Suitable business models to promote 5GDHC implementation

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Challenges in 5GDHC

Business model for both heating and cooling

Higher investments

Involvment of prosumers

The necessity for consumer engagement

Innovative pricing mechanisms;

Should be consistent with alternative heat tariffs

Country/location specific conditions

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A classic business model for DH system

Modified from Business Model Canvas at Strategyzer.com

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5GDHC business model

- **Key partners -** more collaboration and key partnerships
- **Key activities-** shift from production to services
- **Key resources -** new types of competences
- **Cost structure –** more variation in costs
- **Value propositions –** different for different customers
- **Customer segments –** more diversified
- **Customer relationship –** more intense, educational
- **Channels-** different channels will be used for different customers segments
- **Revenue streams-** more diversified many small

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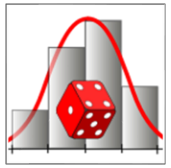
Workflow

Design, test and evaluate at the community level

Game theory Management 5GDHC

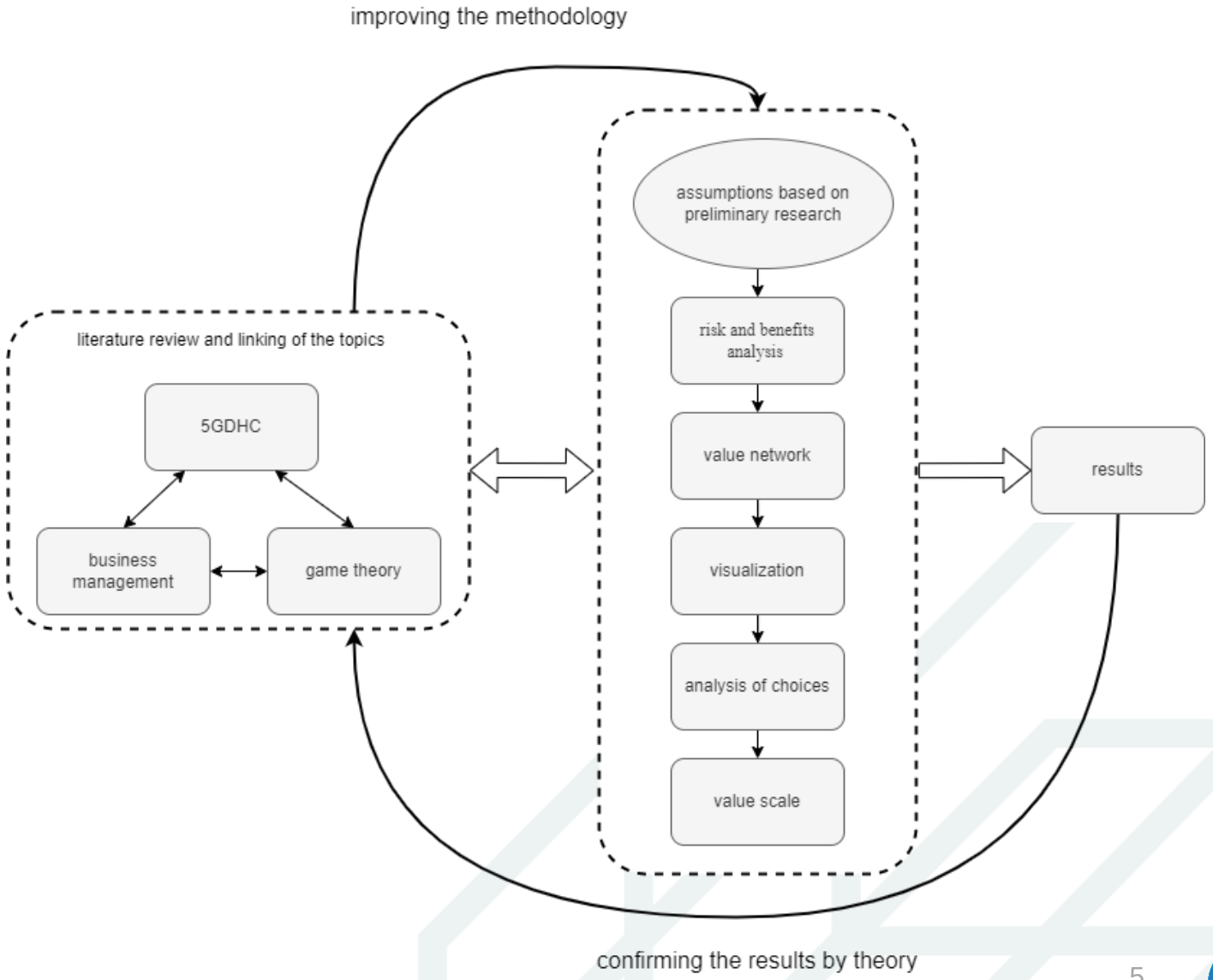


Game theory where various probabilities occur

The process is iterative

Co-opetition principles

Detecting the process for the initiator



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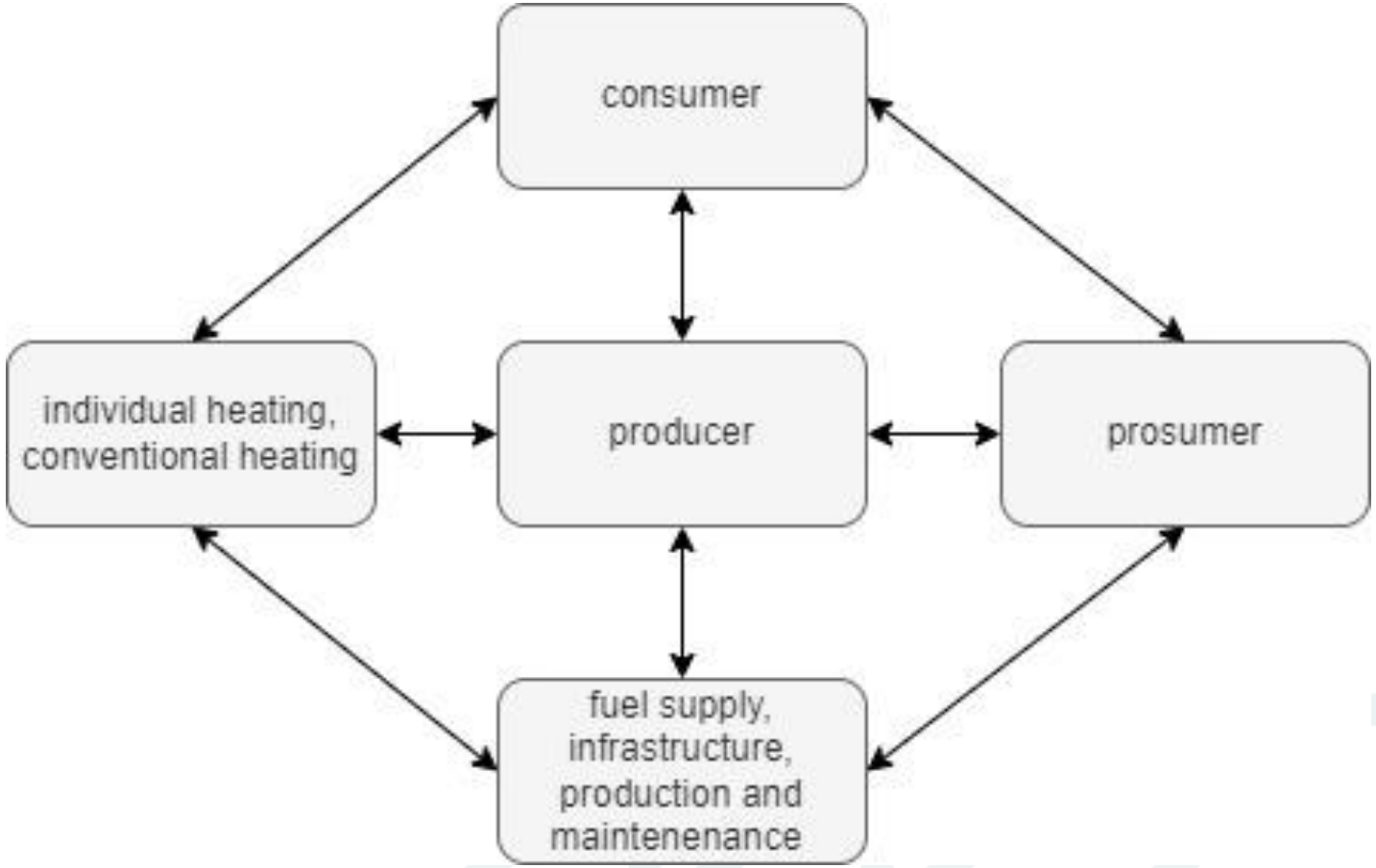
The value network

