

Convergence of the grid – taking all different grids into account:

“Hybridwerk Aarmatt” – At the interface of the electricity, gas and district heating grid

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IEA Bioenergy ExCo80 workshop

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Regional energy provision since 1860



Brief overview (2014)

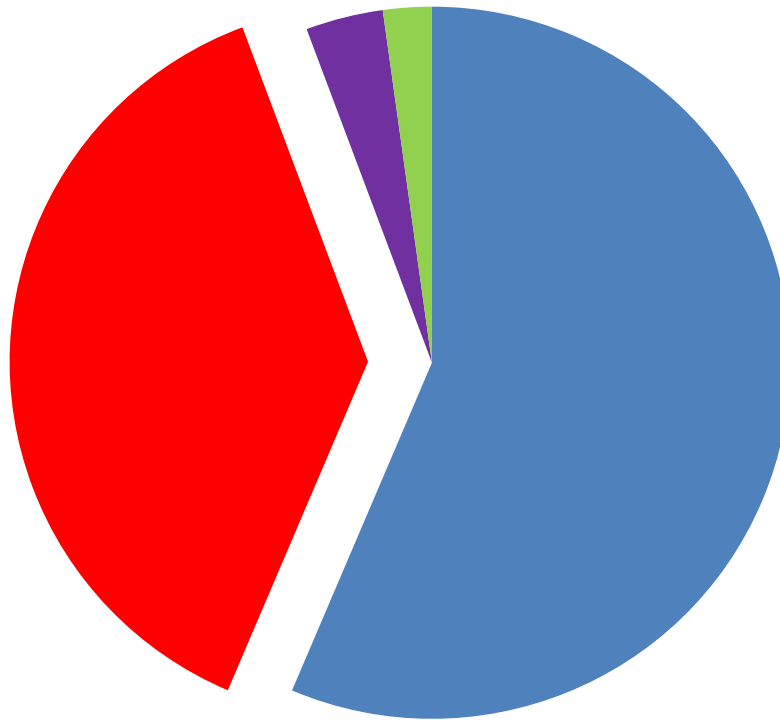
- Revenue CHF 98 million
- 150 employees (20 apprentices)
- Energy supplier and service provider for building services
- Independent public sector enterprise
- Wholly owned by the City of Solothurn

Agenda

1. Challenges for energy suppliers
2. PV as energy source
3. Short-term energy storage systems
4. Long-term energy storage systems
5. Grid convergence
6. Why Zuchwil?
7. Implementation at the hybrid plant
8. Methanation-The missing link
9. Project partners

Future electricity gap

1. Challenges for energy suppliers



■ Hydropower (56.4 %)

■ Nuclear power (37.9 %)

■ Conventional thermal (3.5 %)

■ Div. renewables (2.2 %)

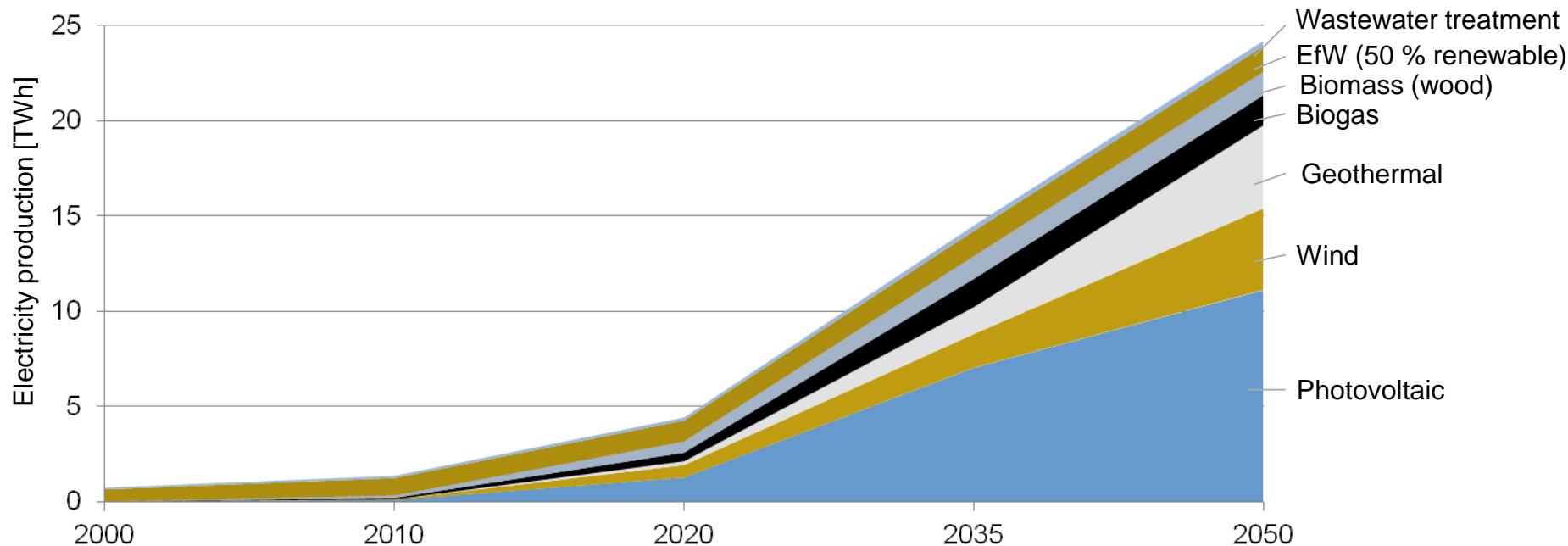
Total: 43.2 TWh (without nuclear power)

To be offset: 26.4 TWh
(based on 2014)

Renewable energy scenario

1. Challenges for energy suppliers

Electricity production in Switzerland from renewable energies¹

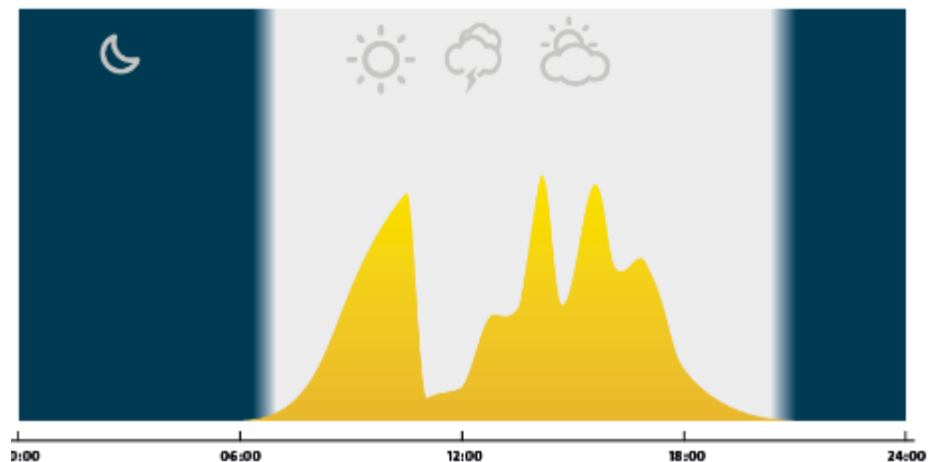


1) Source: SFOE "Energy Strategy 2050", renewables version stressed in the scenario for "Political Measures by the Federal Council"

