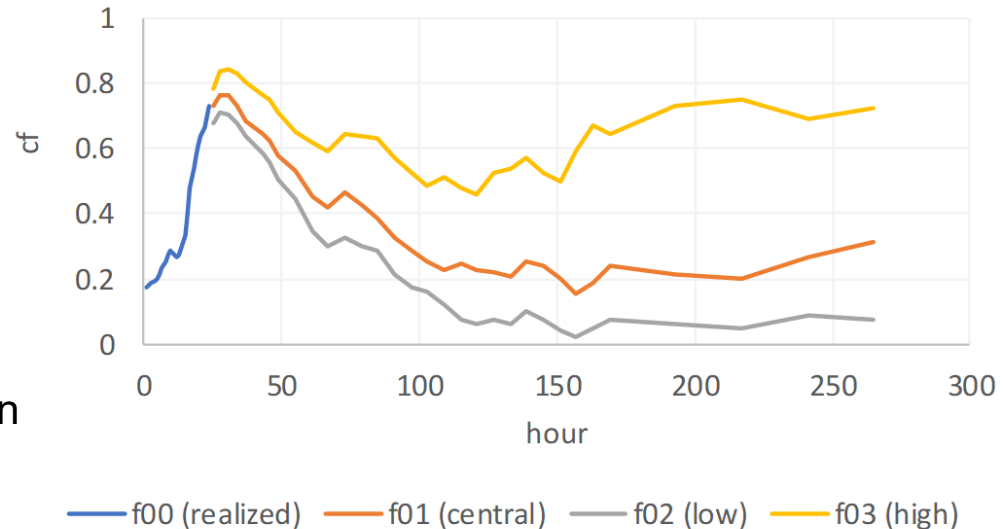


Available (left) and unused (right) bioenergy.  
Note: should we use that is another story.

# Market logic, uncertainty, and other nasty stuff

# Market logic, uncertainty, and other nasty stuff

- We run the full year in 365 looped solves. Each solve has
  - perfect info from only 24 hours,
  - ~week of improving forecast, and
  - the rest of the 70 week horizon with typical low/average/high forecasts
- Impartial information of demands, generation, prices, and unit availability has a significant impact on storage values and electricity price.
- Similarly to biomass areas in Finland, different wind zones are very important for big countries



# Linking TIMES and a dispatch model

# Linking two models

- We've been linking TIMES with many models, such as
  - Macroeconomic models where TIMES is the detailed one
  - Dispatch models (Balmorel, Backbone)
  - Sectoral models (forestry, agriculture, transport, etc)
- The topic is horribly broad, but to summarize:
  - a common mistake is to try to link the models too tightly.
  - Typically it is more important to really sit down and think only the most relevant things to align and then add more only if really needed.
- We are practicing to get an automated runs with PET + NEBB but are not there yet. Manual linking is too laborious and is often skipped.

# bey<sup>0</sup>nd

the obvious

Thank you!

[vttresearch.com](http://vttresearch.com)