Intelligent Energy Management based on Cloud Technologies

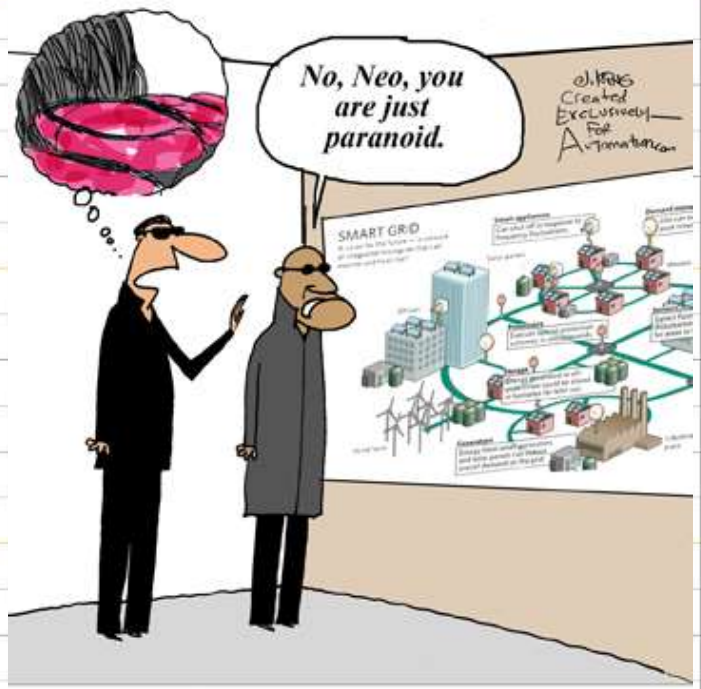
NEOGRID TECHNOLOGIES

Industri 4.0 – Digitalisering i forsyningsindustrien

Ved Henrik Stærmose, Civilingeniør

Outline

- Hvem er Neogrid Technologies ApS
- Why Releasing Energy Data to the Cloud?
- Layer based SW architecture and processes
- Intelligent Energy Management - Case



"Morpheus, I've heard this term, Smart Grid, before. It's what they called the Matrix before it took control of our lives."

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Neogrid Technologies

- Neogrid Technologies tilbyder nye innovative løsninger, inden for energi og informationsteknologi. Vi er faglige frontløbere på områderne termodynamisk bygningsmodellering, intelligent styring, varmepumper, fjernvarme og samtidig integrerer vi teknologierne så de spiller ind i fremtidens Smarte Energisystem.

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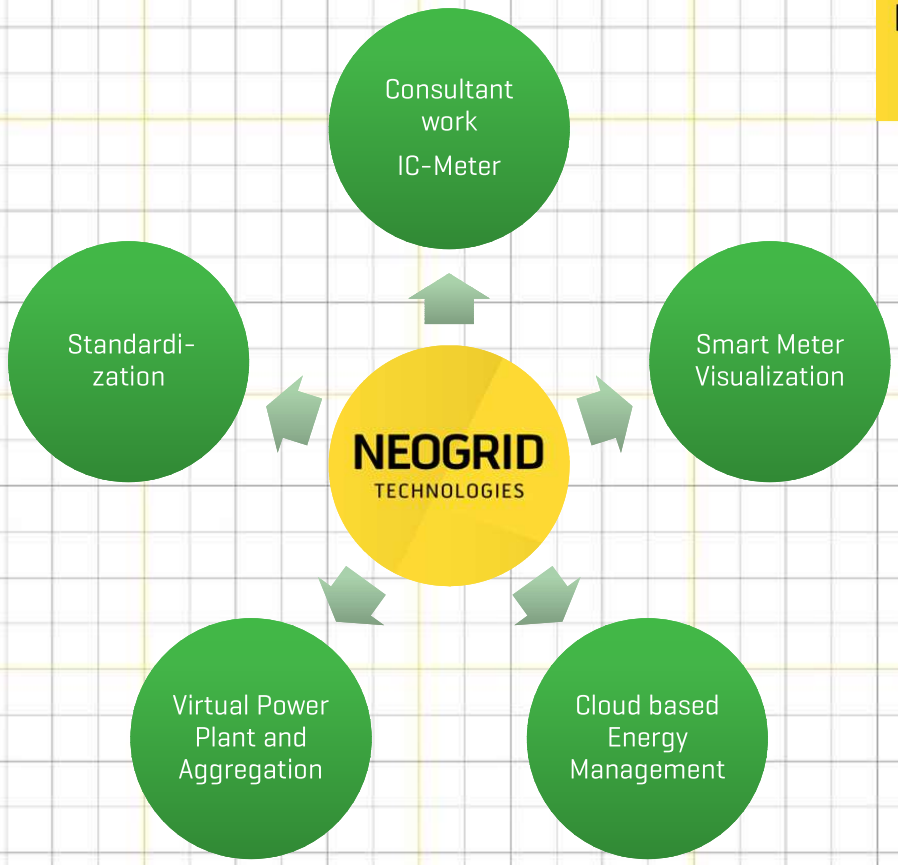
Neogrid Technologies ApS

Hvem er vi?

