

***Technology Collaboration Programs
come together***

TCP ECES

***Energy Conservation through Energy Storage
&***

TCP HPT

***Heat pumping technologies
in 1 Annex***

***Smart heat pumps & Energy Storage
in Smart grids***


ExCo meeting ECES 18/5/2017

ExCo meeting HPT 19/5/2017

Rotterdam – The Netherlands

Peter Wagener

Operating Agent



Energy storage and smart heat pumps in (smart) grids

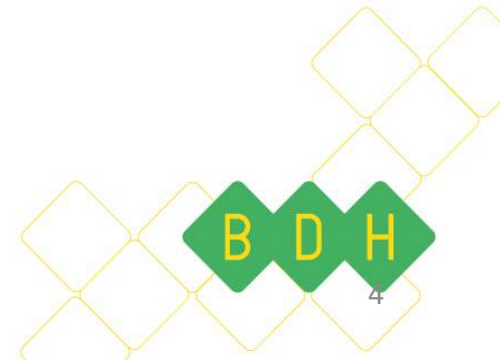
A project idea developed by
Teun Bokhoven, Stephan Renz
and Peter Wagener

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?

'BDH 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 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



Energy in the old days

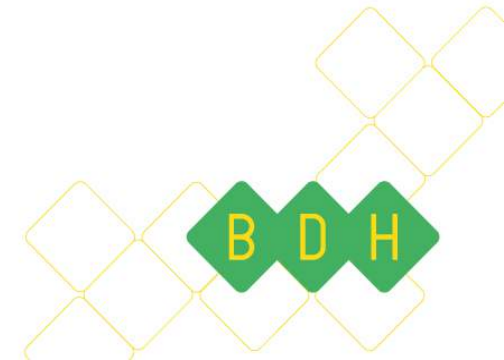
Fossil generated electricity



Natural gas
powered
heating



Diesel/petrol
fueled mobility



Where we are heading for...

