WP MEETING NO 3

READY

Smart Cities and Communities

GRØN ENERGI

AGENDA

09.00 **Welcome to Dansk Fjernvarme** by Nina Detlefsen, Danish District Heating Association

09.15-Summary of presentations on low temperature district heating on day one

10.00 **Presentation of ongoing PhD-projects relating to READY**

10.00- Rasmus Hedegaard, Aarhus University

10.15- Martin Kristensen, Aarhus University

10.30 **Coffee break**

10.45- Theis Pedersen, Aarhus University

11.00- Magnus Dahl, AffaldVarme Aarhus

11.15**-** Rasmus Pedersen, AffaldVarme Aarhus

11.30 **Presentation of work related to industry**

11.30 Marek Brand, Danfoss - *Flat stations*

11.45 Steen Schelle Jensen, Kamstrup - *Smart meters*

12.00 **Lunch**

13.00 **Ideas and discussions as to OIP, Help Desk and Knowledge Sharing Entry**

14.15 **Coffee break**

14.30 **Reflection, wrap up and good bye**

15.00 **End of the day**

GRØN ENERGI

AGENDA FOR DAY1

09.30 **Velkomst og introduktion til temadagen** *v/ Nina Detlefsen, Grøn Energi*

10.00 **Hvorfor lavtemperaturfjernvarme og store varmepumper?** *v/ Bjarke Lava Paaske, Energistyrelsen*

10.30 **Praktiske erfaringer fra Vejen Varmeværk - Udnyttelse af returvarme til lavtemperaturfjernvarme**
v/ Torben Hjorth Pedersen, Vejen Varmeværk

10.50 Pause

11.05 **Resultater fra legionellaprojekt og ideer til nyt projekt** *v/ Carl Hellmers, Fredericia Fjernvarme*

11.25 **Er den eksisterende bygningsmasse klar til at modtage lavtemperaturfjernvarme?**
v/ Svend Svendsen og Dorte Skaarup Larsen, DTU Byg

12.30 Frokost

13.30 **Erfaringer fra Viborg Fjernvarme - bl.a. omkring Apples overskudsvarme**
v/ Morten Abildgaard, Viborg Fjernvarme

13.50 **Erfaringer fra et fjernvarmeselskab** *v/ Jens Rishøj Larsen, AffaldVarme Aarhus*

14.10 Pause

14.30 **Erfaringer med forbrugerinddragelsen ved implementering af lavtemperaturfjernvarme**
v/ Uffe Schleiss, Høje Taastrup Fjernvarme

14.50 **Praktiske erfaringer fra Albertslund Fjernvarme med implementering af lavtemperaturfjernvarme**
v/ Erik Lyhne, Albertslund Fjernvarme

15.10 **Omstillingsparathed hos og inddragelse af forbrugerne** *v/ Line Marie Bille, Transition ApS*

15.45 **Afrunding og tak for i dag** *v/ Nina Detlefsen, Grøn Energi*

GRØN ENERGI

Samlet effekt

Med sol og varmepumpe - 80/40 °C			
Enhed	**Varmeproduktion**	**Varmeproduktionspris**	**Omkostning**
Gaskedel	3.200 MWh	430 kr./MWh	1.376.000 kr.
Solvarme	2.600 MWh	300 kr./MWh	780.000 kr.
Varmepumpe	14.200 MWh		
Samlet	**20.000**		

Direkte besparelse 883.200 kr. = 10 %

Salg af energibesparelse (400 kr./MWh) = 720.000 kr.

Direkte besparelse 764.000 kr. = 9 %

Med sol og varmepu			
Enhed	**Varmeproduktion**	**Varmeproduktionspris**	**Omkostning**
Gaskedel	2.250 MWh	424 kr./MWh	954.000 kr.
Solvarme	2.950 MWh	264 kr./MWh	780.000 kr.
Varmepumpe	13.000 MWh	320 kr./MWh	4.160.000 kr.
Samlet	**18.200 MWh**	**324 kr./MWh**	**5.894.000 kr.**

Direkte besparelse 2.706.000 kr. = 31 %

ENERGI STYRELSEN

Samlede resultater

Scenarie	Varmemængde	Omkostning	Besparelse	Red.
Reference (80/40)	20.000 MWh	8.600.000 kr.	-	
Reference (60/30)	18.200 MWh	7.716.800 kr.	883.200 kr.	10 %
Sol+VP (80/40)	20.000 MWh	7.836.000 kr.	764.000 kr.	9 %
Sol+VP (60/30)	**18.200 MWh**	**5.894.000 kr.**	**2.706.000 kr.**	**31 %**

$$1 + 1 = 3$$

- **Temperature er meget vigtige ifm. Sol og Varmepumper**
- **Lav temperatur minimerer varmetab og sikrer effektiv produktion**

ENERGI STYRELSEN

Returvarme

Kunde: Jette Sørup Korsgaard

Projektnr.:
Projekt: 2 Plan Huset A/S
Dato: 09-09-2009
Udført af:

" Som vi plejer " c/c = 300 mm

wavin
Nordisk Wavin A/S
Wavinvej 1
DK-8450 Hammel
Tlf. 86 96 20 00
Fax. 86 969 461

Fordeler/Unit: Unit 1 (Fast fremløbstemperatur)
Alle units har en maks fremløbstemperatur: 30,0 °C
Delta T: 2,0 °C

Nr:	Kredsbetegnelse	Rum m²	Stik m	Lr m	c/c mm	Q l/h	Effekt W	Behov W	Rørtype	Tryktab kPa	Indstil Omdr.	Trum °C	Tf °C	Tr °C	To °C	Gulvtype
1	Stue	13,1	24	89,5	300	130	273	427	Ø20x2,0 mm Tigris PE-RT	3,8	0,7	20,0	30,0	28,0	22,2	14 mm parket på beton
2	Stue	13,1	24	89,5	300	130	273	427	Ø20x2,0 mm Tigris PE-RT	3,8	0,7	20,0	30,0	28,0	22,2	14 mm parket på beton
3	Værelse 1	11,5	20	77,5	300	114	240	221	Ø20x2,0 mm Tigris PE-RT	2,6	0,5	20,0	30,0	28,0	22,2	14 mm parket på beton
4	Værelse 2	11,5	18	75,5	300	114	240	223	Ø20x2,0 mm Tigris PE-RT	2,5	0,5	20,0	30,0	28,0	22,2	14 mm parket på beton
5	Bad 2	4,5	12	27,0	300	71	157	107	Ø20x2,0 mm Tigris PE-RT	0,4	0,5	20,0	30,0	28,0	23,4	Klinker på betongulv
6	Værelse 3	11,2	3	59,2	300	111	234	307	Ø20x2,0 mm Tigris PE-RT	1,9	0,5	20,0	30,0	28,0	22,2	14 mm parket på beton
7	Bryggers	7,1	2	37,5	300	113	247	289	Ø20x2,0 mm Tigris PE-RT	1,2	0,5	20,0	30,0	28,0	23,4	Klinker på betongulv
8	Entre/gang	8,3	10	37,7	300	132	289	209	Ø20x2,0 mm Tigris PE-RT	1,6	0,6	20,0	30,0	28,0	23,4	Klinker på betongulv
9	Køkken/alrum	19,9	14	70,7	300	269	592	446	Ø20x2,0 mm Tigris PE-RT	10,5	3,5	20,0	30,0	28,0	23,4	Klinker på betongulv
10	Køkken/alrum	19,9	12	68,7	300	269	592	446	Ø20x2,0 mm Tigris PE-RT	10,2	3,0	20,0	30,0	28,0	23,4	Klinker på betongulv
11	Kontor	7,8	24	63,0	300	77	163	165	Ø20x2,0 mm Tigris PE-RT	1,1	0,5	20,0	30,0	28,0	22,2	14 mm parket på beton
12	Bad 1	6,9	30	53,0	300	109	240	208	Ø20x2,0 mm Tigris PE-RT	1,7	0,5	20,0	30,0	28,0	23,4	Klinker på betongulv
13	Soveværelse	17,3	33	119,5	300	171	361	414	Ø20x2,0 mm Tigris PE-RT	8,1	1,2	20,0	30,0	28,0	22,2	14 mm parket på beton
14	Depot	1,6	32	37,3	300	25	56	15	Ø20x2,0 mm Tigris PE-RT	0,1	0,5	20,0	30,0	28,0	23,4	Klinker på betongulv
	Total:	153,7	258	905,6		1.835	3.955	3.904		13,5			30,0	28,0		

KONGEENGEN

Projektet og lokalplanen er godkendt med returvarme i en udstykning med ca. 25 grunde.

Grundsalg i første etape forventes at starte februar 2016 med overtagelse d. 1.juni 2016.

Resultaterne

Tesen holdt

I små varmtvandsproduktionsanlæg (volumen < 3l) sker der på grund af den korte opholdstid ikke nogen opblomstring af legionella.

Men spørgsmålene blev hurtigt flere end svarene.

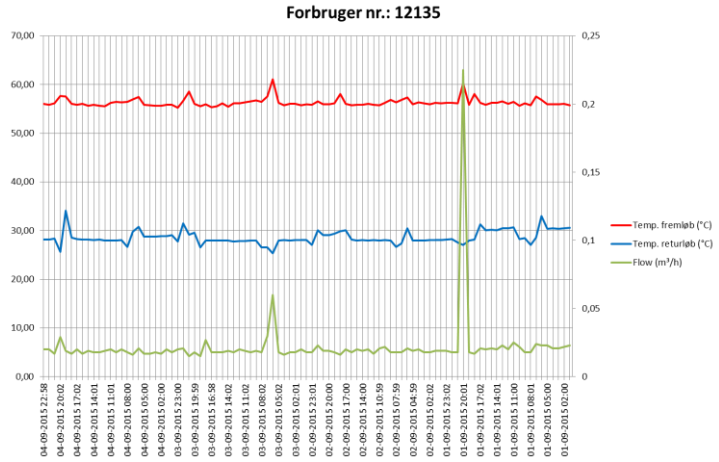
- Er der andet en opholdstiden, der har betydning?
- Kan vi fokusere på de patogene legionella typer?
- Hvad vil en konstant lav fremløbstemperatur betyde?
- Betyder messing og kobber indholdet i vandinstallationen noget?

Hvordan opfører varmevekslere og fjernvarmeinstallationen sig i praksis?

I 2015 afsluttede vi installationen af 8.500 timeaflæste fjernvarmemålere i Fredericia

Vi har nu haft tid og mulighed for at kigge på driftsdata over flere perioder.

Resultaterne er relativt tydelige med hensyn til driftsforhold. Der kan blandt andet identificeres velfungerende anlæg og anlæg der ikke er velfungerende.



Hvor langt skal vi gå?

Der gode grund til at diskutere, hvor langt man som fjernvarmeleverandør skal gå:

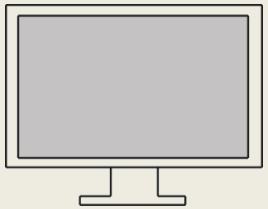
- Hvis bekæmpelsesstrategien er temperaturgymnastik, skal fjernvarmen være eneleverandør? Ville nødvendig temperaturstigninger kunne leveres med el?
- Vandnormen gælder helt frem til tapstedet; men ikke bruserslange og -hoved ?
- Hvis ledninger m.v. ikke drives med regelmæssige tapninger og gennemskylninger, hvor ligger et eventuelt ansvar?
- Kan man ikke bare tilsætte klor på sygehuse, svømmebade, plejehjem, således disse kritiske steder er sikret?
- Kan vi sammenligne os med udlandet, hvor man ofte behandler drikkevandet?

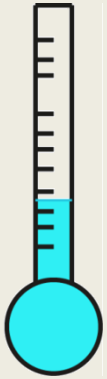
Typer af huse gennem tiden

Opførelsesår	Andel opvarmede m^2 fra byggeperiode [%]	Anddel af huse med fjernvarme [%]
Før 1850	3%	15%
1851-1930	27%	32%
1931-1950	10%	43%
1951-1960	8%	48%
1961-1972	22%	51%
1972-1978	13%	54%
1979-1998	11%	57%
1999-2006	4%	51%
Efter 2006	2%	58%

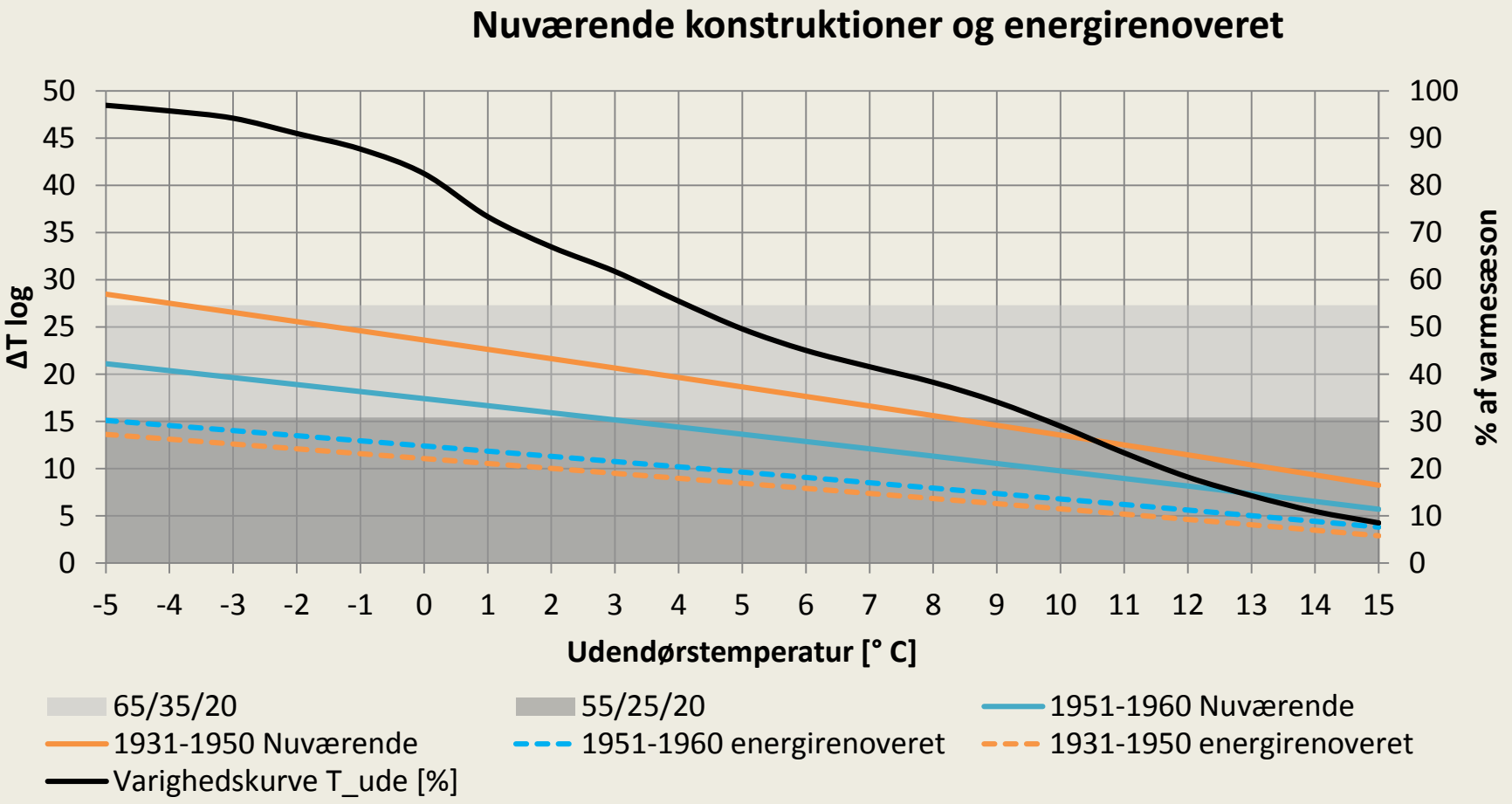
Typer af huse gennem tiden

Originale konstruktioner

\+  Varmetilskud fra udstyr og personer

\+  Varierende udetemperaturer

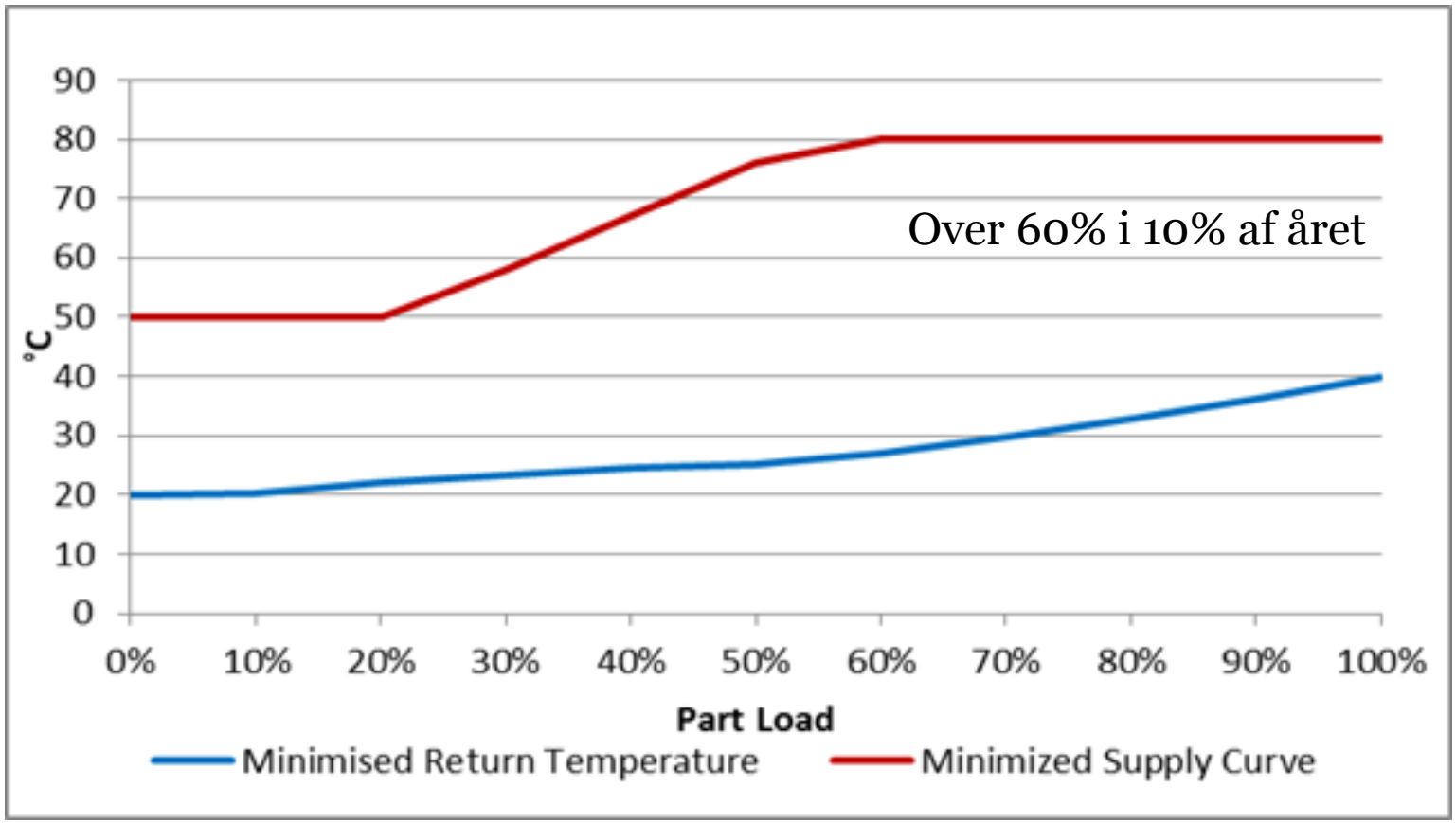
Typer af huse gennem tiden



4. Optimal frem- og returtemperatur

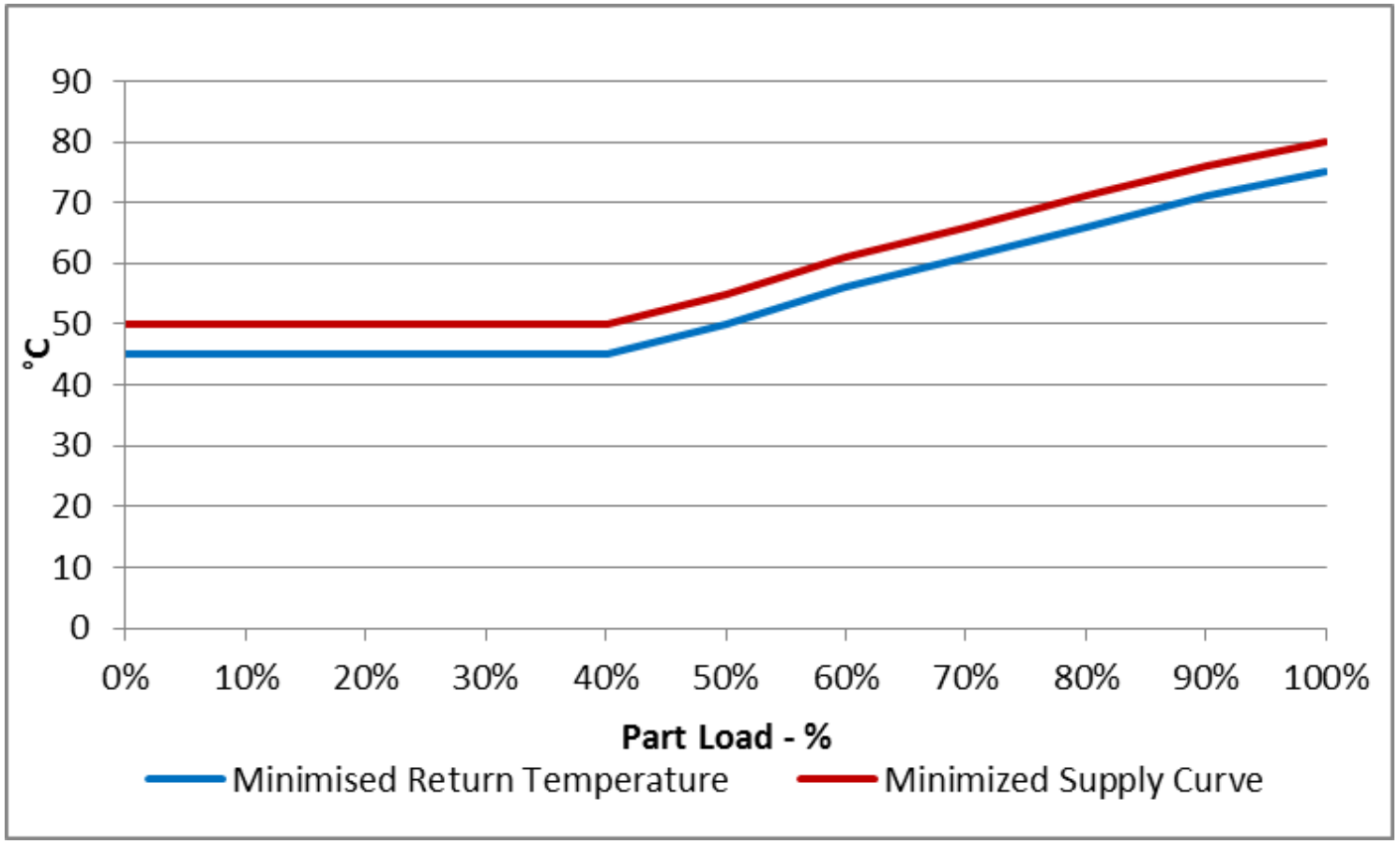
fjernvarmenet og radiatorkreds

ingen vejrkompensering



Bygninger med 1-strengs system indtil ændring til 2-strengs system

- ΔT of 5 °C Fremløb sat ned i huset med **vejrkompensering**



Konklusion

Udkast til metode skal testes

Mulighed for at finde de kritiske elementer I varmeanlæg

Grundlag for 'fejlretning' i varmeanlæg

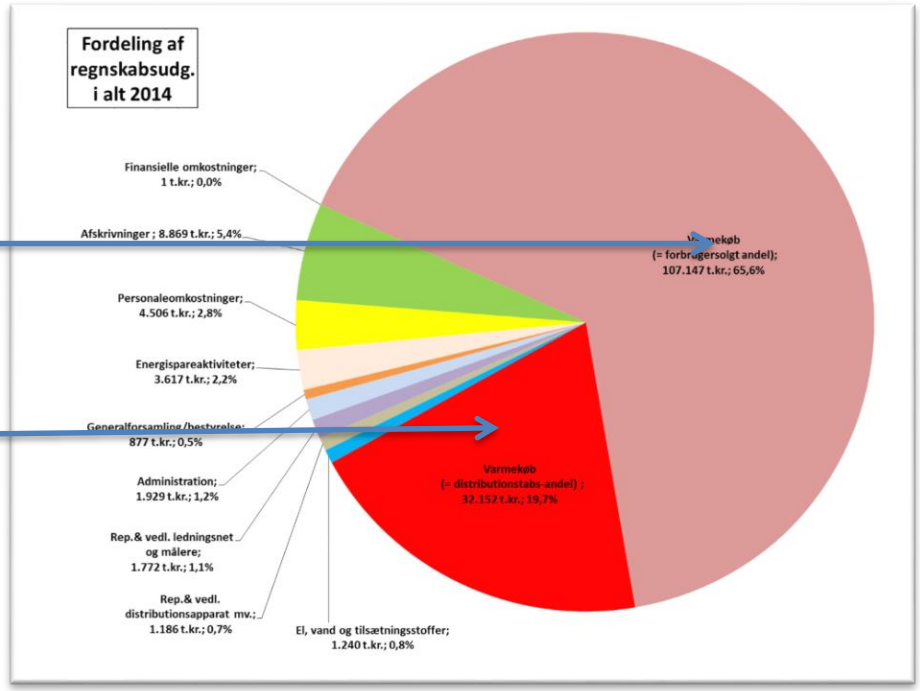
Mulighed for at optimere fjernvarmedrift med udgangspunkt i varmeanlæggene

