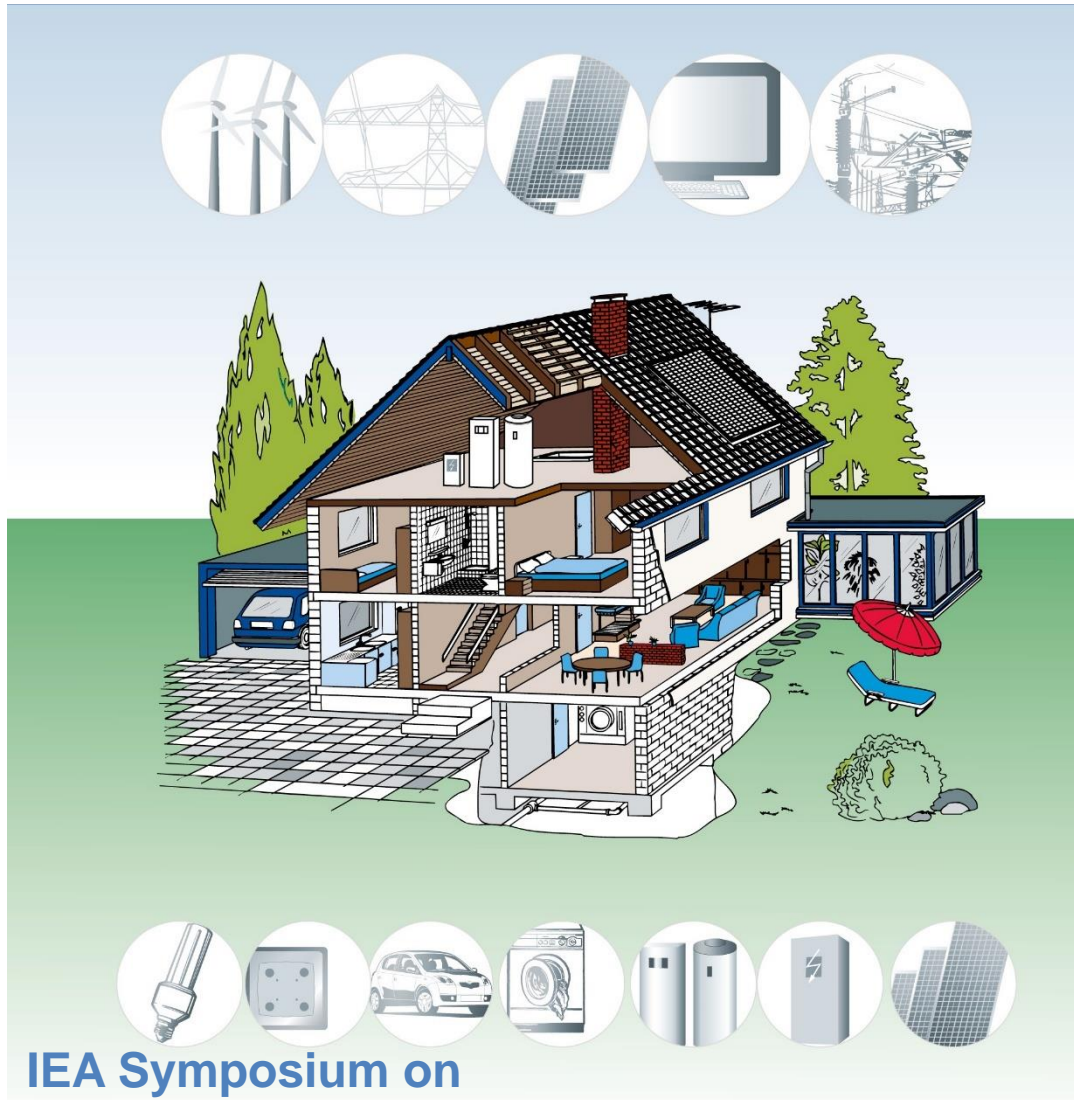


annex⁴²: Heat pumps and smart grids



IEA Symposium on
Demand Flexibility and RES Integration

Content

1. Structure and approach
2. Findings so far
3. The road ahead
4. Challenges
5. Questions

So much to tell and only 15 min...

