

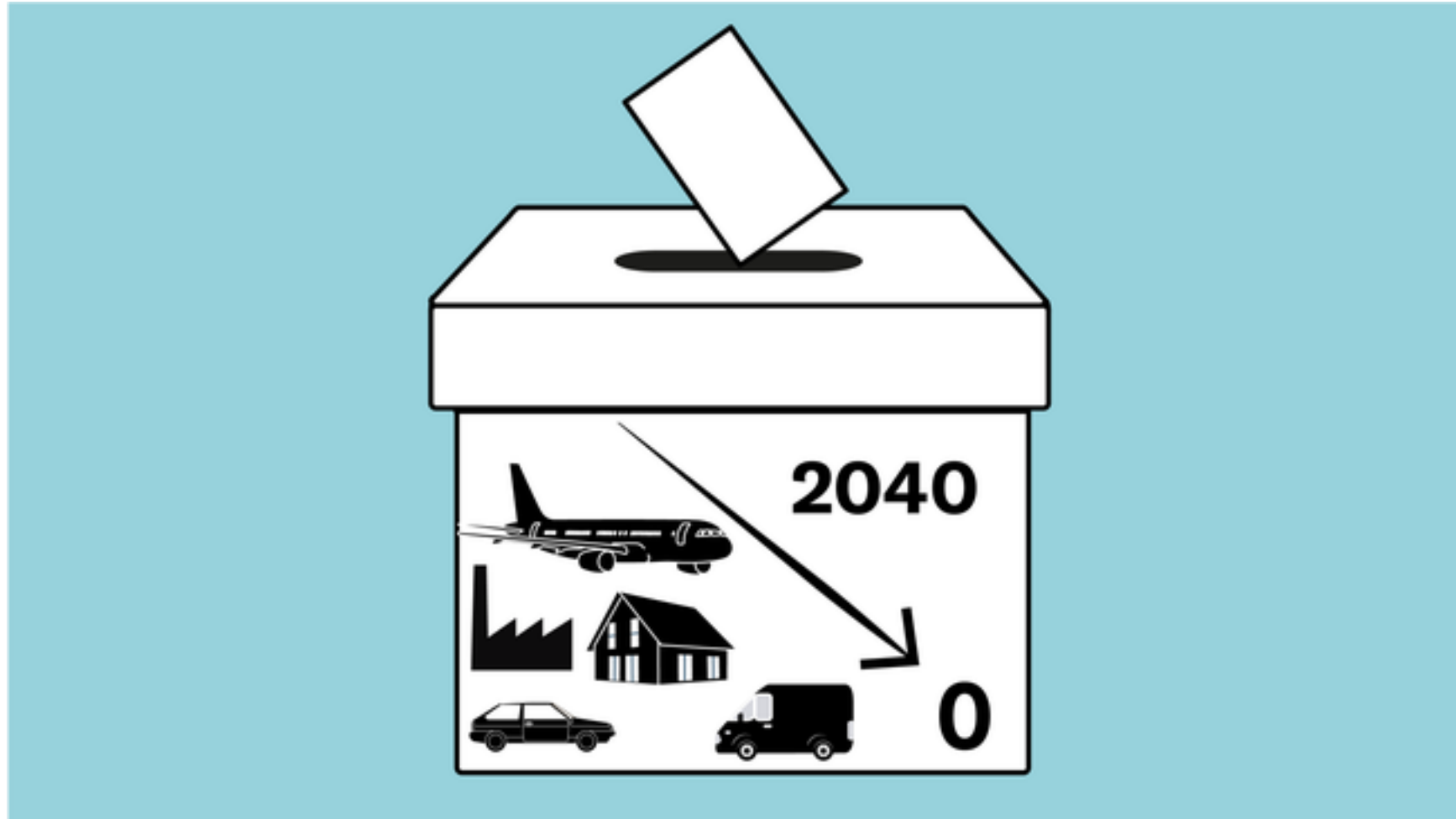
SWEET DeCarbCH: Case Study Decarb Zurich

Lunch Talk June 6, 2022
WP 6

Armin Eberle (ZHAW)



Yes, Zurich can net zero!
(at least, now it's written in the constitution)



May 15 2022
75% YES

Agenda

- Goal
- Where do we start in a city like Zurich
- Main Topics/Challenges for Zurich
- Research from DeCarbCH
- Together we can...
- Next steps (Cases, P&D)

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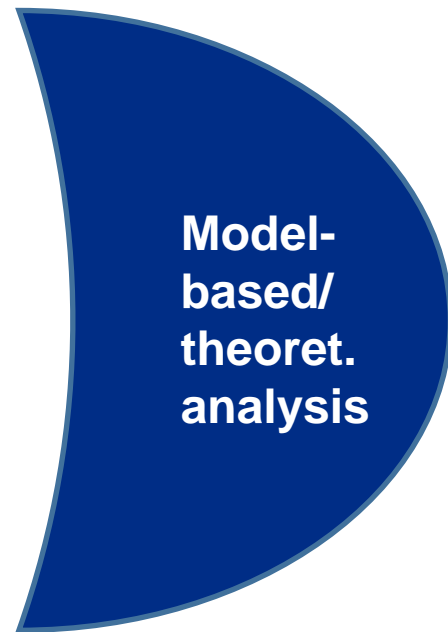
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About the Case Studies

Aim: Bringing Science and Implementation together

- How to realize large-scale thermal grids?
- How to realize weekly and monthly energy storage?
- How to initiate and accelerate change?
- How to...
- How to initiate and accelerate change?

DeCarbCH



The right combinations of technologies in the right place

**Show that it works:
Developing, piloting and
demonstrating (techn.)
solutions**

The right legal measures and actors, ensuring acceptance

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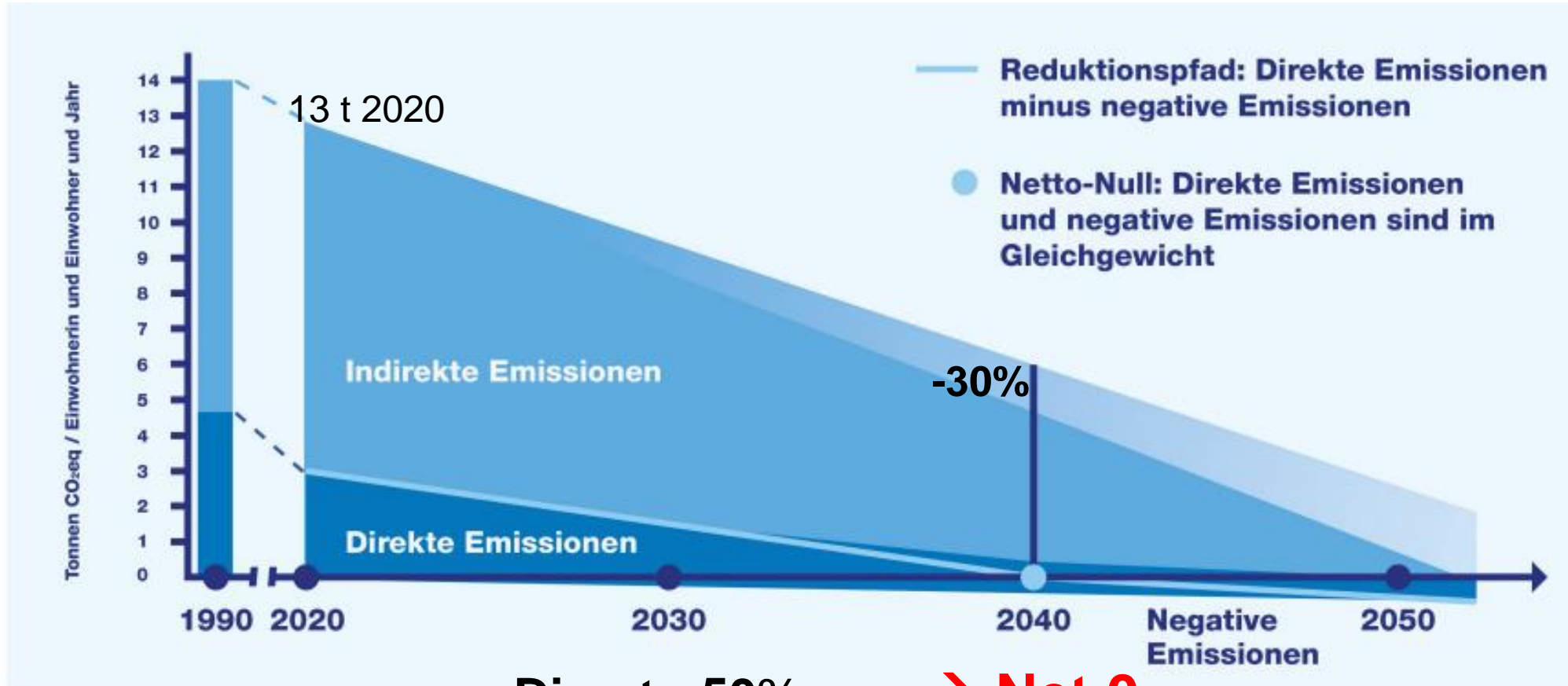
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Goal: Net zero until 2040 (Zurich, Winterthur, Canton)

