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Agent-GIS-5GDHC

5GDHC implementation potential in urban areas with existing district heating systems

Baltic-Nordic Energy Research Programme: Techno-economic performance and feasibility study of the 5GDHC technology using agent based modelling and GIS

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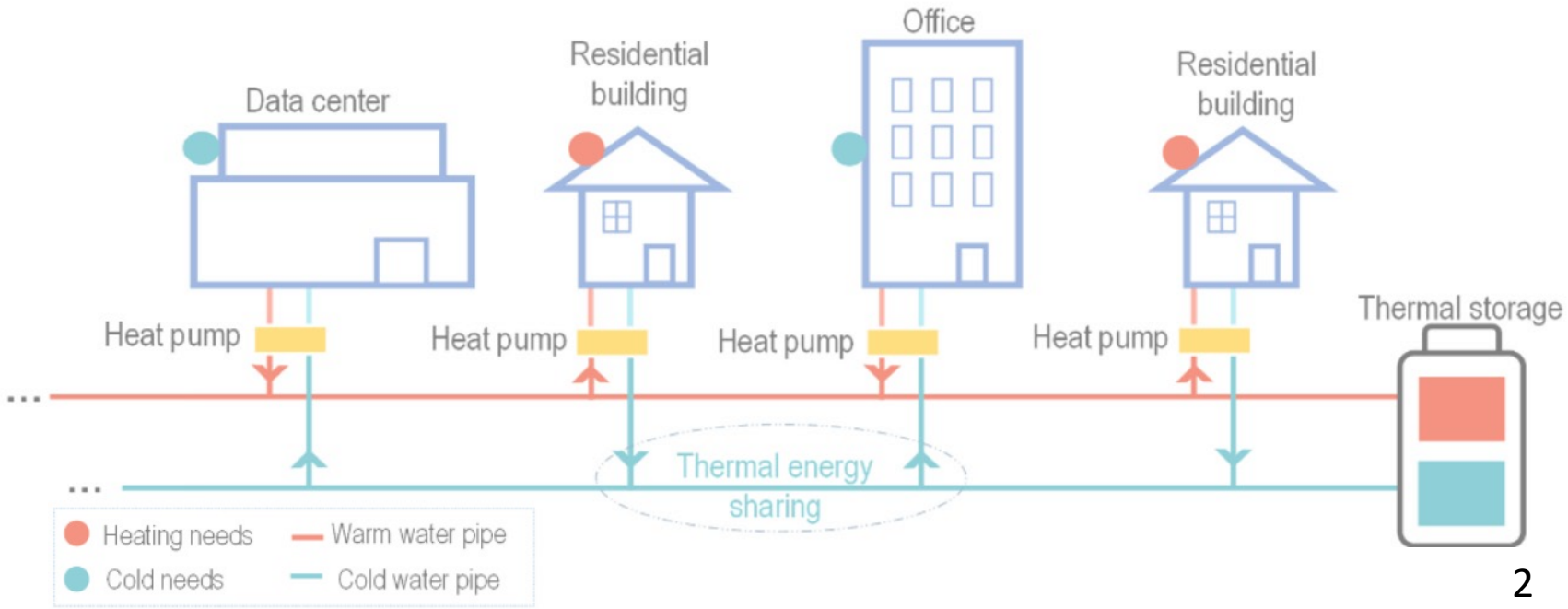
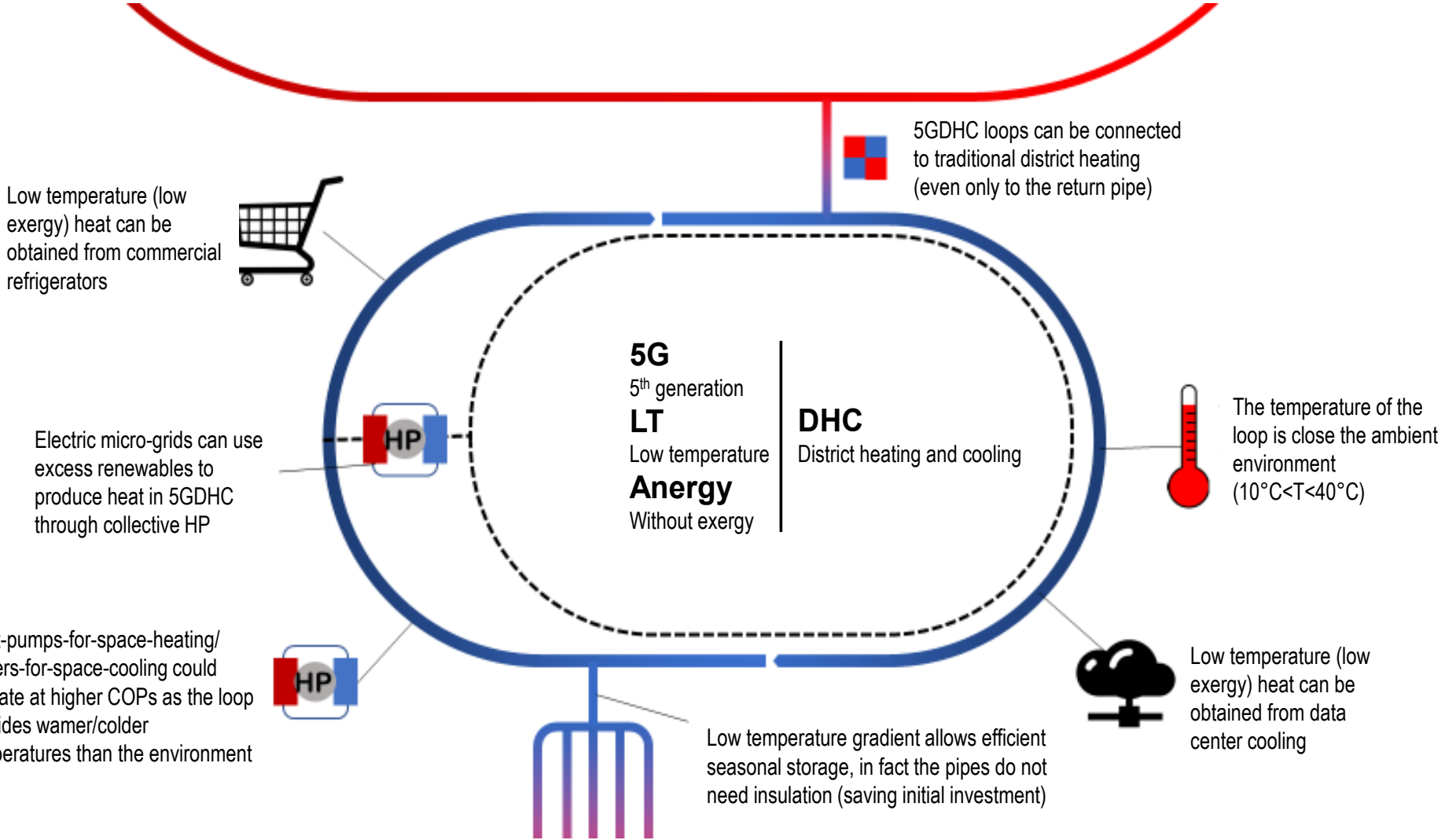
Outline