- Grundlagt 2009
- +30 år fra telekommunikation
- 6 Medarbejdere



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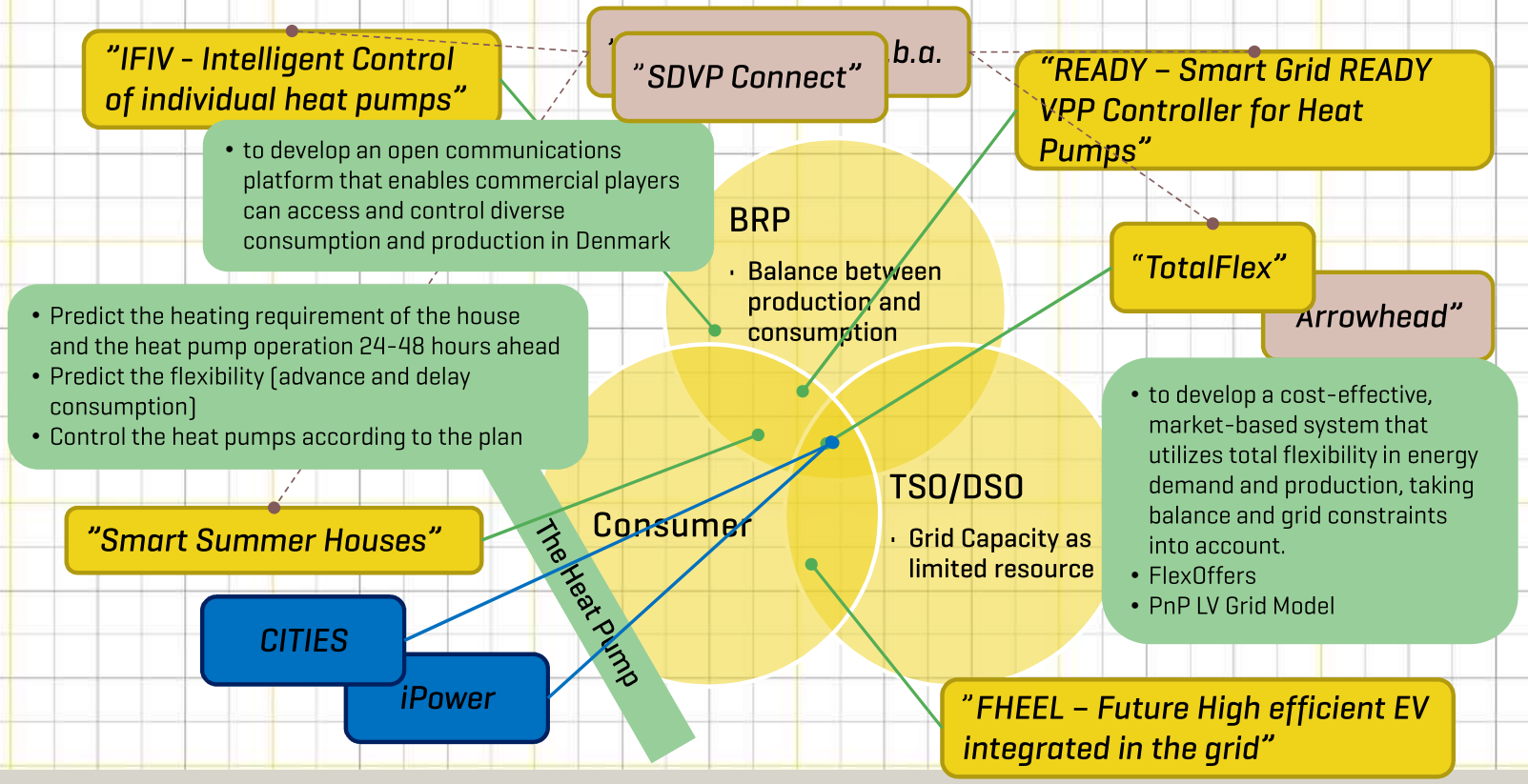
Neogrid Partnerships and Research Focus

Projects funded by Energinet.dk's Research Program – ForskEL & EU FP7



The Challenge

Smart Energy at the consumer and in the grid

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1. Save Energy at the Consumer
2. Move consumption peaks in distribution grid
3. More accurate load forecasts for grid areas

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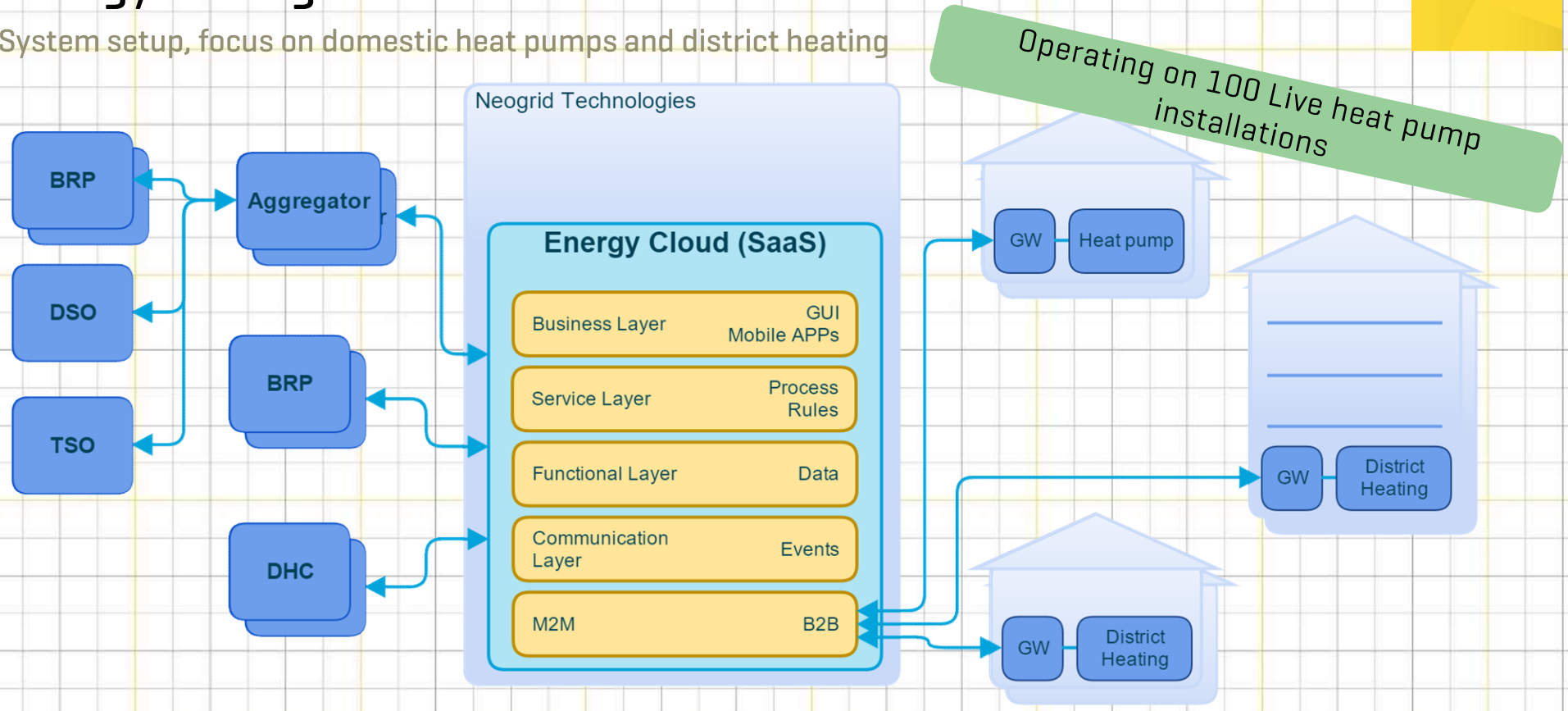
Why Releasing Energy Data?

