WaterWarmth

Introducing the future of cooperative aquathermal energy in the North Sea region

16 October 2024 l 14:00 – 15:30 CEST | Teams webinar

Interreg North Sea

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Agenda

14:00 – 14:05 I Introduction by Aurelia Vanden Steene (EHPA)
14:05 – 14:20 I Explore the varied applications of AE and its adaptability across different context, **Sebastian Baes (EXTRAQT)**

14:20 – 14:35 I The WaterWarmth project and how collective surface water heat pump systems can advance the energy transition, **Shanne Bouma (Province of Fryslân)**

14:35 – 14:50 I The Fryslân approach – The development of a Roadmap for collective AE systems for energy communities, **Andries Metz (Province of Fryslân)**

14:50 – 15:05 I Aquathermal energy governance – examples of frameworks and case studies from the North Sea Region"

1. "Overview of our WP project", **Nthabi Mohlakoana (TU Delft)**
2. "Deep-dive Friesland cases", **Thomas Hoppe (University of Twente)**
3. "Deep-dive Swedish cases", **Sara Brogaard (LUCSUS)**

15:05 – 15:10 I Conclusions by Shanne (Province of Fryslân)
15:10 – 15:30 I Questions & Answers session

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Explore the varied applications of Aquathermal Energy and its adaptability across different contexts

16 Oct 2024 | 14:05 – 14:20 CEST

Sebastian Baes
Engineer, Co-Founder EXTRAQT

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Aquathermal Energy Systems – for everyone

Sebastian Baes - EXTRAQT

Aq-What?-thermal energy

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Types of sources:

- Surface water
- Wastewater/sewage water
- Drinking water

Surface water as a thermal battery ...

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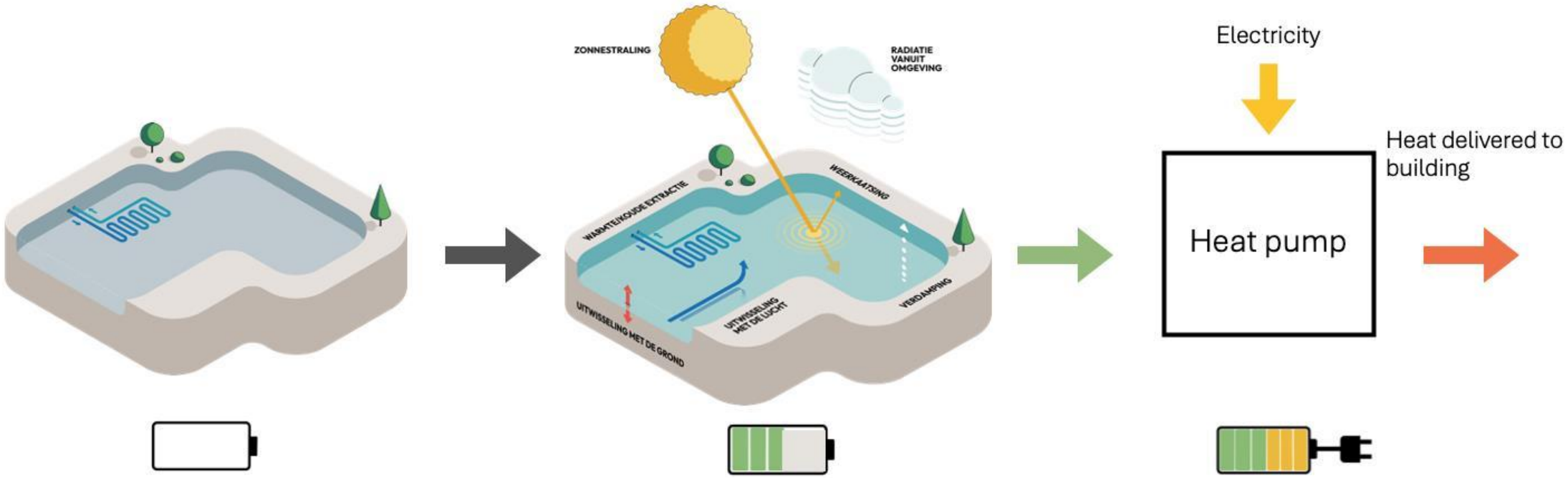

Water body without stored energy by the environment

Water body thermally charged by the environment

Thermal capacity of water body activated by heat pump

… Connected to existing technology

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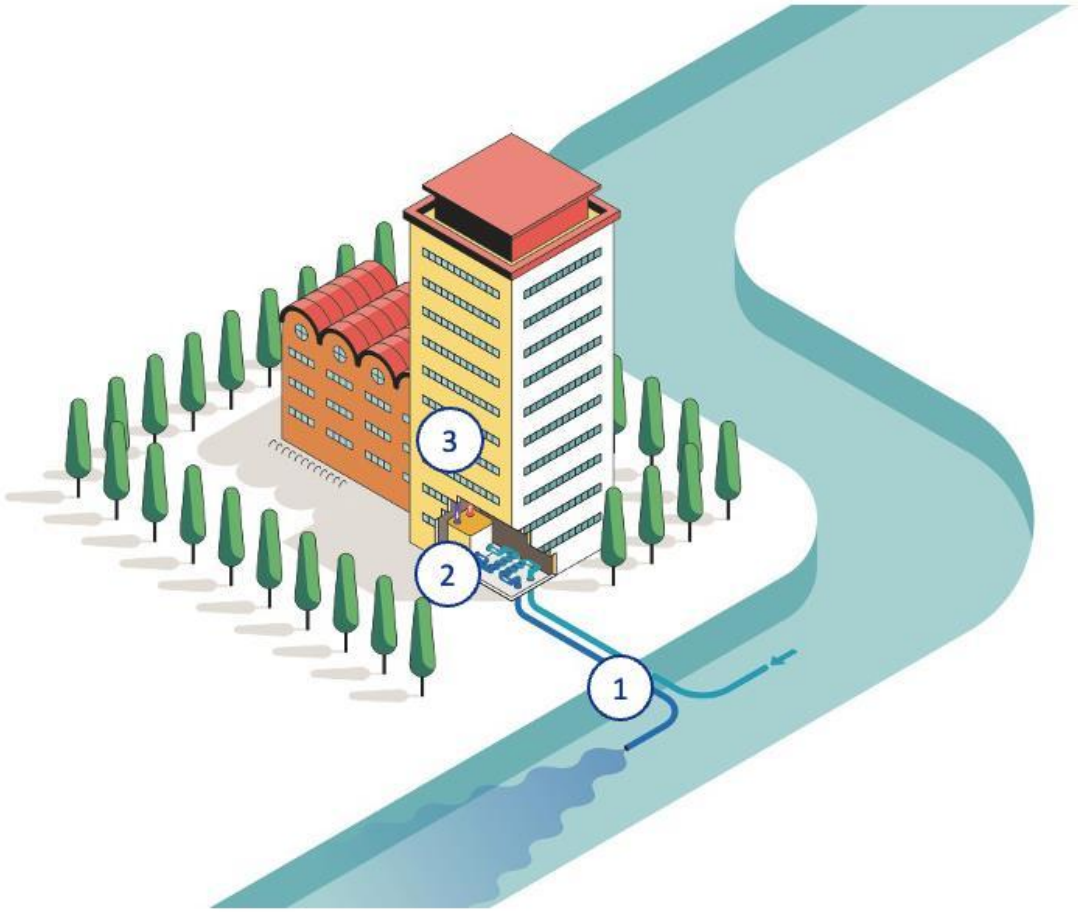

1 **AQE skid**

Pumping and filtering water, extracting heat via heat exchanger and discharge again

2 **Heat pump**

The heat in the water combined with electricity provides hot water to the building.

3 **Internal heating system**

Hot water is supplied to the building through the internal distribution system.

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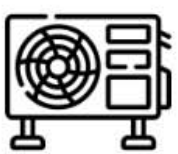
Heating solutions

Gas burner

Bio-mass



Air

Geothermal

Aquathermal

	Gas burner	Bio-mass	Air	Geothermal	Aquathermal
Independant supply	✗	−	✓	✓	✓
Sustainable	✗	−	✓	✓	✓
Efficient / Comfort	−	✗	−	✓	✓
Temperature range	✓	✓	✗	✗	✗
Investment cost	✓	✓	✓	✗	−
Operational cost	✗	−	−	✓	✓
Cooling	✗	✗	✓	✓	−
Estethics	−	−	✗	✓	✓
Lifetime	−	−	✗	✓	✓

