nanoverbund

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sweet swiss energy research for the energy transition

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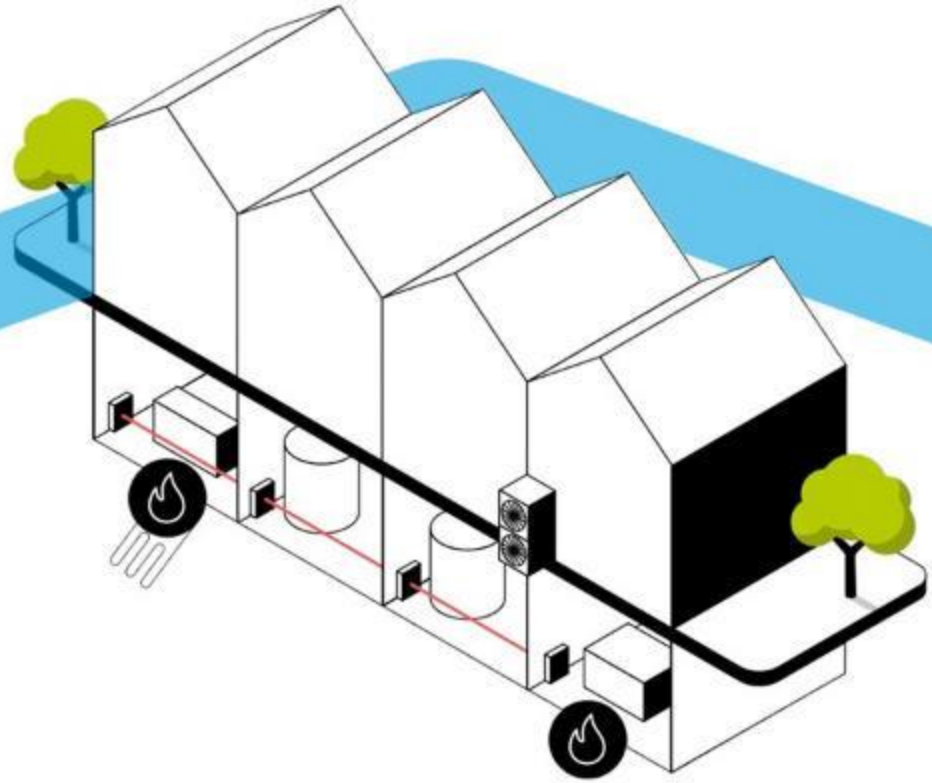
ETH zürich Empa PSI zhaw HOCHSCHULE LUZERN UNIVERSITÉ DE GENÈVE EPFL TU Delft

Lunch talk series V:

Agenda

Explain the concept of the nanoverbund for practice
Highlight learnings from the nanoverbudn for theory

1. **The nanoverbund as an example for heating pump flexibility**
2. **Community-scale heating grids as an example for ecosystem benefits**



