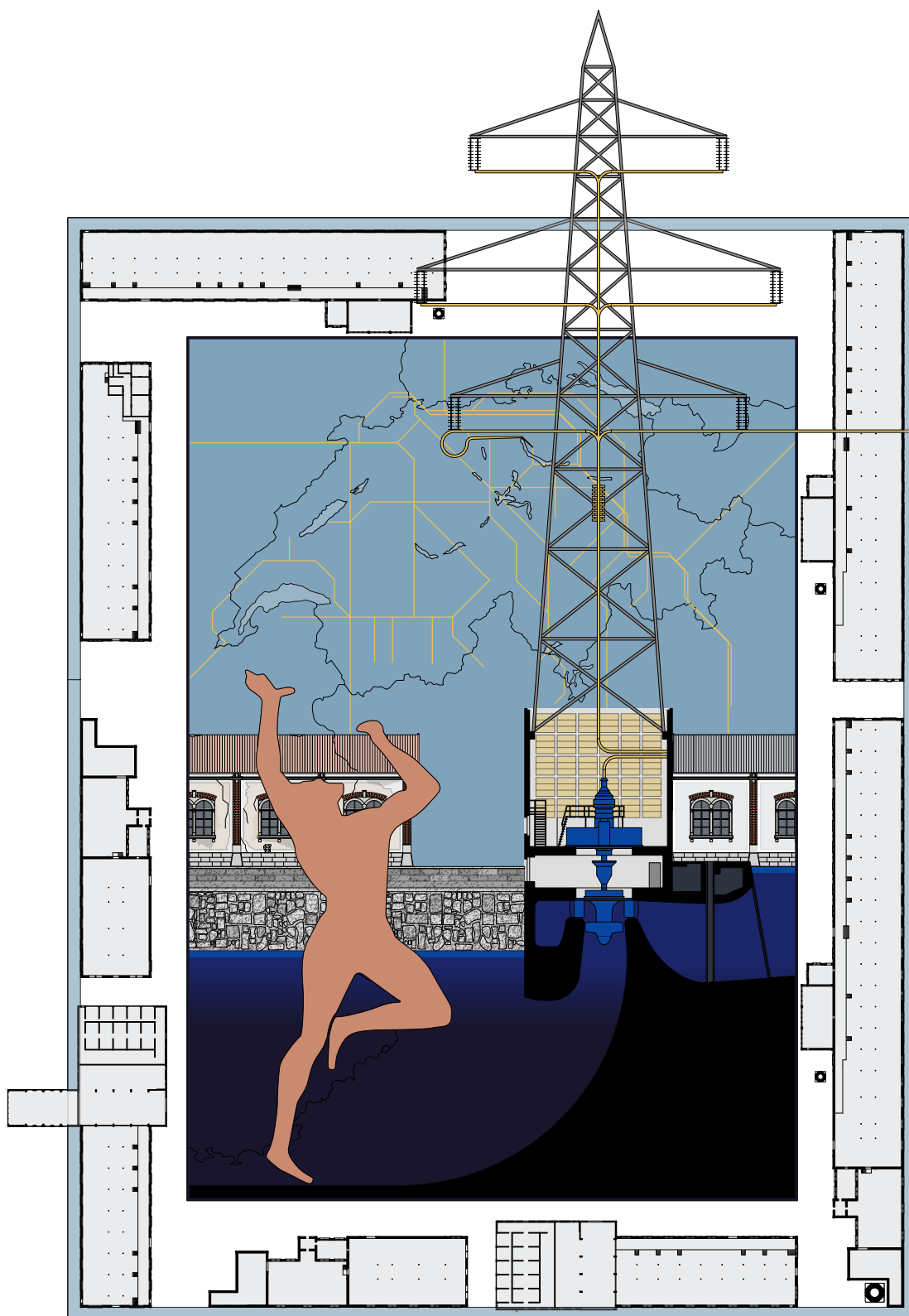




LAUFKRAFTWERK LETTEN

or

A LETTER TO ELEA

To Elea*

Tantalos was once a king,
born son to Zeus, god of high voltage;
born son to Plutos, goddess of earthly
wealth.

His castle close to a lake,
fruitful land to establish a kingdom
whose lands extended twelve days',
whose wealth was mined in the
mountains.

Welcomed to table with his father
he deceives him, steals nectar to
eternal life, but the gods became
aware.

Tantalos thrown out of the Olympus,
abandoned by his father, cut off,
was to stand in water,
below an apple tree, fruit of energy.
He was made to desire two things
without ever attaining them again:

water
energy

* Elea is the greek mythological
personification of mercy, clemency,
compassion

Laufkraftwerk Letten

The Laufkraftwerk Letten was initially built as a water supply station for Zürich. Extended in the same formal language, it became an electricity plant, based on hydropower and coal.

In the beginning of the twentieth century Zurich built up its energy network by connecting the city to the mountains of Graubünden. Electricity was transported from the dam in the mountain to the city.

Soon the demand for electricity increased drastically, calling for a more efficient way of production even in the Laufkraftwerk Letten. The coal driven steam engines were outdated and hydropower could be used better. With the construction of the Unterwerk the original extension was cut off to lower waters.

From this point on the Laufkraftwerk Letten took on two very different paths: one into the world and one into slow decay

This is its story, its reach, its architecture, its life:

from birth to abandonment

a chronographic history

EVOLUTION IN IMAGES

1878

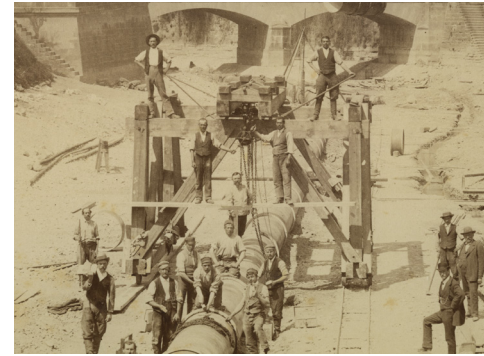
Turbine-/ Waterpumphall
Canal/ Dam & Sluice
Cabletransmission



1878

1893

Expansion into electricity plant
Extension turbine-/pumphall
Construction first boiler house
Construction first chimney



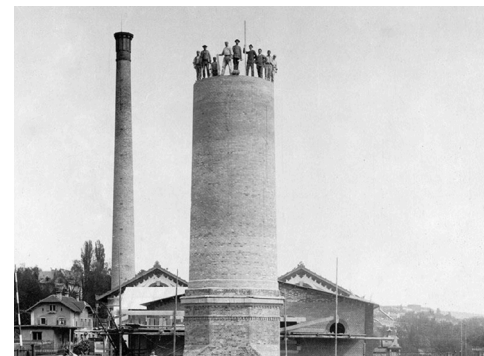
1895

1896

Extension steam-engine part
Construction filterstation Sihlquai

1898

Construction steam-boiler-house
Construction of second chimney
Connection filterstation Sihlquai
Deconstruction of first chimney



1898

1911

End of drinking water distribution

1914

Turbine exchange (Francis)



1914

1937/38

New machine house (Unterwerk)
Deconstruction of machinehouse

1950/51

New machine house across river
+ 2 turbines + 2 generators
Nadelwehr replacement
Deconstruction of Männerbad