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Types of AQE installations

Closed Loop

Open Loop

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Types of AQE installations

Closed Loop

Closed Loop Heat Exchanger

Open Loop

Pre-filter

Fine Filter

Open Loop Heat Exchanger

General

Heat Pump

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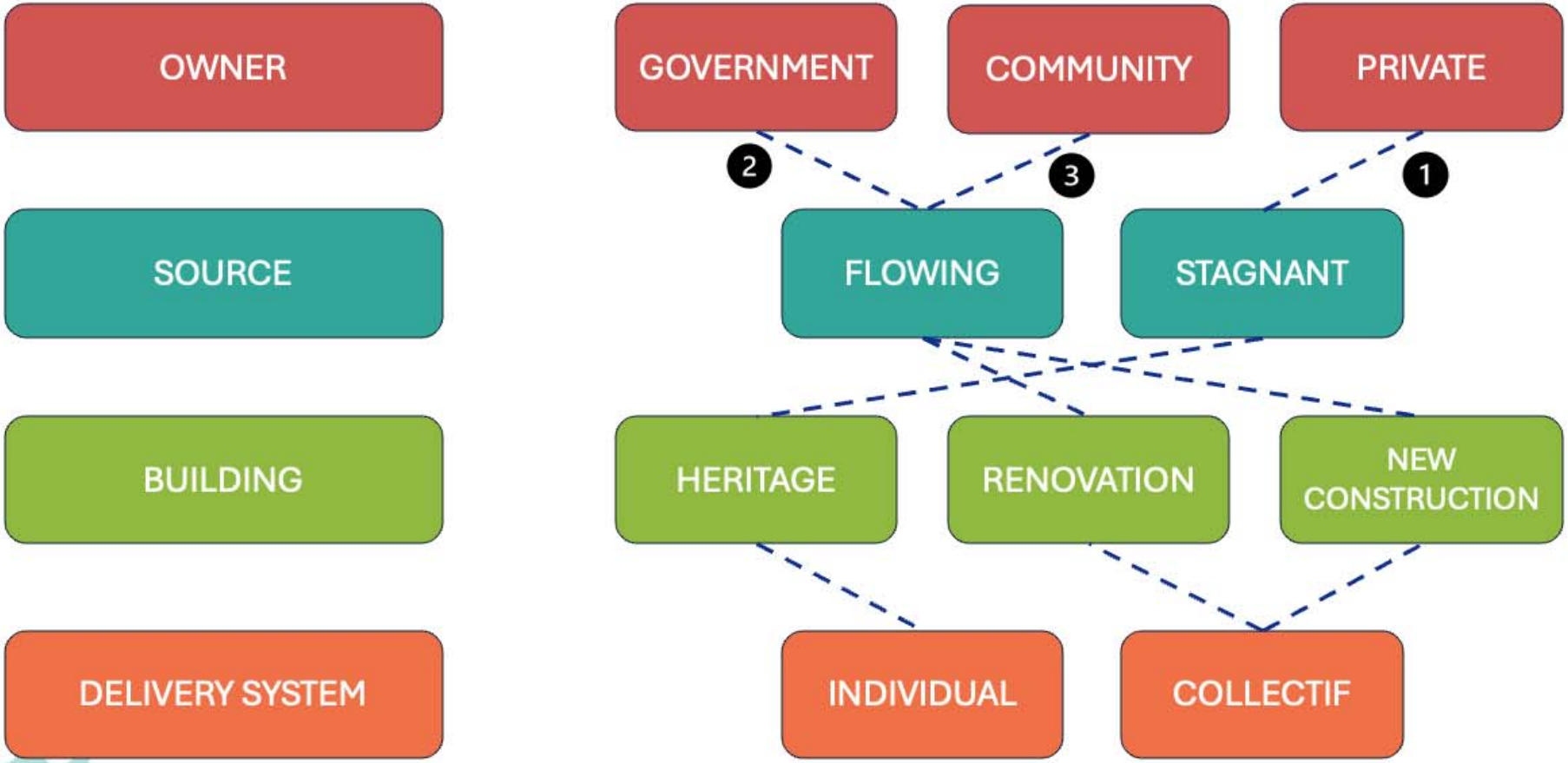
Aquathermal menu



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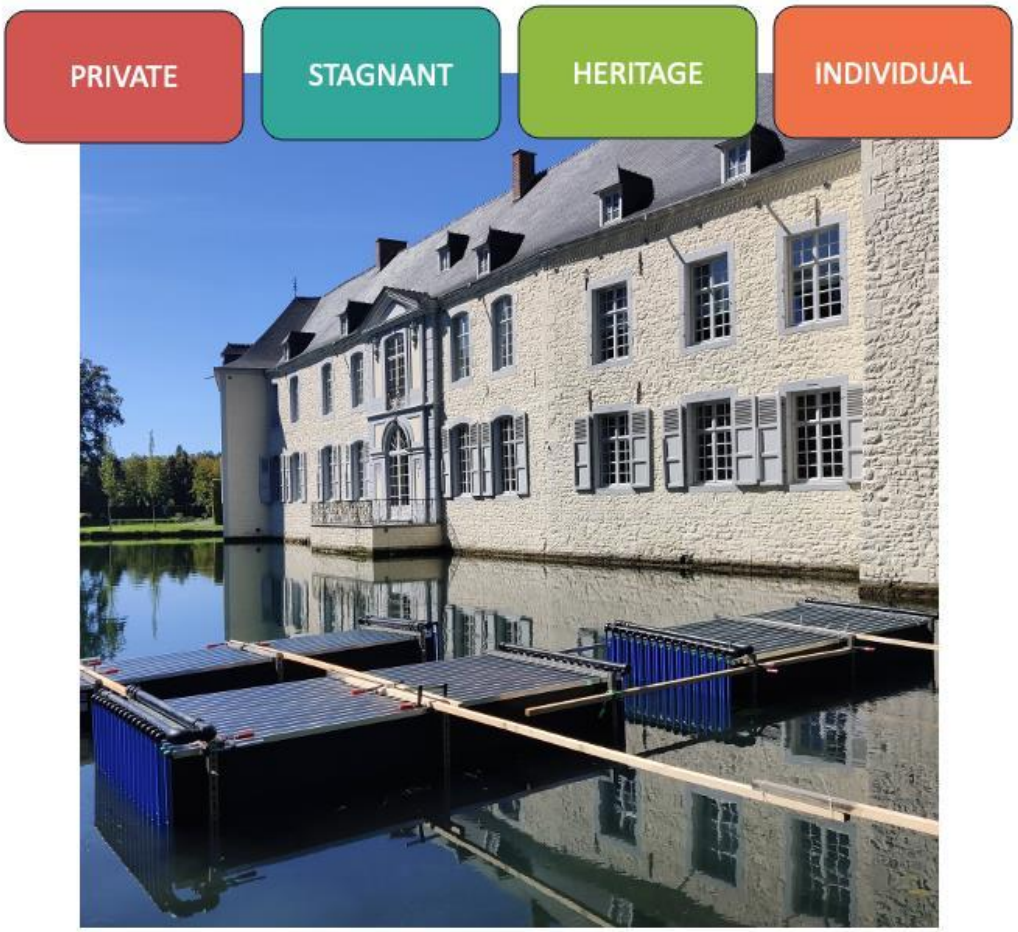
Jardins d'eau d'Annevoie

- **Owner:**
  - Private
- **Source:**
  - Mirroring lake connected to a natural spring
- **Building:**
  - Renovated heritage building
- **Delivery System:**
  - Individual heating by 2 heat pumps
- **Type:**
  - Closed loop system
- **Heat demand:**
  - 100 kW radiators
  - 40 kW floor heating



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Buda island Kortrijk

- **Owner:**
  - City of Kortrijk
- **Source:**
  - Leie
  - Thermal impact -0.25°C
- **Building:**
  - Public building, elderly house, private houses
- **Delivery System:**
  - Collective energy hub – district heating
- **Type:**
  - Hybrid with open loop aquathermal
- **Heat demand:**
  - 1 MW Aquathermal
  - 0.5 MW Geothermal
  - Back-up/Top-up aerothermal

GOVERNMENT | FLOWING | NEW CONSTRUCTION | COLLECTIVE

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COMMUNITY FLOWING RENOVATION COLLECTIVE

Dijlemolens Leuven

- **Owner:**
  - VME Dijlemolens
- **Source:**
  - Dijle
  - Thermal impact -0.01°C
- **Building:**
  - 35 apartments, Offices and Commercial spaces
- **Delivery System:**
  - Central heating
- **Type:**
  - Open loop
- **Heat demand:**
  - 90 kW delivered by heat pump (80% of peak demand)
  - Delivery temperature 55°C

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The WaterWarmth project and how collective surface water heat pump systems can advance the energy transition

16 Oct 2024 | 14:20 – 14:35 CEST

Shanne Bouma
Project Leader
Province of Fryslân

> Aquathermal Energy:

- Promising idea...
- Interesting small scale examples...
- .... but how do we go from niche technology to widely adapted practice
- Addressing all these aspects in one coherent project.