Prosumers as key participants

Without the prosumer, the whole network cannot exist

Prosumers might push for equal prices for heat and cooling, making heating more expensive



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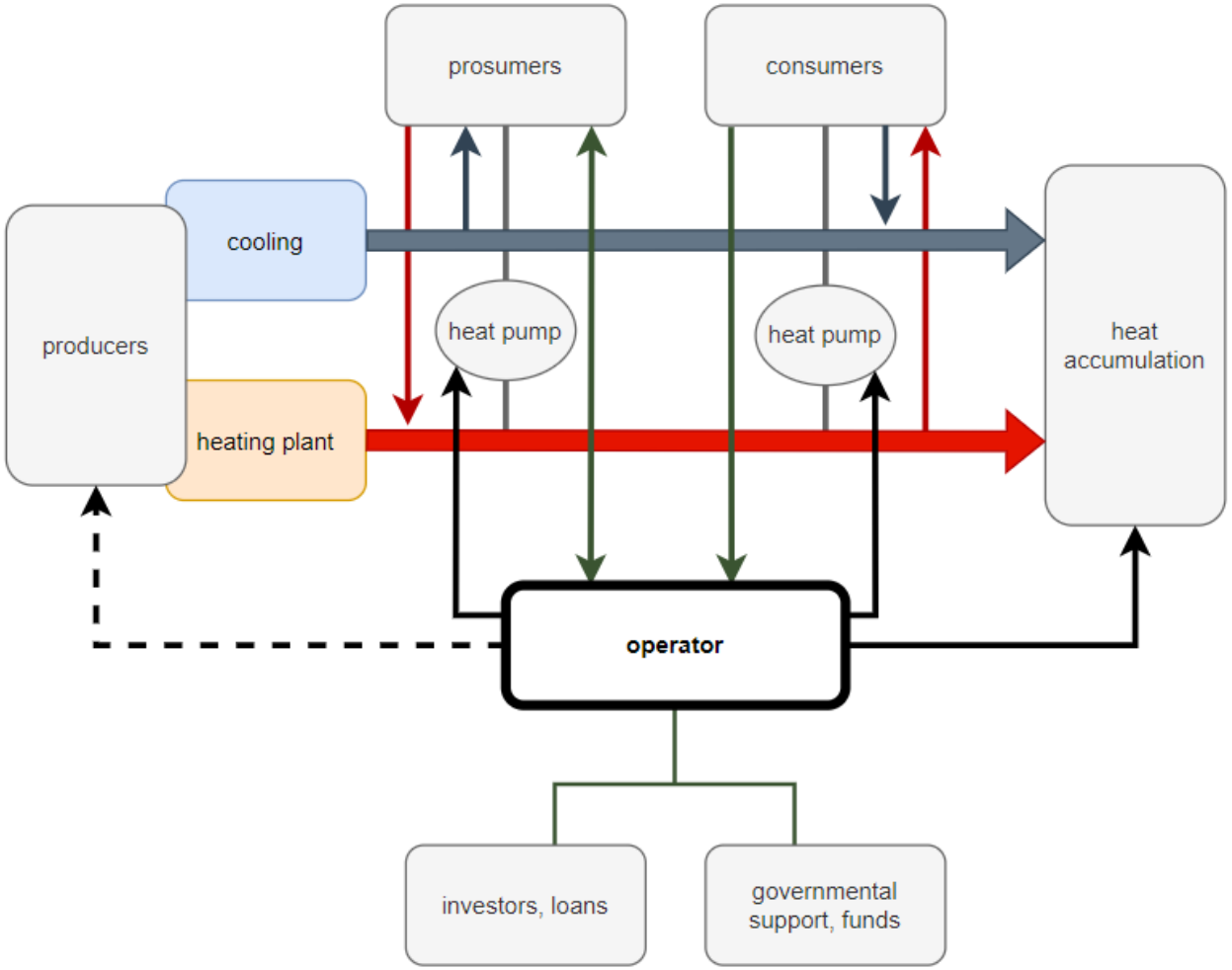
Scenario 1 (a)