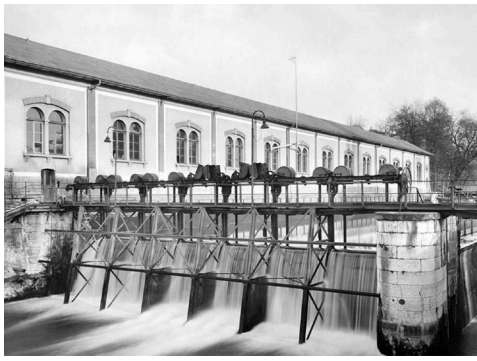
1950

2003

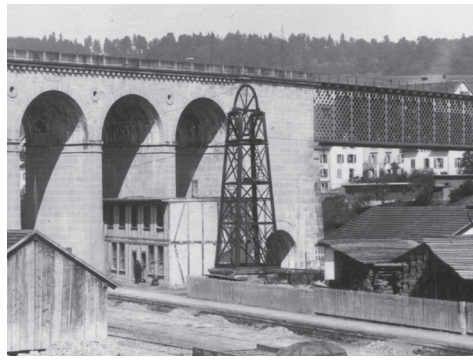
Renewal of turbines

2016

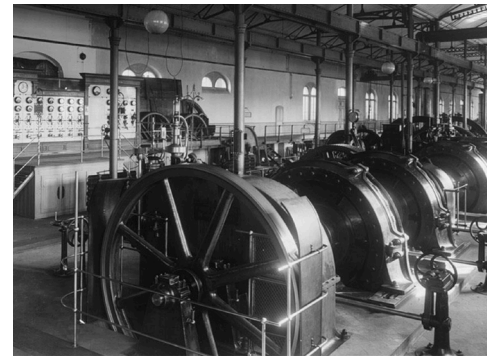
Solar roof
Fish ladder



1878



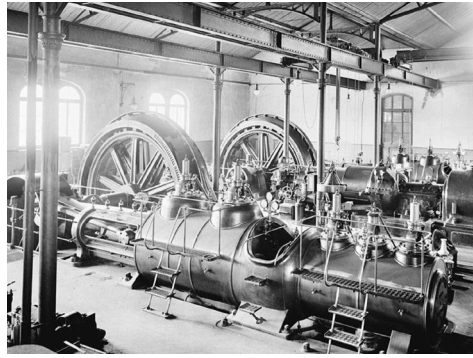
1878



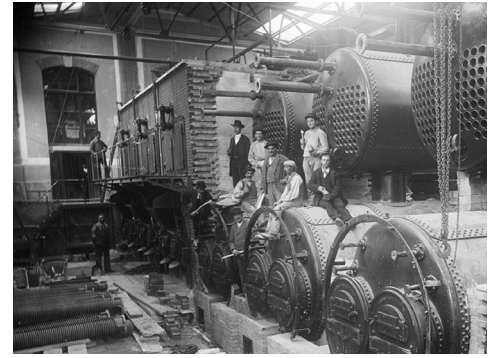
1893



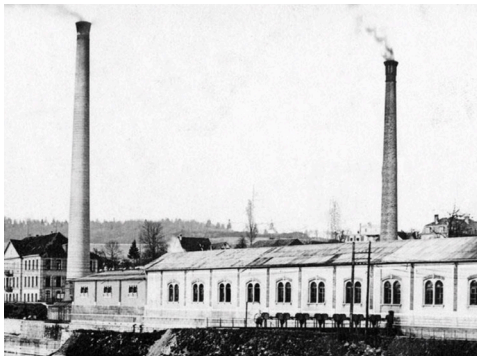
1896



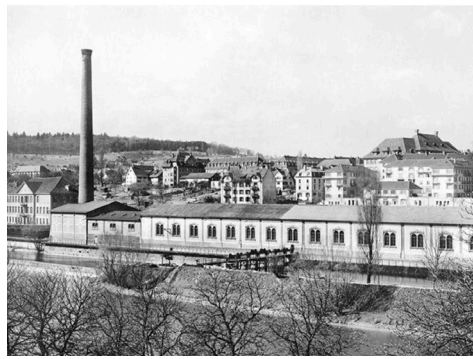
1896



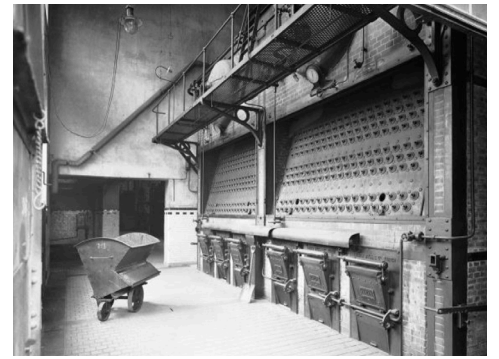
1898



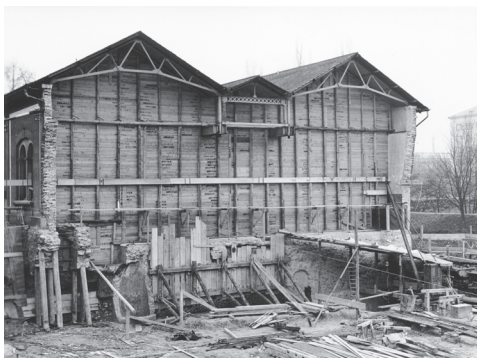
1898



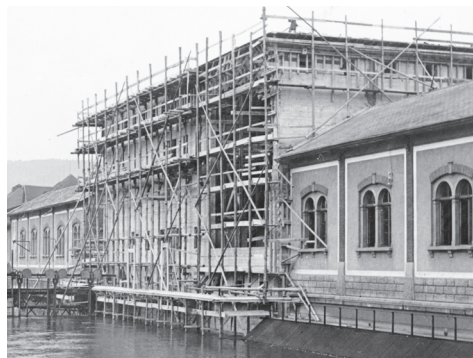
1898



1898



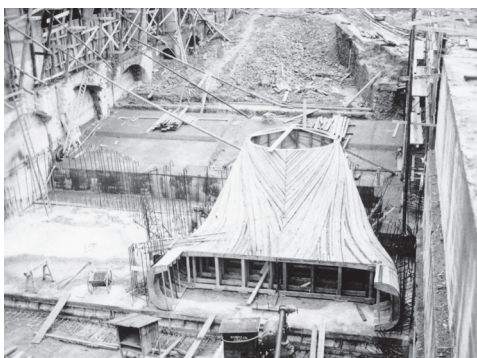
1937



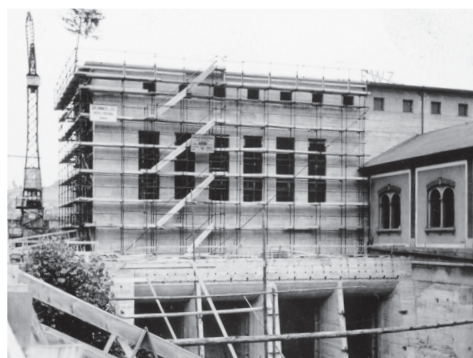
1938



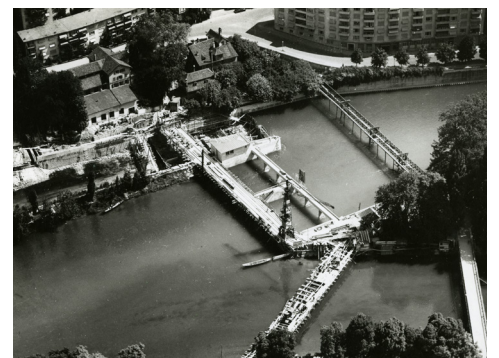
1938



1950

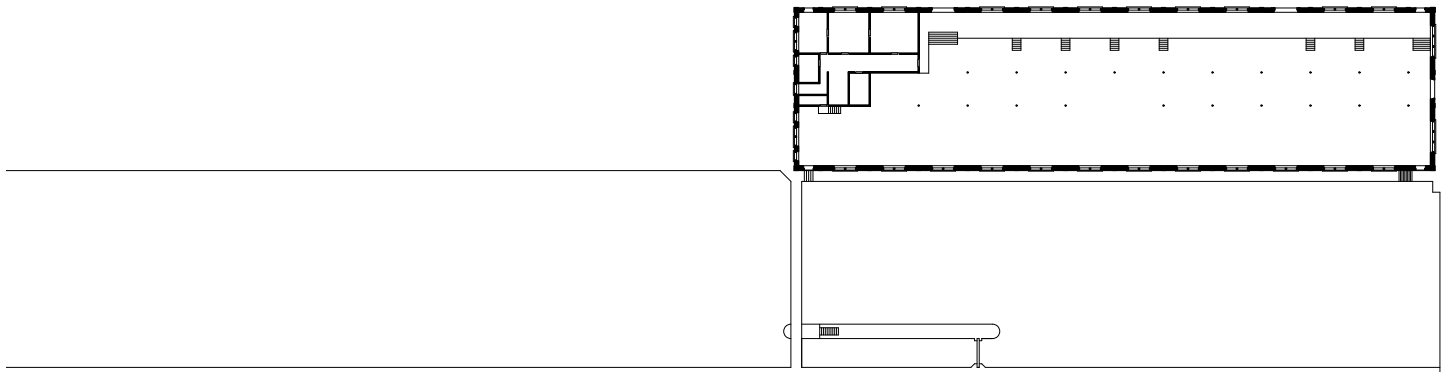


1951

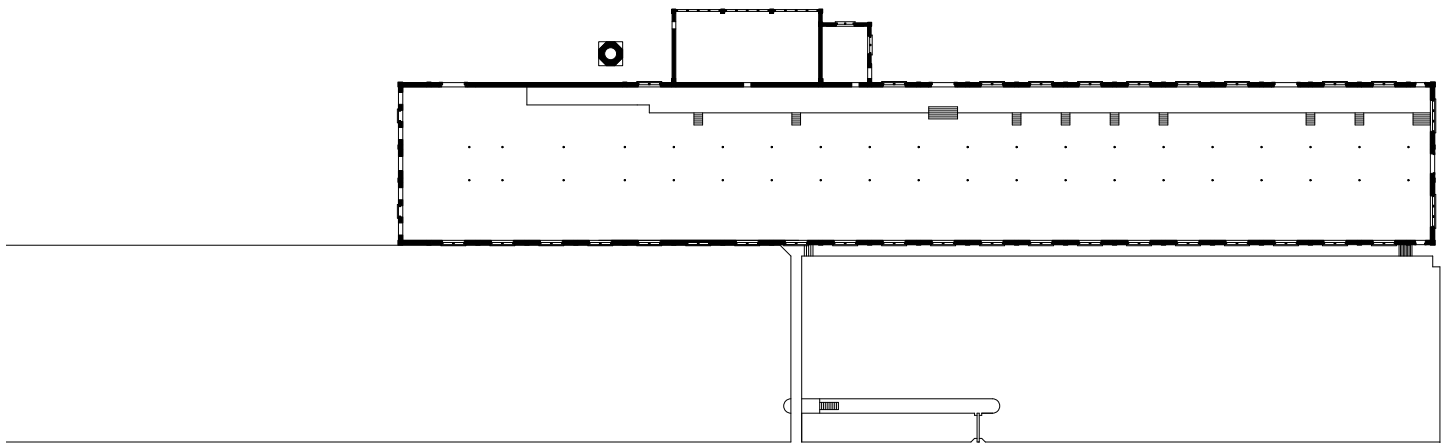


1951

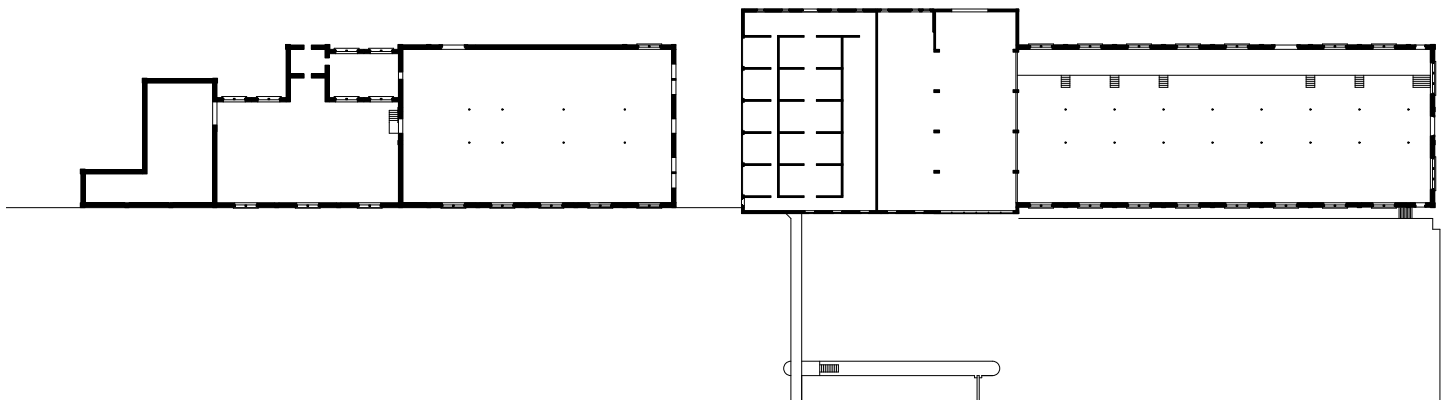
EVOLUTION IN PLAN



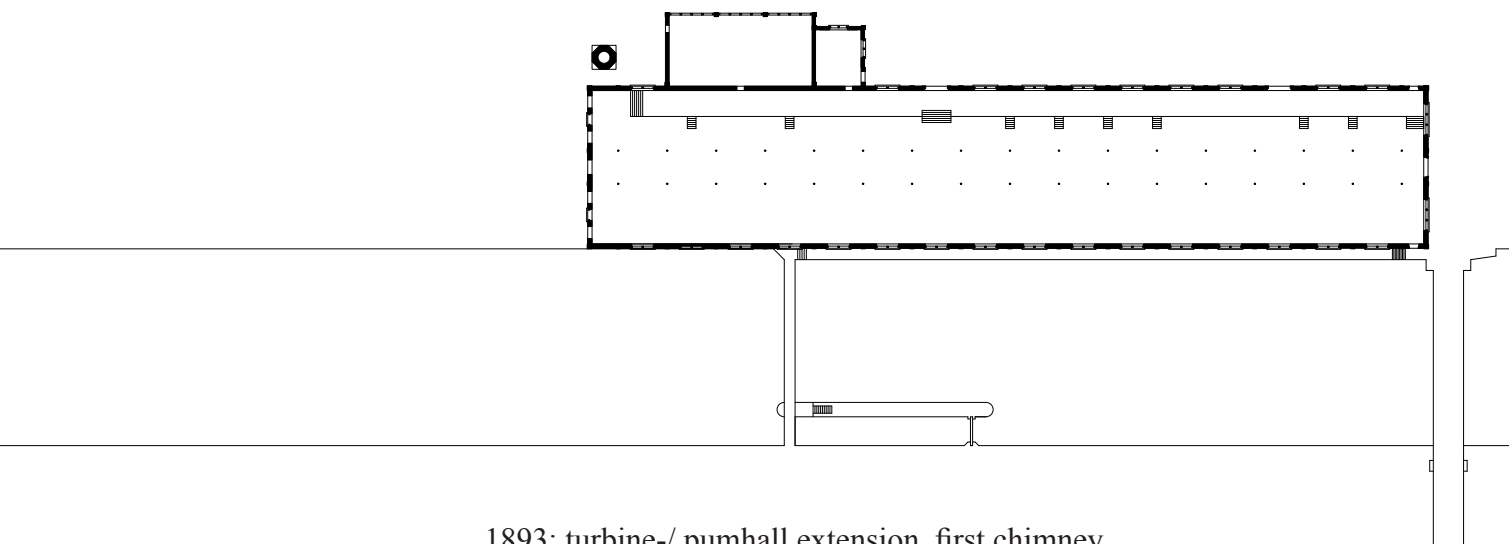
1878: turbine-/ pumphall



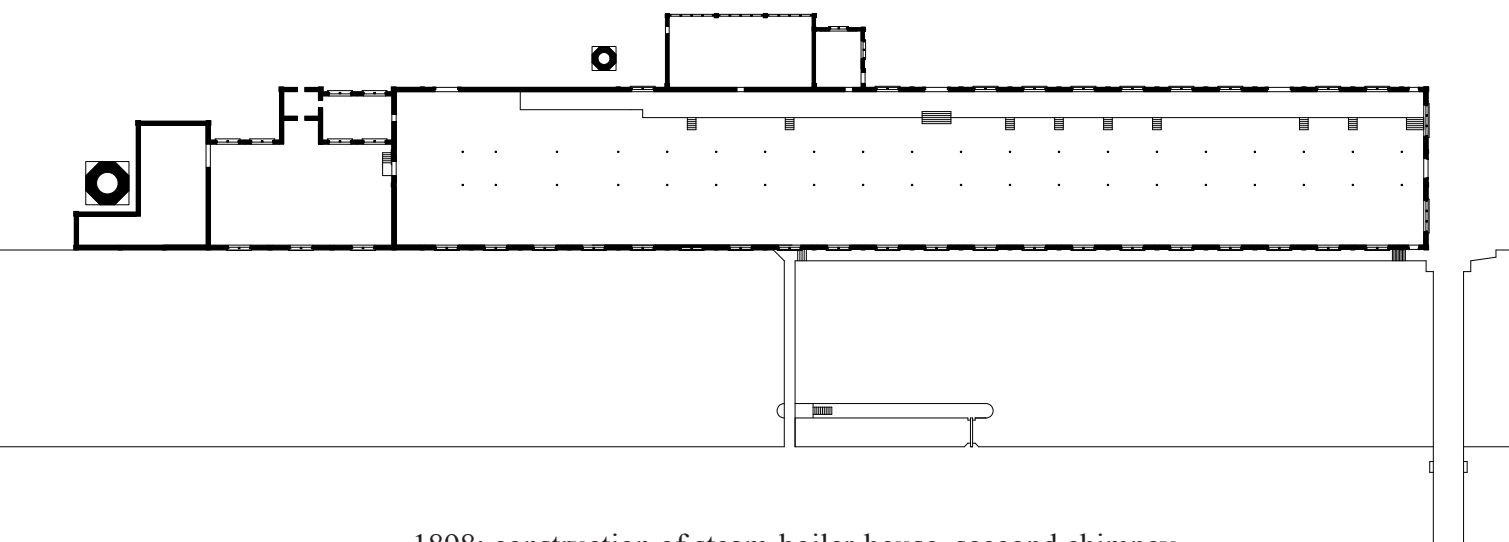
1896: second turbine-/ pumphall extension for steam engines



