Webinar The Heat is on!

30 March 2023

The heat is on!

Agenda

- Introduction
- The heat is on – Kay van der Kooi
- EWE – Barbara Altmann
- Heat transformation – Dr. Oliver Ruch
- Practical excellence – Tobias Nienaber
- Questions from the audience

The heat is on! - Your presenters

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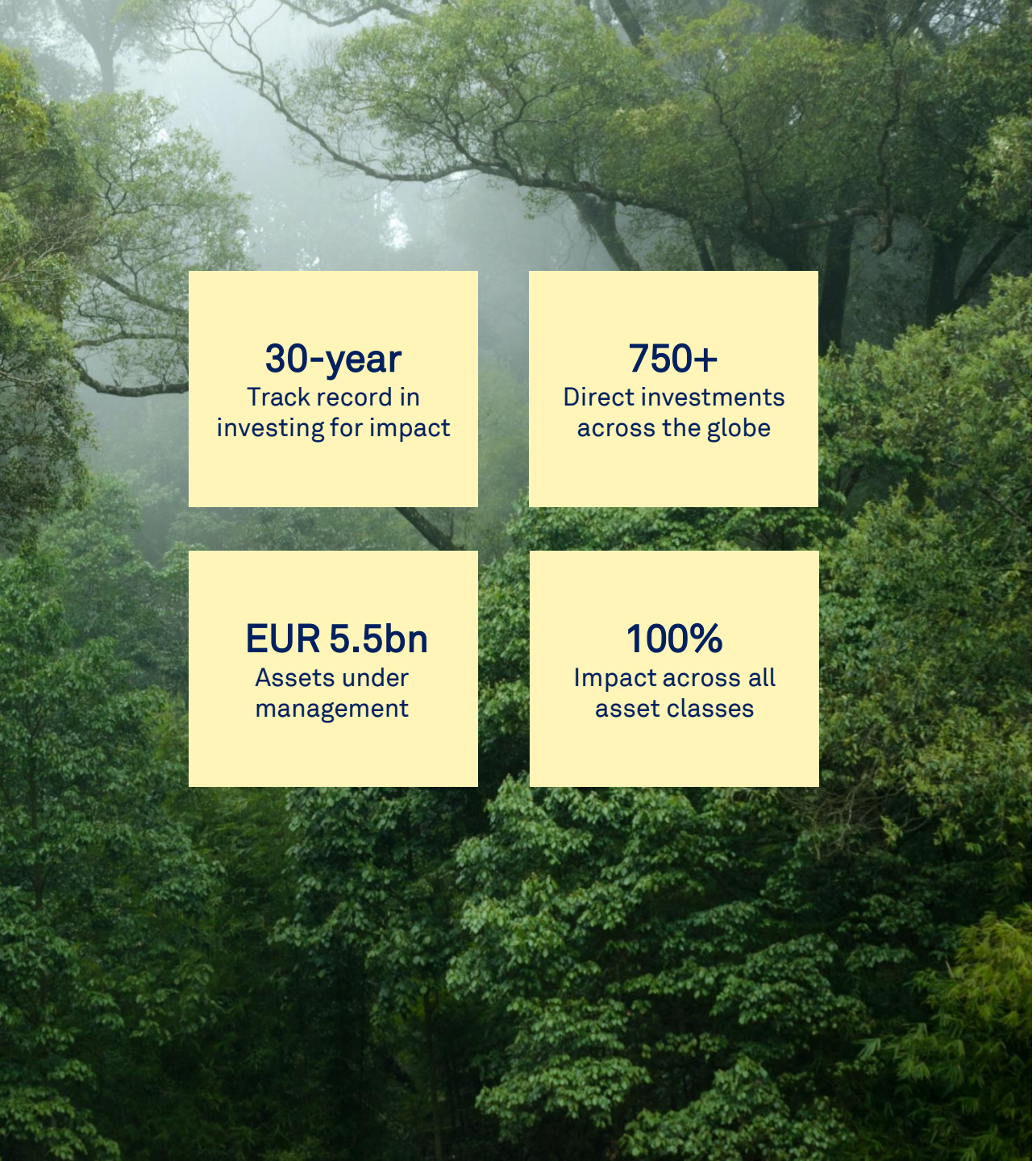

Triodos Investment Management

We are a globally active impact investor.

We see impact investing as a driving force in the transition to a more inclusive and sustainable world.

The Energy Transition – Heat Transition (and now for the hard part)

Triodos Energy Transition Europe Fund operates within EU and UK. EUR180m AUM across electricity generation, storage, energy efficiency. From Equity to debt. SFDR article 9.

Given the EU energy crisis: Heat transition has become a necessity.

EU Green deal
- Climate neutral by 2050
- RED II Directive into REDD III/ Repower EU
- 2.3% per year of RES share increase in heating&cooling starting from 2020 levels

National execution
- Point of departure differs per country
- Regulatory framework differs per country
- Case in point: Denmark versus Netherlands (departure from vision versus departure from necessity)

This webinar covers the heat transition for the built environment. For purposes of scope, we omit industrial heat & cold applications.

