

Some existing solutions and possible contributions to Smart Cities project

Henrik Aalborg Nielsen

ENFOR A/S

han@enfor.dk



ENFOR

- DTU spin-off company based on research within the areas of wind power and district heating forecasting and optimization.
- Started 2006.
- Working with system integrators home and abroad; COWI, B.V. Electronic, Overspeed.
- Typically outsources trivial development tasks.
- Systems in Europe, North America, Australia



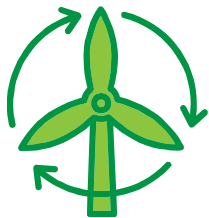
Consumption and production forecasts



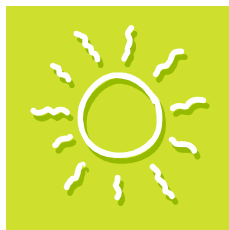
- Heat load forecasts and temperature optimization for district heating systems – usually for a horizons up to one week.



- Power load forecasts – for horizons up to one week, could be longer.



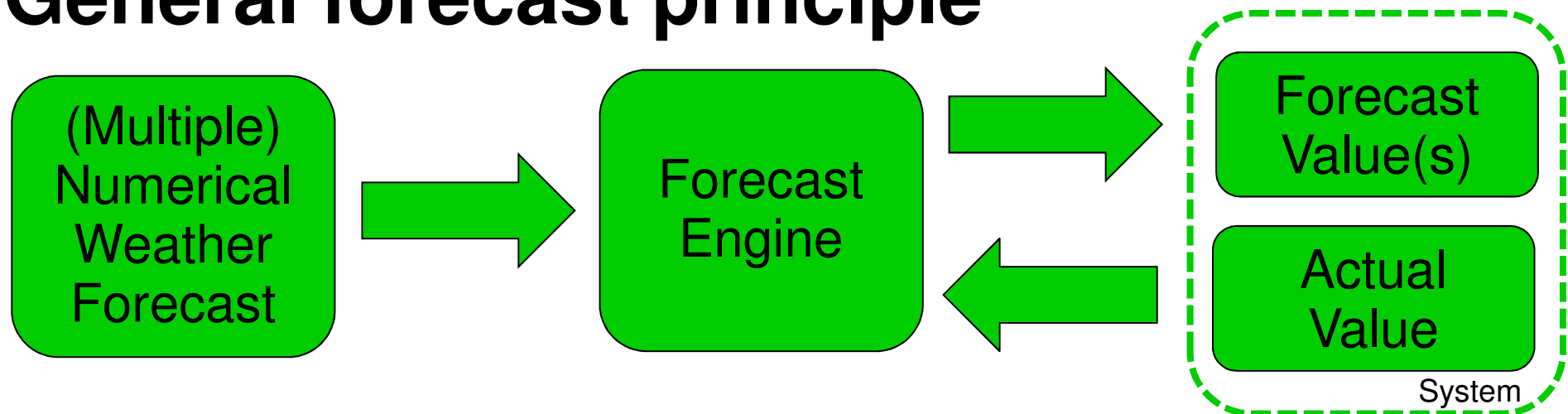
- Wind power production forecasts – usually day ahead, but up to one week is feasible.



- Solar PV power production forecasts – usually day ahead, but up to one week is feasible.



General forecast principle



- Calibrated against actual production / consumption available on-line or off-line in batches.
- If on-line data is available the autocorrelation is used in order to improve short-term performance.