Thermal Energy Purchase Agreement

the district heating operator owns the network and sells services to end-users

- The owner’s responsibility is to maintain the infrastructure
- The operator is the central point for all financial deals



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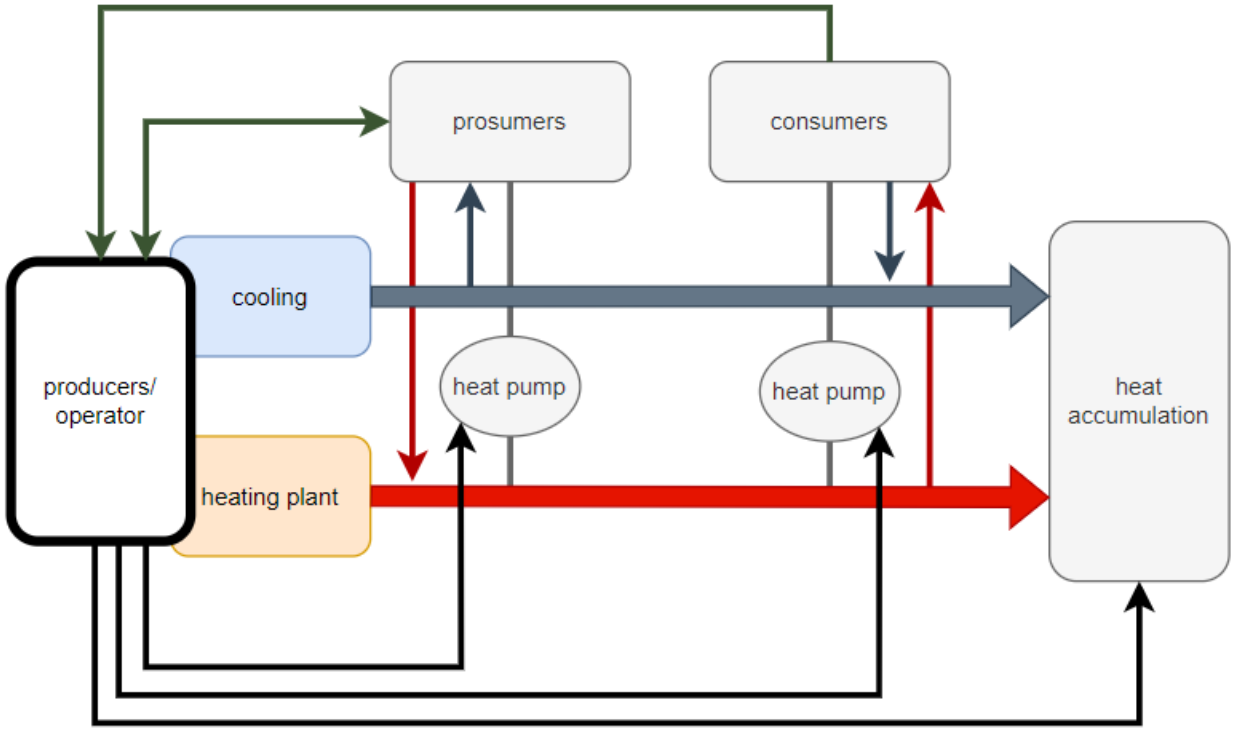
Scenario 1 (b)

- The owner has the highest business potential and the greatest financial risk here
- The owner will put the business interests first.
- Most likely not be the cheapest option for the consumer, but it is the most hassle-free
- Extra participants always mean extra costs