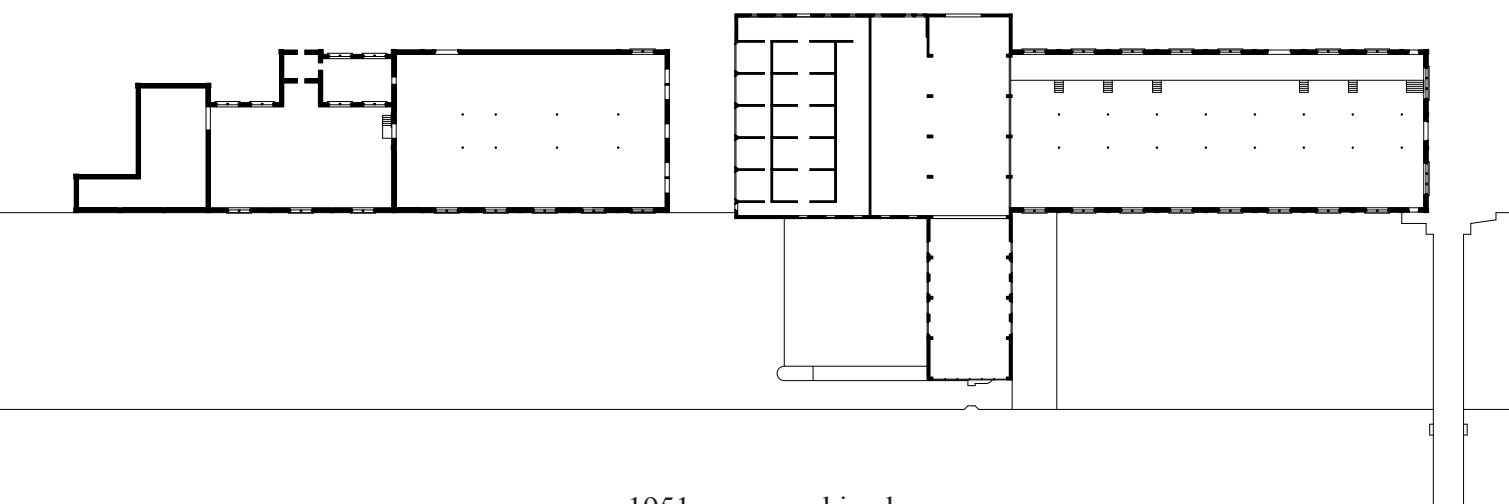
1937: construction of Unterwerk



1893: turbine-/ pumhall extension, first chimney



1898: construction of steam-boiler-house, second chimney

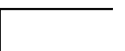


1951: new machine house

1937 CONSTRUCTION OF UNTERWERK: SPLIT IN TWO

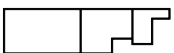


split: destruction for construction of Unterwerk





wall of detached part



a kingdom whose lands extended twelve days', whose wealth was mined in the mountains

an evolution of a network

WATERSUPPLY ZURICH

The Laufkraftwerk Letten was built as a water supply station.
(1884 map)

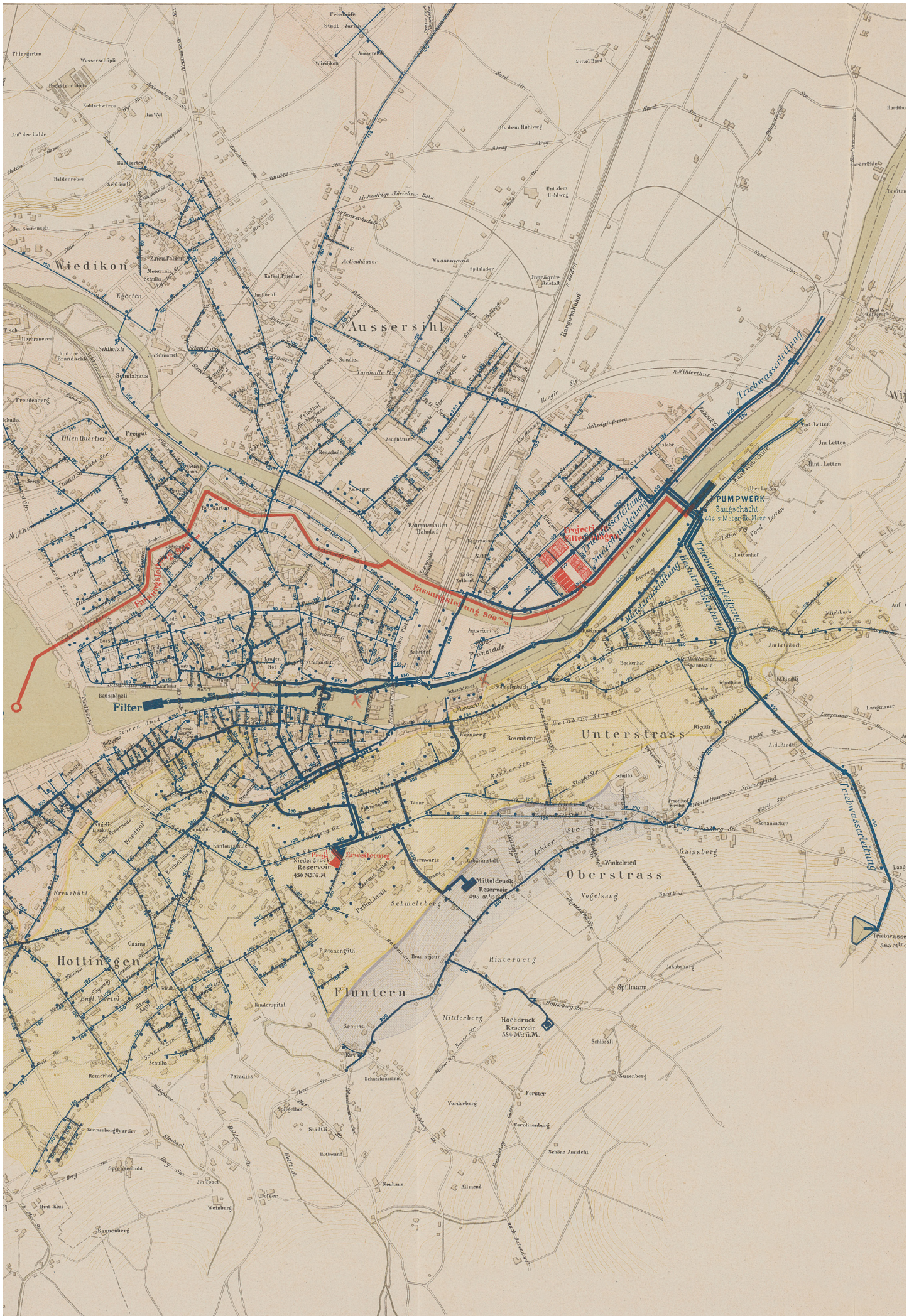
At the beginning the distributed water was collected at the beginning of the Limmat, filtered and transported through underwater pipes.

With the construction of the Filterstation Sihlquai in 1898 the watercollection shifted towards the lake and was transported through the Schanzengraben (red).

The water supply was distributed by three networks that included a reservoir each for over supply:

1. Low Pressure Network
(reservoir hospital meadow)
2. Medium Pressure Network
(reservoir near observatory)
3. High Pressure Network
(resi-pond)

It was used as a water supply station until 1911



CABLETRANSMISSION

The cabletransmission was the additional function to the Laufkraftwerk Letten.

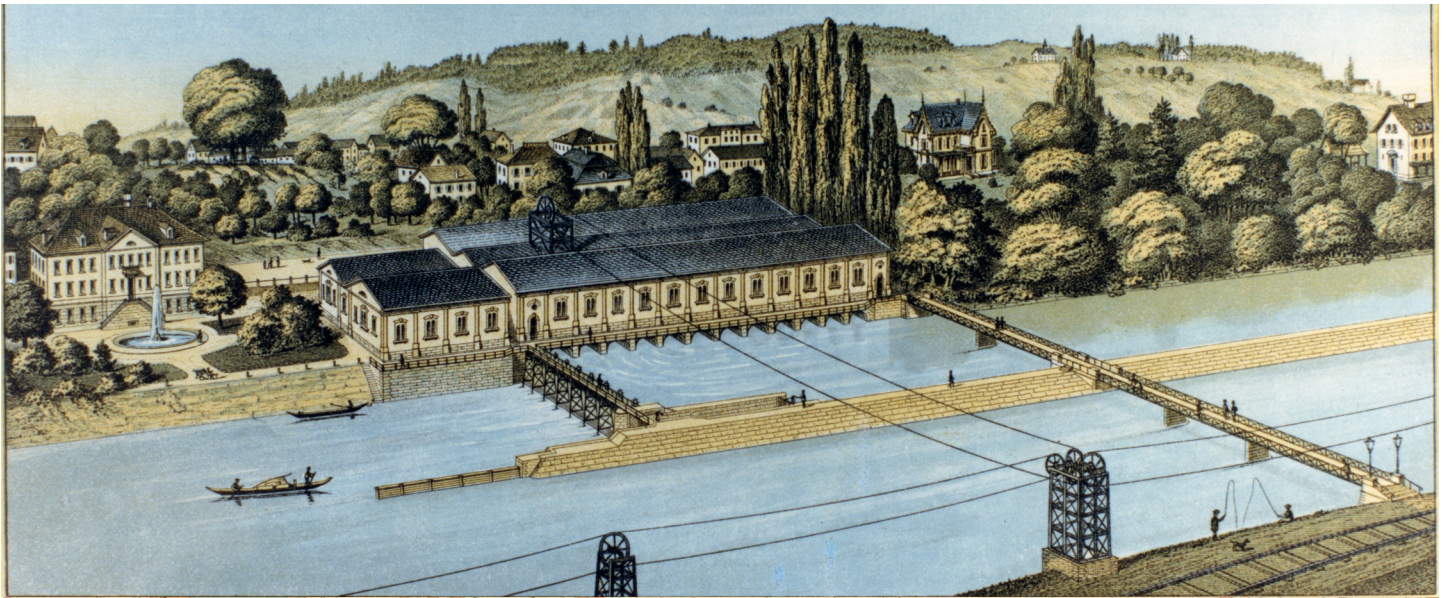
It served as a direct energy transmission via cable for the industry on the other shore. Therefore, twelve transmission towers were designated of which 9 have been built.

The energy was collected by the turbines, via wire cable transported over the water and distributed to where it was drawn of for industrial production.

Despite the cabletransmission there was as well high pressure watertransmission for the industry.

The cabletransmission was taken out of service in 1895.

Two fundaments of such towers still remain intact today.



CABLETRANSMISSION



remaining fundament



remaining fundament

EWZ HYDROELECTRIC ENERGY SUPPLY

 Kraftwerke Letten (1893)
Supply: 169GWh. (100% EWZ)

(Laufkraftwerk Letten (1893))
(Supply: 21GWh. - 7000 Households)

 Kraftwerke Mittelbünden (1909)
Supply: 740 GWh. (100% EWZ)

 Kraftwerke Wägital (1926)
Supply: 120GWh. (50% EWZ)

 Kraftwerke Oberhasli (1932)
Supply: 2180GWh. (16.6% EWZ)

 Kraftwerke Maggia (1956)
Supply: 1265 GWh. (10% EWZ)

 Kraftwerke Bergell (1959)
Supply: 145GWh. (100% EWZ)

 Kraftwerke Blenio (1963):
Supply: 835 GWh. (17% EWZ)

 Kraftwerke Hinterrhein(1964):
Supply: 1500 GWh. (19.5% EWZ)

Total: ca 2037 GWh./ year

In 2020 the final electricity consumption
of Zurich was 2'875 GWh. provided by:

hydro: 1959 GWh.

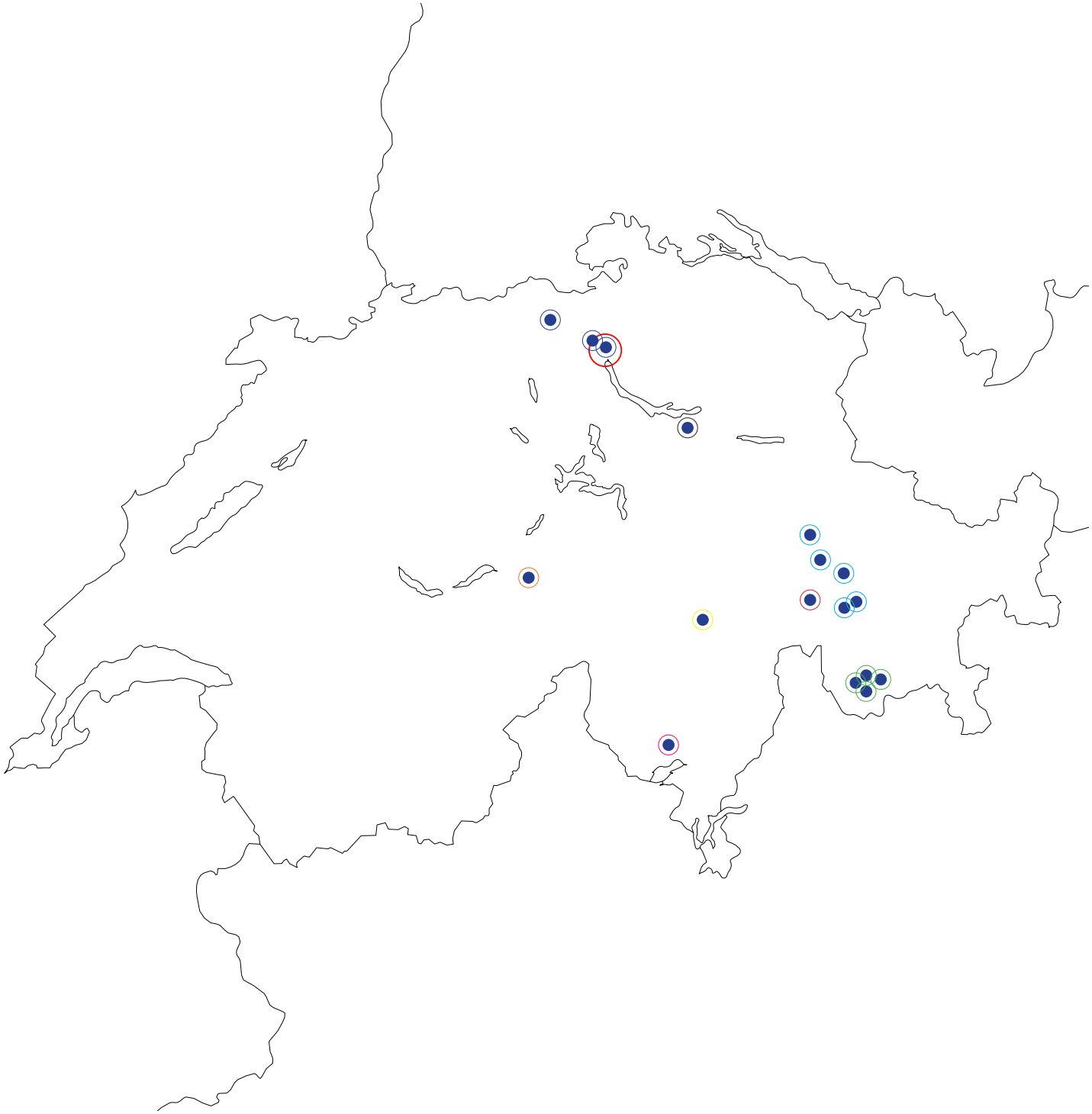
solar and wind: 202 GWh.

wood, rubbish: 73 GWh.

nuclear: 0 KWh.

mix Europe: 642 GWh.*

*Once the electricity consumption of an
institution/ company surpasses 100'000
kWh they are free to choose the provider.