FOKUS

Viborg Fjernvarme

- Samlet omk. (omsætning) på ca.163 mio. DKK

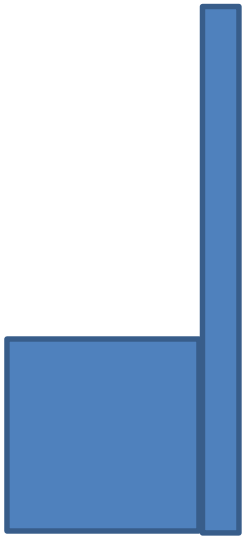
- 66 % videresalg
- 20 % varmetab
- 5 % afskrivninger



- 9 % løn, energibesparelser, drift og vedligehold af nettet

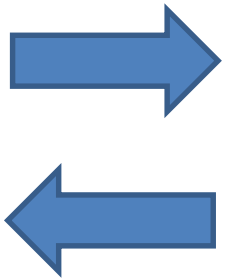
Hele værdikæden er udfordret

Produktion



Nye store investeringer,
når de fossile brændsler skal ud
Usikker afgiftspolitik
Volatible energipriser

Distribution



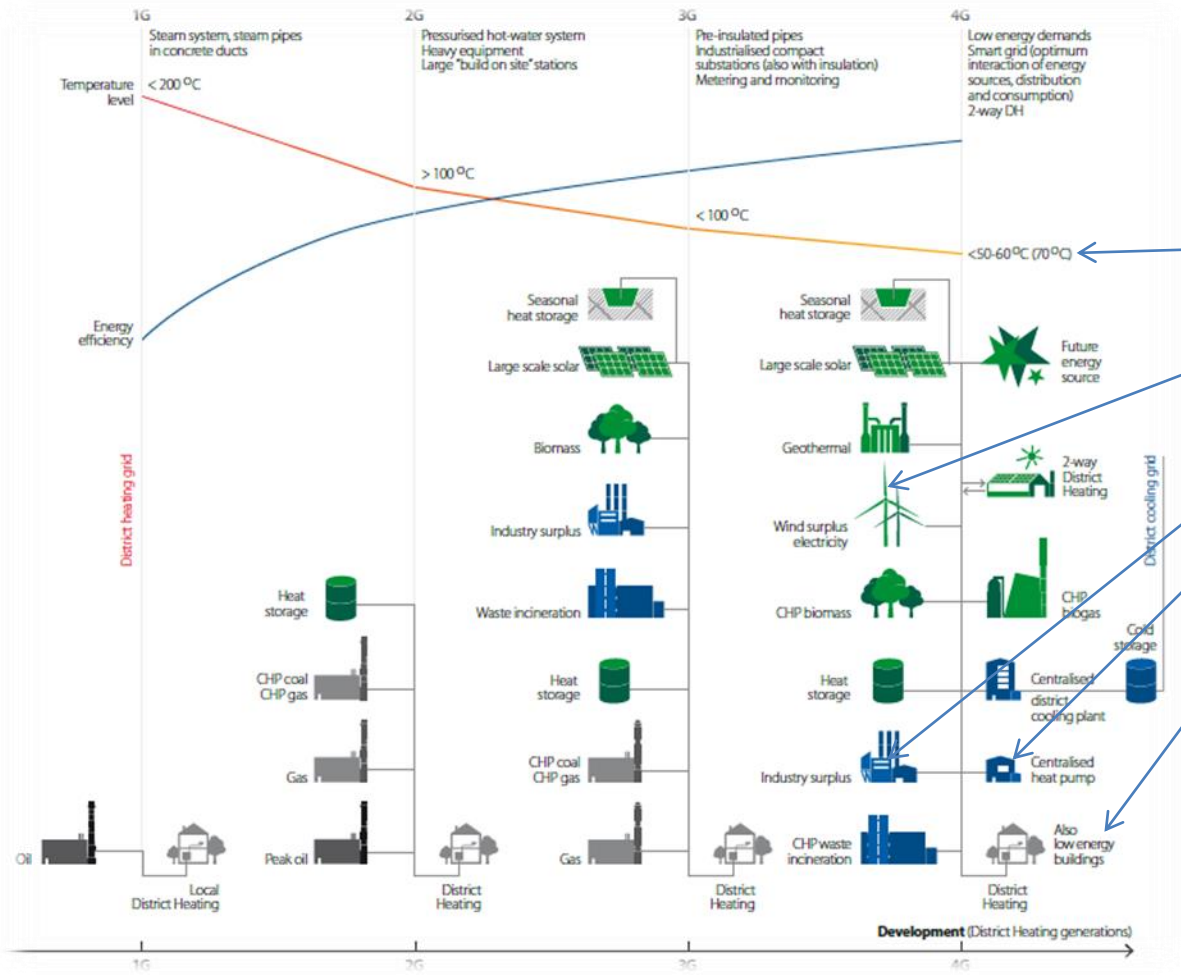
Effektivitet afhænger af salget,
som er under pres pga. energibesparelser
og BR2015/BR 2020

Forbrugere

Forbrugere er kritiske og illoyale,
når mulighederne byder sig

Viborg Fjernvarme
NEMT TRYGT BILLIGT

Fjernvarme fortid, nutid, fremtid - 4DH



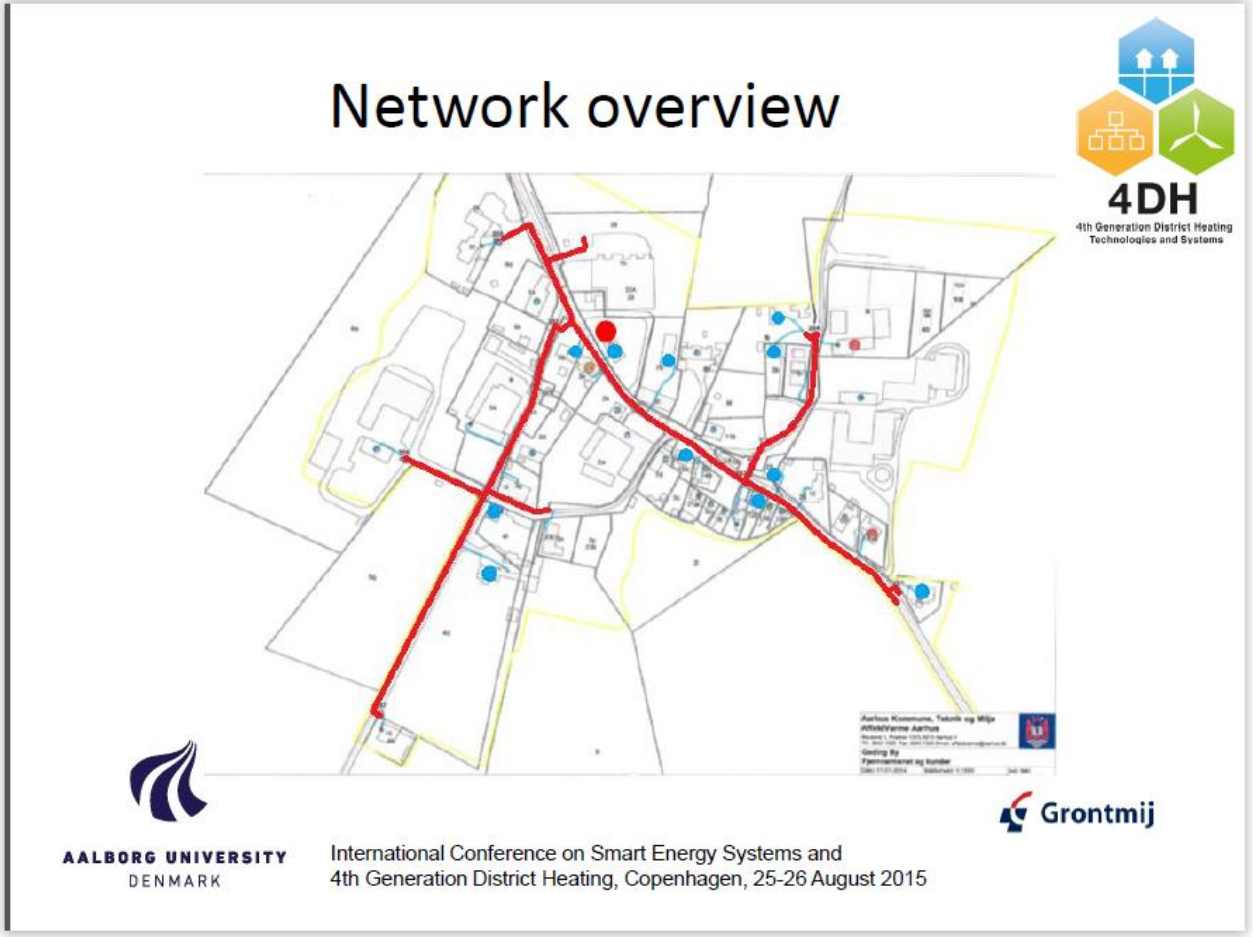
Apple

Viborg Fjernvarme

NEMT TRYGT BILLIGT

Geding

21 installationer i et lille net. Fremløbstemperatur hos kunden på ca 40 grader. Varmepumper hos kunderne.



Døgnvariationer

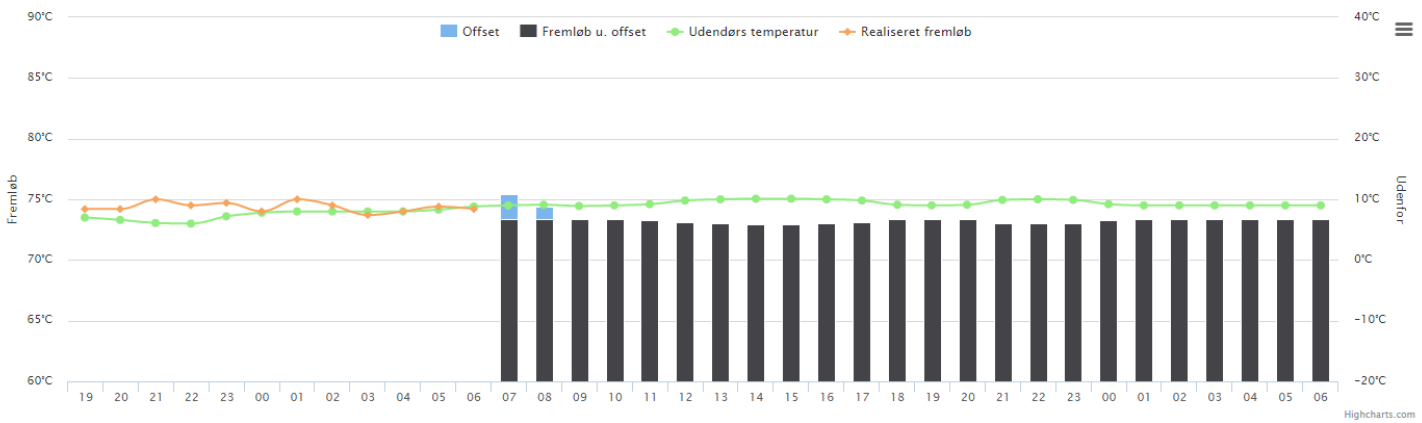
Fredag - 30. okt - 2015

124 - Brabrand nord

Juster Offset

Juster Bånd

Oversigt



Optimér hverdag

0-11 | 12-23

°C \ Timer	0	1	2	3	4	5	6	7	8	9	10	11
-30												
-20												
-10												
-5												
0												
5						1	2	2	1			
10						1	2	2	1			
20												

Gem

Optimér weekend

0-11 | 12-23

°C \ Timer	0	1	2	3	4	5	6	7	8	9	10	11
-30												
-20												
-10												
-5												
0												
5										1		
10										1		
20												

Gem

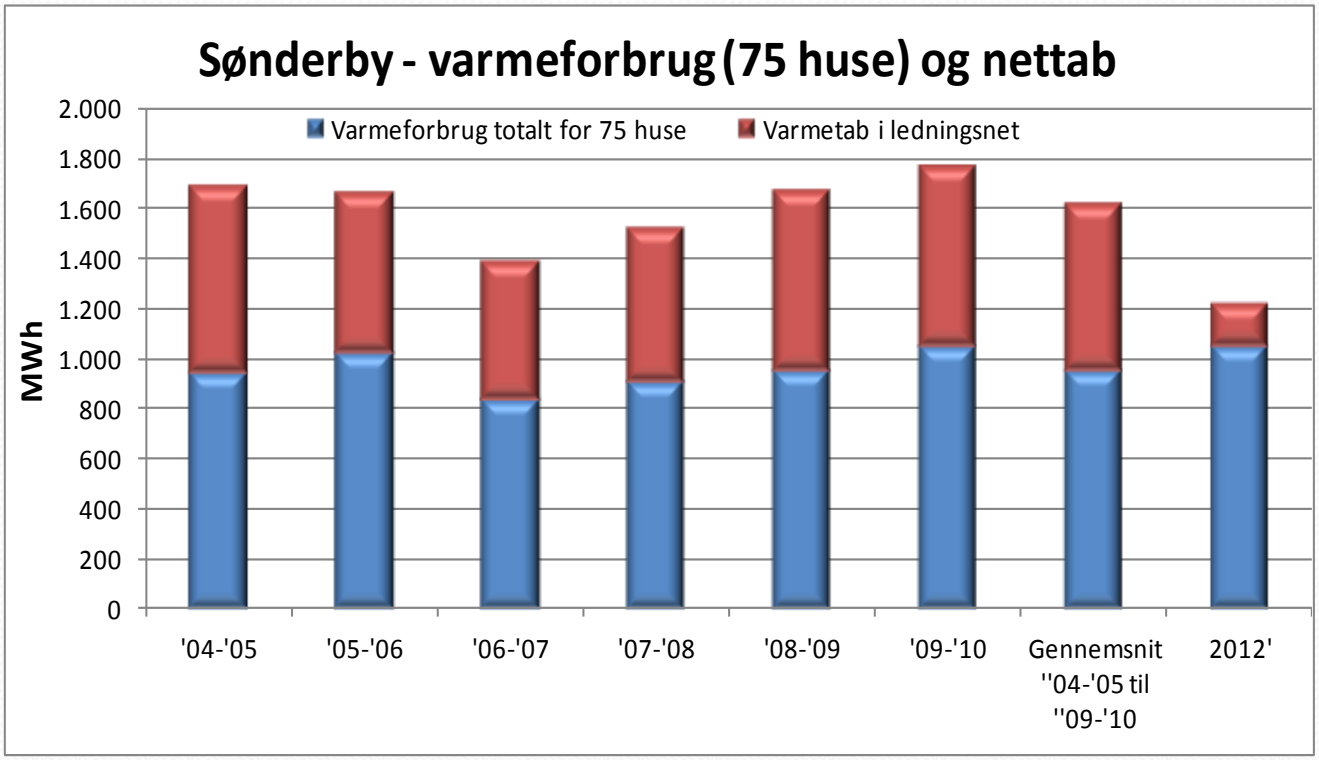
Sønderby

HØJE TAASTRUP
fjernvarme amba

- 75 Huse fra 1999
- Ledningsnettet var Tarco serie 1 uden alarmer samt pex
- De var tilsluttet som én forbruger via en varmecentral med en veksler
- Alle huse havde gulvvarme og en varmtvandsbeholder
- Der var individuel måling i alle huse
- Gadeledningstabet var mellem 41% og 48%

HØJE TAASTRUP
fjernvarme amba

Varmeforbrug



- *Samlet varmeforbrug og varmetab i net for før og efter fjernvarmerenoveringen. Søjlen med kalenderåret 2012 viser varmeforbrug og varmetab for det nye system, mens de øvrige søjler er tal for det gamle system.*

HØJE TAASTRUP
fjernvarme amba

Problemer

- Støj/vibrationer
- Manglende afkøling
- For lidt varme i de yderste ledninger
- Manglende skriftlige aftaler
- Intern kommunikation
- Dokumentation af forhold hos kunden

ALBERTSLUND FORSYNING

Albertslund Kommune

Total renovering i Albertslund

544 rækkehuse renoveres til lavenergi-byggeri i 2012-15.

Yderligere 1.500 huse følger indtil 2019.

- Gammelt net i krybekældre fjernes.
- Nyt lavtemperaturnet lægges uden for husene. Dimensioneres for 55/30°C.
- Nye units med pladevarmeveksler installeres

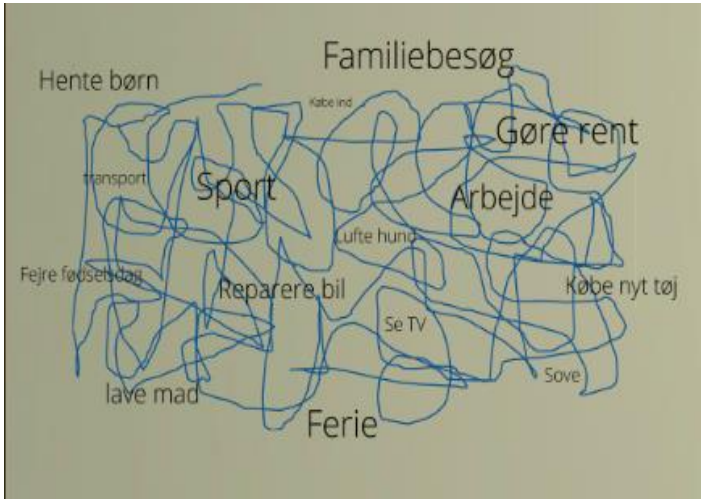
Beboere klager over manglende varme/varmt vand

Entreprenør melder pas…
”Det er ikke med i deres entreprise”

Energi fylder meget lidt i folks hverdag

- Teknikken ”skal bare virke og passe ind i folks travle hverdag!”.

- Ændring af fremløbstemperaturen, er mindre ”synligt” og ”håndgribeligt”, til trods for at det kan mindske Co2 udslip og bane vej for grønnere energikilder.



❖ **For at imødekomme borgerne bør man starte med at:**

- Anerkende menneskene bag energiforbrugene, fremfor blot at se dem som energiforbrugere.
- Undersøge adfærdsmønstre.
- Informere om handlemuligheder.

Adfærdspsykologisk teori

"Mål regerer eller sætter "rammer" for, hvordan folk har tænkt sig at handle, hvordan viden og holdninger bliver kognitivt mest tilgængelige, hvordan folk vurderer forskellige aspekter af situationen, og hvilke alternativer der bliver overvejet"
(Lindenberg & Steg 2007:119)

Og når det kommer til visse teknologier, baserer enkeltpersoner deres accept på:

- Den samlede vurdering af **omkostninger, risici og fordele** (Theory of Planned Behaviour /Prospect Theory).
- **Moralske evalueringer**, afhængigt af, i hvilket omfang den teknologi har en mere positiv eller negativ effekt **på miljøet eller samfundet** (The Norm Activation Theory).
- På positive eller negative følelser relateret til den teknologi, såsom følelser af tilfredshed, **glæde, frygt eller vrede** (Affect Theory).

MEN….

- **Antropologiske undersøgelser** har også vist, at der ikke nødvendigvis er lighed mellem økonomiske incitamenter og komfortabel teknologi → udrulning af varmepumper i udkantsdanmark (DREAM) er et eksempel, hvor gør-det-selv-kultur og fællesskabet havde større betydning for de lokale borgere.

- **Seneste psykologiske forskning** → det har ikke fungeret, at få mennesker til at interessere sig for klimaforandringer ved udelukkende at sige, at vi bør tackle et miljøproblem, fordi det er vigtigt. Hvilket skyldes, at det er så tæt forbundet med den enkeltes politiske overbevisning.

"De afledte effekter betyder generelt set, at man tager ting, som folk allerede bekymrer sig om, og forbinder dem med at skride til handling over for klima eller andre miljømæssige anliggender. Det kunne for eksempel være den økonomiske eller videnskabelige udvikling eller simpelthen at leve i et mere omsorgsfuldt og elskværdigt samfund"
(Videnskab, 2015)

READY "ADD-ON" PHD PROJECT:

CREATING FLEXIBLE ENERGY CONSUMPTION IN THE RESIDENTIAL BUILDING STOCK.