Electricity from renewable source



Energy storage
electricity, heat, power2gas,
power2heat



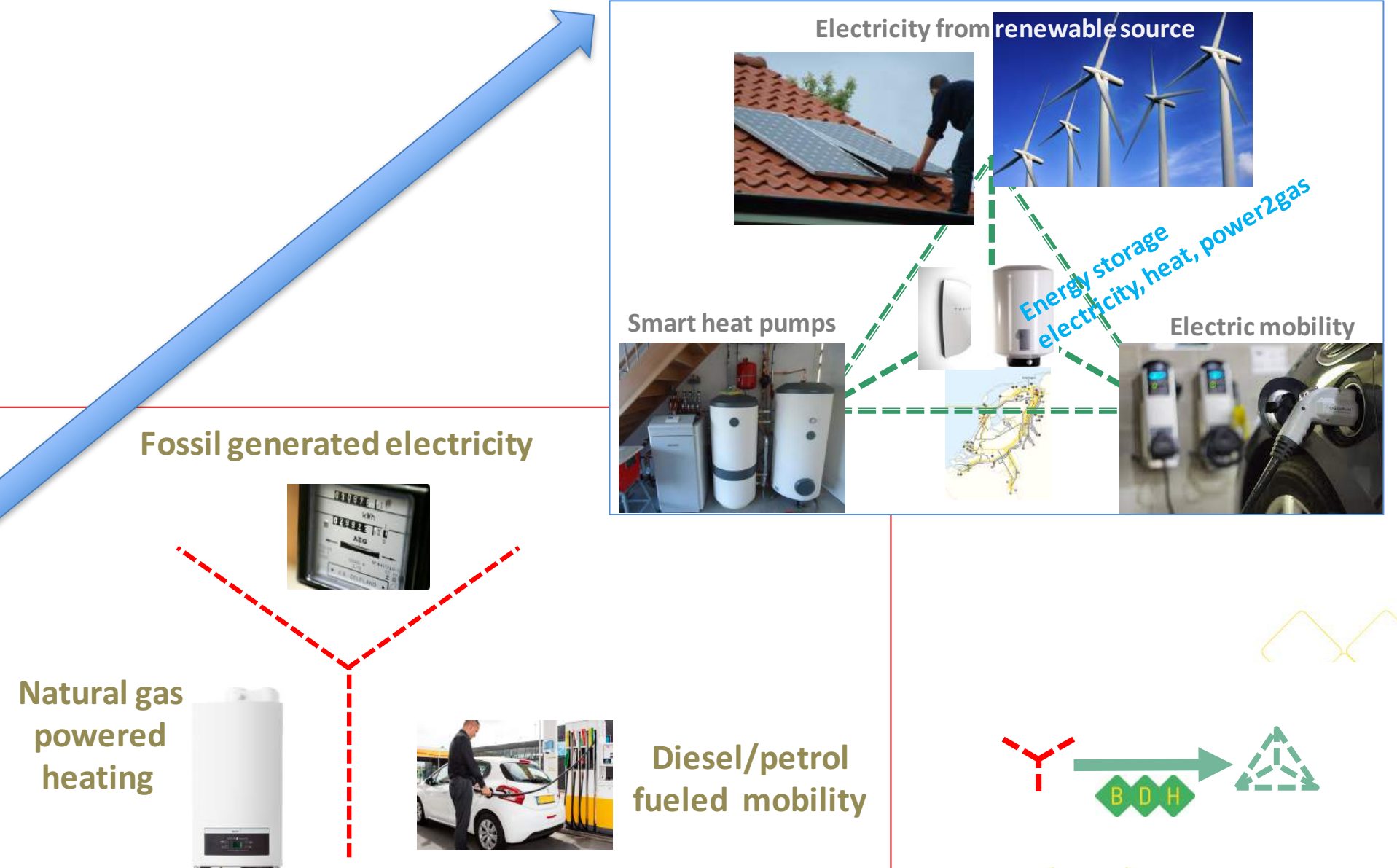
Smart heat pumps



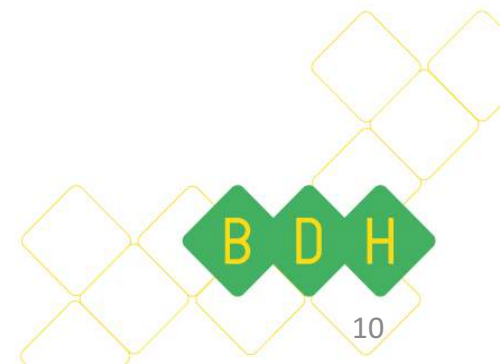
Electric mobility



Generation, consumption and storage of energy get integrated

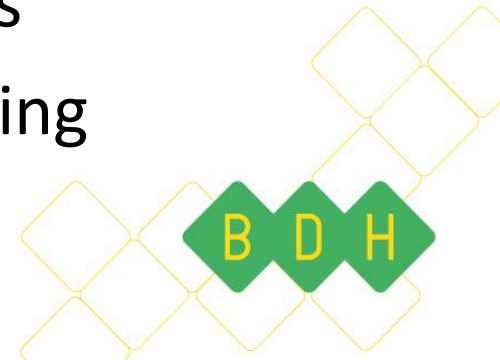


Combined Annex from
IEA TCP ECES 'Energy storage'
and
IEA TCP HPT 'Smart heat pumps'



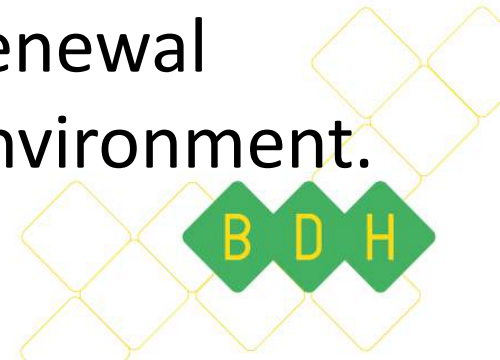
TCP ECES scope

- Research and dissemination activities in both thermal as well as electrical storage technologies
- Storage technologies as a main driver for the transformation of the energy system towards a low-carbon renewable based supply
- The international collaboration within a framework of IEA countries in combination with developing and transition countries
- Scientific community and industry working together for best deployment of results

