

Energy storage and smart heat pumps in (smart) grids

A project idea developed by:

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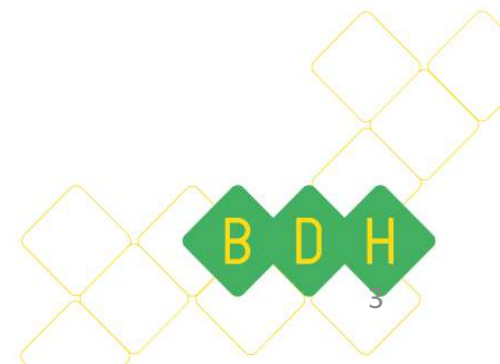
Peter Wagener (Operating Agent Annex)

Agenda for today

- Introduction Peter Wagener & BDH
- Brief introduction project idea;
- Energy storage in a changing energy system: Storage & Heat Pumps in a smart grid;
- Steps to start a new combined Annex.

Business Development Holland b.v.

Introduction



BDH

Renewable energy in domestic housing, smart grids and heat pumps

'Strategic thinking, pragmatic doing'

Knowledge development and advanced online tooling



What does BDH?

'We are strategy- and process consultants in renewable energy in domestic housing, smart grids and heat pumps.

We help our customers to bring abstract strategies into practical results'

ScenarioTool.nl:

Herewith scenario's on street, urban area, town, province can be made within matter of hours, i.s.o. weeks



Warmtepomplein.nl:

The independent information portal for end consumers for heat pumps in NL.



Warmtepompstrategie.nl:

Knowledge on heat pumps, based on a 'knowledge menu' approach. From brainstorm upto strategic approach, for economics, technology application and emissions effects.



Annex 42 & 45 International Energy Agency:

International knowledge dissemination on (hybrid) heat pumps and heat pumps in smart grids in domestic housing.

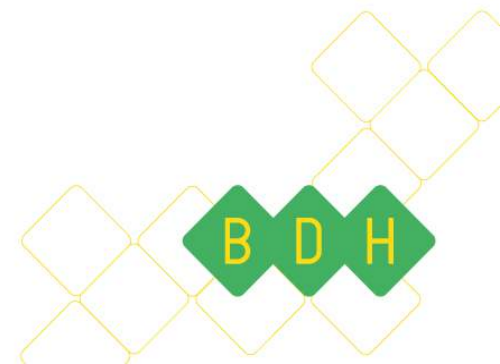


Dutch Heat Pump Association:

Industry organization for heat pumps for domestic and commercial application. BDH facilitates chairmanship and project management.



The idea behind an combined Annex



Energy in the old days

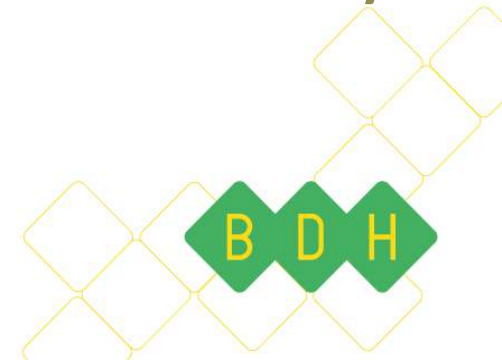
Fossil generated electricity



Natural gas
powered
heating



Diesel/petrol
fueled mobility



Where we are heading for...