Energy Management Cloud and Virutal Power Plant

System setup, focus on domestic heat pumps and district heating



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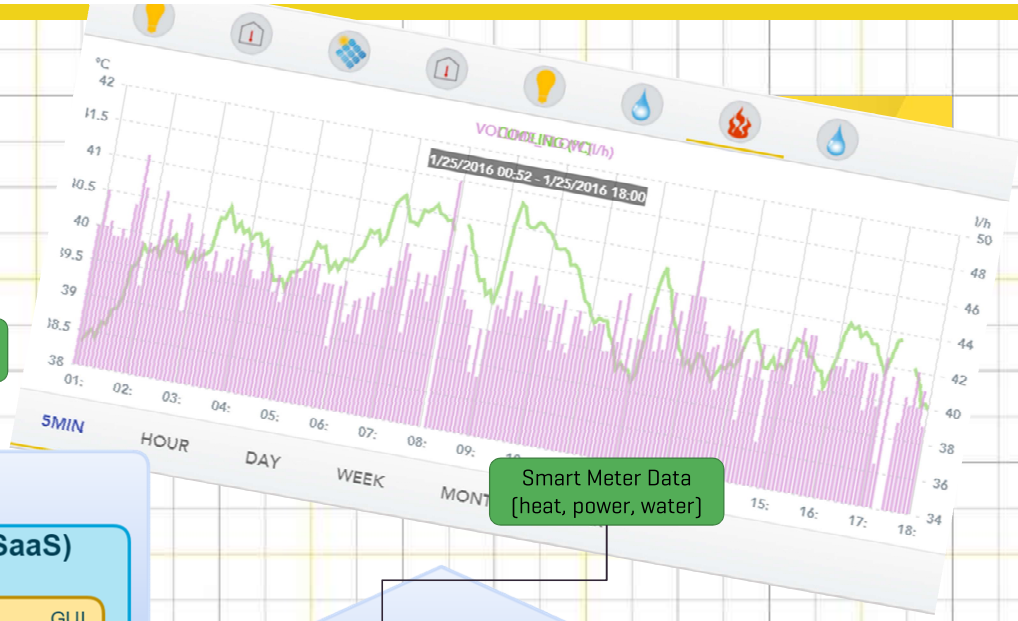
Smart Meter Data - Visualization



Price Data

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Energy Cloud (SaaS)

Business Layer	GUI Mobile APPs
Service Layer	Process Rules
Functional Layer	Data
Communication Layer	Events
M2M	B2B

3rd Party Service Providers

District Heating Company

Data & Control

Smart Meter Data (heat, power, water)

GW

District Heating

Benefits

1. High Resolution Meter Data
2. Smart Meter Infrastructure

Benefits

1. Energy Visualization
2. Alarms

Intelligenet Energy Management

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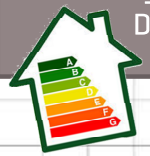
Benefits

1. Generalized Data
   - Building Envelope and Demands



Energy System Status

Price Data

Local Weather Forecasts

Optimization Strategy

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Energy Cloud (SaaS)

Business Layer	GUI Mobile APPs
Service Layer	Process Rules
Functional Layer	Data
Communication Layer	Events
M2M	B2B

3rd Party Service Providers

District Heating Company

Sensordata [temperature]

Smart Meter Data [Heat, power, water]

Set-Point / Comfort

Settings / Strategy

Data & Control

GW

District Heating

GW

Heat pump

Benefits

1. Load Shift
2. More Acurate Load Estimations for Pool

Benefits

1. Reduced Heating Cost
2. Improved Comfort

Benefits – District Heating

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Area	Type	District heating
Reduce Heating Cost	Optimize forward temperature according to demand	√
	Operation due to sunlight	√
	Night setback	√
	Out-of-house setback	√
Improve Comfort	Reduce excess temperature due to sunlight	√
Services for District heating companies	Load shifting	√
	Price optimization	√
	More acurate demand estimates	√
Service	Monitoring	√
	Building envelope	√
	Remote diagnostic	√

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Layer based SW architecture and processes

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Market segments

Heat pumps and district heating

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- Energy Trading
  - Maximize income for production and trading (Power and and flexibility)
- Energy Efficiency
  - Maximize energy efficiency for smart buildings
- Energy Grid
  - Grid stability and supply guarantee
- Energy Island
  - Optimize local production and consumption