> **We need to scale up aquathermal energy**

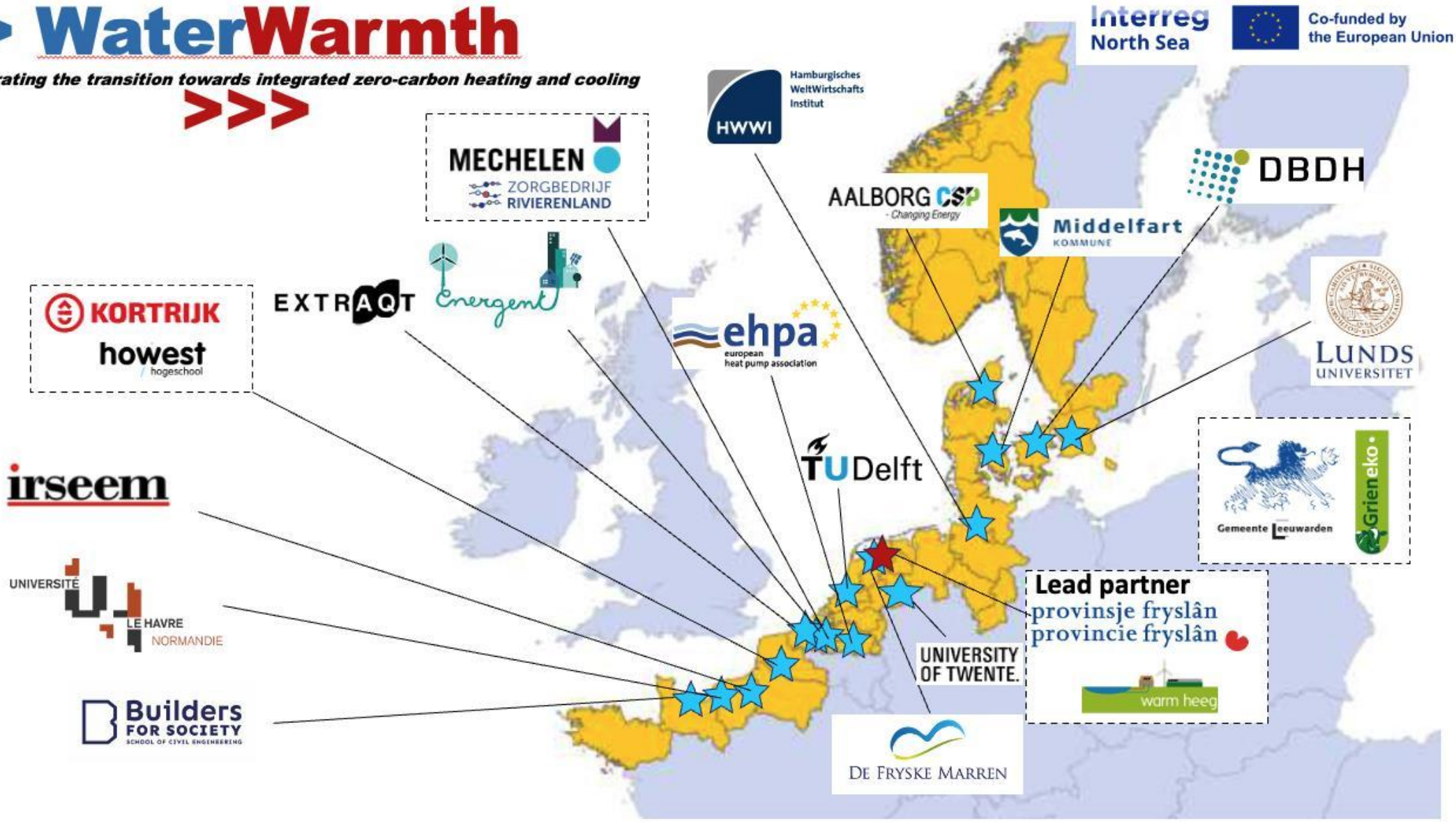
> **We need to learn about ?**

- **Technique**
- **Policies**
- **Societal acceptance & energy communities**
- **Environmental aspects**
- **Legal aspects**
- **Distribution of heat: the perspective of AE in community-based collective heating systems**

> WaterWarmth

Accelerating the transition towards integrated zero-carbon heating and cooling

>>>



WaterWarmth: 6 complementary workpackages

Workpackage 1: Potential of AE.

Workpackage 2: 5 small-scale inspirational pilot sites

Workpackage 3: Preparatory work and action plan for the construction of large ascale collective heating networks based on AE.

Workpackage 4: Energy-management strategies for small scale pilots & decentralized energy systems

Workpackage 5: Market potential, economic potential, environmental aspects. Market barriers.

Workpackage 6: Government policies necessary for scaling up and wider uptake of aquathermal energy systems.

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The Fryslân approach - The development of a Roadmap for collective AE systems for energy communities

16 Oct 2024 | 14:35 – 14:50 CEST

Andries Metz
Project Leader
Province of Fryslân


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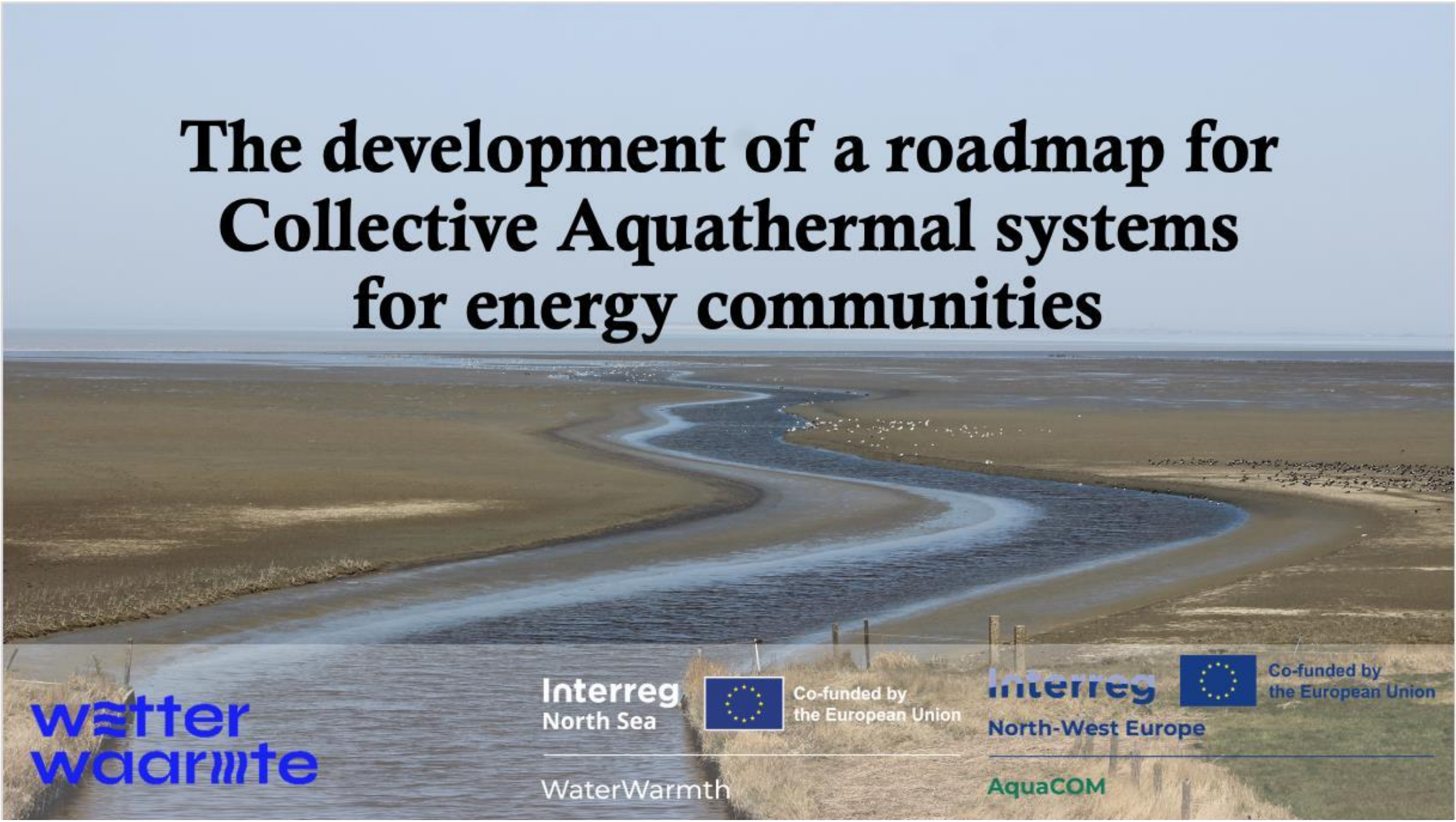
The development of a roadmap for Collective Aquathermal systems for energy communities



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AquaCOM


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The Fryslân Approach

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Our regional programme for aquathermal energy

- Stimulate project development
- Learn first hand from projects
- Lobby for financing and regulations
- Develop a guide/standard for project development

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Our story

"It's Warmth out of water, that's all to it!"

- Conventional techniques in our surroundings
- Community approach – keeping the money in the region and in the community
- Strong branding and network of projects

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warmte

Our approach

- Strong regional working group of municipalities, water body and province
- Supported by leading companies in aquathermal field
- Community of practice with 14 district heating projects

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Our connections

- Interreg NWE – **AquaCOM**
- Interreg Northsea – **WaterWarmth**
- Collaboration with Danish embassy and Danish board of district heating
- Part of three national programme's that stimulate district heating and aquathermal