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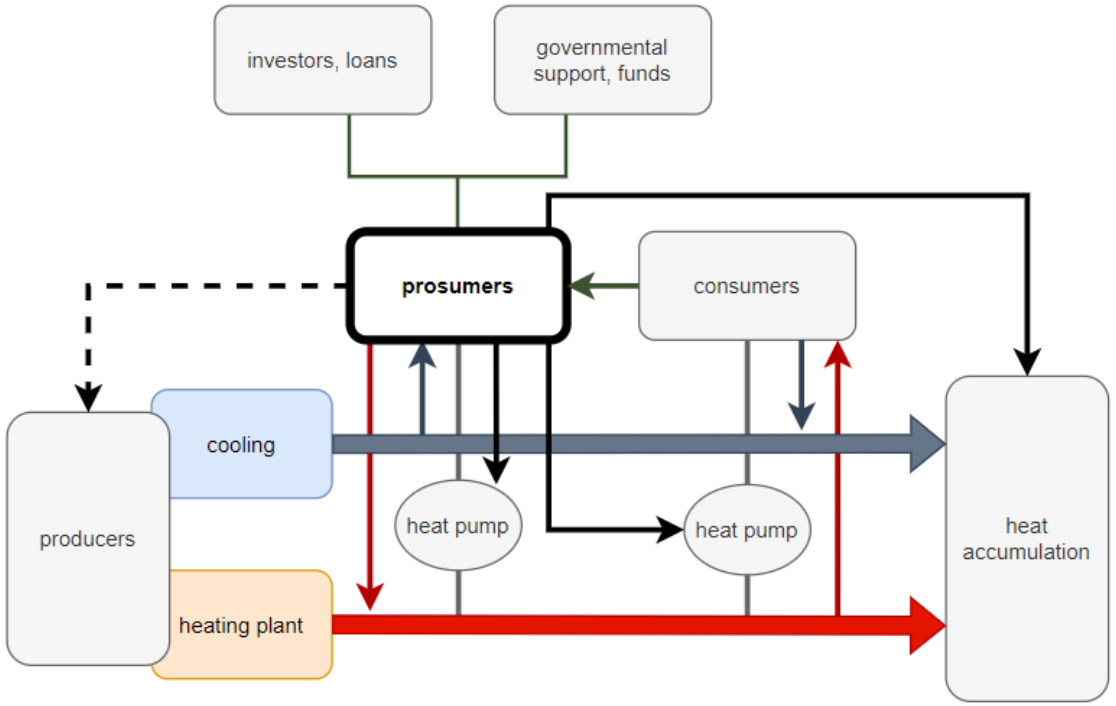
Scenario 2

Local Thermal Energy Provider

real estate companies invest in and operate the network, purchasing heat from various sources

- More suitable for a small-scale system