Electricity from renewable source



Energy storage
electricity, heat, power2gas,
power2heat

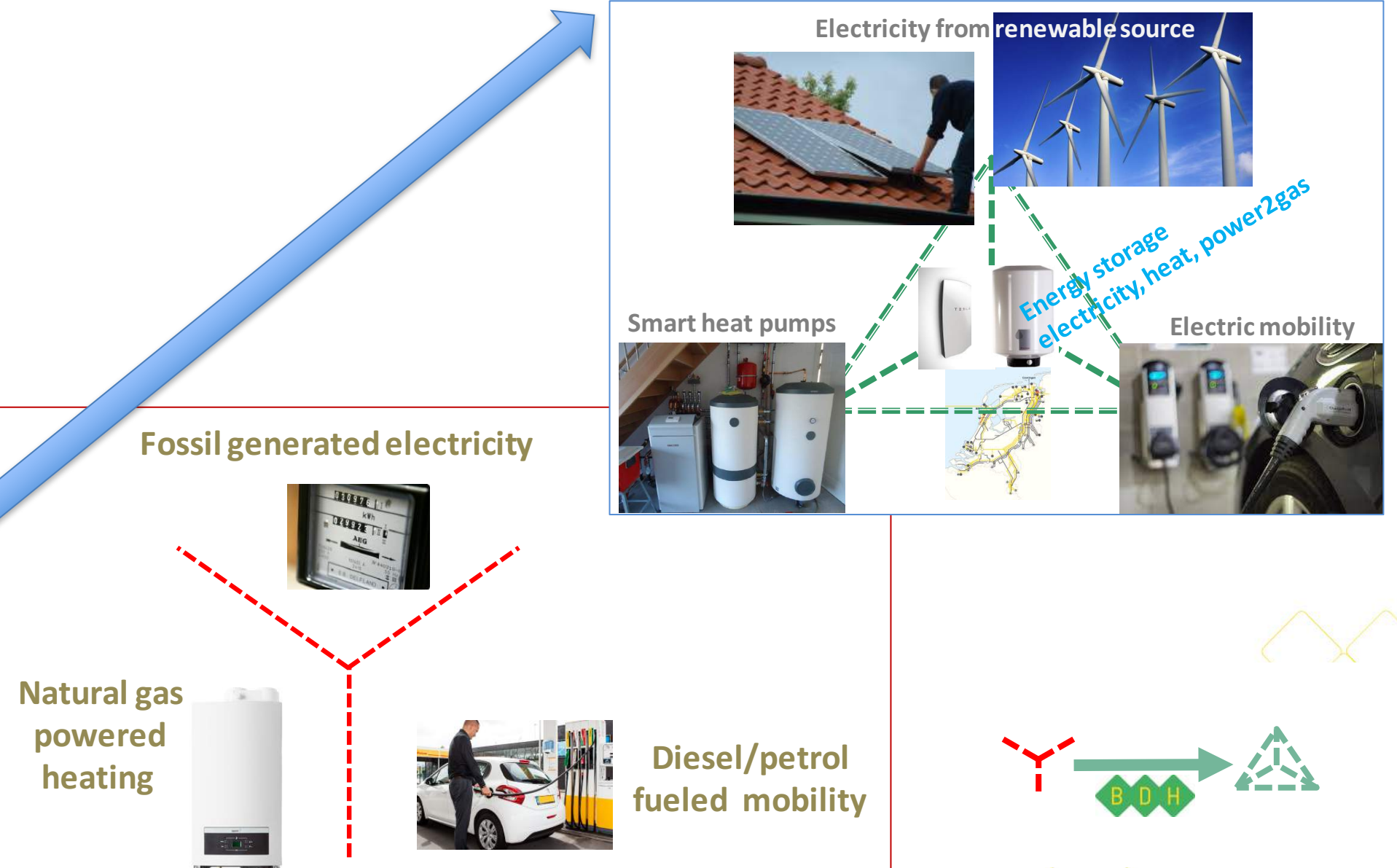
Heat pumps



Electric mobility



Generation, consumption and storage of energy get integrated



Domestic energy consumption Netherlands 2016

Natural gas (heating & DHW)

11 billion m³ gas
= 400 PJ energetic value
= 110 TWH_{th}
= 80 TWH_{th} primary demand
at SCOP = 3,5 of heat pump
= approx. 23 TwH_{elec}

Electrical power (Domestic)