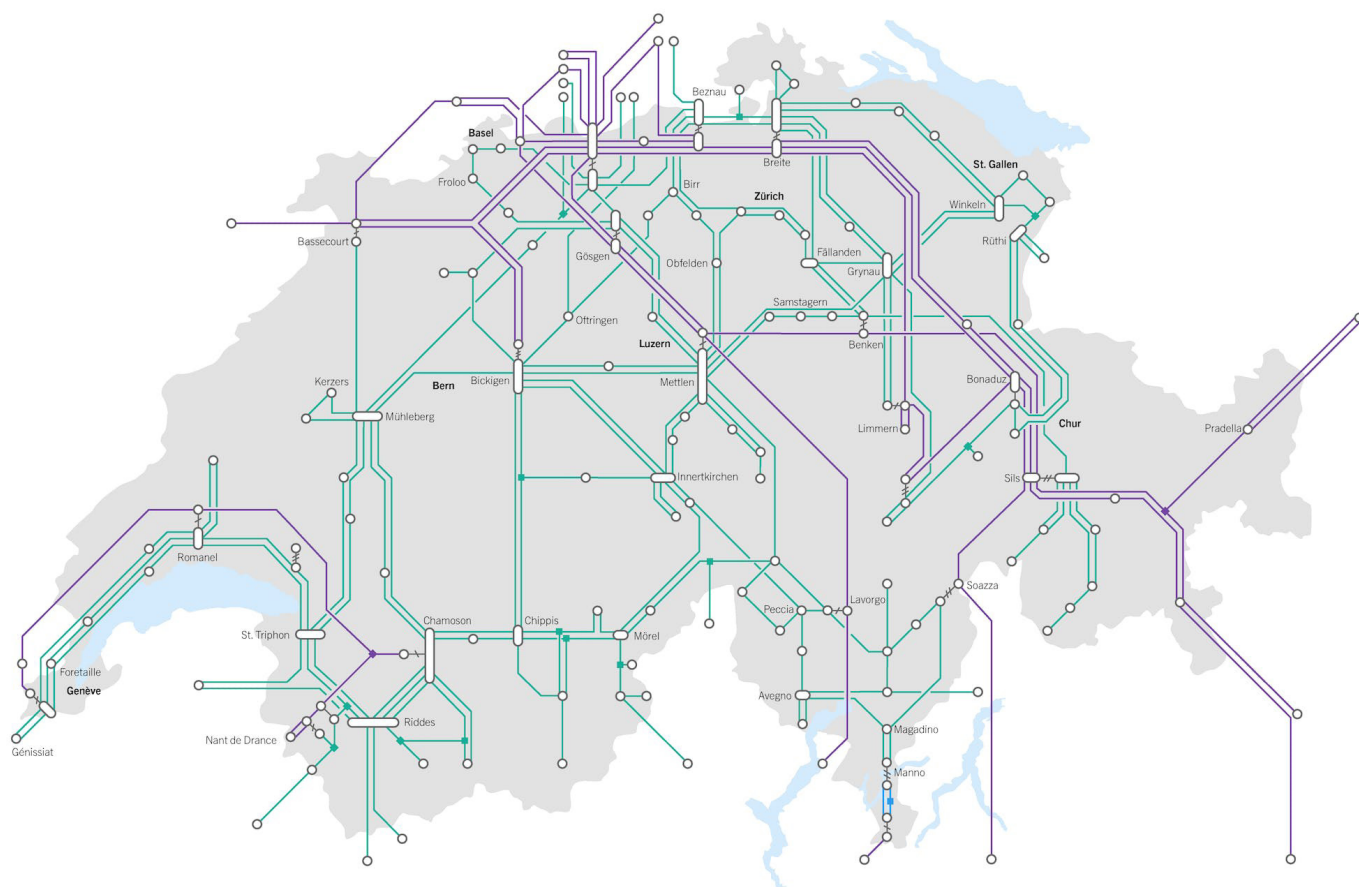


SWISSGRID

The transportation of electricity over long distance is granted by alternating current (AC). The energy loss is determined by voltage system:
 $110\text{kV} = 6\% \text{ loss/ } 100\text{km}$
 $800\text{kV} = 0.5\% \text{ loss/ } 100\text{km}$

If the distance increases to 600 to 800 km direct current (DC) becomes more lucrative due to higher efficiency (oversea).

Switzerland transports its electricity by 380kV (violet) and 220kV (green).

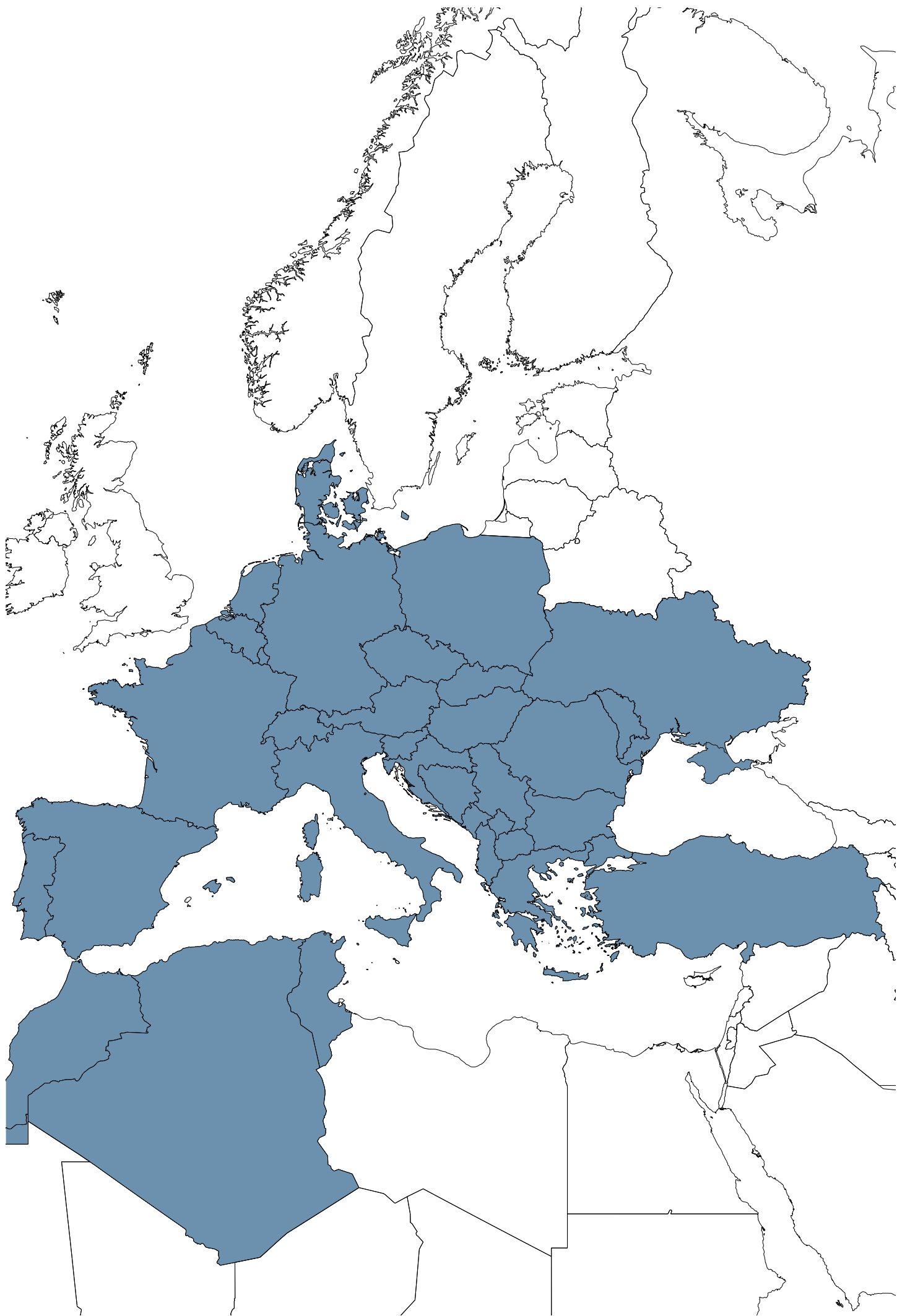


SYNCHRONOUS GRID OF CONTINENTAL EUROPE

41 cables guarantee the border crossing of electricity in Switzerland.

Switzerland is part of the continental synchronous area. An interconnected electricity grid between 30 Countries for 510 million people. It is built upon a coherent frequency of 50 Hz.

Control energy is bought internationally (contracts with power plants) to balance sudden imbalances of the frequency (if a power plant fails to provide). With increasing risk the demand and as well the price of such increases.



EWZ EUROPE ELECTRICITY SUPPLY

● WIND

● SOLAR

● NUCLEAR

○ 100% EWZ

In 2020 Switzerland imports 31.5 TWh. from Germany, France, Austria and exports 29.1 TWh. to Italy as an electricity transit country.

In winter Switzerland imports 40% of its electricity.

ECONOMY OF ELECTRICITY

Merit Order (1)

The price of electricity is constituted by the merit order:

The most expensive supplier defines the price for all supply.

Price for Energy source:
(from least to most expensive)

1. Solar
2. Wind
3. Water
4. Nuclear
5. Coal
6. Gas
7. Oil

Coal, Gas and Oil are marketable assets and therefore defined by market developer.

Daily Fluctuation (2)