- Real estate companies of a particular area will invest in that area – personal interest
- Excluding extra players might decrease prices for the customer.



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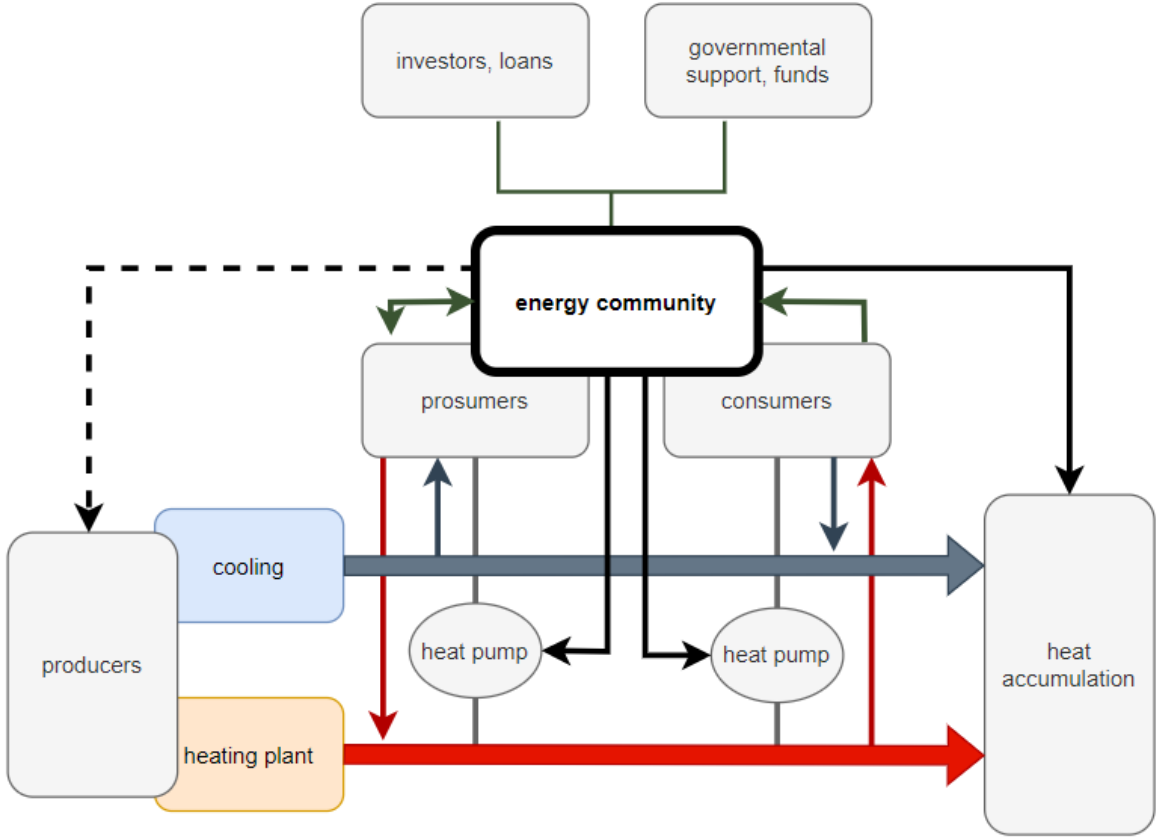
Scenario 3