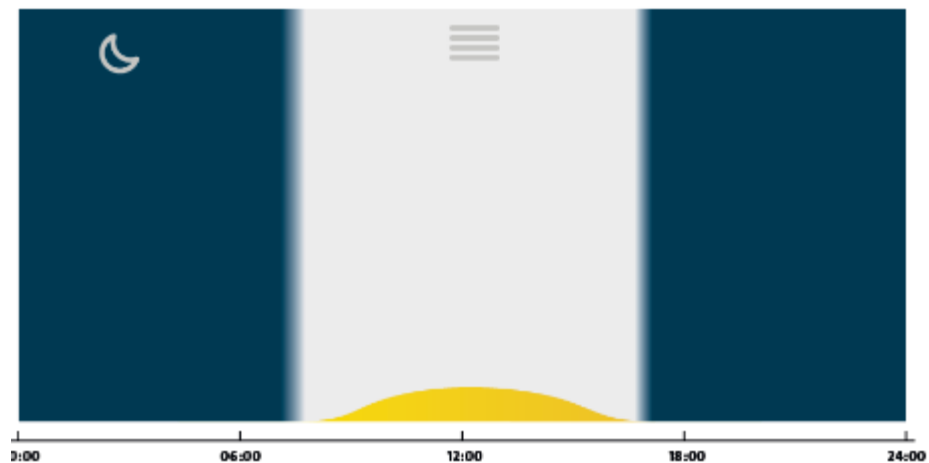
PV production is weather-dependent

2. PV as energy source

Unstable



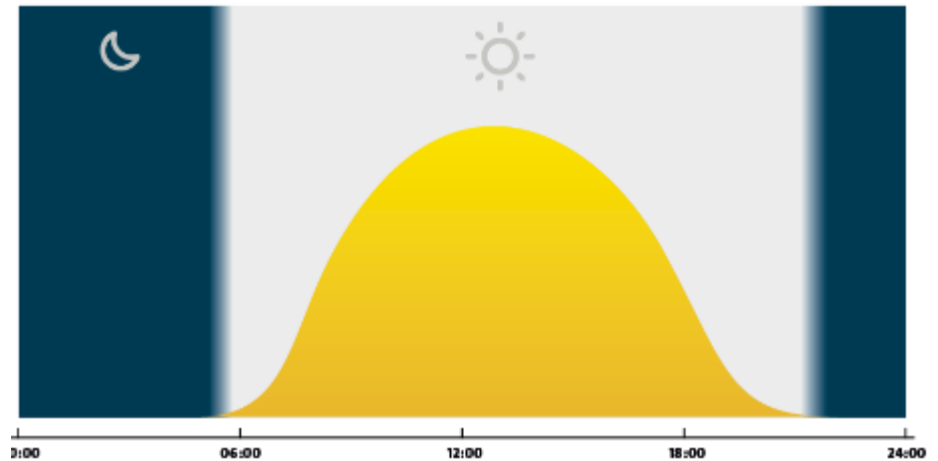
Foggy



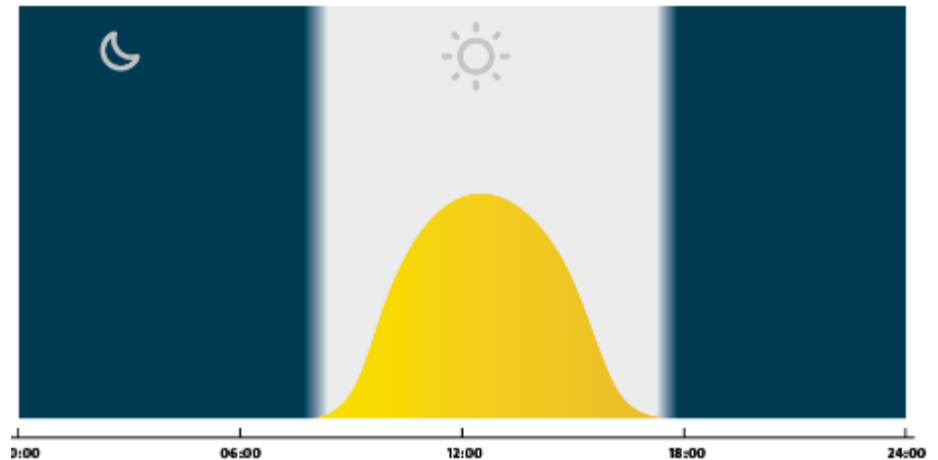
PV production is seasonally dependent

2. PV as energy source

Summer

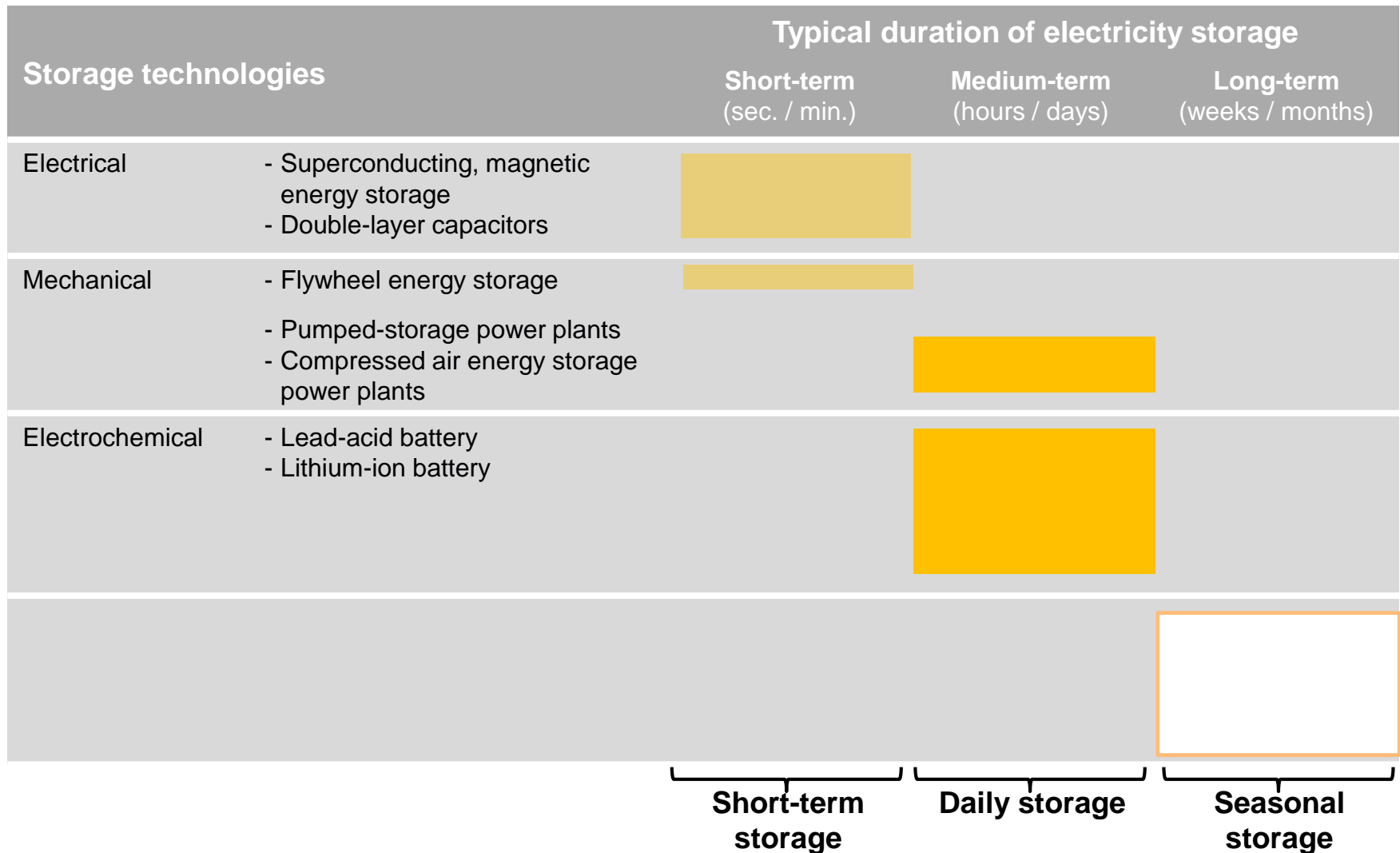