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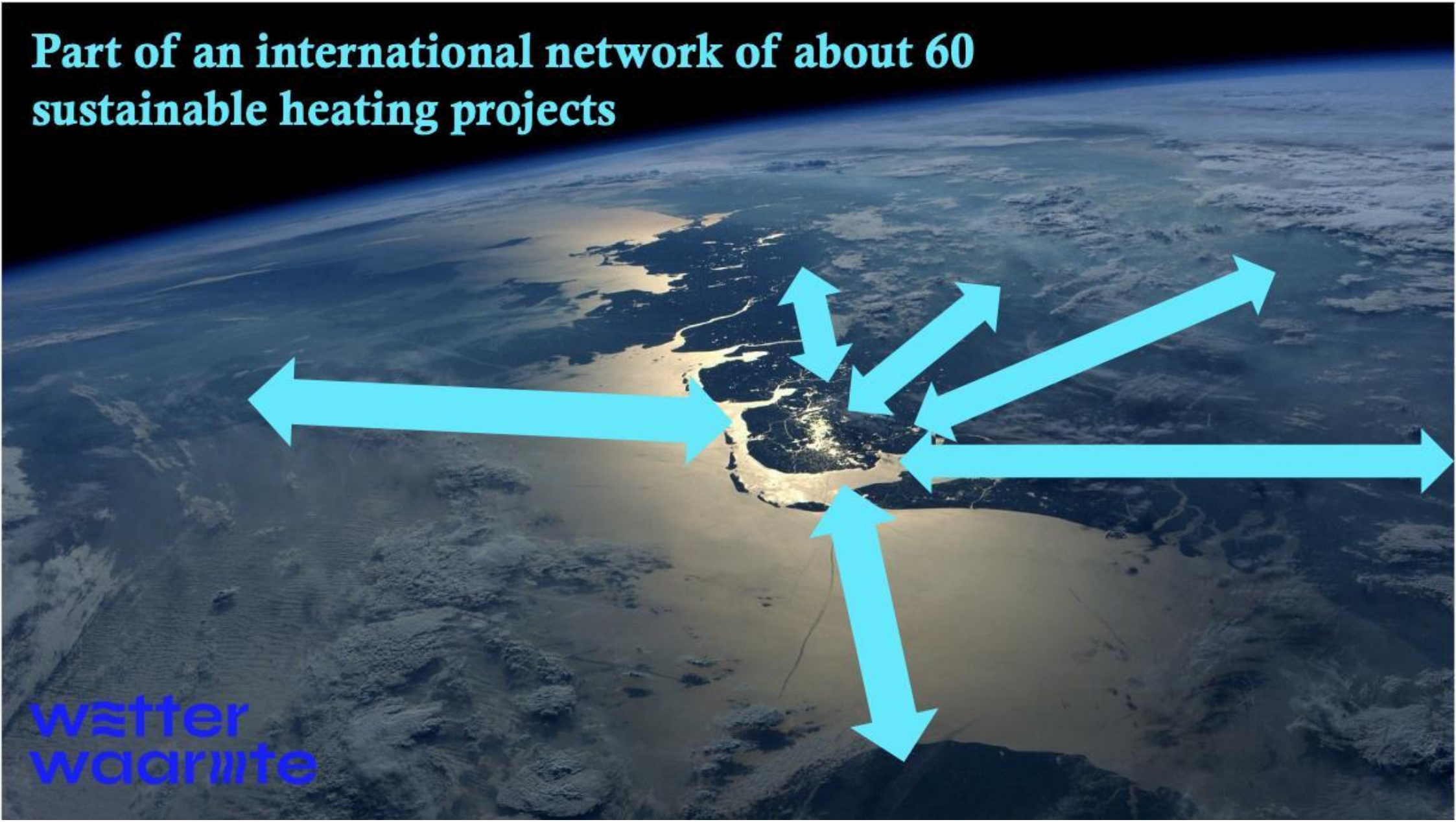
Part of an international network of about 60
sustainable heating projects
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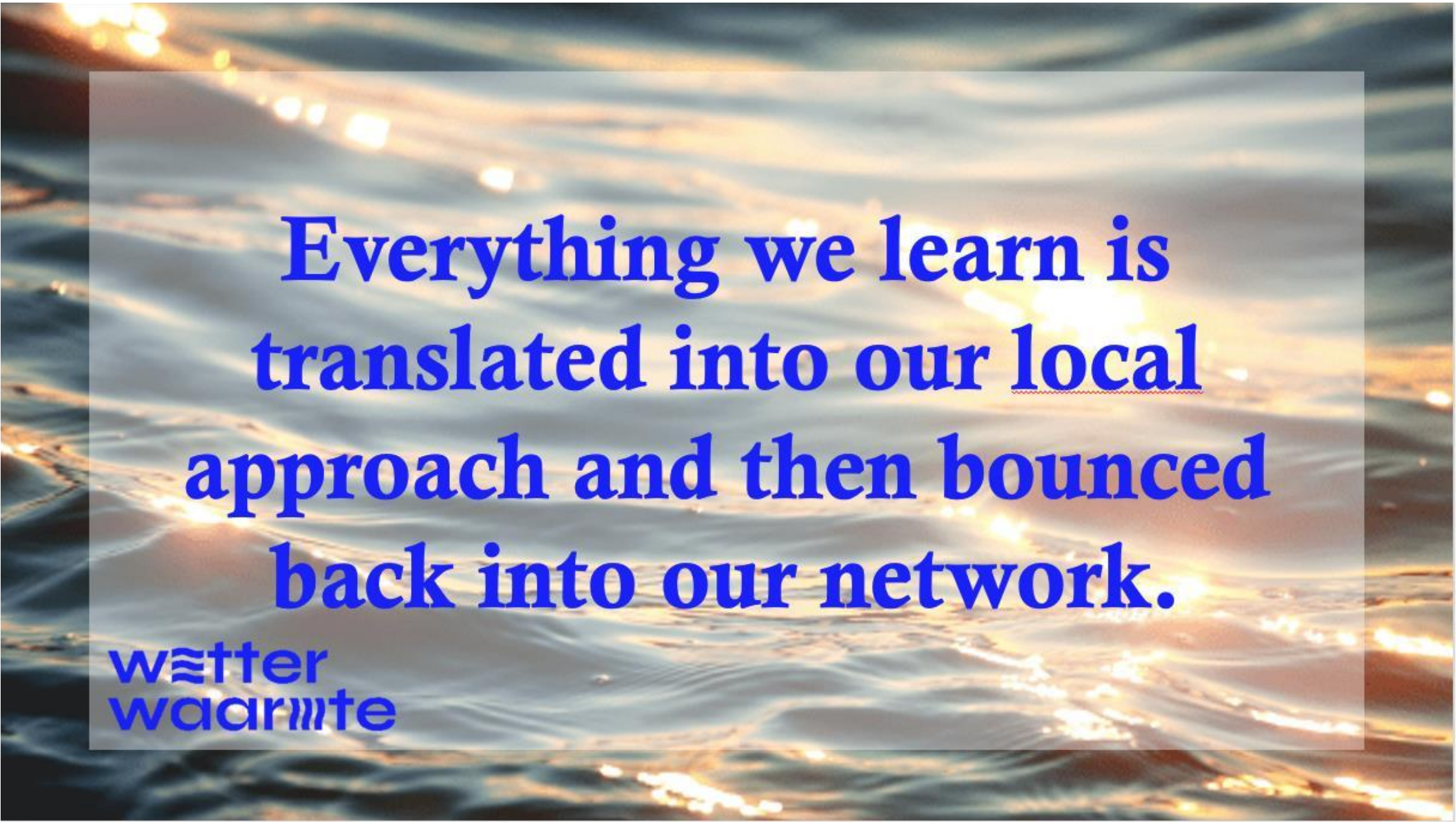
Everything we learn is translated into our local approach and then bounced back into our network.
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waarmte


Questions?
wetter
waarmte
a.metz@fryslan.frl

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Aquathermal energy governance - Examples of frameworks and case studies from the North Sea Region

16 Oct 2024 | 14:50– 15:05 CEST

Nthabi Mohlakoana
Researcher
TU Delft | Technology, Policy and Management

Thomas Hoppe
Professor Sustainability of Rural-Urban Systems
University of Twente

Sara Brogaard
Senior Lecturer
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WaterWarmth webinar 16 Oct. 2024

WP6 Team:
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Thomas Hoppe
Sara Brogaard
Barry Ness
Magdalena Wiedermann

TU Delft

Lund University

University of Twente.

Aquathermal energy governance – examples of frameworks and case studies from the North Sea Region