FUNDED BY AARHUS UNIVERSITY

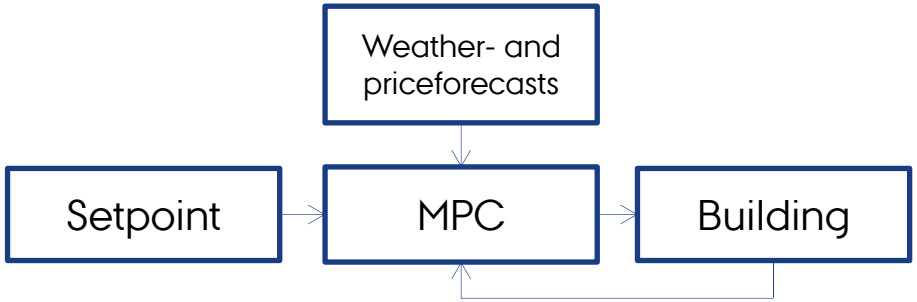
AARHUS
UNIVERSITY

RASMUS ELBÆK HEDEGAARD

READY WORKSHOP NO. 3
13 NOVEMBER 2015

FLEXIBLE SPACE HEATING IN BUILDINGS

- Model predictive Control
  - Uses price- and weather forecasts
  - Uses knowledge of the building to plan HVAC-operation ahead
- Objective of MPC-control
  - Allocate consumption in periods with high energy production



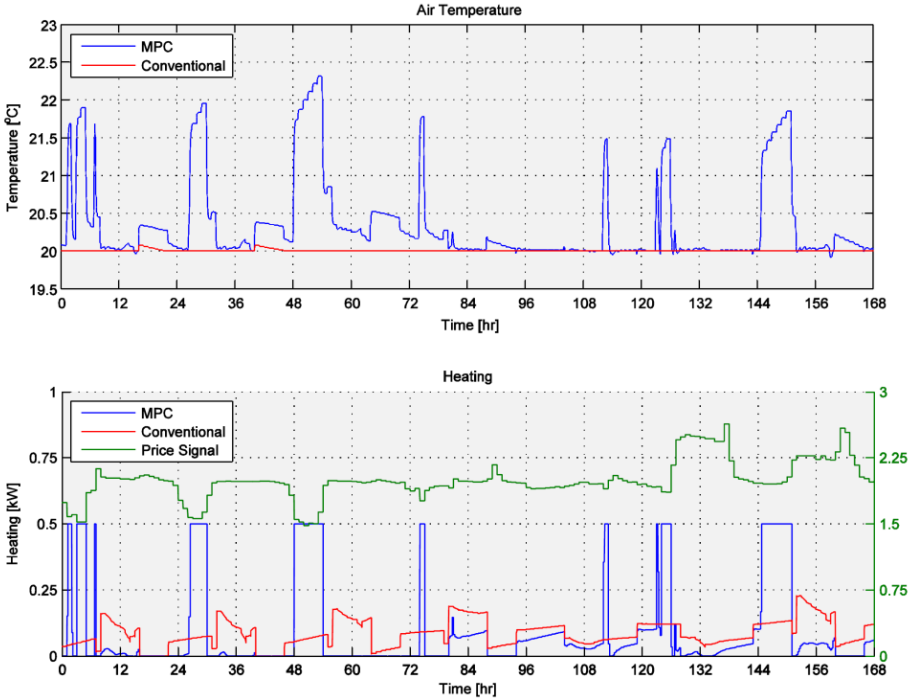
Simulation-based study

MASTERS PROJECT:
Deterministic Grey-Box Model for Model Predictive Control of Heating Systems in Dwellings

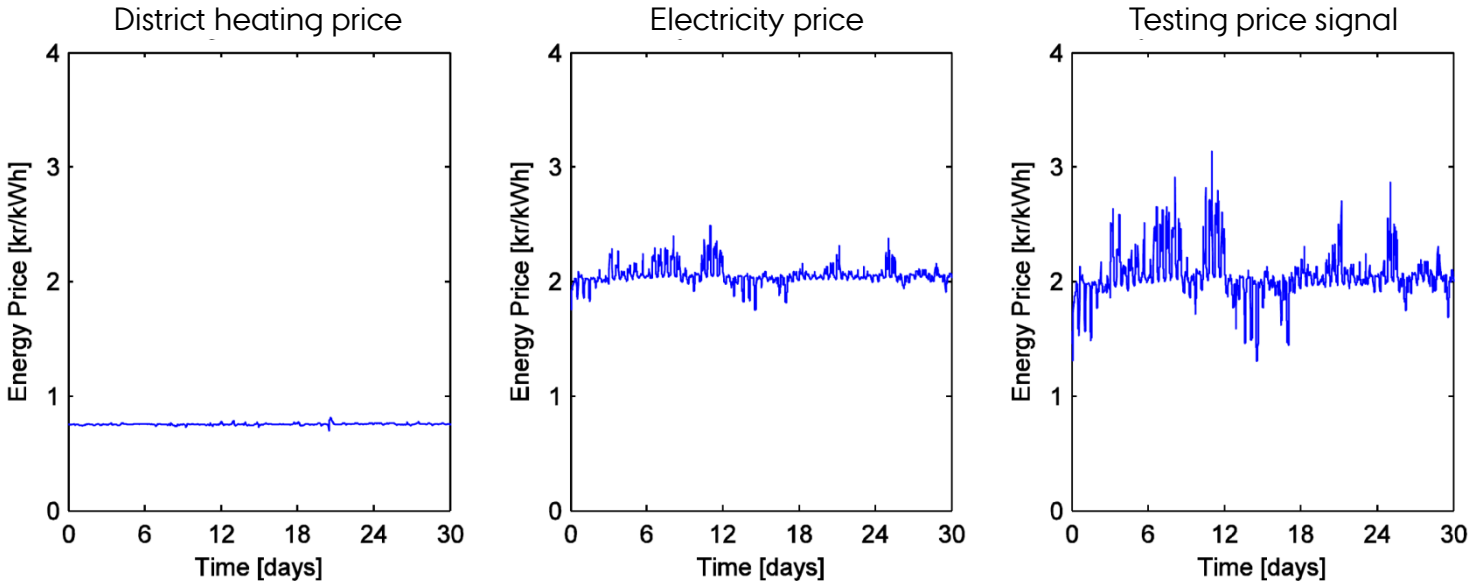
MODEL PREDICTIVE CONTROL

- Possibilities with model predictive control:
  - Varying comfort criteria
  - Energy use optimized with respect to various aspects, including:
    - Consumer energy bill
    - CO2 (from production)

- Objective: Minimize the consumer costs.
- Energy is stored through temperature boosting when price is low.

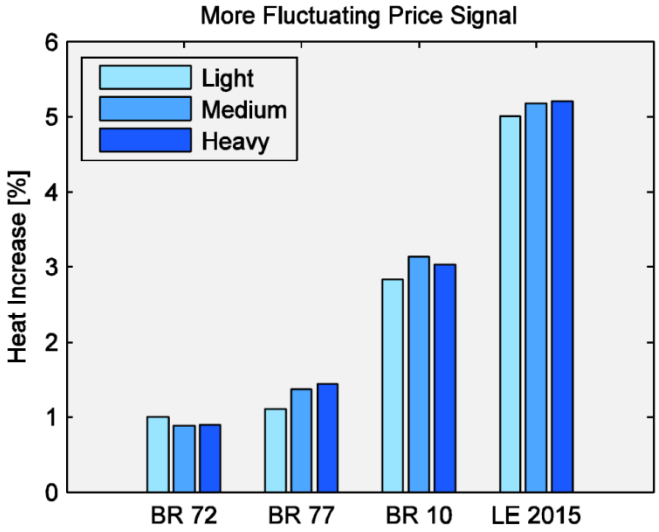


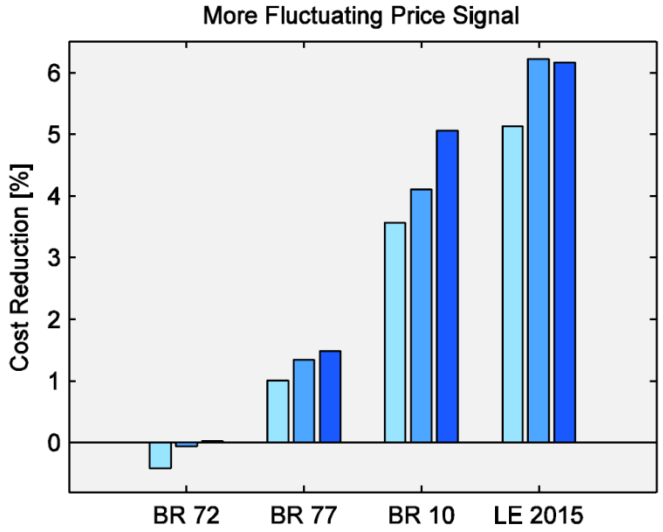
THE IMPORTANCE OF PRICE SIGNALS



POTENTIAL

- Results: Higher heat consumption but lower energy bill!



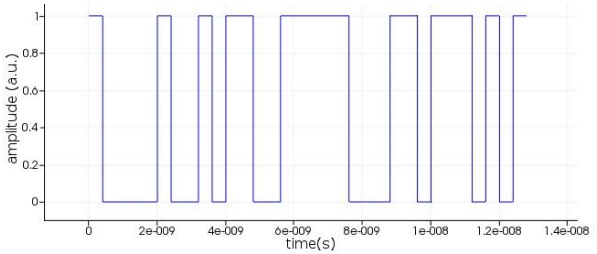


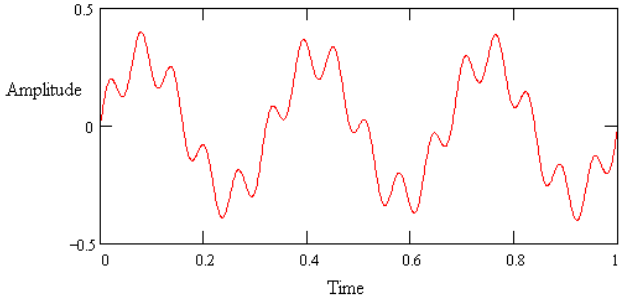
Current work

Contribution to the Clima 2016 World Conference.

HOW TO OBTAIN GOOD MODELS OF BUILDINGS?

- Model predictive control needs mathematical models of the building to work. Models can be derived using either:
  - Expert knowledge based on the laws of thermodynamics
  - Statistical methods using measurement data





- **Task: Develop experiments that yield good results without causing discomfort to occupants.**

WORK AHEAD

- Carry out modelling-related experiments within the **FlexLab laboratory**
- Investigate how building occupants react to model predictive control
- Create models of Danish buildings in preparation of field tests.
- Test model predictive control in real Danish dwellings.

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PRESENTATION OF PHD PROJECT

DEVELOPMENT OF RETROFIT SOLUTIONS FOR UTILIZATION OF THE SMART ENERGY POTENTIAL IN EXISTING RESIDENTIAL BUILDINGS

PHD PROJECT

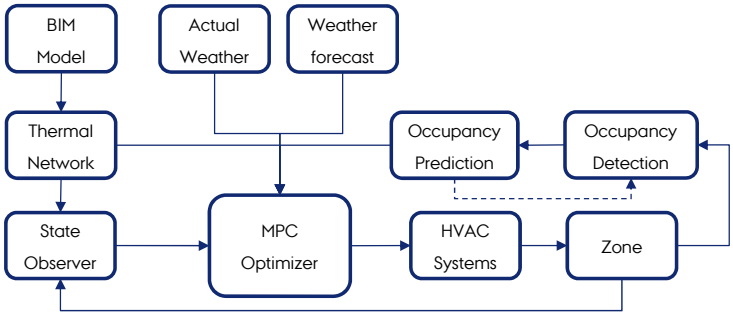
- **Title**: Development of retrofit solutions for utilization of the smart energy potential in existing residential buildings
- **Funding:** ForskEL
- **Time period:** May 2015 – April 2018 (3 years)

PROJECT DESCRIPTION

- Investigate the smart energy potential in existing residential buildings.
- Identify retrofit solutions that increases the buildings' smart energy potential
- Set up a general methodology for targeting and quantifying the effect of different energy flexibility technologies related to energy retrofit of buildings.

CURRENT WORK

- Maintain acceptable indoor climate when room is occupied
- Using trajectories of indoor climate parameters (CO_2, Temperature, PIR etc.)



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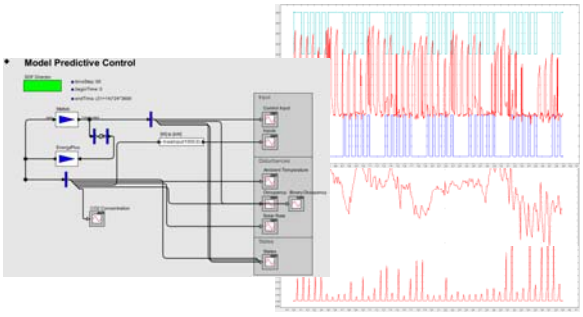
THEIS PEDERSEN
PHD. FELLOW, M.SC. IN ENGINEERING
READY WP MEETING NO. 3
13 NOVEMBER 2015

CURRENT WORK

- Multi-Zone MPC Control

Apartment A	Apartment D
Apartment B	Apartment E
Apartment C	Apartment F

FUTURE WORK



- **Current Stage:** Computer Simulation
- **Next stage:** Laboratory
- **Future stage:** Implementation in existing buildings

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13 NOVEMBER 2015


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PH.D. PROJECT PRESENTATION

Optimization of building retrofit in an integrated energy system based on renewable energy

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SCIENCE AND TECHNOLOGY

MARTIN HEINE KRISTENSEN
PH.D. FELLOW, M.SC. IN ENGINEERING

READY WORKSHOP #3
13 NOVEMBER 2015

PROJECT FORMALITIES

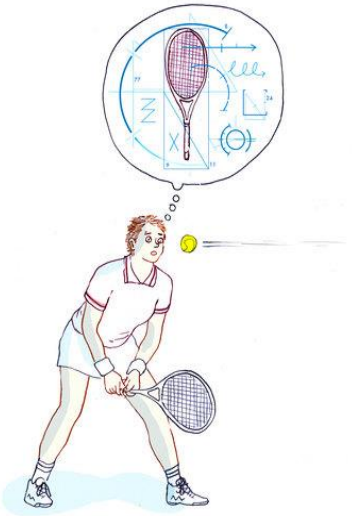
- **Title**: Optimization of building retrofit in an integrated energy system based on renewable energy

- **Time period:** August 2015 – July 2018 (3 years)

- **Affiliation:** READY work package 3.3 (D3.356)

THE CHALLENGE

- Theoretical building energy simulations differ from actual measured energy use in buildings
- Especially in retrofit projects is the savings potential difficult to assess due to uncertainties about the existing construction
- Uncertainty is very difficult to incorporate in the simulation process
- **We need a better understanding of how to retrofit buildings in cities**

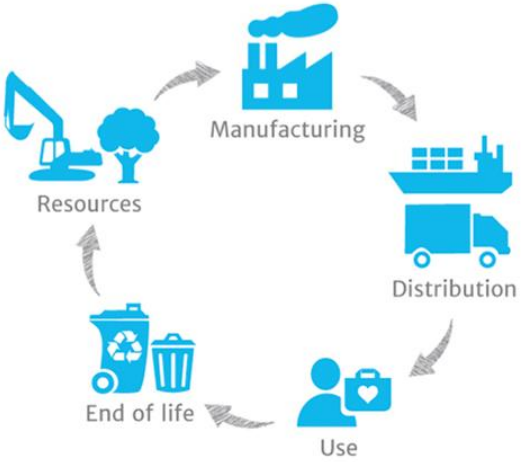


PROJECT DESCRIPTION

- The Ph.D. project aims at setting up a **platform to quantify the operational energy demand and demand-side flexibility** of the different types of buildings in a city district depending on their application, location, construction year, etc.

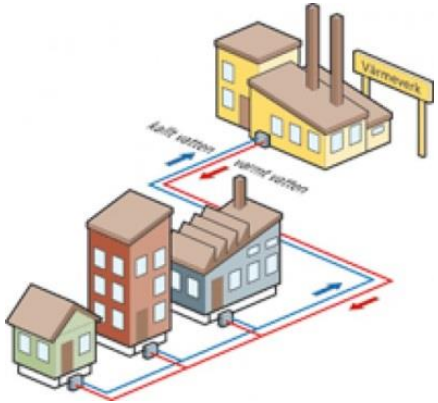
PROJECT DESCRIPTION

- The purpose of the platform is to enable the identification of **cost-optimal solutions** that minimize the **life-cycle energy need** (i.e. include embodied energy), maximize the **demand flexibility** and guarantee **high-quality indoor environments** for the end-user.



PROJECT DESCRIPTION

- These solutions should not only consider the performance of individual buildings but the **whole city district including operation of the energy supply**.

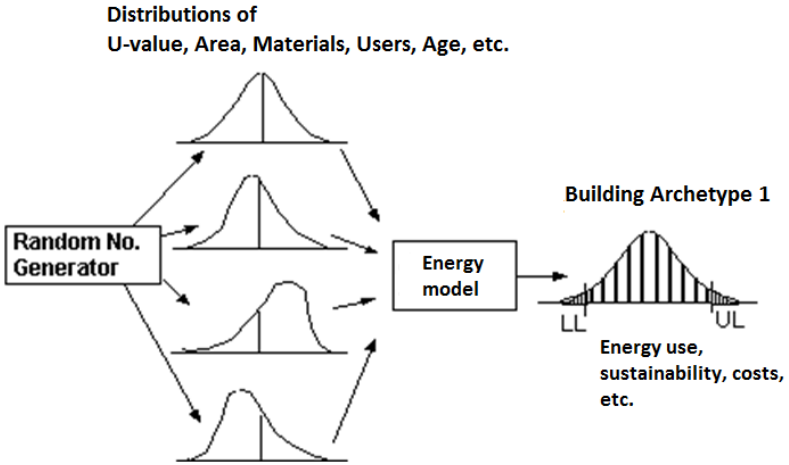


PROJECT DESCRIPTION

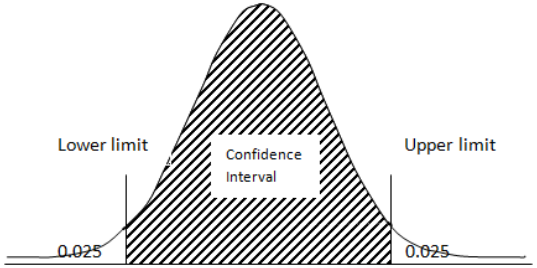
- The platform is initially set up and calibrated using Aarhus energy district as case study, but should be **generally applicable when finalized**.

METHODOLOGY

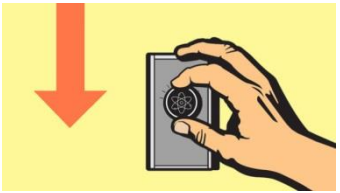
- Aarhus city and district heating system as test case
- Generalising buildings into archetypes
- Employing stochastic (probabilistic) modelling to account for uncertainties in input parameters



POTENTIAL (EXAMPLES)



- Micro level (building scale):
  - If we e.g. have DKK 200.000 for energy retrofits, how much will we be able to reduce the energy consumption given a 90% or 95% confidence interval?



- Macro level (urban scale):
  - If we reduce DH supply temperature by e.g. 10 °C, which retrofits will then be necessary in a given city area, and what will it cost society (subsidies, rate of return, etc.)?

If the facts don’t fit the theory, change the facts.

ALBERT EINSTEIN

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Production planning of energy systems

Cost and risk assessment for district heating

Magnus Dahl
magda@aarhus.dk

READY workshop 13/11/2015

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This PhD project in READY

- AffaldVarme Aarhus and Aarhus University
  WP3, D3.354 (1/5/2015-30/4/2018)

- From the **production side** of district heating:
  Determine the **value** of
  - Flexibility (production, consumption)
  - Heat pumps and electric boilers
  - Solar heating technologies
  - Building retrofitting
  - Low temperature district heating

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District heating

$$?

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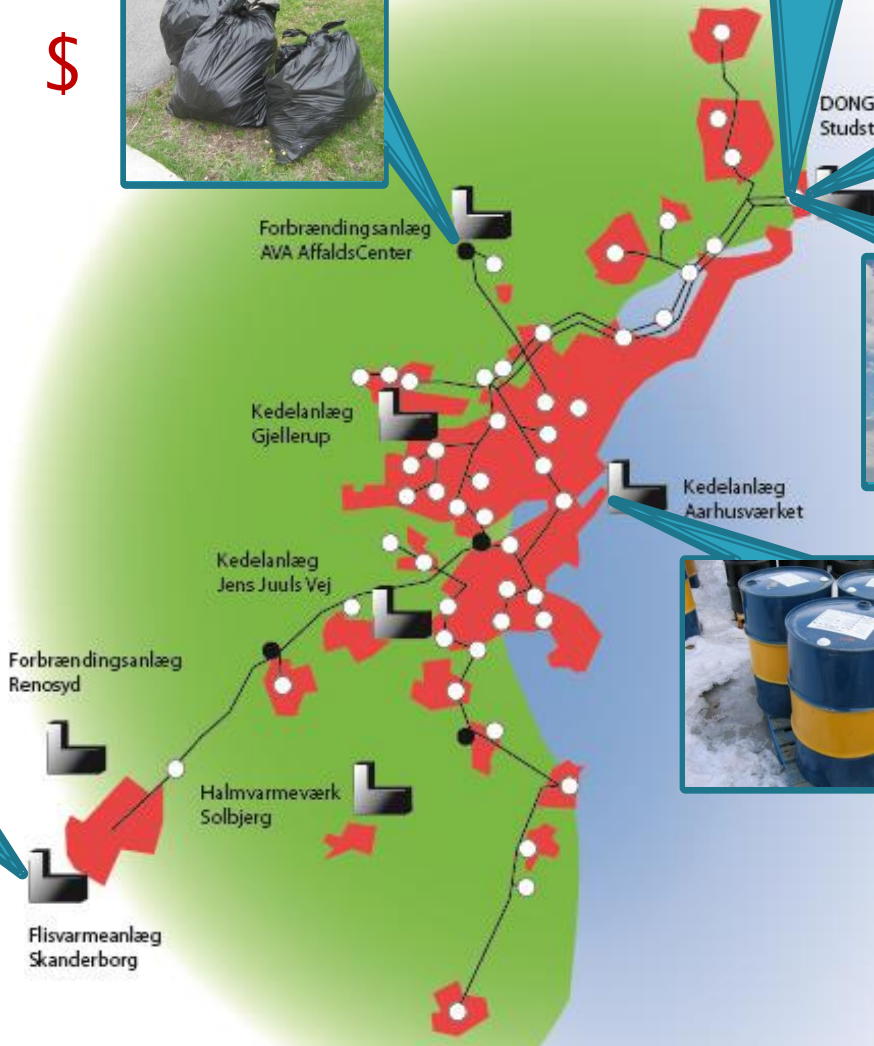

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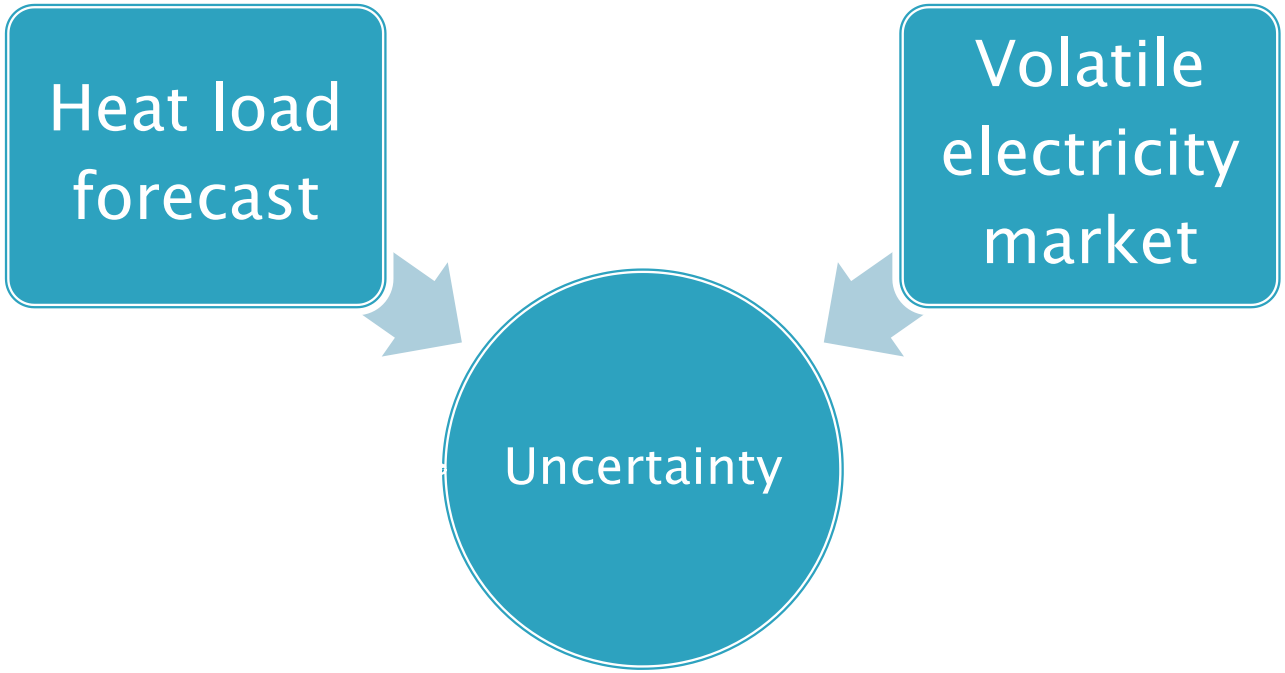
Decisions, decisions…



Making the right decision is non-trivial

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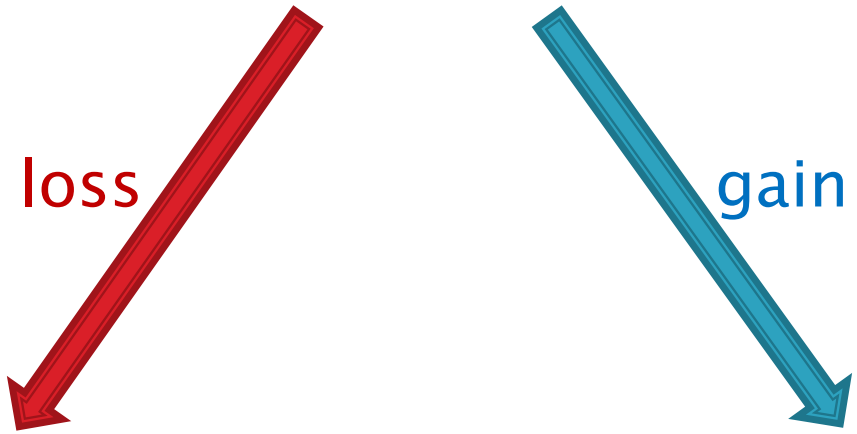
Example decision

Should we turn on the electric boiler?