Winter



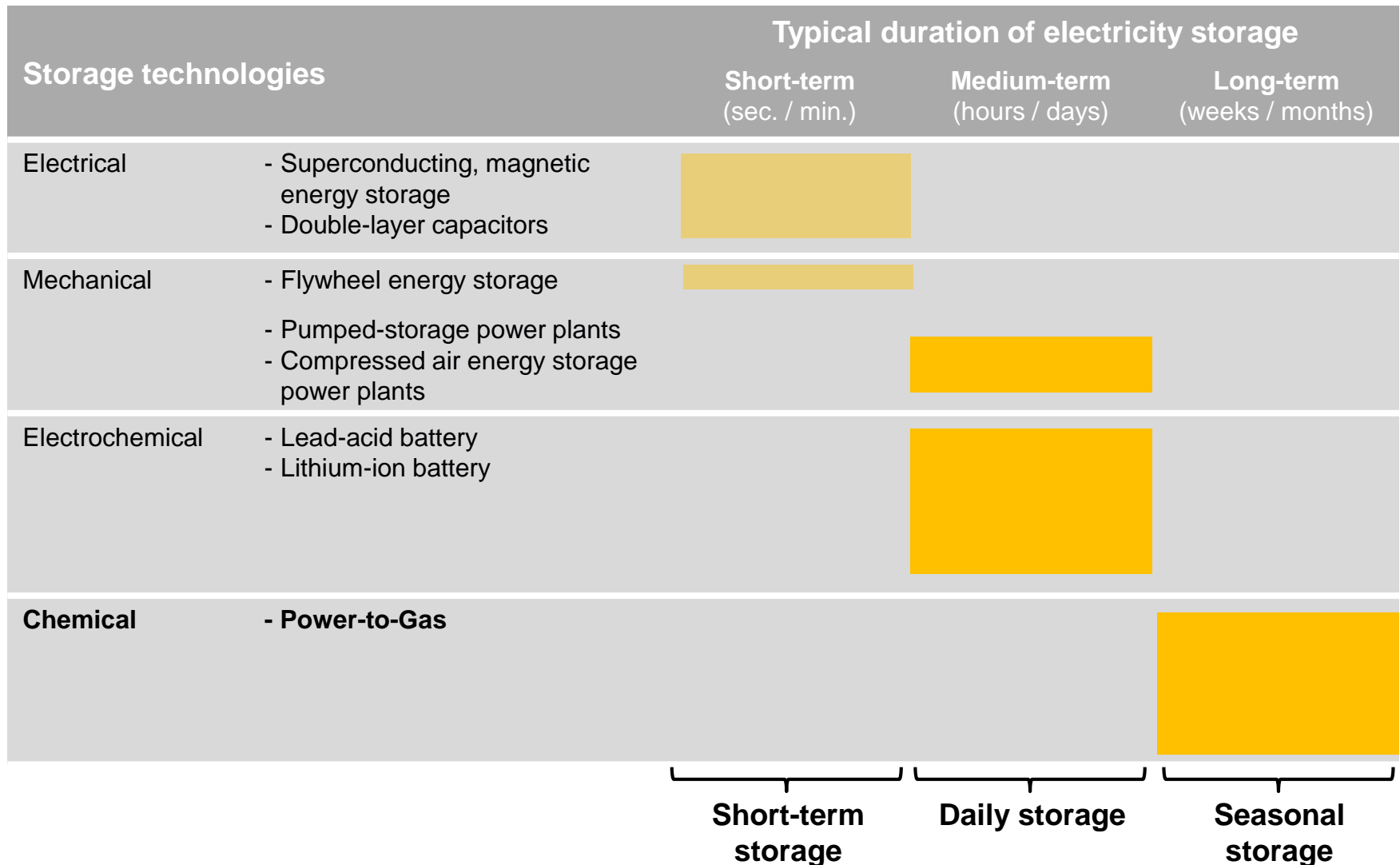
Electricity storage technologies

3. Short-term energy storage systems



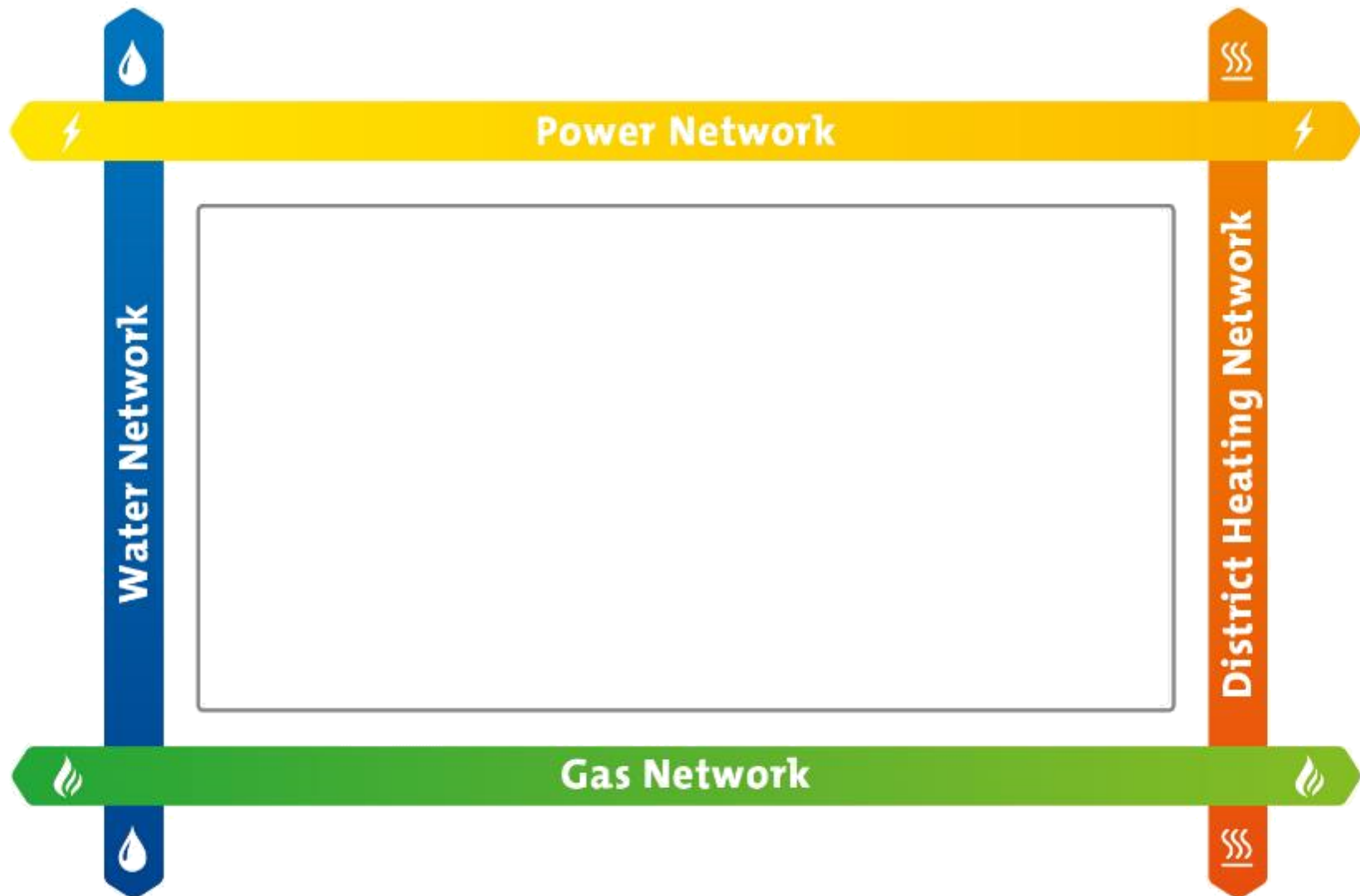
Electricity storage technologies

4. Long-term energy storage systems



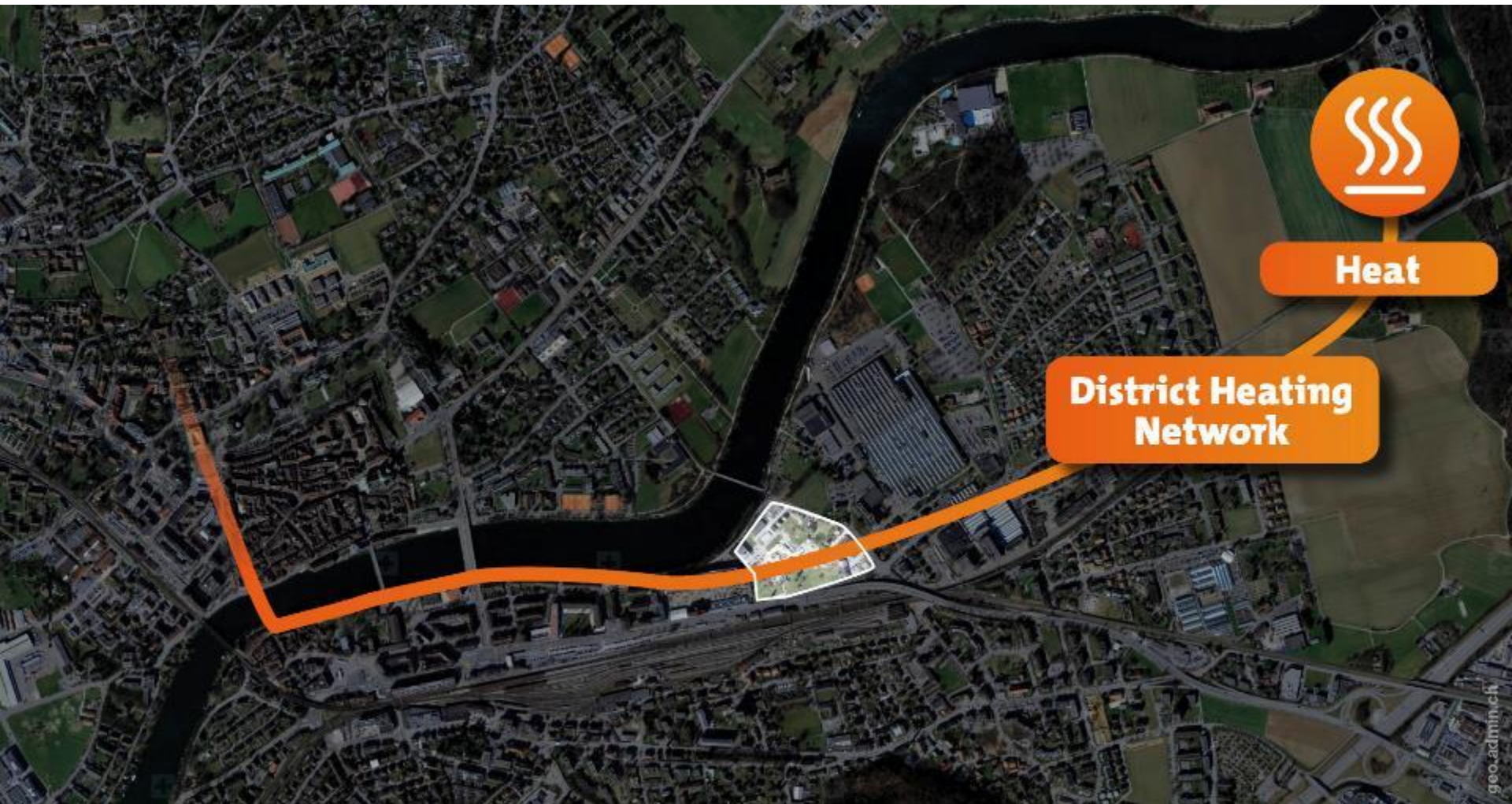