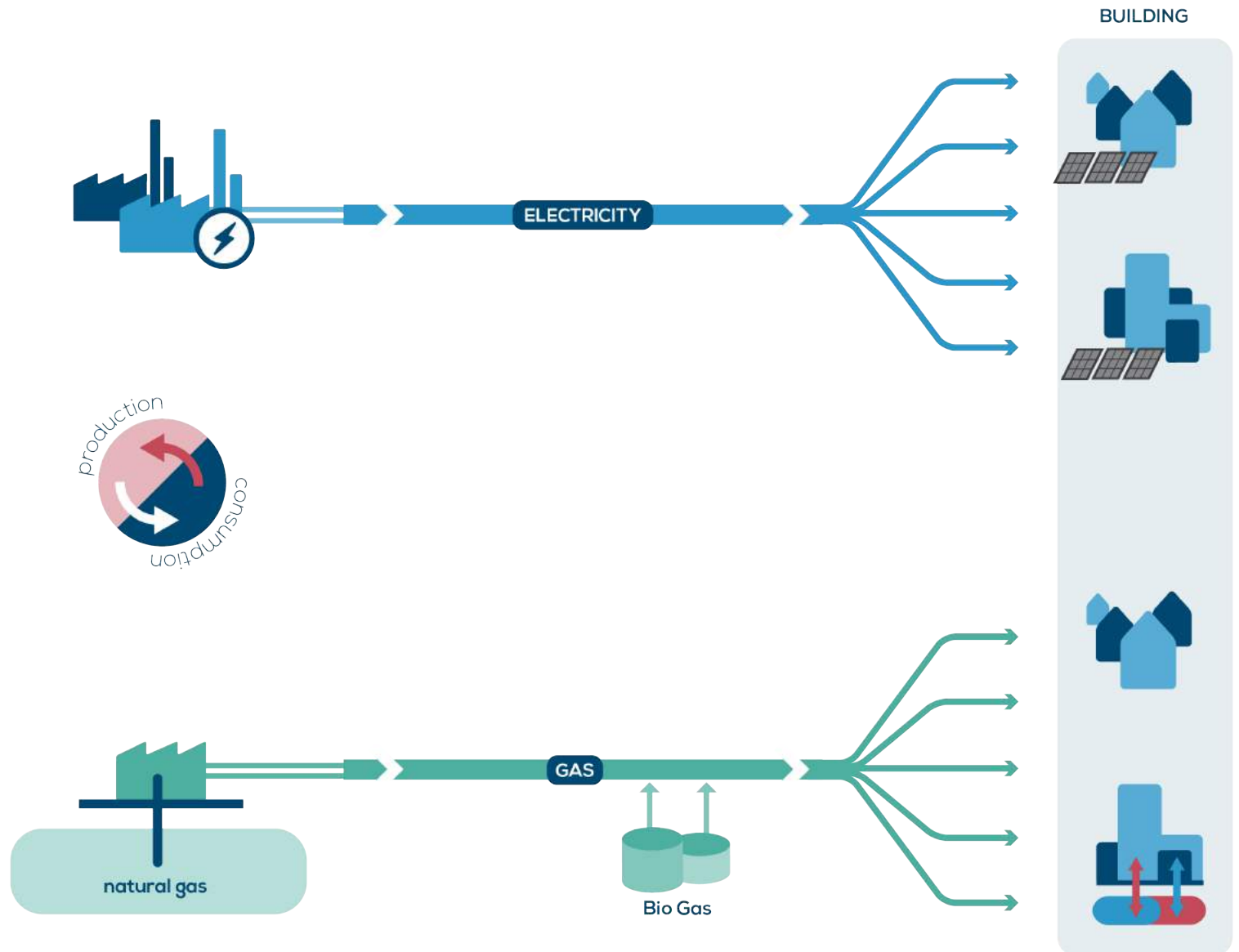


TCP HPT-scope

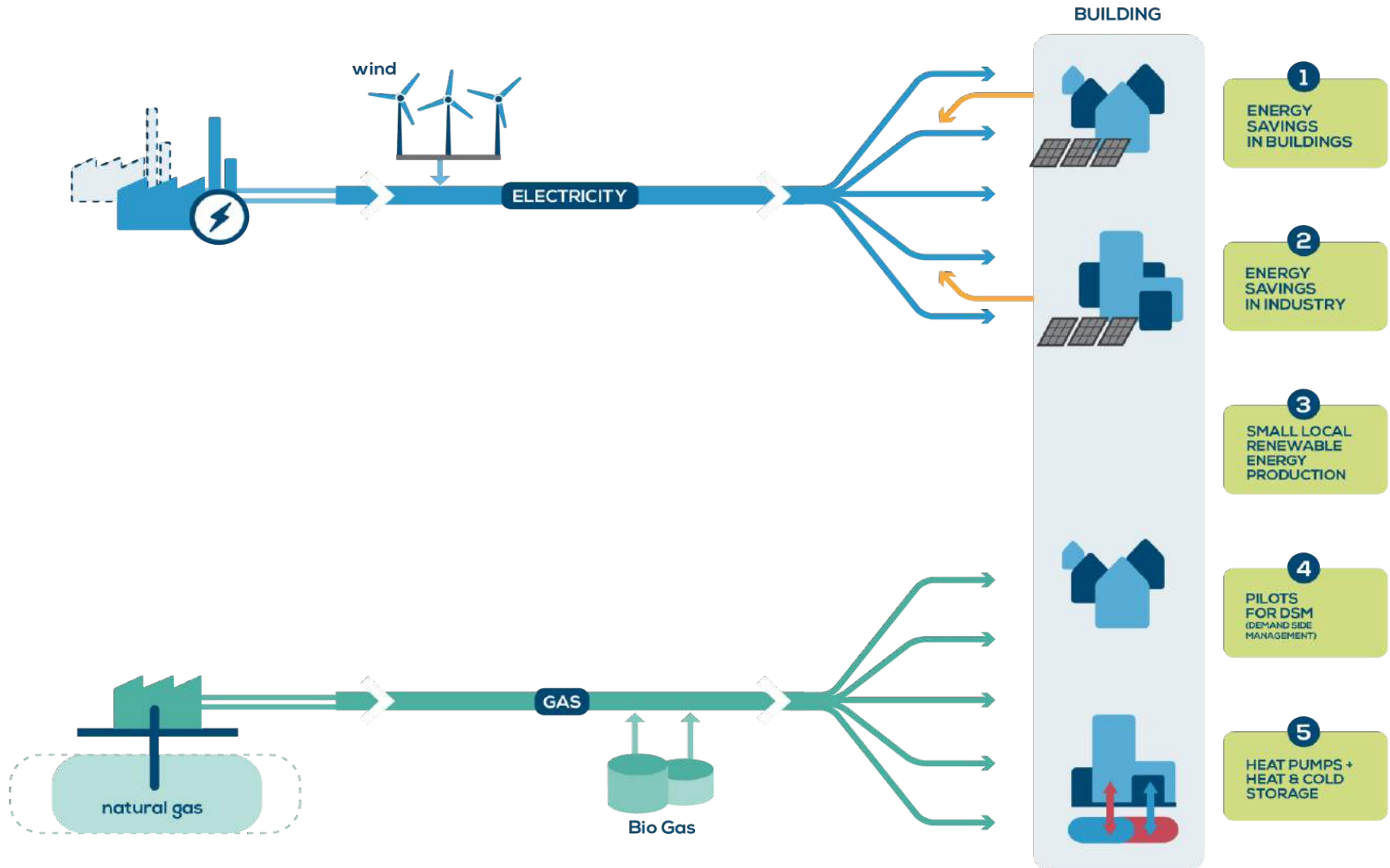
- The HPT TCP is a non-profit organization working in the field of heat pumping technologies.
- All technologies where heat is pumped from a lower temperature level to a higher one, such as heat pumps, air conditioning and refrigeration.
- The programme carries out a strategy to accelerate the use of heat pumping technologies.
In all applications where they can reduce energy consumption and increase the use of renewal energy sources for the benefit of the environment.