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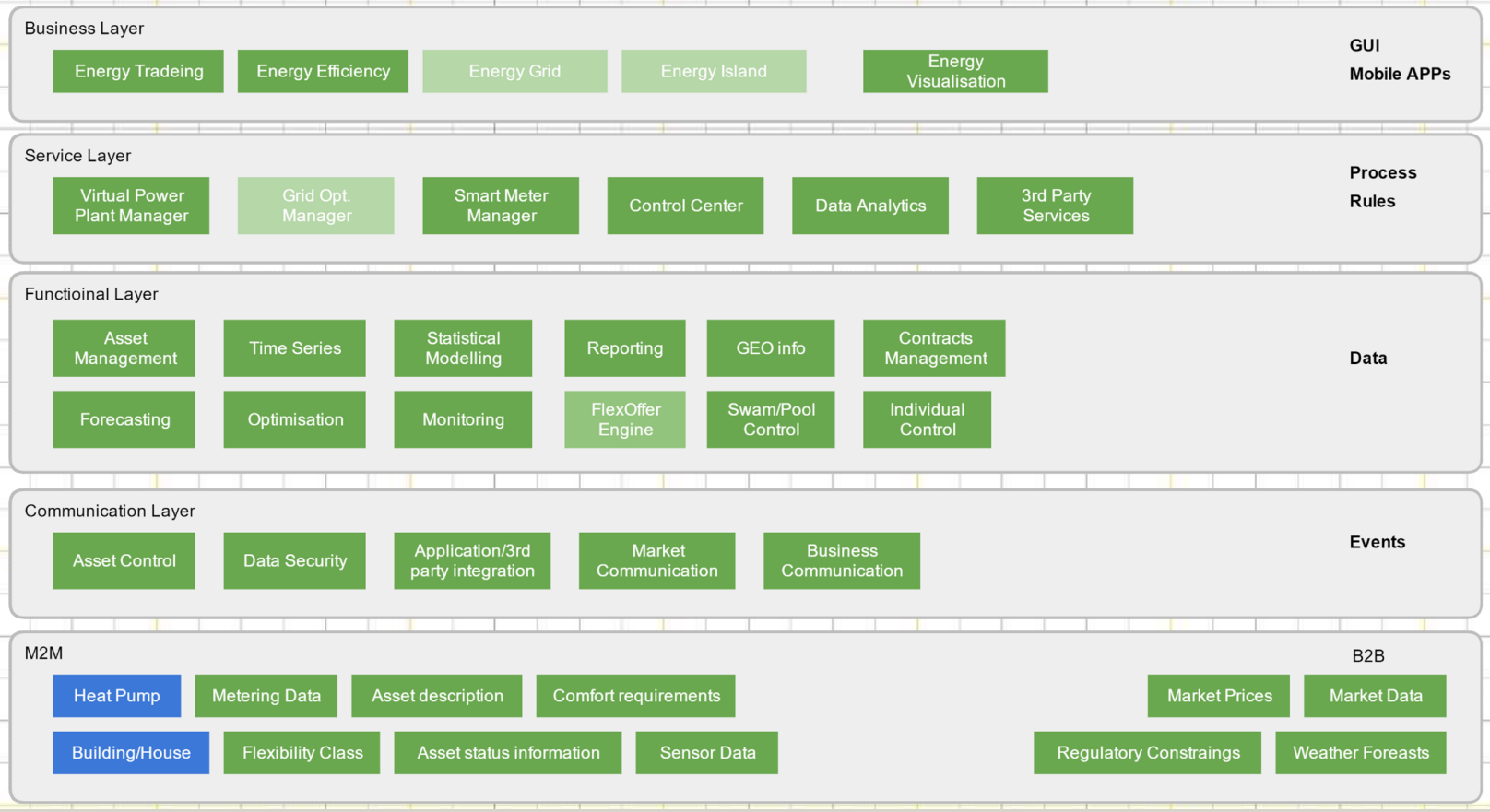
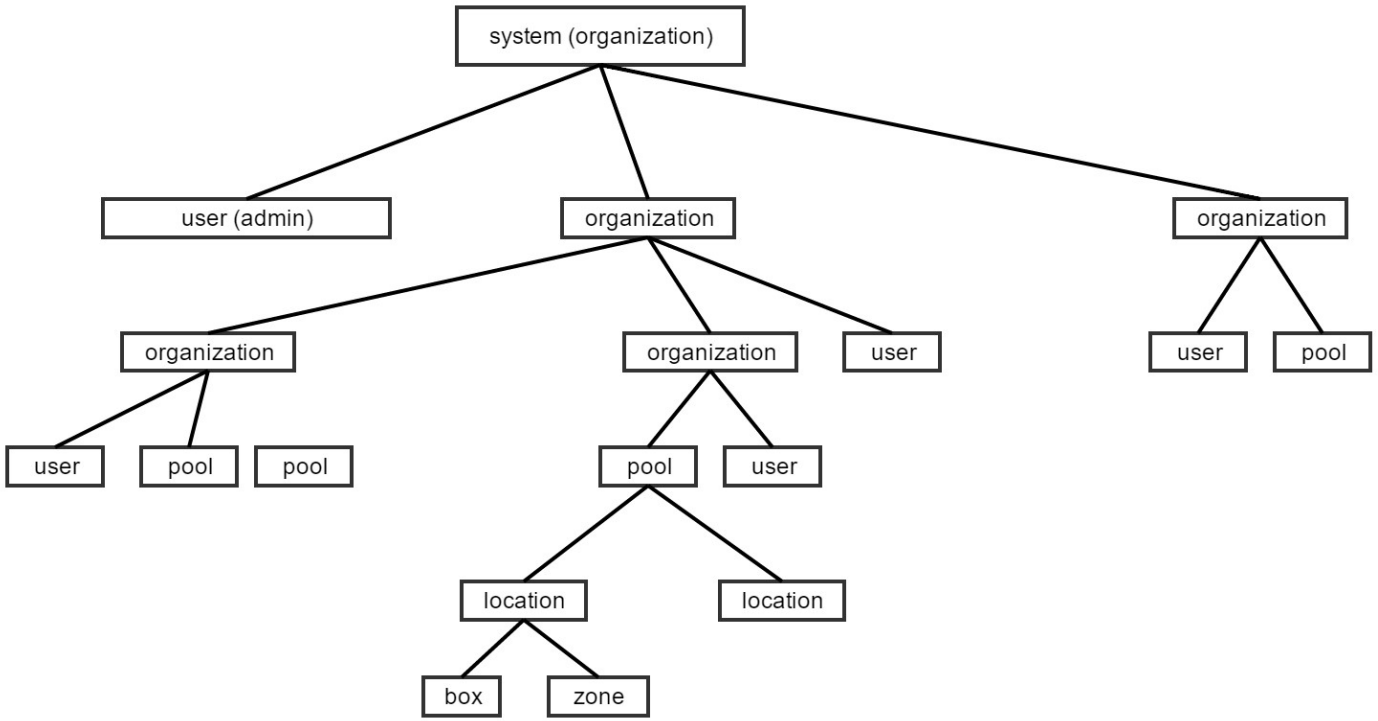
Software Architecture



Security, Roles and Capabilities

Hieracy



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Security, Roles and Capabilities

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#	Role Title	Short description (see matrix for exact capabilities)
1	Administrator	Gives rights to do everything
2	Super User	Used in the context of organisation administration
3	User	Gives mostly view access appropriate to the context
4	Owner	Gives read and write access
5	Technician	Gives access to setup and change the same entities as home owners
6	Aggregator	Access to pools and pool control
7	Demo Aggregator	Gives read-only anonymized view similar to the aggregator view.
8	Demo User	Gives read-only anonymised view of a location/box