1. Definition of 5GDHC
2. Agents in 5GDHC
3. Barriers and drivers



1. Definition of 5GDHC

Definition



1. Definition of 5GDHC

Main characteristics

- **Bi-directional** operation: possibility to distribute heating and cooling simultaneously;
- Ultra **low temperatures**: very close to the surrounding ground temperature;
- Prosumers /**heat sharing**/heat-cooling exchange;
- **Decentralised flow**: enable multiple heat sources and heat sinks in the network.

Research gap: Until now, there is still a lack of feasibility study for early opportunities and potential barriers.

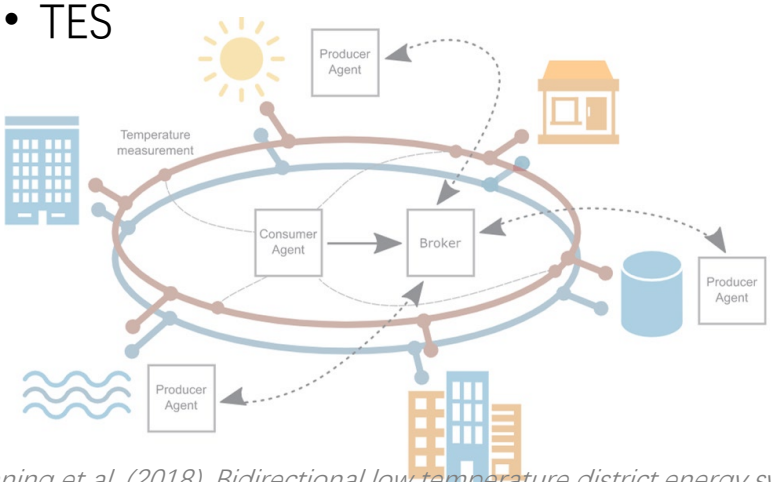
2. Agents in 5GDHC

Agents

- Office buildings
- Healthcare
- Industries
- Data centers
- Shopping malls
- Water heat exchangers
- Electric transformers
- TES