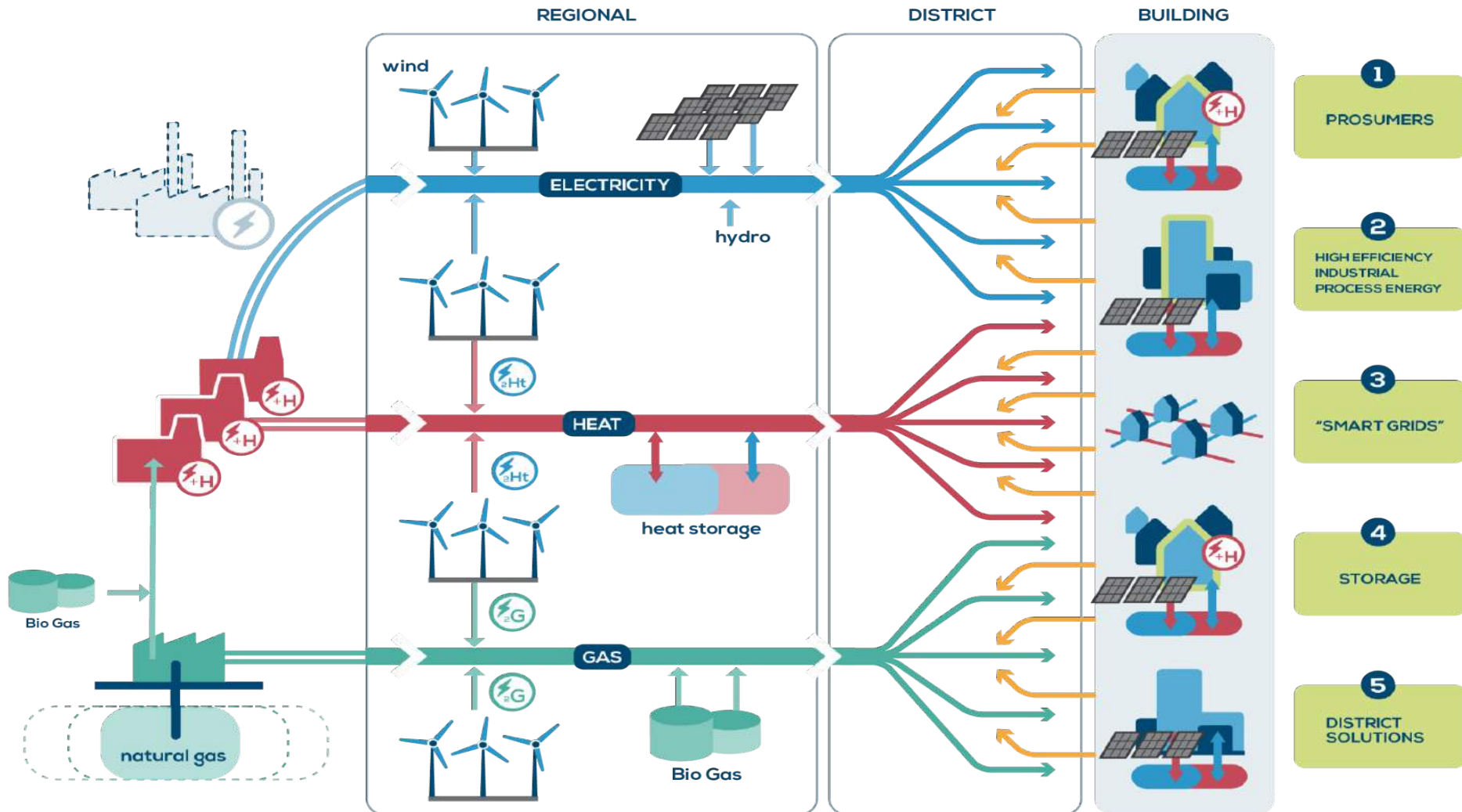
Our energy system is rapidly changing, from a centralised approach to.....



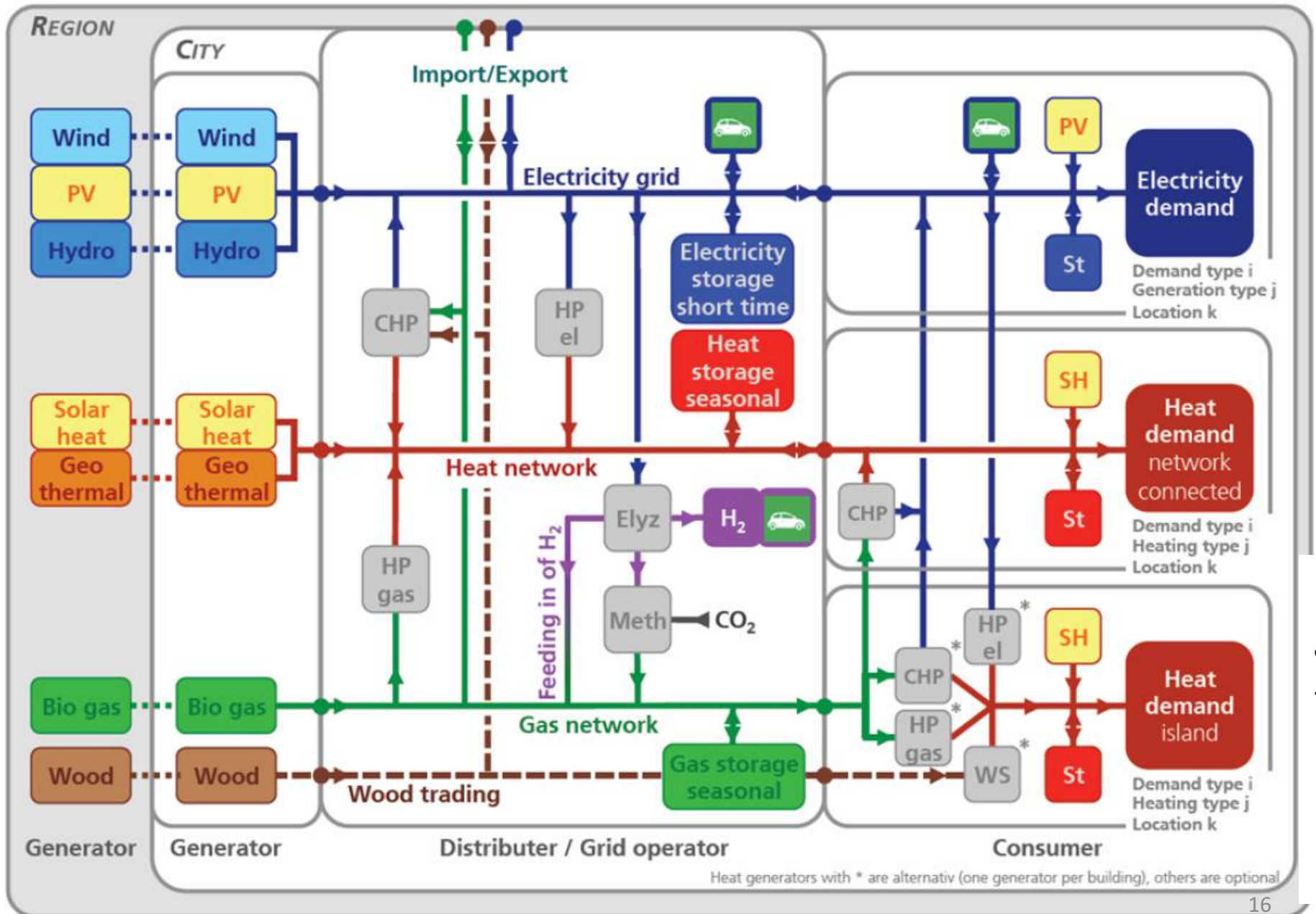
The energy system slowly into transition