Heat load
lower than expected

Heat load
as expected or higher

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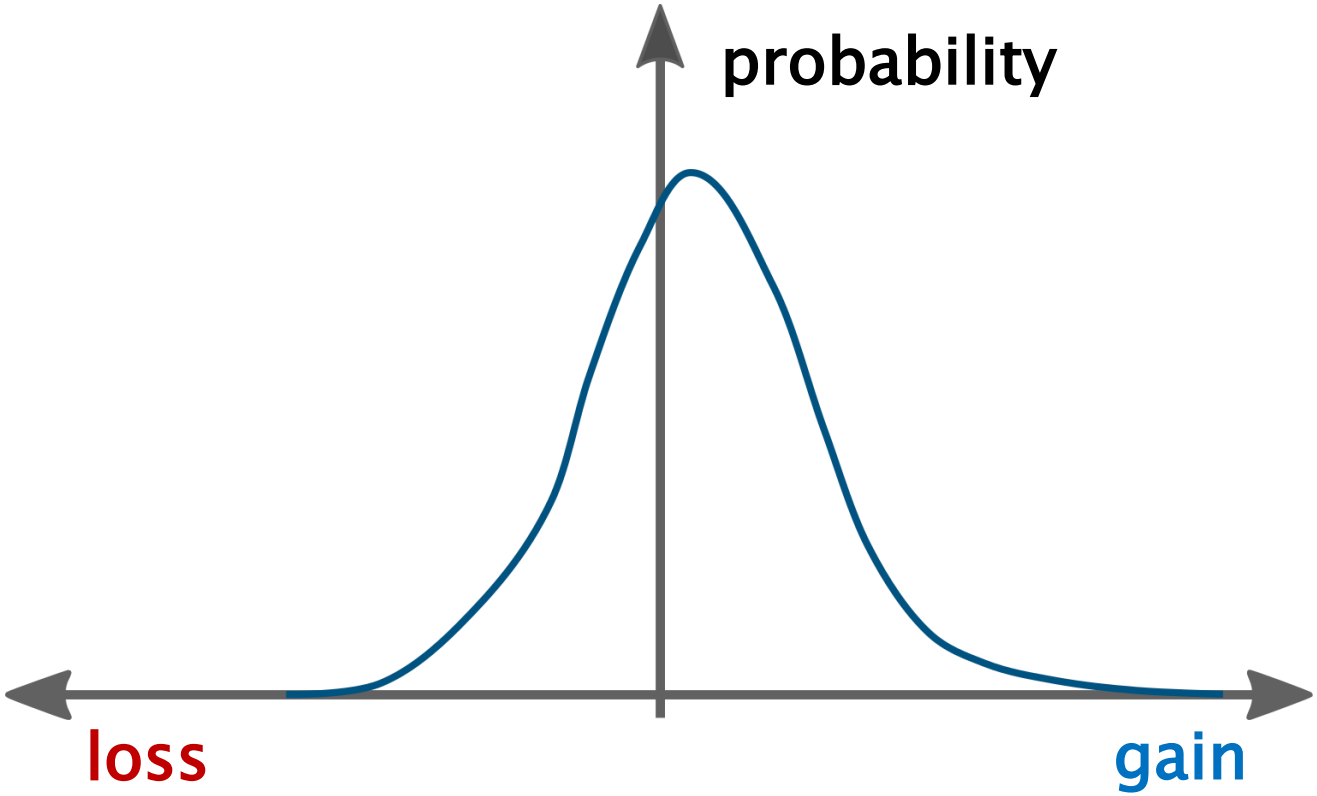
Quantifying risk



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First results – idea

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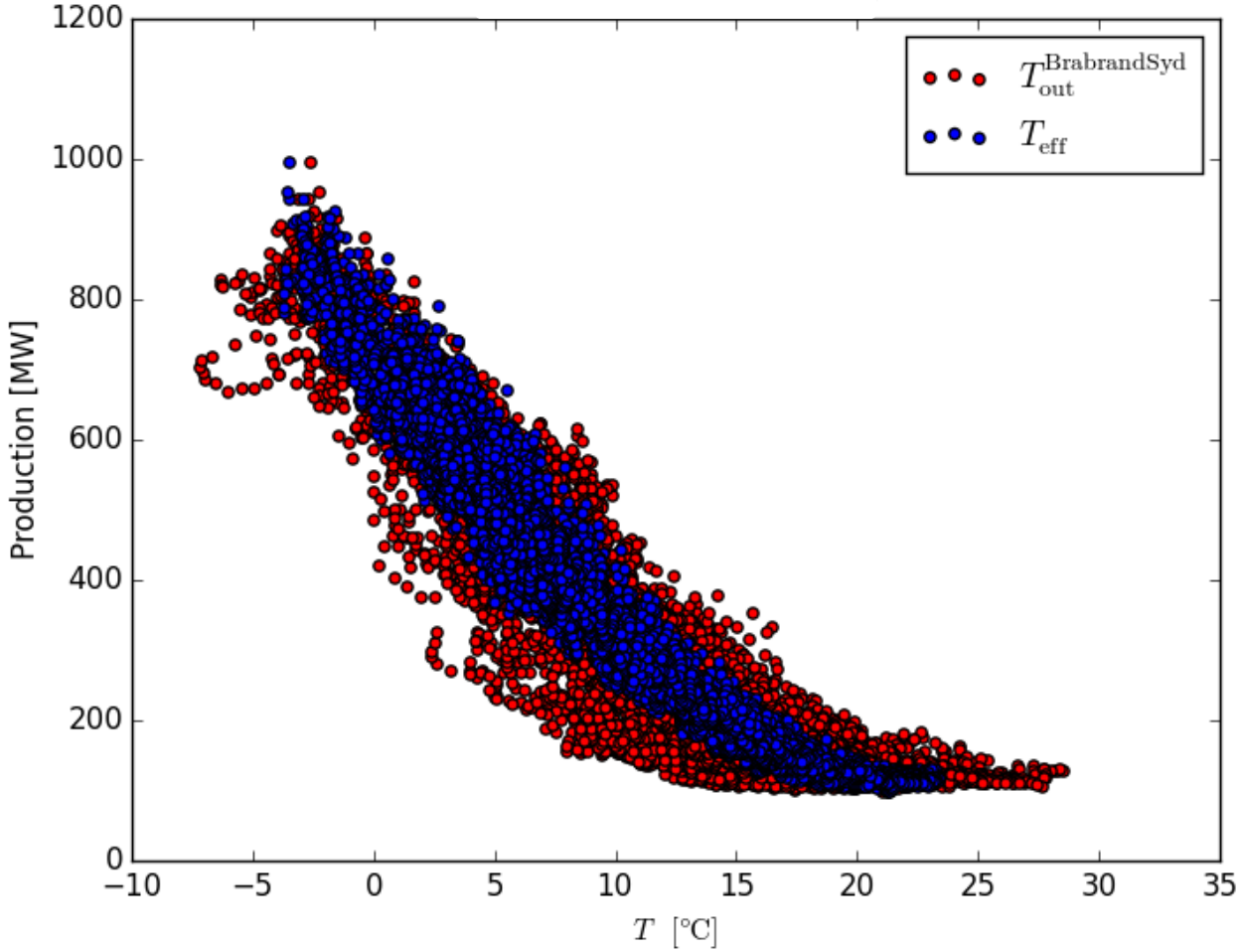
Effective temperature



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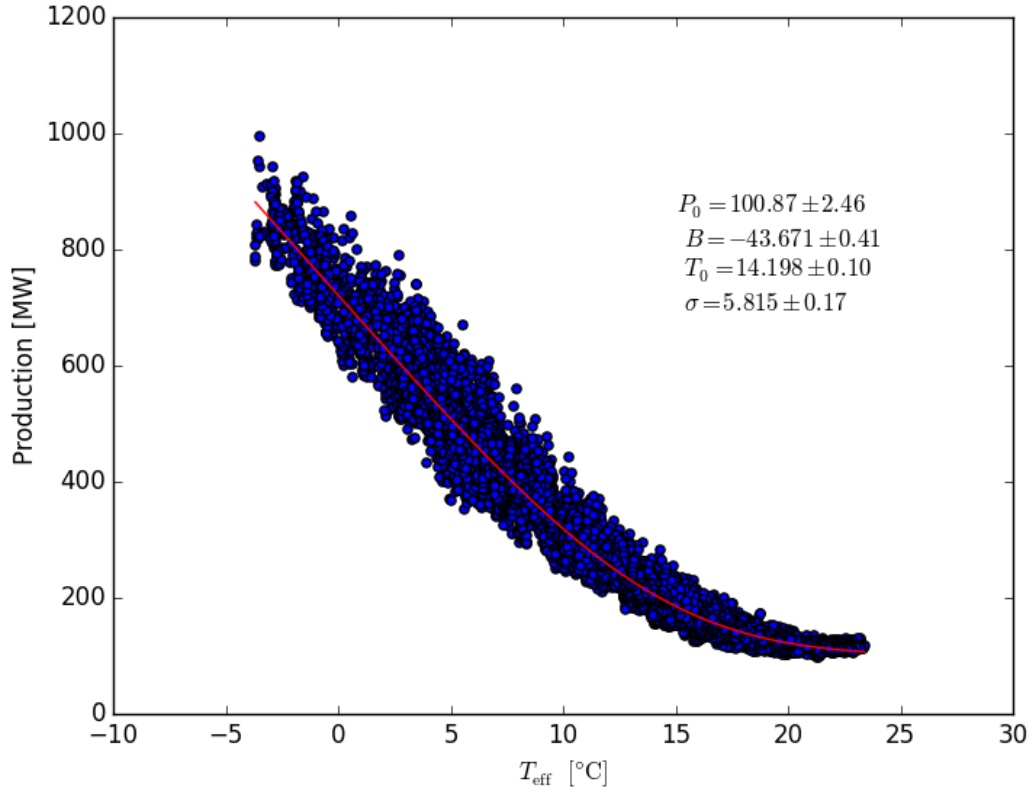
Production model



$$P_{\text{model}}(T) = B\left[(T - T_0)\frac{1}{2}\text{erfc}\left(\frac{T - T_0}{\sqrt{2}\sigma}\right) - \frac{\sigma}{\sqrt{2\pi}}\exp\left(-\frac{(T - T_0)^2}{2\sigma^2}\right)\right] + P_0$$

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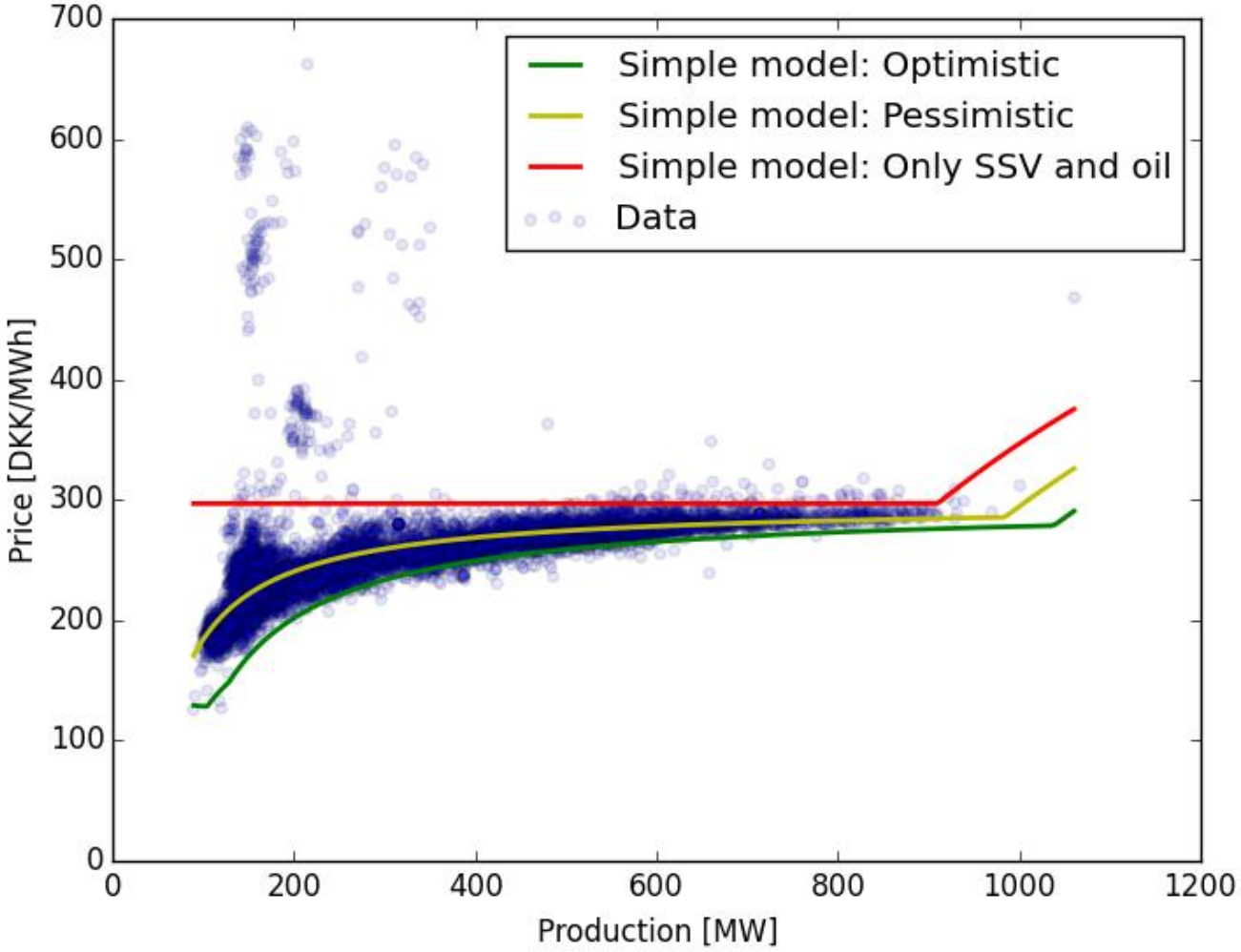
Price models



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Thank you for listening!

Questions?

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Practical methods for collaborating between private consumers and energy companies

Sustainable replication of green district heating projects

Rasmus Pedersen

raspe@aarhus.dk

2015-11-13

AffaldVarme Aarhus
Center for Miljø og Energi
Teknik og Miljø

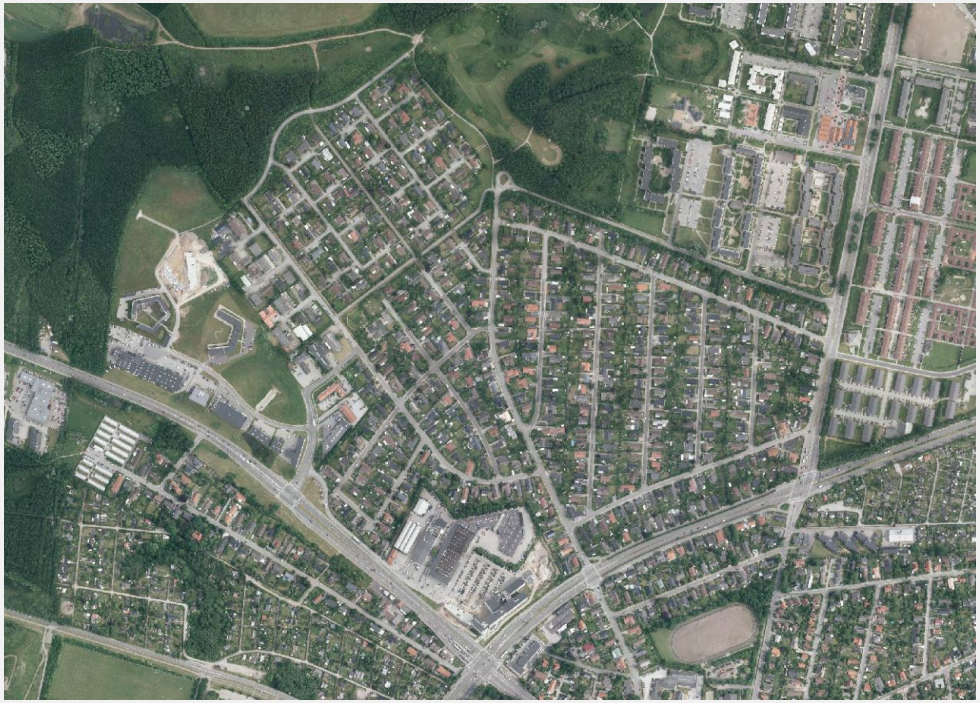
- Industrial phd (AVA and AU)
  - September 2015 – 2018

- Supervisors:
  - Gorm B Andresen (AU)
  - Adam Brun (AVA)

Rasmus Pedersen
raspe@aarhus.dk

Case: Private residences

- 500 single family houses in Aarhus
- Test of low temp. DH
  - Business cases
  - Techinical solutions
  - Participation



AffaldVarme Aarhus
Center for Miljø og Energi
Teknik og Miljø

Rasmus Pedersen
raspe@aarhus.dk

Case: Cooperation between DH and building

AARHUS KOMMUNE

- Using buildings heat demand to prevent pipe upgrade
  - Localization of buildings/regions
  - Overall cost savings

- In cooperation with Aa+
  - http://www.aarhus.dk/aaplus

AffaldVarme Aarhus
Center for Miljø og Energi
Teknik og Miljø

Rasmus Pedersen
raspe@aarhus.dk

Case: Absorption cooling

- Using DH as media for cooling
- Pros and Cons as a DH company
  - Mostly used in the summer
  - Cheaper cooling solution

Rasmus Pedersen
raspe@aarhus.dk

Sustainable solutions

- Technically
- Economically
- Anthropologically

Practical methods for collaborating between private consumers and energy companies
Sustainable replication of green district heating projects

Rasmus Pedersen
raspe@aarhus.dk

ENGINEERING
TOMORROW

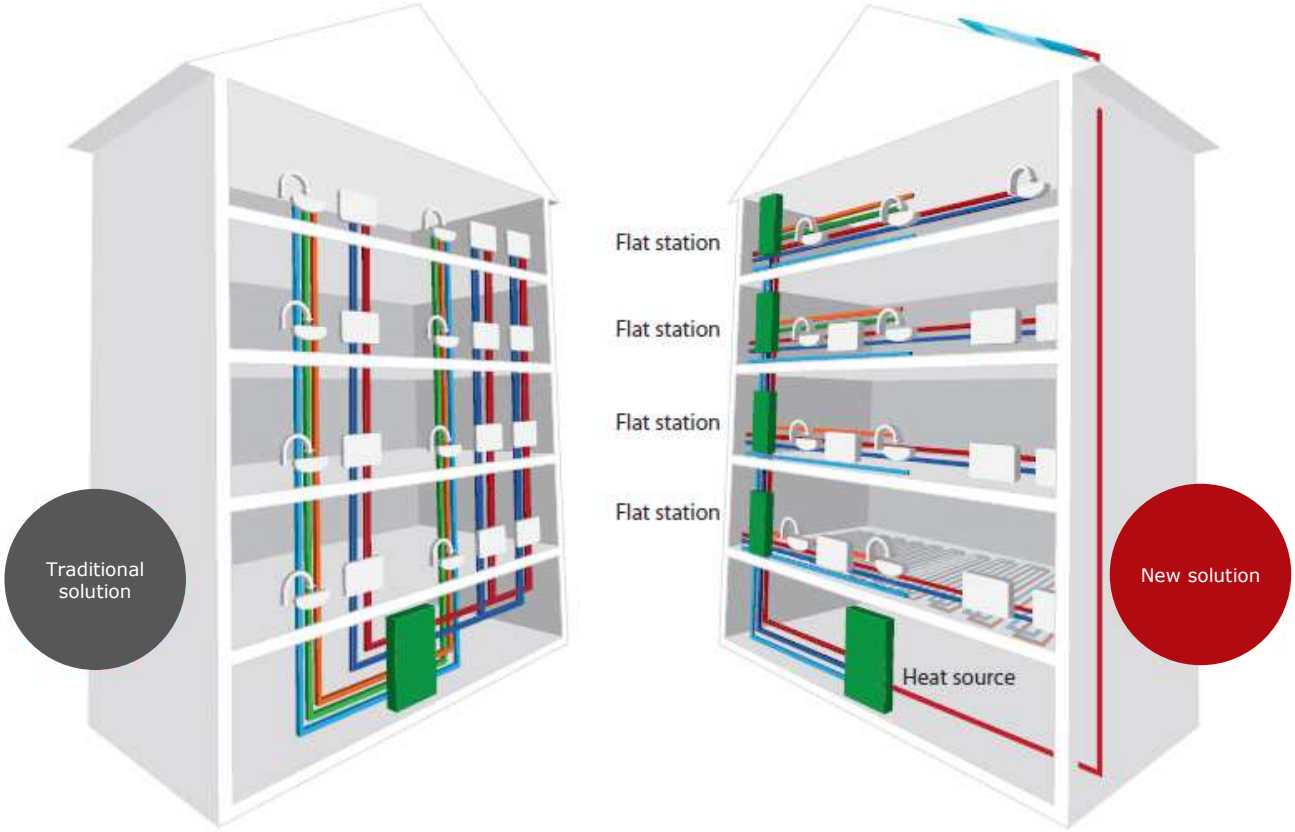
Flat stations in Ready project

Marek Brand
marek.brand@danfoss.com
Application Specialist
Danfoss District Energy Application Center