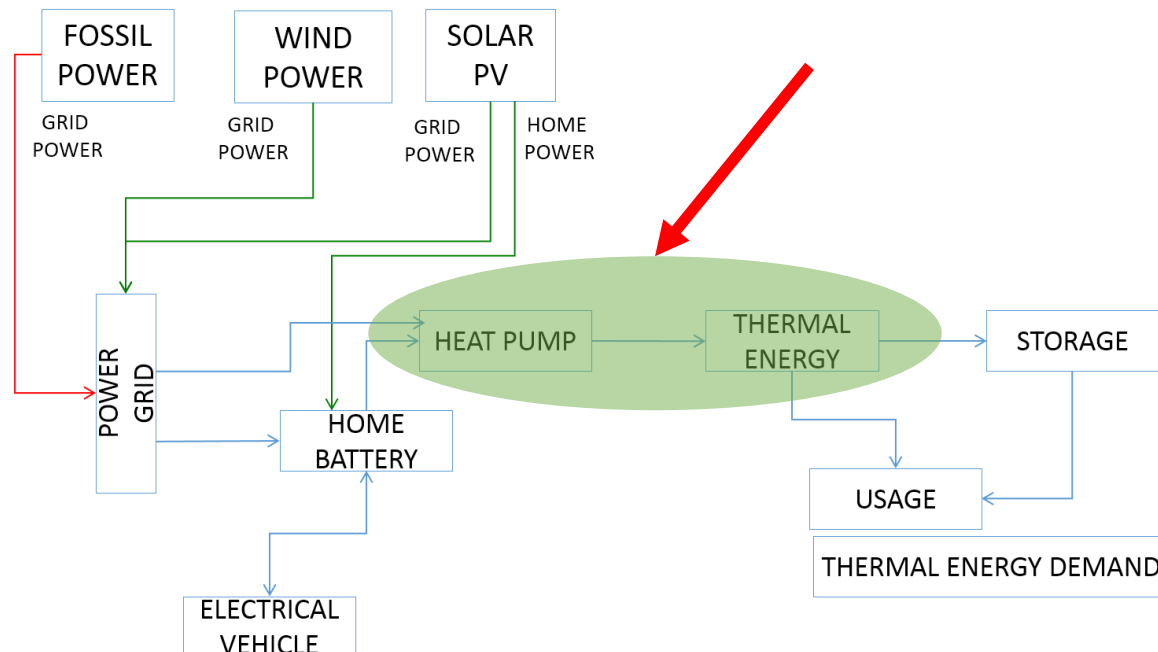
The presentation will be available on www.annex42.com!

1 Structure and approach – Why this annex?

Largely installed heat pump systems oppose both opportunity and threat for the grid:


- 1) A heat pump can shift electrical power to heat
- 2) It will be the largest electricity consumer in the house
- 3) It can ramp up in minutes and postpone for day's with thermal storage
- 4) It's predictable in demand for day ahead


Annex42 will come with rules, guidelines and best practices for smart heat pumps




1 Structure and approach - Participants


United Kingdom:

 Department of Energy & Climate Change
Department for Energy and Climate Change (DECC)


 DELTA Energy & Environment
DeltaEe Consultants


United States of America:


 EPRI | ELECTRIC POWER RESEARCH INSTITUTE
Electrical Power Research Institute (EPRI)


 OAK RIDGE National Laboratory
Oakridge Laboratories

The Netherlands:


 TNO innovation for life
TNO Innovatie

 Berenschot
Berenschot Energy & Sustainability


 alliander
Alliander N.V.