1. Overview of the WP6 project

2. Deep-dive Friesland cases

3. Deep-dive Swedish cases

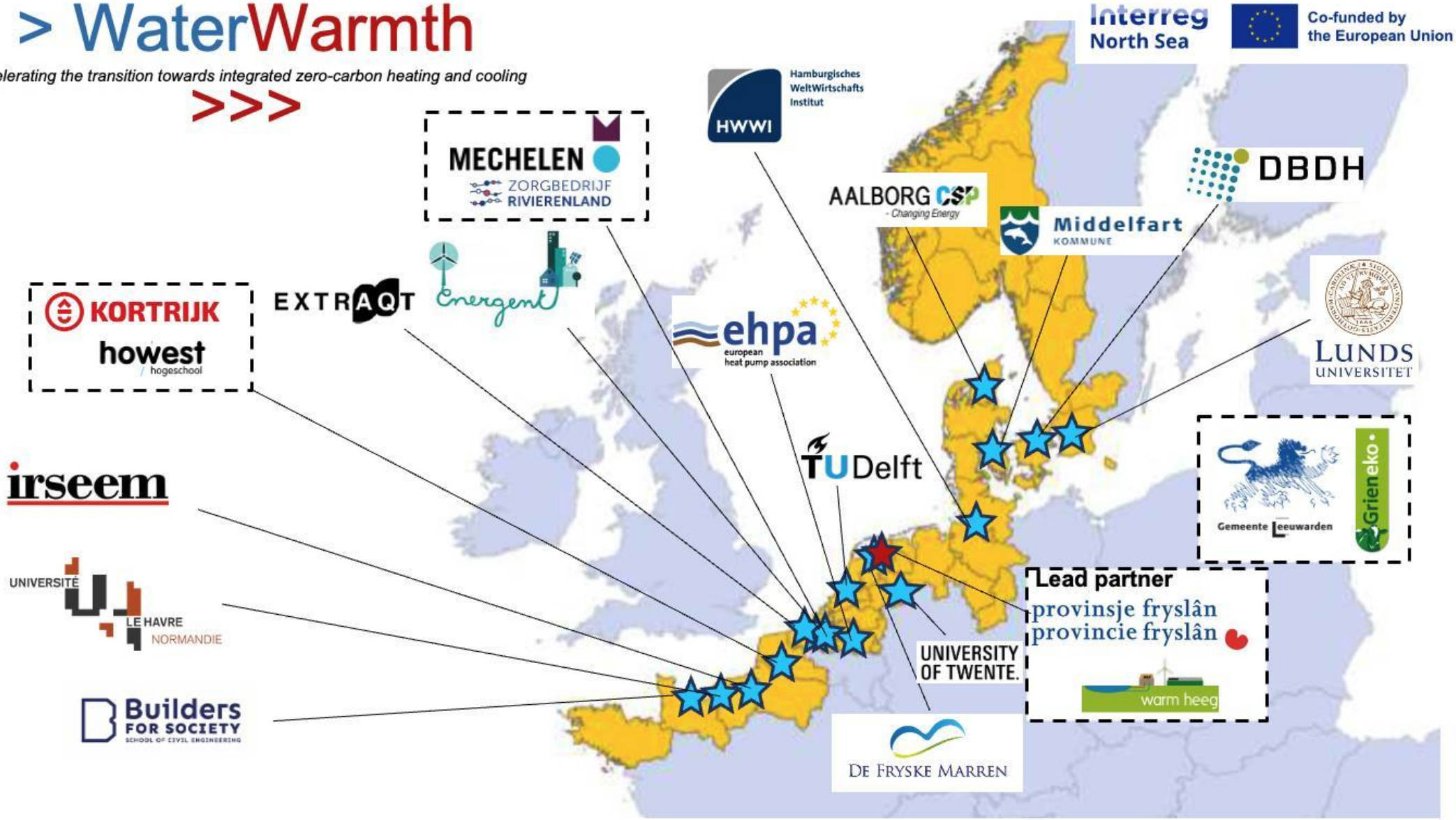
4. Conclusions

Q&A Session

> WaterWarmth

Accelerating the transition towards integrated zero-carbon heating and cooling

>>>



Overview of the WP6 project

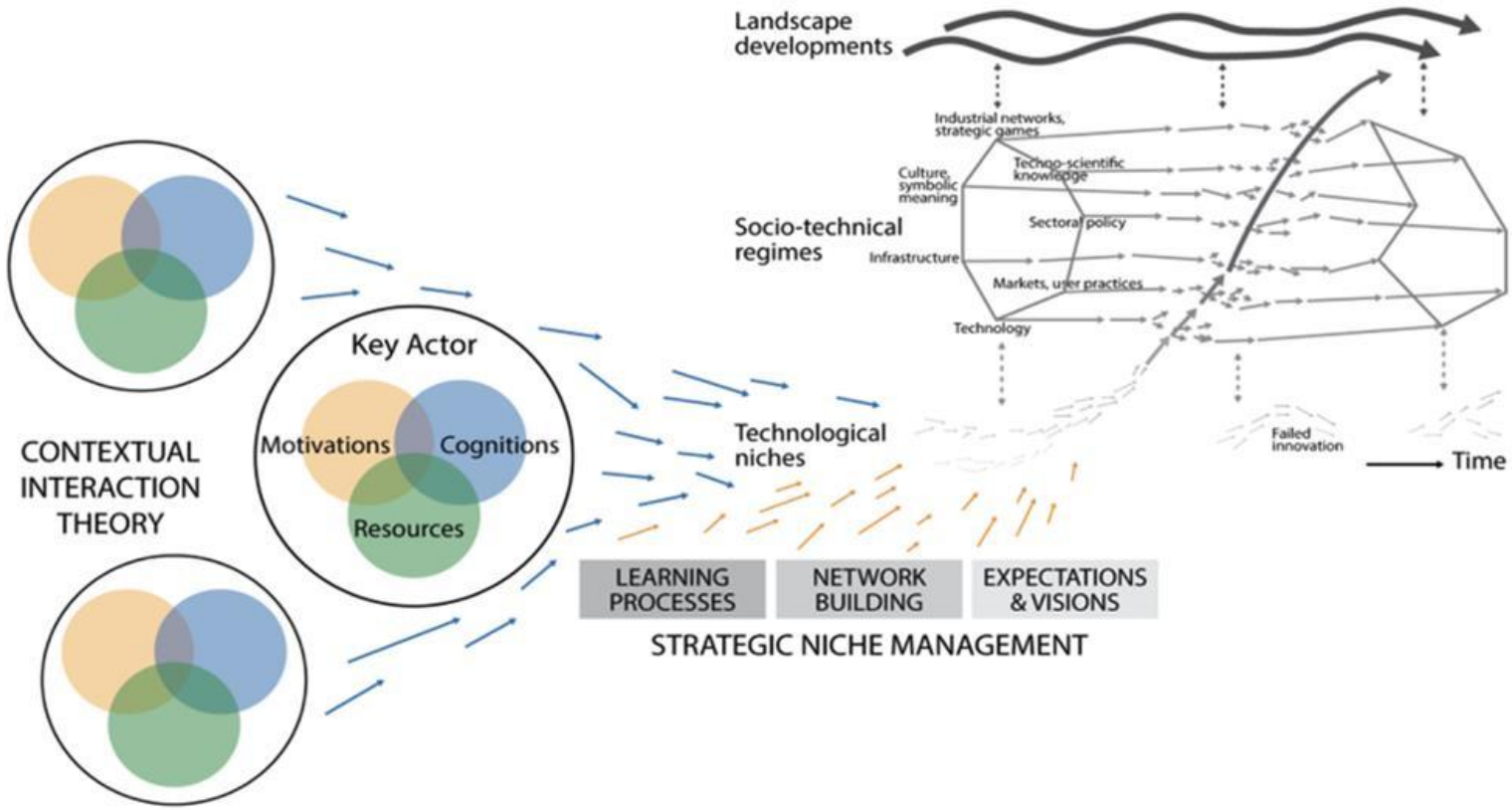
Overall objective:
To develop a framework for the analysis of current governance (arrangements), policies and stakeholder involvement in AE developments.

How we are doing this:
- Conducting literature studies
- Collecting empirical and theoretical insights from cases
- Data analysis
- Mapping and assessment of governance arrangements and enabling policies
- Identification of barriers that can hinder AE system niche development
- Co-developing an AE “vision” for 2050 with regional authorities and related stakeholders

Proposed theoretical frameworks from the literature

- Multi-Level Perspective (MLP)
- Strategic Niche Management (SNM)
- Contextual Interaction Theory (CIT)
- Governance Arrangements
- Governance of Change
- Community Energy
- X-Curve Tool

Graphical overview on how CIT, MLP and SNM can be used to complement each other. Adapted from: Bressers (2007); Geels (2011) and Kamp and Vanheule (2015)



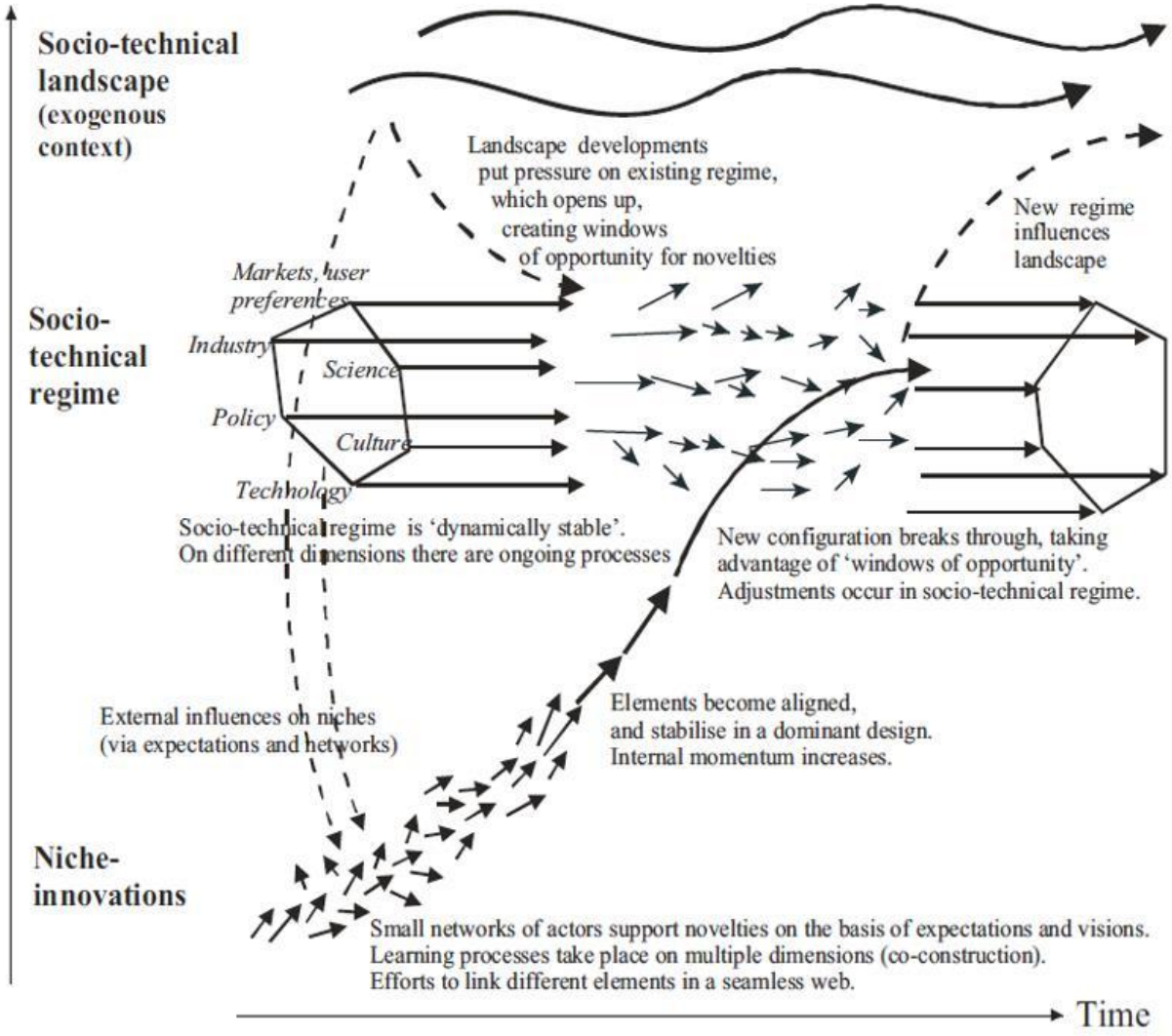
Example: Pilot A- Netherlands

- Climate change mitigation
- Energy security in relation to geopolitical instability

- A long-term heating plan, called 'Transitievise Warmte' (i.e.transition plan heating') is in place

- The municipality (e.g., elderman, direction) are divided in opinions. Result: slow and difficult planning.
- The scale of Pilot A and the expanse of a heat network especially aquathermal make a bad business case
- Lack of skills, time, professionality of the energy company
- Lack of project “ownership”: municipality and energy company

Multi-Level Perspective (MLP)