Local Thermal Energy Community

community owns and operates the network, participants sharing the ownership

- Implements the social initiative and the local energy community.
- The consumer is protected, but there are risks to the management, potentially unsustainable
- As a grassroots self-organizing institution, energy communities are preferable from the aspect of strengthening cooperation in society



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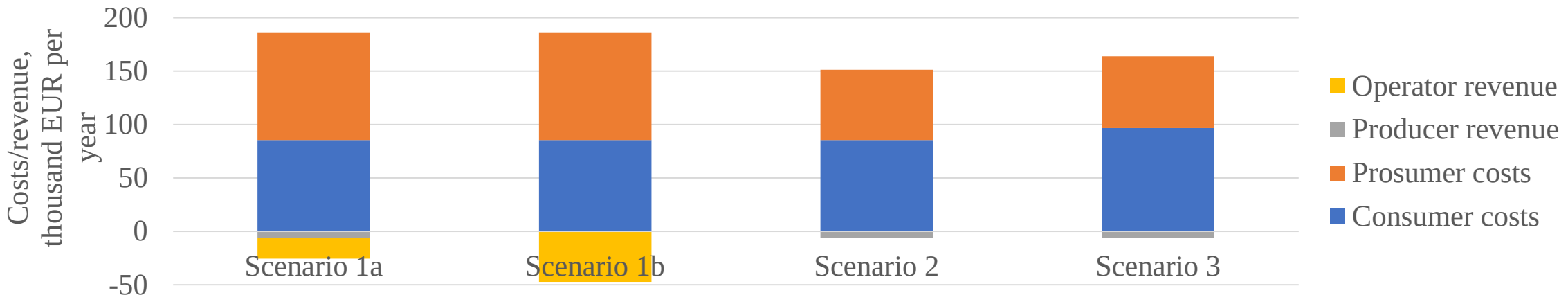
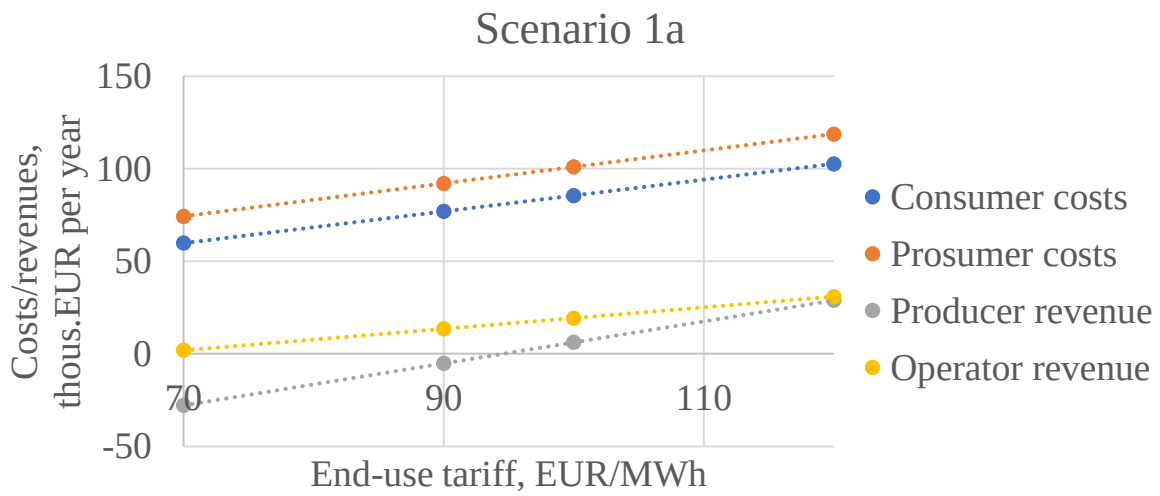
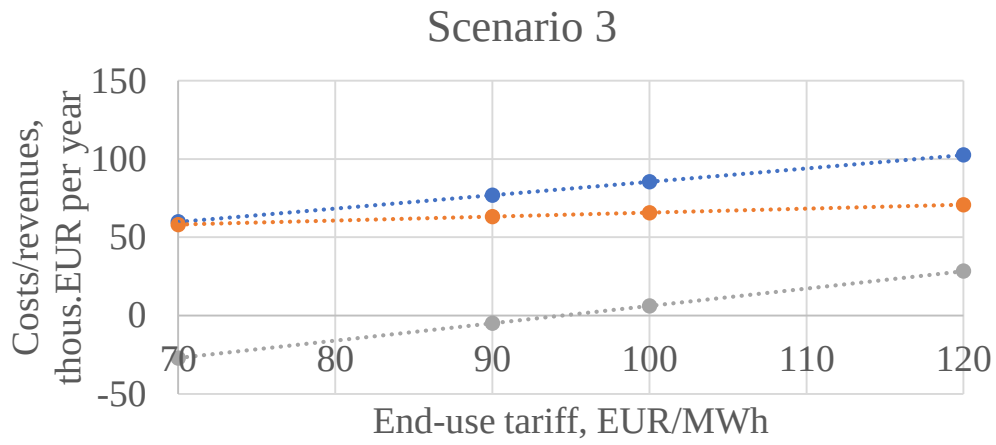
Cost and revenue streams