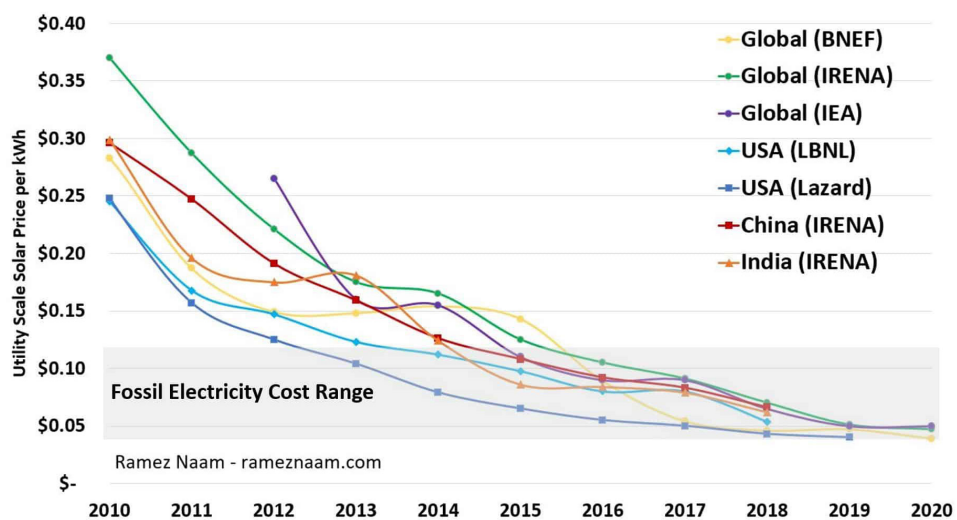
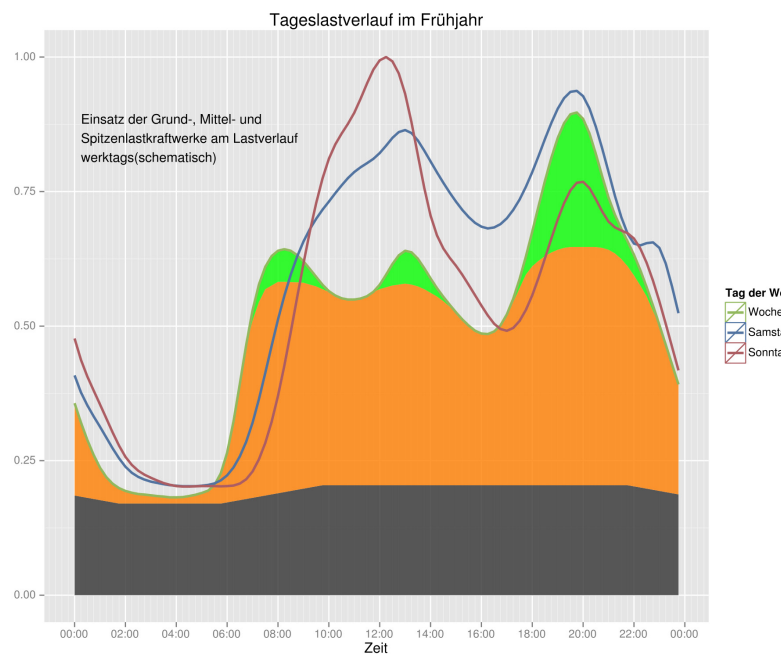
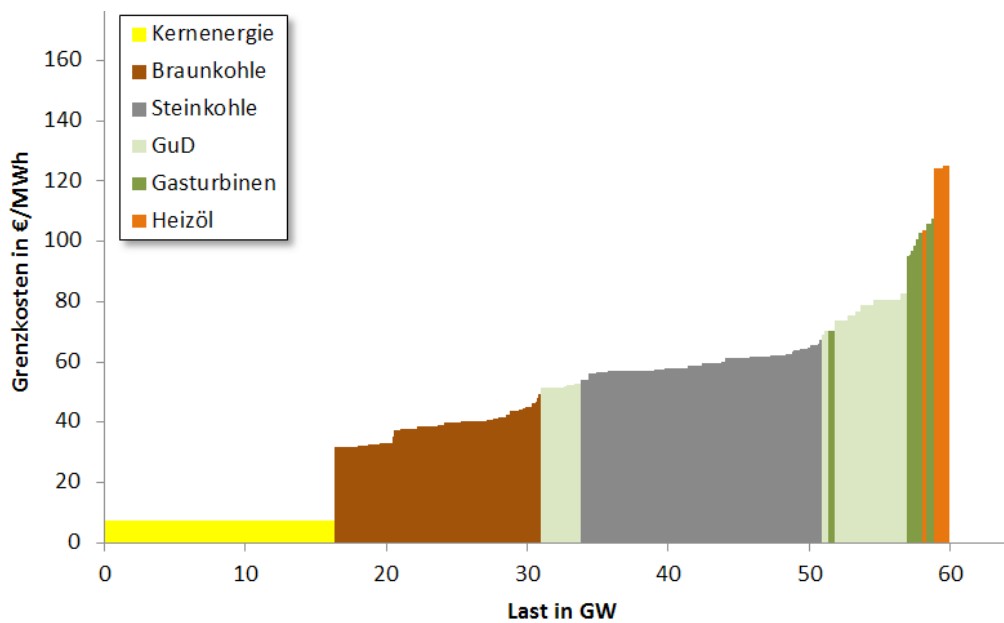
In Switzerland the price of electricity fluctuates due to the time of the day.

Hochtarif: 27.51 Rp./kWh
Monday to Saturday 6:00 - 22:00

Niedertarif: 16.31 Rp./kWh
Monday to Saturday 22:00 - 6:00
Saturday 22:00 - Monday 6:00

Market Development: Solar (3)

The tendencies of renewables are to decrease in costs per kWh due to increasingly cheaper production costs of such.



he deceives him, steals nectar to eternal life, but the gods became aware.

an alternative and implied consequences

SOLAR EQUIVALENT ELECTRICITY

Solar panel

Supply: 200kWh/ m²/ year

Laufkraftwerk Letten

Supply 21 GWh/ Jahr

Solar Equivalent Area

$21'000'000 \text{ kWh/ year} : 200 \text{ kWh/ year/ m}^2$

$= 105'000 \text{ m}^2$

$= 324\text{m} \times 324\text{m}$

Zurich electricity consumption

2875 GWh/ Year

Solar Equivalent Area

$2'875'000'000 \text{ kWh/ Jahr} : 200 \text{ kWh /year/ m}^2$

$= 14'375'000 \text{ m}^2$

$= 3791\text{m} \times 3791\text{m}$

Solar Equivalent Fossil Fuels

In 2020 the final energy
consumption of the city of Zurich
(excluding electricity) was
constituted as follows:

Kerosin: 457 GWh

Diesel: 851 GWh

Benzin: 346 GWh

Gas: 1858 GWh

Oil: 793 GWh

Total: 5021 GWh/ year

Solar Equivalent Area

$5'021'000'000 \text{ kWh/ year} : 200 \text{ kWh/ year/ m}^2$

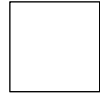
$= 25'105'000 \text{ m}^2$

$= 5010\text{m} \times 5010\text{m}$

324m



Solar equivalent area Laufkraftwerk Letten supply



1187 m

Surface Lai da Marmorera (Kraftwerke Mittelbünden)



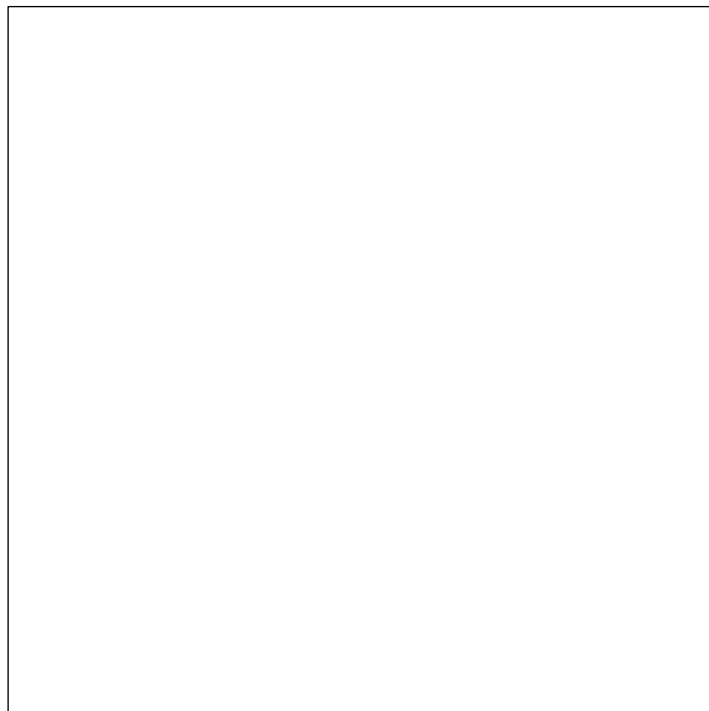
3791 m

Solar equivalent area zürich elecricity consumption



5010 m

Solar equivalent area zürich energy consumption



9380 m

Surface city of Zurich

ENVIRONMENTAL CONSEQUENCES:

Linear logic of time

Consumption:

35% Resources

40% Energy

12% Water

Production:

39% Carbon Emissions

- 28% Operational,

- 11% Construction (8% Cement)

59% Landfill

Grey Energy - Embodied Energy

Laufkraftwerk Letten: Fragments

Part 1 (x 592m²)

146 kg CO₂ pro m² facade

brick: 0.6m³ x 900kg/m³ x 0.267kgCO₂

plaster: 0.015m³ x 925kg/m³ x 0.158kgCO₂

Part 2 (x 450m²)

171 kg CO₂ pro m² facade

brick: 0.71m³ x 900kg/m³ x 0.267kgCO₂

wood: 0.004m³ x 436/m³ x 0.29kgCO₂

Part 3/5 (x 1931m²)

122 kg CO₂ pro m² facade

brick: 0.46m³ x 900kg/m³ x 0.267kgCO₂

plaster: 0.019m³ x 925kg/m³ x 0.158kgCO₂

glas: 0.003m³ x 2500kg/m³ x 1.14kgCO₂

wood: 0.0014m³ x 436/m³ x 0.29kgCO₂

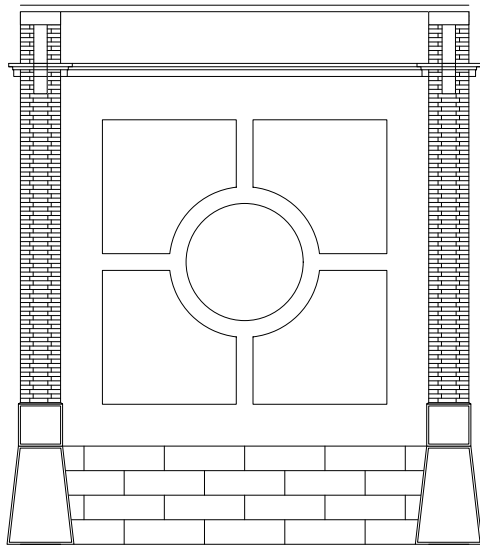
Part 4 (x 3700m²)

562 kg CO₂ pro m² facade

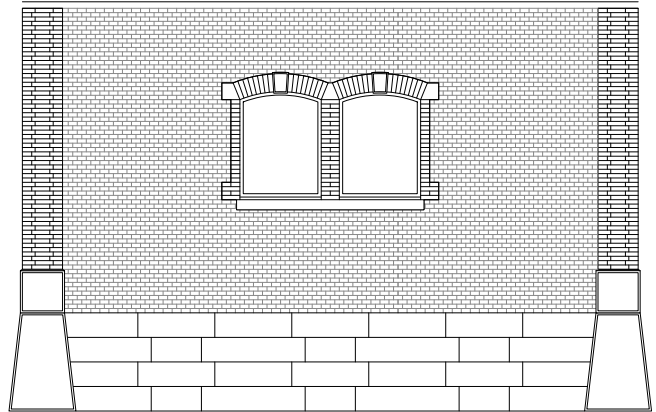
concrete: 0.36m³ x 2'300kg/m³ x 0.101kgCO₂

steel: 0.04m³ x 7860kg/m³ x 1.52kgCO₂

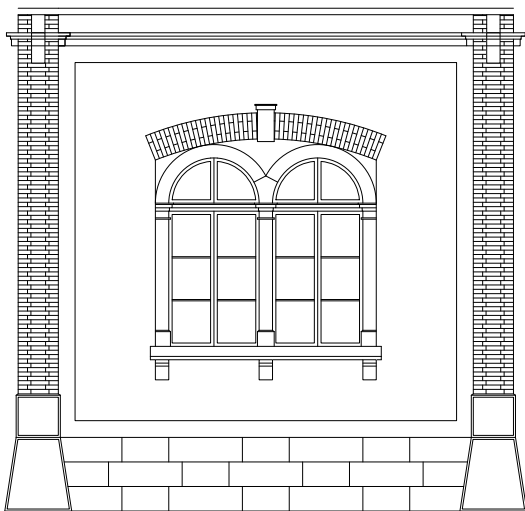
Total: ca. 2500t CO₂



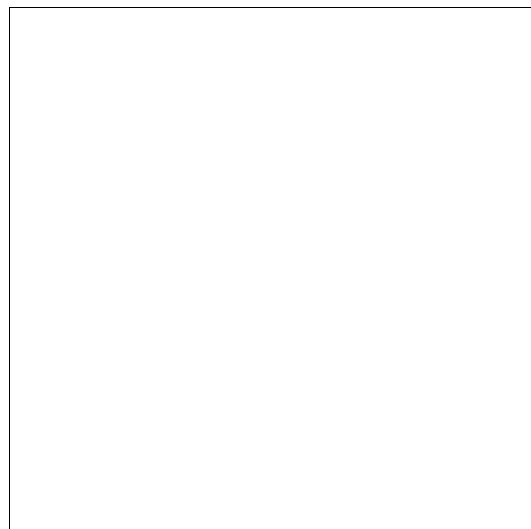
Part 1



Part 2



Part 3/5



Part 4

CONTEXT: CO2

CO2 emissions by the City of Zurich 2020 (estimation without construction materials, including transport)

Values in gram

Kerosin: 257 CO2/ kWhpe

Diesel: 267 CO2/ kWhpe

Benzin: 250 CO2/ kWhpe

Gas: 201 CO2/ kWhpe

Oil: 279 CO2/ kWhpe

(pe: primary energy including mining, processing, transport)