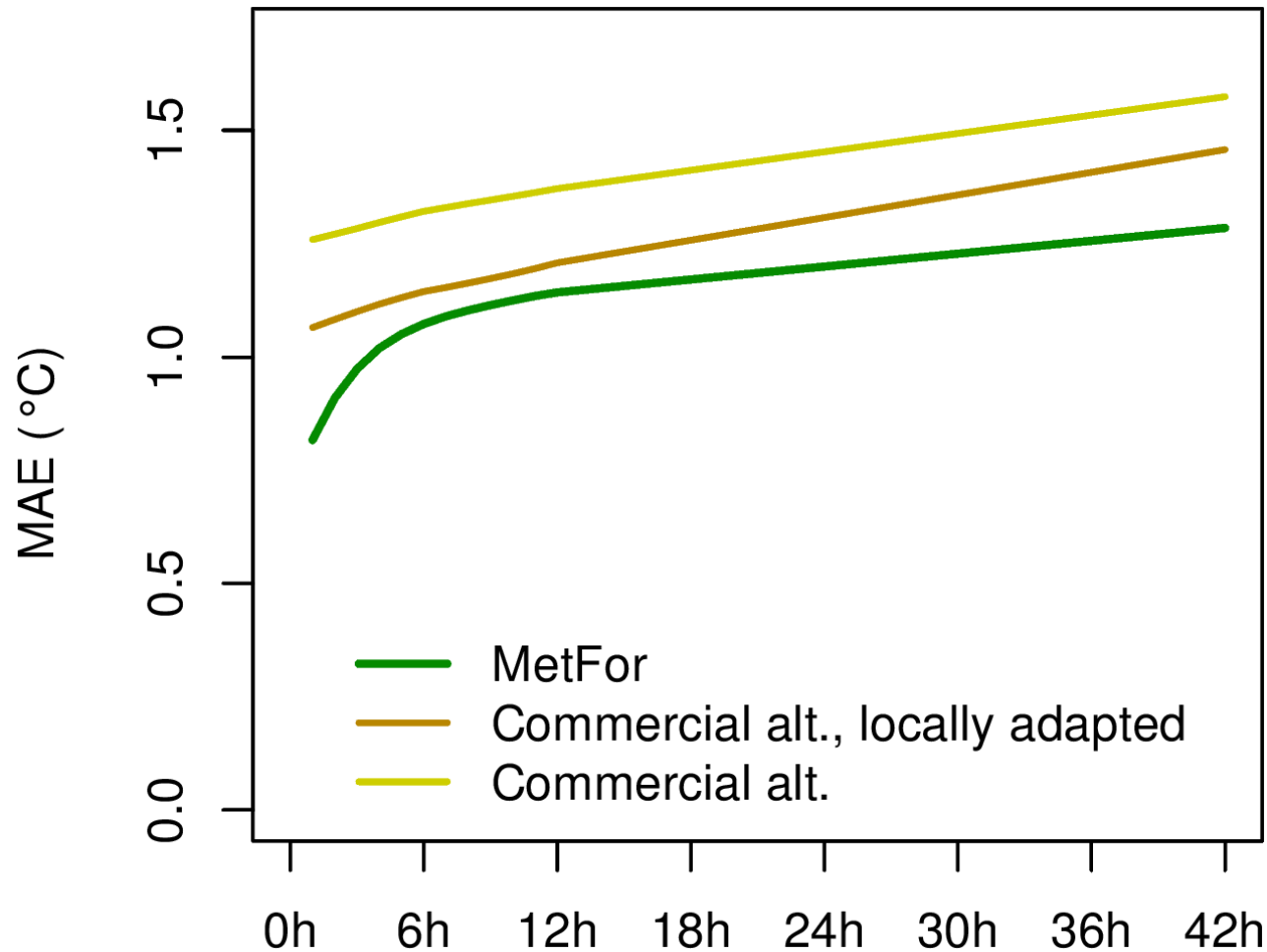
Example: MetFor



- Standard meteorological forecasts (temperature, wind, sun).
- Calibrated against local temperature measurements.
- Based on optimally combined ECMWF and GFS forecasts.
- Outperforms standard meteorological forecasts.