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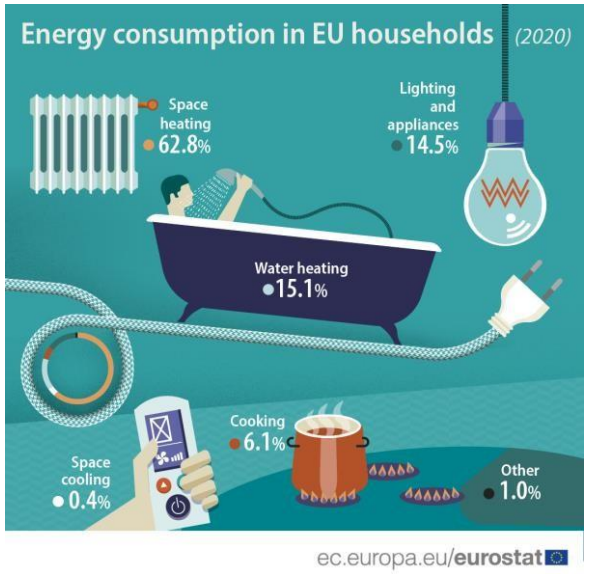
A feel for market size and rule-of-thumb dynamics

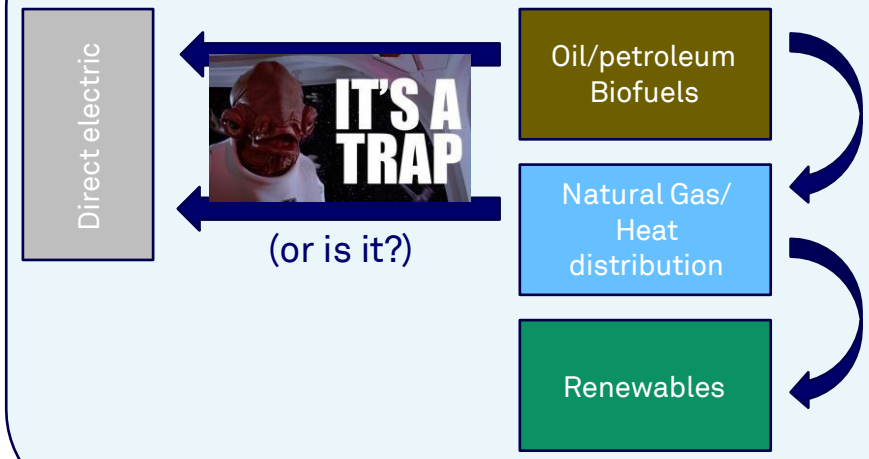


Share of fuels in final energy consumption for space heating (res)

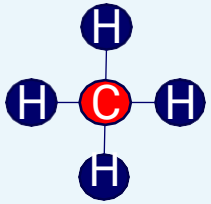
Country	solid fossil fuels & peat	Natural gas	Oil and petroleum	Renewables and biofuels	electricity	Heat distribution
EU	4.2	38.0	15.6	26.8	5.2	10.2
Netherlands	0.0	83.9	0.6	9.3	2.9	3.2
Germany	0.8	43.8	28.0	16.8	1.7	9.0
Denmark	0.0	17.2	3.2	38.0	3.9	37.7
Belgium	0.6	44.1	41.5	10.5	3.0	0.2
France	0.1	35.7	13.6	34.1	12.6	3.9
Spain	0.6	27.4	31.3	32.8	7.9	0.0

*Source; eurostat

Multiple heat transitions



A feeling for impact



≡~ 10KWh

Dutch Natural gas infrastructure **~210GW** (506mn m3/day 2007 peak).

Dutch National Electric grid **~30GW**

Rebound effect!

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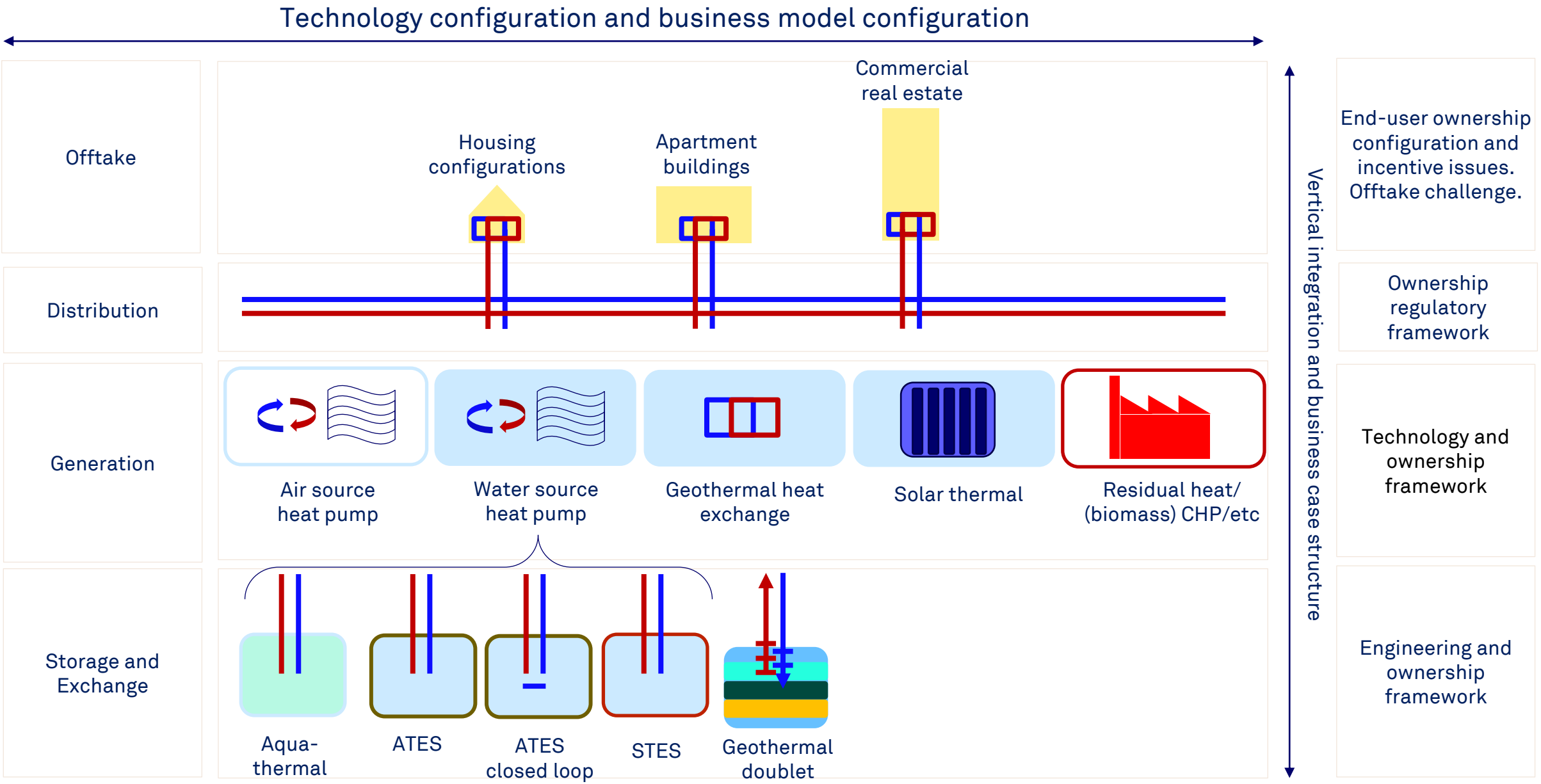
Interaction between technologies and business models