NANOVERBUND

iwb

Our expertise

Solar

HEAT

E - MOBILITY

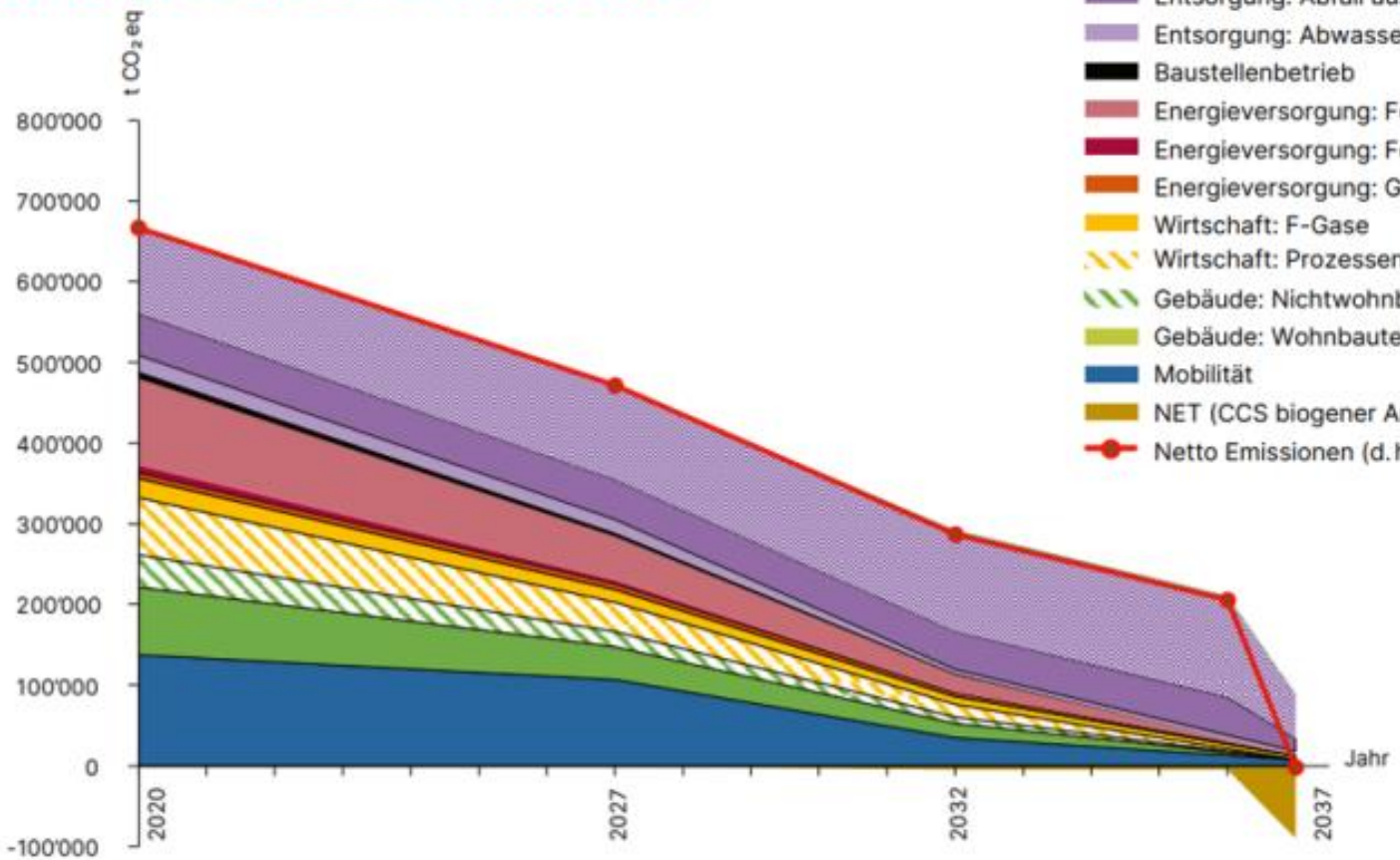
ELECTRICITY
100% renewable

WATER

TELEKOM

Klima Basel 2037

Klimaschutzstrategie



- Landwirtschaft
- Entsorgung: Abfall ausserhalb BS (inkl. CCS fossiler Anteil KVA)
- Entsorgung: Abfall aus BS (inkl. CCS fossiler Anteil KVA, inkl. Deponie, Biogasanlage)
- Entsorgung: Abwasserreinigung
- Baustellenbetrieb
- Energieversorgung: Fernwärme für Gebäude (Komfortwärme)
- Energieversorgung: Fernwärme für Wirtschaft (Prozesse)
- Energieversorgung: Gasnetzverluste
- Wirtschaft: F-Gase
- Wirtschaft: Prozessenergie
- Gebäude: Nichtwohnbauten (Öl und Gas dezentral)
- Gebäude: Wohnbauten (Öl und Gas dezentral)
- Mobilität
- NET (CCS biogener Anteil KVA und weitere)
- Netto Emissionen (d.h. inkl. NET)

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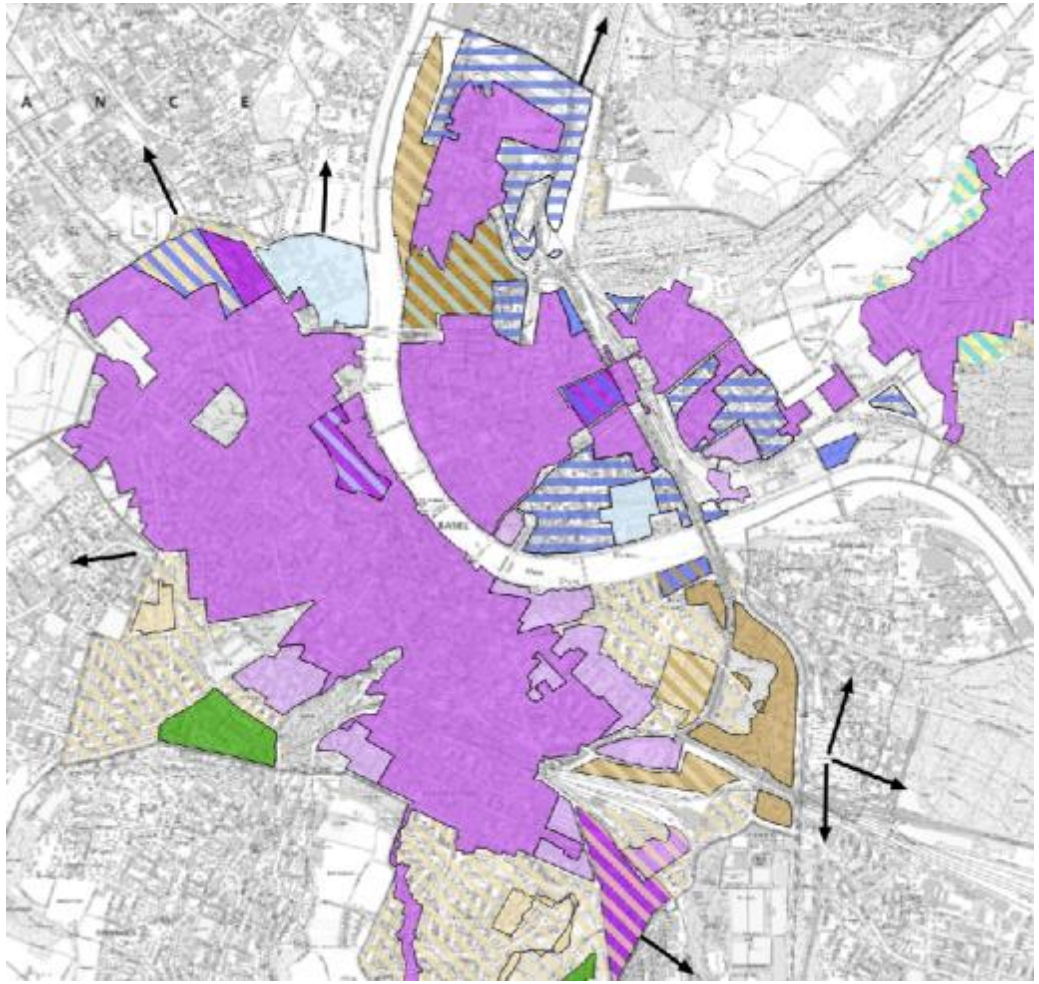
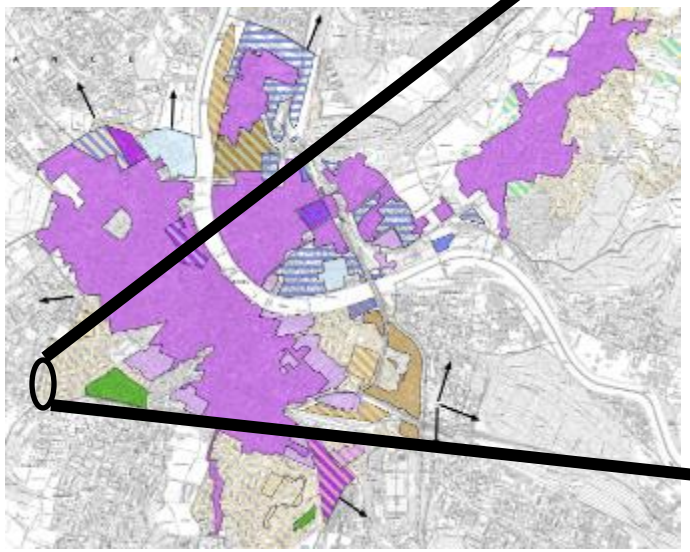
Initial situation



- Fossil heating systems impossible by law
- Gas is being phased out
- District heating too expensive in less populated areas and smaller buildings
- Alternative solutions not always easy to implement
- Older heating systems were often oversized based on rules of thumb and planning data

Areas without district heating connection



Carve-, Board- und
Sport 061 411 46 16 / Scheiwi 061 70

Vaillant
SCHEIWI - S
Carve-, Board- und M
061 411 46 16

Overview Pilot 'Langen Loh'