Direct emissions: (within perimeter of the City)

From 4.8 t CO₂ per capita -> today 3.1 -> zero until 2040



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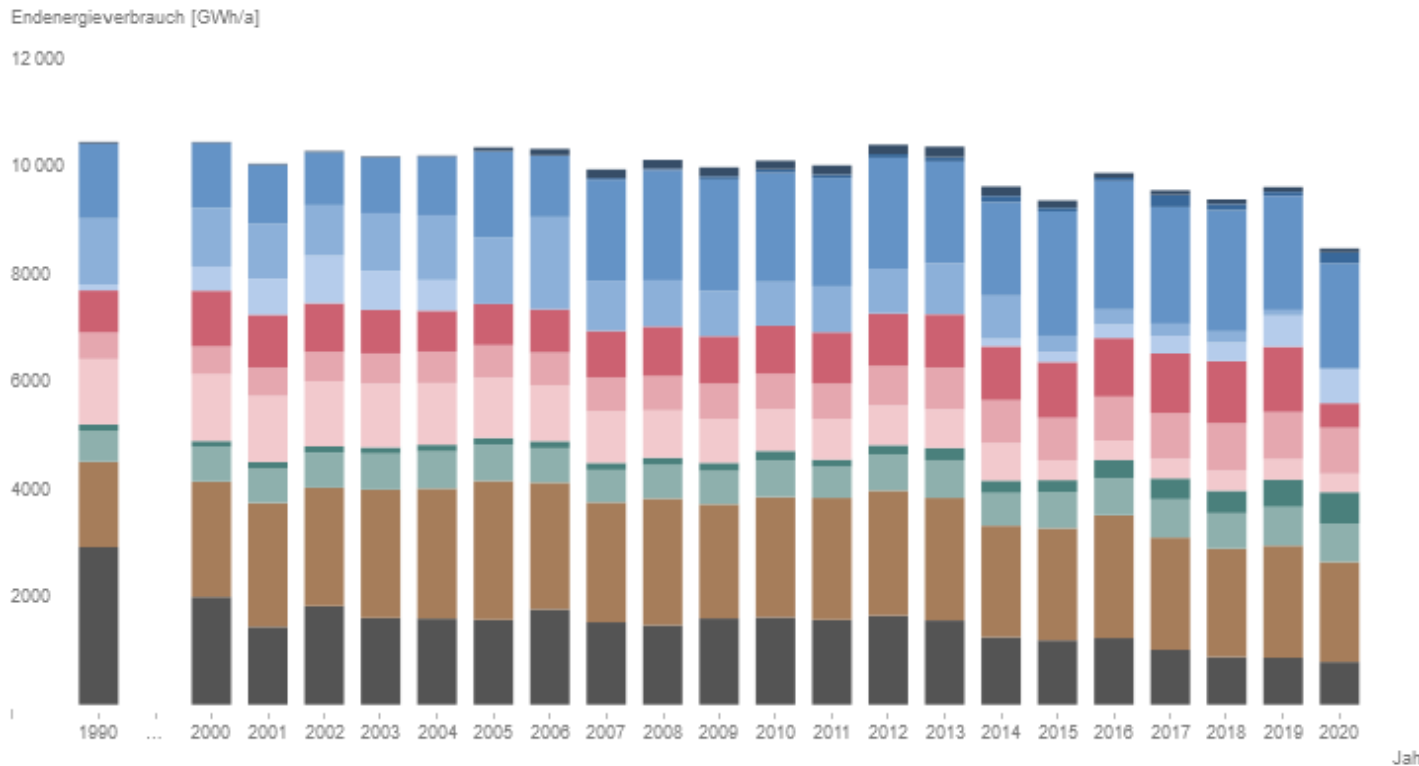
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Where do we start in Zurich: Energy Consumption

Endenergiebilanz 1990 bis 2020



Fossil Fuels
>50%
(2019 pre-pandemic)

- Strom Holz und Kehrlicht
- Diesel
- Strom Photovoltaik und Wind
- Benzin
- Strom Wasserkraft
- Holz, Umweltwärme, Biogas, Sonnenkollektoren
- Strom Kernkraft
- Fernwärme
- Strommisch Europa
- Erdgas
- Kerosin
- Heizöl EL