Barriers to the heat transition; forming valuable partnerships

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Technical barriers

- Building era vintages influence required intervention
- Shortage of qualified installation professionals
- Technology demand outstrips supply
- Electrification of heat/cold puts additional challenge to Electricity transition

Legal & legislative barriers

- Policy framework transition from incentivized to mandatory
- Complex interplay of contractual obligations and ownership structures from development to operation of solutions

Socio-economic & geographic barriers

- Ownership is unevenly distributed (social rent, fee sector, ownership) and as such incentives are misaligned
- Biomass to oil, oil to gas, gas to electrification – different member states at different stages
- Energy inequality

Financial barriers

- Long project lifetimes (30 yrs)
- Heat/cold supply versus or in combination with rent/lease of installation
- Onboarding risks for collective installations
- Offtake risks with single sector exposure

Application to Newly built environment

Initiates	Develops/ operates	Offtake
Real estate developer	ESCO	Owner/renter & HOA as key contract party

Vertically integrated business model (within hand). Engineered to fit. Potentially mandatory under regulation, uniform contractual structure for development and operation. Long-term offtake/operations/ownership, oversight by regulatory authorities.

Application to existing built environment

Initiates	Develops/ operates	Input	Offtake
Cooperative? Municipality? Housing corporation? Utility?	ESCO? Grid operator? Utility?	Residual heat? Collective installation? Geothermal?	Individual owner/renter and foundation?

Potentially vertically separated business model. Engineering for broad offtake. Various regulatory (dis)incentives may apply. Risk of multiform contractual structures. Duration of rights for different assets may vary as may oversight by regulatory authorities.

COOLING & HEATING AS A UTILITY

SHAPING THE FUTURE OF ENERGY – TOGETHER!

Oldenburg, 30.03.2023

Presented by Barbara Altmann, Dr. Oliver Ruch & Tobias Nienaber

EWE

Shaping the future of energy – *together*!

Revenue
EUR 6.1 billion

EBIT
EUR 354 millio

Employees
9,500

Facts and Figures (2021)