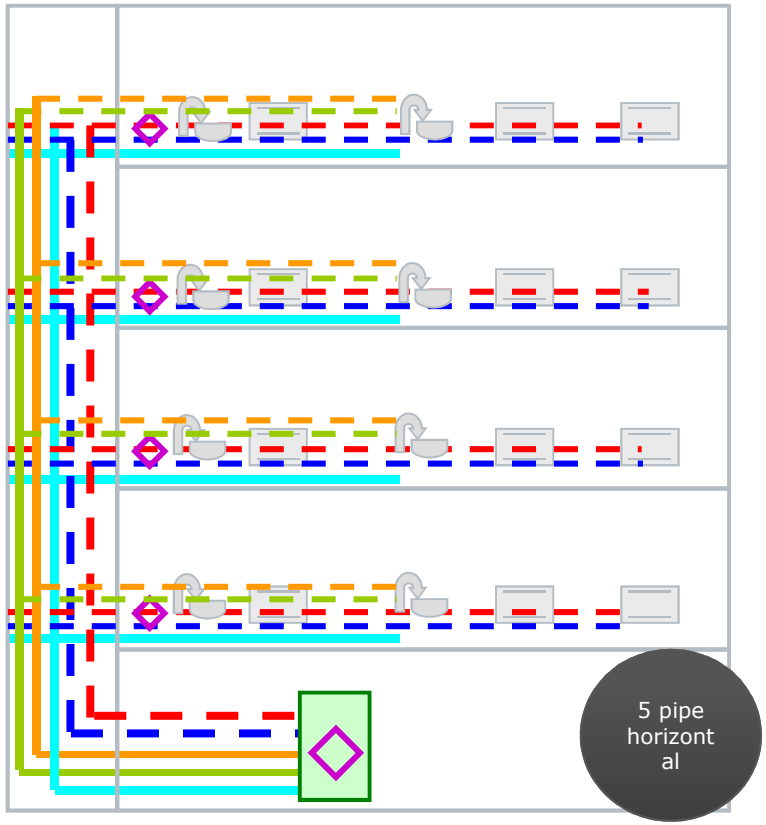
Possible solutions for DHW and space heating

Traditional centralised solution = No flat stations

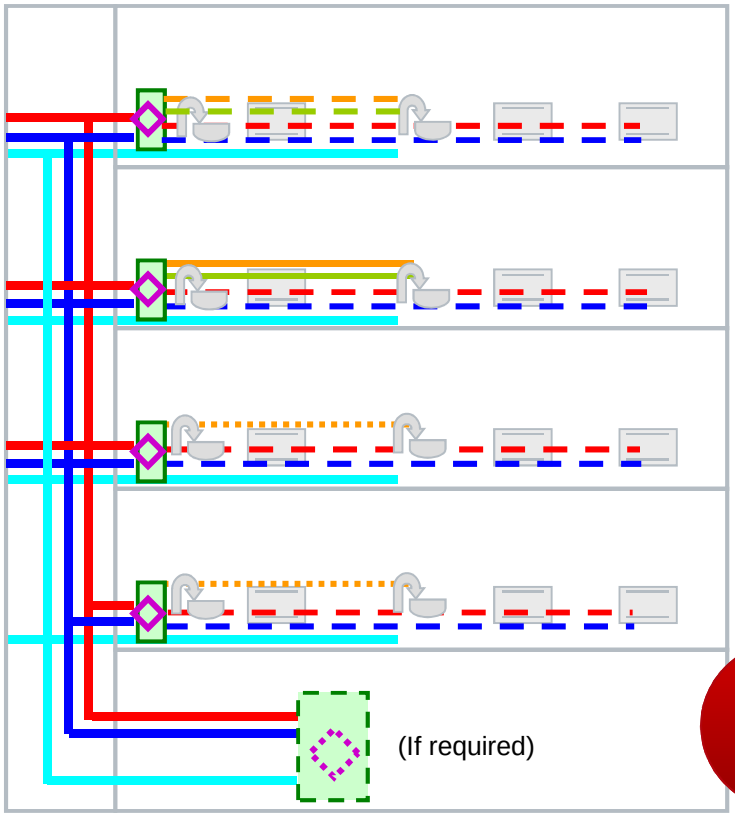
Decentralised solution = Flat stations



Possible solutions for DHW and space heating



5 pipe horizontal



(If required)

Flat stations

Station, unit, normally with HEX

Heat meter

Heat meter optional

Radiator

District Heating, Room Heating Pipe

Hot Tap Water, Circulation Pipe

Cold Water Pipe

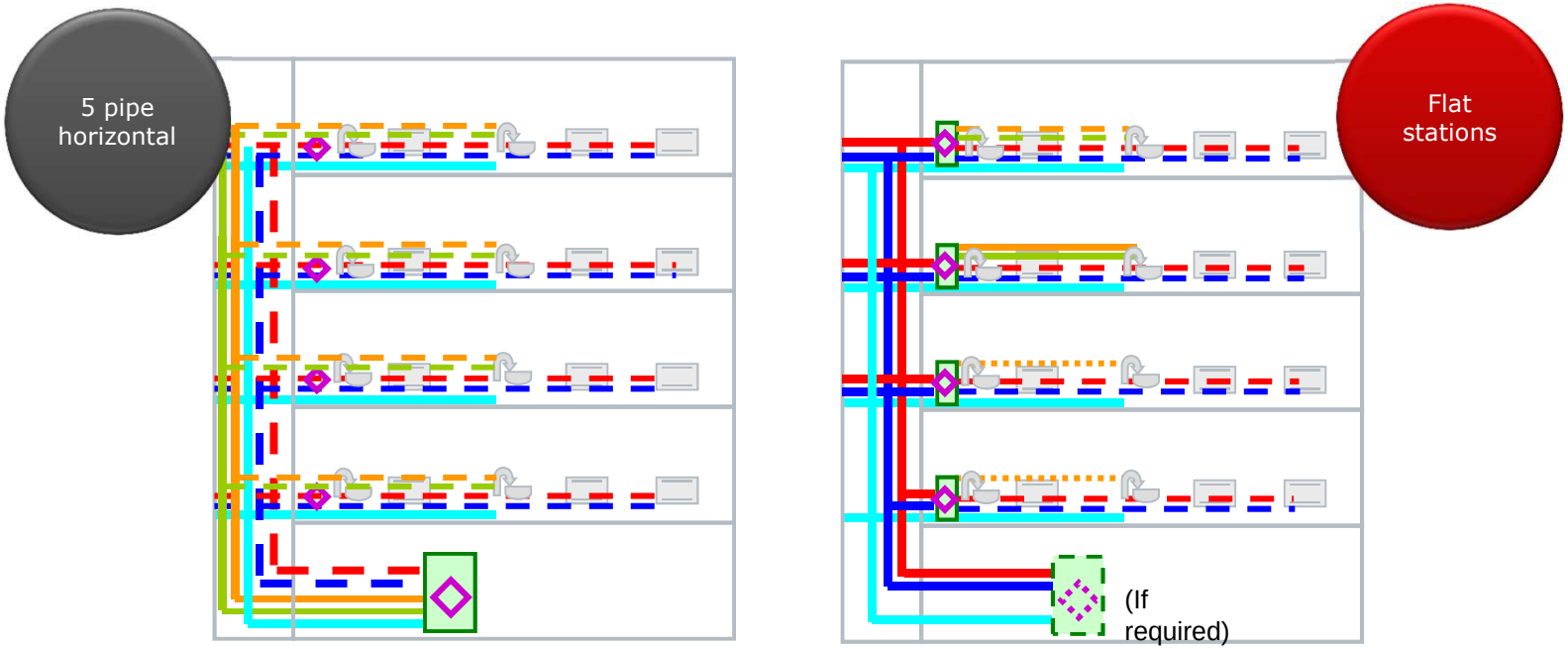
Sink, shower, etc

Hot all day and all year

Hot all day only during the winter

Hot few hours/day all year

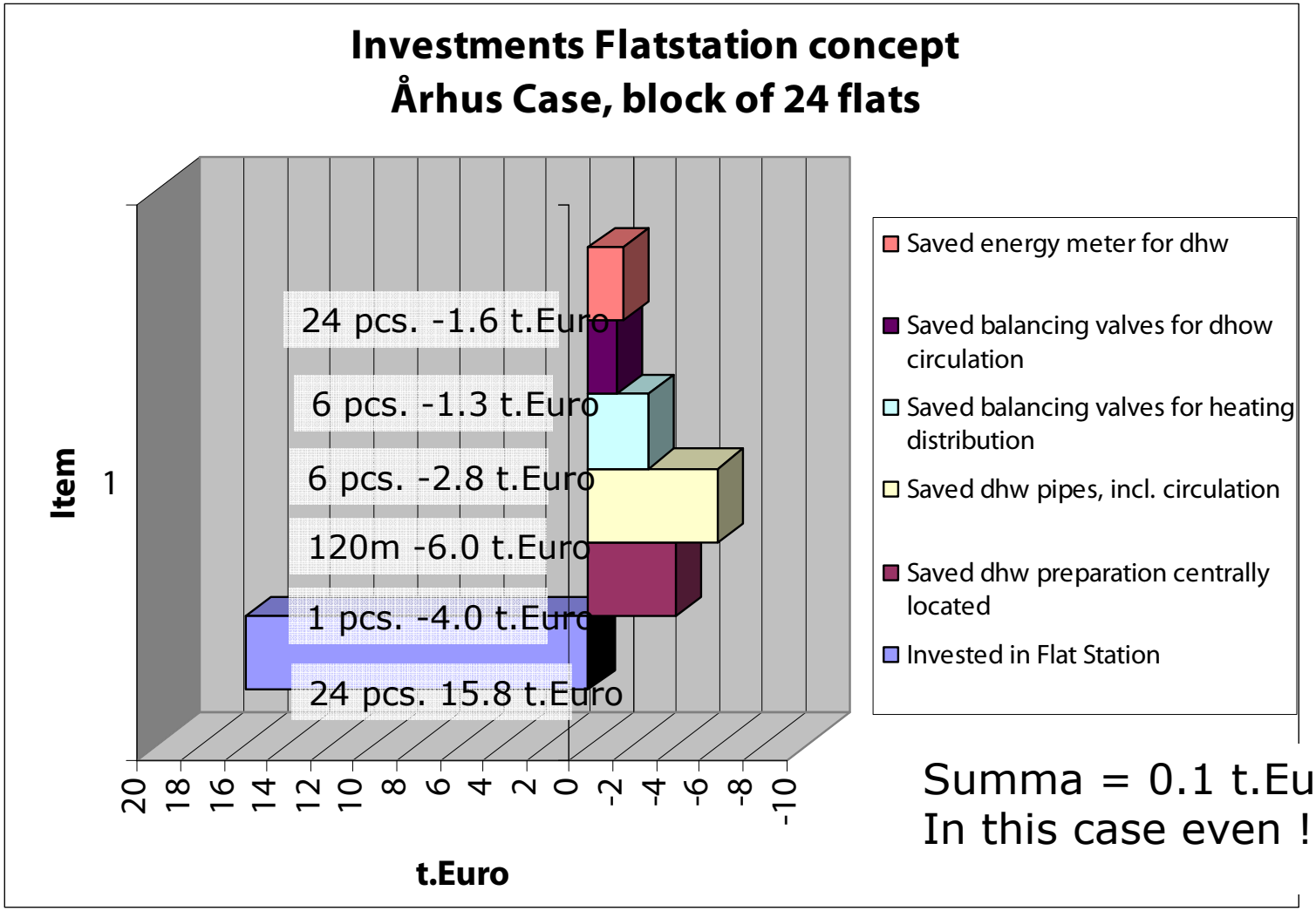
Possible solutions for DHW and space heating



5 pipes
DHW supply (from HEX or tank): 55°C
DHW circulation (back to HEX or tank) : 50°C
Heating in/out: 50/30

3 pipes
DH water in/out: 50/25
Bypass: 35°C

Economy



Summa = 0.1 t.Euro
In this case even !

Flat stations in READY

demonstrate

evaluate

optimise

theoretical

- HEX
- DHW control
- Bypass solution

measurements

ENGINEERING
TOMORROW

Marek Brand
marek.brand@danfoss.com
Application Specialist
Danfoss District Energy Application Center

kamstrup

READY WP meeting no. 3

Smart meters

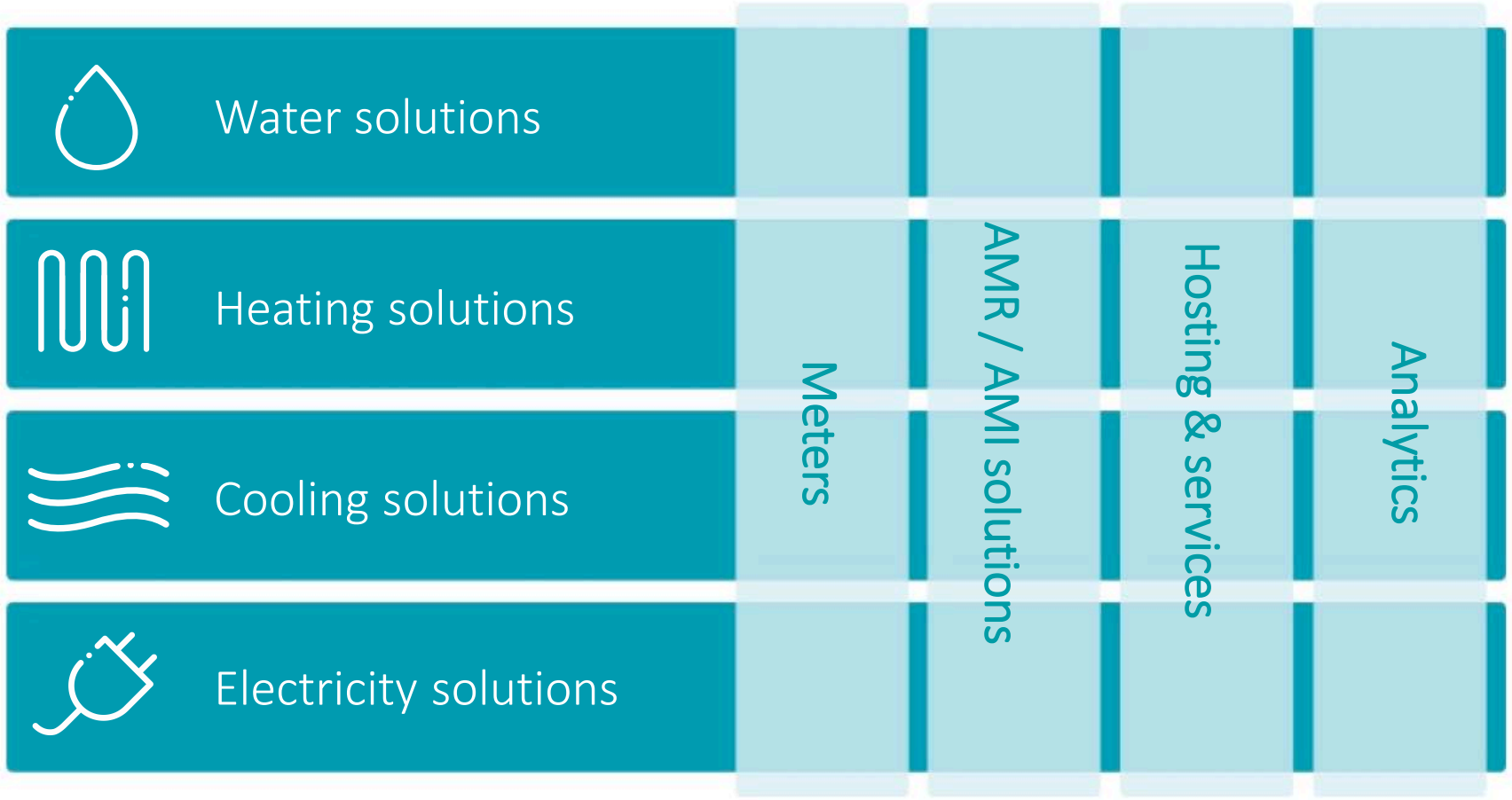
Head of Product Management
Steen Schelle Jensen
Kamstrup A/S