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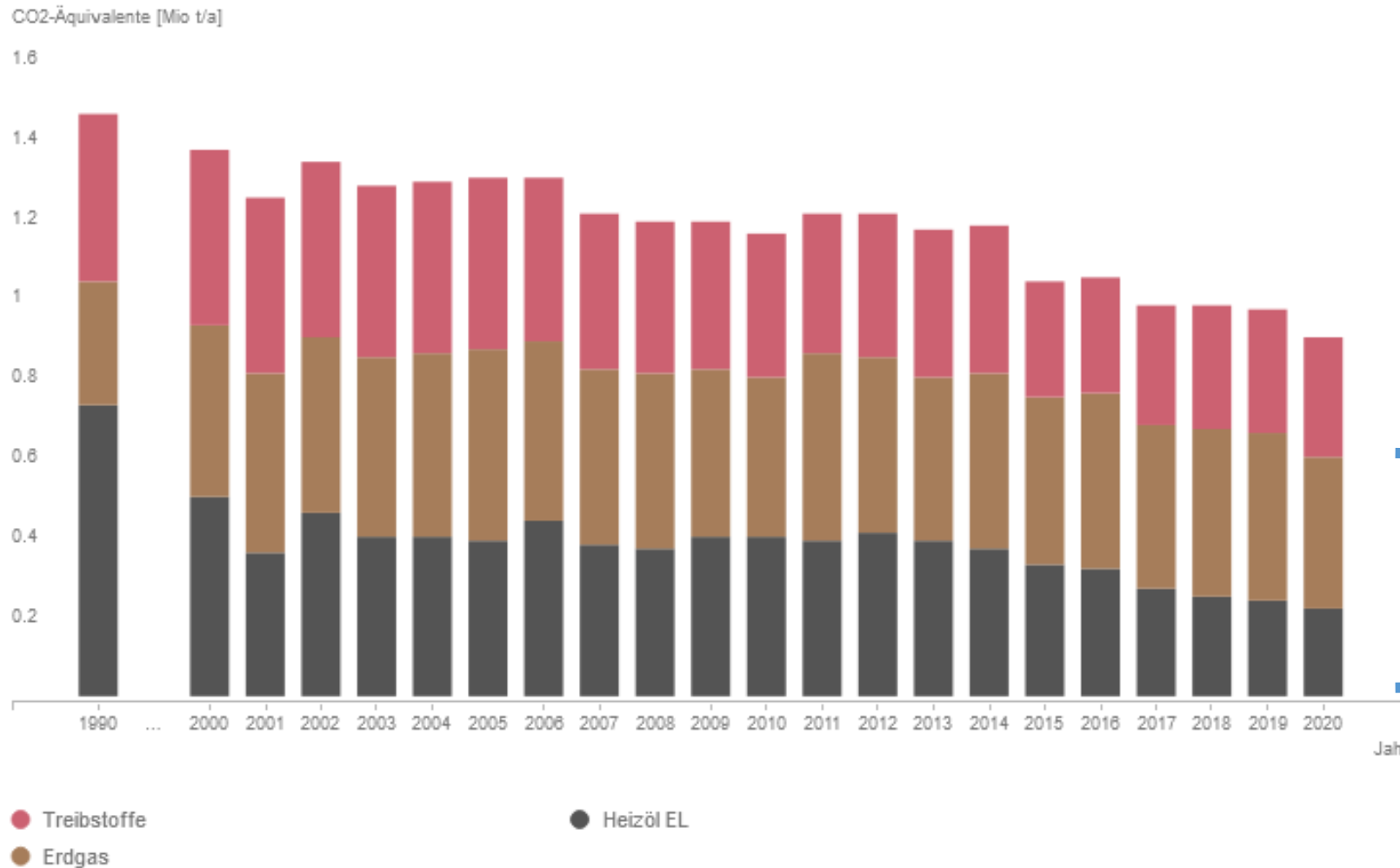
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Where do we start in Zurich: CO2-Emission

CO2-Statistik 1990 bis 2020



- 35%
from 1990

Heating:
>67%

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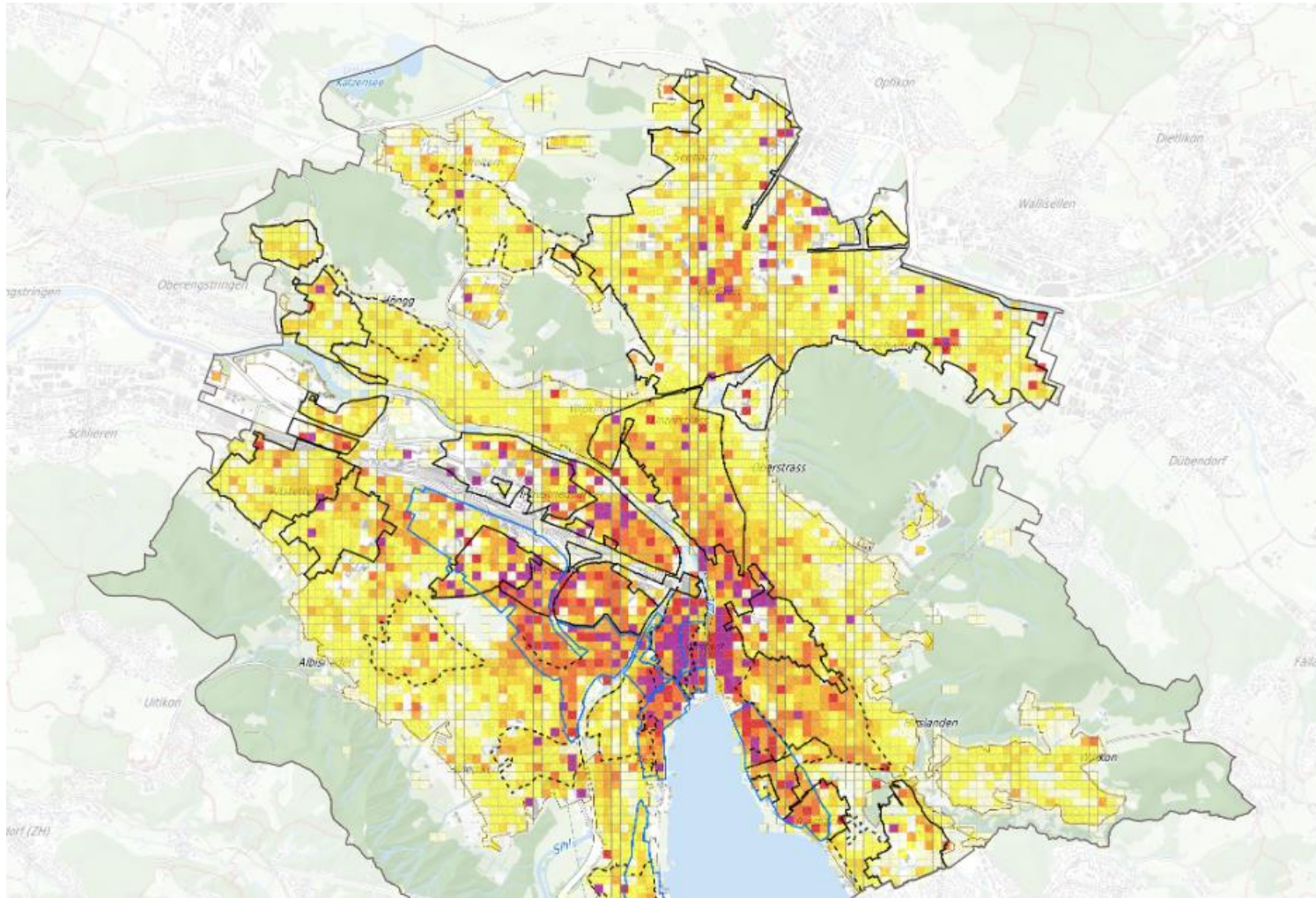
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Energy Planning of Zurich: Heating Demand 2015



Kommunale Energieplanung

Themenkarte T1 Nutzwärmebedarf im Jahr 2015 (Raumheizung und Wassererwärmung)

Nachfragedichte in MWh pro Jahr und Hektare
gemäss Konzept Energieversorgung 2050 der Stadt Zürich



Festlegungen gemäss Energieplankarte

- Gebiet der öffentlichen Fernwärmeversorgung oder Energieverbund mit Gebietsauftrag
- Prüfgebiet der öffentlichen Fernwärmeversorgung oder Energieverbund mit Gebietsauftrag in Prüfung
- Gebiet mit koordinierter Energienutzung aus Grundwasser oder Seewasser

