

Forecasting and Energy Information Services

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Outline

- Cloud service solution.
- Consumption and production forecasts.
- Monitoring signals for systematic changes.
- Smart meter readings.



Cloud service solution



- FTP / SFTP file up- and down-loads with retries and book-keeping.
- Client-specific (SOAP, XML, ...)
- Highly configurable HTTPS based graphical user interface, supporting access level restrictions.
- Security of supply (NWP providers, data centres, ...)
- Data security (firewalls, encryption, ...)



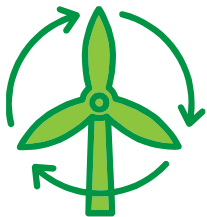
Consumption and production forecasts



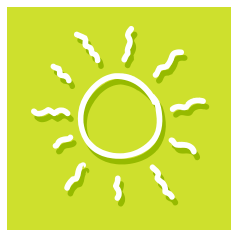
- Heat load forecasts and temperature optimization for district heating systems – usually for a horizons up to one week.



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



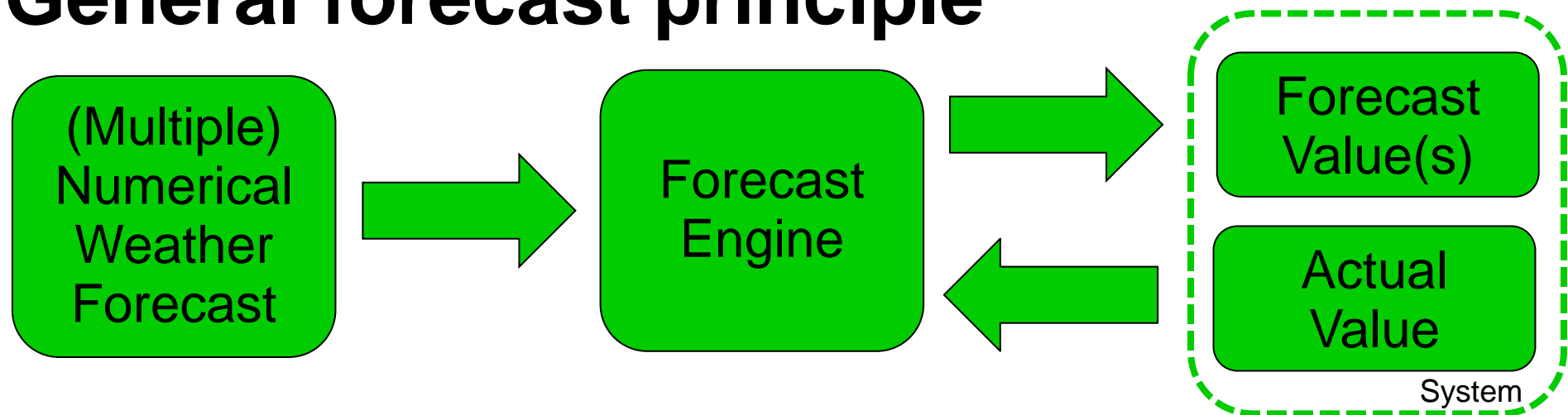
- Wind power production forecasts – usually day ahead, but up to one week is feasible.



- 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:

SolarFor – combined phys./stat. model

- Core of model based on physical principles (direct/diffuse irradiation, panel efficiency, ...).
- Model characteristics estimated from NWP data and actual PV power production.
- An number of secondary NWP variables (e.g. atmospheric water content) used in order to detect systematic NWP errors via data mining / machine learning methods.
- Continuous re-calibration of models.