The energysystem is actually in transition into a decentralized one

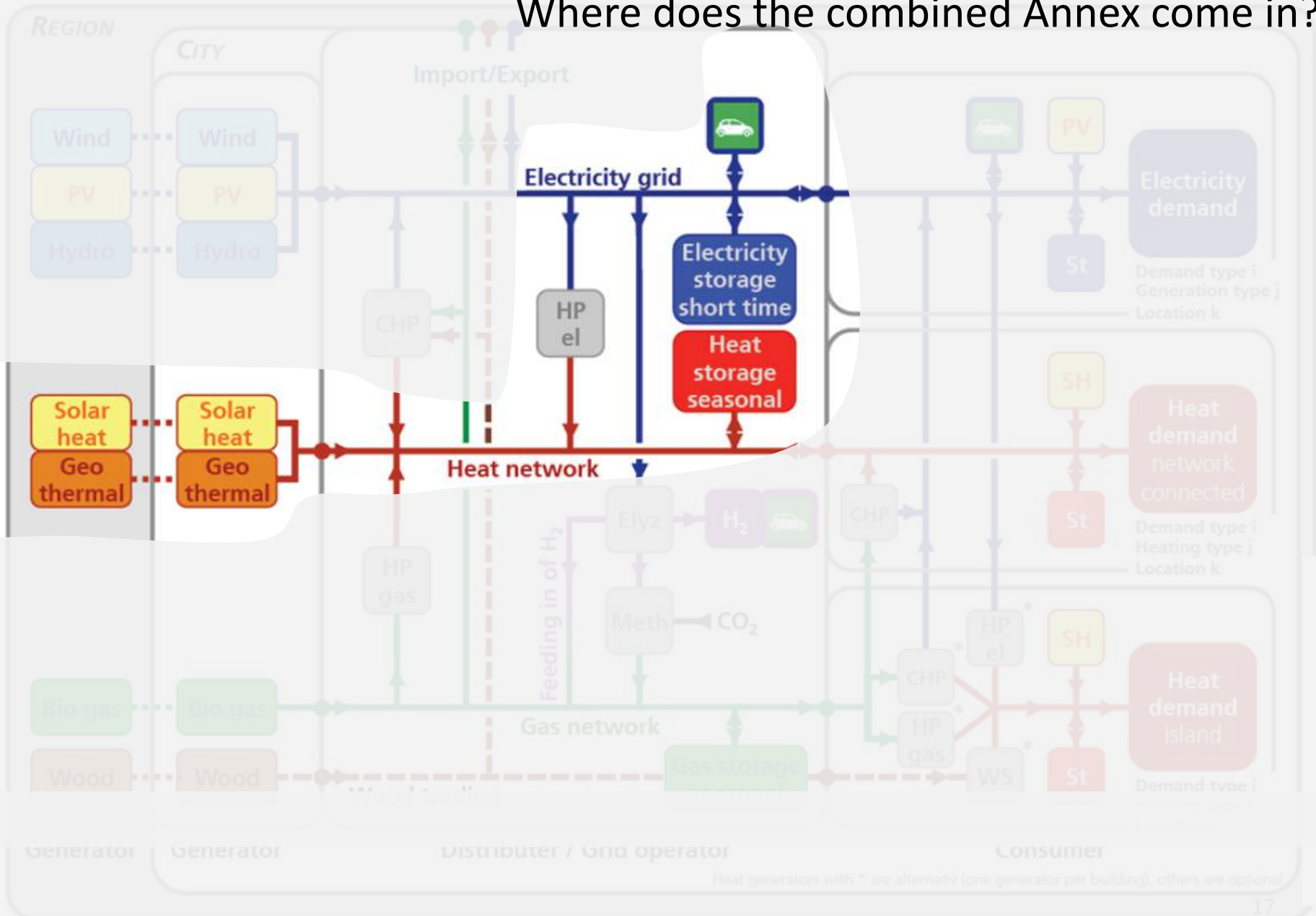


Urban energy system based on 100% renewable energy



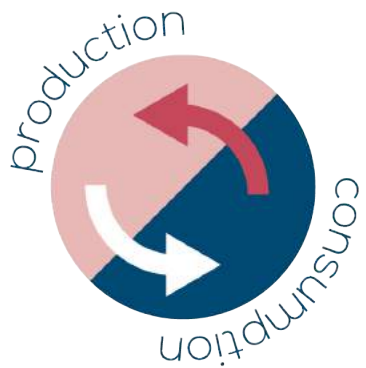
Urban energy system based on 100% renewable energy

Where does the combined Annex come in?