Grid convergence as a prerequisite

5. Grid convergence



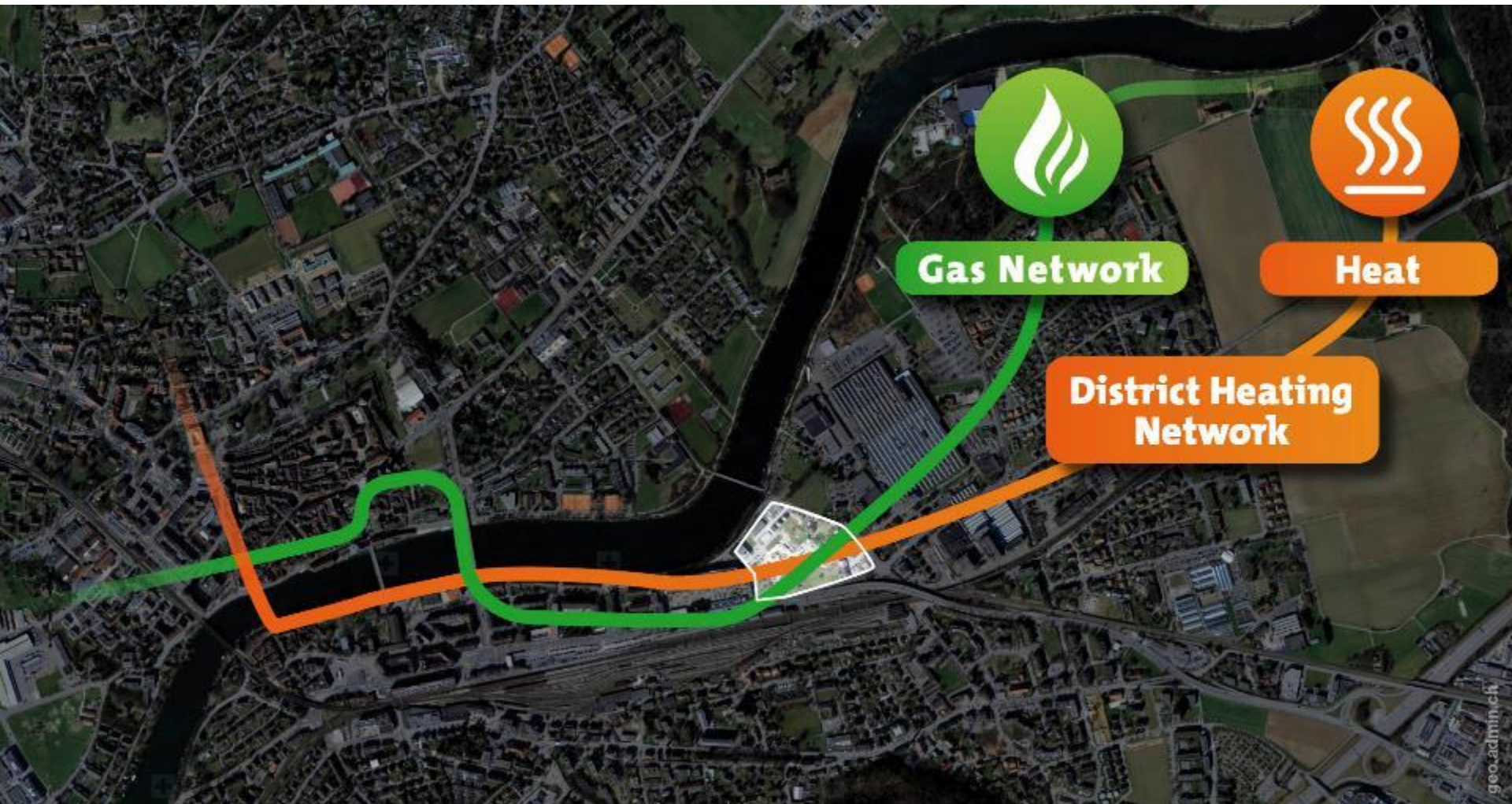
Site with great potential - Heat

6. Why Zuchwil



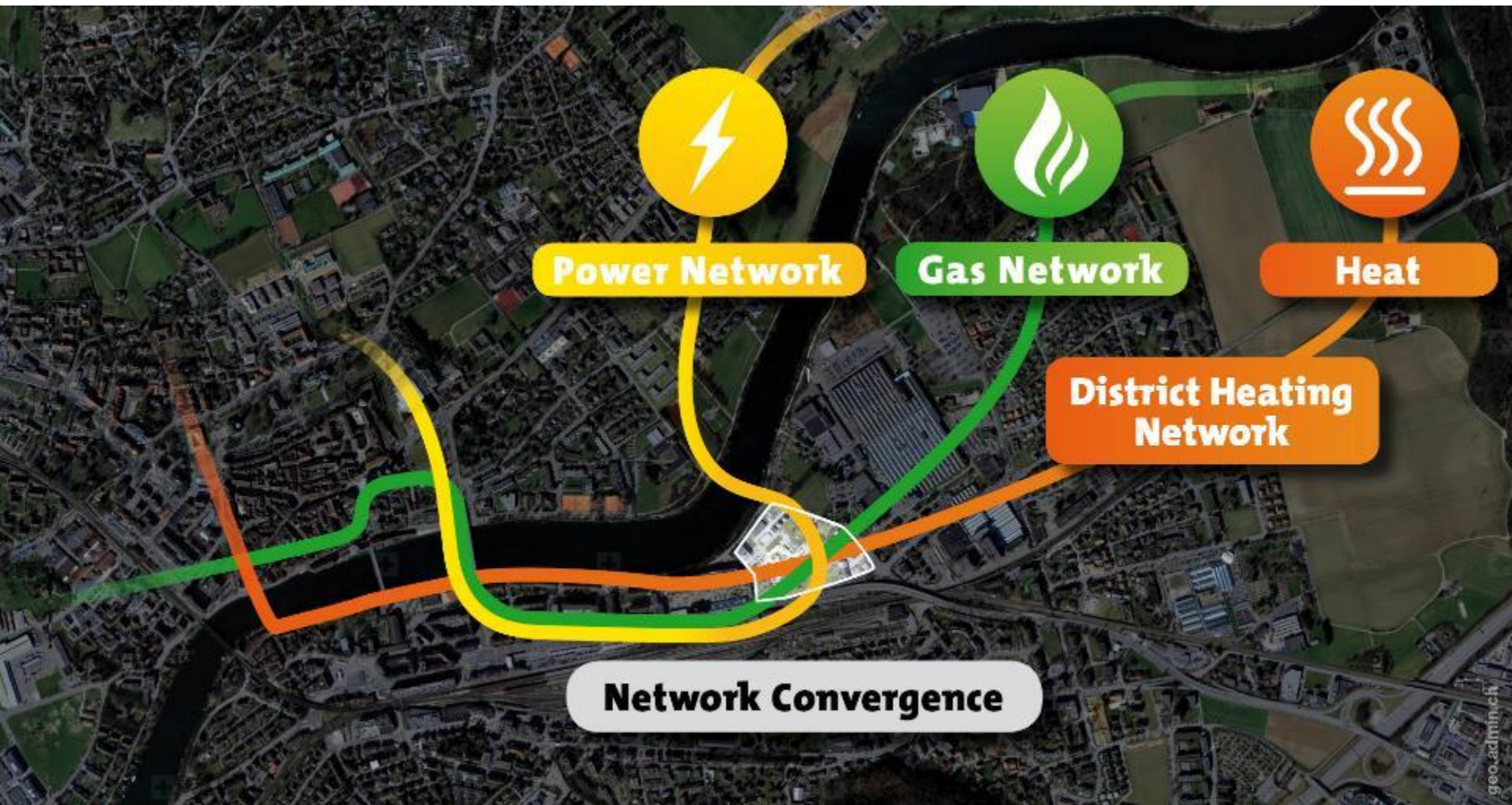
Site with great potential - Gas

6. Why Zuchwil



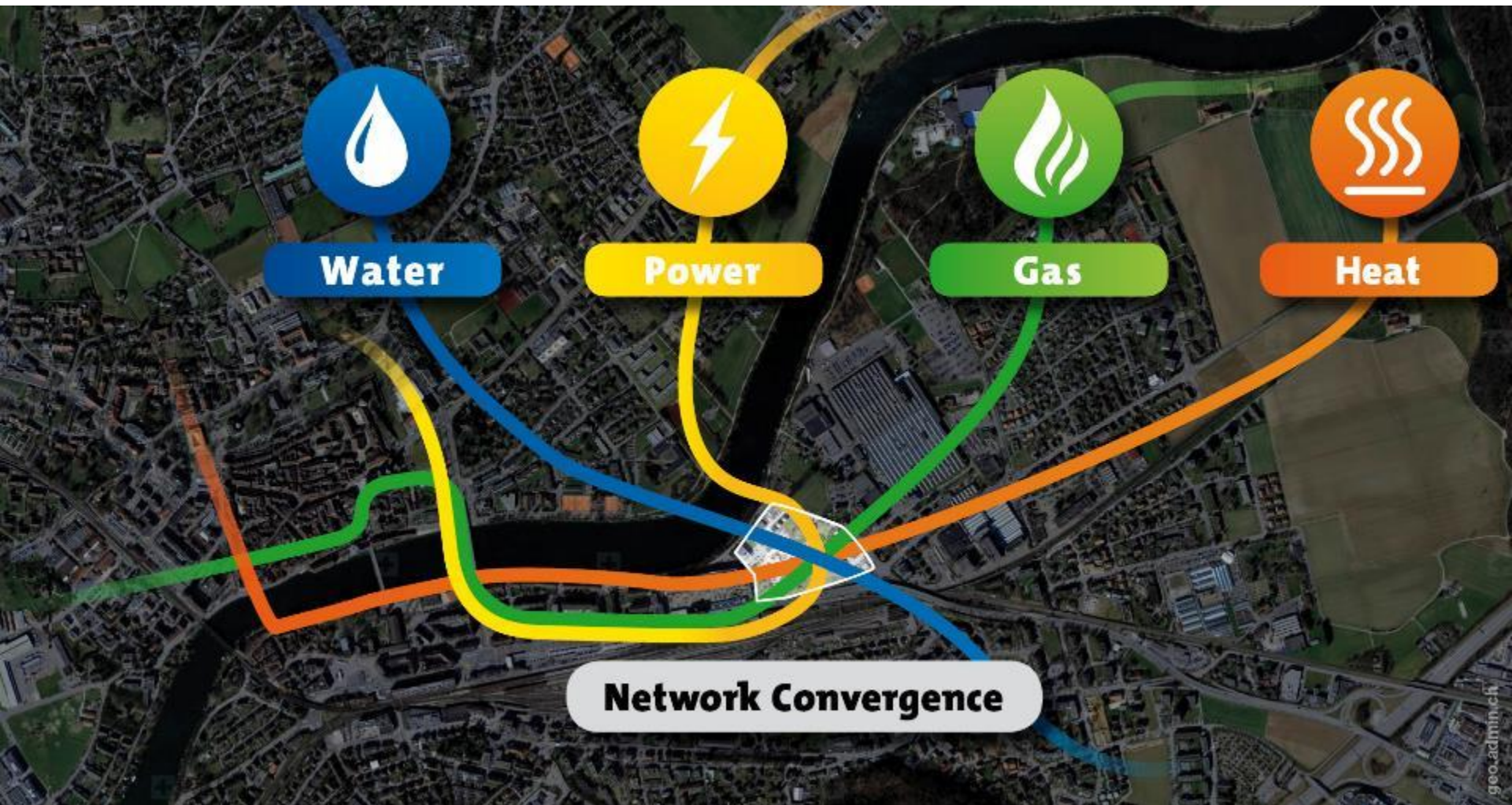
Site with great potential - Electricity