Clients

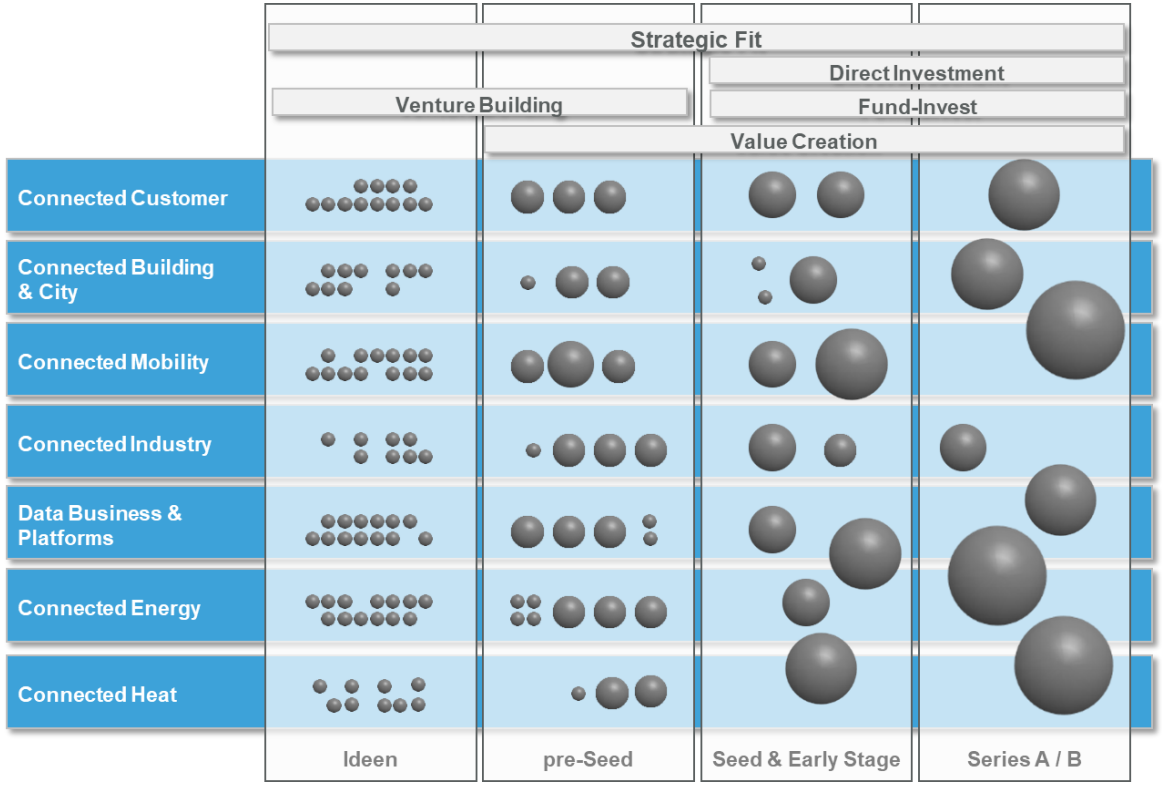
Electricity
1 million

Gas
0.6 Million

Telecom
0.7 Million

EWE | VENTURES

The goal is a balanced portfolio of digital business opportunities



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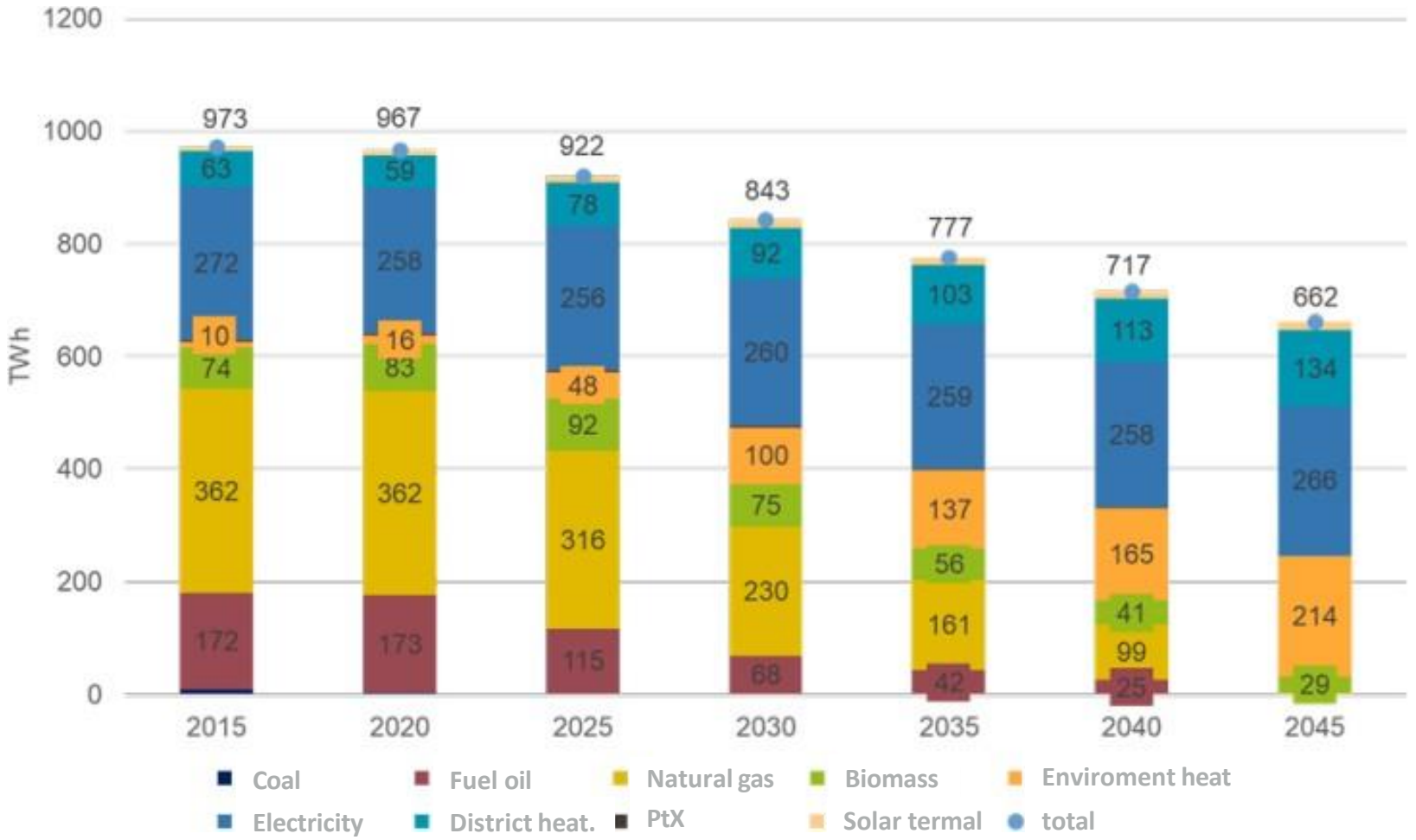
Heat Transformation