Übriger Informationsinhalt

- Siedlungsgebiet

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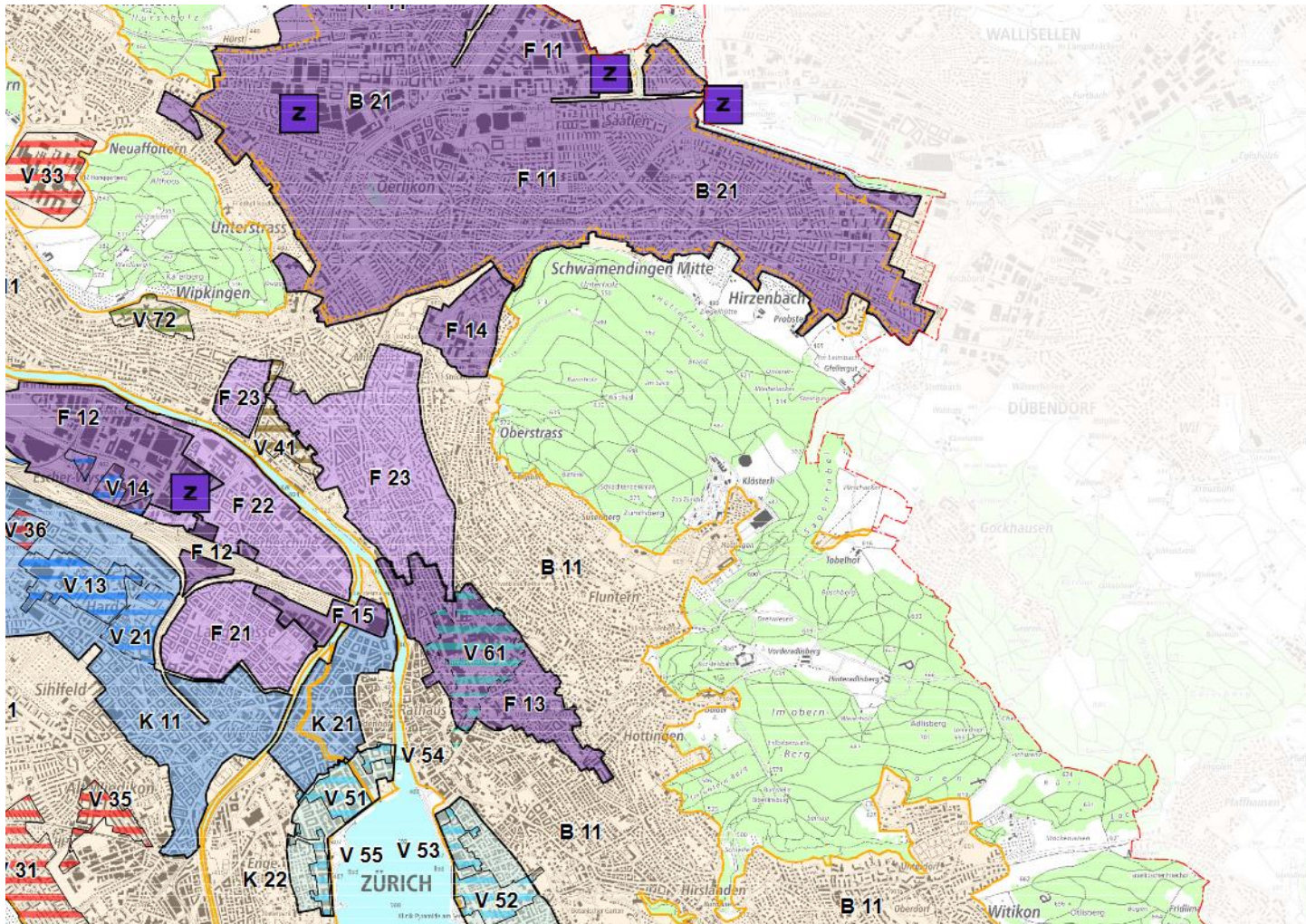
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Energy Planning of Zurich: Potential supply



- Prioritätsgebiet geplant (W)
- Prioritätsgebiet geplant (W)
- Prüfgebiet (Wärme und Kä)

Koordinierte Energienutzung

- aus Grundwasser
- aus Seewasser

Gasversorgung

- Gasversorgung
- Perimeter beschlossener F Gasversorgung

Informationsinhalt

Energieverbunde > 5 GWh/a

- Abwärme
- Wärme und Kälte aus Grur
- Wärme und Kälte aus See
- Wärme aus Rohabwasser
- Wärme aus Biomasse

Energieverbunde in Prüfung

- Wärme und Kälte aus Grur
- Wärme und Kälte aus See

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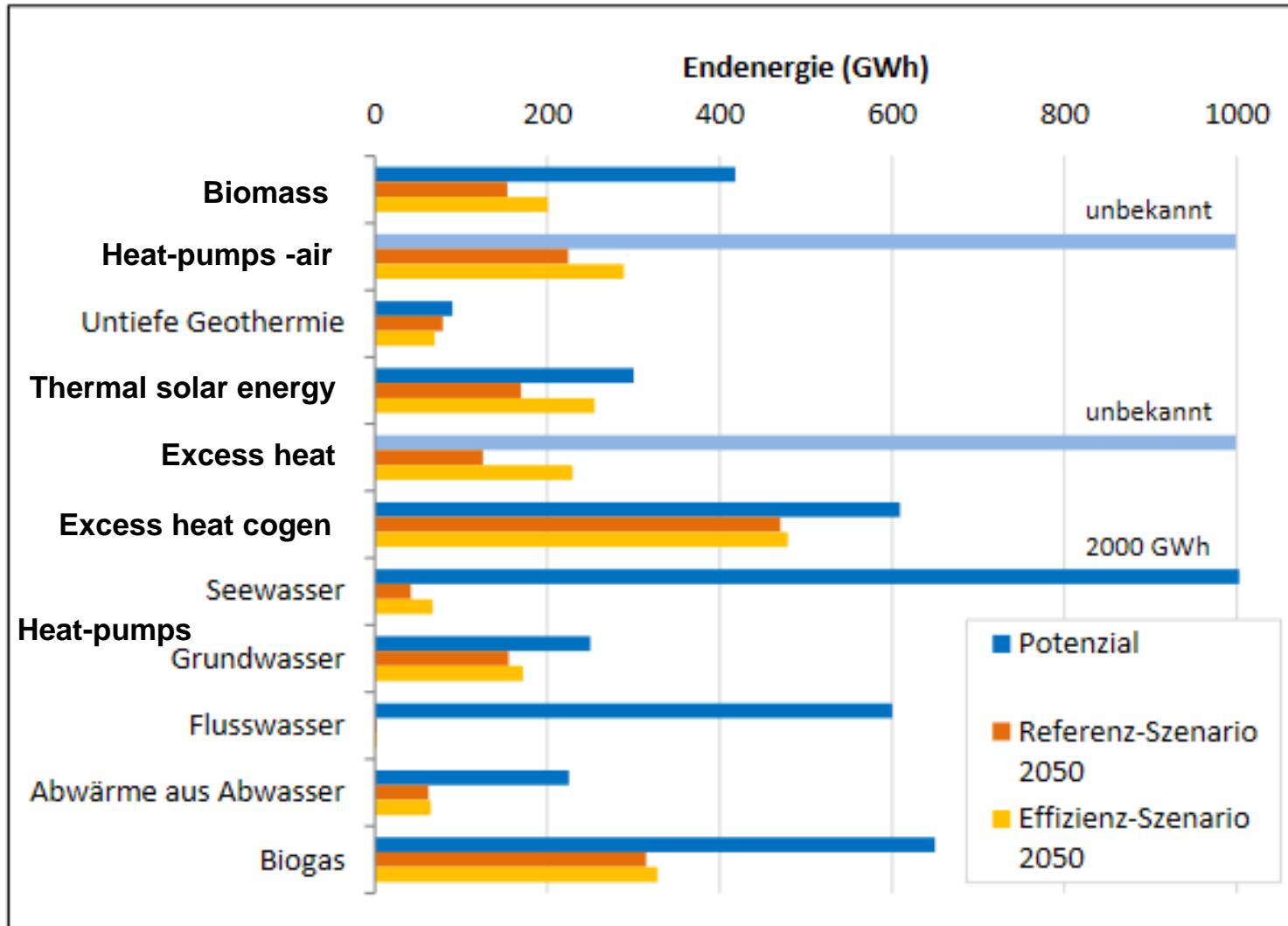
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Zurich- Potential for the transition