6. Why Zuchwil



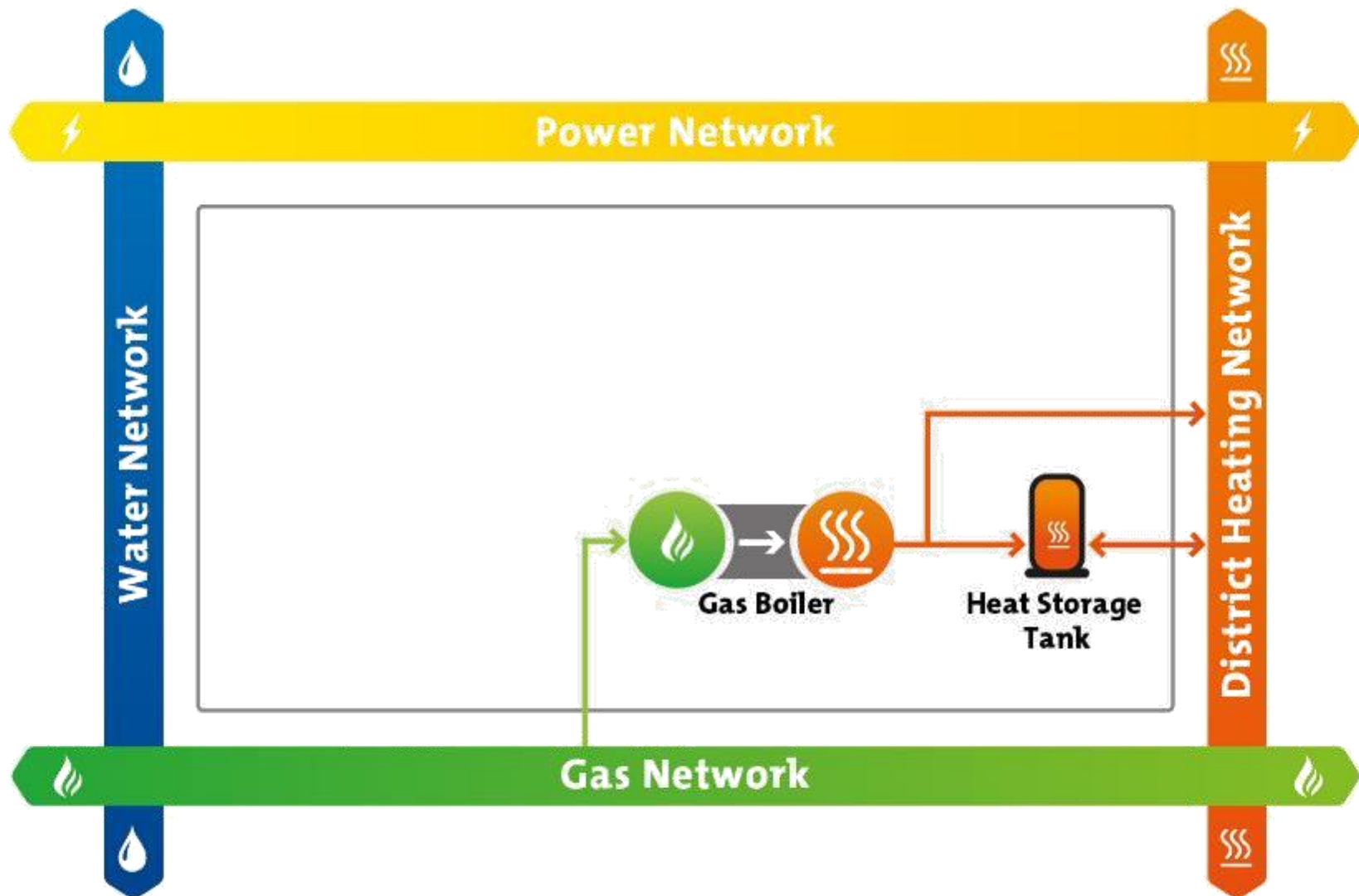
Site with great potential - Water

6. Why Zuchwil



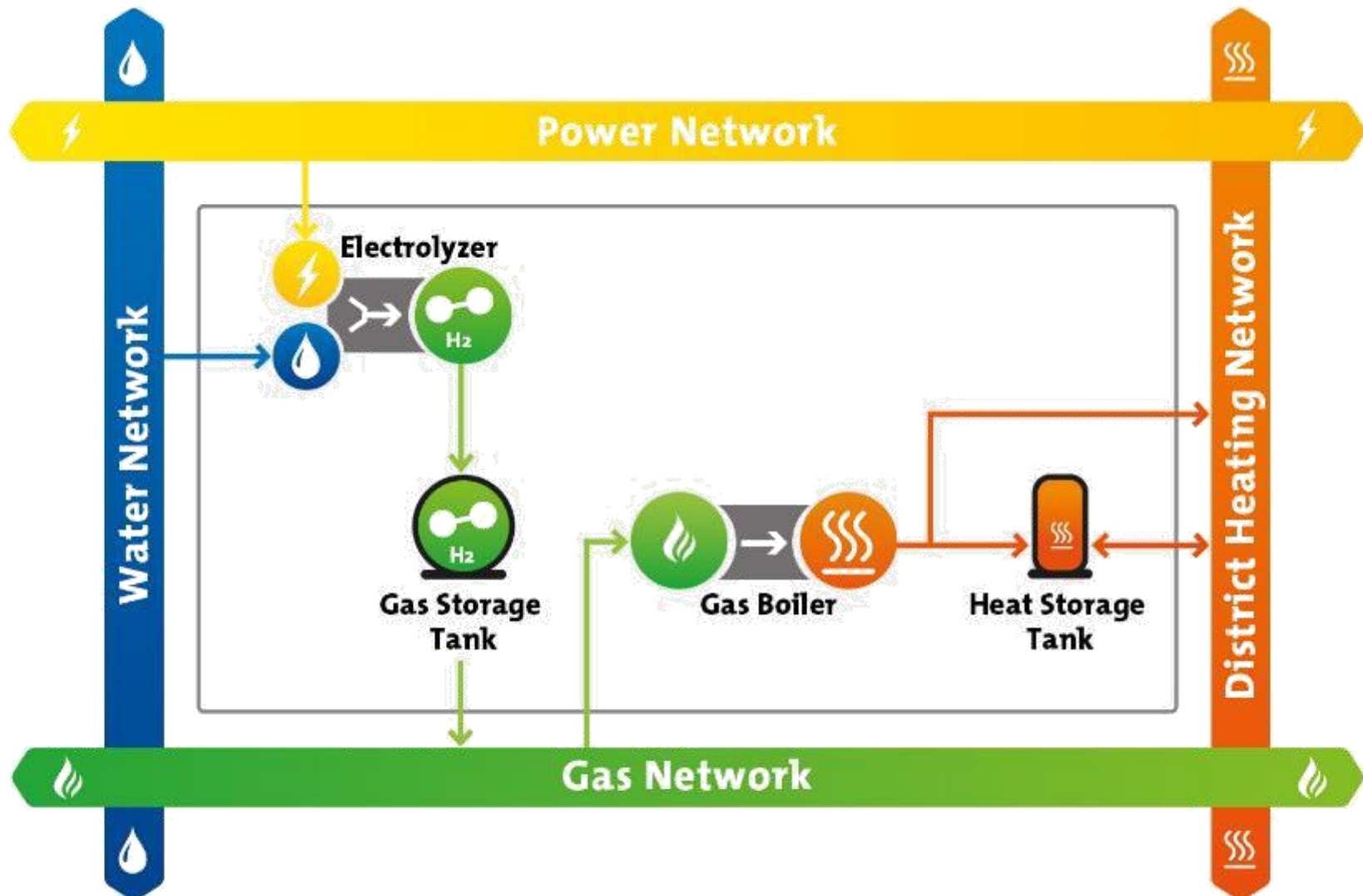
Implementation stage 1

7. Grid convergence – Implementation at hybrid plant Aarmatt



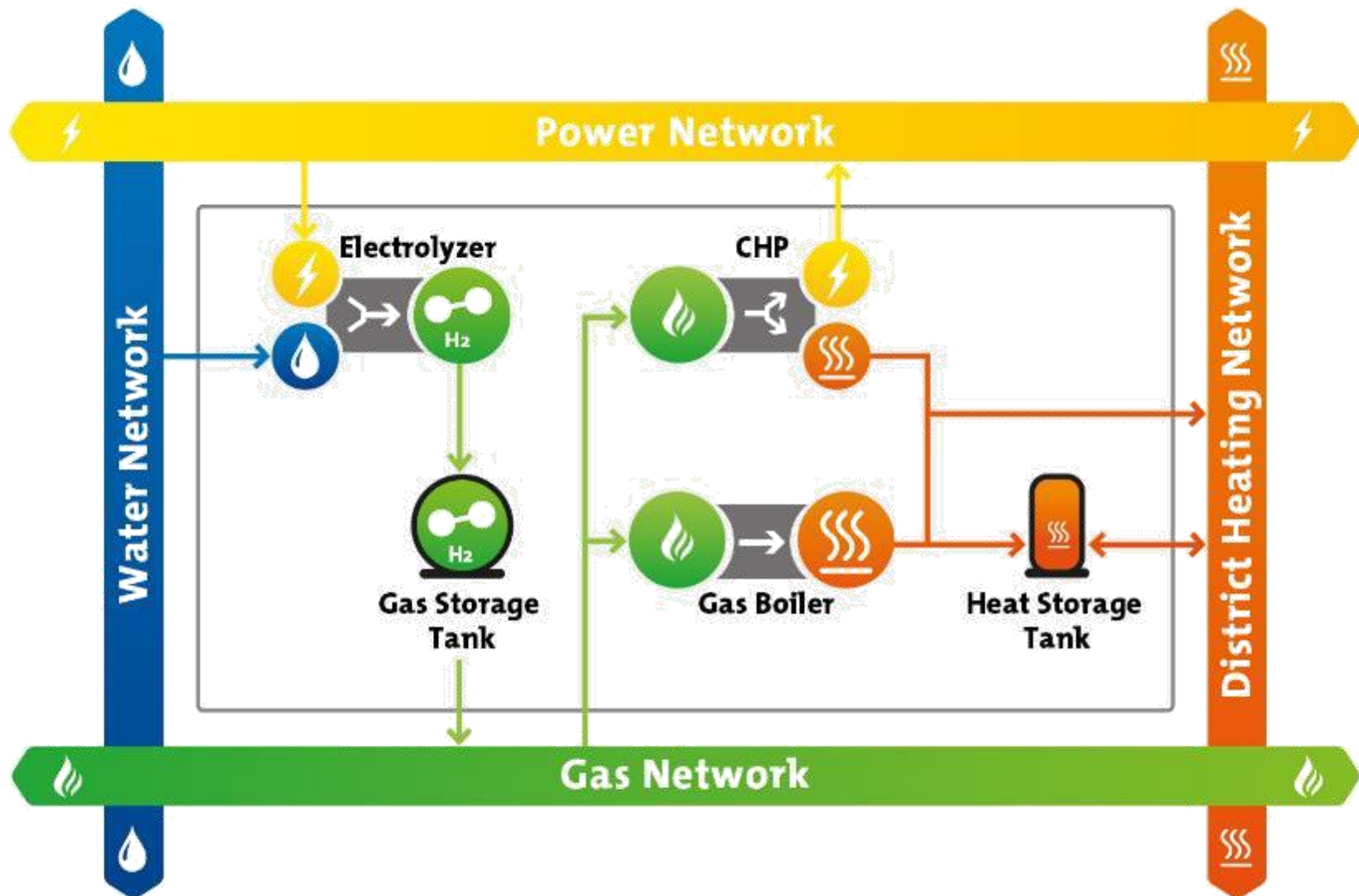