Kerosin = 117'449 t CO2

457'000'000 kWh x 257 CO2/ kWhpe

Diesel = 227'217 t CO2

851'000'000 kWh x 267 CO2/ kWhpe

Benzin = 86'500 t CO2

346'000'000 kWh x 250 CO2/ kWhpe

Gas = 373'458 t CO2

1'858'000'000 kWh x 201 CO2/ kWhpe

Oil = 221'247 t CO2

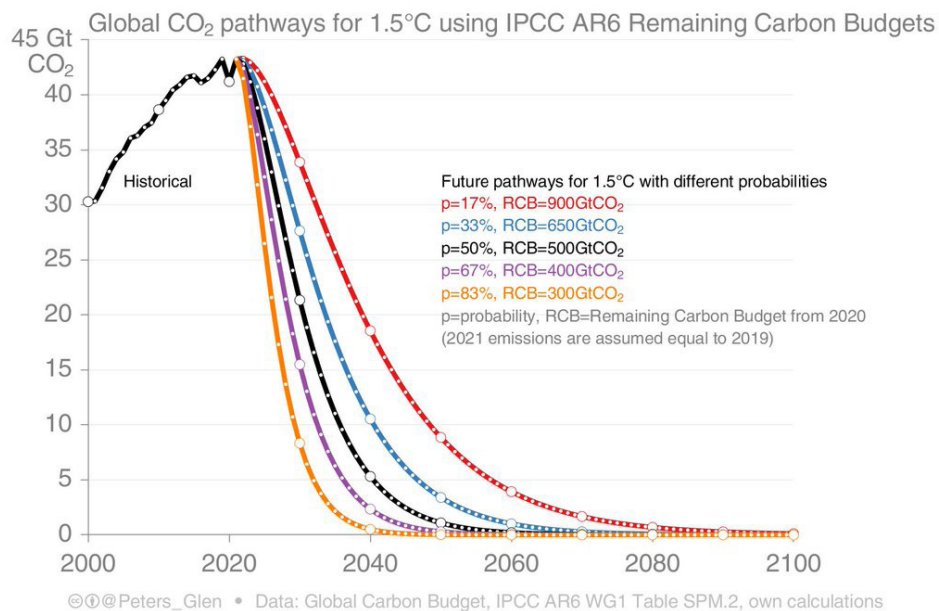
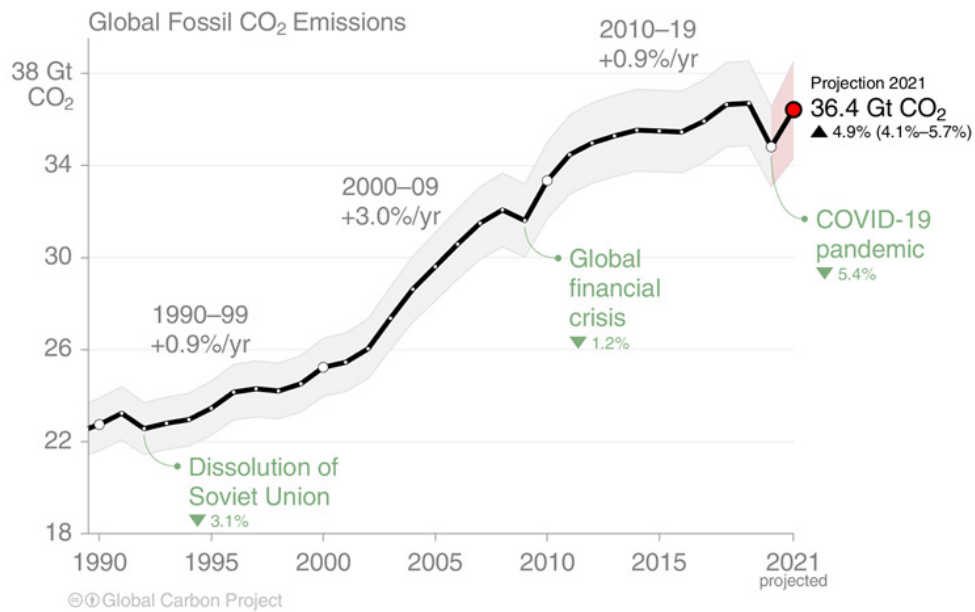
793'000'000 kWh x 279 CO2/ kWhpe

Total = 1'025'786 t CO2

(= 25 Cruise Ships (t = 500 m3))

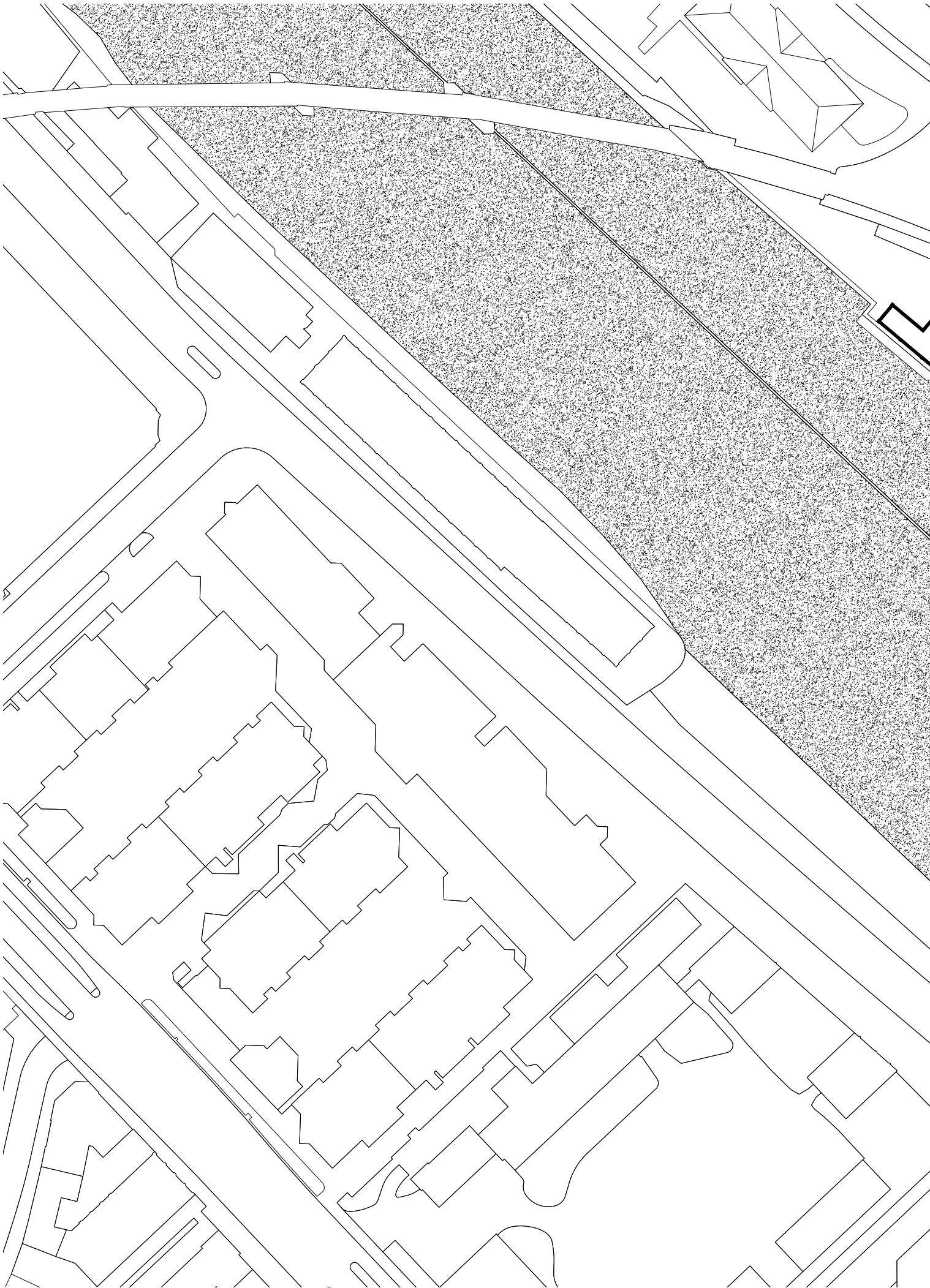
The goal should be to strive for a circular logic of time, a circular economy that includes a regenerative logic of space.

late 14c., regeneratif, of a medicine
“having the power to cause flesh to grow again.”

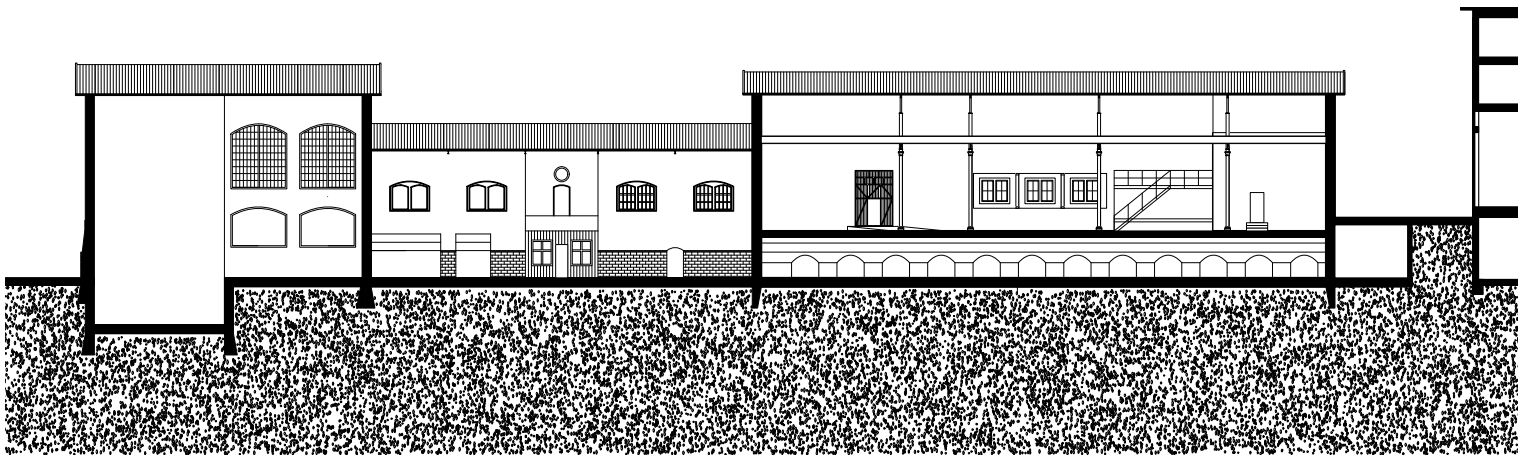
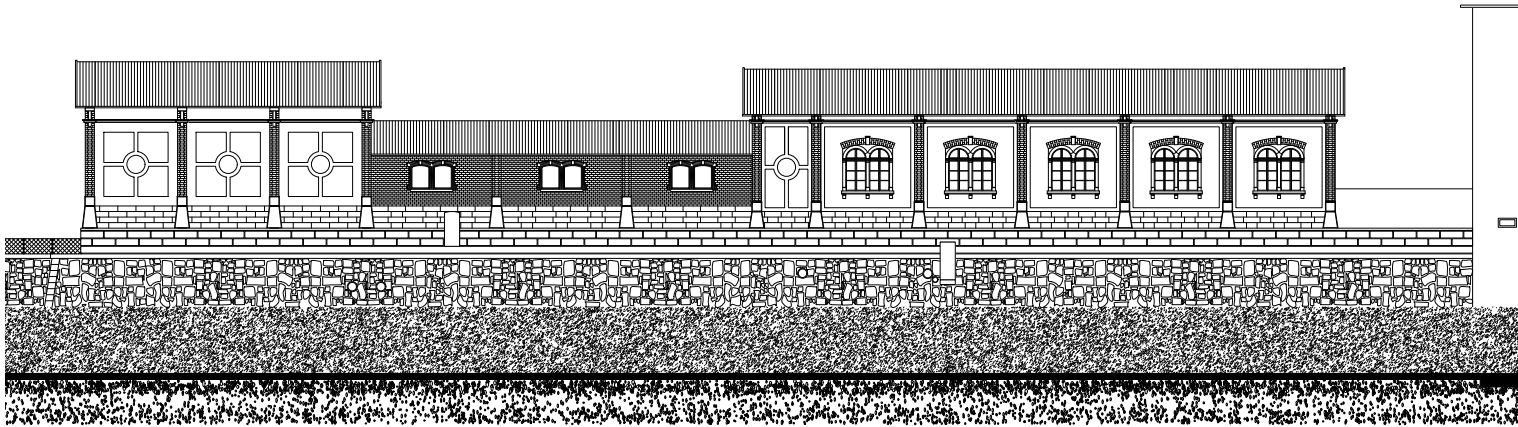