3.500 KwH/house
x 7,5 million houses
= approx. 26 TWH_{elec}

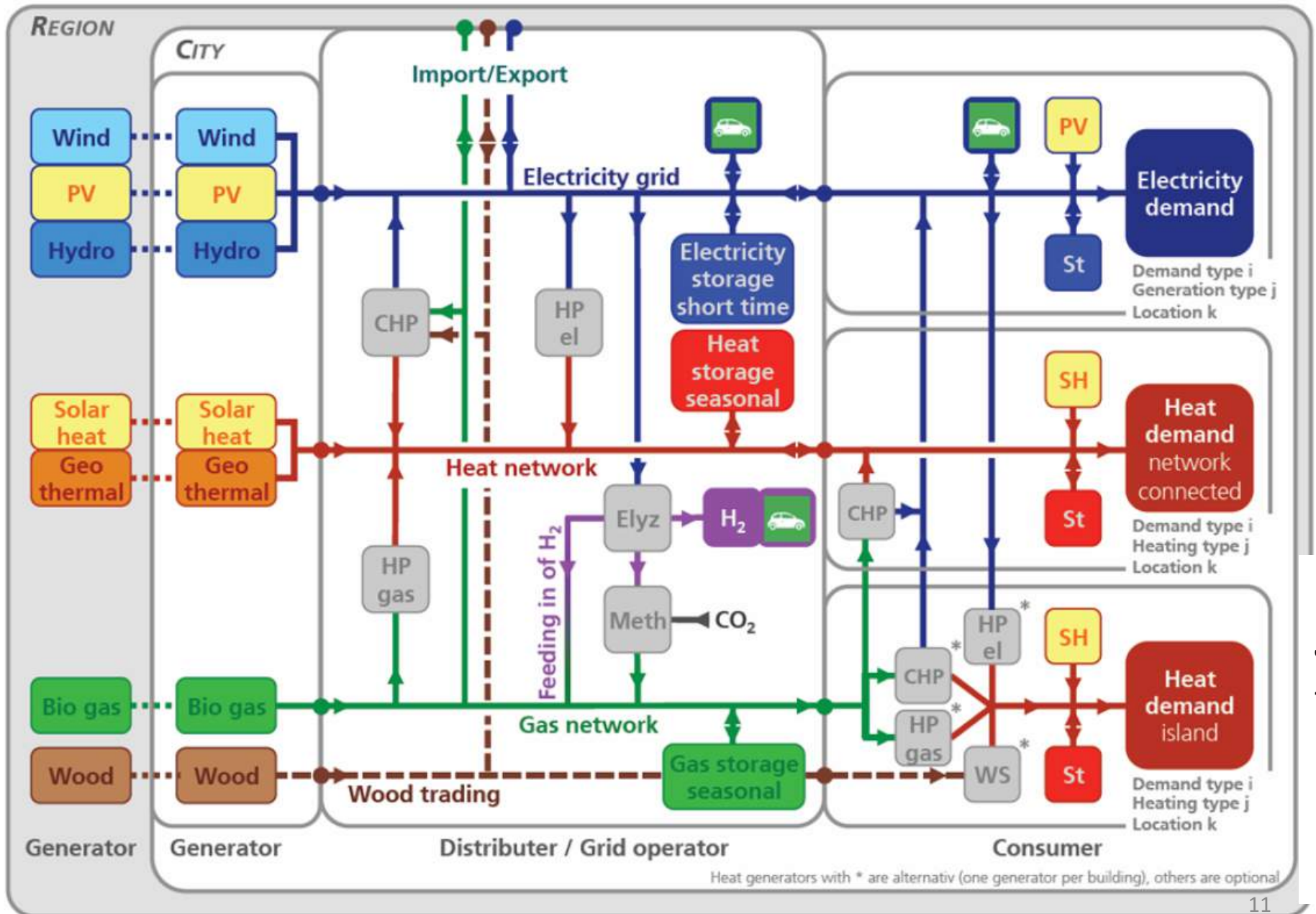
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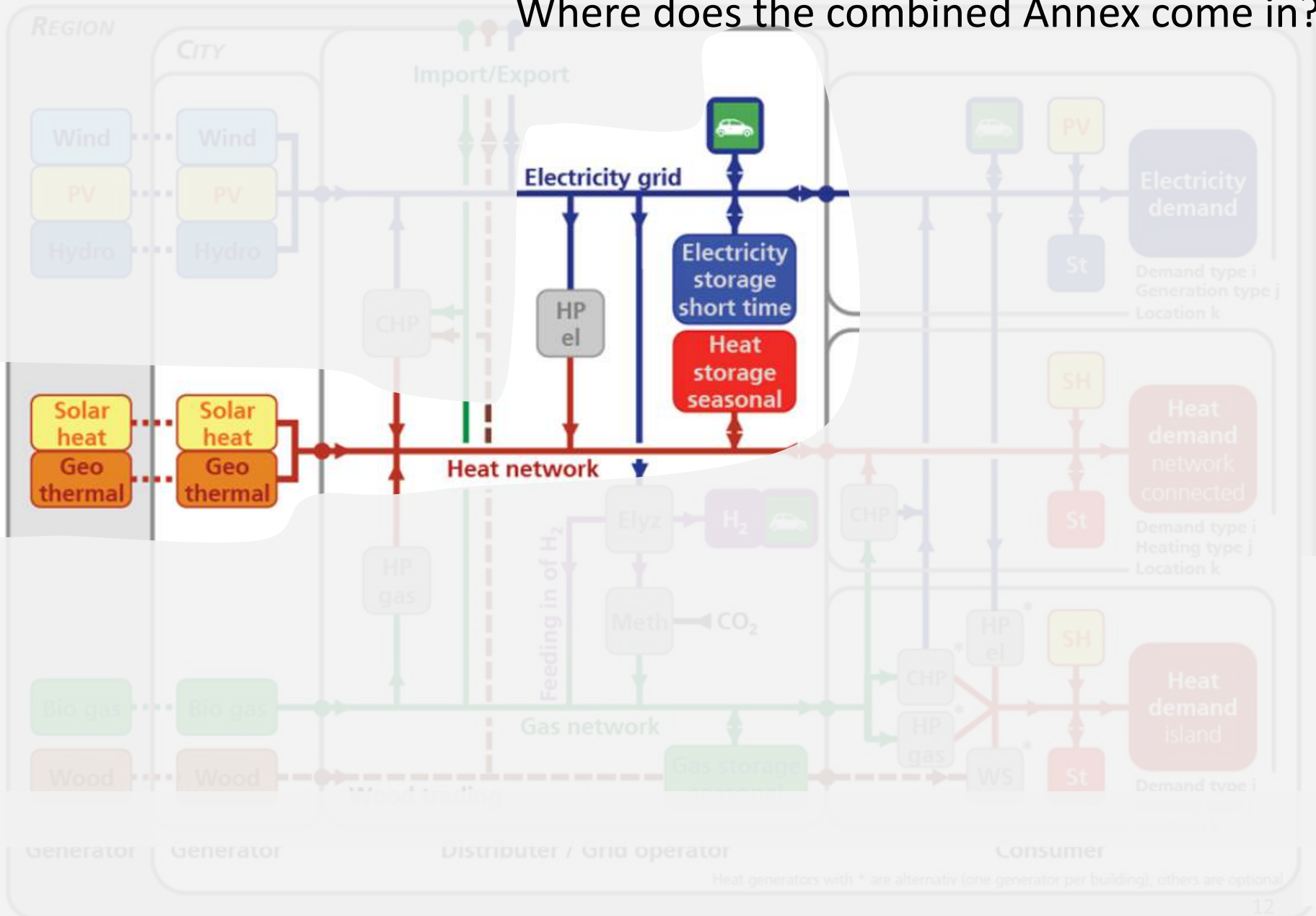
END USERS IN DOMESTIC HOUSING, COMMERCIAL BUILDINGS AND INDUSTRY