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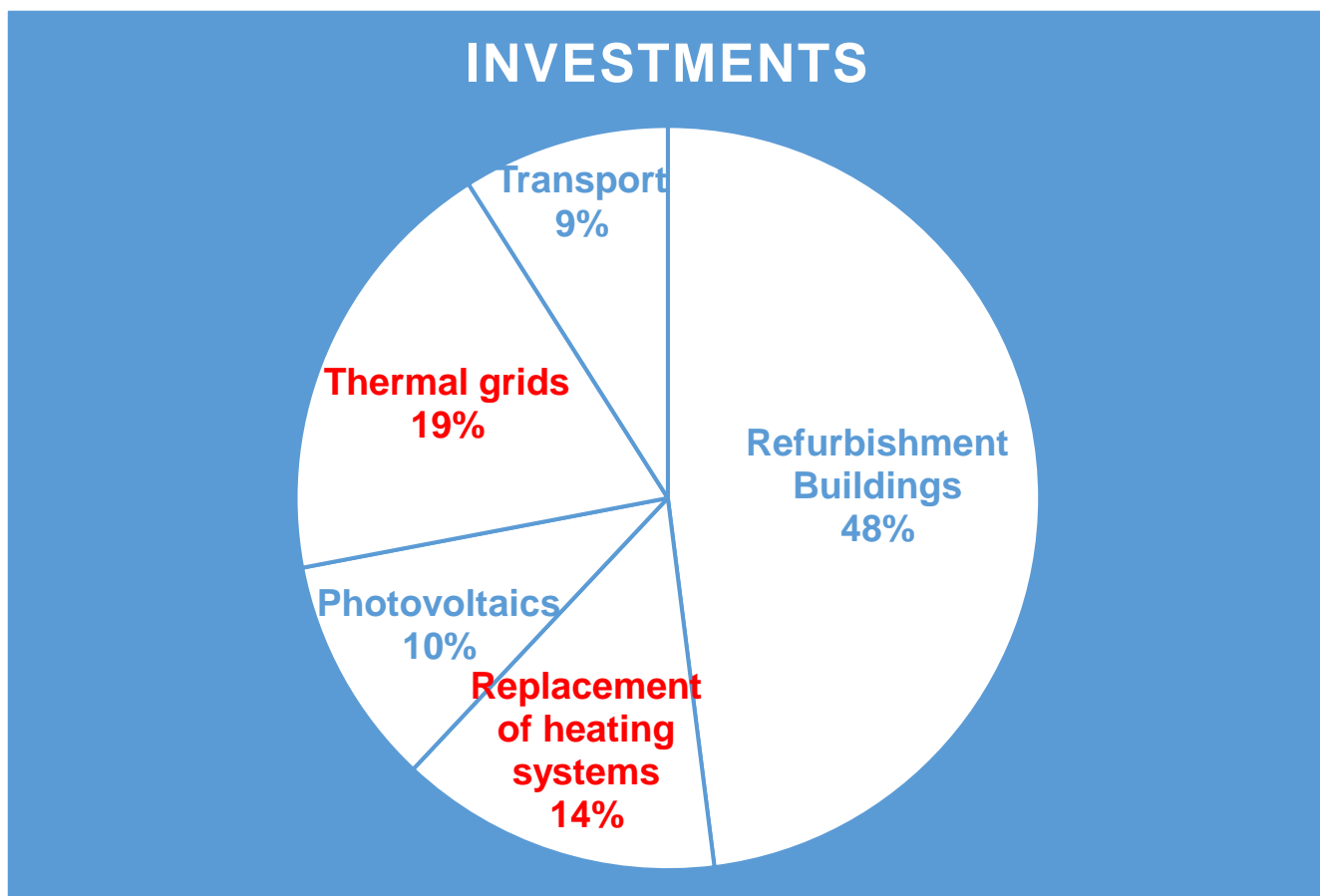
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Measures and Means (as planned by the city)



Investments
CHF 430 Millions p.a.
by the city,

CHF 90 Millions by
private sector

Total CHF 520 Millions
p.a.

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Measures towards net zero

	Actual	Net Zero 2040 (needed)	Acceleration
Refurbishment (insulation, windows)	1% rate p.a.	2.2% rate p.a.	Double
Replacement of fossil heating	200 (0.9% p.a.)	1300 (5.6% p.a.)	6-fold
Thermal grids (investments, CHF)	10 Millions p.a.	80 Millions p.a.	8-fold
PV installations	35'000 m2 p.a.	340'000 m2 p.a.	10-fold

Zurich main Topics

Heating and Cooling

- Goal 2040: 60% of the heating demand covered by thermal grids (distance and local)
- Usage of local sources
 - Energy from waste, wastewater treatment, incineration plant
 - Ground water, water from lake or river
 - Geothermal heat
- Development of the grid in stages

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Zurich main Topics

Renewables, Efficiency

- Photovoltaics, intensified development
- Biomass (limited)

- Energy consulting
- Incentives, subsidies

- Forced transformation of public buildings (net zero 2035)

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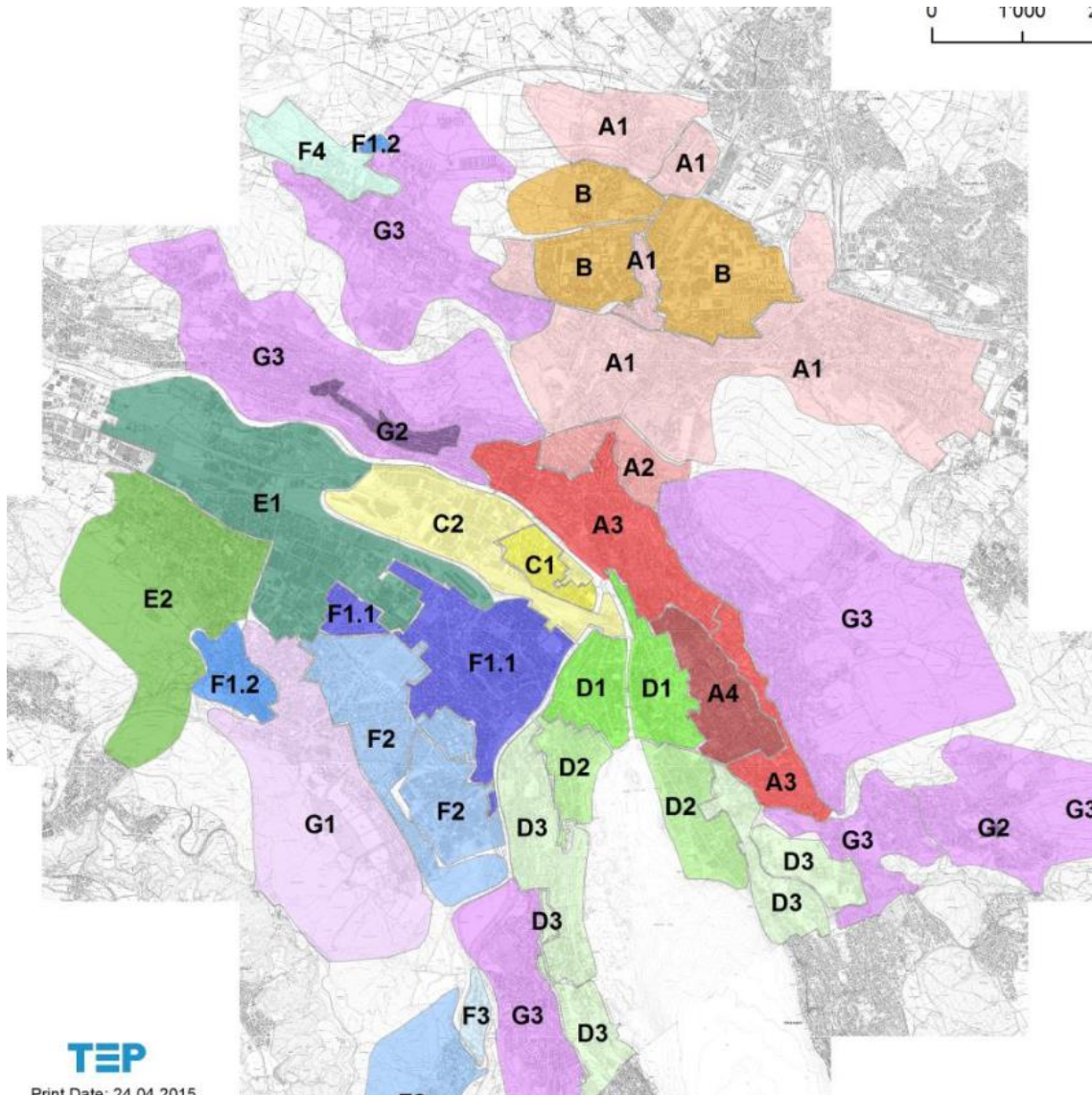
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Zurich- a perfect sandbox