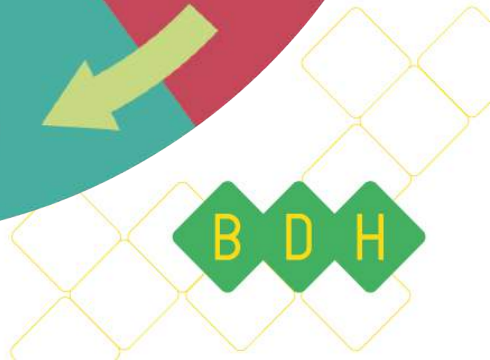
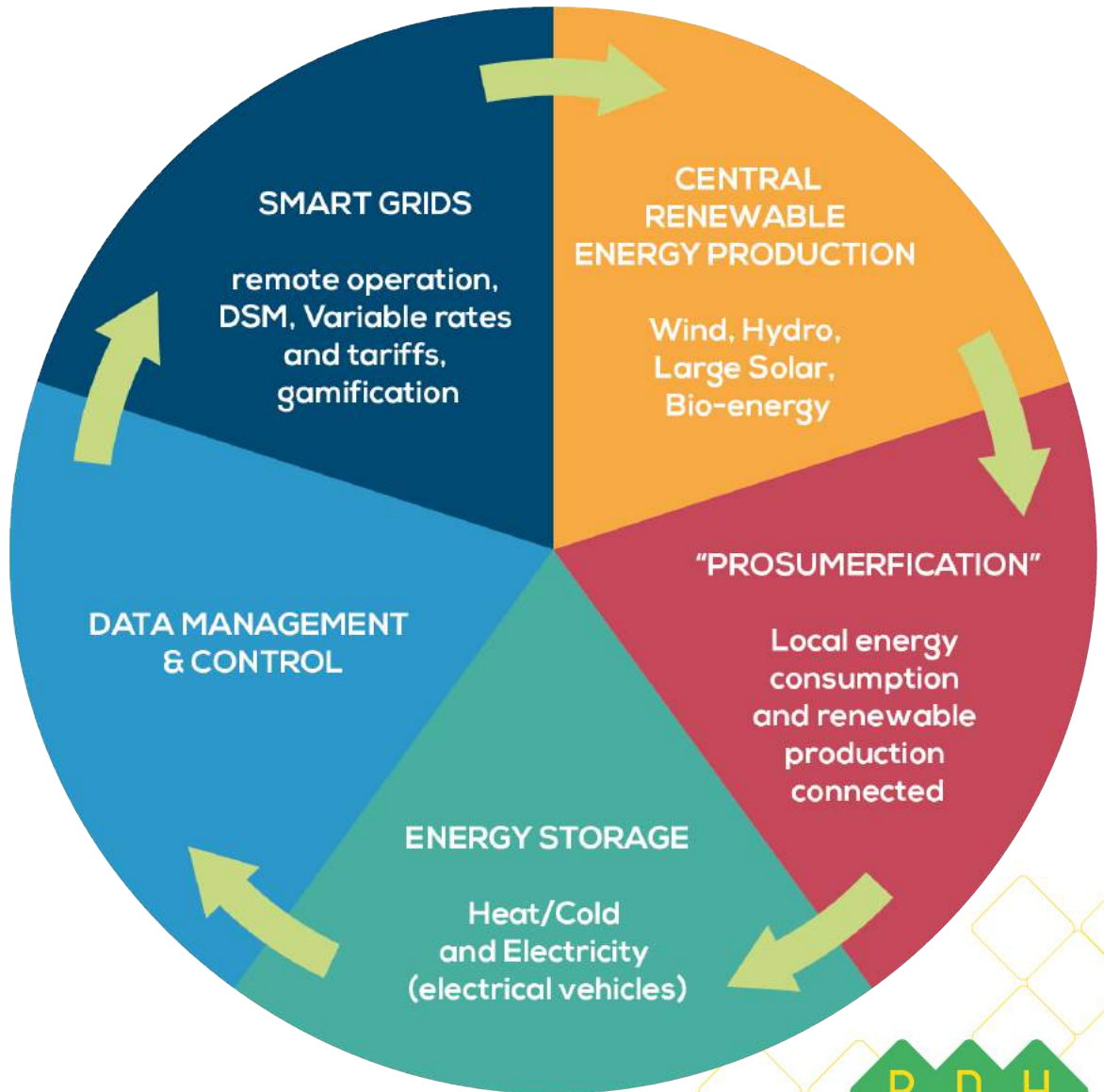


HP el/gas = Heat pump electric / gas driven, CHP = Combined heat and power, WS = Wood stove, St = storage, SH = Solar heat, Elyz = Elektrolyzer, Meth = Methanation

All this requires a new approach...



"old model"



Domestic energy consumption Netherlands 2016

Natural gas (heating & DHW)

11 billion m³ gas =
400 PJ = 110 TWH_{th}
= 80 TWH_{th} demand
At SCOP = 3,5
= approx. 23 TWh_{elec}

Electrical power (Domestic)