Gas heating

EWS-WP

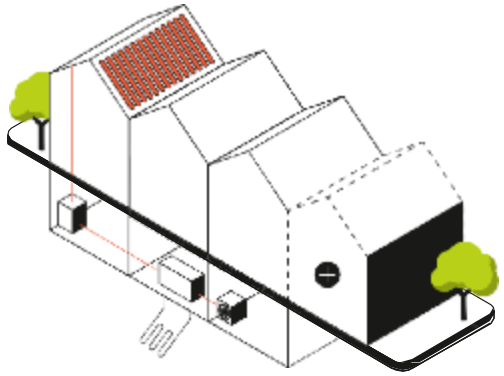
Solar thermal energy

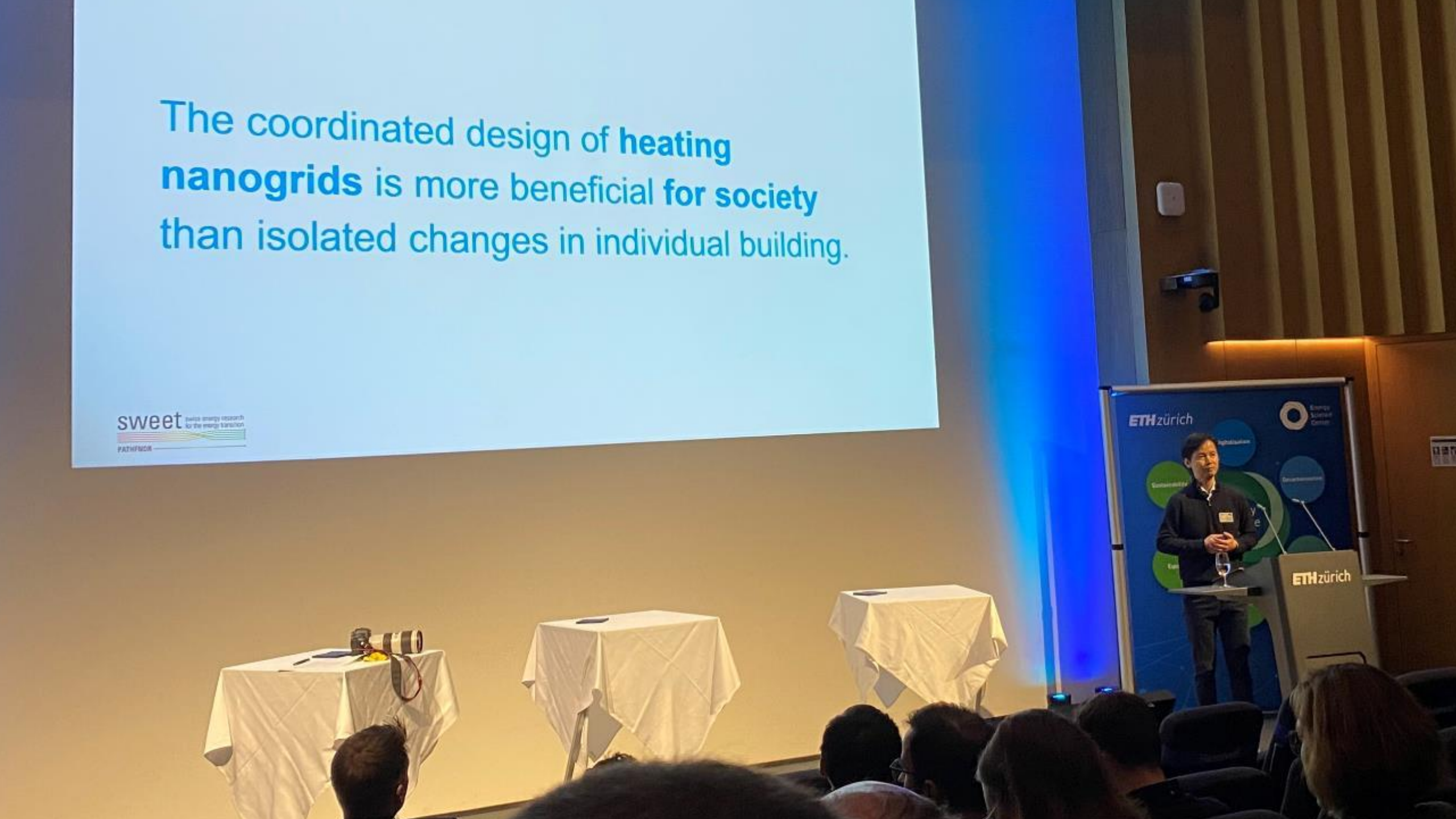
Connecting pipe


SAN FRANCISCO

Potential for Switzerland

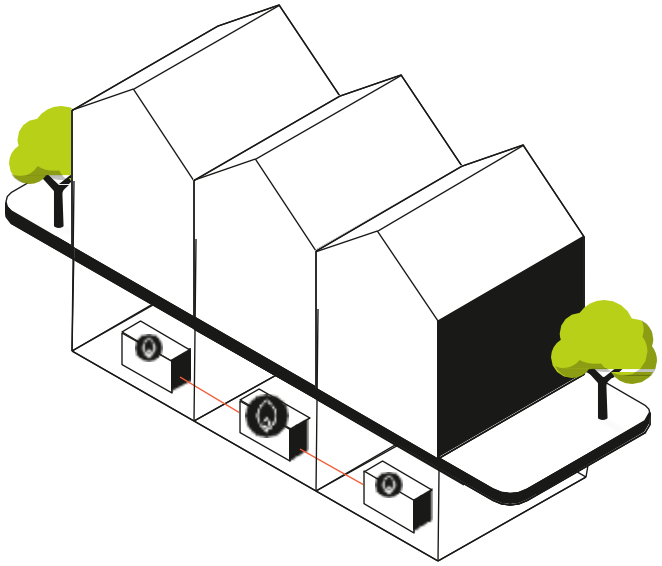
- Over 75,000 suitable building networks identified
- Savings of 1,079 GWh of fossil energy
- Avoidance of 252,000 tonnes of CO_2 per year <u>without heating replacement</u>




The coordinated design of **heating nanogrids** is more beneficial **for society** than isolated changes in individual building.
sweet
ETH zürich
ETH zürich