Zones of supply solutions Concept of energy-provision 2050

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Legende

- A1 Fernwärme (FW) bestehend, Erdsonden teilw. zulässig
- A2 FW erweitert, Erdsonden teil. zulässig, mittlere Energiedichte (ED)
- A3 FW erweitert, Erdsonden zulässig, hohe ED
- A4 FW bestehend, Option Seewasser, EWS teilw. erlaubt
- B FW bestehend, Grundwasser (GW)-Angebot vorhanden, Erdsonden teilw. zulässig, mittlere ED
- C1 FW erweitert, GW-Angebot vorhanden, Erdsonden nicht zulässig, sehr hohe ED
- C2 FW bestehend, GW-Angebot vorhanden, Erdsonden nicht zulässig, mittlere ED
- D1 FW teilw. bestehend, GW-Angebot teilw. vorhanden, Erdsonden teilw. zulässig, Seewasserangebot vorhanden, sehr hohe ED
- D2 Erdsonden teilw. zulässig, Seewasserangebot vorhanden, hohe ED
- D3 Erdsonden teilw. zulässig, Seewasserangebot vorhanden, tiefe ED
- E1 Nähe zu ARA, Erdsonden v.a. nicht zulässig
- E2 Nähe zu ARA, Erdsonden v.a. zulässig
- F1.1 Grundwasserangebot vorhanden, Erdsonden nicht zulässig, sehr hohe ED
- F1.2 Erdsonden teilw. zulässig, tiefe ED
- F2 Grundwasserangebot teilw. vorhanden, Erdsonden teilw. zulässig, mittlere ED
- F3 Energieverbund mit GW und EWS, mittlere ED
- F4 Erdsonden teilweise zulässig, sehr tiefe ED
- G1 Abwärmeverbund Friesenberg, Holzverbund Triemli, EWS teilw. erlaubt, ED mittel
- G2 Erdsonden zulässig, mittlere ED
- G3 Erdsonden v.a. zulässig, tiefe ED

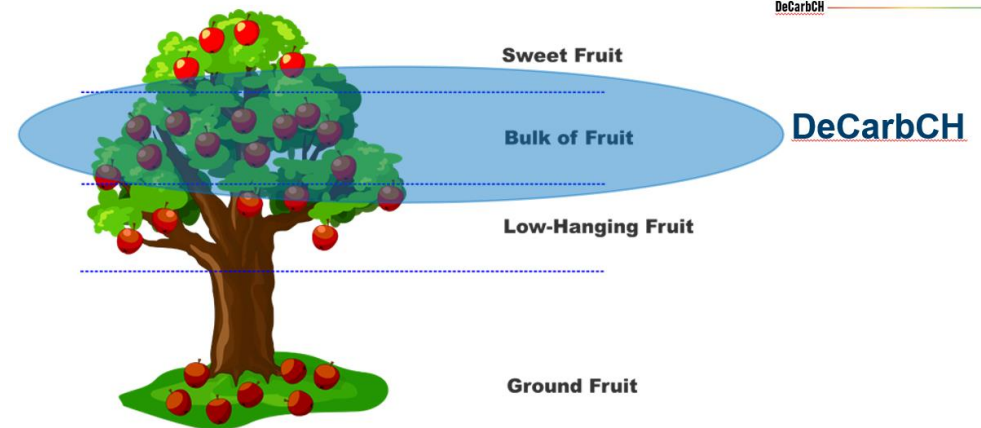
Goals SWEET DeCarbCH

- The DeCarbCH project addresses the colossal challenge of **decarbonisation** of heating and cooling in Switzerland within three decades and it prepares the grounds for negative CO₂ emissions.
- The overall objective of the project (with the ultimate target of net zero emissions) is to **facilitate, speed up and de-risk** the implementation of renewables for heating and cooling in the residential sector (for various scales and degrees of urbanization) as well as for the service and the industry sector



SWISS ENERGY RESEARCH FOR THE ENERGY TRANSITION OVERVIEW CONSORTIA MONITORING

DECARBCH KICK-OFF MEETING • LAURA DING, SFOE • 01.06.2021



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WP06 – Case Study of Zurich

The work package aims to apply, test validate and improve approaches, tools and results developed in other work packages to concrete locations in the city of Zurich

Tasks

- Identification of current challenges and research contributions with respect to the challenges of the city and the planned transformation of a district
- Results, learnings for scaling
- Thermal grid technologies for the City of Zurich

Outcomes

- Definition of topics and of 3 concrete cases
- Report on framework conditions underlying cases
- Test Report of Methods
- Guideline for successful transition
- Conclusion on optimized future thermal grids in Zurich