Cold/heat dominated

Different profiles



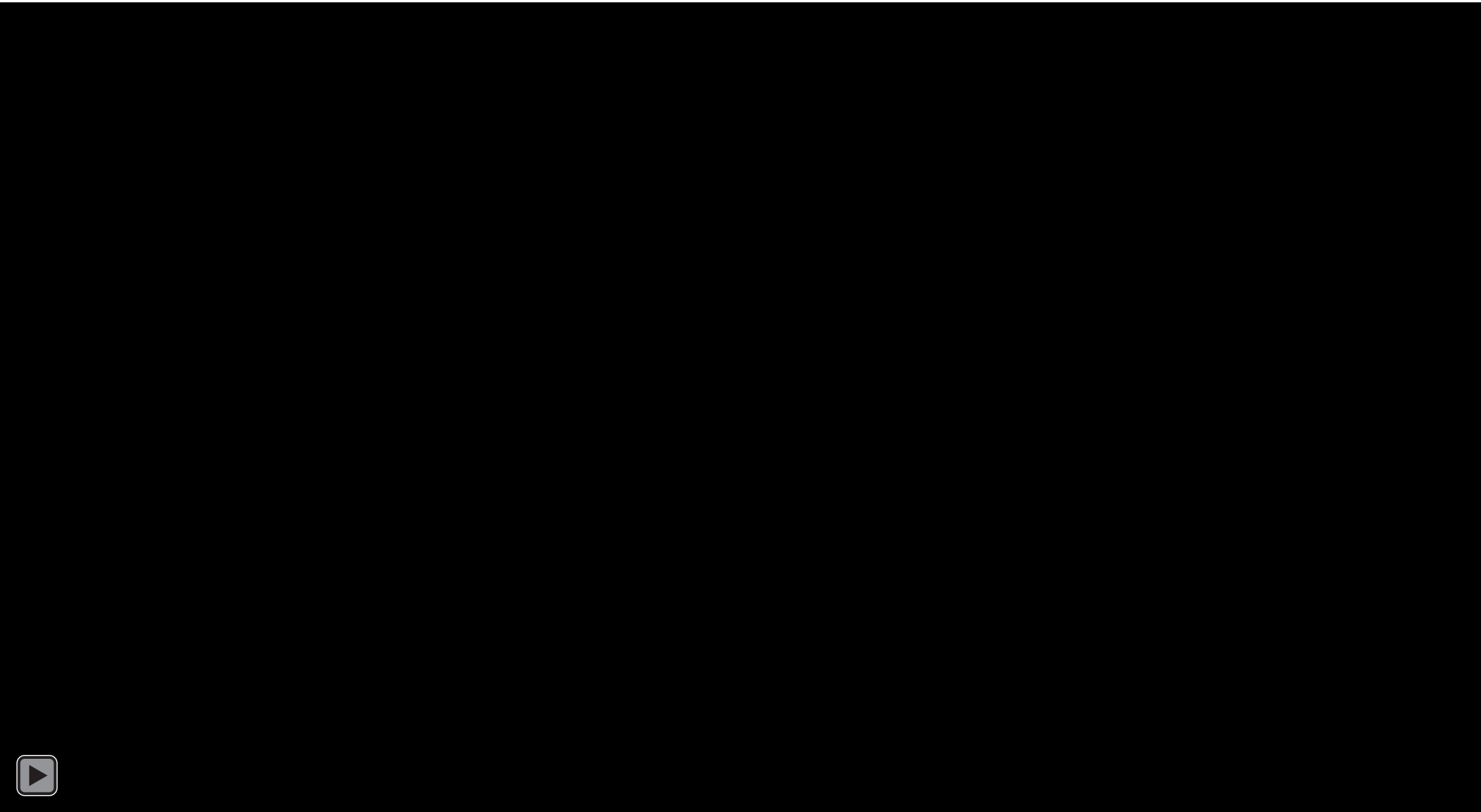
Heat sources

- Urban low-grade excess heat without HP
- Sea water
- Lake/river water
- Ground water
- Air
- Solar heat + individual solar panels
- Intercoolers of combined heat and power
- Geothermal wells
- Borehole TES
- Sewage water
- Mine water (from flooded mines- 15°C)
- Electrical transformers