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Processer

- Individual Energy Saving
- Individual Energy Saving and Load Shift
- Pool swarm control securing improved HP operation

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Individual Energy Saving

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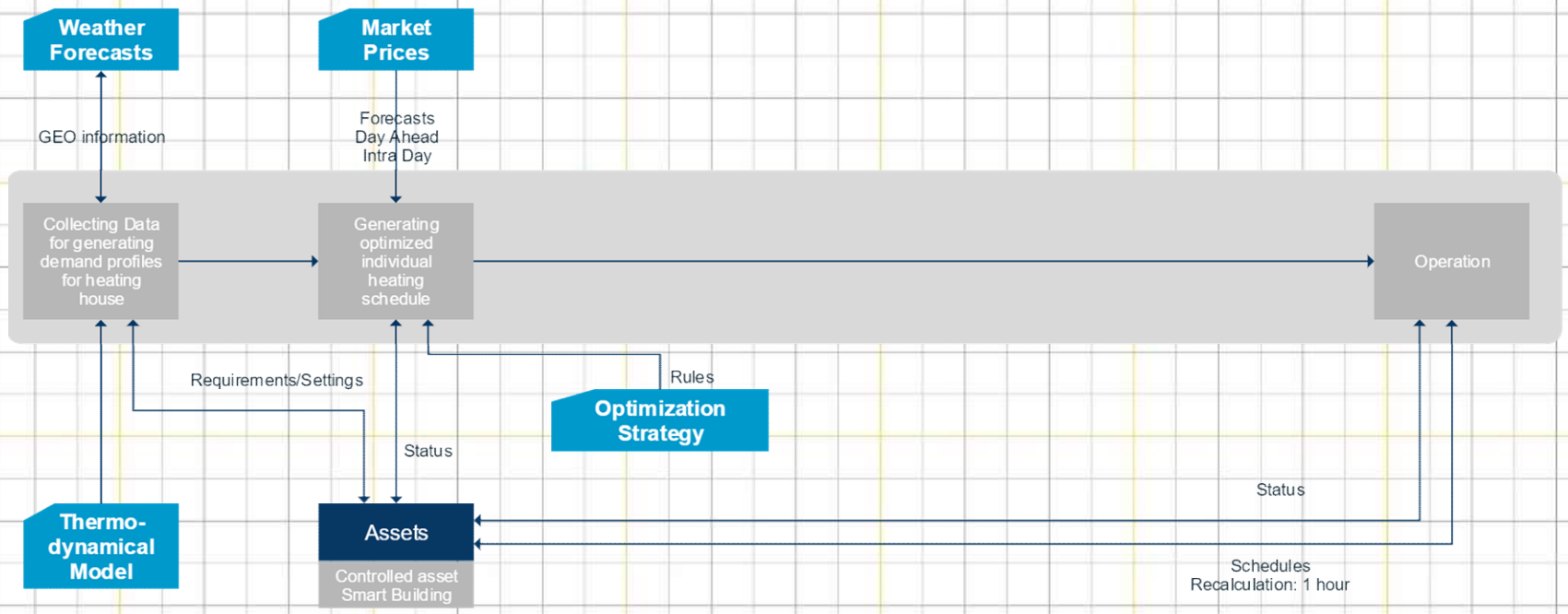

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Individual Energy Saving and Load Shift

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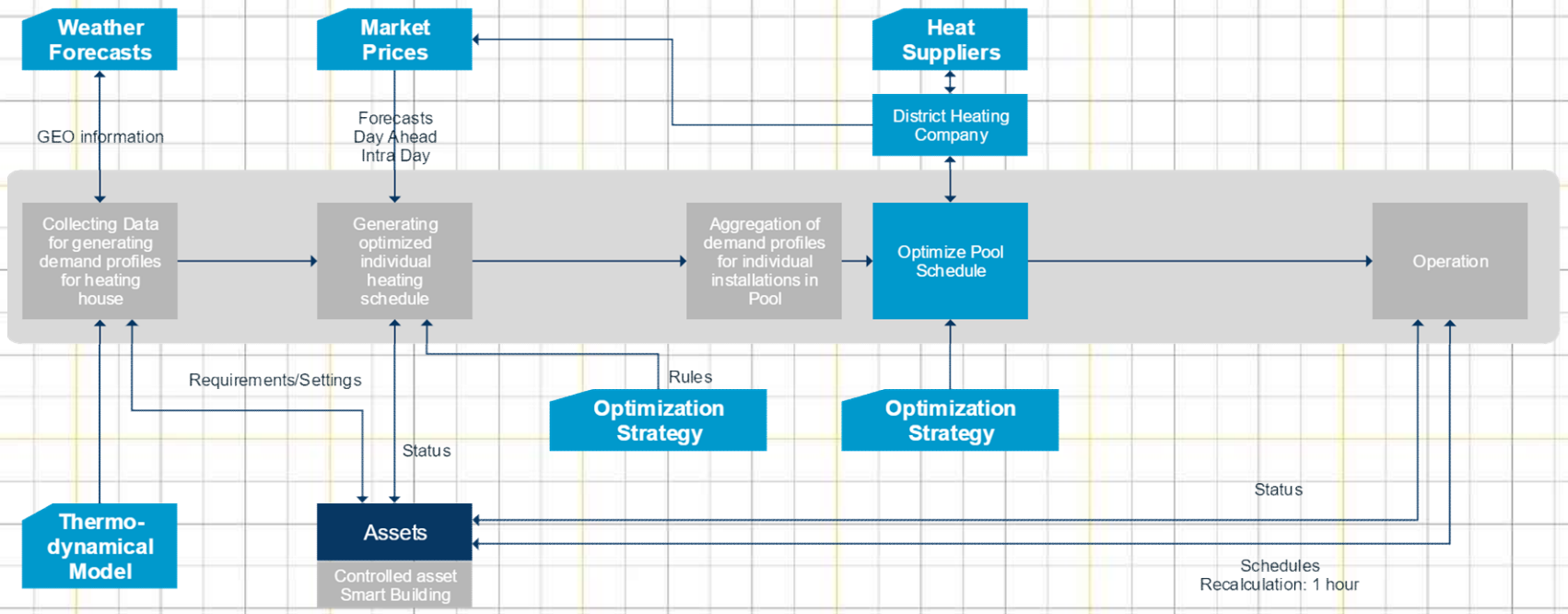