Implementation stage 2

7. Grid convergence – Implementation at hybrid plant Aarmatt



Implementation stage 2

7. Grid convergence – Implementation at hybrid plant Aarmatt



Description of building activities

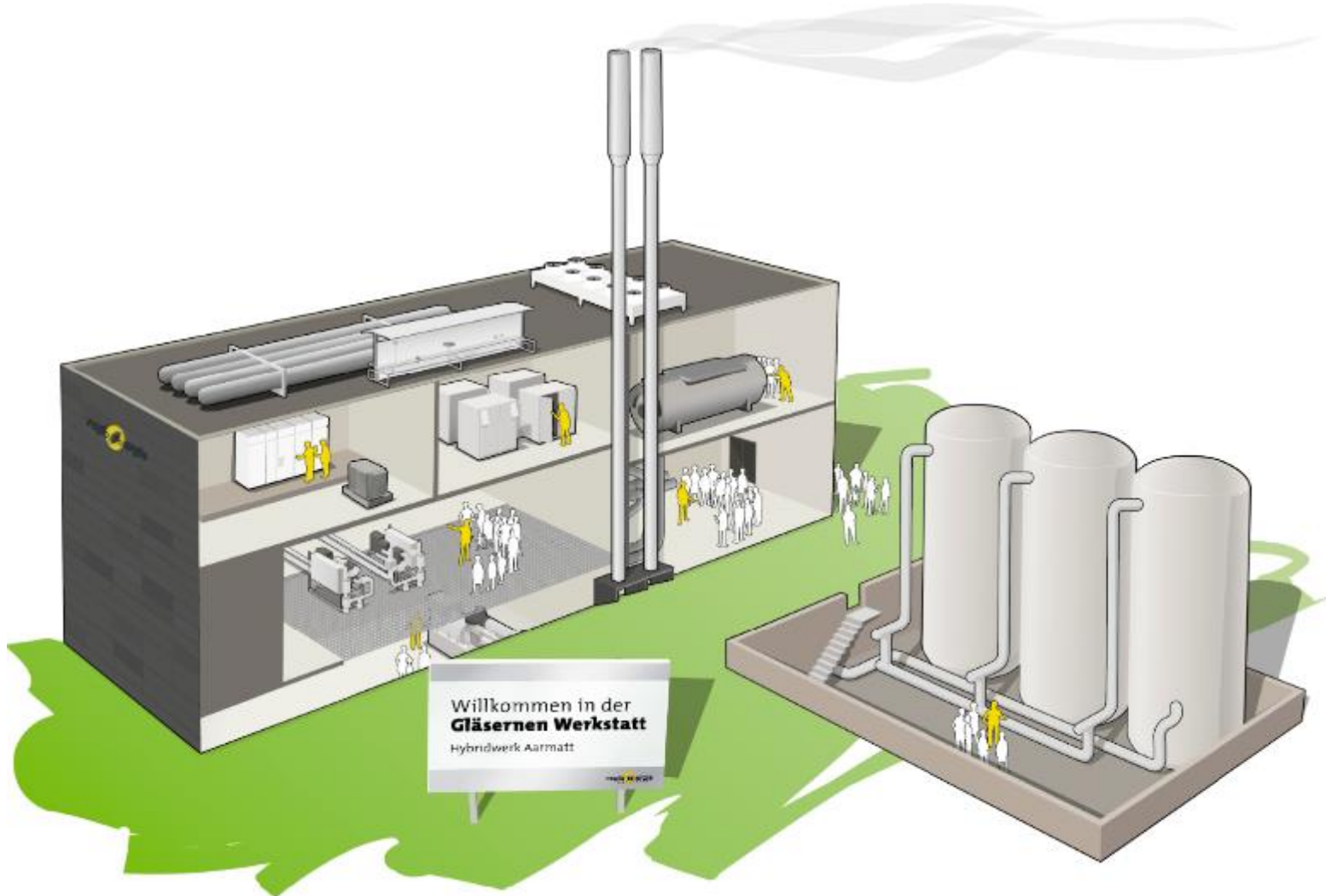
7. Grid convergence – Implementation at hybrid plant Aarmatt