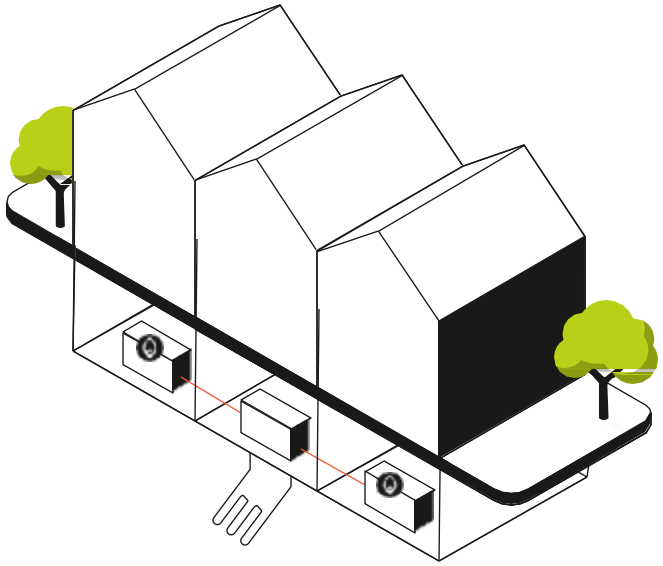
Step by step to climate neutrality

Step 1



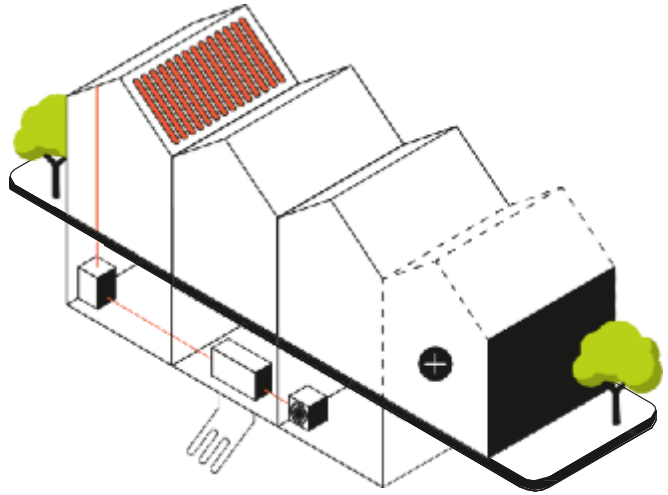
- Connecting existing heating systems
- Measure and optimise
- Up to 20% energy savings
- Minimise the risk of heating failure

Step 2



- Install renewable heating
- Already 91% renewable
- Up to 15% more favourable in operation and investment compared to a single solution

Step 3

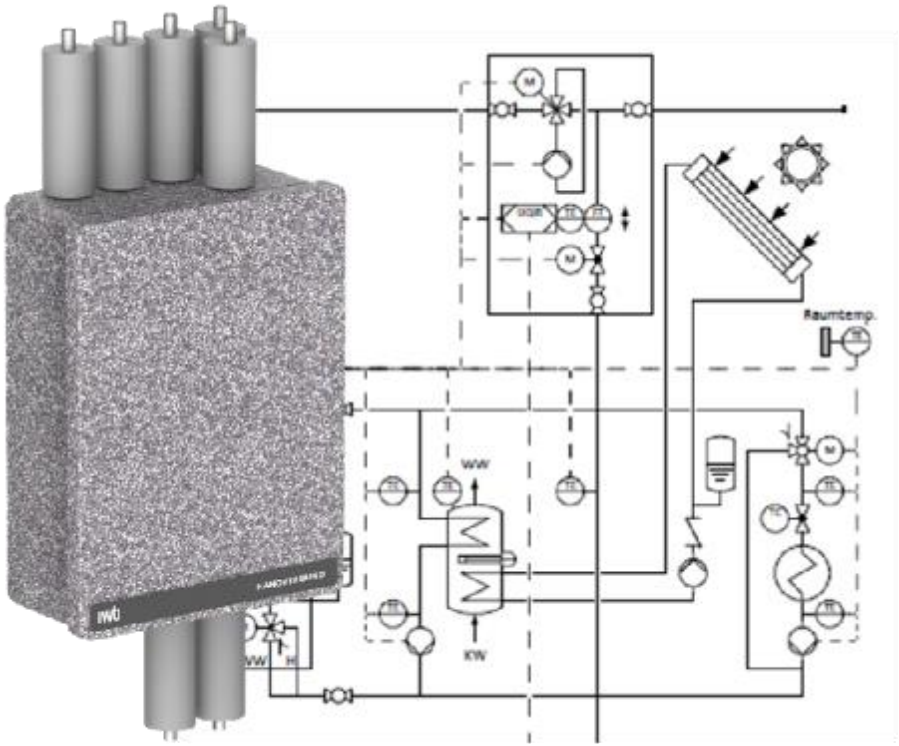


- Replacement with a sensibly dimensioned heating system
- Space savings through distribution
- Expansion possible at any time
- Reaction options thanks to technology flexibility

Service IWB in collaboration with Yuon

Construction

Wall station, plans, sample contract



Operation

Optimisation, measurement and support

Canton of Basel-Stadt and Baselland promote the Nanoverbund

- **Maximum funding amount**
- BS: up to max. 40% of the total investment costs
- BL: up to max. 50% of the total investment costs

- **Composition of the funding amount**
- BS: Basic amount CHF 4,000 + CHF 200/kW_{th}
- BL: Basic amount CHF 5,000 + CHF 200/kW_{th}

- **Requirements for funding**
- Funding is provided for the connection or replacement of fos
- Fossil heating system must be replaced within 5 years (BS)

- **Outside BS/BL**
- Other cantons in clarification

Nanoverbund interim solution for district heating (Luzern)

Gemäss GWR-Daten oder Aufnahme Begehung oder Kontaktaufnahme

Legende

Heizung mit Erdgas:

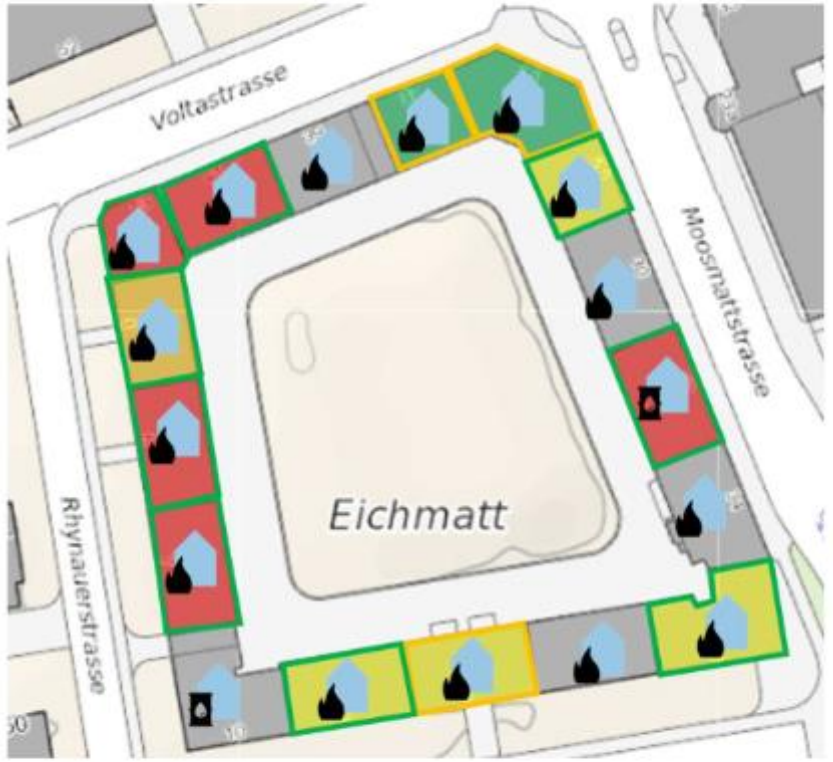
Heizung mit Heizöl:

Heizungsalter in Jahren:

	0-10 Jahre
	10-15 Jahre
	15-20 Jahre
	Älter als 20 Jahre
	Keine Information

Beteiligt an Beratungsstufe 2

Offenheit bekundet



- source: diePROJEKTFABRIK

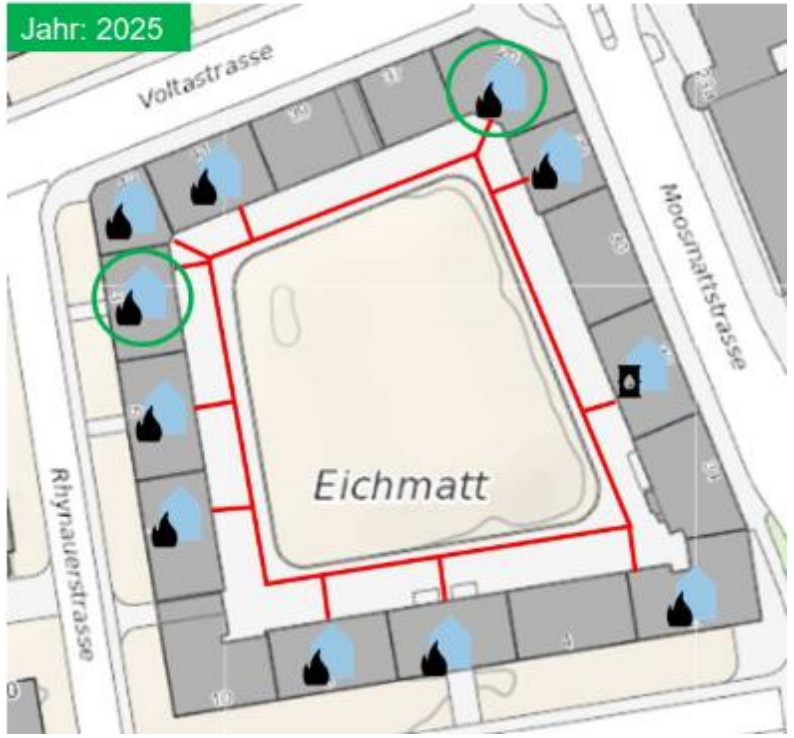
Nanoverbund interim solution for district heating (Luzern)

Variante 2.2: «Fernwärme mit Übergang Gas dezentral»

Resultate der Machbarkeitsklärung 2025

- Zusammenschluss zum «Nanoverbund»
- Alle Gebäude können produzieren und beziehen
- Die **effizientesten** Heizungen laufen prioritär

	Leistung (kW)
Heizleistung Bedarf	360
Heizleistung installiert	590
Reserve im Verbund	**230**



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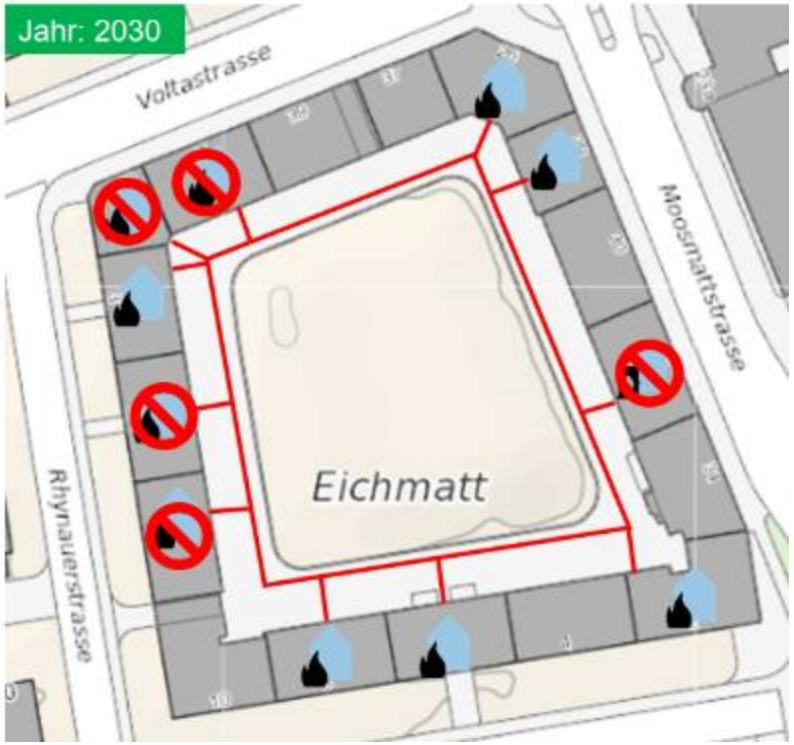
Nanoverbund interim solution for district heating (Luzern)

Variante 2.2: «Fernwärme mit Übergang Gas dezentral»

Resultate der Machbarkeitsklärung 2030

- Kontinuierliche Optimierung der Heizungen und Reduktion des Heizleistungsbedarf um min. 15%
- Ausfall der 5 ältesten Heizungen (>25 Jahre)

	Leistung (kW)
Heizleistung Bedarf	320
Heizleistung installiert	330
Reserve im Verbund	**10**