Urban energy system based on 100% renewable energy

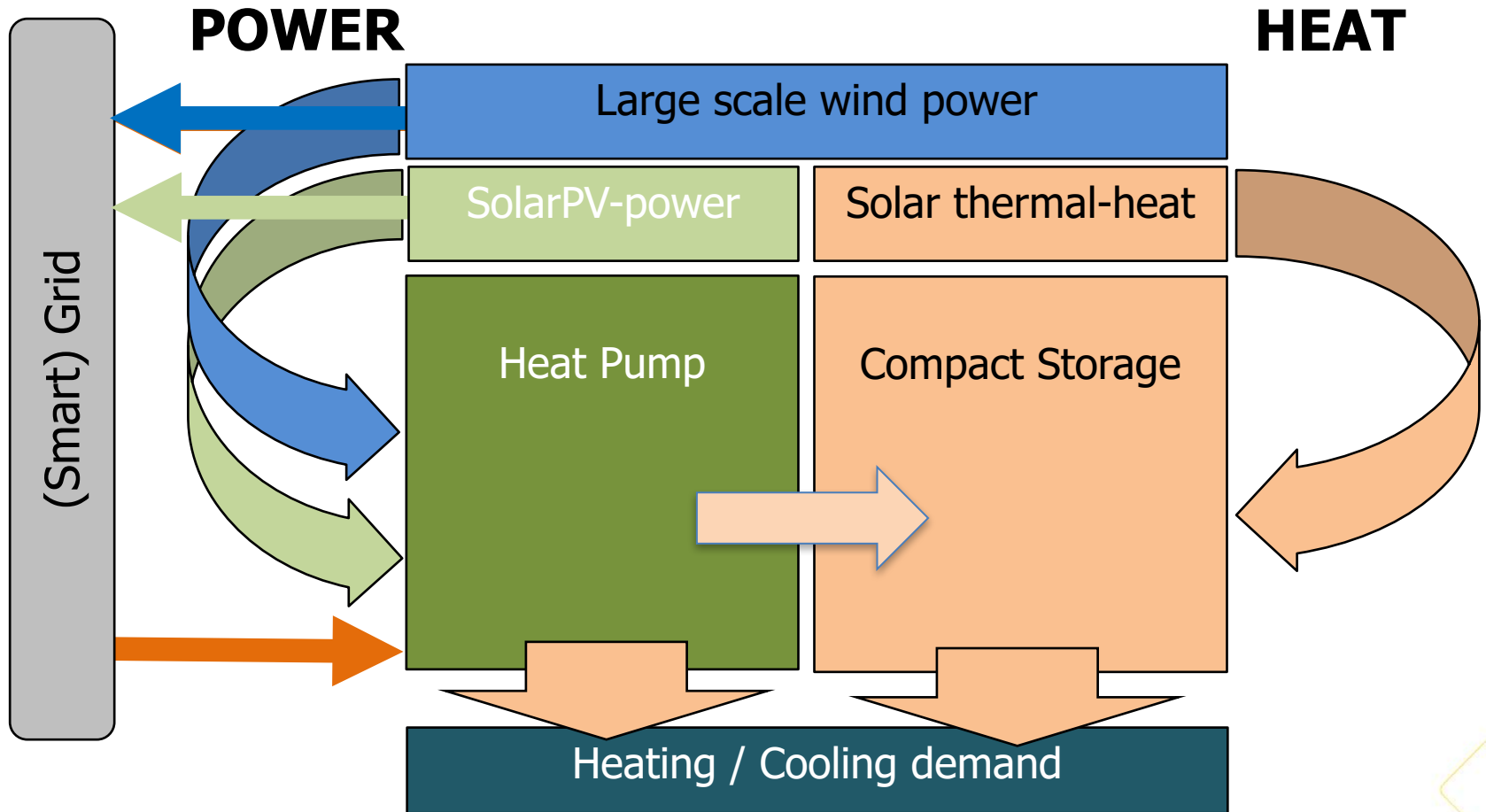


Urban energy system based on 100% renewable energy

Where does the combined Annex come in?

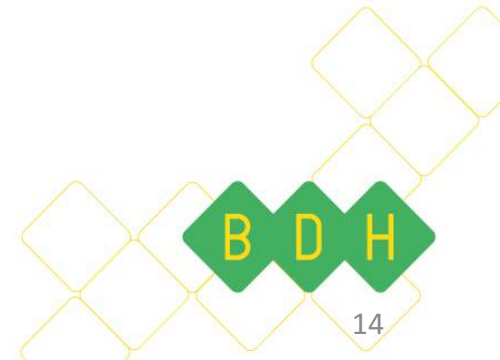


New integral solutions required



Heat battery = Electrical heat pump + (TCM) storage

Combined Annex from
IEA TCP ECES 'Energy storage'
and
IEA TCP HPT 'Smart heat pumps'



Domestic energy consumption Netherlands 2016

Natural gas (heating & DHW)

Electrical power (Domestic)

11 billion m³ gas

= 400 PJ energetic value

= 110 TWh_{th}

= 80 TWh_{th} primary demand

at SCOP = 3,5 of heat pump

= approx. 73 TWh_{elec}

3.500 Kwh/house

x 7,5 million houses

= approx. 26 TWh_{elec}

Even partly electrification

requires storage, thermal and electrical,

to manage this challenge

Gas high pressure and and power high tension infrastructure
(100% governmental owned in NL)