Dr. Oliver Ruch

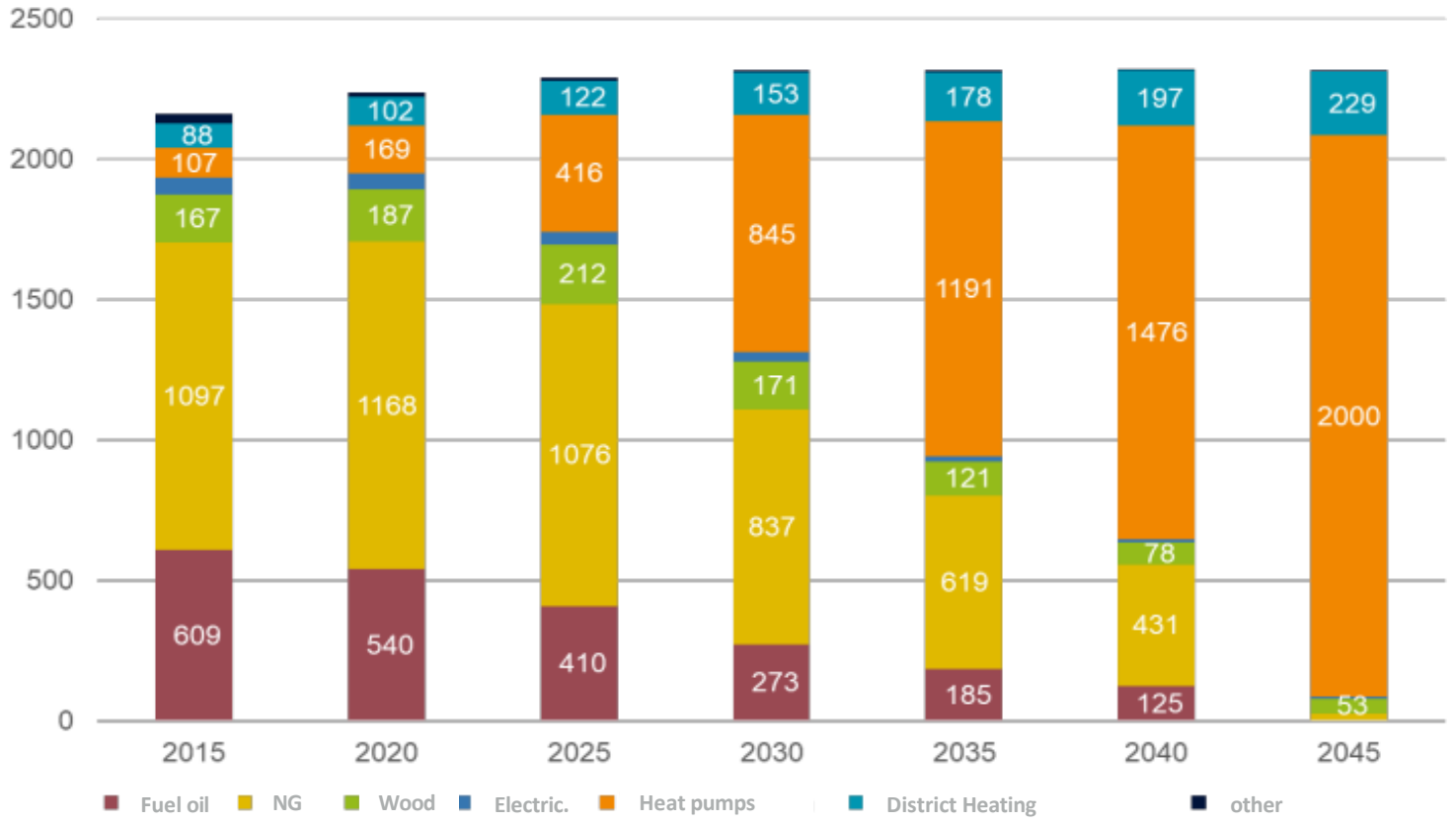
Energy consumption in the building sector, by energy source, in TWh



- Climate protection goals require a reduction of energy consumption.
- Due to the falling energy consumption become new generation technologies be required.
- The buildings play a special role.

Source: Federal Ministry for Economic Affairs and Climate Action; 2023

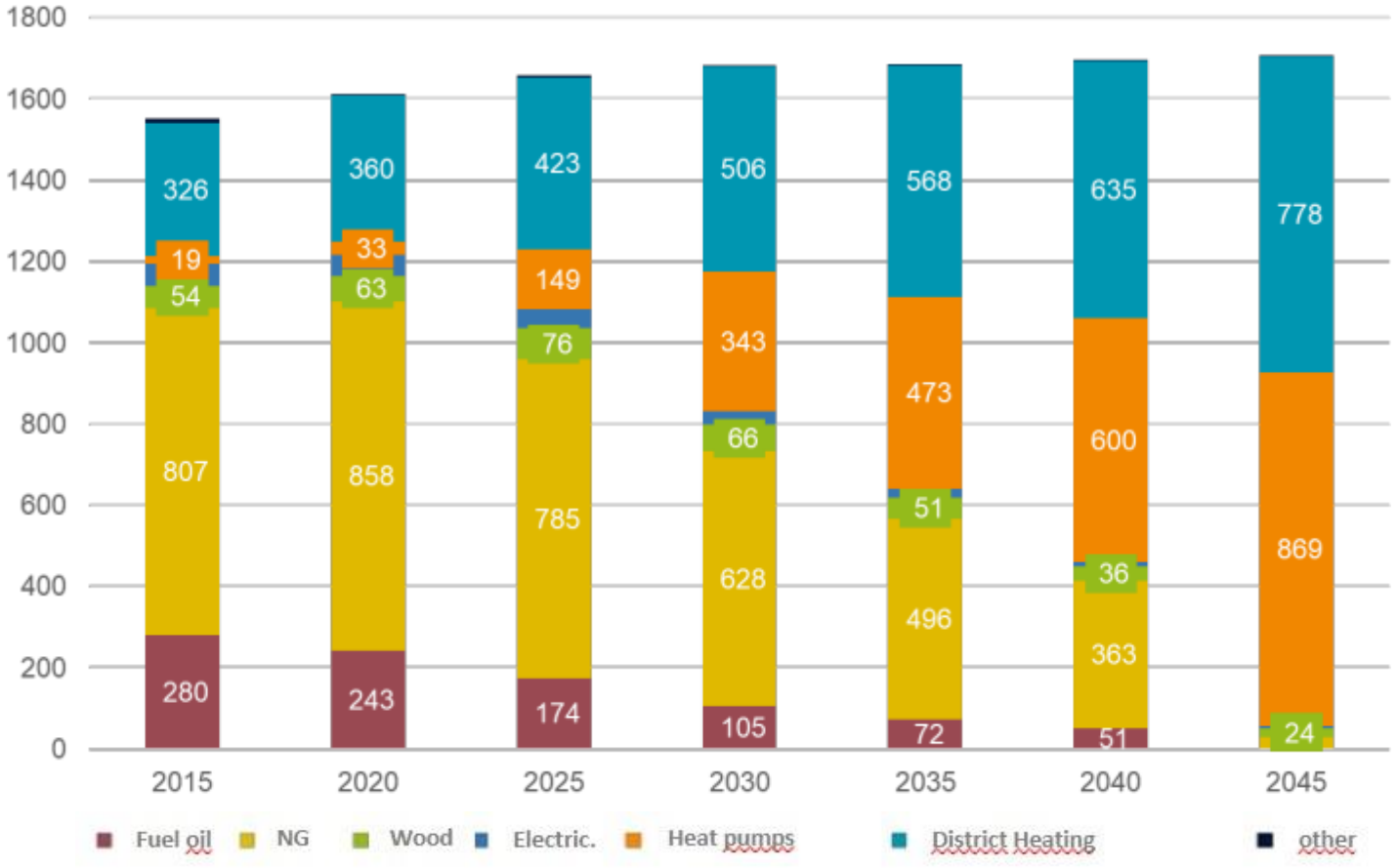
Heating structure according to installed heat generators in single and two-family houses, broken down by living space in million m²