 Rijkdienst voor Ondernemend Nederland
Rijkdienst voor Ondernemend Nederland (RVO)


Germany:

 Fraunhofer ISE
Fraunhofer ISE – Freiburg


Denmark:

 DANISH TECHNOLOGICAL INSTITUTE
Danish Technology Institute (DTI)


Austria:

 AIT AUSTRIAN INSTITUTE FOR TECHNOLOGY
Austrian Institute for Technology (AIT)


South-Korea:

 한국에너지기술연구원
KORAN INSTITUTE OF ENERGY RESEARCH
Korean Institute for Energy Research (KIER)

Switzerland:

 Hochschule Luzern
Hochschule Luzern

France:

 EDF
Electricité de France (EDF)

All research institutes
No market parties?

1 Structure and approach – Tasks

Try to find answers to big questions:

Task 1:

What kind of grid problem is your country facing, how big and how urgent is it?
What is the potential for heat pumps in the domestic market?

Task 2:

Design four case scenario's for your country
Building type/ heat pump type/ thermal storage / control

Task 3:

How much of the problem can you solve with case scenario 1, 2, 3, or 4?
What is the potential flexibility heat pumps can offer?
What is the price to pay for this solution(s)?
Efficiency loss; size of the buffer; investments; comfort; infrastructure etc.






Task 4:

What's the road ahead? What are the foreseen implementation barriers?

Task 5:

How can we let the world know we are working on this?

2 Findings so far – Benchmark for flexibility

Differentiator	Benchmark position: What characteristics would maximise flexibility?	“score”
1. Drivers for HP in smart grid / flexibility	<ul style="list-style-type: none"> ▶ The country faces an immediate challenge to which flexibility offers a solution (therefore policy & industry driven to stronger action) 	
2. Potential size of flexible HP resource	<ul style="list-style-type: none"> ▶ Large HP market / high growth ▶ hydronic HP & underfloor heating ▶ commonly use storage 	
3. Building characteristics – impact on flexibility	<ul style="list-style-type: none"> ▶ new buildings, well insulated ▶ lots of space (i.e. for storage) 	
4. Energy prices / structures / tariffs – impact on flexibility	<ul style="list-style-type: none"> ▶ low elec price, high gas/other fuel prices encourage HP market growth ▶ flexible tariffs an enabler for HP flexibility 	
5. End-users – impact on flexibility	<ul style="list-style-type: none"> ▶ constant heat need (not bursts of heat) ▶ high level of experience to know how best to engage customers ▶ high proportion owned properties (more control over choice of system) 	

2 Findings so far – Flexibility ‘score’

Differentiator	UK	DE	FR	NL	KR	US	CH	DK
1. Drivers for HP in smart grid / flexibility	●		●	●	●	●	●	
2. Potential size of flexible HP resource	-		●	-	-	●	●	-
3. Building characteristics – impact on flexibility	●	●	●	●	●	-	●	●
4. Energy prices / structures / tariffs – impact on flexibility	●	-		-	●	●	●	-
5. End-users – impact on flexibility	●		●	-	●	●	●	●
Overall score	-	●		-	●	●		●

2 Findings so far – How to create flexibility

Building type, heat pump type and storage size **create** more or less flexibility potential

But..

Different signals and levels of control will have large impact on **unlocking** it!