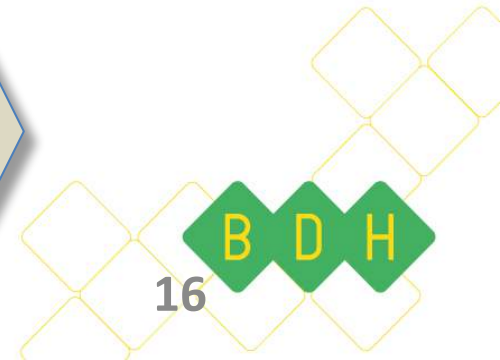
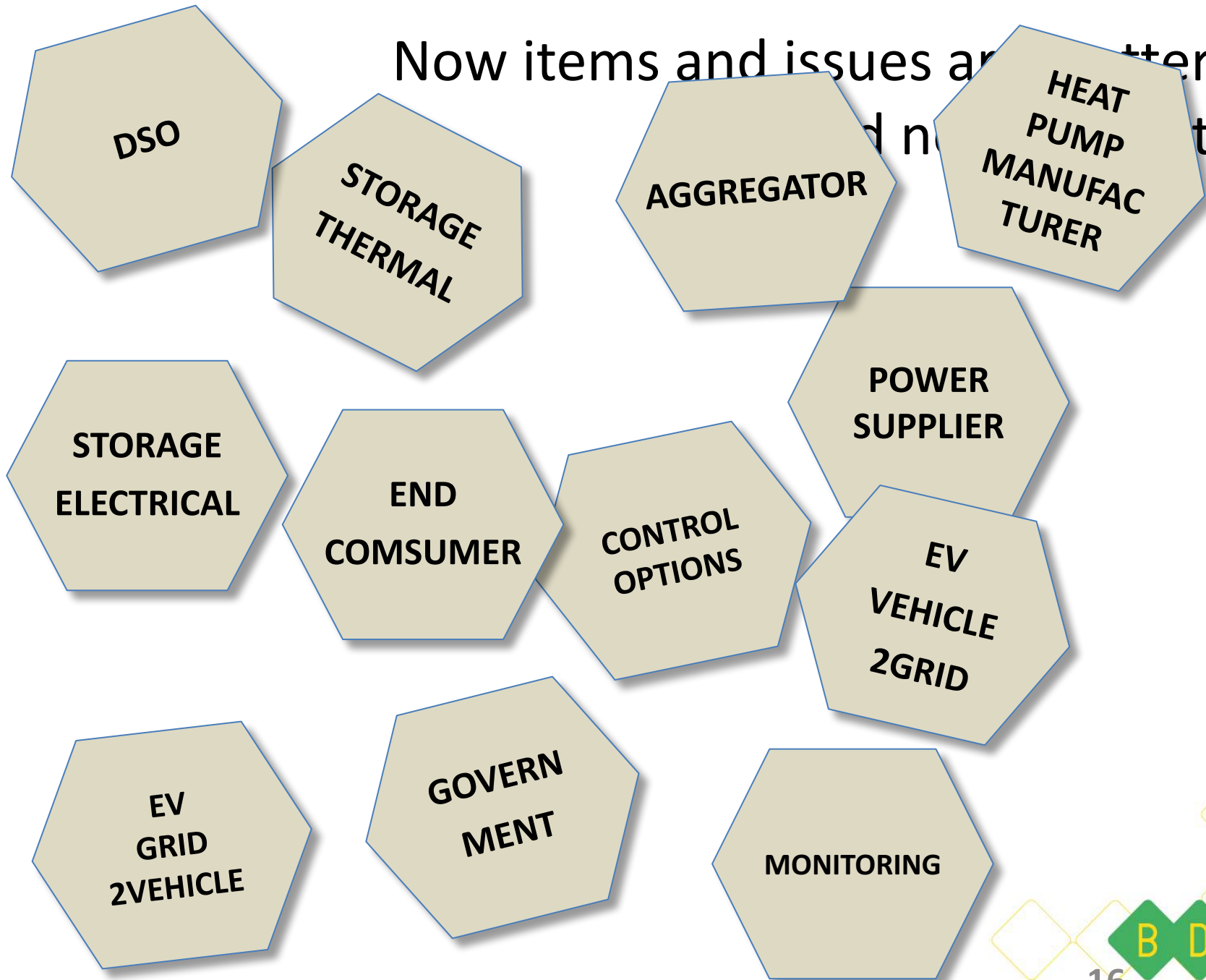
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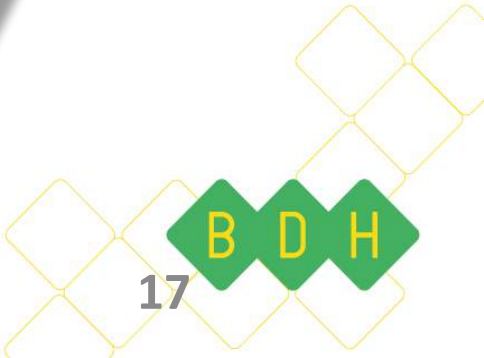