February 2012:	First plans were drafted while working out solutions for emergency and peak support of the district heating network
Stage 1a: May 2013	Ground breaking of the first stage: district heating station, including a 6 MW gas fired boiler
Stage 1b:	Parallel installation of three heat storage tanks 3 x 100 m ³ / 16 MWh storage capacity
Stage 2: March 2014	Groundbreaking second stage <ul style="list-style-type: none"> • CHP unit 1.2 MW_{el} / 1.2 MW_{th} • 2 elektrolysers with 175 kW capacity attached to a H₂ storage, 150 Nm³ • Heat recovery system



Graphical view of the setup

7. Grid convergence – Implementation at hybrid plant Aarmatt



Picture of the hybrid plant

7. Grid convergence – Implementation at hybrid plant Aarmatt



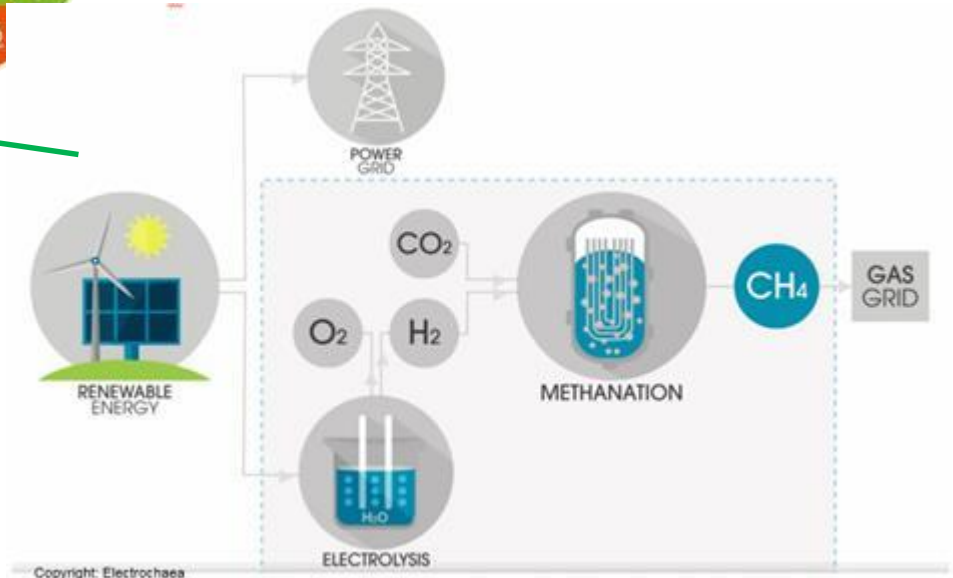
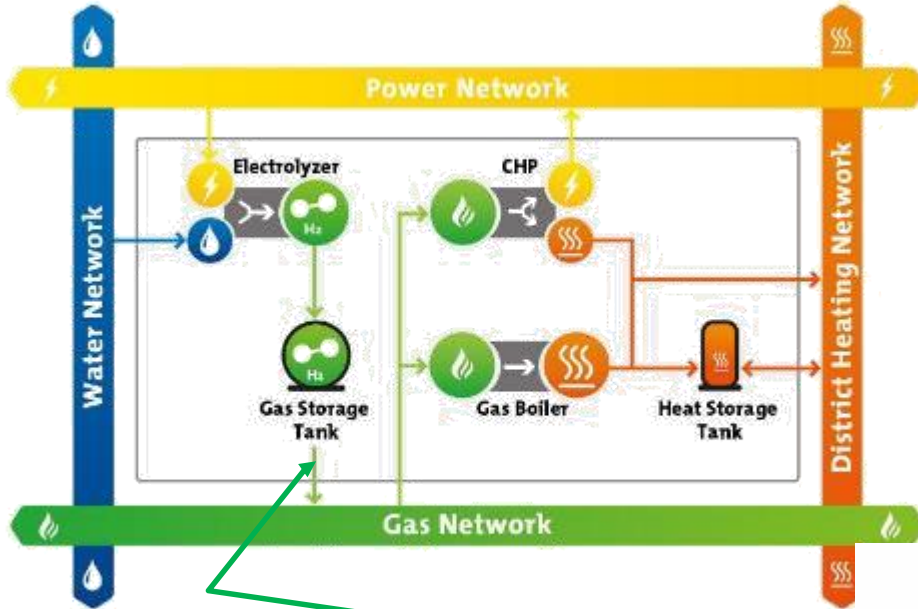
Current issues with H₂

8. Methanation – The missing link

- Limitations regarding grid injection (CH max. 2%)
- Infrastructure does not allow for unlimited injection
- Security issues, UEL/LEL
- More stringent requirements
- Higher costs (materials, instruments)
- Inferior volumetric energy density (H₂/CH₄:~1:4)

Technology

8. Methanation – The missing link



Technology

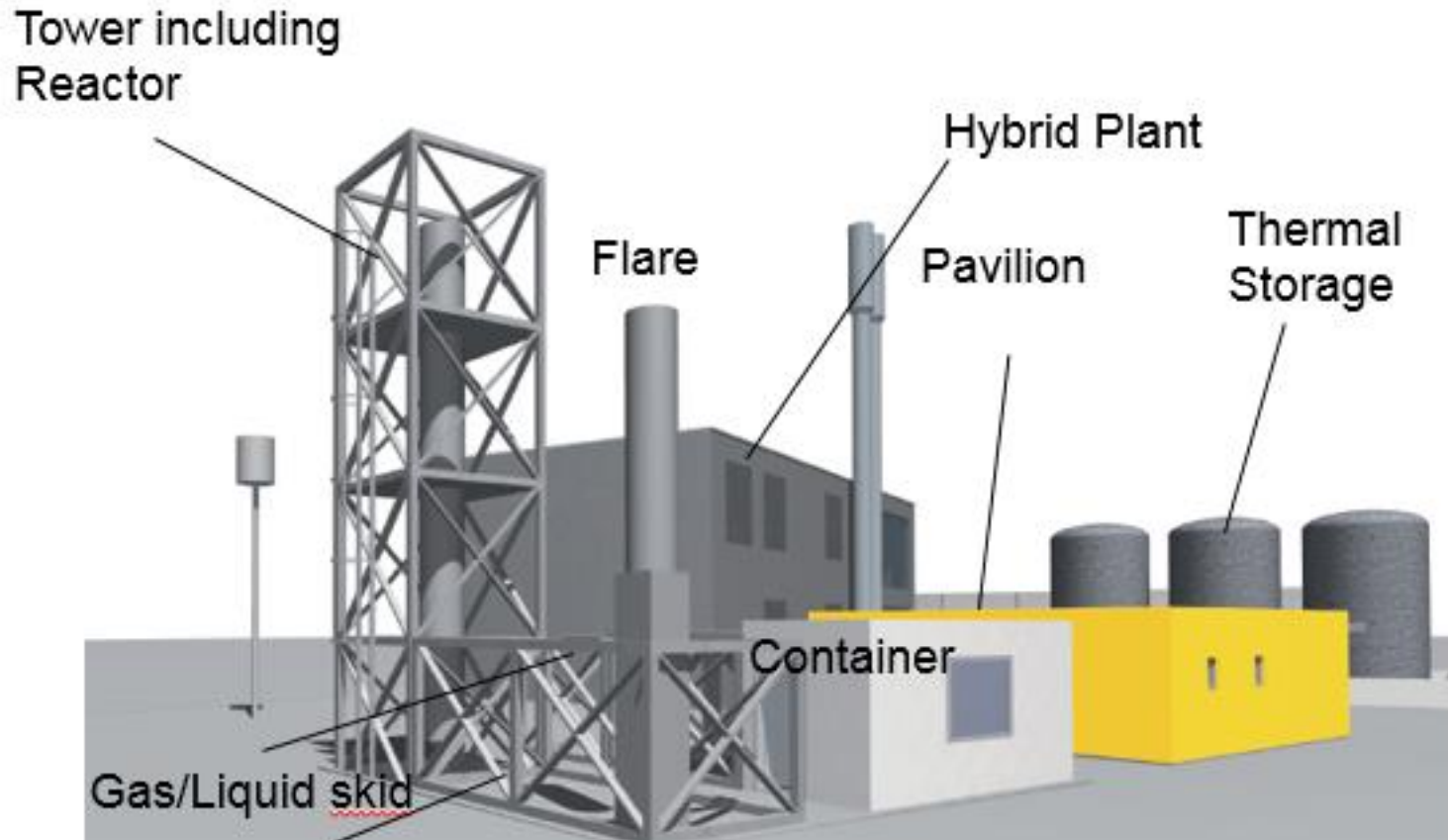
8. Methanation – The missing link

Key characteristics:

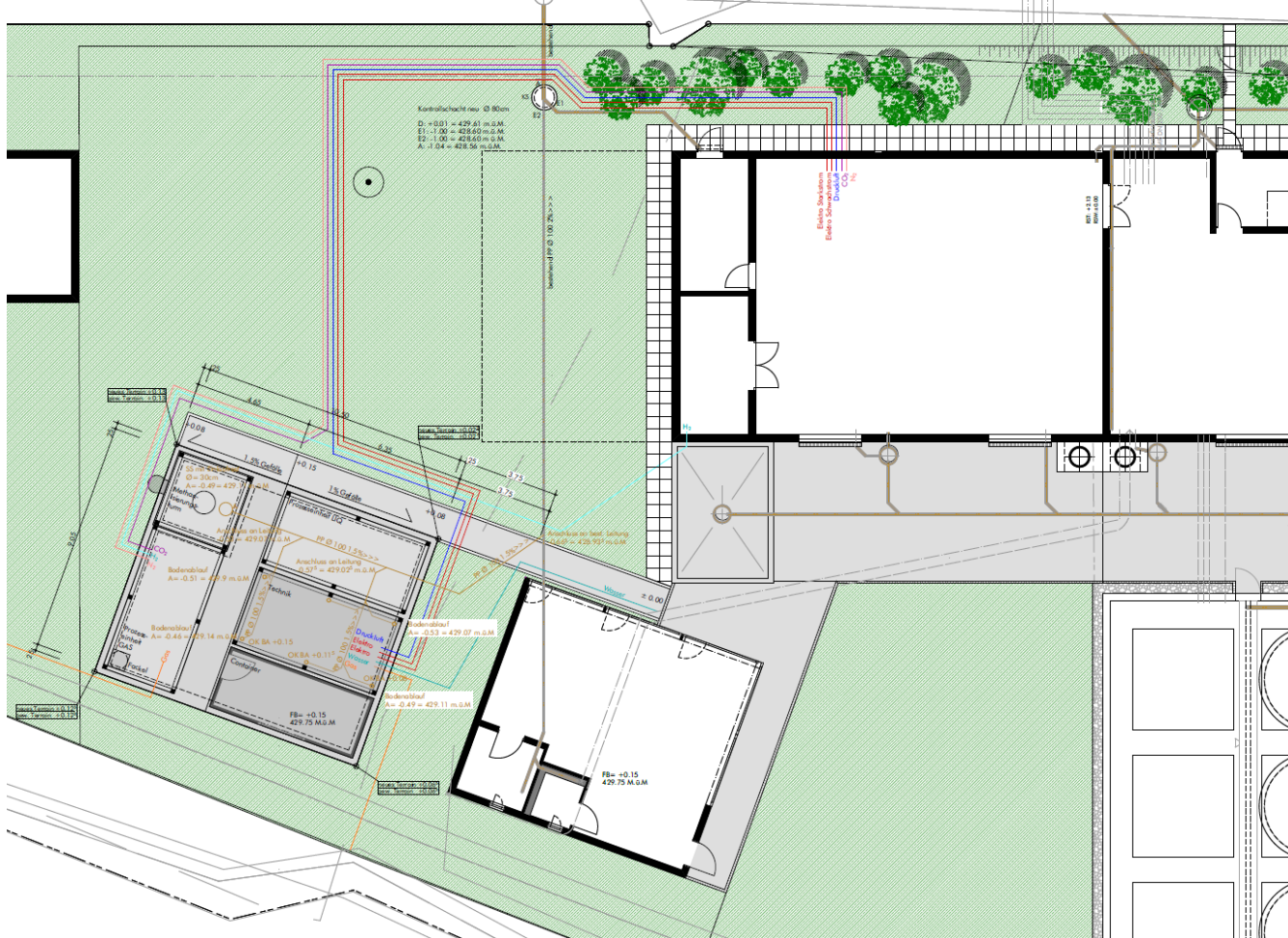
- PEM Electrolyser, 350 kW installed, 700 kW simulated
- Production of 30 Nm³/h SNG
- Biological methanation plant
- Plot size 11x10 m, tower height 12 m
- CO₂ from waste water treatment plant (2.5 km)

Implementation into the hybrid plant

8. Methanation – The missing link



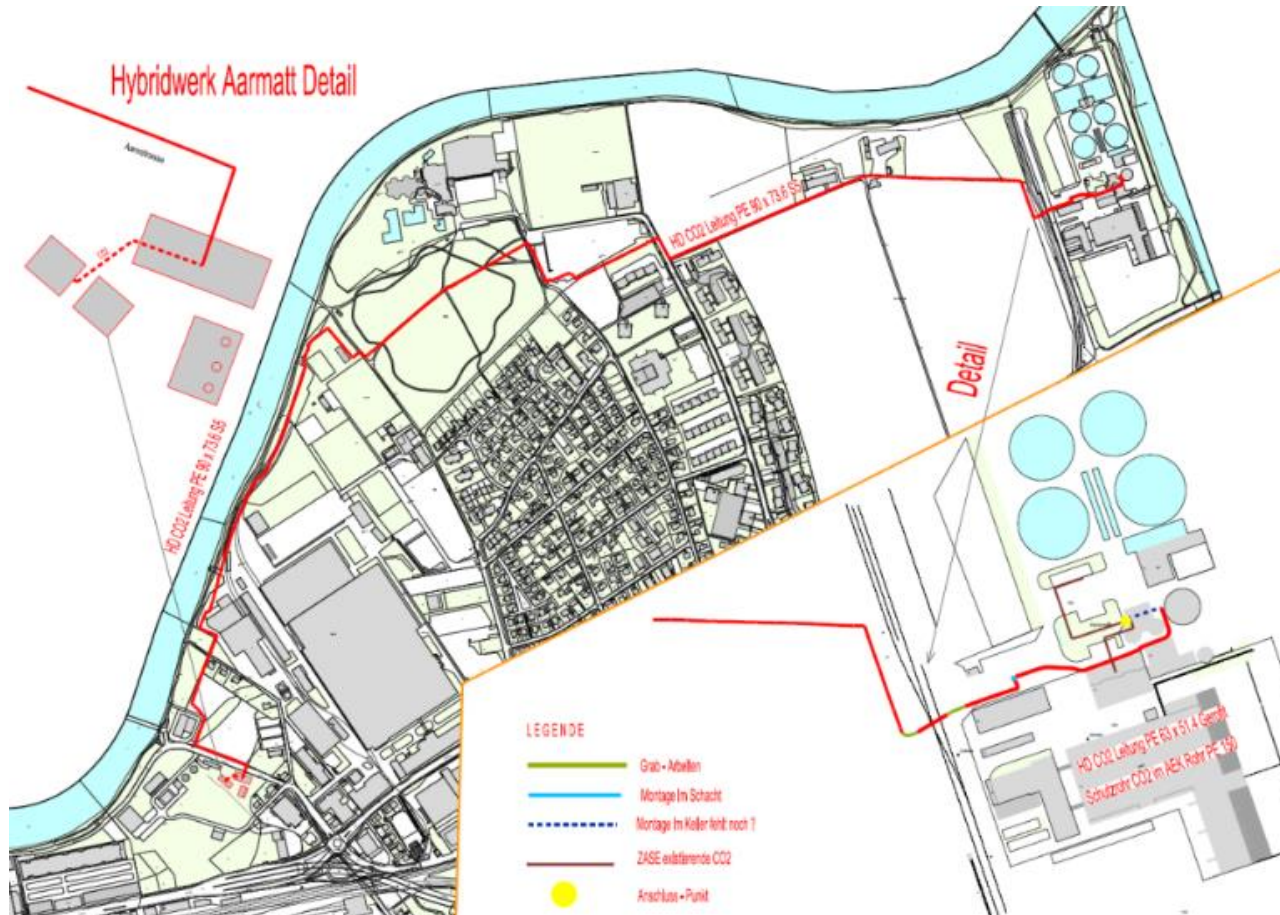
Top view Hybrid plant, top right, with Methanation plant, bottom left and interconnecting piping



Implementation into the hybrid plant

8. Methanation – The missing link

2.5 km CO₂ line, red



Present situation

8. Methanation – The missing link

Present status on site



Project partners

9. Project partners

Hybrid plant



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE



**HOCHSCHULE
LUZERN**

KANTON solothurn



HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

STADT SOLOTHURN

Methanation plant, Horizon 2020 Project «STORE&GO»

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Empa

Materials Science and Technology

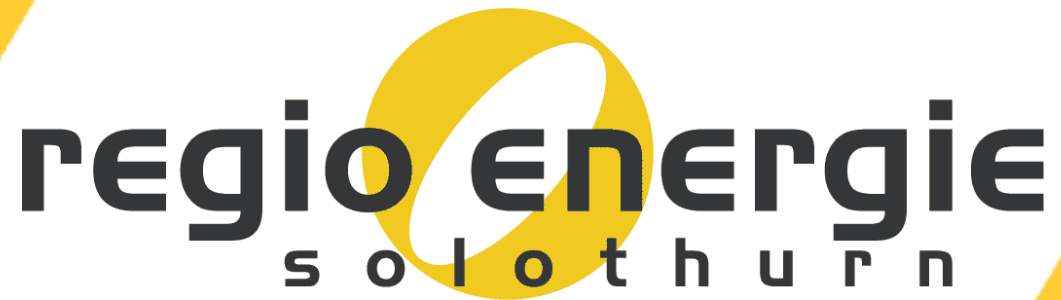


**ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE**

Conclusion and opportunity for questions

The hybrid power plant is one step on the way to achieving Energy Strategy 2050.

It illustrates what is already possible with the latest technology and an entrepreneurial mindset ... and where the limits are.



Thank you

for your attention