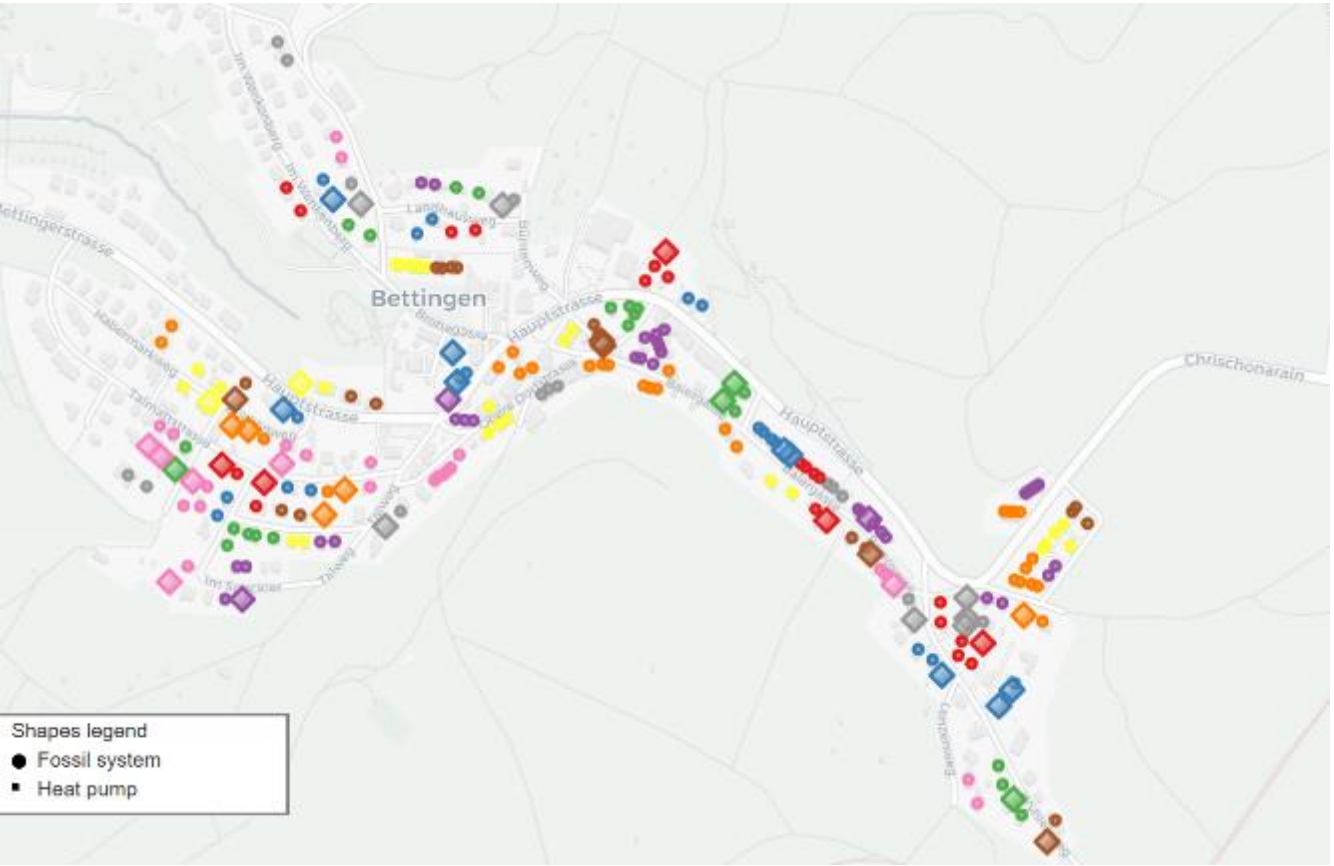
- source: diePROJEKTFABRIK

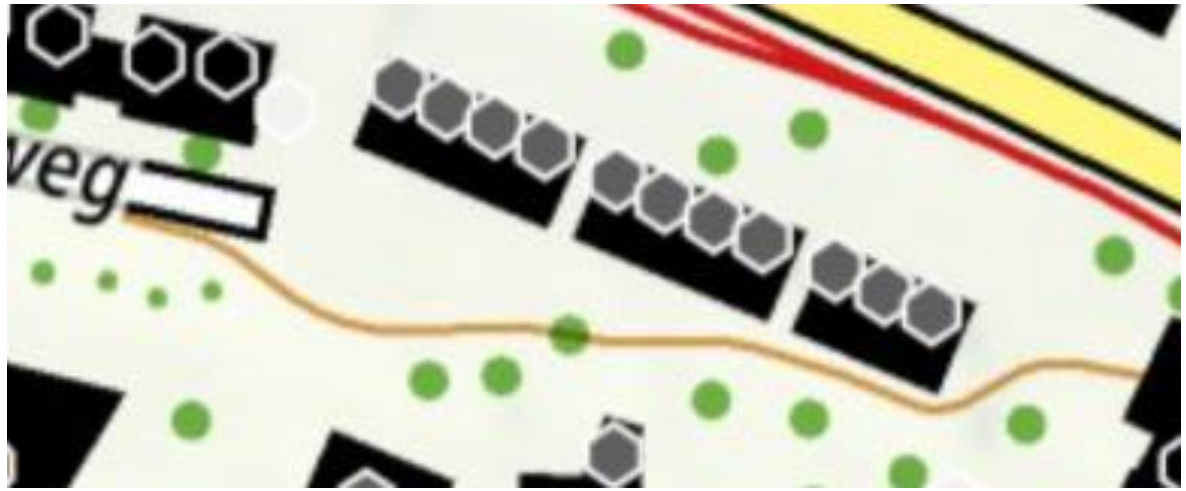
Terraced single-family house and terraced multi-family house

Single-family house
- up to max. 25 kW / building
- Connection DN 25
- Wall mounting
- 40 kg
- Availability: in stock

Apartment block
- Up to max. 85 kW / building
- Connection DN 50
- Floor standing
- Approx. 150 kg
- Availability: Q2/2026