Demand response signals to heat pumps

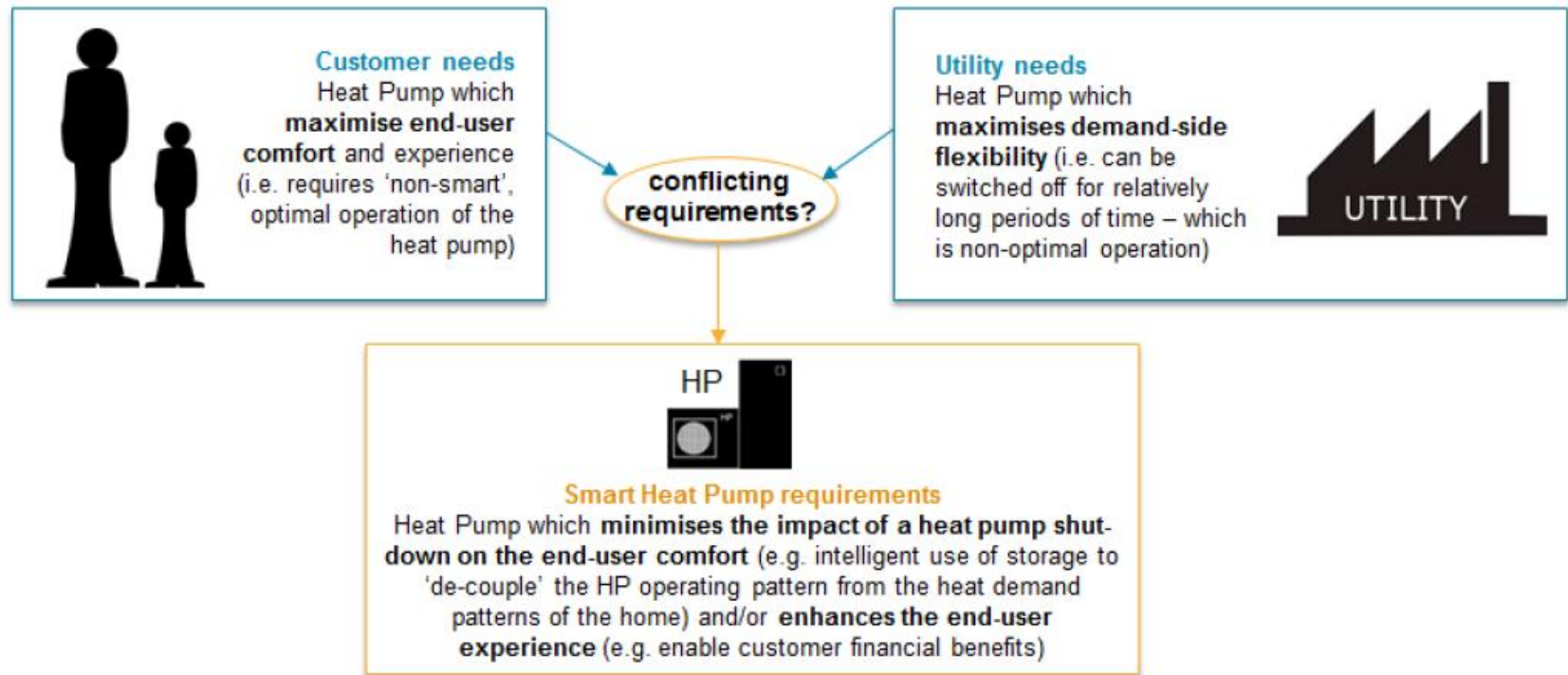
- ▶ Electricity price signals – NL, FR, KR;
- ▶ Availability of renewable generation – FR, DE, UK;
- ▶ High demand period anticipated; heat pump to reduce power draw (turn off, reduce speed, etc.) – US, UK, CH;
- ▶ Ancillary grid services (frequency and/or voltage level) control – US
- ▶ Continuous, “one-way” live signal to heat pump from aggregator
- ▶ Two-way communications - AT (for one scenario), US

3 The road ahead

1. Calculations and simulations are currently being executed, results expected in the end of 2016
 - What is the flexibility that can be offered in typical situations? (the case scenario's)