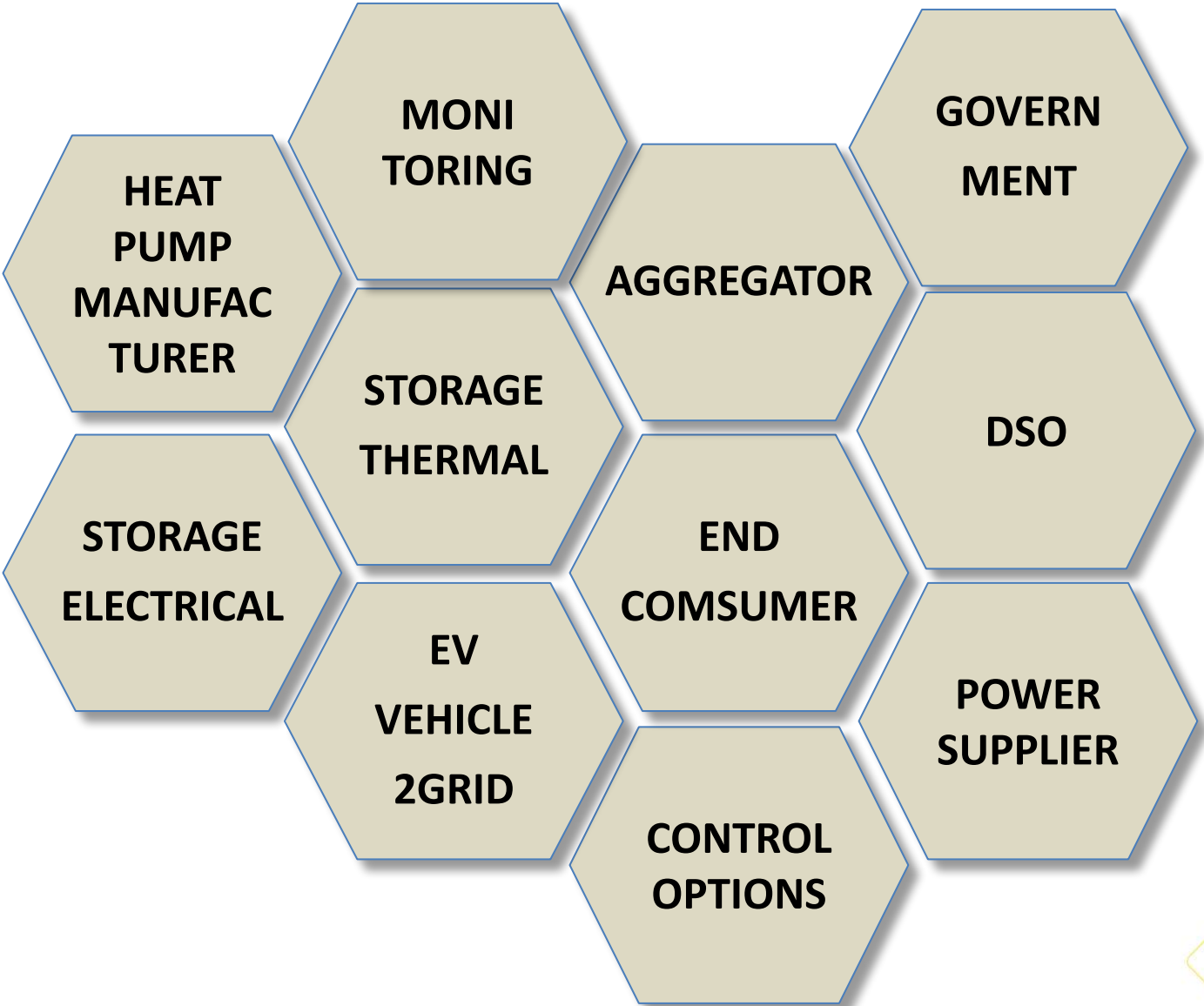
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END USERS IN DOMESTIC HOUSING, COMMERCIAL BUILDINGS AND INDUSTRY