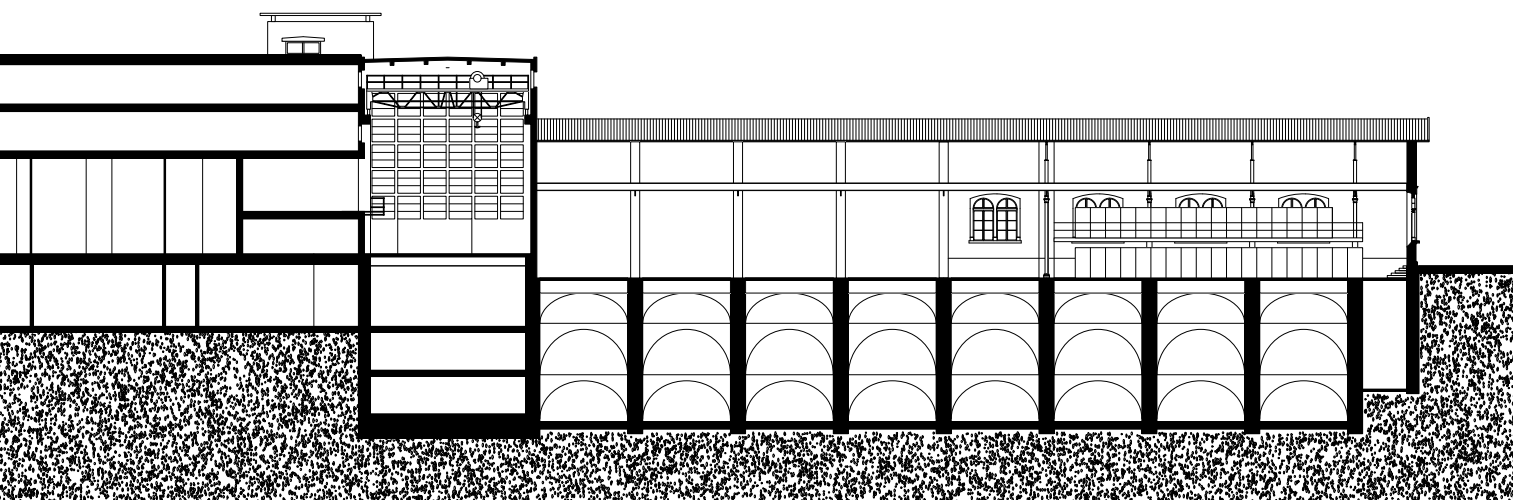
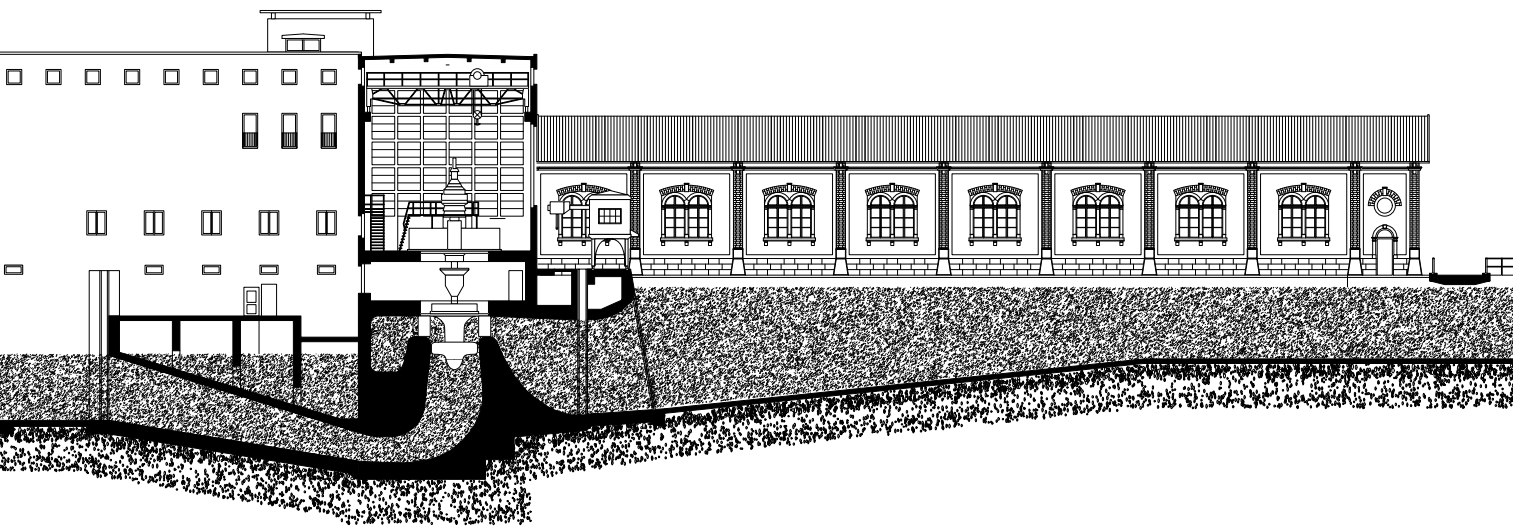
his castle close to a lake was made to desire two things without ever attaining them again: energy and water

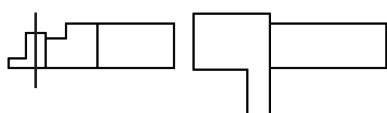
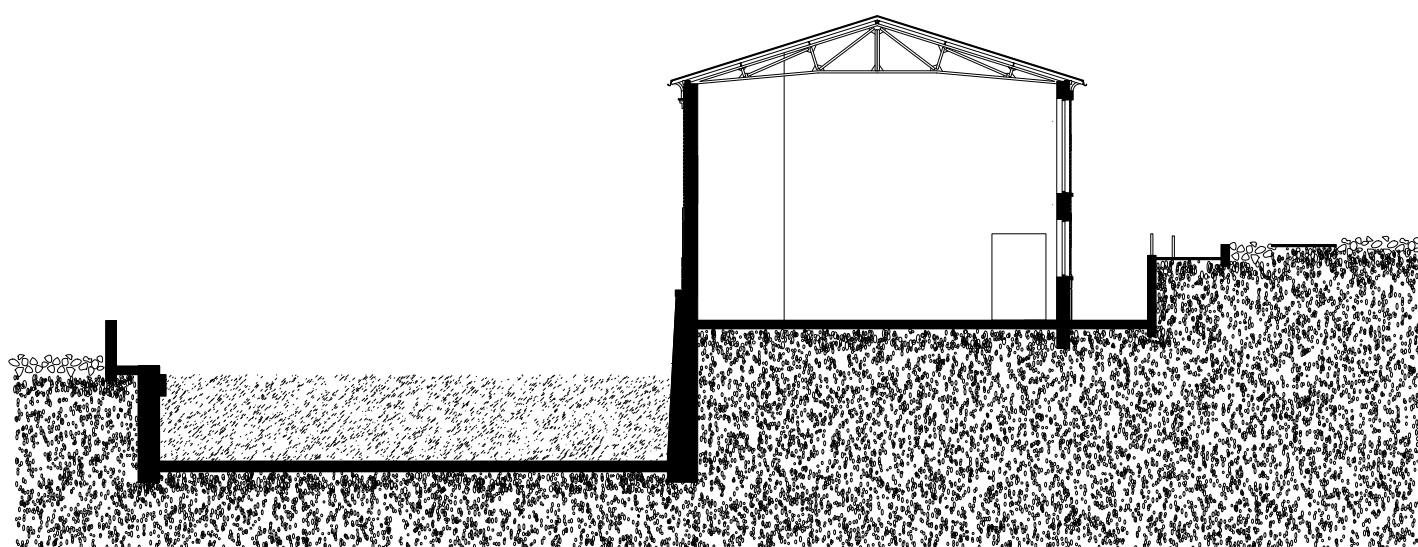
a current representation of the Laufkraftwerk Letten

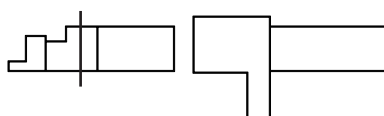
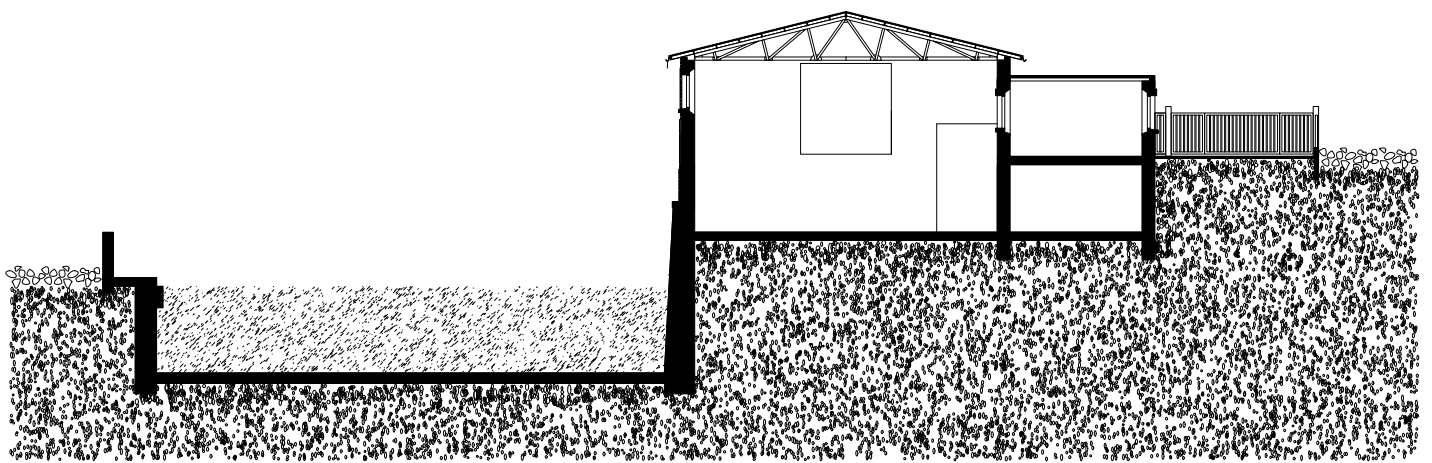


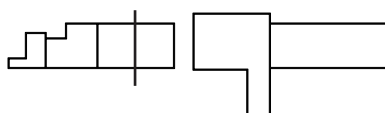
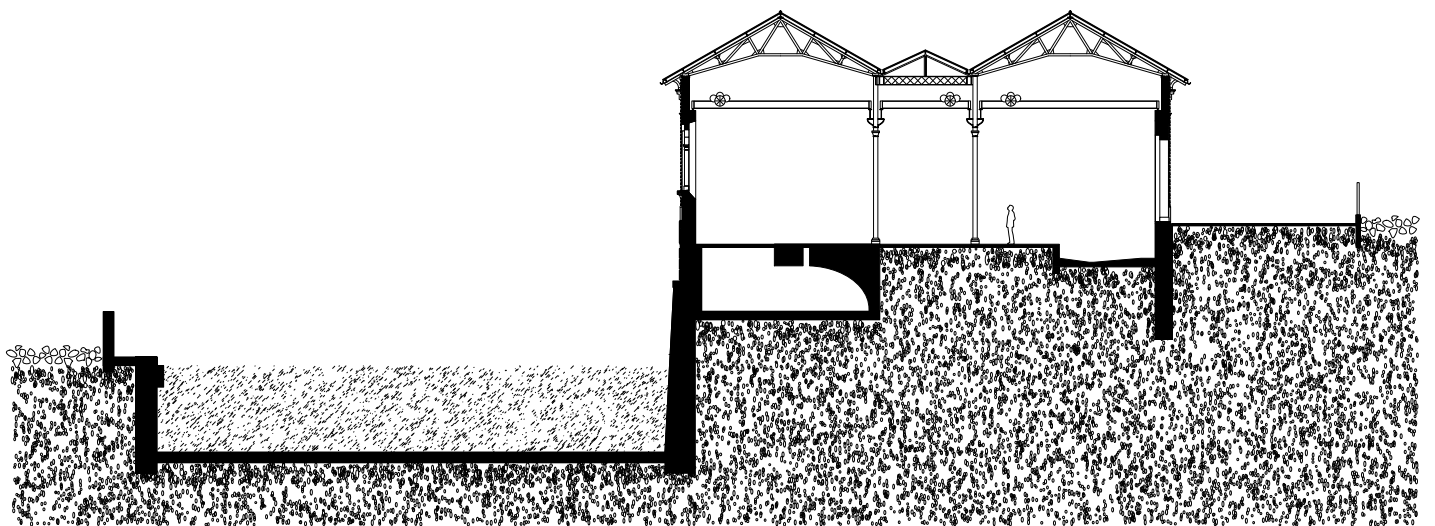


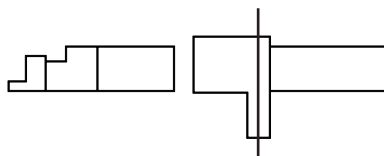
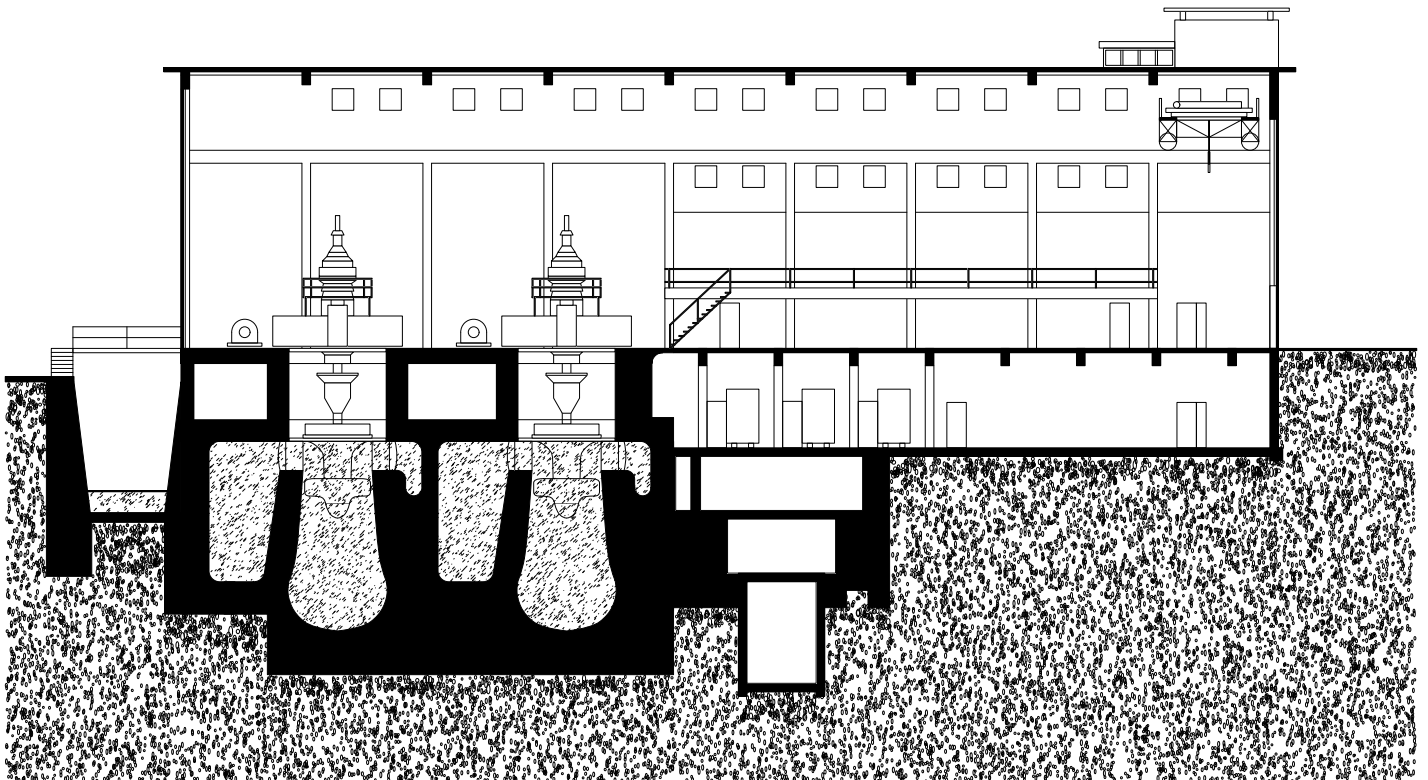