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

Gas infrastructure
100% governmental owned

Power infrastructure
100% governmental owned

DSO

DSO

DSO

END USERS IN DOMESTIC HOUSING, COMMERCIAL BUILDINGS AND INDUSTRY

DSO

**STORAGE
THERMAL**

AGGREGATOR

**HEAT
PUMP
MANUFAC
TURER**

**STORAGE
ELECTRICAL**

**END
COMSUMER**

**CONTROL
OPTIONS**

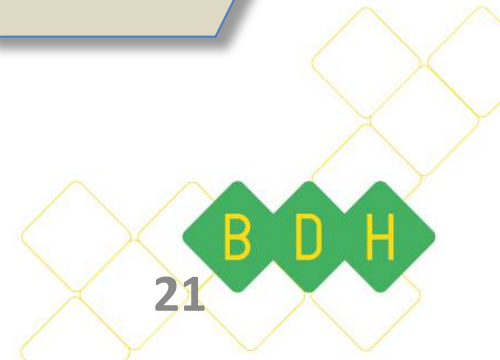
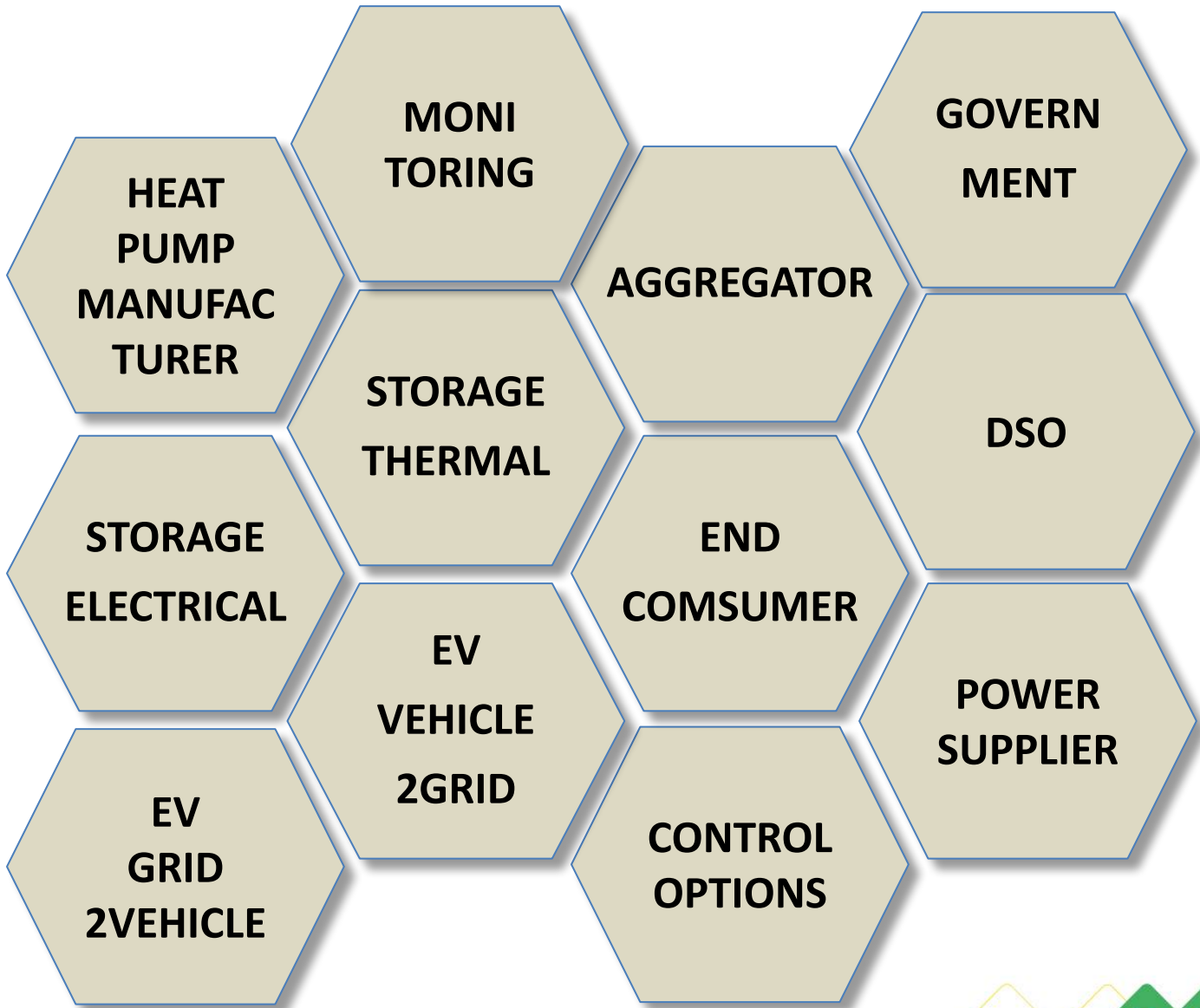
**POWER
SUPPLIER**

**EV
VEHICLE
2GRID**

**EV
GRID
2VEHICLE**

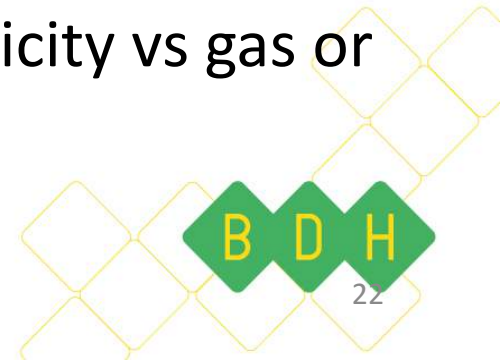
**GOVERN
MENT**

**MONITORI
NG**



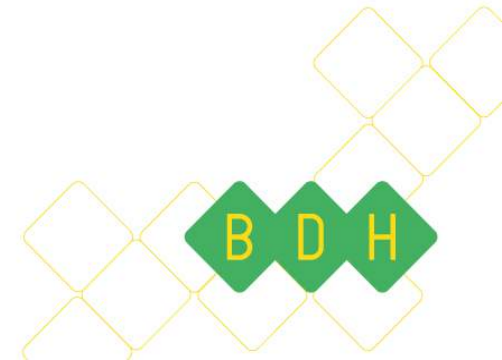
Which problem will we solve? E.g. which opportunity do we offer?

- Disconnect intermittent renewable power supply and heat supply, from asynchronous demand for power and heat.
- Facilitate and 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).



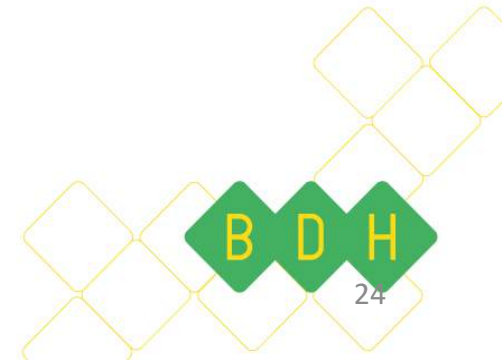
Which problem will we solve? E.g. which opportunity do we offer? (2)

- Energy storage 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 will provide these solutions for certain markets.



Essence of 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.



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.

Support: + cost ▼, lifetime ▲, efficiency ▲

Scope essentials

Research and Innovation with highest priority in 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