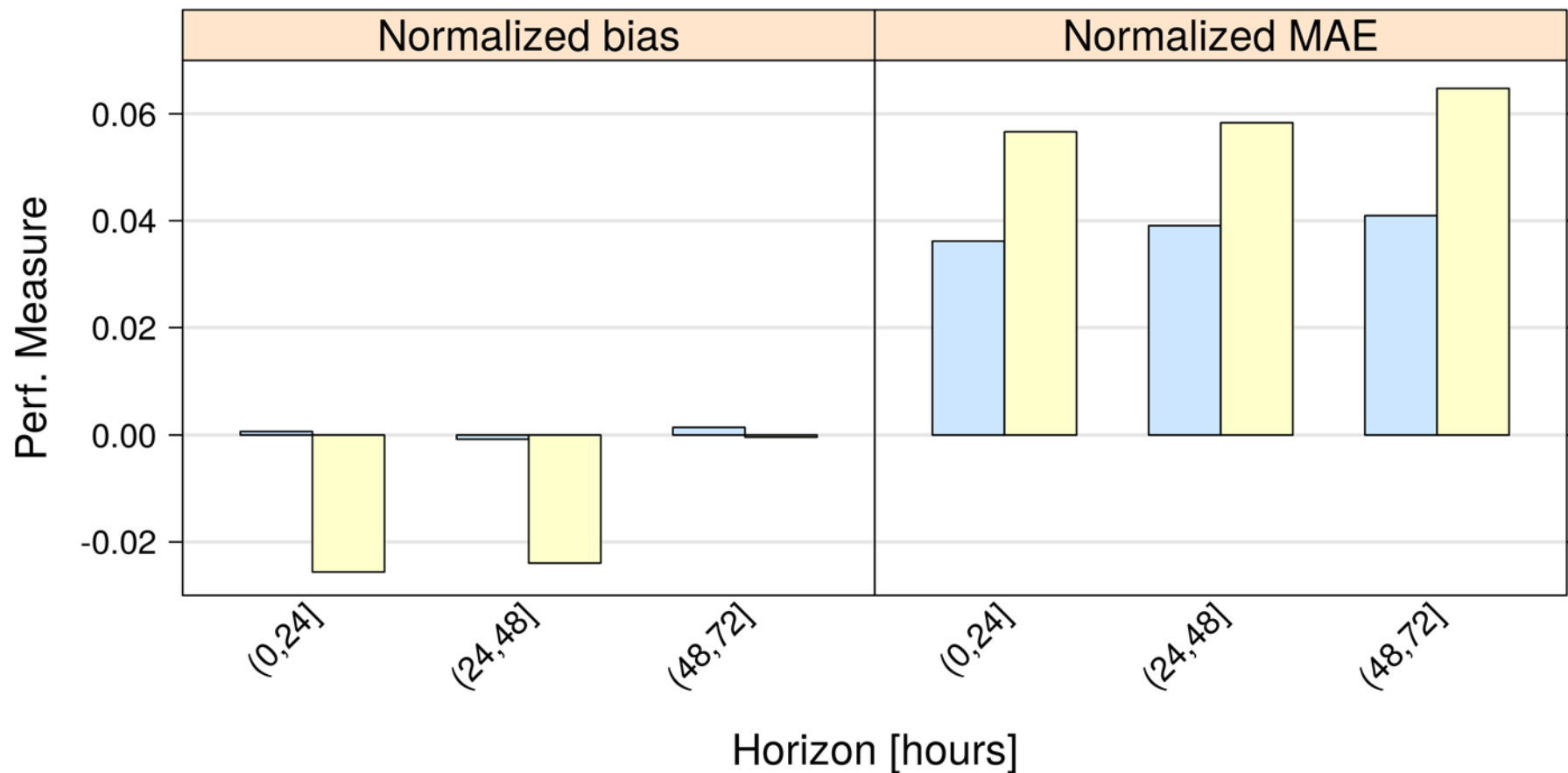
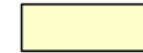
Comparison of models using ECMWF 12z