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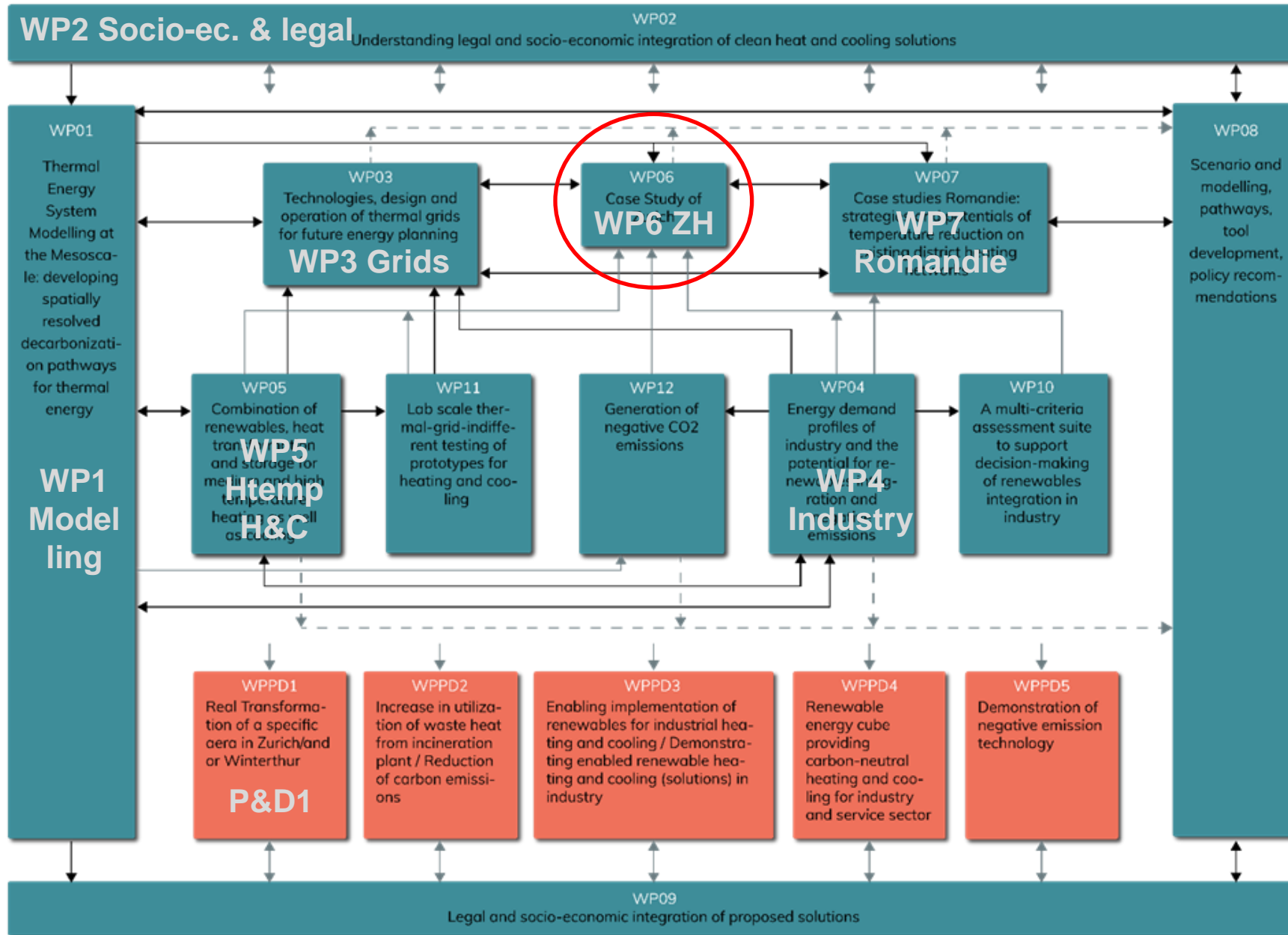
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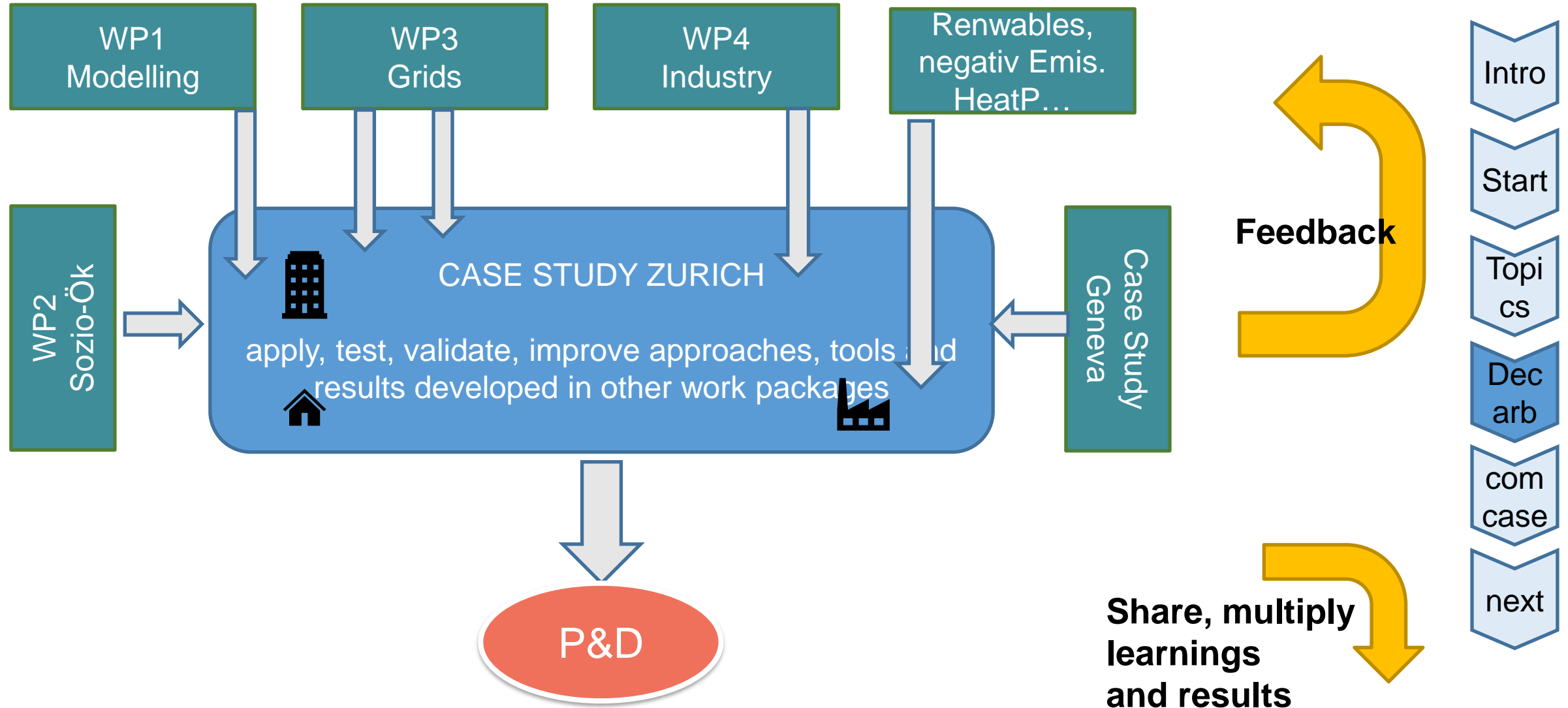
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DeCarbCH by Workpackages



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WP06 – Case Study Zurich



For example WP2, WP3

Conceptualization

Business ecosystem perspective
on decarbonization:

- No «command-and-control»
governance
- Common value proposition
- Interdependence
- Need for **orchestration** and
alignment

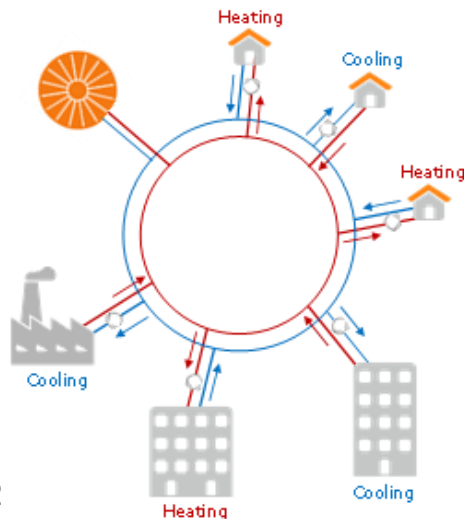
Legal framework and solutions, legal barriers,
framework