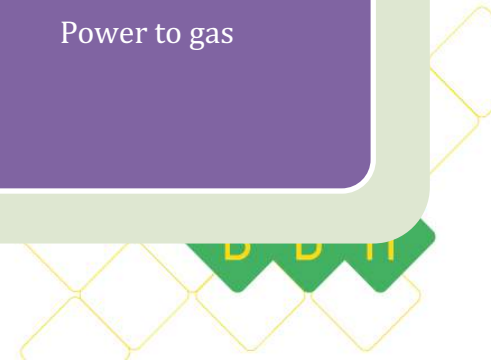
Underground Thermal Energy Storage

High temperature UTES for industrial waste heat

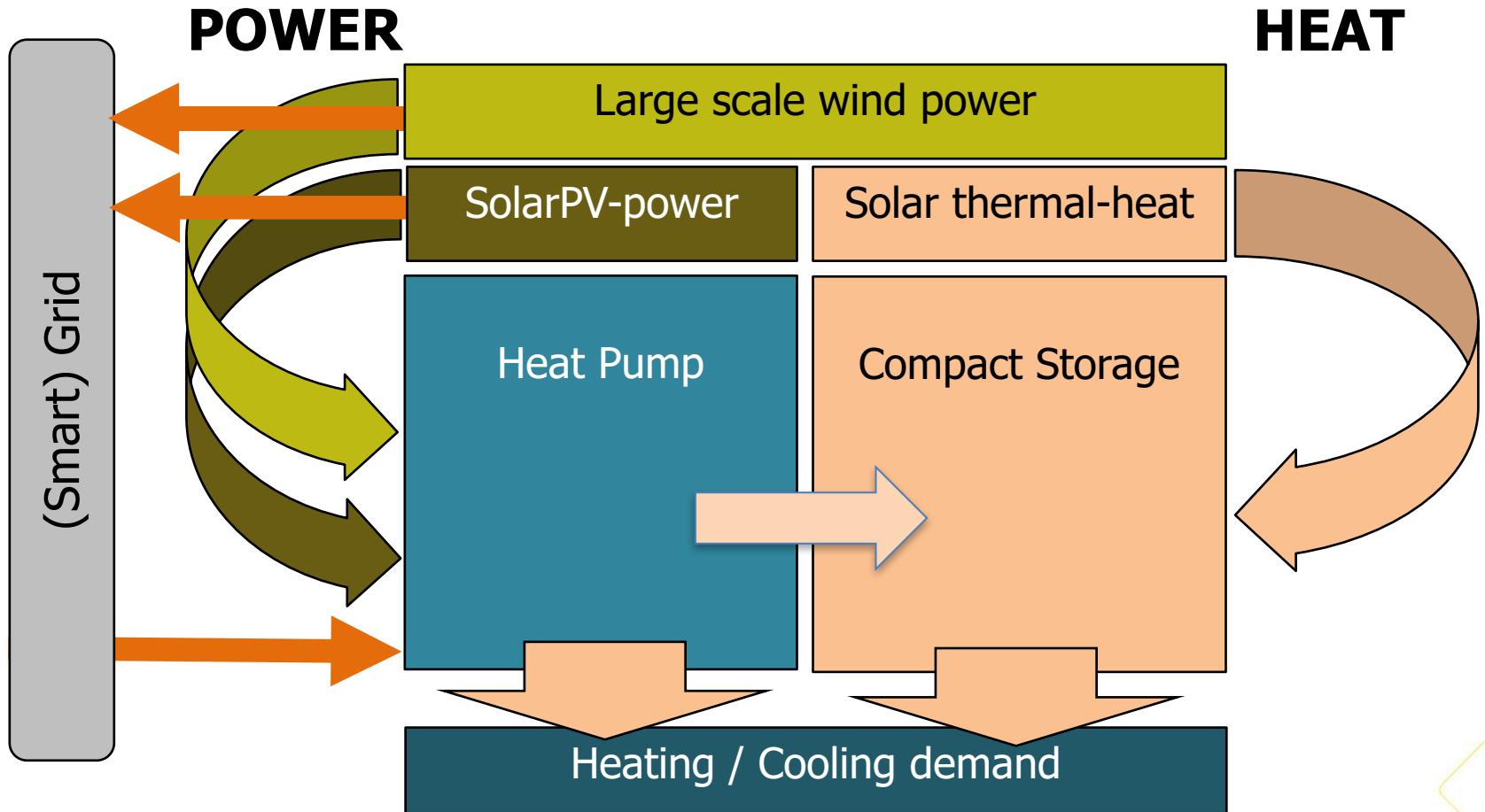
3. Hybrid Energy Storage Options

Power to heat

Power to gas



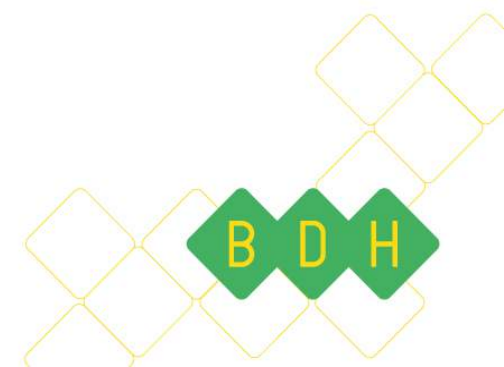
New integral solutions required...



Heat battery = Electrical heat pump + (TCM) storage

Potential participating countries in combined Annex

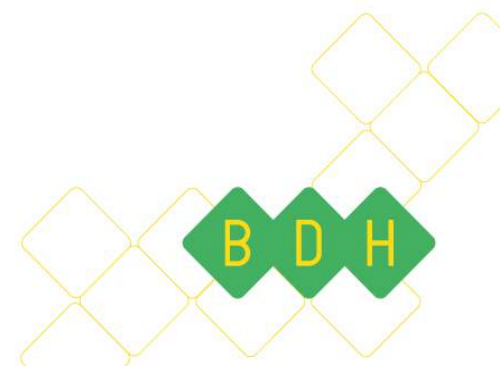
Country	Membership TCP		Interest in combined Annex?	
	ECES	HPT	ECES	HPT
Austria				
Belgium				
Canada				
China				
Denmark				
Finland				
France				
Germany				
Italy				
Japan				
S-Korea				
The Netherlands				
Norway				
Slovenia				
Sweden				
Turkey				
USA				
Switzerland				
UK				



Next steps...

- ✓ Gauge interest during ExCo meetings ECES and HPT
- Draft 1st version of project outline;
- Comments and feed-back step;
- Draft 1st version of Legal Text;
- Organize meeting to discuss;
 - Scope;
 - Draft Legal Text;
 - Project duration;
 - Project budget and financing;
- Finalize Legal Text;
- Meeting to approve Legal Text and formal participation;
- Provide both ExCo's with concrete request for approval;
- Start of Annex (Summer/Fall 2018)







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

**Thank you
for your
attention**