Source: Bünning et al. (2018). Bidirectional low temperature district energy systems with agent-based control: Performance comparison and operation optimization. Applied Energy, 209: 502-515

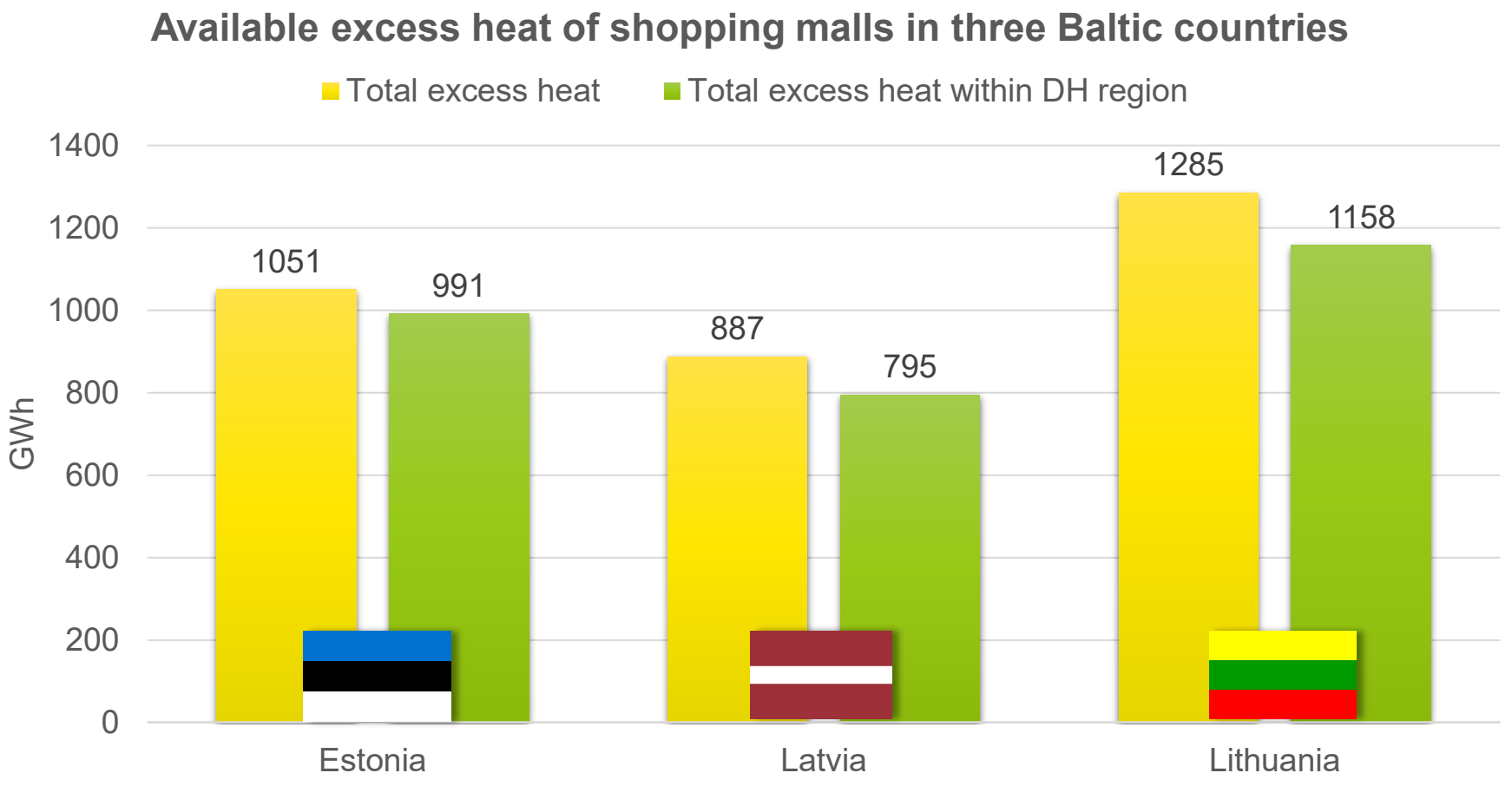
2. Agents in 5GDHC

Agents-Shopping malls

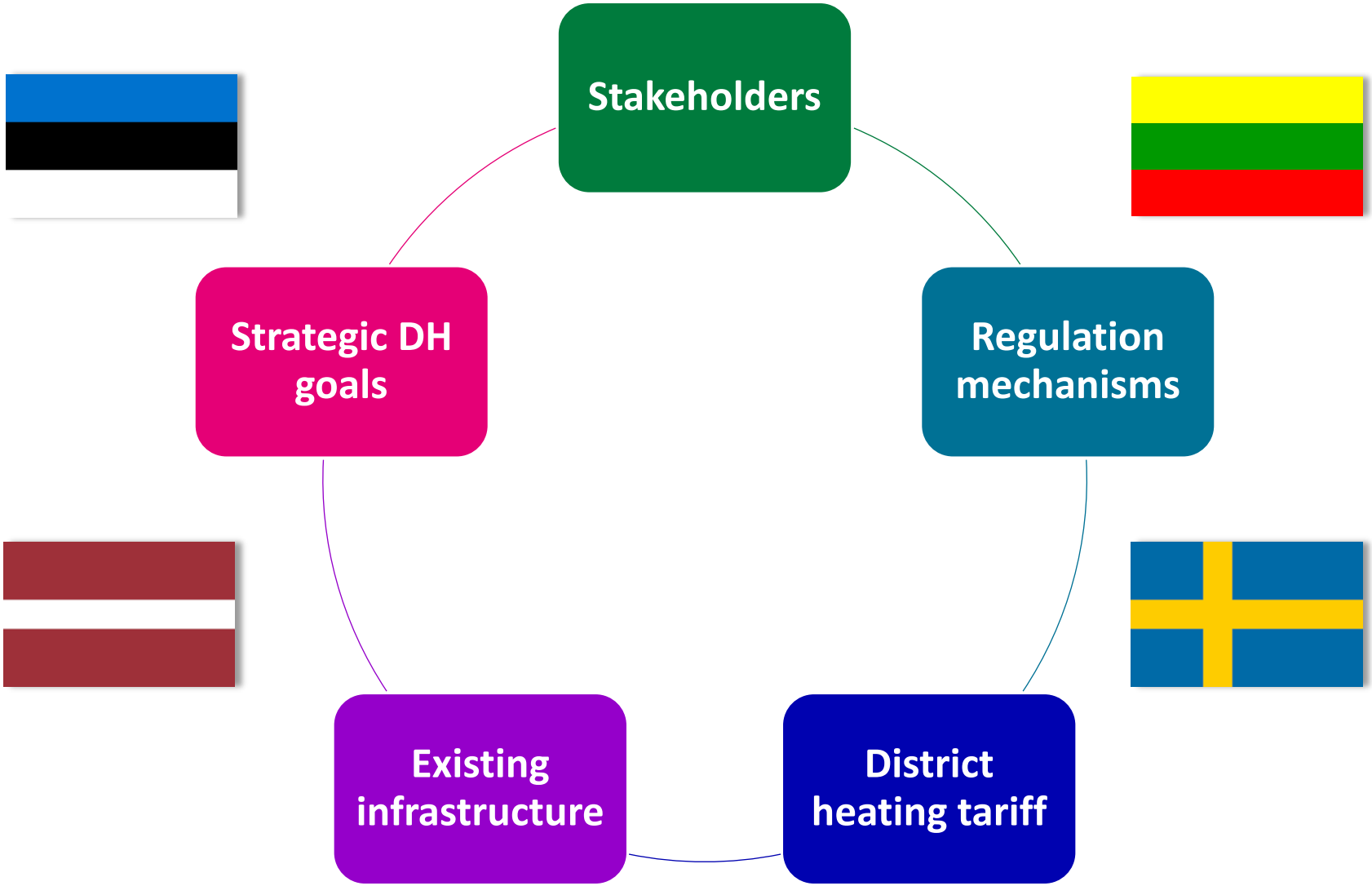


2. Agents in 5GDHC

Evaluation of the excess heat potentials in shopping malls



3. Barriers and drivers



3. Barriers and drivers

Strategic DH goals

Estonia: National Development Plan of Energy Sector 2030 (NDPES 2030). 11 TWh of the total heat demand will be met by biomass in 2030, and **80%** of district heating in Estonia will be provided using renewable sources

Lithuania: In 2020 renewable energy sources had a share of 71.5% of total energy production in district heating networks. It raised a goal to increase this percentage to **90%** by 2030 and reach **100%** by 2050.