No correction for autocorrelation

SolarFor ECMWF



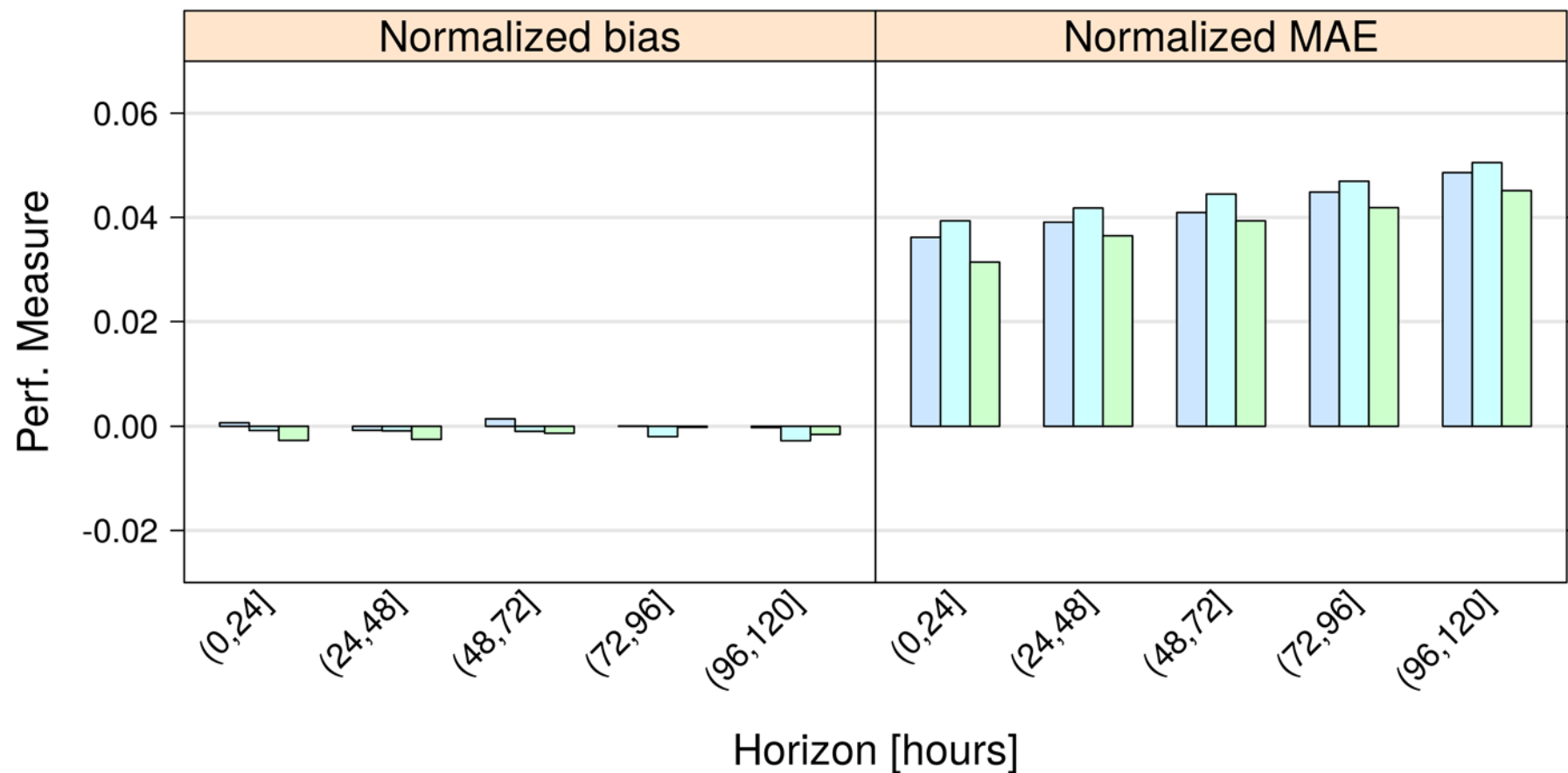
Physical model



SolarFor using GFS-HD 18z / ECMWF 12z

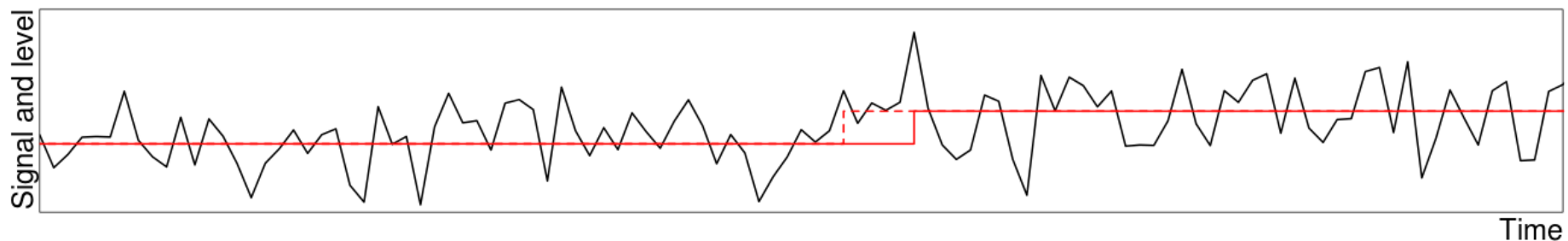
No correction for autocorrelation

ECMWF █ GFS-HD █ Combination █



Automatic monitoring signals for changes

- Issue alarms if signal properties (e.g. mean and variance) change systematically.
- Setup by specifying how fast a given change should be detected, together with an acceptable false alarm rate.
- Monitor for fixed level or tracks the level.