Now items and issues are scattered

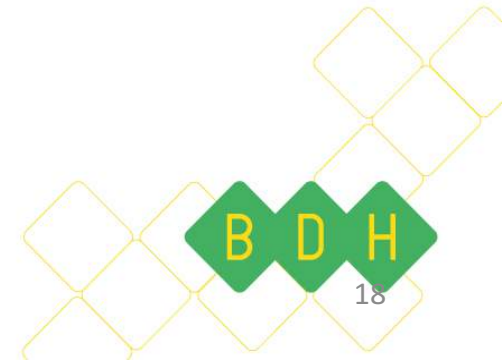


Loose items and issues to be connected



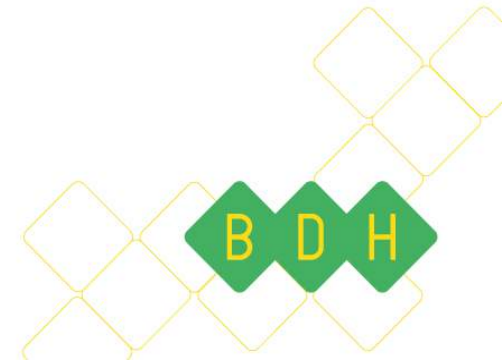
Which problem will we solve? Even more, which opportunity do we offer?

- Developing and exchanging knowledge to:
 - Handle (intermittent) renewable power supply and renewable heat supply, to manage increasing asynchronous demand for power and heat.
 - Increase use of renewable power and heat, in domestic housing and on urban area level, to reduce CO₂ emissions.
- Concrete:
 - Facilitate energy grid stability;
 - Optimize renewable energy production to match specific demand;
 - Create flexibility in energy form (i.e. electricity vs gas or heat and cold, DSM etc).



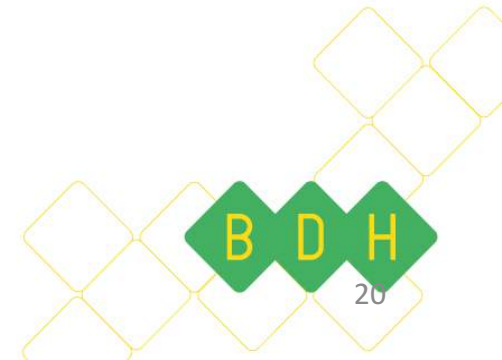
Which problem will we solve? E.g. which opportunity do we offer? (2)

- Energy storage and heat pumps creates efficiency and flexibility in the overall energy system;
- New integral solutions are required to match the variable renewable production and load;
- Heat Pumps + Storage + Smart Grids
>> Smart Energy system will provide possible solutions for an ‘increasing problem’
- Example: ‘Sun, wind, heat pumps’ initiative in NL, this NEEDS this knowledge of probable solutions



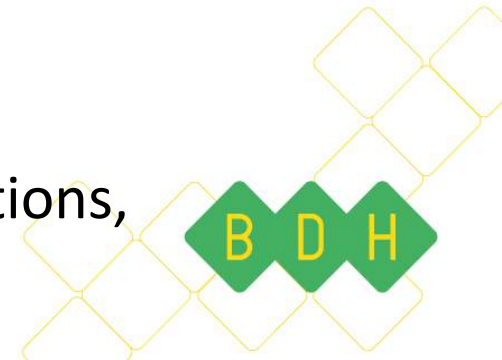
Program for 2 TCP's combined in 1 Annex could be:

1. Charting the waters:
 1. Existing projects and programs;
 2. How can we connect the 2 TCP's into 1 solid project frame.
2. What kind of new projects do we need?
3. Start needed projects as much as feasible;
4. Modelling and simulation of configurations;
5. Connectivity and monitoring;
6. Communications & dissemination.