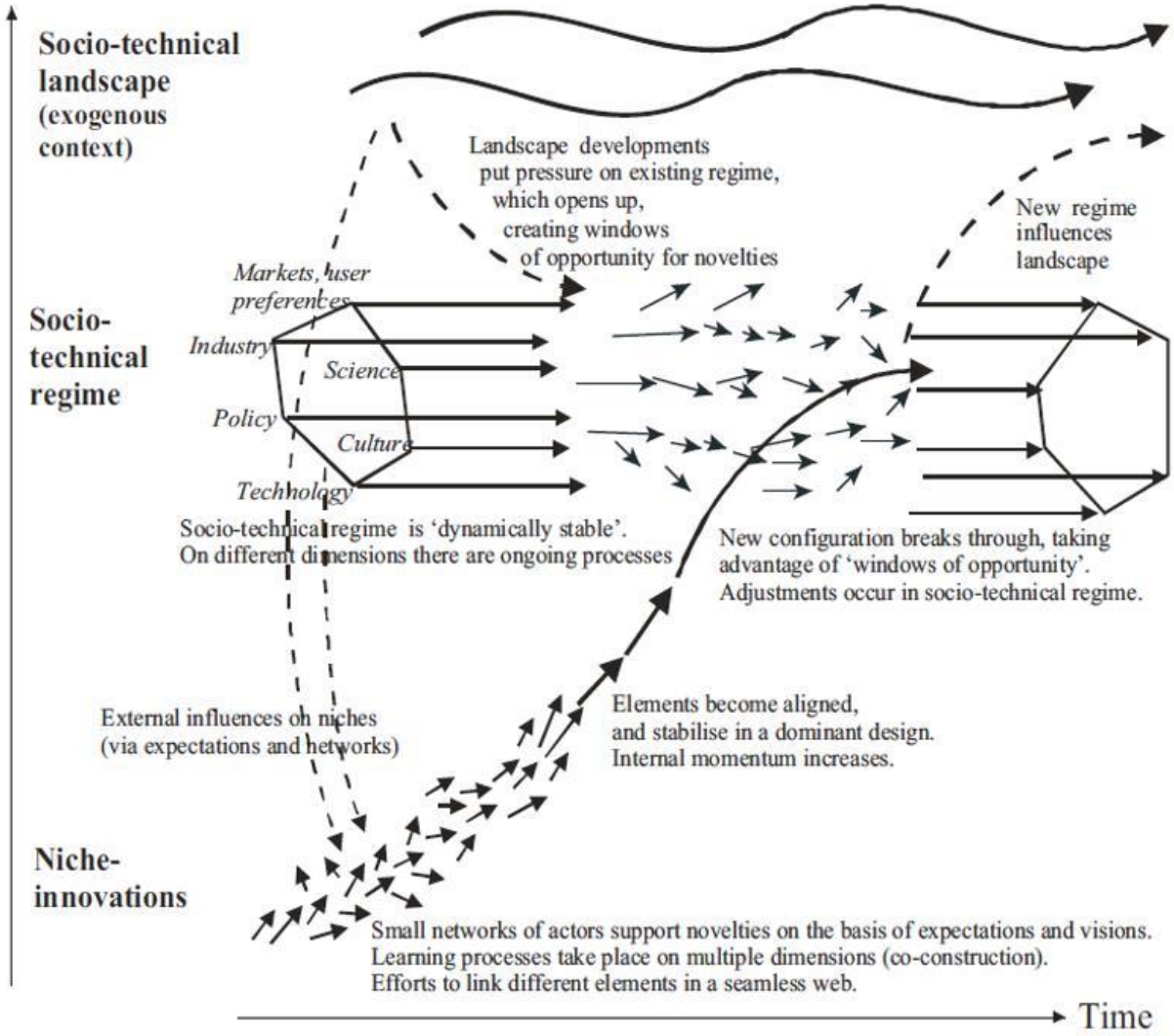
Example: Pilot B - France

- Climate change mitigation
- Energy security in relation to geopolitical instability

- April 2024: national action plan to promote heat pump use and trigger the production of one million heat pumps by 2027.
- Support from the mayor
- many authorizations required
- Cost of implementation leading to a change in the budget

- Choice of a company already carried out work on the pilot site before
- Pilot site is close to research partners' premises, easier to monitor
- Support from the lead partner

Multi-Level Perspective (MLP)



Deep-dive Friesland cases – using the governance of innovation lens

Main enabling factors of the Frisian AE system case in The Netherlands.

Climate change: COP21; Paris Agreement 2015

- Supporting RE adoption
- Green Deal Aquathermie
- Regional Energy Strategies

Groningen earthquakes

- Attention to phase out of natural gas use.
- Encouraged experimentation with alternative RE sources.
- Municipalities leading heat transition policies

Energy cooperatives / Citizen's green energy

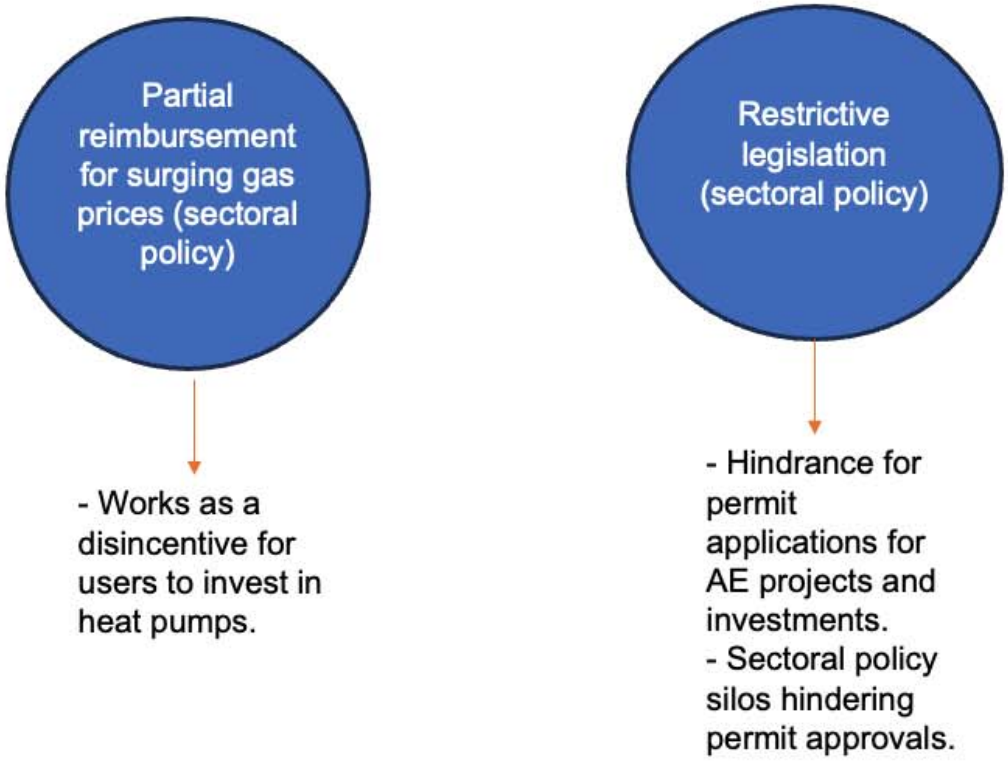
- Knowledgeable citizens able to mobilise green energy systems
- Rise of community energy since 2010.

Russian invasion in Ukraine

- Market demand and adoption of heat pumps and thermal insulation due to surging gas prices.

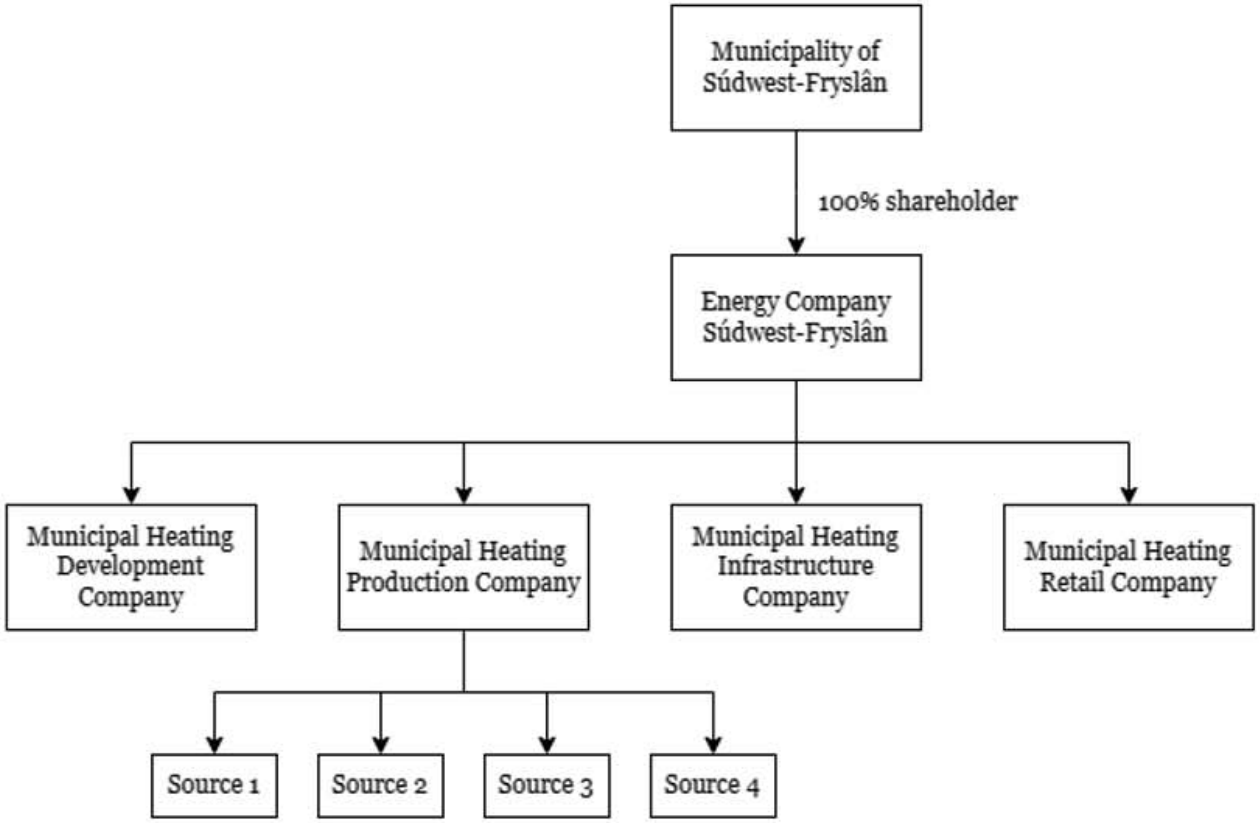
Deep-dive Friesland cases – using the governance of innovation lens

Main inhibiting factors of the Frisian AE system case in The Netherlands.