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Aggregators

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- Focusing directly towards energy markets and TSO's, where the aggregator is maximizing the earnings for heat pumps connected to the pools towards energy markets.
  - Flexibility as a commodity
  - Ancillary services – by participating in short term grid balancing events
  - Can also sell the services to DSO and BRP's

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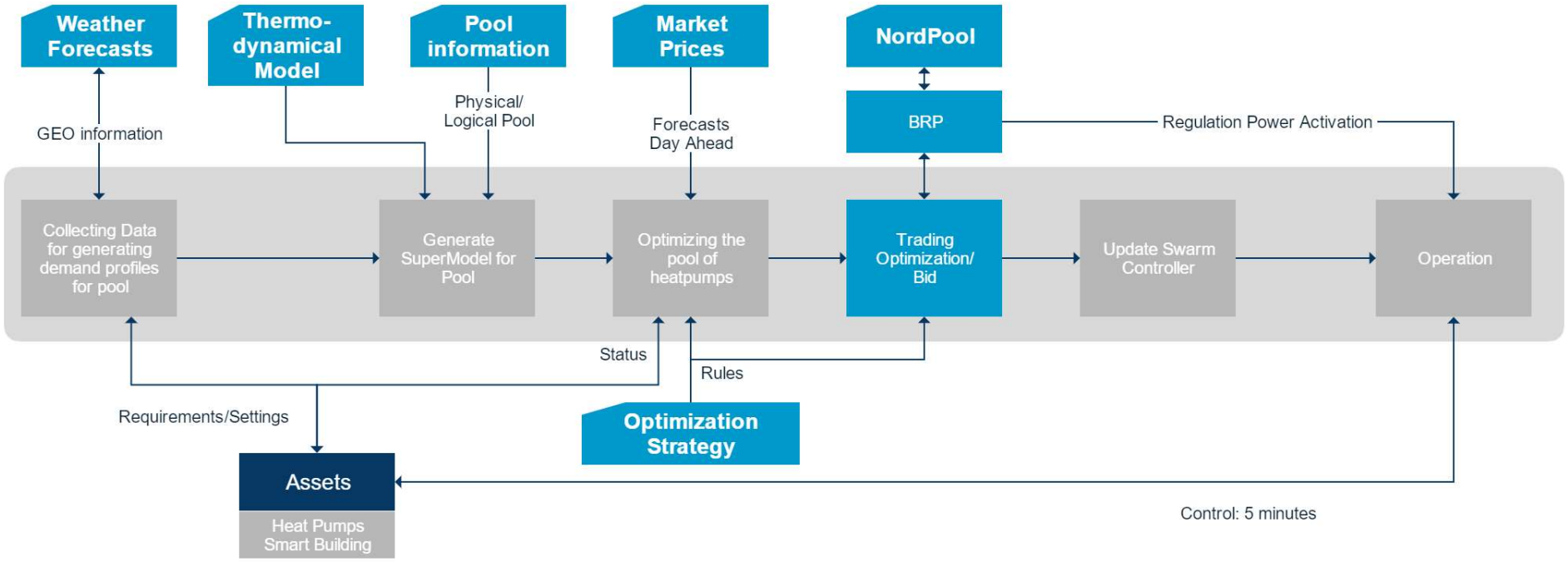
Virtual Power Plant Process

Pool Swarm Control



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Pool tracking - example

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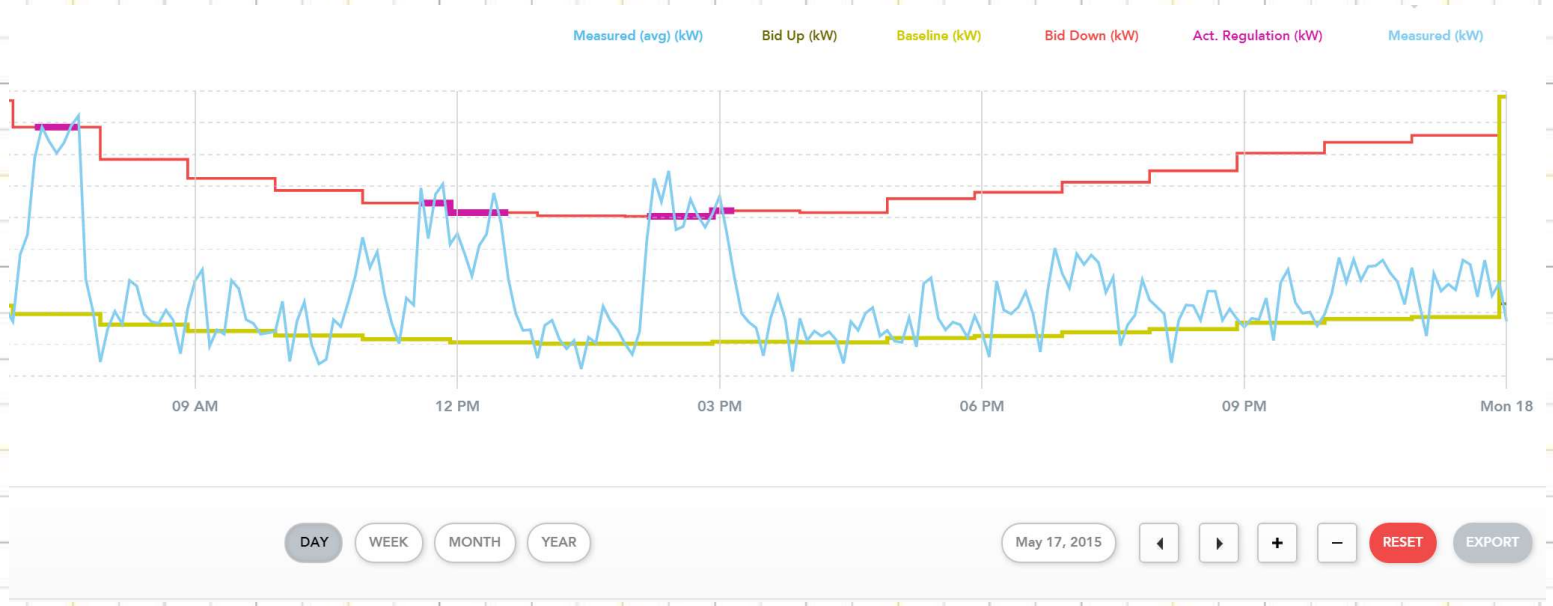