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Case study example – Belgium (1)

- New residential project Janseniushof in Leuven, Belgium;
- Combination of renewable energy sources and two thermal energy networks:
  - a low-temperature energy grid with cold and heat storage (geothermal) in aquifers for the new buildings
  - a local district heating network at higher temperatures (90/70°C) for the existing buildings
- Water-to-water heat pumps are applied to get the operating temperature (40°C for floor heating; 55° C for domestic hot water);
- In summer, the water of the primary circuit cools the building mass through the floor heating.

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Case study example – Belgium (2)

Business model

- An energy manager - company IFTech (ESCO principles)
  - Investor in the low-temperature energy system;
  - The detailed design;
  - The execution;
  - Management;
  - Energy supply;
  - the invoicing.
- Basic principle - the heating costs should not be higher than those of gas boilers.
- The sharing of the individual costs depends on the configuration. In homes which have their own heat pump installation, everything is paid via the electricity bill.
- Cooling is delivered for free!

Source: P. Pattijn, Alex Baumans Fifth-generation thermal grids and heat pumps A pilot project in Leuven, Belgium. Available online: https://etkhpcorderapi.extweb.sp.se/api/file/1888

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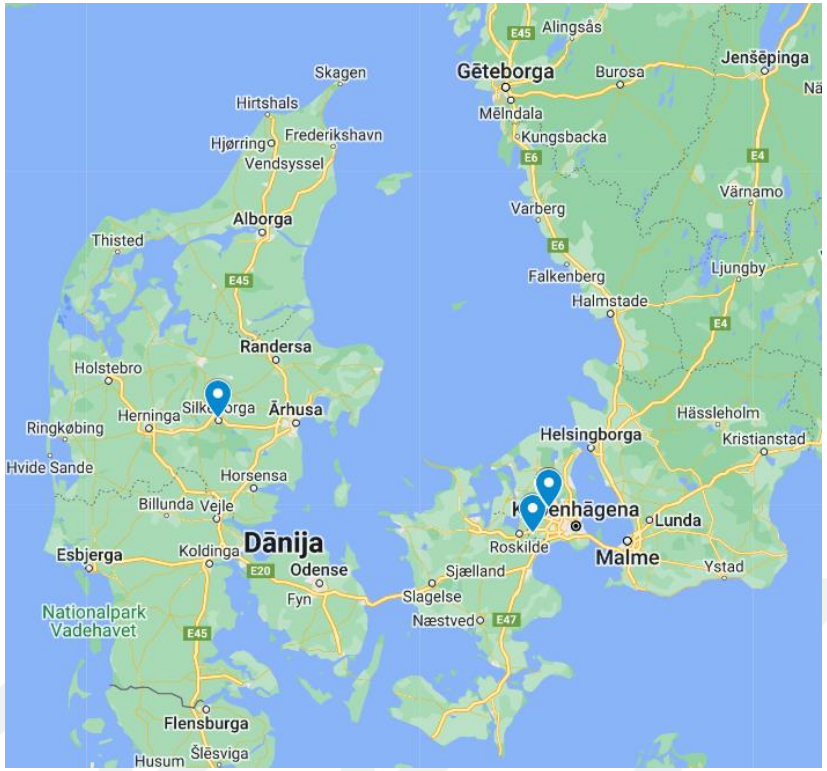
Case study example – Denmark (1)

- 5GDHC microgrids (Thermonet supported by shallow geothermal energy use (11 in total);
- Heat is provided by using mainly boreholes or wells and heat pumps
- Different owner structures
- Cooling not used

- **Silkeborg - 15 houses**
  - Heating but no cooling DH company owns both grid and HPs.
  - Standard DH price of heat

- **Tune** - 51 total houses
  - Heat pumps purchased and maintained by house owners.
  - A local energy community owns the grid.

- **Mageløse (Værløse)** - 32 houses
  - Heat pumps purchased by house owners.
  - Grid financed by house mortgage.



Source: Dr. Søren Erbs Poulsen (VIA University College), Dr. Theis Raaschou Andersen & Søren Skjold Andersen (Geodrilling). 5GDHC micro grids (Thermonet) in Denmark supported by shallow geothermal energy use. Available online: https://www.ucviden.dk/ws/portalfiles/portal/113583841/COST_DHC_WEBINAR_5GDHC_1730_1755_13012021_v02.pdf

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Conclusions

The price for the customers can be significantly affected by scenarios changing the cost balance thus affecting the risks of energy poverty

While energy communities are the most beneficial for society to lower the price for the customers, lack of professional management is the weak point of the scenario that anticipates energy communities

The role of prosumer involvement is high; therefore business models should motivate them to transfer the waste heat to 5GDHC network

Governmental support can significantly change the equilibrium.

Without differentiated tariffs and prioritizing the environmental benefits, there is a threat that 5GDHC will not be even considered

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More information

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Comparison of Suitable Business Models for the 5th Generation District Heating System Implementation through Game Theory Approach

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Abs.rac. **– Distr ct He: ti.. ar d Cooli.g (DHC) tech..ology is wi.dely recoga i ed as a p.omising so.ution to e.ucin_ pri.ary ene.gy .onsu: ption and e.i.sions. The 5th Generation Dis rict Heating and Cooling (5GDHC) network i. the la est DHC concept characterised by low-tem.erat"re su.ply, bi directional heating network o.eration, decentralised energy flows, and surplus heat sharing. Unlike the 4th Generation District Heating (4GDH) technology, the 5GDHC technology switched to a consumer/prosumer-oriented perspective. The introduction of 5GDHC solutions requires high investments, an important barrier to further developing DHC systems. Therefore, a novel pricing and business model could include introducing co-owners or energy managers into the system. Three different local market business models for 5GDHC at the community level have been tested. The reverse technical and economic simulation has been used for a feasibility study to determine the resources, business models, and combinations closest to the break-even point with lower costs and higher gains for all involved stakeholders.**

Keywords **– Business models; game theory; prosumers; 5th generation district heating**

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