Latvia: National Energy and Climate Plan (NECP) draft of Latvia 2021-2030. Share of RES in district heating increases by about 0.8–1.0 percentage points per year in the period from 2020 to 2030 and reaches **57.6%** in 2030

Sweden: Heat Roadmap Sweden. 'deep decarbonisation' is taken to mean a moving towards a 95% reduction in CO2 emissions by 2050, compared to 1990 levels.

3. Barriers and drivers

Stakeholders

Estonia: DH operators are mainly **private** companies.
E.g., Utilitas, Adven, Fortum, SW Energia, N. R. Energy

Lithuania: DH operators include both **private** and **public** operators.
E.g., 52 heat suppliers (25 regulated and 19 non-regulated by NERC)

Latvia: DH systems are mainly owned by local **municipalities** and, in some cases, **private** owners.

Sweden: There is a **transformation** from municipal to diverse ownership, decreased municipal ownership and increased internationalization

3. Barriers and drivers

Regulation mechanisms

Estonia: DH network is regulated by **District Heating Act**.
E.g., DH operator is responsible for network's operation and maintenance, even if the network belongs to local municipality.

Lithuania: DH sector is regulated by the **Law on the Heat Sector**.
E.g. Main authorities include Government of the Republic of Lithuania; Ministry of Energy; Ministry of the Environment; National Energy Regulatory Council (NERC); Municipalities.

Latvia: There is **no specific** laws for the DH sector.
The main legal act covering DH is the Energy Law

Sweden: DH network is regulated by **District Heating Act**.
E.g., DH operator is responsible for network's operation and maintenance, even if the network belongs to local municipality.

3. Barriers and drivers

District heating tariff

Estonia: The price limit for the district heating must be justified, cost effective and enable the company to perform the obligations provided by law.

Lithuania: The National Energy Regulatory Council (NERC) sets the basic price of heat. Council of Municipality determines specific components of the heat price. Heat supplier calculates and publishes the final heat prices.

Latvia: Heating tariffs depend on many factors, including the size of the system, the used fuel, technical conditions of the system, and even political aspects. Heat production, transmission and distribution are public services that are regulat the Public Utilities Commission.

Sweden: The most common is that companies use a variable price, but also fixed and effect-based prices occur in fairly large extent.

3. Barriers and drivers

Existing infrastructure

Estonia: Mostly space heating, domestic hot water; some provide district cooling; some also produce electricity.
System: 3rd generation DH network

Lithuania: Mostly space heating, domestic hot water.
System: only first steps of reducing temperatures were realized in Lithuanian capital for the summer time

Latvia: Mostly space heating, domestic hot water.
System: 3rd generation DH network

Sweden: Mostly space heating, domestic hot water; some provide disctrict cooling; some also produce electricity.
System: 3rd, 4th generation DH network

3. Barriers and drivers

BARRIERS

- Dependency on the electricity system
- High initial costs
- Specific new infrastructure required
- The increase of the electricity price
- Financial sources (lack of adequate funding, financing products)
- Awareness (lack of skilled personnel)
- Institutional and administrative barriers
- Market barriers
- Lack of public acceptance
- Regulatory and policy barrier
- Separate pipes are needed to provide both heating and cooling
- Centralized production of energy which restricts network expansion area
- Dwelling spatial impact and dwelling noise

DRIVERS

- Climate change goals (low GHG emissions): e.g. stop using natural gas
- Geopolitical implications of using imported natural gas
- Ambitious energy transition targets of the country
- Reduced price volatility
- Positive effect on health
- Strengthening energy security
- Creating local economic value and jobs
- Increase access to affordable, reliable and sustainable energy for heating and cooling
- Ability to recycle waste heat

About the research consortium

Four partners in the Baltic-Nordic region

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Thank you!

Q & A

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