Four potential arrangements for governing AE in Friesland (1)

1: The municipal model

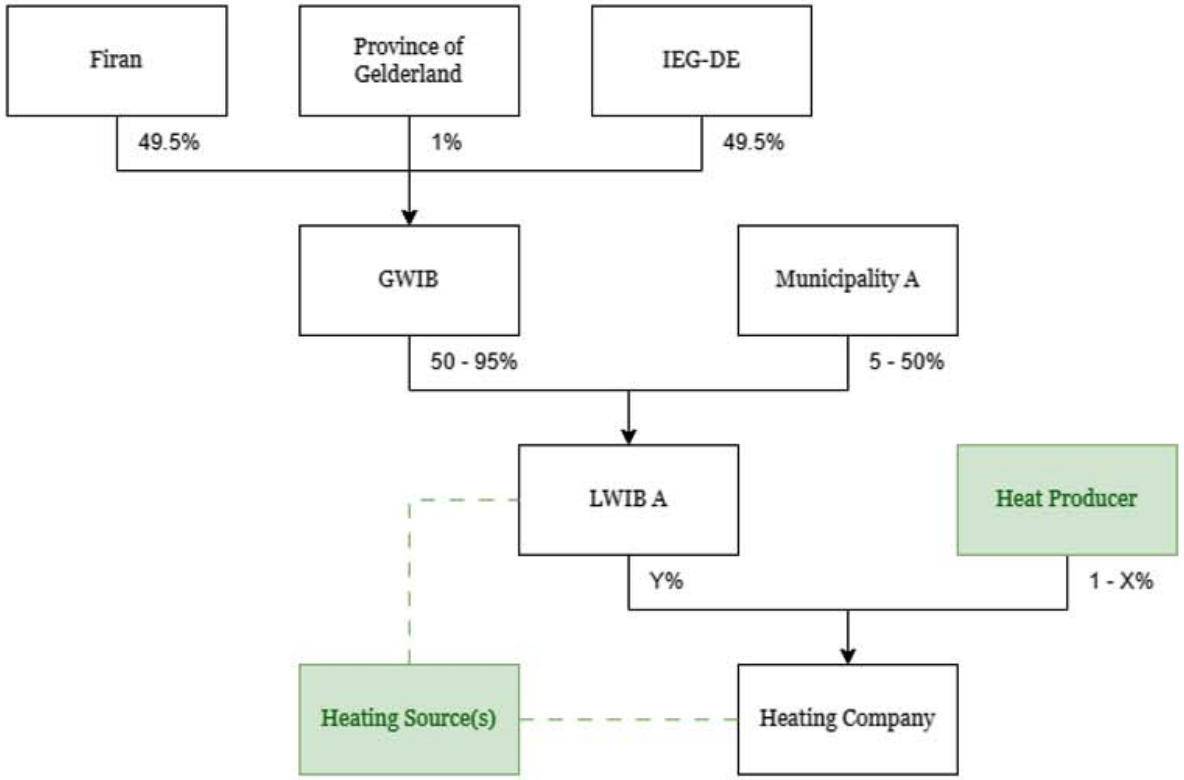


From: Groot, F.L.G, (2024). Governancei n Hot Water; Exploring the Governance of Aquathermal District Heating Network sin Fryslân. Master thesis, Delft University of Technology, Delft, The Netherlands

Four potential arrangement for governing AE in Friesland (2)

2: The provincial heat company model

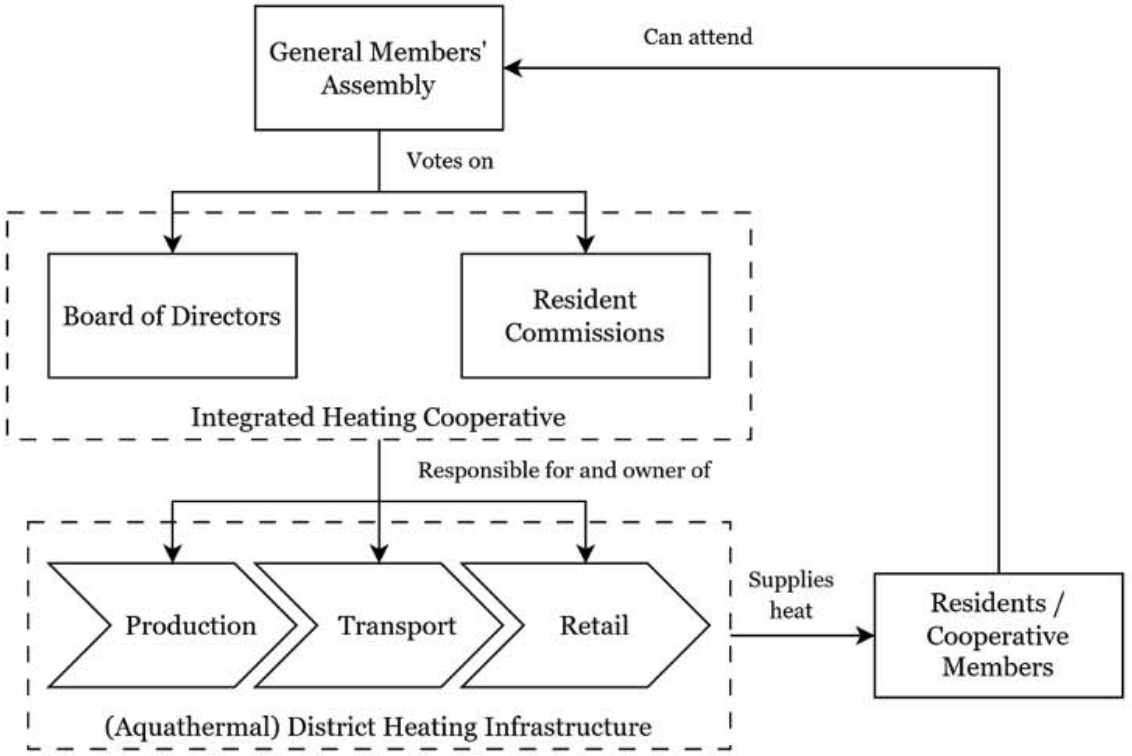
Example: Gelderland



From: Groot, F.L.G, (2024). Governancei n Hot Water; Exploring the Governance of Aquathermal District Heating Network sin Fryslân. Master thesis, Delft University of Technology, Delft, The Netherlands

Four potential arrangement for governing AE in Friesland (3)

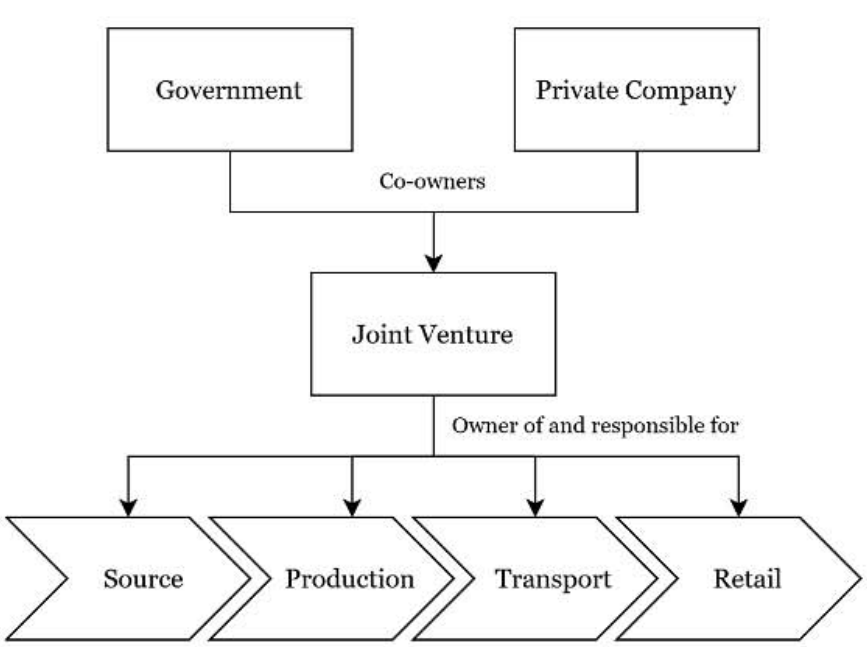
3: The thermal energy community model



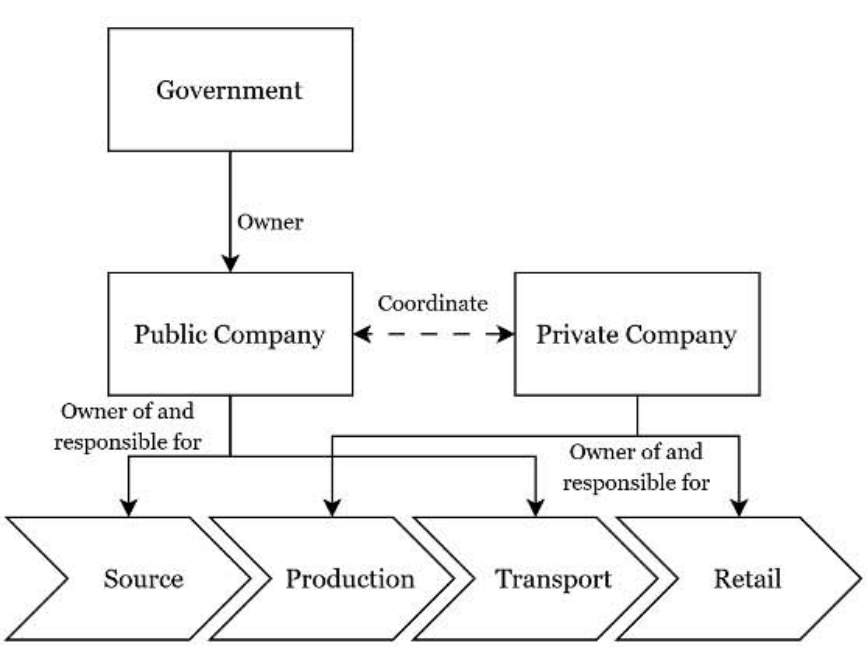
From: Groot, F.L.G, (2024). Governancei n Hot Water; Exploring the Governance of Aquathermal District Heating Network sin Fryslân. Master thesis, Delft University of Technology, Delft, The Netherlands