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Intelligent Energy Management - Case

Udfordringen

Eksisterende energistyringsløsninger

- Kender tilstanden af bygning op til hvordan situation er nu
- For høj fremløbstemperatur giver unødig varmetab
- Unødig opvarmning giver varmetab
- Anlæg ofte kun justeret ind på installationstidspunkt
- Kører med samme fremløbstemperatur året rundt
- *intelligente* anlæg reagerer på nu-situationen

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Fokus for Neogrids løsning

Thinks Ahead

- Software beregner dynamisk varmebehov for bygning
  - Afhængig af sol, vind, udetemperatur og brugeradfærd
- Styrer varmetilførsel til bygning ud fra
  - Avanceret Termodynamisk Model og brugerindstillinger
  - Prognose for bygningens energibehov
- Laveste mulige fremløbstemperatur
- Varmepriser kan tages med i planlægningen

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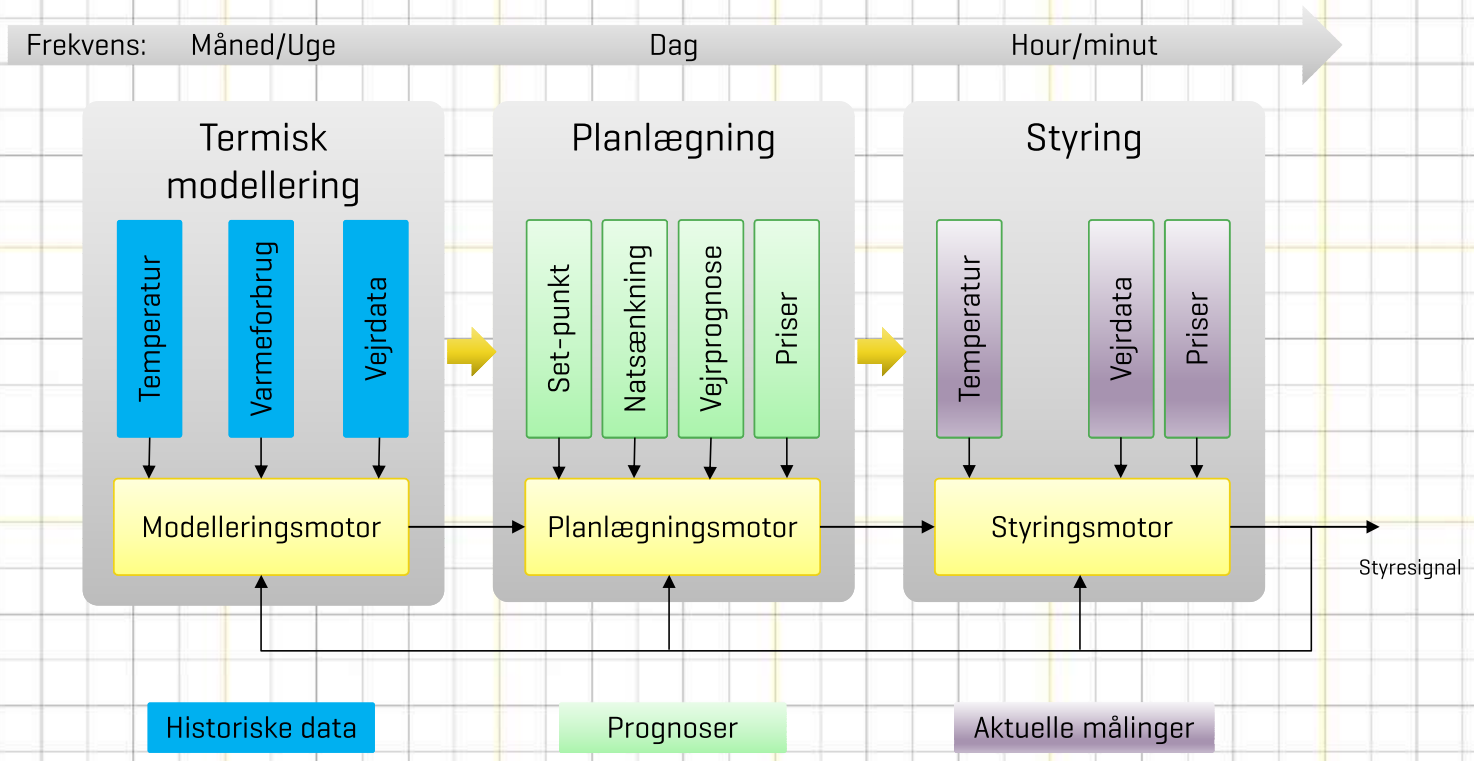
Funktionsdiagram