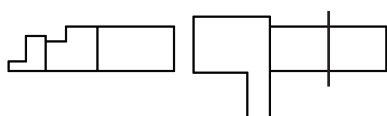
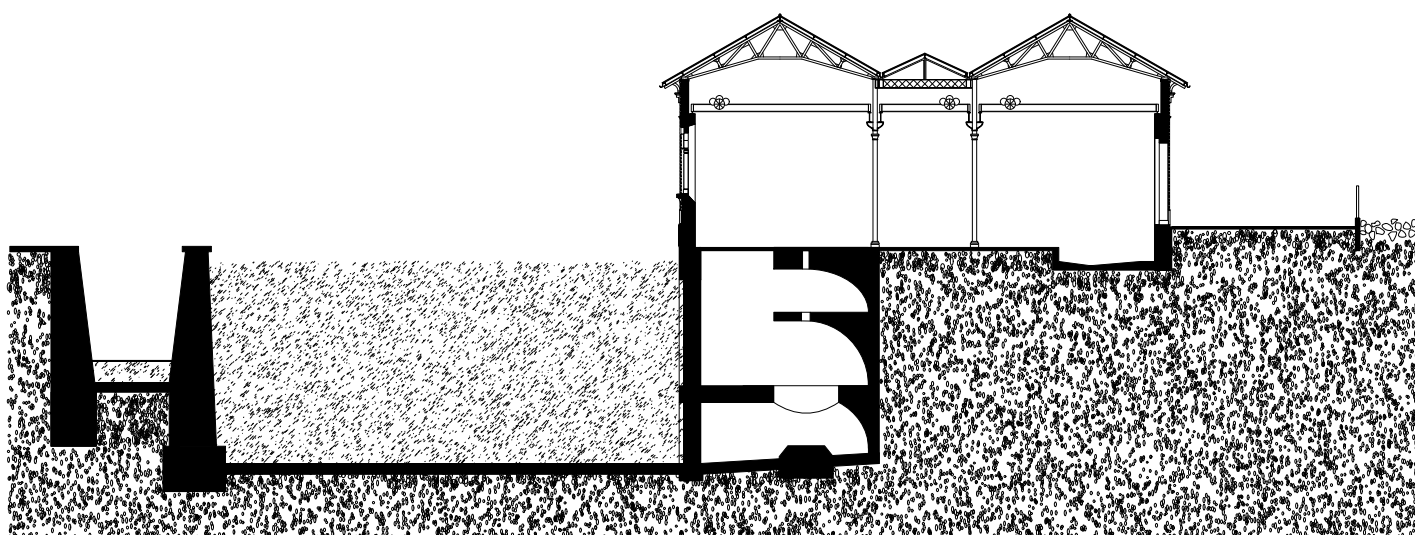


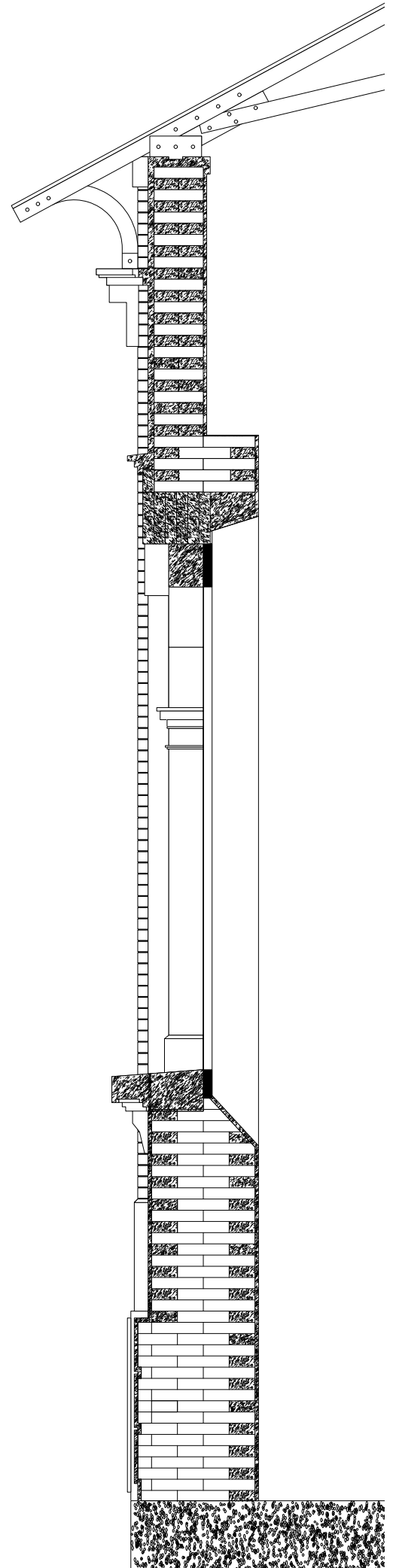




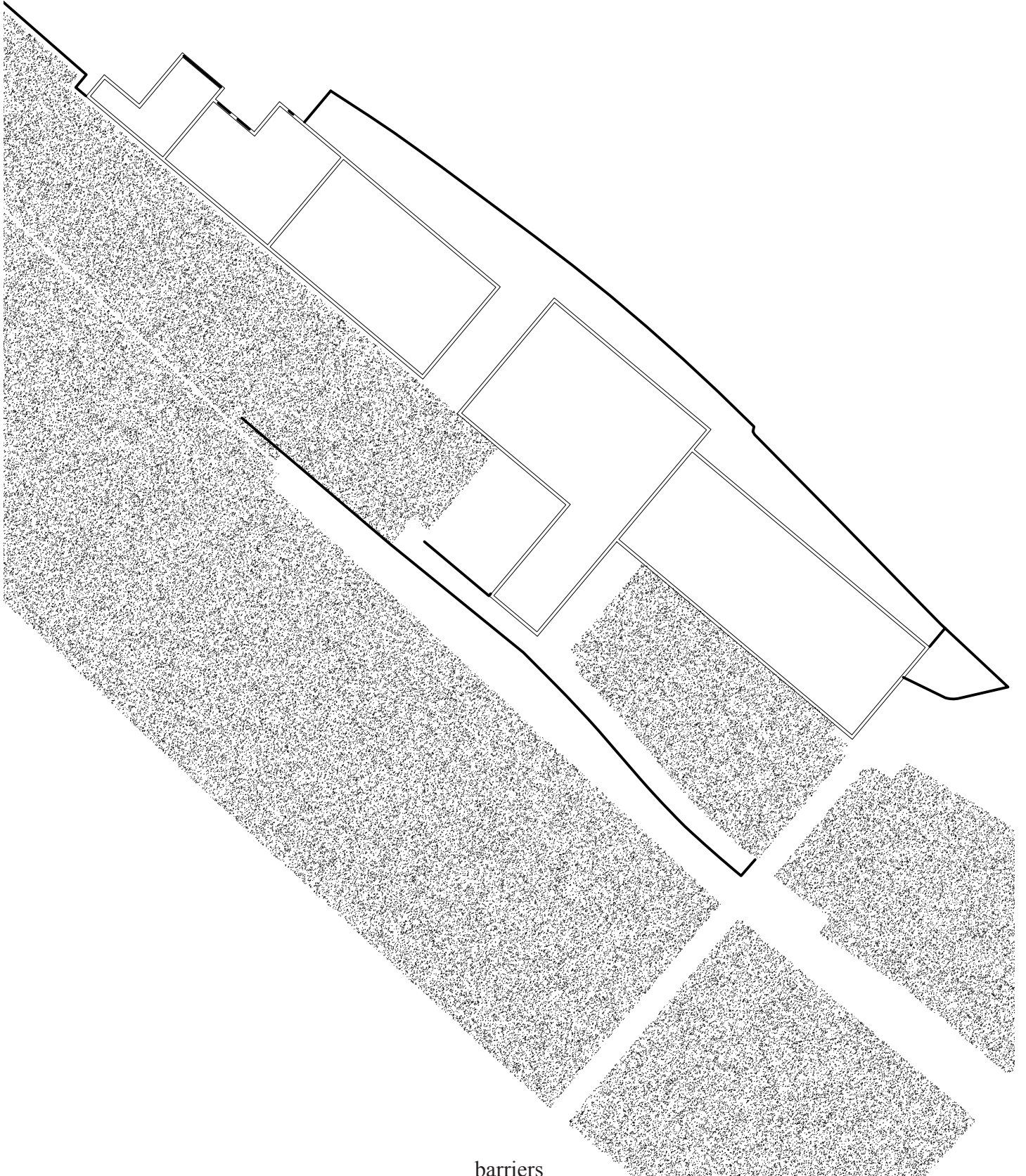






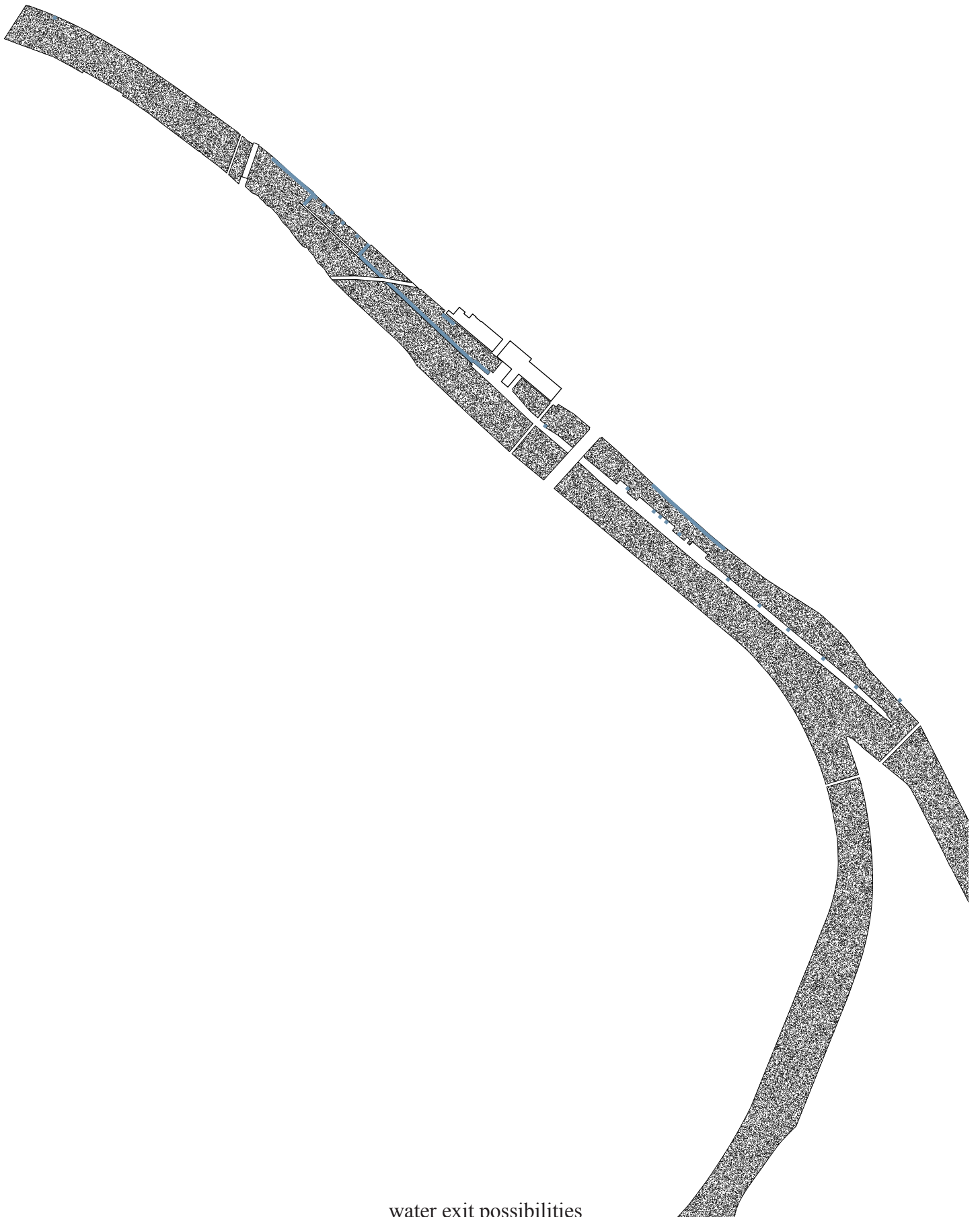








by christian senti



water exit possibilities