Four potential arrangement for governing AE in Friesland (4)

4: Public Private Partnership (2 models)



Integrated Public-Private Heating Company

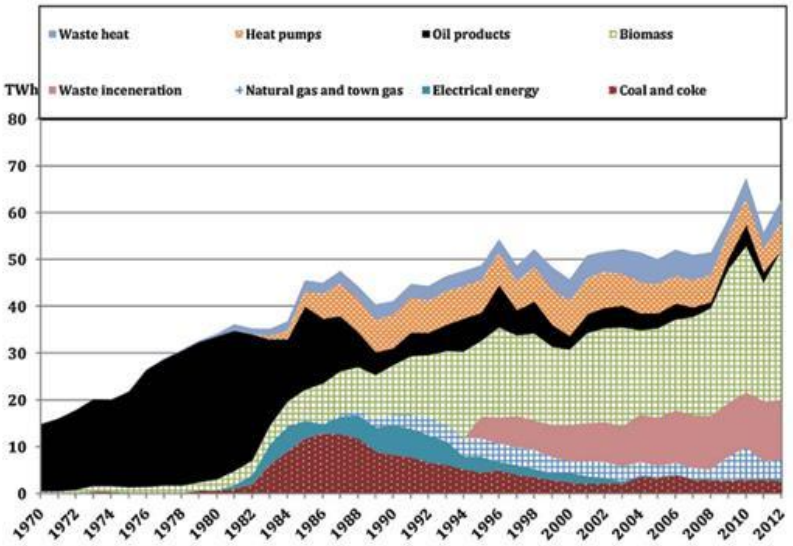


Unbundled Public and Private Heating Chain Roles

From: Groot, F.L.G, (2024). Governancei n Hot Water; Exploring the Governance of Aquathermal District Heating Network sin Fryslân. Master thesis, Delft University of Technology, Delft, The Netherlands

Example Sweden: initial analysis using the Multi-level Perspective

- Heating and cooling - four main technologies: district heating, heat pumps including water and air, electrical heating, and biofuel boilers such as wood pellets
- DH started 1948. 1950s - nine more cities. With 1973 and 1979 oil crises also smaller cities developed these due to replacing expensive oil
- > 1 million heat pumps, started in the 1970s
- Heating sector advancing towards fossil free.
- AE projects to be found from '80s and '90s
- For example, AE Stockholm Exergi 1985 – Ropsten 275 MW
- AE can be viable option for detached houses - precondition access to suitable water bodies



Example of AE system Sweden – 36 rental apartments in western Sweden from the 1990s

Aqua thermal energy in Sweden

Landscape:

Climate Change, Low energy demand in new buildings, Geopolitical tensions

Regime:

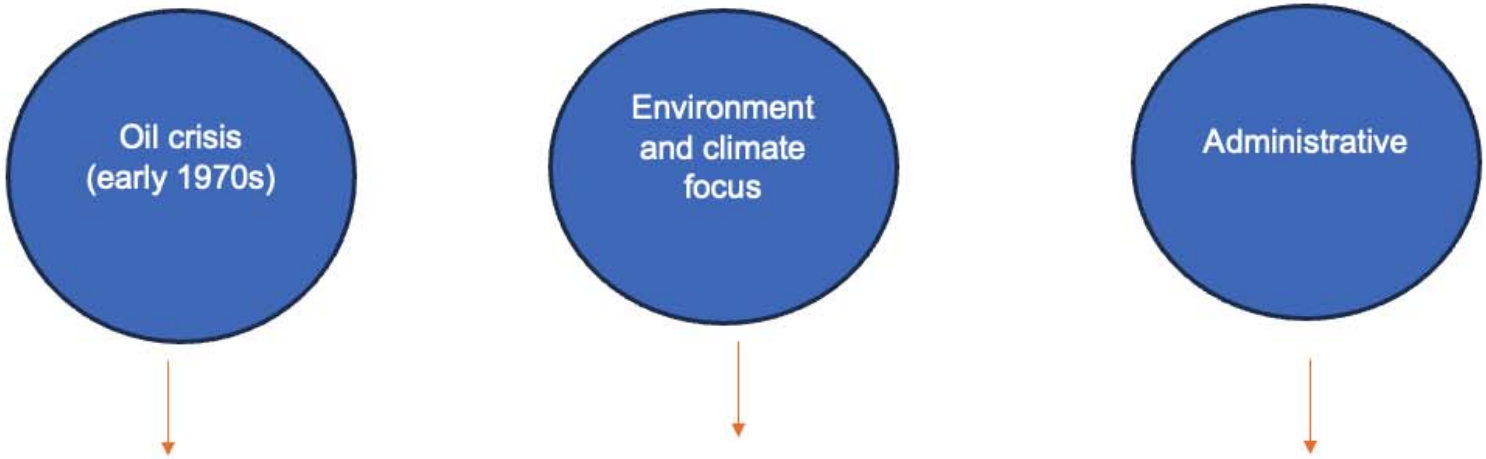
Socio technical system presently dominating: heat pumps and district heating

Niches around AE:

Limited development

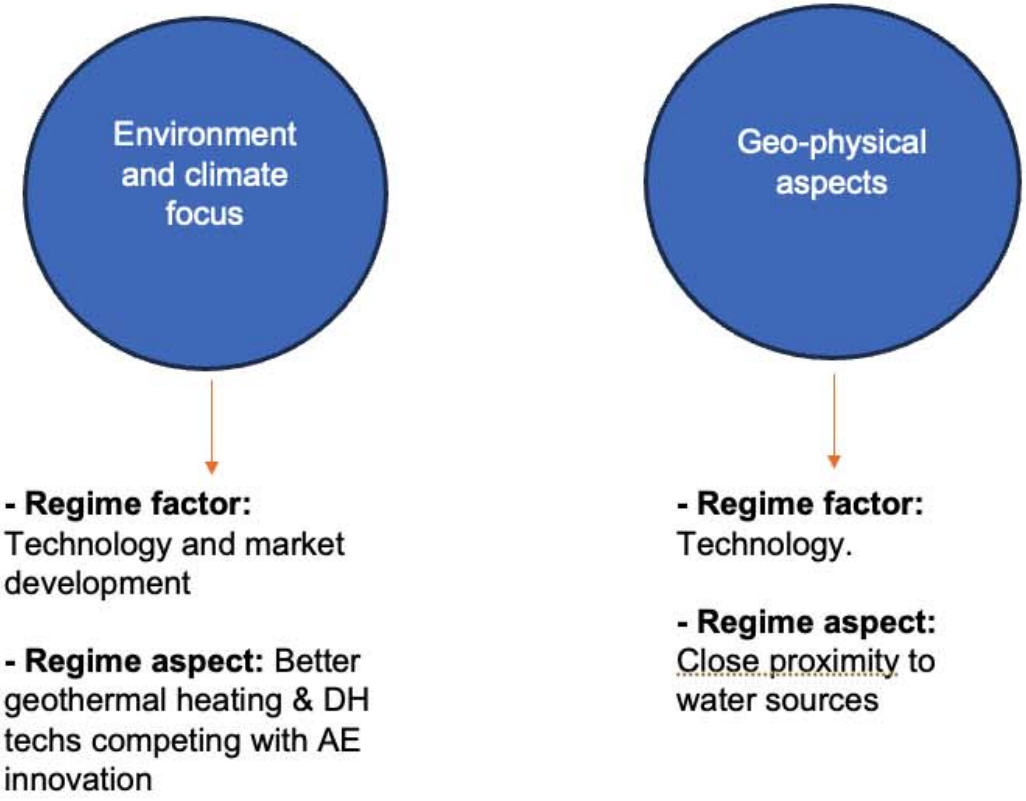
Deep-dive Sweden – using the governance of innovation lens

Summary of enabling factors of the Swedish household AE system development case.



Deep-dive Swedish cases – using the governance of innovation lens

Summary of inhibiting factors of the Swedish household AE system development case.



Niche and Conclusion

Visions/Networks:

- In our first analyses we did not identify specifically formed networks around AE energy.
- Collaborations and networking were built mainly to solve more immediate technical challenges.

Experimenting:

- Some experimenting - information sharing through company promoting and developing new AE technology

Conclusions from the case studies in Frislan & Sweden:

The **Frisian case** demonstrates:

- how experimenting with AE is programmatically conducted.
- dependence on Regime and Landscape factors at the national and international level.
- importance of framing and connecting AE to the cultural identity and related preferences.
- several governance arrangements on managing AE regionally.

The **Swedish case** demonstrates:

- the relevance of MLP, presenting a longitudinal analysis highlighting several regime barriers impeding AE development and scaling.
- why AE in Sweden is currently a small niche market contributing little to transformative and environmental change of the domestic heat system.

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Conclusions

16 Oct 2024 | 15:05 – 15:15 CEST

Shanne Bouma
Project Leader
Province of Fryslân

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Questions & answers

16 Oct 2024 | 15:10 – 15:30 CEST

Shanne Bouma
Project Leader
Province of Fryslân

Sebastian Baes
Engineer
Co-Founder EXTRAQT

Andries Metz
Project Leader
Province of Fryslân

Nthabi Mohlakoana
Researcher
TU Delft | Technology, Policy and Management

Thomas Hoppe
Professor Sustainability of Rural-Urban Systems
University of Twente

Sara Brogaard
Senior Lecturer
LUCSUS

Thank you

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