Probable deliverables

- Overview of running projects and developments;
- Reference guide for storage/hp solutions;
- Models for estimating flexibility results;
- Component and system modelling;
- Comparison of storage & heat pumps with other technologies in terms of their energetic and economic performance;
- Performance evaluation and quality assessment;
- Proposal on technical procedures to be included in future standards for determination of the performance of storage combined with heat pumps;
- Regulatory recommendations;
- Website, workshops, newsletter articles, publications, ppt's on congresses, etc. etc.



Strategic direction of the combined Annex

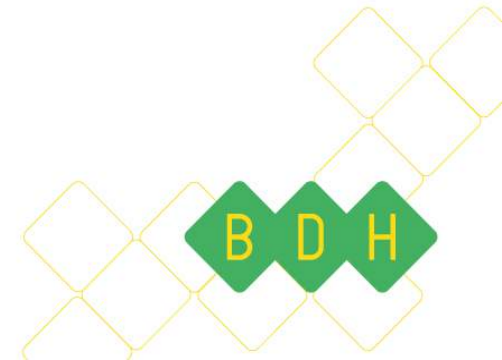
Innovation focus of the Annex on:

– Technological and economic requirements:

- Compact and robust;
- Safe, durable, affordable and reliable;
- Integral part of the system

– Economic-regulatory:

- market access;
- market design;
- security of investments;
- regulatory hurdles.



Scope essentials

Perspective on this Annex idea within ECES

1. Increasing Storage Density

PCM and TCM storage for urban area

Small scale pure electrical storages

PCM with seasonal storage for peak shaving

2. Sensible Thermal Storage

Pumped Thermal Energy Storage (PTES)

Underground Thermal Energy Storage (UTES)

High temperature UTES for industrial waste heat

3. Hybrid Energy Storage Options

Power to heat

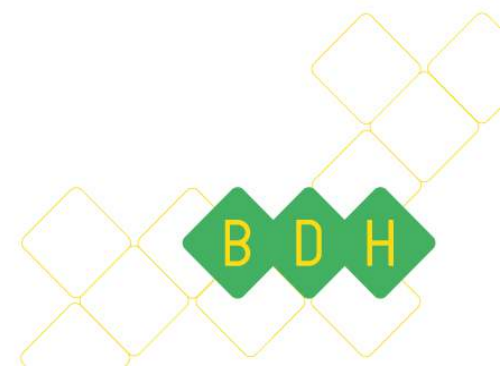
Power to gas



Potential participating countries in combined Annex

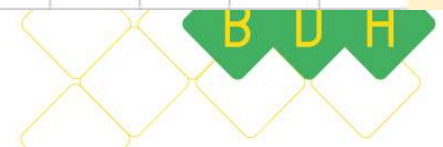
	Membership TCP		Interest in combined Annex?		Combination of TCP's
	ECES	HPT	ECES	HPT	
COUNTRY					
Austria					
Belgium					
Canada					
China					
Denmark					
Finland					
France					
Germany					
Italy					
Japan					
S-Korea					
The Netherlands					
Norway					
Slovenia					
Sweden					
Turkey					
USA					
Switzerland					
UK					

Table updated after both ExCo meetings May 2017



Next steps...

	2017				2018							
	May	Oct	Nov	Dec	Jan	Feb	Apr	May	Jun	Jul	Aug	Sep
✓ Gauge interest during ExCo meetings ECES and HPT;	■											
•Gauge interest potential participants ECES and		■										
•Draft 1st version of project outline;			■									
•Organisational set up / reporting structure;			■									
•Comments and feed-back step;			■	■								
•Draft 1st version of Legal Text;					■							
•Organize meeting central in Europe (Freiburg) to discuss;						■						
–Project budget and financing (Task sharing ECES vs cost sharing HPT)				■								
•Finalize Legal Text;						■	■					
•Meeting to approve Legal Text and formal participation;							■	■				
•Provide both ExCo's with concrete request for approval;								■	■	■		
•Projected start of Annex (1st projectmeetingFall 2018)												■





**Energy storage and smart heat pumps
combine essential technologies.
Let's make it work together!**

**Thank you
for your
attention**