Example of monitored signals

- Wind farm / turbine performance indices (with DONG Energy).
- Household electricity standby power consumption (previously with Elsparefonden).
- Monitoring of data quality, e.g. the fraction of missing, out of range, and “frozen” values.
- Monitoring of excess energy consumption not explainable via climate measurements.
- ...



Use of smart meter readings

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

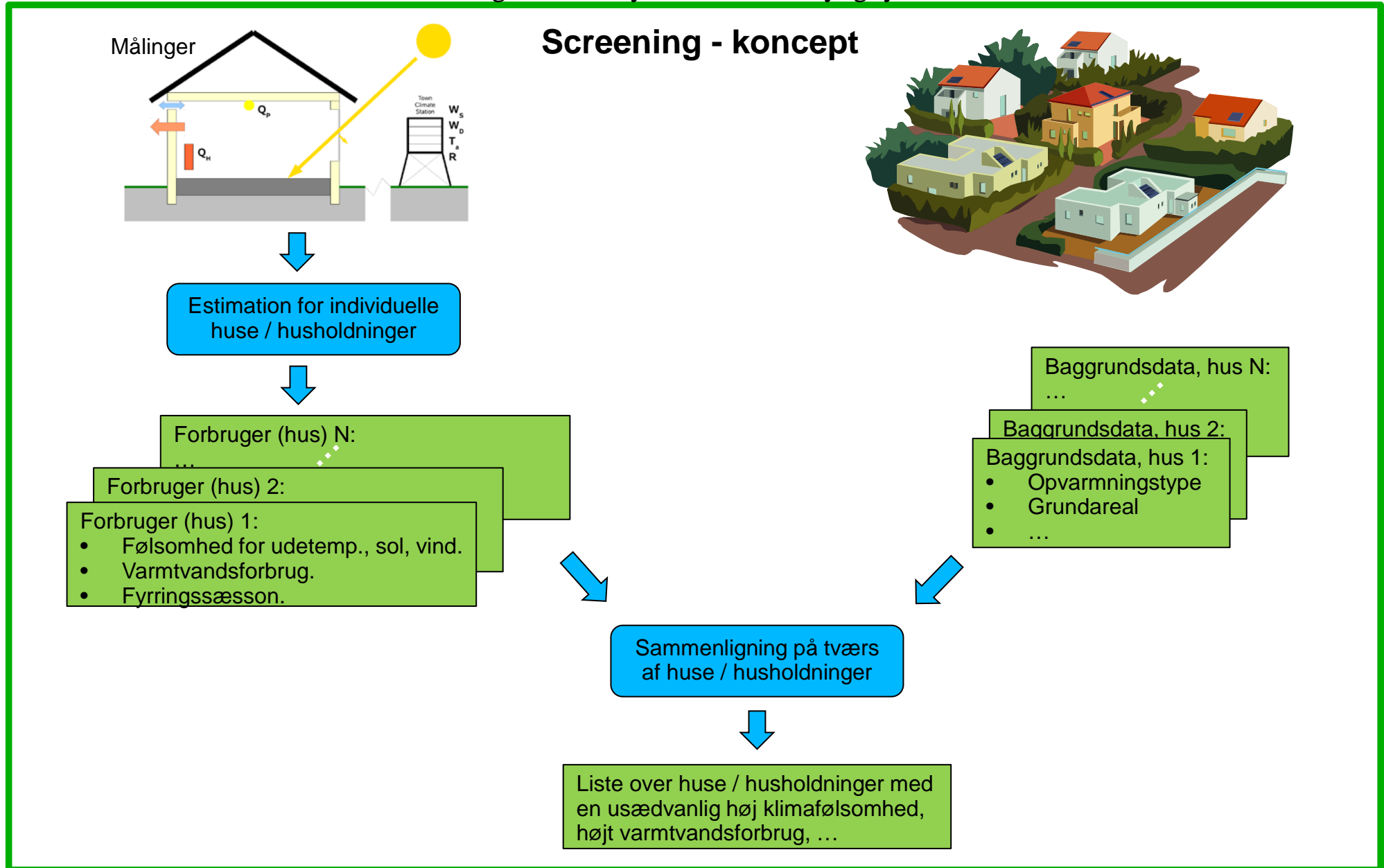
- Cost-efficient district heating temperature optimization using closed-loop control (on-line measurements).
- Screening for houses / households with poor energy performance (off-line measurements).
- ...



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.
- New development?: Use smart meter measurements of building supply temperature as a replacement for network measurements.





Thank you for your attention!