Who we are

The world's leading supplier of intelligent energy and water metering solutions

Our customer segments

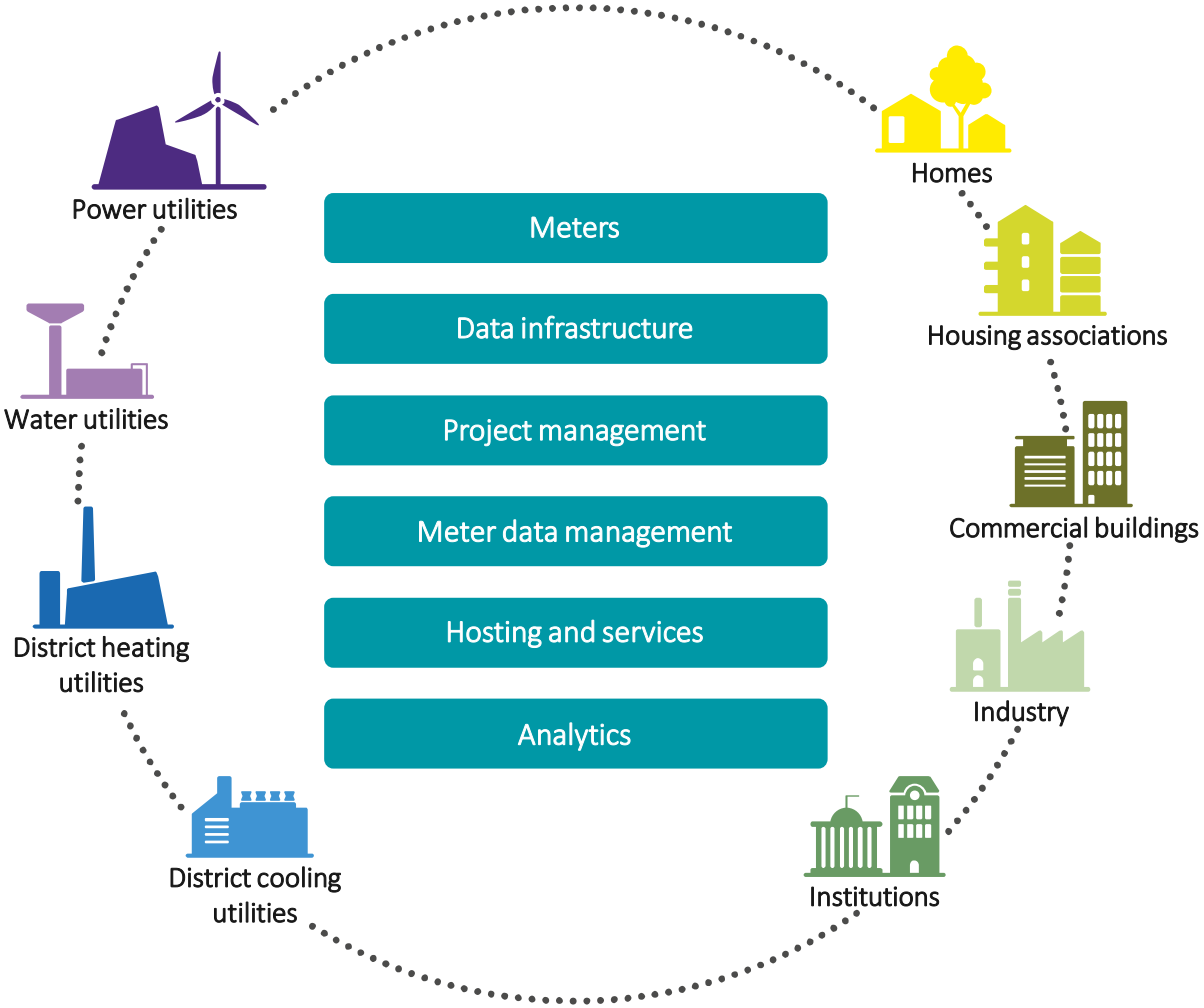
kamstrup



Our solutions

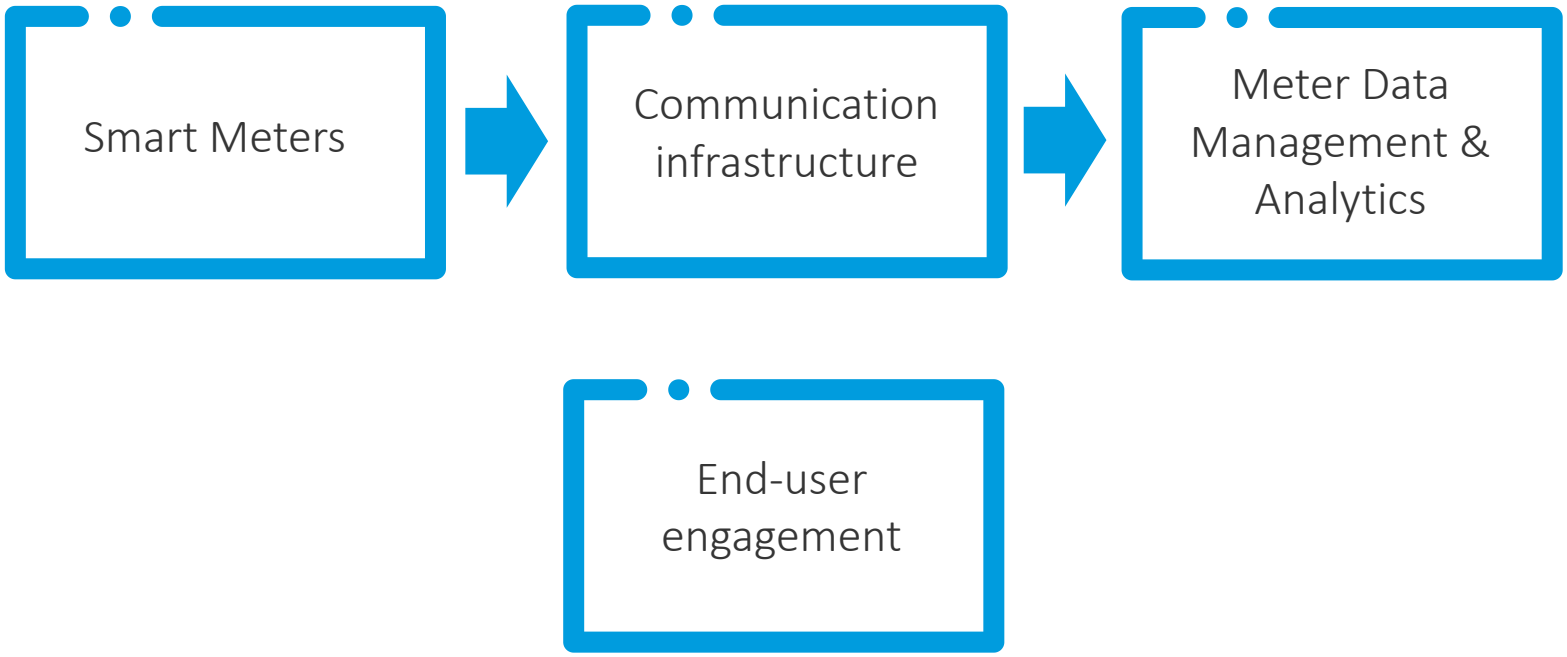
kamstrup

Providers

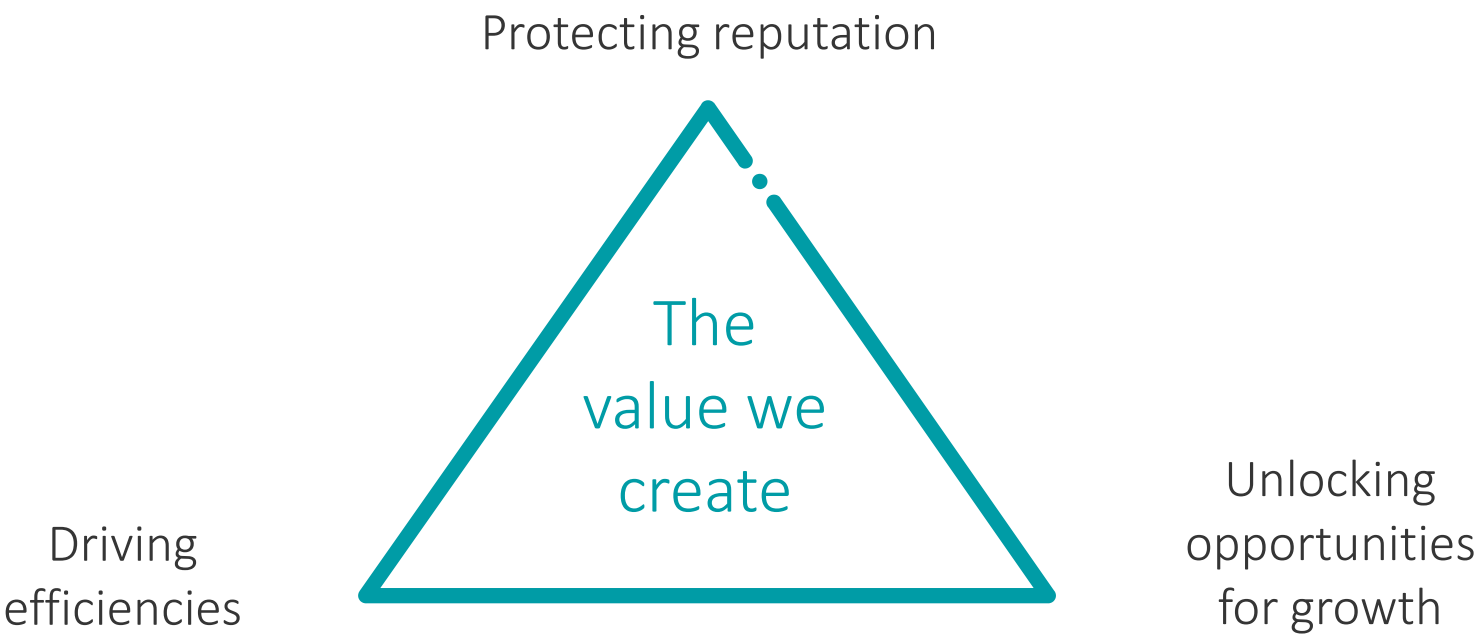


Consumers

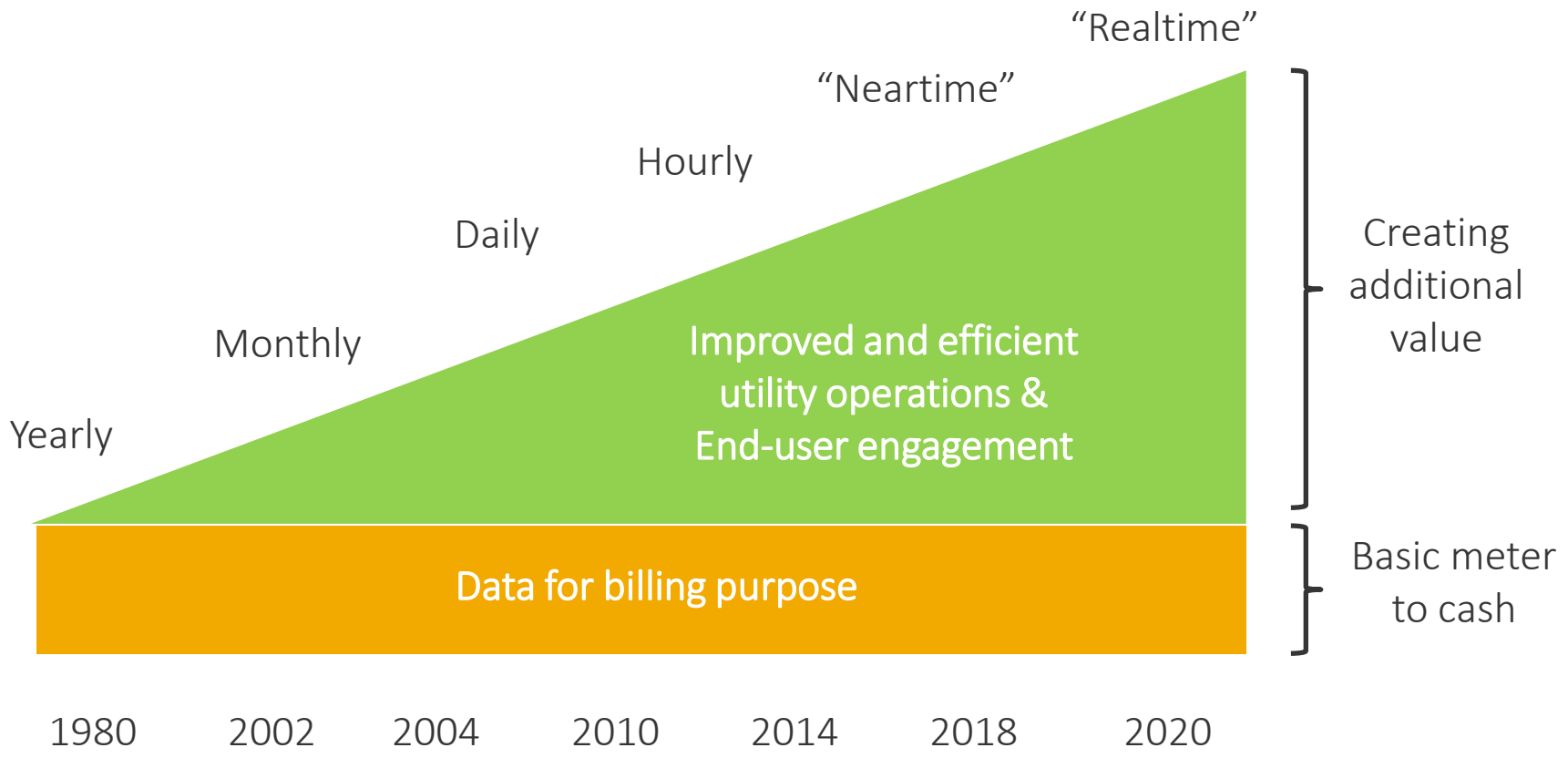
A typical Kamstrup smart metering delivery



At Kamstrup, we define our value by the progress we create for others

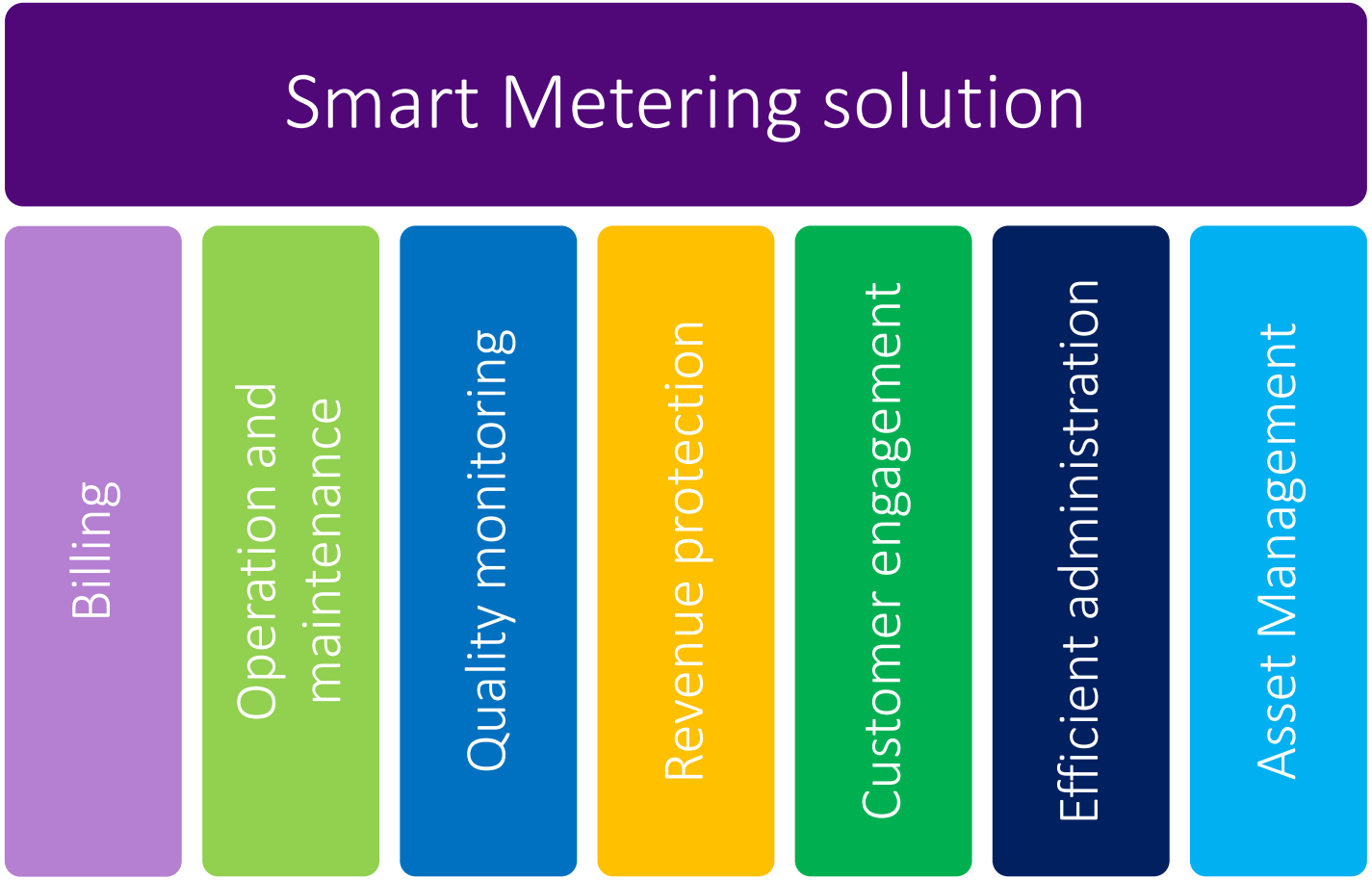


Smart metering data demands



Where to benefit from smart metering?