Other projects under review





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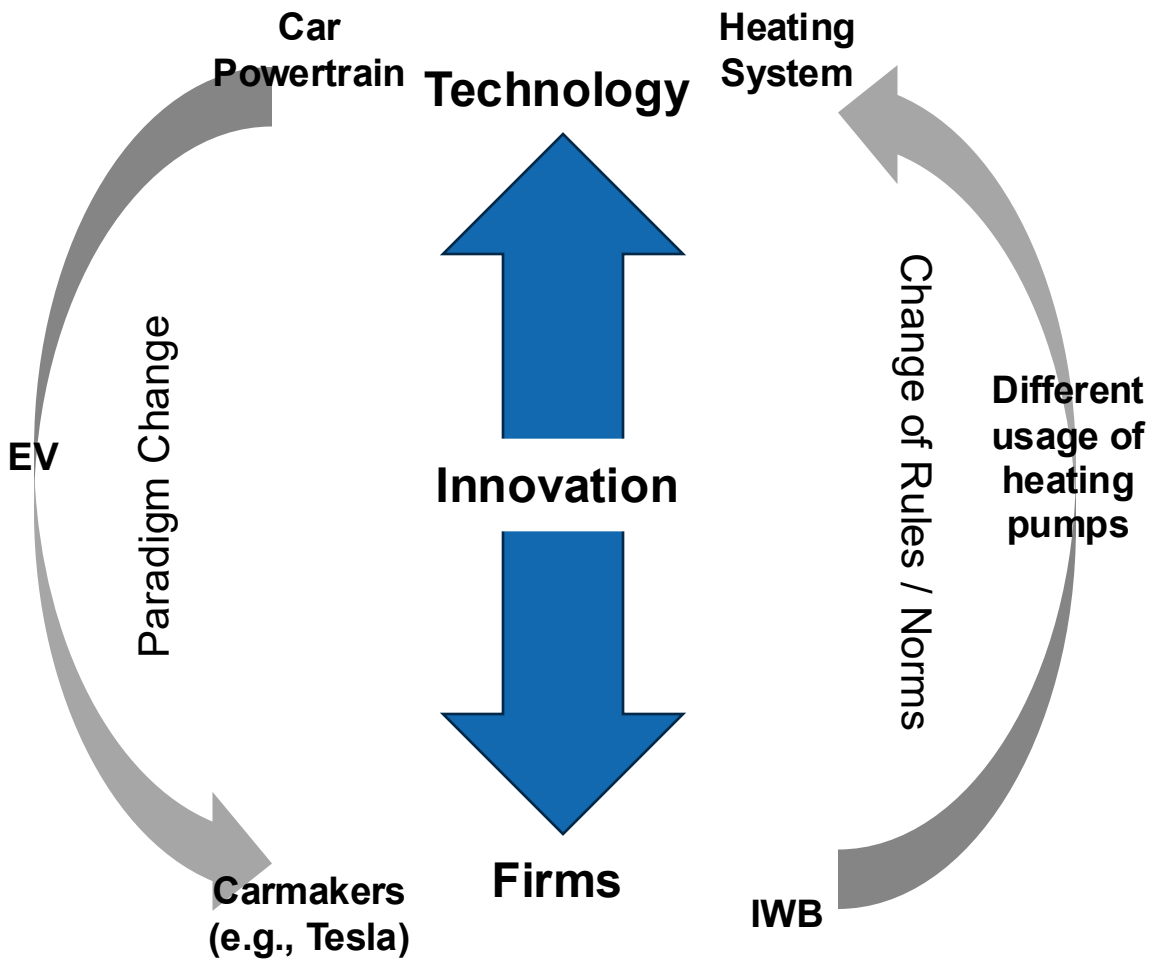
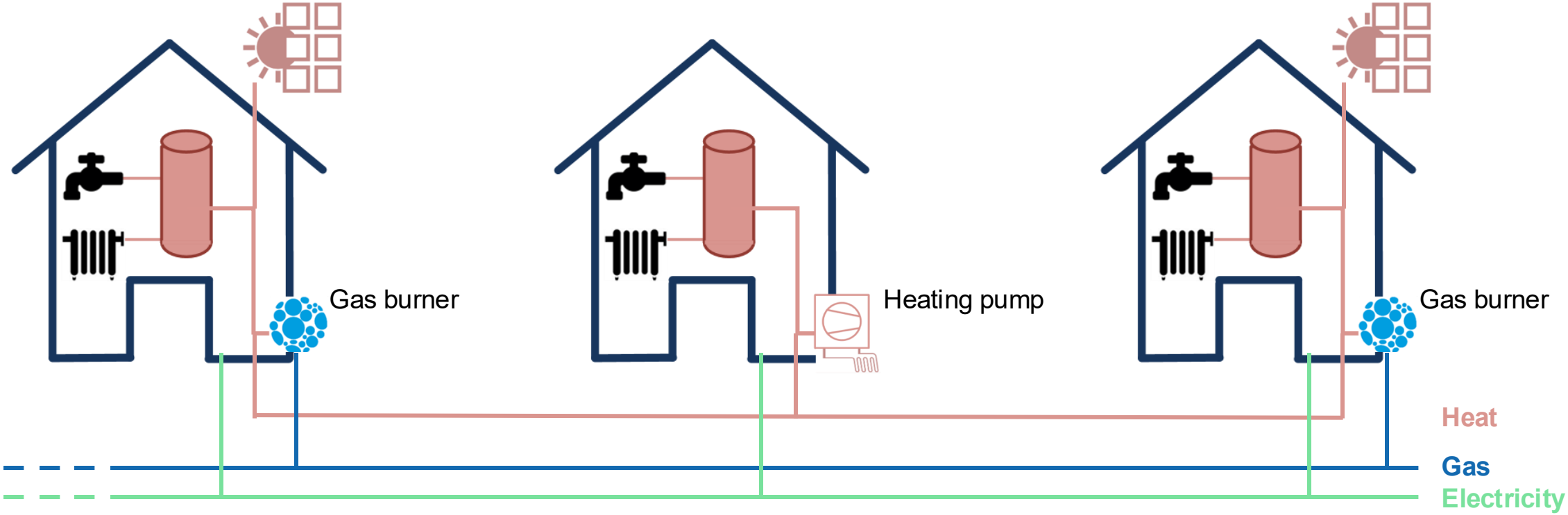
Theoretical Classification: Innovation with Established Technologies