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User Dashboard

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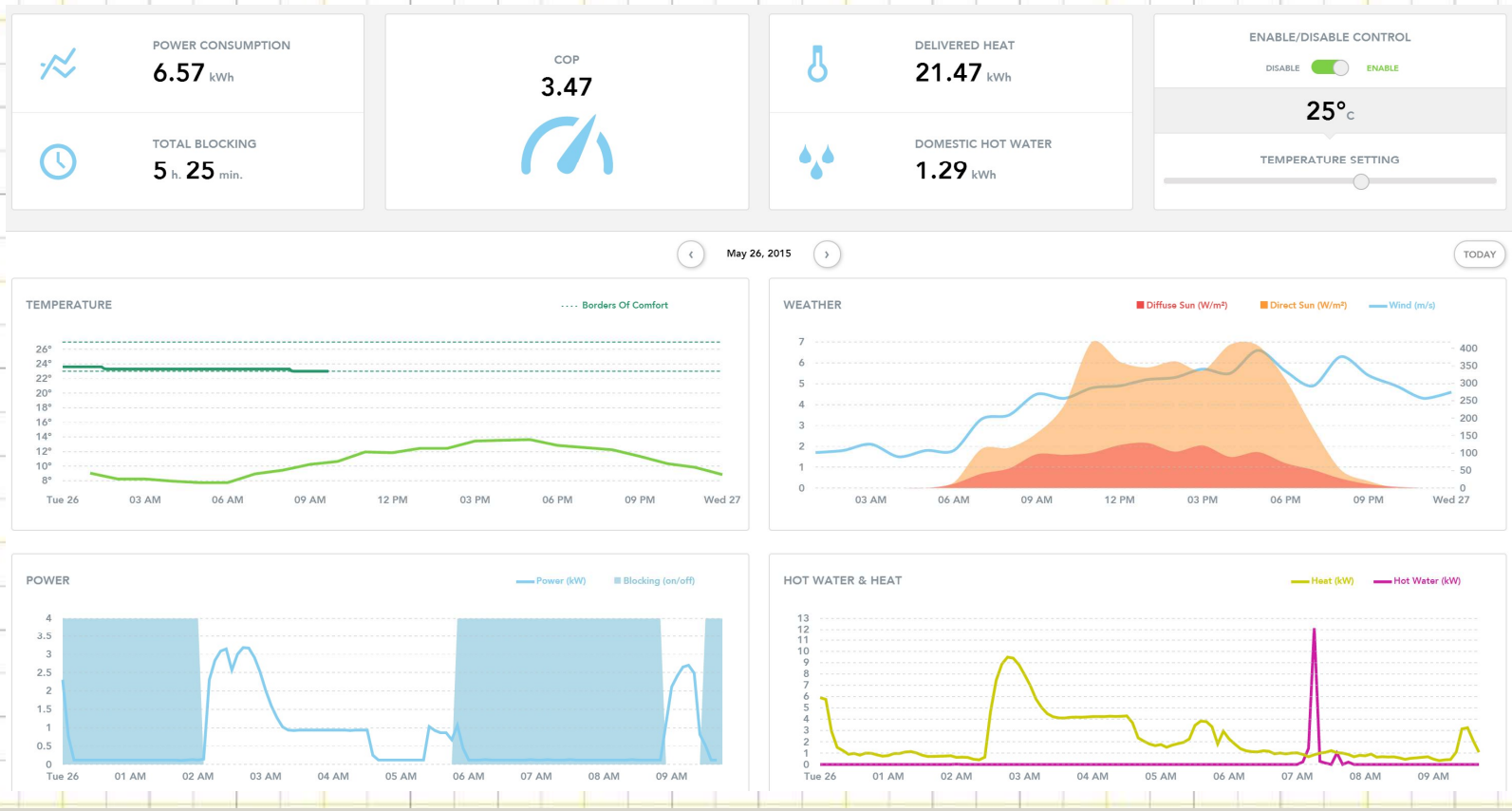

Fordelene for husejeren

Cloud Based Energy Management – Thinks Ahead

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- Reducerer varmeomkostninger op til 20% ved at anvende avanceret styring
- Forbedrer indeklima ved at reducere overophedning
  - Giver en mere flad temperaturkurve
- Husets CTS* anlæg I skyen:
  - Monitorerings- og alarmerings service
  - Visualisering af bygningens klimaskærm og energiforbrug
    - Identifikation af besparelsespotentialer
- Fjernstyring via mobil app og web

**central tilstandskontrol og styring*

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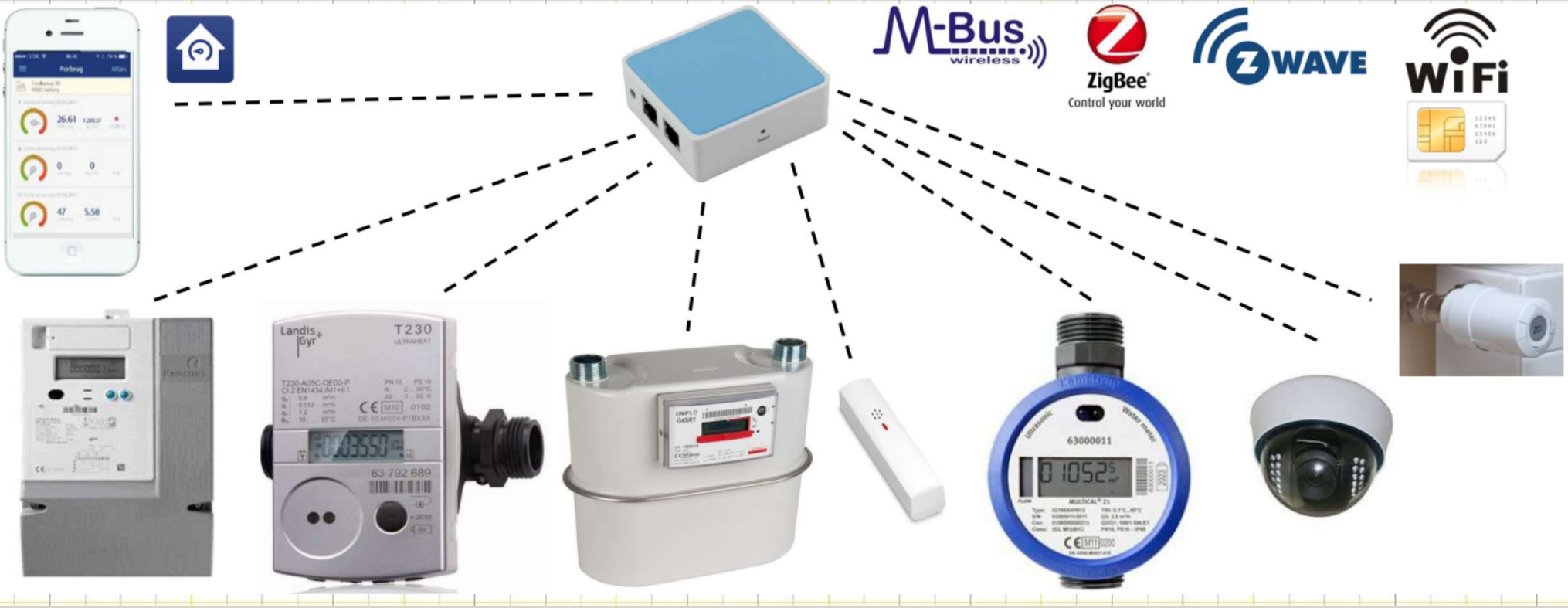
More Data Enables New Services



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Thank you for your attention

Questions are welcome!

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