MetFor performance



Based on:

- Hourly values
- Two years of data
- Three sites
- Mean abs. error (lower is better)



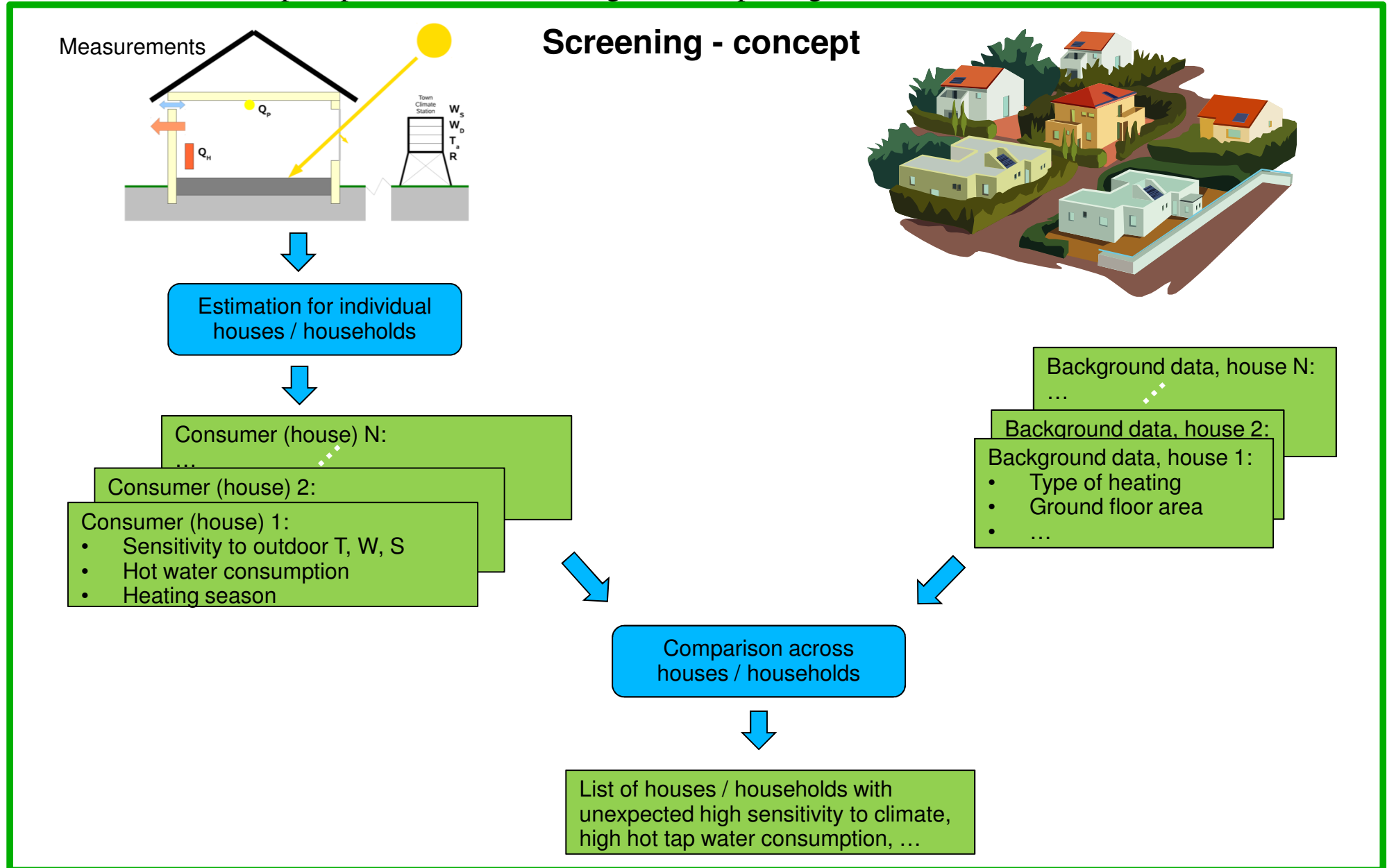
Use of smart meter readings

(frequent energy measurements from houses / households, e.g. hourly values)

Two suggestions for new projects:

- Screening for houses / households with poor energy performance (off-line measurements).
- Cost-efficient district heating temperature optimization using closed-loop control (on-line measurements).