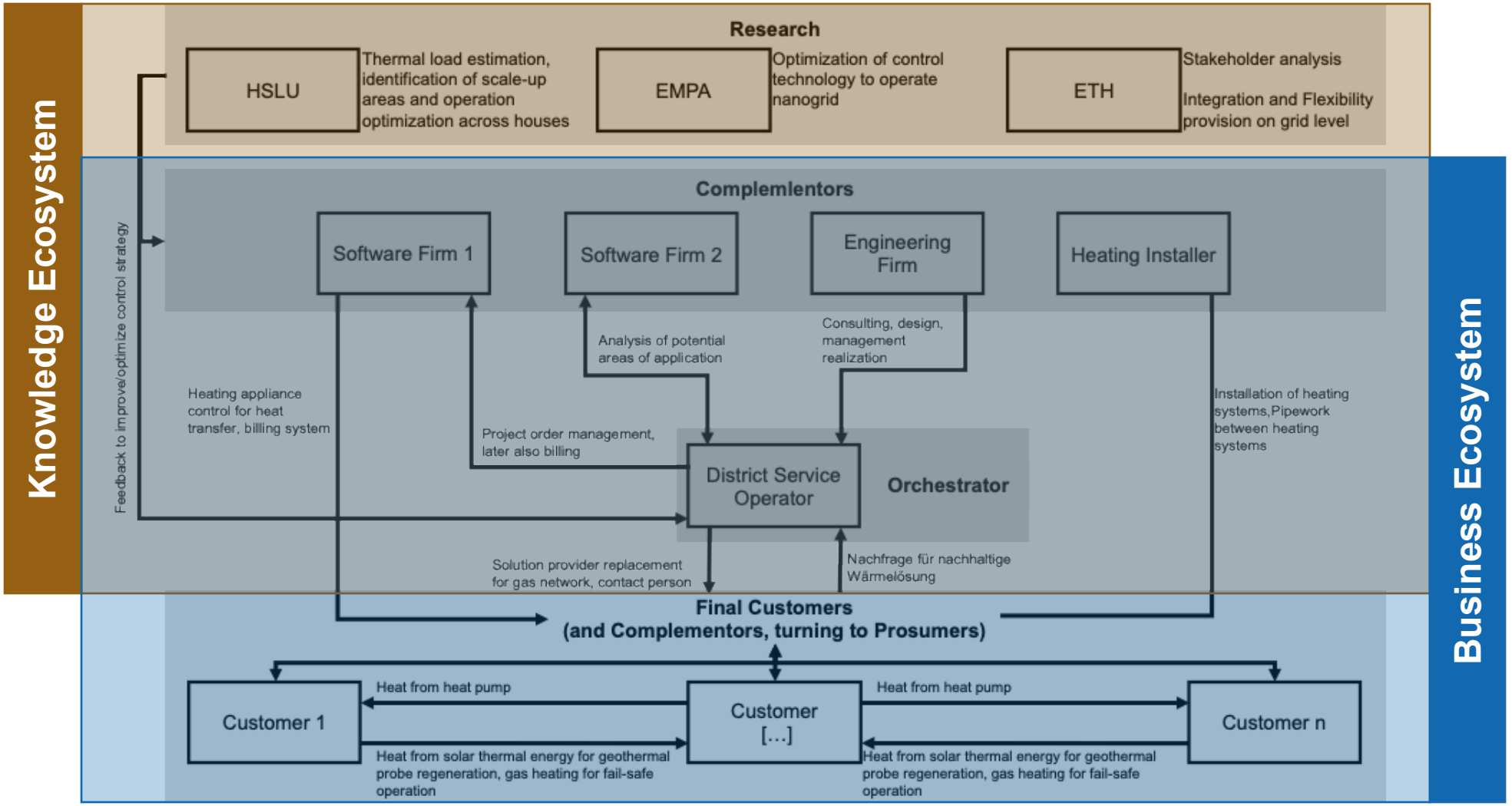
(Brusoni & Laureiro, 2023)

Conceptualization of Heating Systems as a Platform through Modularization



Platforms integrate a set of optional modules contributing value to a system. (Baldwin, 2024)

Heterogenous Actors with Different Strengths form the Nanoverbund Ecosystem



Key

Actor | Type of actor → Activity (value creation)

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Nanoverbund Grew Through an Ecosystem

Ecosystems create a collective output

> "A community of hierarchically independent, yet interdependent heterogeneous participants who collectively generate an ecosystem output and related value offering targeted at a defined audience." (Thomas & Autio, 2020)

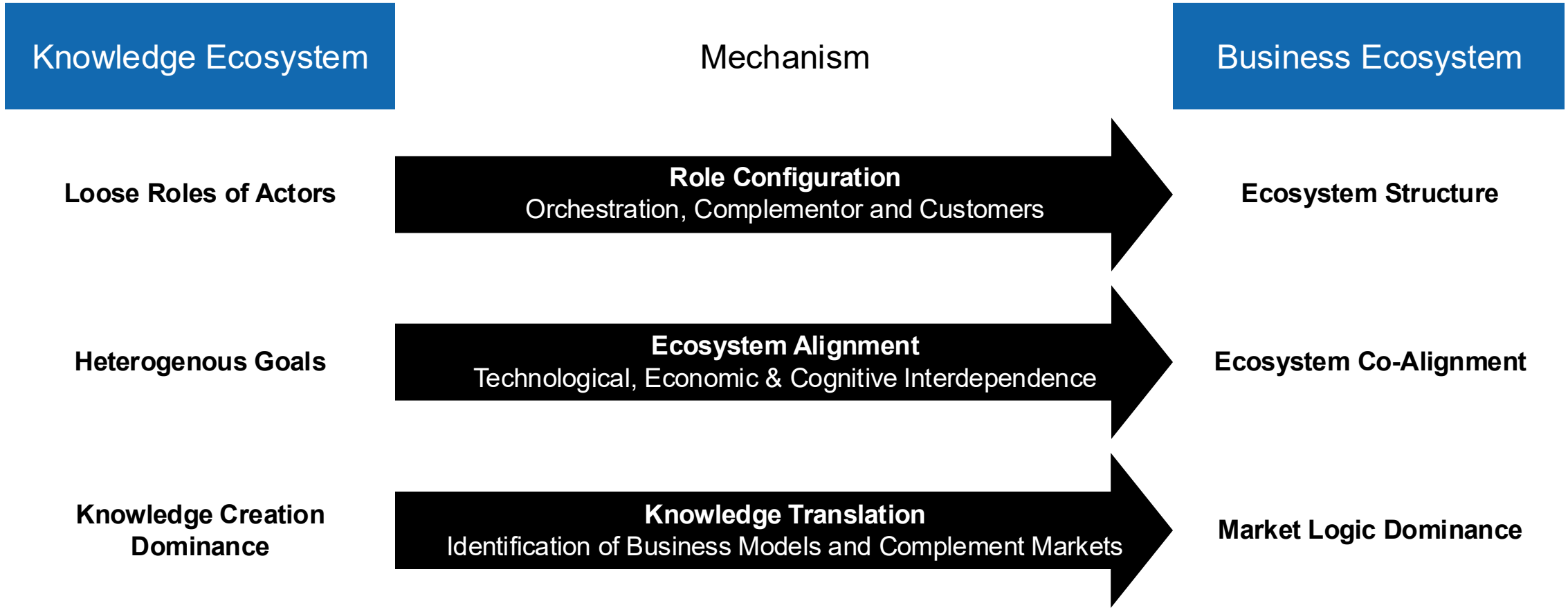
Ecosystems consist of independent but interdependent actors (Jacobies et al., 2018)

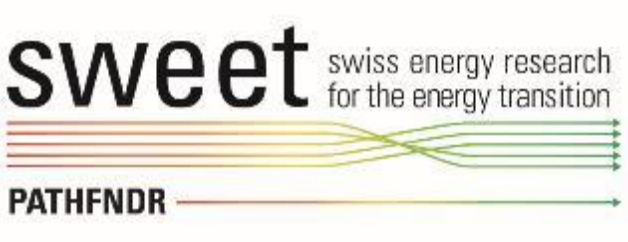
Actors identify as part of the ecosystem while having different understanding on their role (Thomas & Ritala, 2022)

Ecosystems participants come from multiple industries (Aarikka-Stenroos & Ritala, 2017)

Ecosystems might have an orchestrator (Altman & Tushman, 2017)

Evolving from a Knowledge toward a Business Ecosystem





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