kamstrup



MULTICAL® 302

MULTICAL® 402

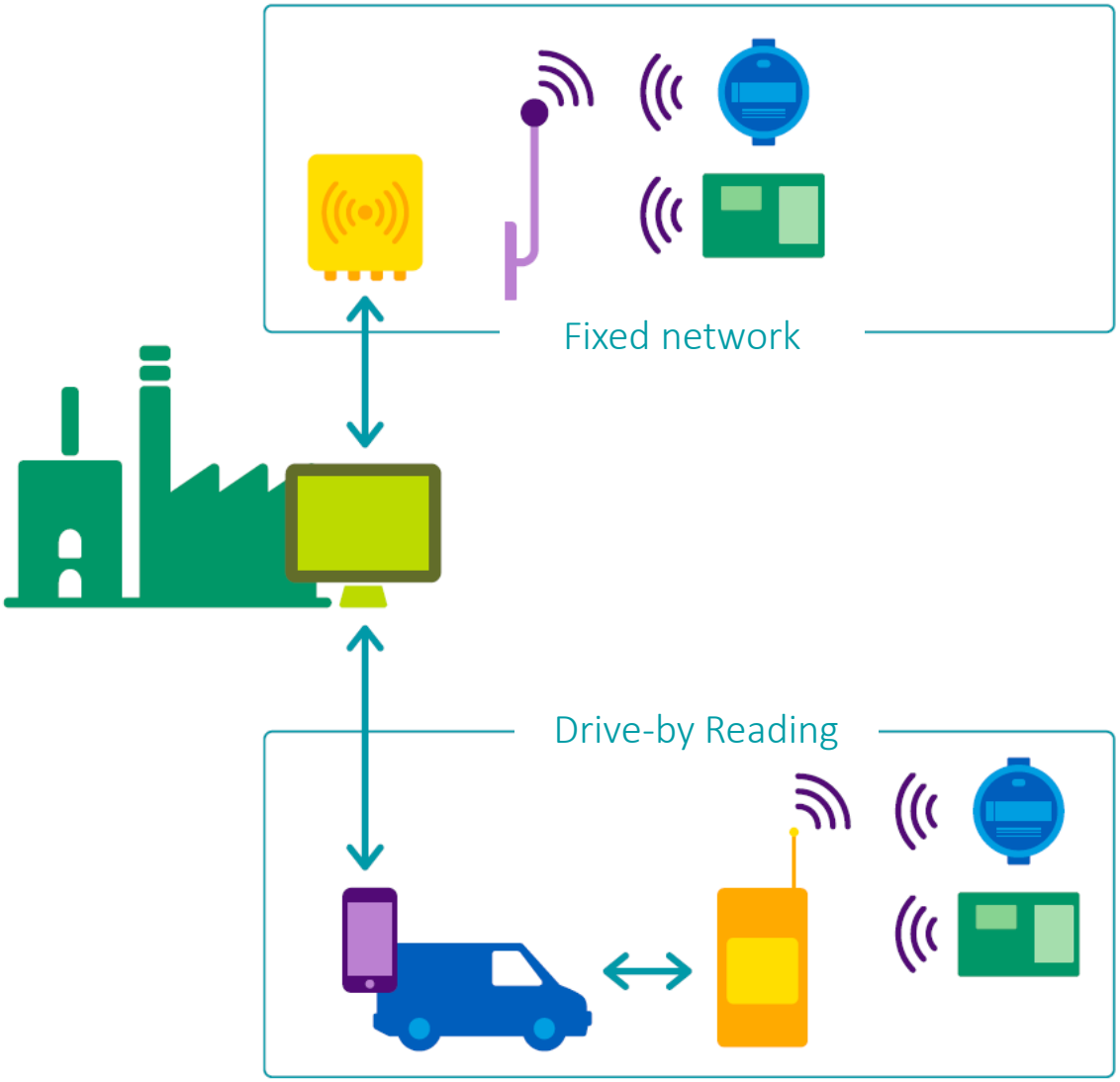
MULTICAL® 602

MULTICAL® 801

OMNIPOWER
Electricity Meter

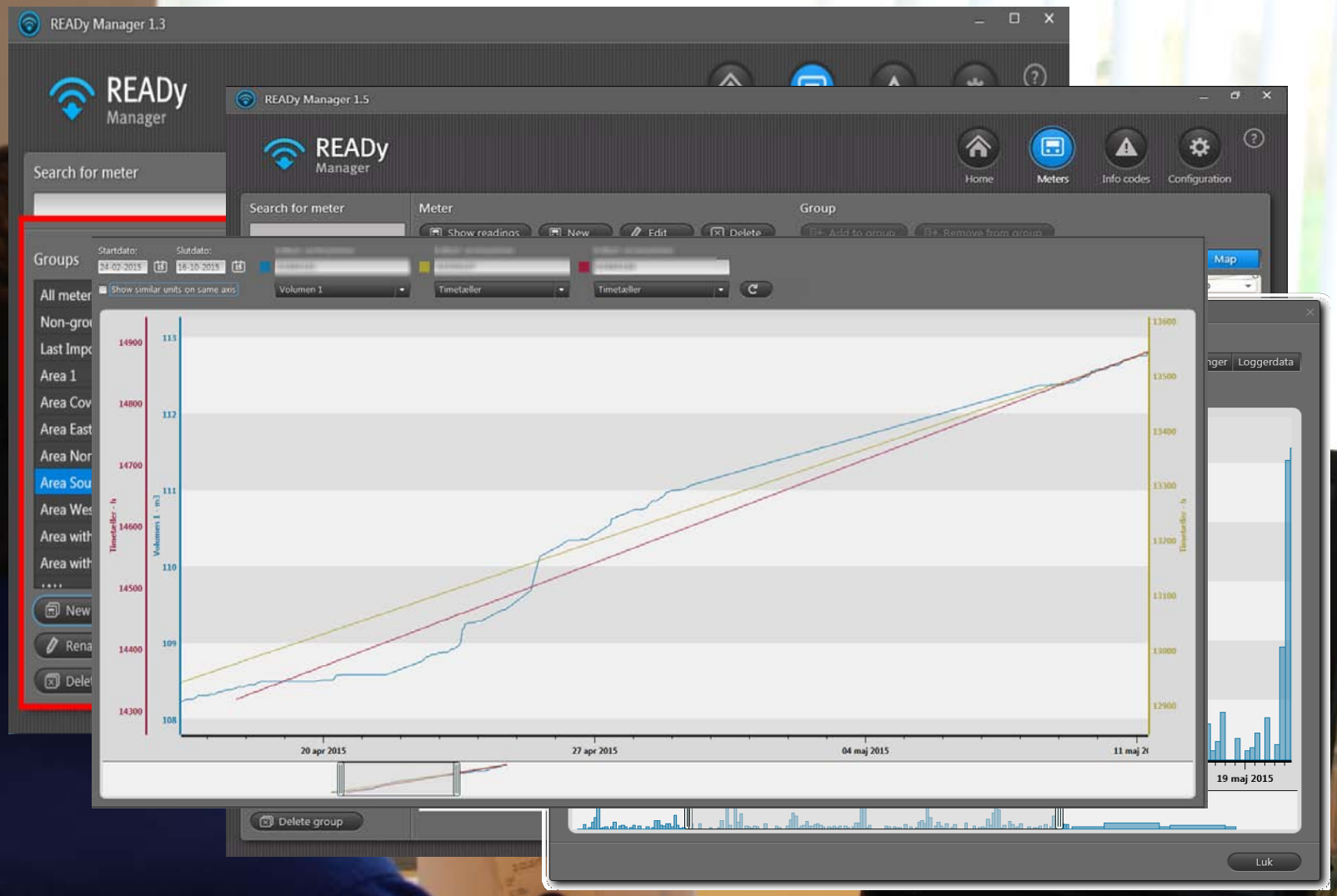
MULTICAL® 21
Water Meter

READy

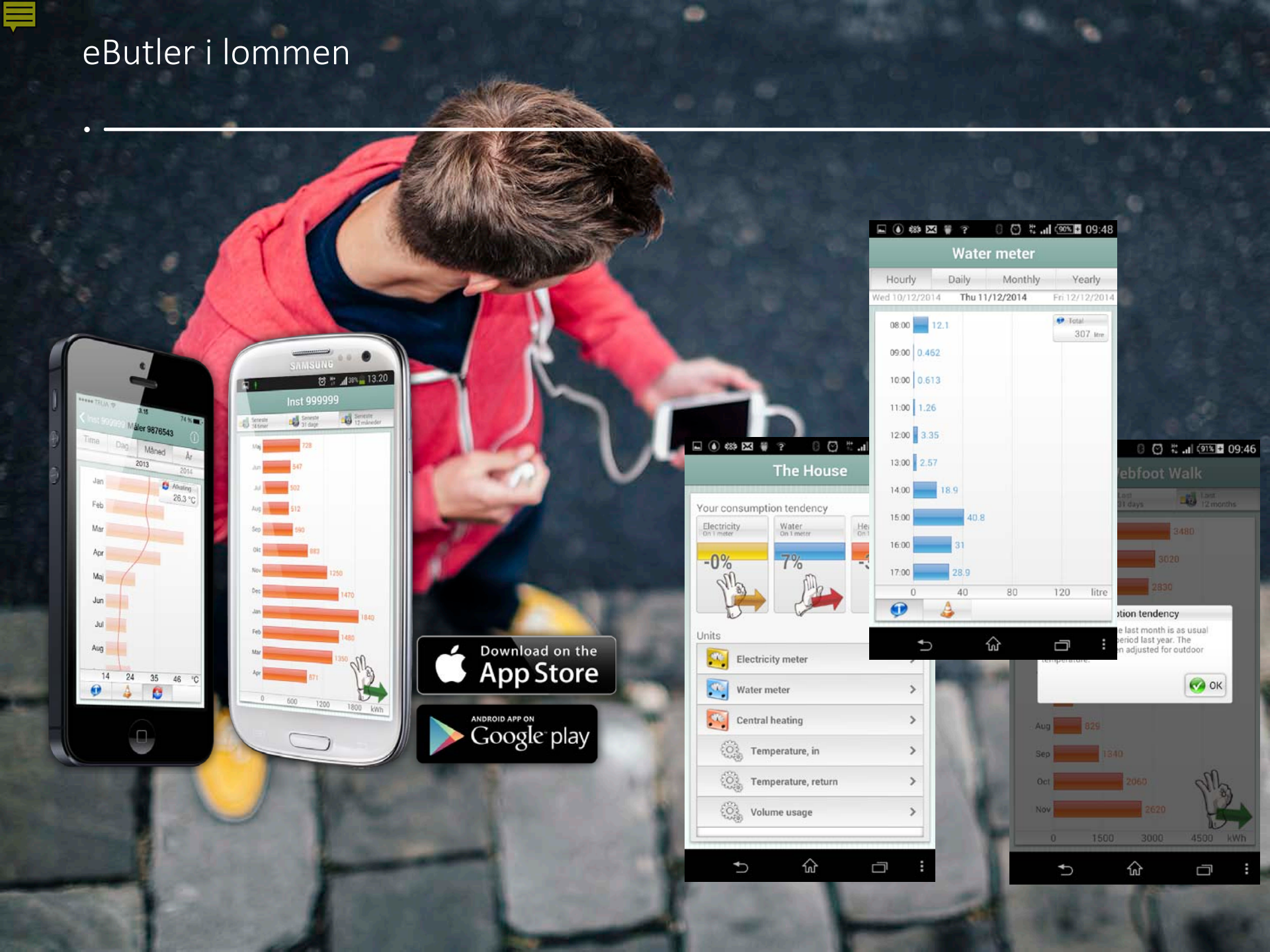


READy

kamstrup



eButler i lommen

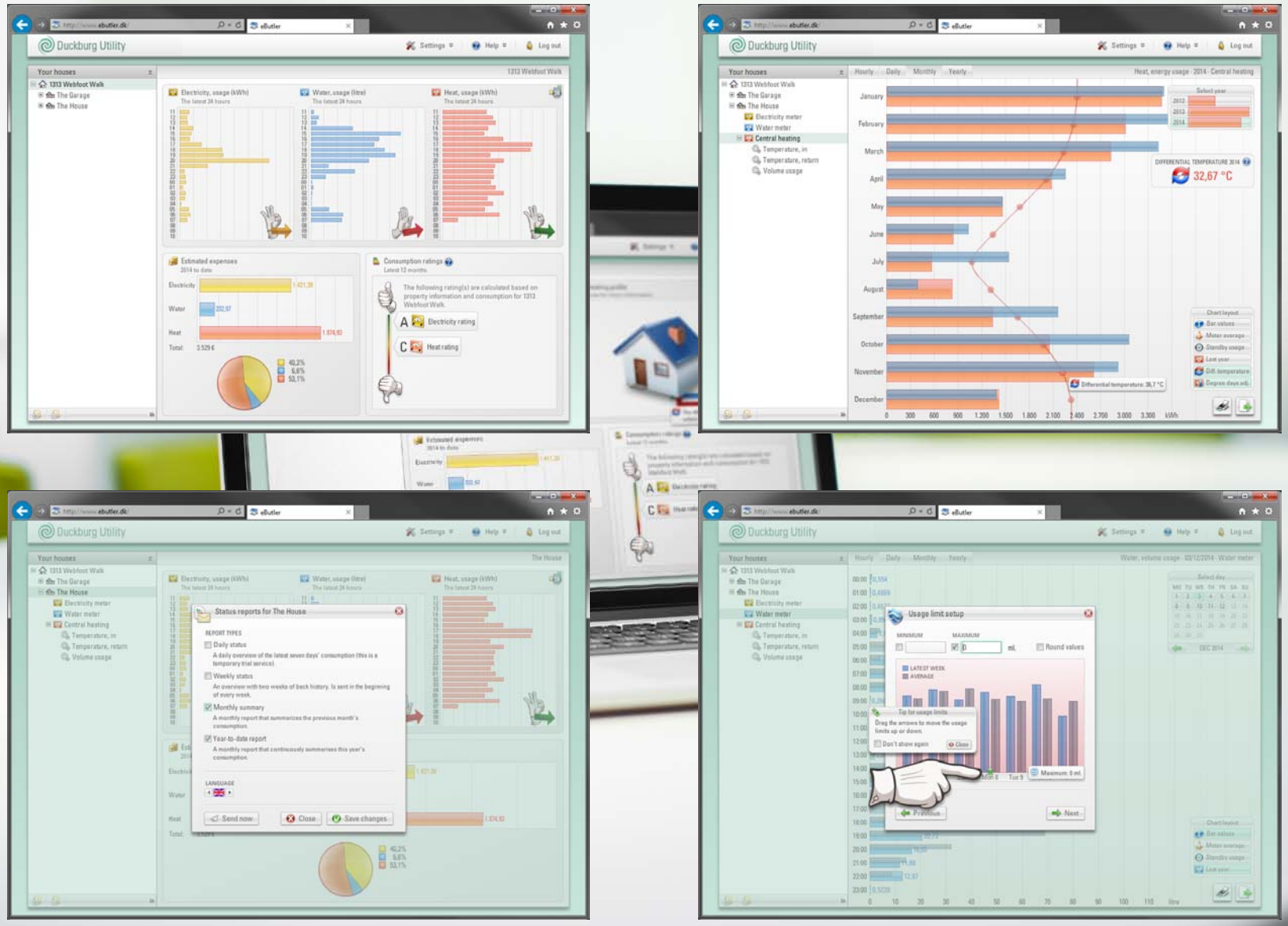


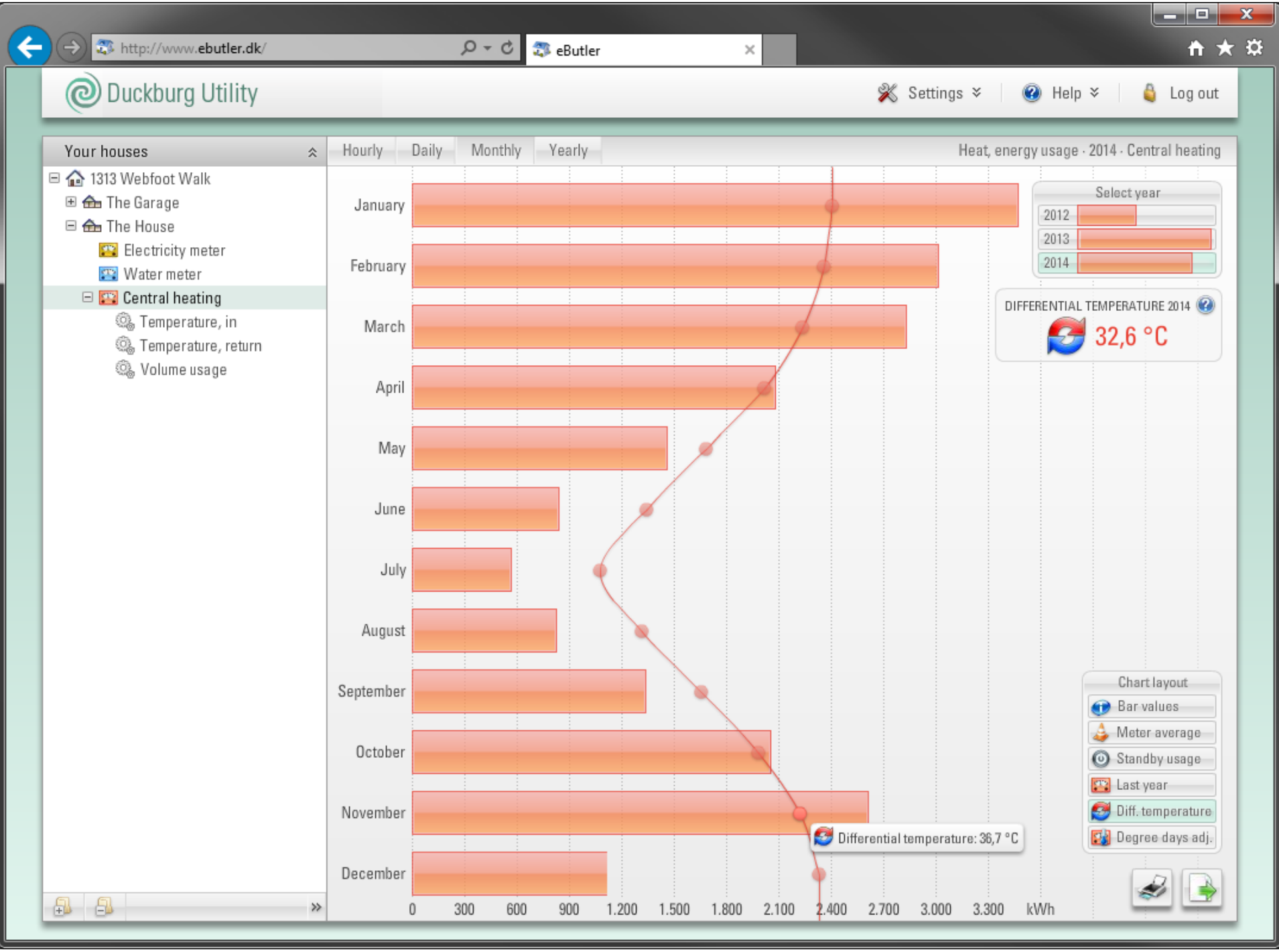
eButler

kamstrup

- Graphical overview of consumption
- Setup own SMS or Email notifications
- Analyze and identify errors
- Benchmark with other consumers

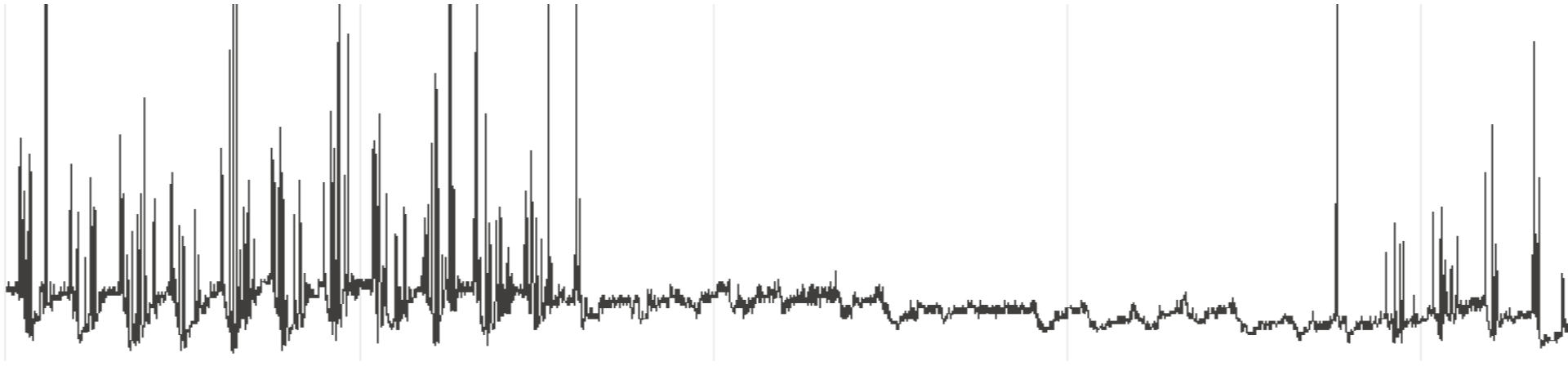
eButler


Duckburg Utility
Your houses
1313 Webfoot Walk
The Garage
The House
Electricity, usage (kWh)
Water, usage (litre)
Heat, usage (kWh)
Estimated expenses
Consumption ratings
Electricity rating
Heat rating
Duckburg Utility
Heat, energy usage - 2014 - Central heating
January
February
March
April
May
June
July
August
September
October
November
December
32,67 °C
Duckburg Utility
Status reports for The House
Daily status
Weekly status
Monthly summary
Year-to-date report
Send now
Close
Save changes
Duckburg Utility
Usage limit setup
Previous
Next


http://www.ebutler.dk/
eButler
Duckburg Utility
Settings
Help
Log out
Your houses
1313 Webfoot Walk
The Garage
The House
Electricity meter
Water meter
Central heating
Temperature, in
Temperature, return
Volume usage
Hourly
Daily
Monthly
Yearly
Heat, energy usage · 2014 · Central heating
January
February
March
April
May
June
July
August
September
October
November
December
Select year
2012
2013
2014
DIFFERENTIAL TEMPERATURE 2014
32,6 °C
Chart layout
Bar values
Meter average
Standby usage
Last year
Diff. temperature
Degree days adj.
Differential temperature: 36,7 °C
0
300
600
900
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
kWh

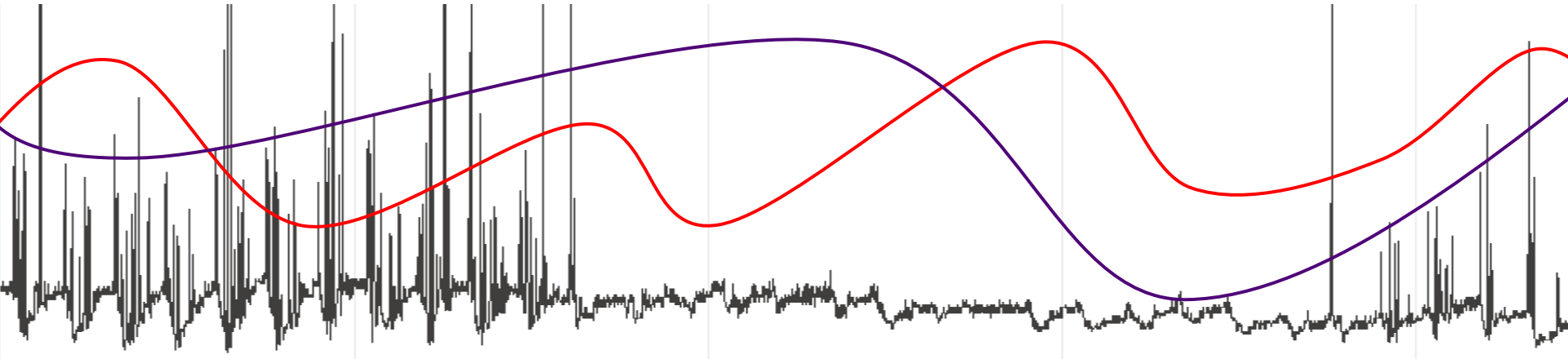
kamstrup

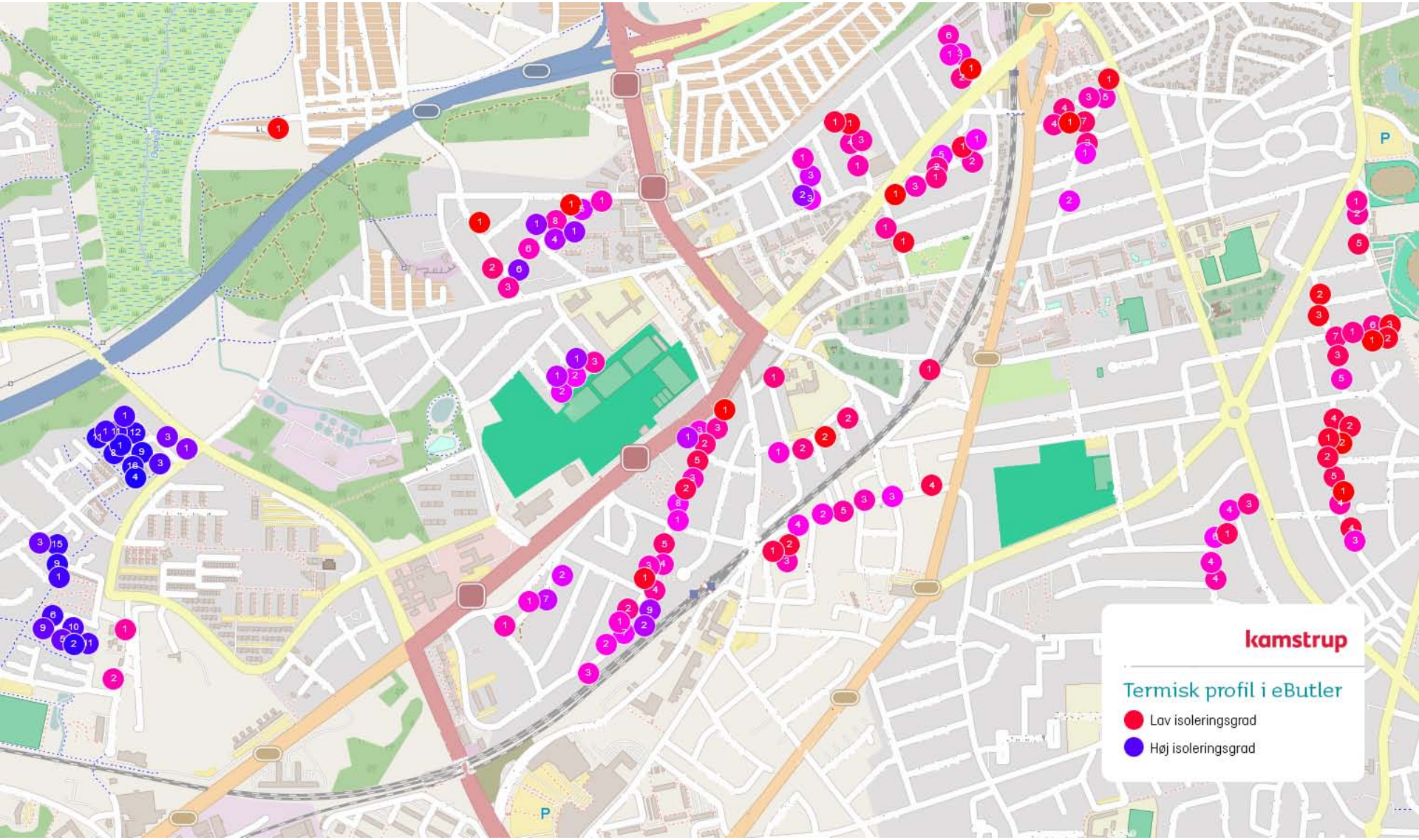
Hourly values from Kamstrup heat meters …



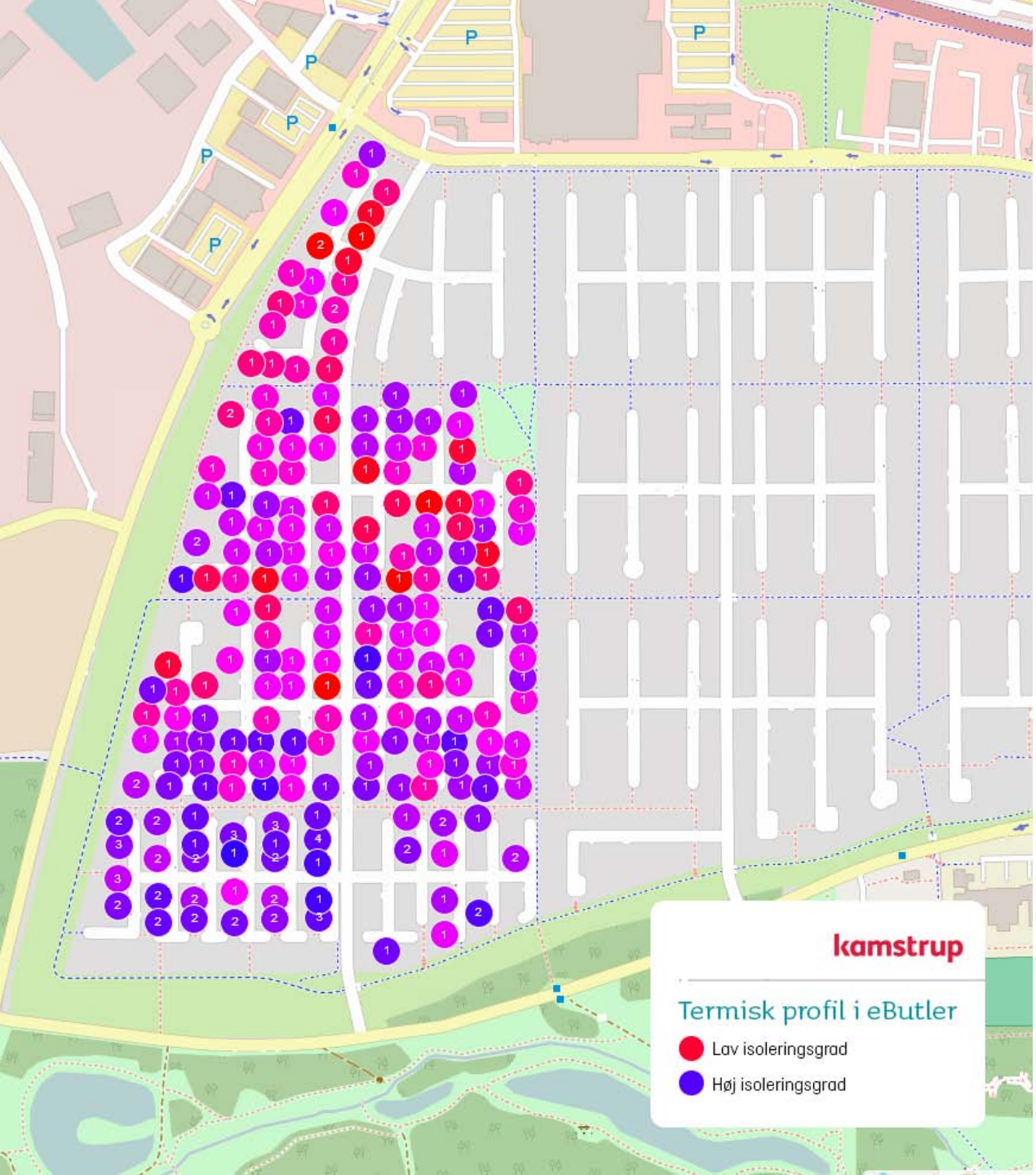
kamstrup

… and weather data from Danish Metrological Institute…




kamstrup
Termisk profil i eButler
Lav isoleringsgrad
Høj isoleringsgrad

kamstrup


kamstrup
Termisk profil i eButler
Lav isoleringsgrad
Høj isoleringsgrad

kamstrup

Think forward

Steen Schelle Jensen
Head of Product Management, Smart Metering
ssj@kamstrup.com

LGI CONSULTING

INNOVATION STRATEGY ▪ MANAGEMENT & COMMUNICATION ▪ DIGITAL SOLUTIONS

Open Innovation in the **Ready Project**

LGI Consulting

Version Beta is ready!

- Register
- How it works

Register

- Currently → Available for READY partners.
- READY partners from contact List
  - (Excel – Contact information)

- If you have any problem with login, please contact us:
  - READY Hub <ready.admin@lgi-consulting.com>

READY HUB CONCEPT

Cities are at the top of the sustainable agenda today. Their role in defining new sustainable transition pathways is essential, as they will be facing strong pressures particularly concerning energy, water and transport.

Being aware of that, several European municipalities have launched a diverse set of smart cities projects to test new sustainable technologies at building and district level with a systemic approach.

Use of natural resources

Although cities occupy just 2% of the Earth's surface, their inhabitants use 75% of the planet's natural resources.

City population

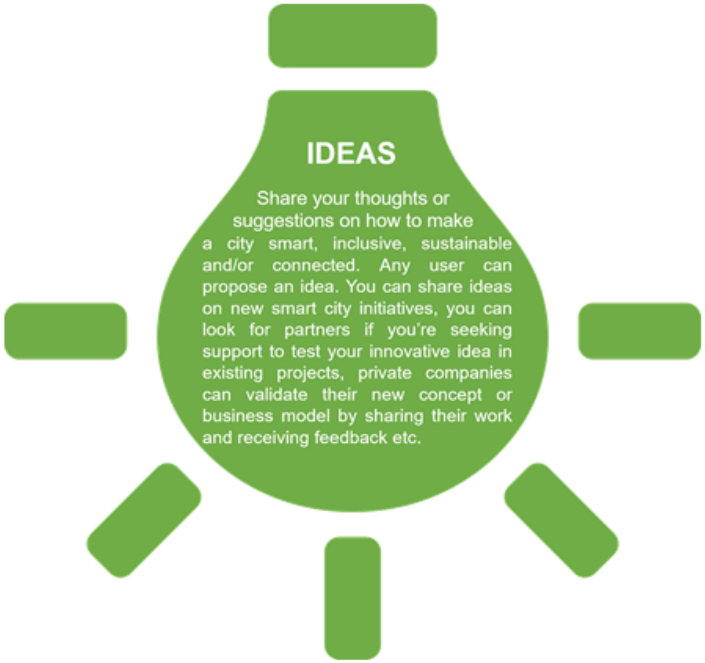
More than 50% of the worldwide population lives in cities - this percentage is up to 75% in Europe.

City emissions

Cities generate 80% of global GDP, but are also responsible for 80% of worldwide CO2 emissions.

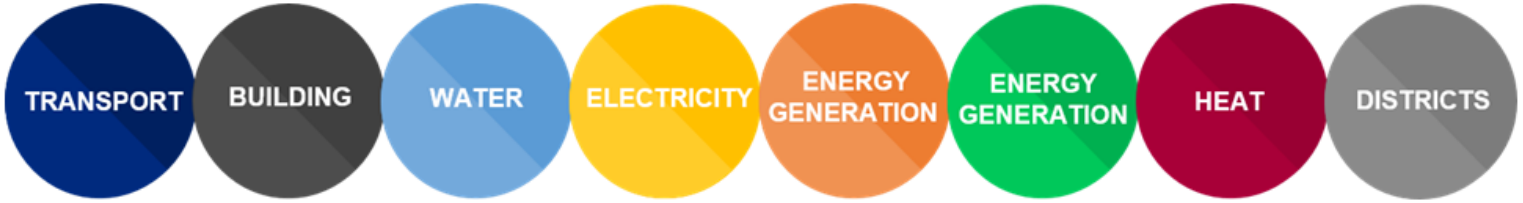
HOW IT WORKS

The READY Hub is driven by **Open Innovation and social media**: anyone can like and comment other users' posts. It is accessible to all, however, to interact with other users, post comments and share your ideas, you will need to sign up.



The platform is made up of **ideas and discussions.**

Once you sign in, the dashboard displays **all open discussions and ideas**, arranged **by topic**, and divided into **8 main categories**:



WHAT'S IN IT FOR YOU?

STAY UP-TO-DATE

Visit the READY Hub to access *knowledge exchange*.

The READY Hub is an online platform where municipalities, private companies, research organisations and citizens share innovative ideas to make a city smarter, more resilient and more sustainable. You don't even have to sign up. Just check out how things are progressing and identify the main smart city trends on the Hub.

- Ideas and discussions have different colours to easily identify them. It is also possible to filter them on the left.
- If you're only interested in one specific topic you can also filter by topic, on the left.
- Finally, you can sort ideas and discussions by date to access the most recent news.
- Are you interested in a specific thematic on smart cities? Just type the keywords in the Search function on the top left side of the screen, and ideas and discussions will be filtered accordingly.