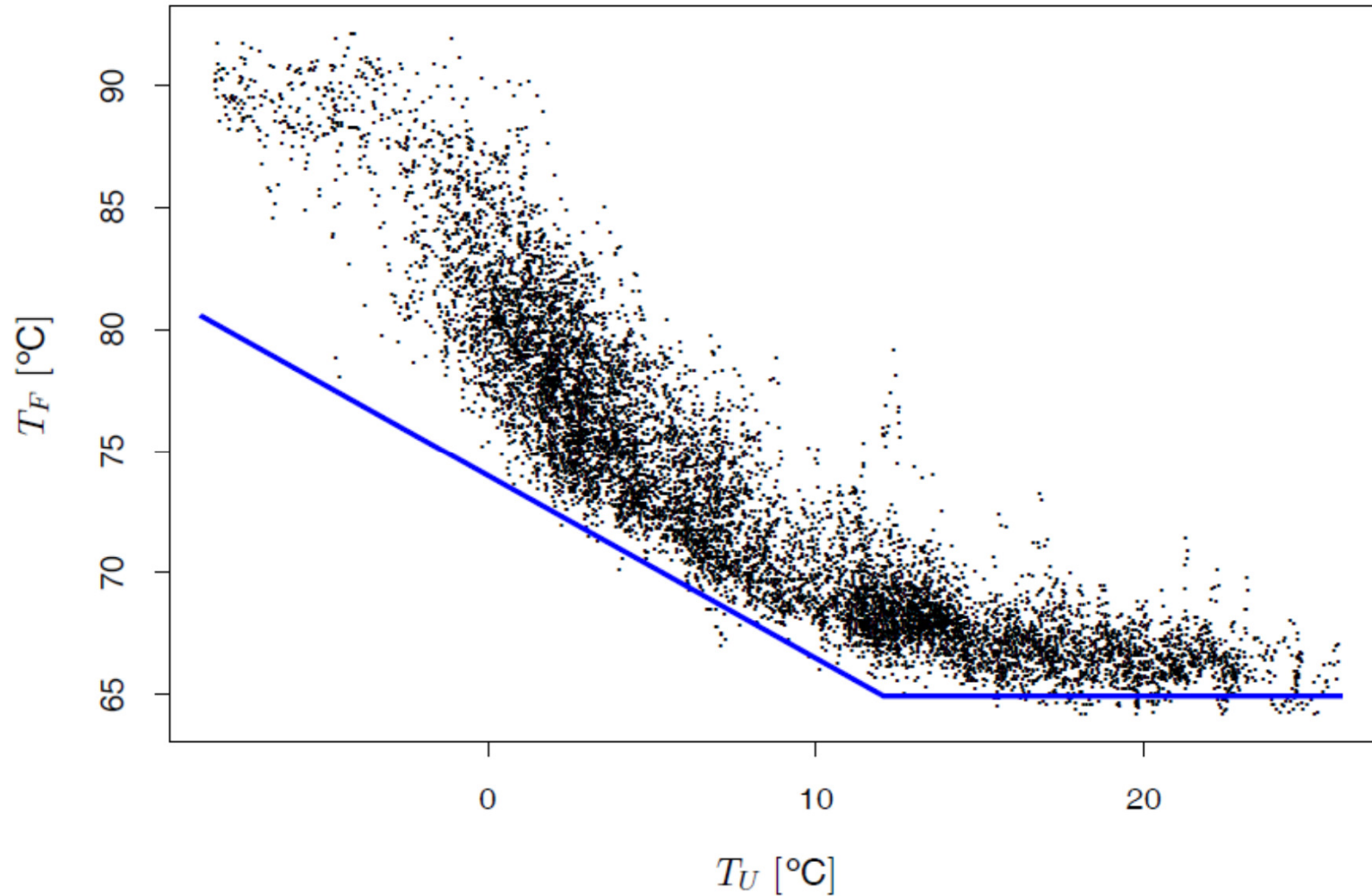
PRESS-TO for DH systems



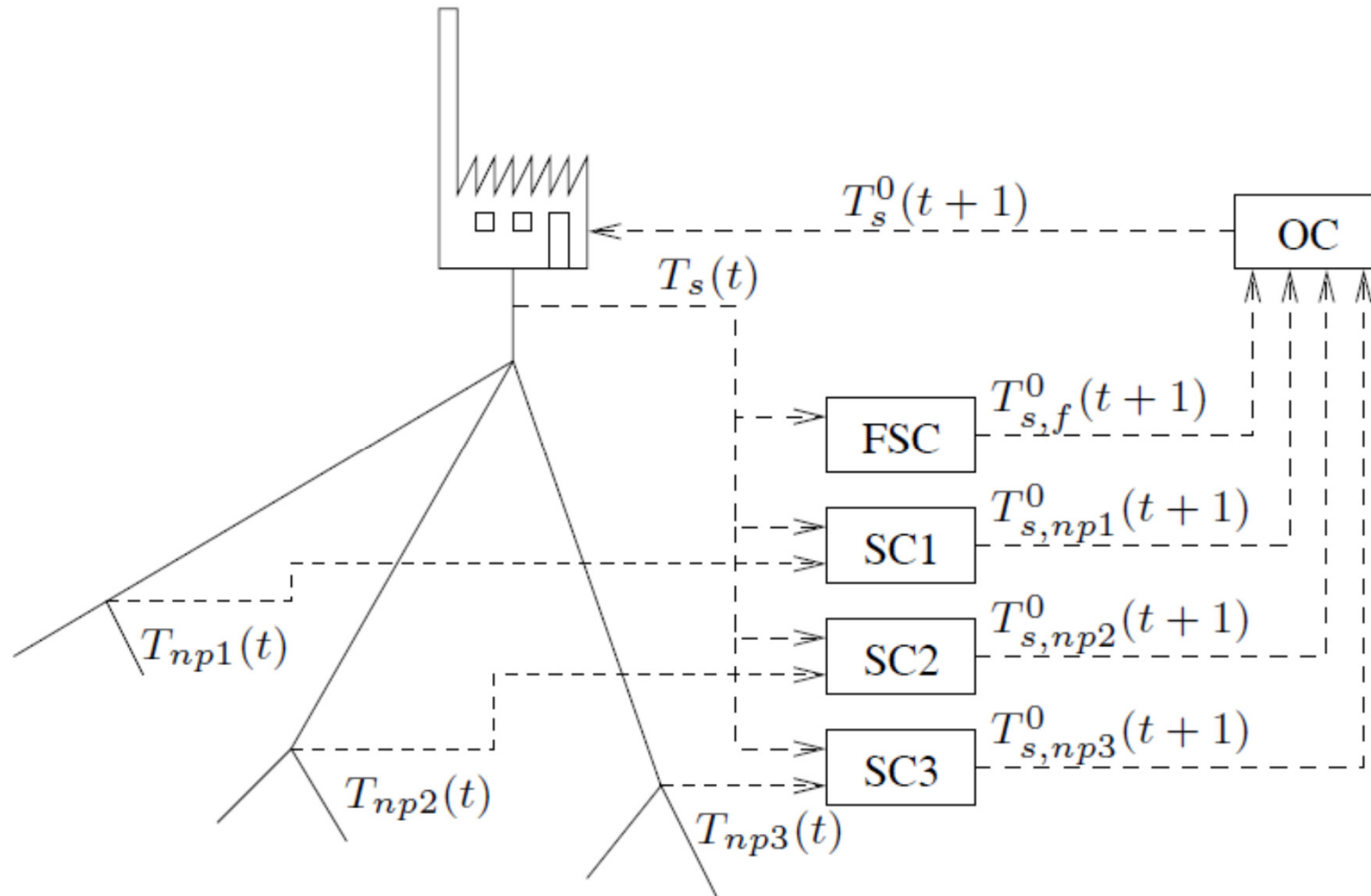
- Temperature Optimisation.
- Keep the network temperature as low as possible, while meeting consumer *energy* and *temperature* demands.
- Closed-loop control using on-line measurements of network temperature.



PRESS-TO detects and use uncertainties



PRESS-TO scematic



PRESS-TO – new development?

- Use smart meter measurements of building supply temperature as a replacement for network measurements.
- Measurements should be available on-line for a considerable number of consumers.



Thank you for your attention!