- Heat pumps will be used in detached or semi-detached houses in the future.
- This requires a massive ramp-up of the heat pumps.
- These will work at a low temperature level.
- As a result, the building envelope has to be renovated.

Source: Federal Ministry for Economic Affais and Climate Action; 2023

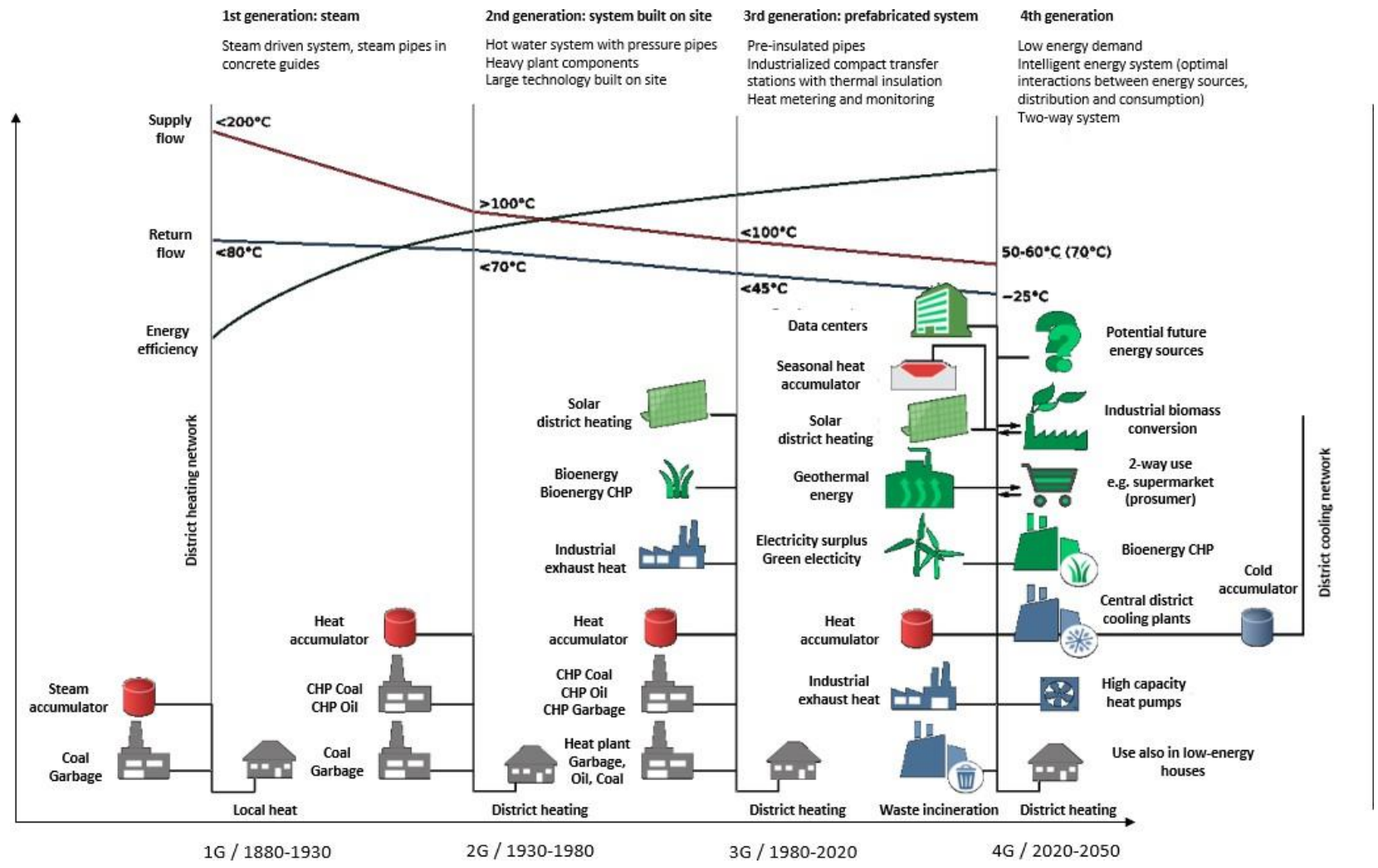
Heating structure after installed heat generators in apartment buildings, broken down by living space in million m²



- In urban areas, heating networks will be used in the future.
- This requires a massive intervention in the infrastructure of the municipalities.
- There are differences between East and West Germany.