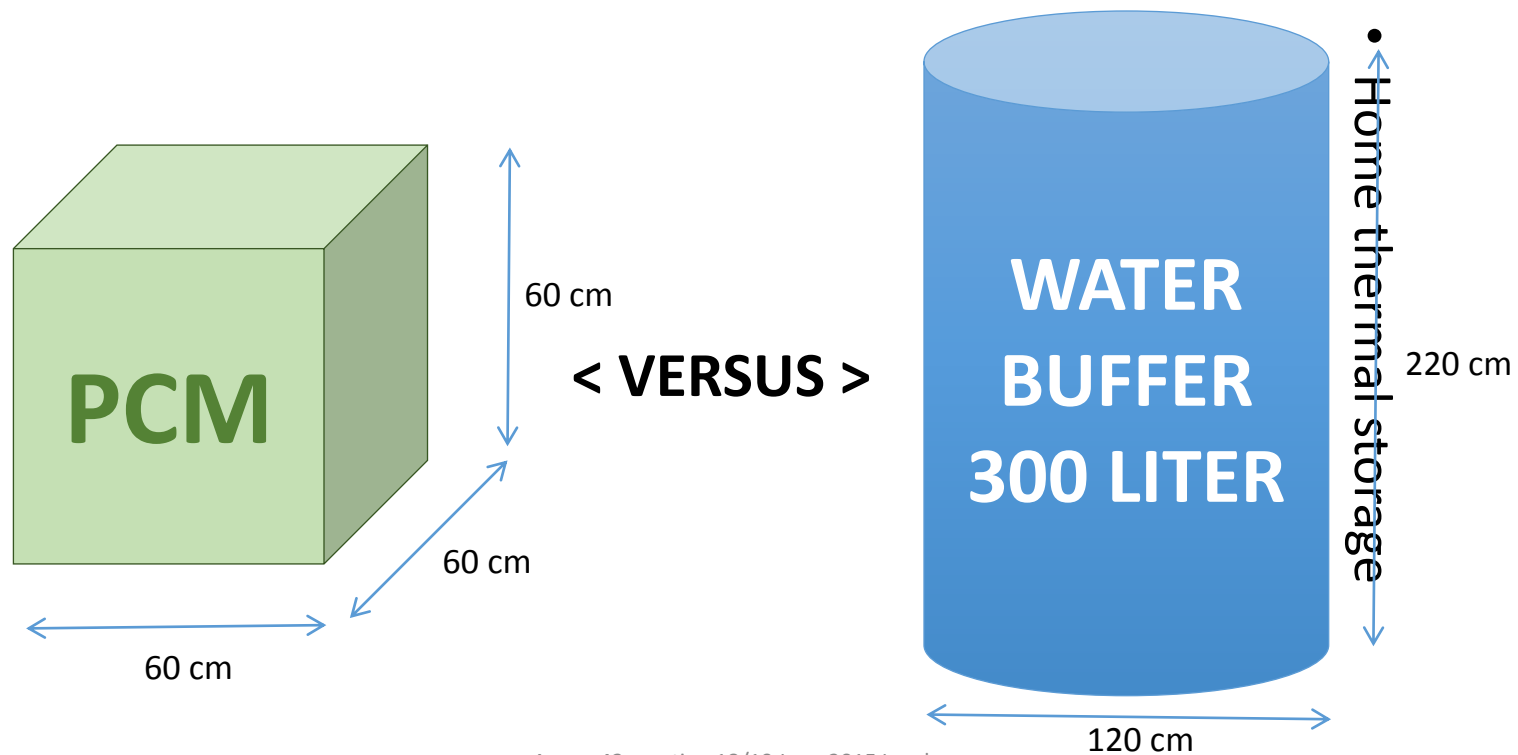
2. Defining the roadmap for smart heat pumps
 - Identifying implementation barriers
 - Finding possible solutions to overcome them

4 Challenges – Conflict on interests



(taken from smart ready heat pumps in UK task 1)

4 Challenges – The progress of other research area's



Annex 42 meeting 18/19 June 2015 London

4 Challenges – The world is moving fast!

Home battery systems from a complete other market:

- Tesla;
- Mercedes-Benz;
- Toyota?
- Volkswagen?