SEEK FEEDBACK

Take part in open discussions to provide insight and comments, interact with municipalities, private companies, research organisations and/or citizens; i.e. innovative business models engaging different organisations can be presented to validate the real needs of the users involved.

The process is easy, first step: sign up to join the READY Hub.

- Post your great idea on the platform by clicking on the "Create new idea" button on the top left. Innovative products and services can be published as ideas to receive *feedback* from experts with different backgrounds and expertise.
  - Write the name of the idea and a short description to be displayed on the homepage.
  - Choose the main topic of your idea. Topics help to find ideas easily and quickly.
  - Set the status of your idea:
    - ❑ Draft: if you want to save it as draft and wait for its final publication.
    - ❑ Public: if you want to publish your idea directly.
    - ❑ Private: If you want to restrict its access by making it visible only to READY partners.
  - Write the long description of your idea. Describe it with enough detail to make it understandable for other users. What is your idea about? What are its main advantages? Will it be a commercial product? Who will be the clients? What will your business model be?
  - You can attach documents to clarify certain aspects.
  - Choose the Header: an image related to the topic you have chosen will be suggested. You can also select another image that is available for the topic or you can attach one of your own if you prefer.
  - Once posted, you will be able to follow views, ratings and comments on your idea.

SPREAD THE WORD

If you're looking to join the smart cities debate by sharing your main accomplishments in your city or organisation, then the READY HUB can help you. You will have access to a targeted audience, eager to learn more about your advancements in smart city solutions and projects.

The process is easy, first step: sign up to join the READY Hub.

- Post your discussion on the platform by clicking on the "Start a new discussion" button on the top left.
  - Write the name of the discussion and a short description to be displayed on the homepage.
  - Choose the main topic of your idea. Topics help to find ideas easily and quickly.
  - Set the status of your idea:
    - ❑ Draft: if you want to save it as draft and wait for its final publication.
    - ❑ Public: if you want to publish your idea directly.
    - ❑ Private: If you want to restrict its access by making it visible only to READY partners.
  - Write the long description of your idea. Describe it with enough detail in order to make it understandable for other users. What is your discussion about? Does it integrate a larger project? What is the main progress compared to the state of the art? Is it a new product? Who will be the target users?
  - You can attach documents to clarify certain aspects.
  - Choose the Header: an image related to the topic you have chosen will be suggested. You can also select another image that is available for the topic or you can attach one of your own if you prefer.
  - Once posted, you will be able to follow views, ratings and comments on your idea.

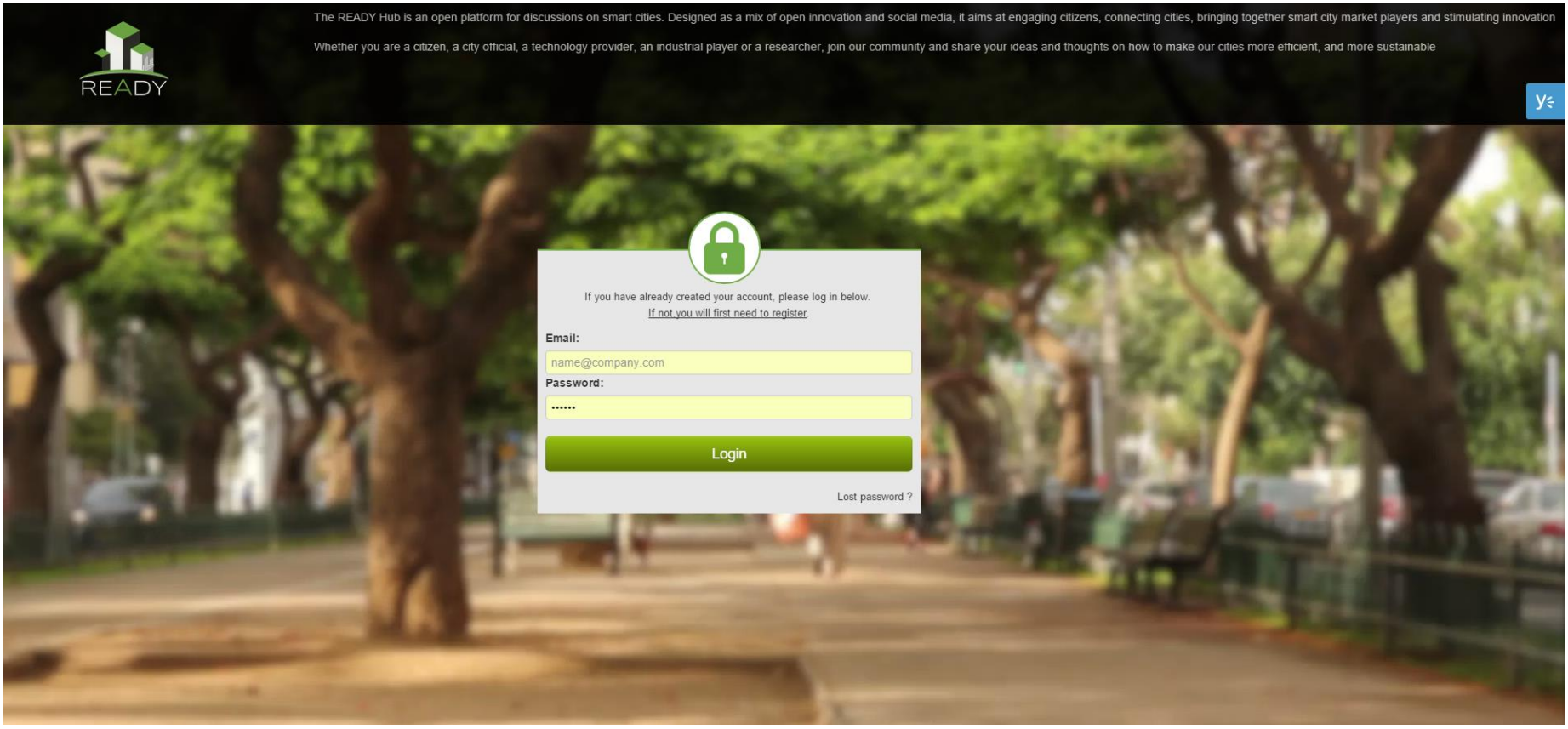
WHO ARE WE?
ABOUT THE READY PROJECT

Based on thorough integrated climate planning, the READY project demonstrates a Whole City Approach that includes innovative technologies at building and district level. These measures demonstrate how the energy demand, the need for fossil fuels and CO2 release can be considerably reduced to nearly zero, and show a sustainable way forward to other European cities. The demonstration takes place in 2 cities: Aarhus (DK – 300 000 inhabitants) and Växjö (SE – 83 000 inhabitants). Both cities have a long standing technical experience and have been frontrunners for years in setting and carrying out ambitious climate and smart city policies. Kaunas (LT – 300 000 inhabitants) takes part as an observer city to bring in Eastern European experience.

The project team consists of internationally well-known industrial companies, energy supply companies, SMEs, housing companies, universities, consultants and other organisations. All partners are devoted to improving RES integration in energy supply systems and housing standards towards nZEB.

Visit our website to learn more: http://www.smartcity-ready.eu/

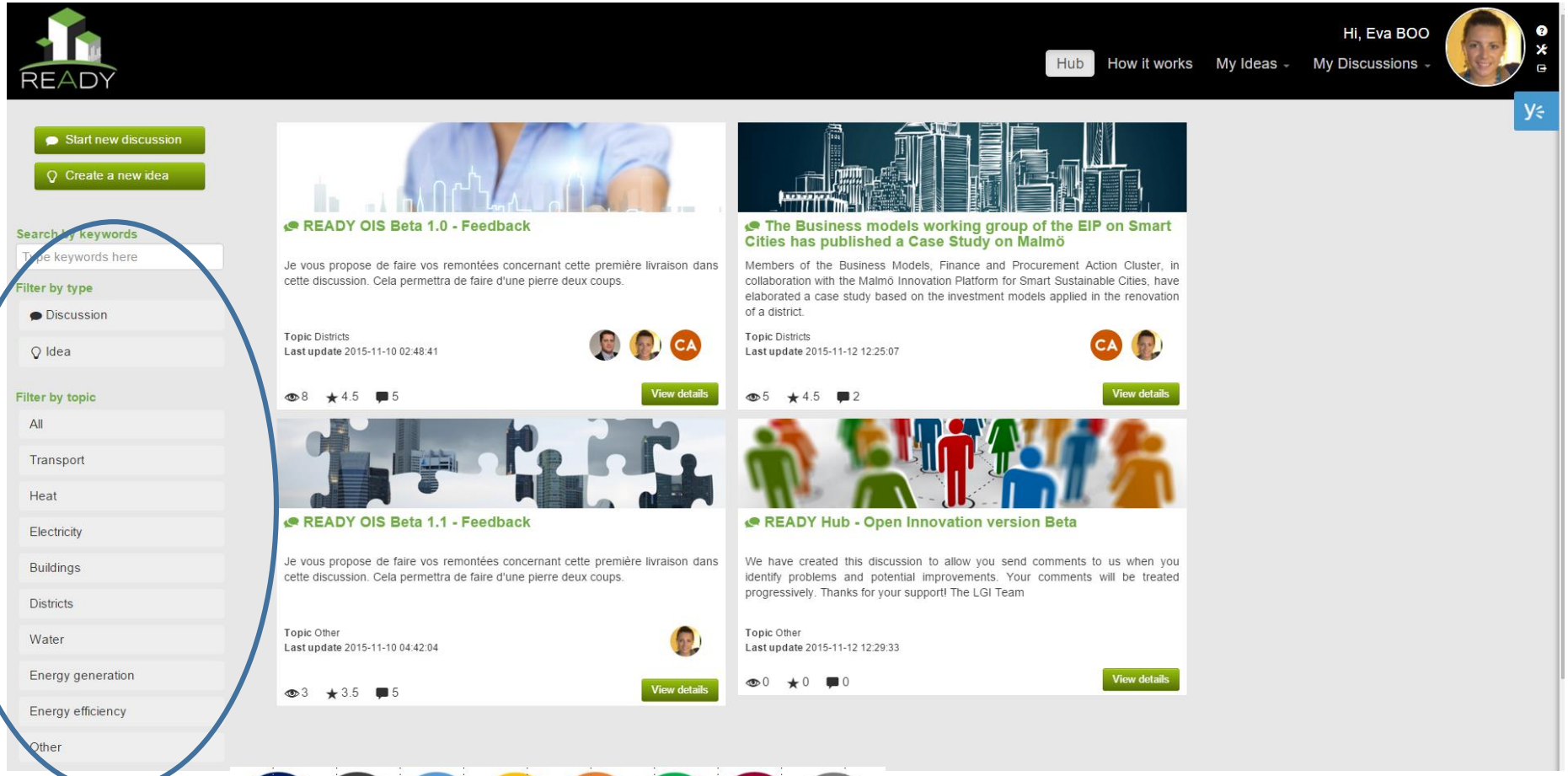
Login


READY
The READY Hub is an open platform for discussions on smart cities. Designed as a mix of open innovation and social media, it aims at engaging citizens, connecting cities, bringing together smart city market players and stimulating innovation
Whether you are a citizen, a city official, a technology provider, an industrial player or a researcher, join our community and share your ideas and thoughts on how to make our cities more efficient, and more sustainable
If you have already created your account, please log in below.
If not you will first need to register.
Email:
name@company.com
Password:
Login
Lost password ?

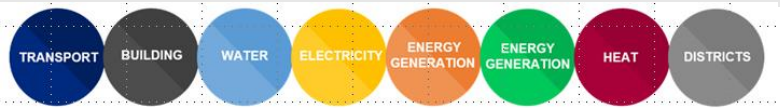
Home page

Existing discussions and ideas

Home page



Filtering



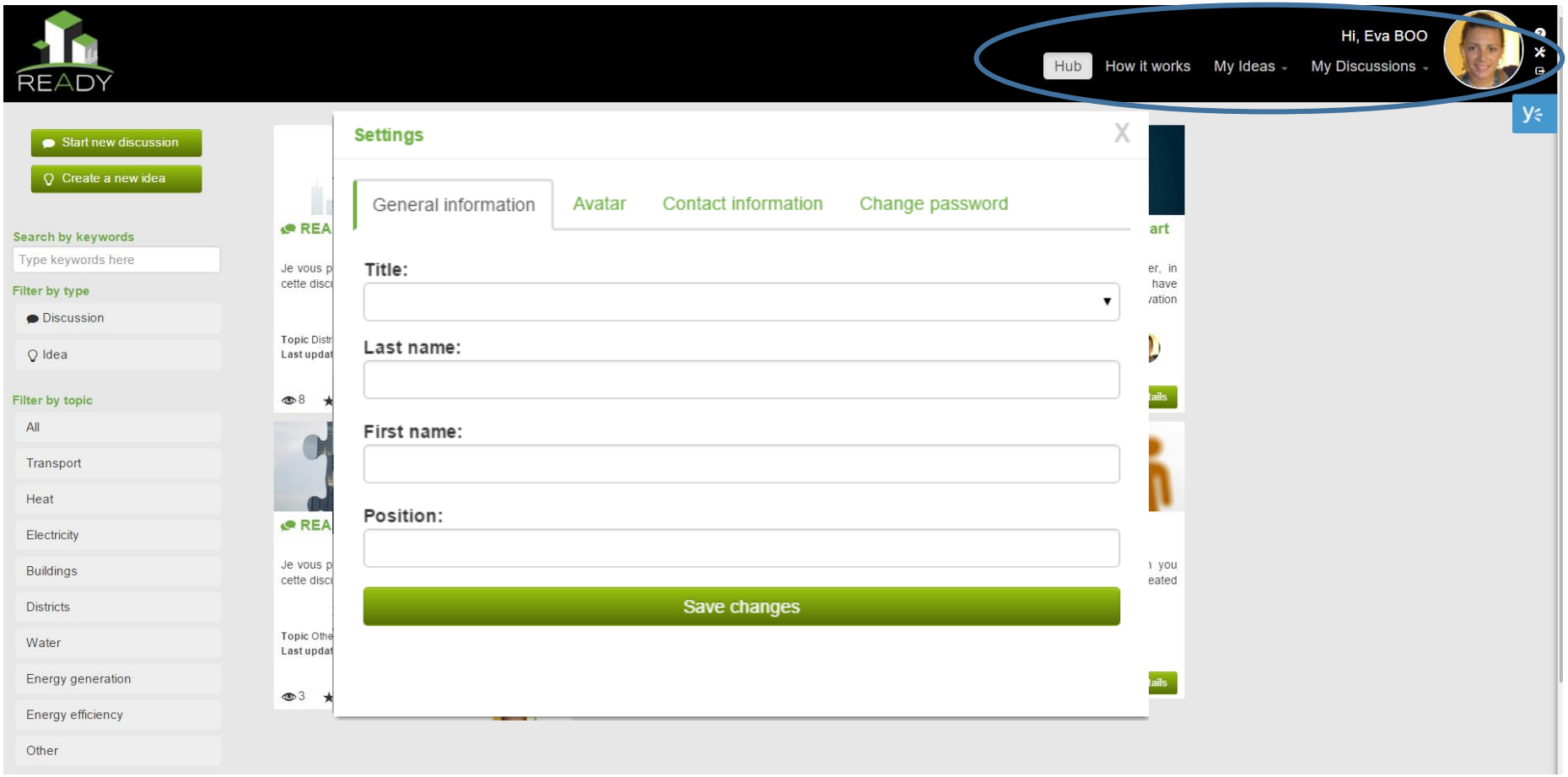
Item on homepage

Social media information

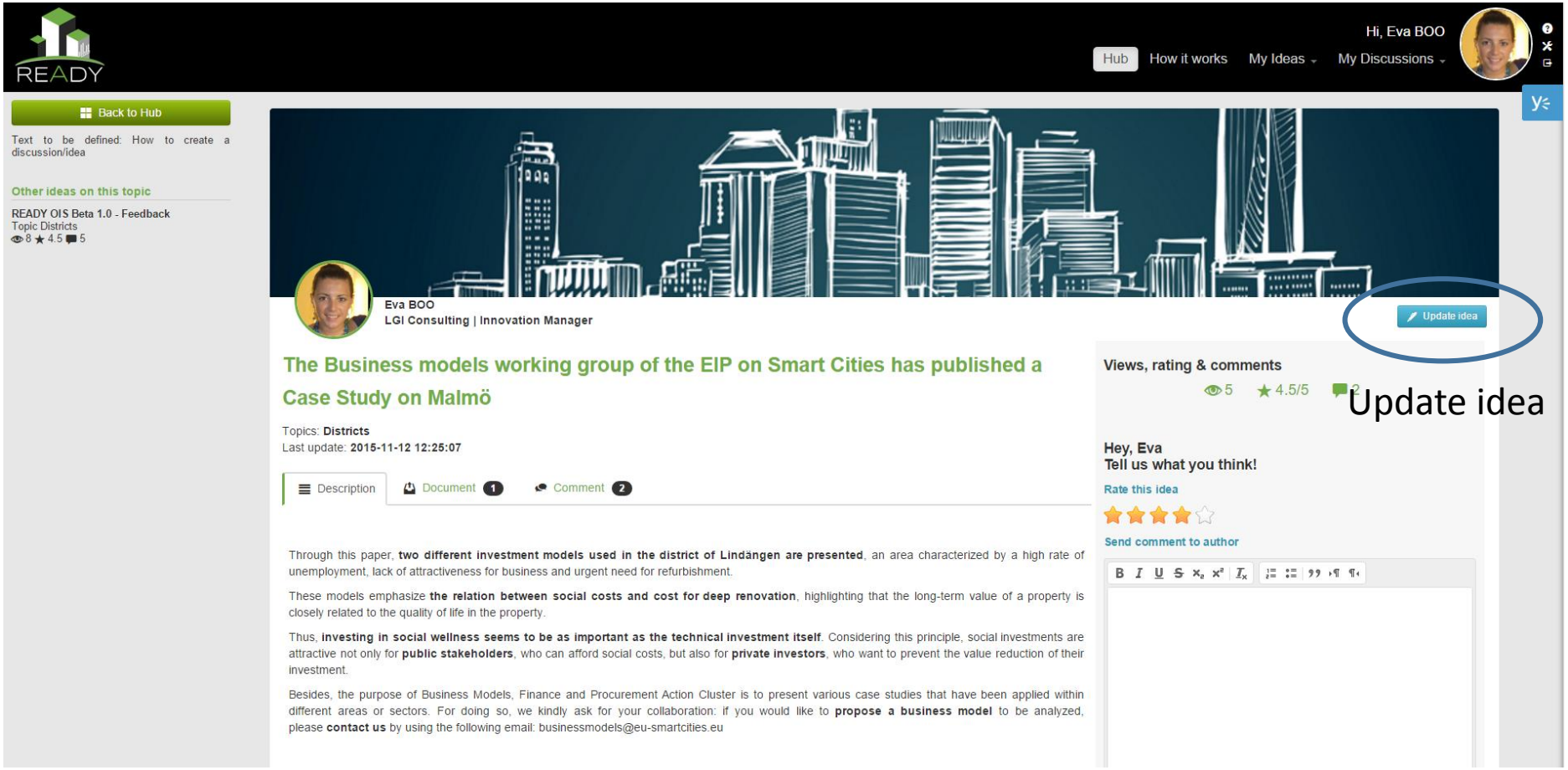
Title
Short Description
Topic
Last update
Social media

Settings

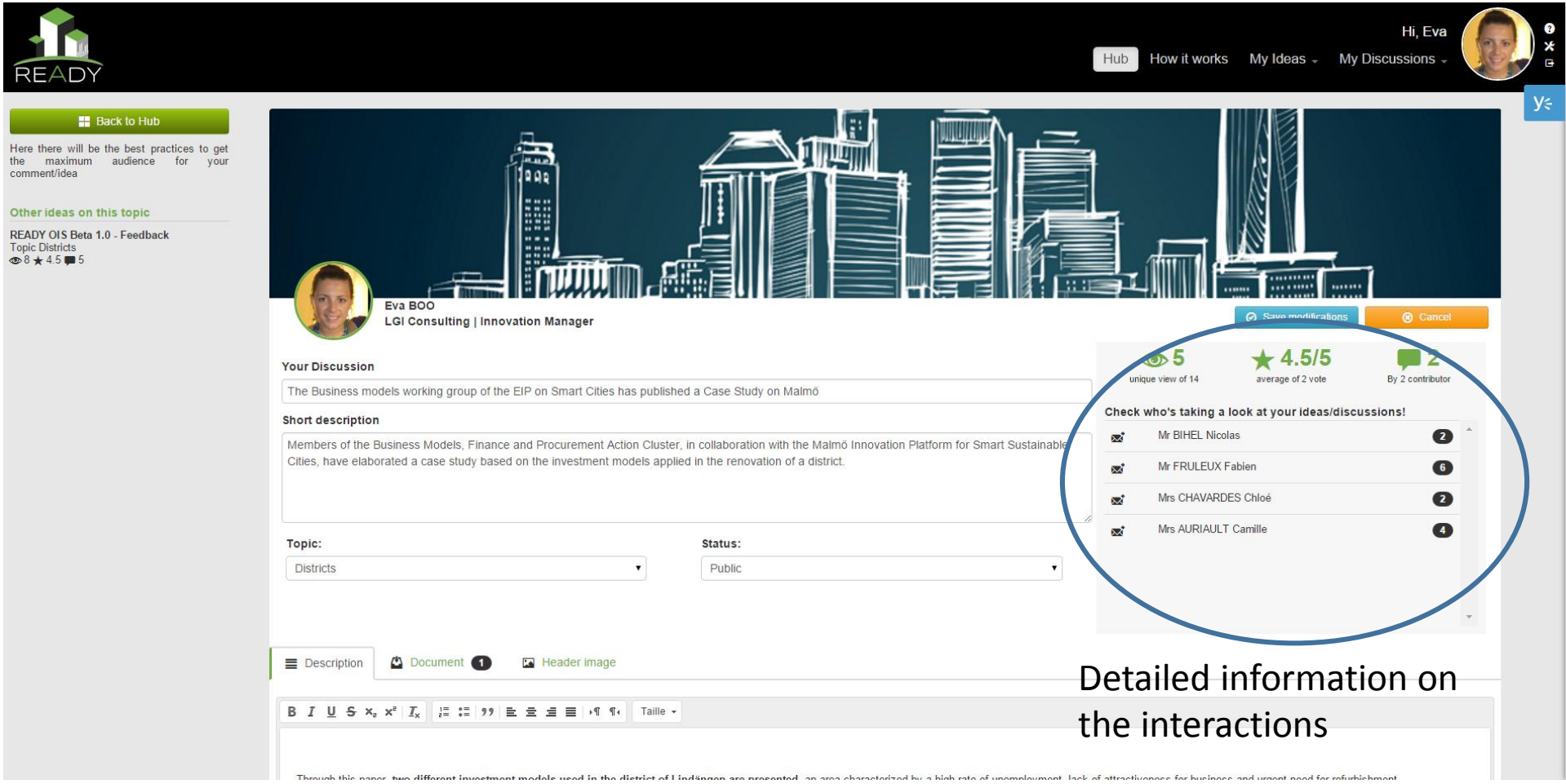
Settings & Options



One idea/discussion



Your idea/discussion



Detailed information on the interactions

Pending questions

- How will the helpdesk be integrated?
- Is a an notification email (new ideas/discussions on a topic, new comments, etc.) sent on a weekly basis enough for you?

Thanks

Camille Auriault

LGI Consulting

camille.auriault@lgi-consulting.com

Eva Boo

LGI Consulting

eva.boo@lgi-consulting.com