Source: Federal Ministry for Economic Affairs and Climate Action; 2023

Transformation process of district heating supply



Source: Aalborg University; 2018

- Gradual addition of fossil primary energy carriers.
- Integration of renewable energies.
- Networking of generation, storage and application.
- Goal by 2045 - climate-neutral heat supply.

EWE

Practical Excellence

Tobias Nienaber

Special challenges in modern heating networks

Each project has to be viewed holistically. This means that the energy production as well as the energy demand as well as the environment must be captured.

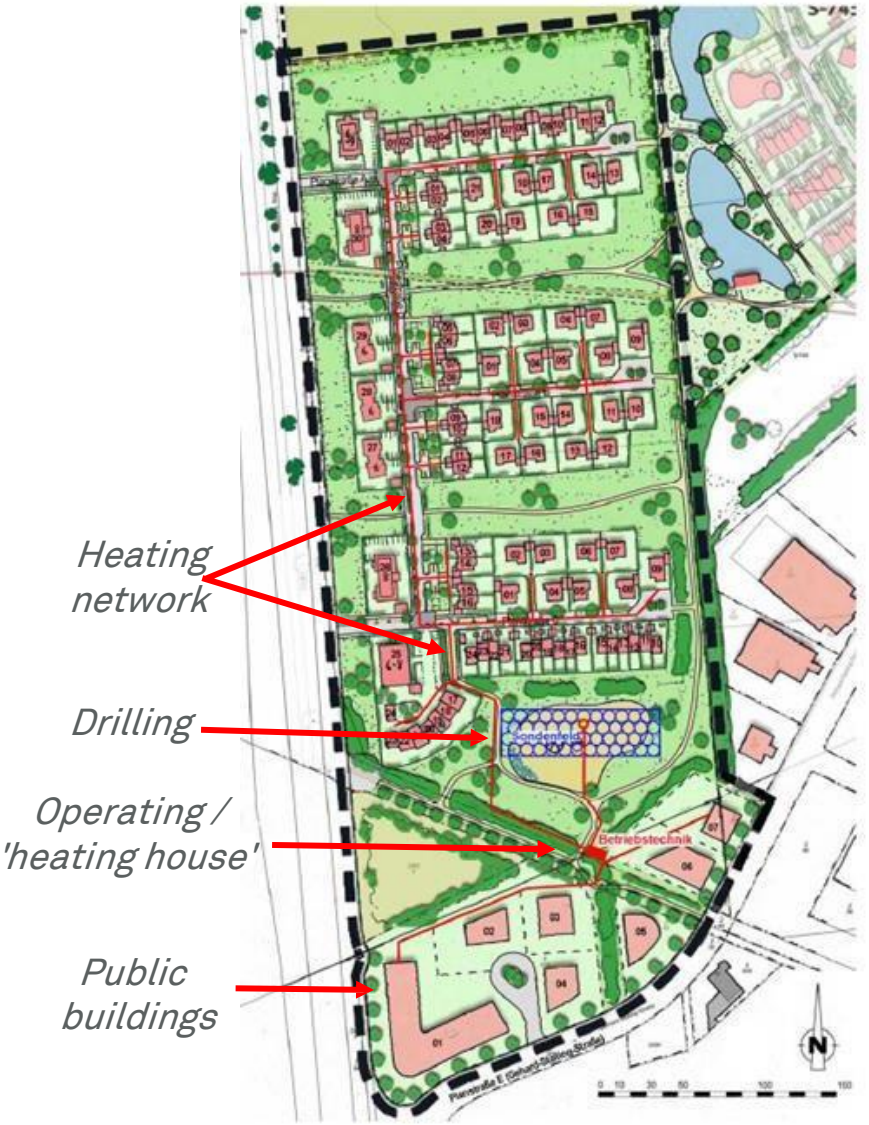
In the picture, the conditions appear to be ideal at first glance:

- Enough space and drilling is possible
- A new district / quarter in a town that is to be connected to a heating network

On second glance the same conditions

- Density of the buildings is too low --> heating network will be long (heat losses)
- Too few buyers, not enough apartment buildings
- New buildings mean high energy standards, which results low consumption

➢ The project is unprofitable compared to individual air-to-water heat pumps.



Expansion of a heating network with a heat pump

An existing heating network is operated with natural gas in gas boilers

It is now to be expanded and the energy required for this is will be provided by an air-to-water heat pump

Challenges are:

- Place of installation (weight on roof)
- Temperature (60°C)
- Integration of the heat pump on the water side (plate heat exchanger)

In the long term, the heating network is to be completely green. A temporary solution could be use of biomethane.