High capital
Can mass produce
And react fast

4 Challenges – The world is moving fast!

The Digital Disruption Has Already Happened

- World's largest taxi company owns no taxis (Uber)
- Largest accommodation provider owns no real estate (Airbnb)
- Largest phone companies own no telco infra (Skype, WeChat)
- World's most valuable retailer has no inventory (Alibaba)
- Most popular media owner creates no content (Facebook)
- Fastest growing banks have no actual money (SocietyOne)
- World's largest movie house owns no cinemas (Netflix)
- Largest software vendors don't write the apps (Apple & Google)

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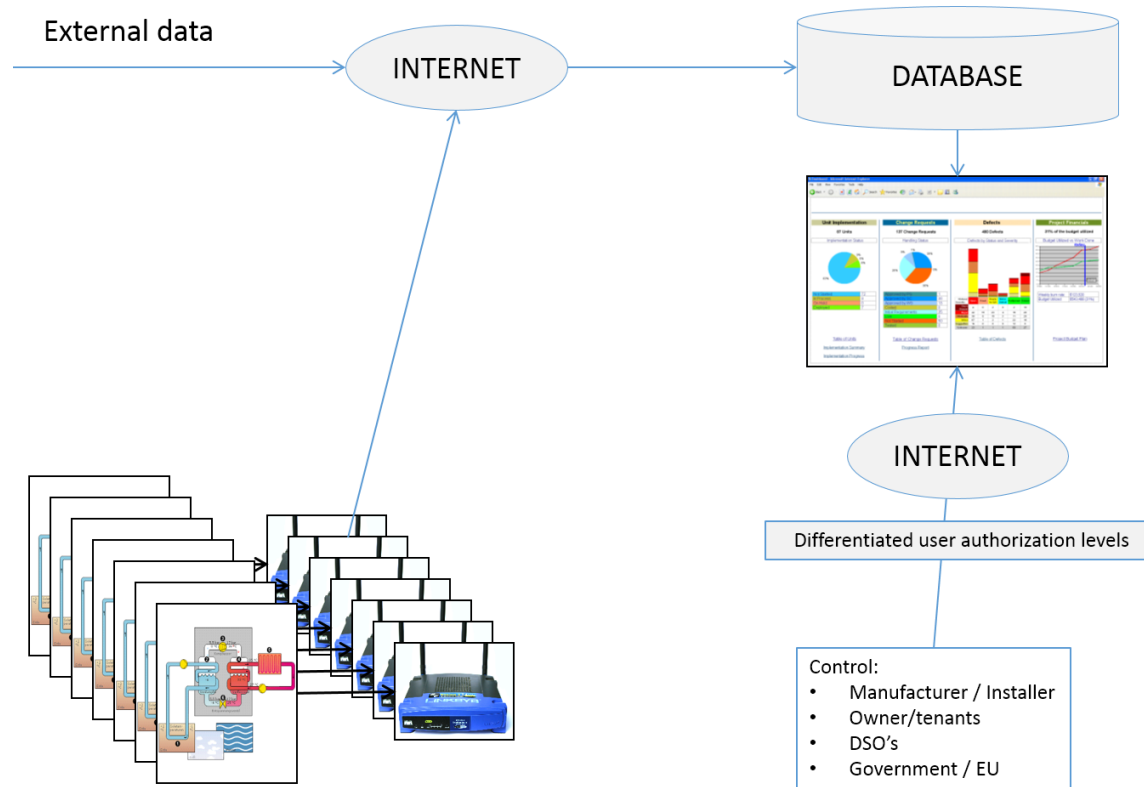


The largest flexibility trader owns no grid?
→ That's should terrify utilities!

4 Challenges – Internet of Things (IoT)

“A severe constraint on the development of a Smart Grid is the lack of integration and interoperability of devices, data, and applications.”

Steven Collier Chairman, IEEE Smart Grid Education Committee Director, Smart Grid Strategies, Milsoft Utility Solutions



4 Challenges – The world is moving fast, but the smart grid world is still in chaos



No price signals

Concerned Grid operators

Inflexible electricity price

No governmental action

Unknown benefit

- On/off
 - Forced 'on'
 - Forced 'off'
 - Normal operation based on heat
- That is not really ready!



Thank you for your attention!



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www.bdho.nl



www.scenariotool.nl