Socio-economic integration

Pricing, distribution of competencies

→ WP2 Social & Socio-economic

Low-temperature network

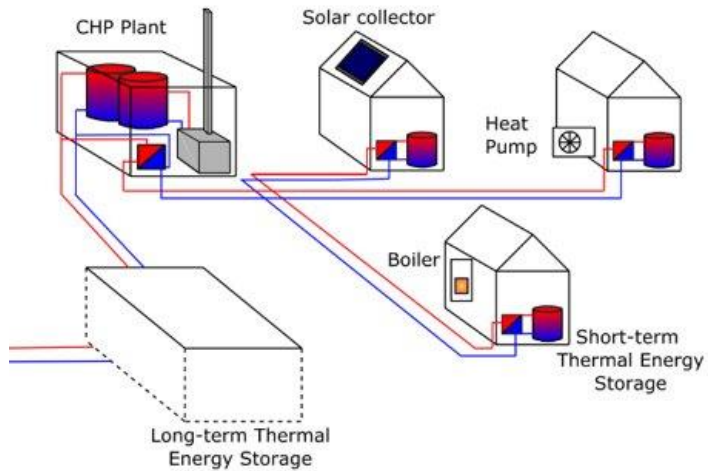


Design and optimization of thermal networks

Technology options for storage in thermal grids

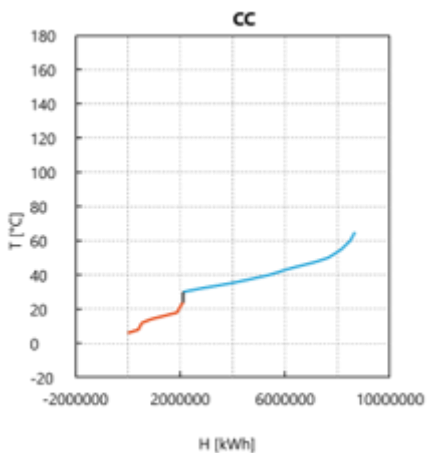
→ WP 3 Networks

For example WP4, WP7



Lowering of DH return temperatures

→ WP7 Case Study Geneva



Process Integration methods to characterize and optimize thermal grids and use of digital twins to simulate and optimize the grid operation

→ WP 4 Industry

- Thermal Energy System Modelling (WP1)
- Technologies, Design, operation of thermal grids (WP3)
- Legal and socio-economic integration (WP2)
 - Energy demand profiles (WP4)
- Renewables, heat transformation, storage (WP5)
 - Negative CO₂-emissions (WP12)
 - Scenario, pathways, policy (WP8)

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How to identify case studies

- Identification of supply (DeCarb)
scientific results from workpackages
Who is working on what

and

- demand (City)
what are actual challenges for Zurich,
possible cases
What are priorities, where is support
needed



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Common fields of research interest, implement findings in case studies

Zurich

- Modelling demand
(by actors, role of industry)
- Diverse energy supply (heating and cooling)
 - how, where, when (speed)
 - centralised/decentralised
 - Storage, peak load
- Development of district heating networks,
dismantling of gas grids
 - Transition (how to get there, legal,
social, economic frameworks)

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So far

Fields of high priority (time, topic)

- Modelling of (local) demand, (city development, efficiency, industry/services, cooling)
- Energy supply: Potenzial of renewables, dismantling of gas grids
- Development of thermal grids, district heating networks

Fields of high importance (topic)

- Peak load, energy storage, security of supply
- Pricing, legal framework

How to organize work

- Workshops, large scale exchange
 - Setting priorities (time, topic)
 - «bilateral» meetings of thematic groups
 - Coordination meetings
-
- Communication with partners
→ identify P&D Projects

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Challenges

- Gap between research and implementation partners (in terms of resources, time constraints)
- Problems should ideally be defined bottom up. Crucial to discuss and define problems together with partners: “co-construction”
- No more low hanging fruits: Network is almost built (or at least decided). What is needed, are solutions for the last 10% (from 90% to 100% renewable), some areas with difficult infrastructure conditions.
- Non technical issues (multiple suppliers, legal constraints, acceptance of change)
- Handling of data, know-how, organize know-how transfer
- Local influences, difficulties for scaling

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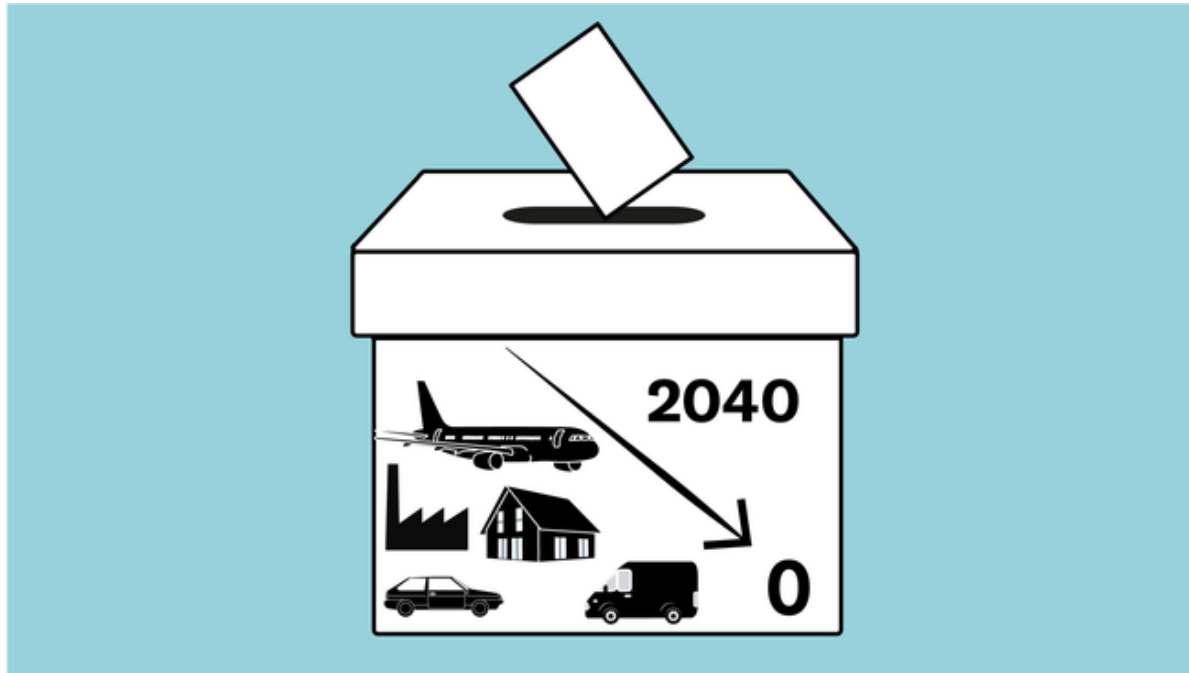
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Last



Goal is set, now let's walk the talk!

We are looking forward to great and fruitful collaboration between researchers and implementation partners.

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Thank you!!

Time for discussion, remarks, recommendations

ZHAW Zurich University of Applied Sciences
School of Engineering

Prof. Dr. Armin Eberle
Head of Institute, Head of ZHAW Energy Research Board (ZERB)

INE Institute of Sustainable Development
Technoparkstrasse 2
P.O. Box
CH-8401 Winterthur, Switzerland

E-Mail: armin.eberle@zhaw.ch
Internet: www.zhaw.ch/ine