Existing gas boiler

New air-to-water heat pump

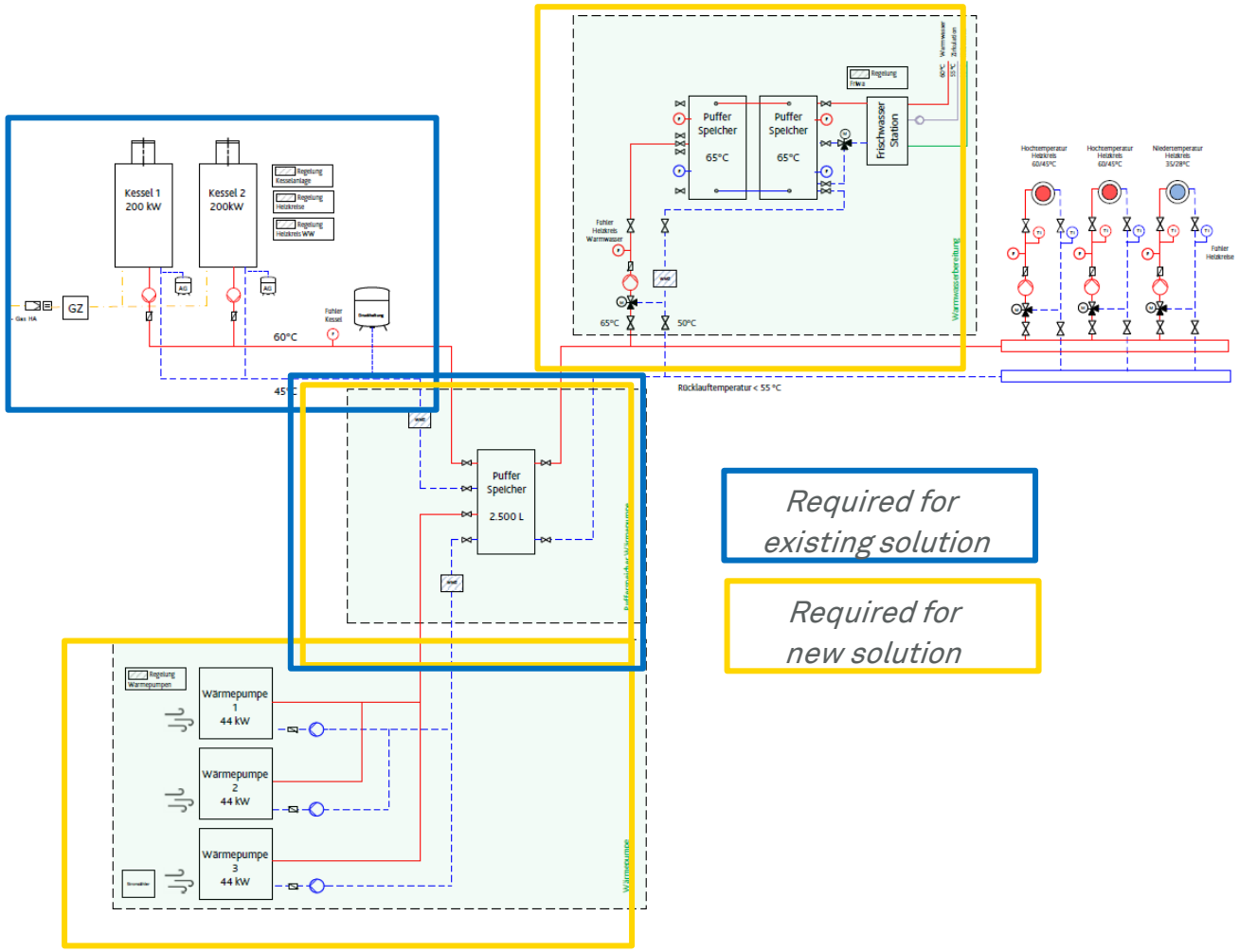
Conversion from gas boiler to heat pump

An individual customer wants to replace gas boilers with a heat pumps.

Challenges are:

- Space requirements inside, larger storages are required (hybrid solution cannot be accommodated)
- Space requirements outside, air exhaust
- Lower temperature (55°C, secondary system adjusted)
- Noise emissions

With the use of green electricity or photovoltaics, the proportion of renewable energy can be further expanded.



Questions from the audience

How to address the tight supply market in insulation and sustainable equipment companies? How to face the need of mobilised capital (mostly from third parties) for projects in favour of less wealthy people?
We are considering entering strategic partnerships with other companies in the industry to share resources and expertise and reduce costs. This can help us address supply chain issues and improve our competitive advantage. We also assume that the offer will be adjusted to the needs of the market in the medium term. In addition, we could imagine that funding programs for socially disadvantaged people will make a big different.

Can you elaborate on the need for storage?
The storage of heat is important to be able to use the primary energy efficiently and at the same time to be able to compensate for the volatility of renewable energies. These applications can be easily implemented in urban areas with heating networks.

Barbara Altmann showed a graph on page 10 which refers in almost all cases to connectivity. Why is connectivity so important in energy transition?
Connectivity is essential for the successful transition to a more sustainable energy system. It enables the integration of renewable energy sources, efficient energy management, electric vehicle charging, and digitalization. This includes the use of data analytics, artificial intelligence, and the Internet of Things to optimize energy production and consumption. These technologies rely on connectivity infrastructure to collect and transmit data in real-time, enabling decision-making that can improve energy efficiency and reduce greenhouse gas emissions.

Could you share your thoughts on geothermal heating in the context of the energy transition at EWE?
Geothermal energy will be an important part of the heat transition. This is particularly suitable for higher energy requirements and when there is sufficient space for drilling. This can be particularly interesting for heating networks. At the same time, the investment costs are higher due to the drilling, the drilling companies have a high workload, there are stricter requirements due to mining law and the soil must be of a suitable condition. It is therefore necessary to weigh up which technology is used for each project.

Is there a real alternative to natural gas central heating other than heat pumps? Is there a possible conversion of existing gas water heaters to another green fuel?
Green fuels are currently not available on the market in the quantities required to power existing gas water heaters. In Germany, governments focus on the heat pump and believes in it. Other technologies include geothermal energy, solar panels or biomass (e.g. pellets, wood), the latter currently not being funded.
However, an individually suitable solution must be found for each location. Since heat pumps often deliver heat at a low temperature level, an electric boiler must also be integrated for hot water generation.