

Agro Energie Schwyz AG

How to build and integrate a district heating network -
success story with hurdles

IEA Bioenergy - Baden, 20th October 2017

Dr. Urs Rhyner



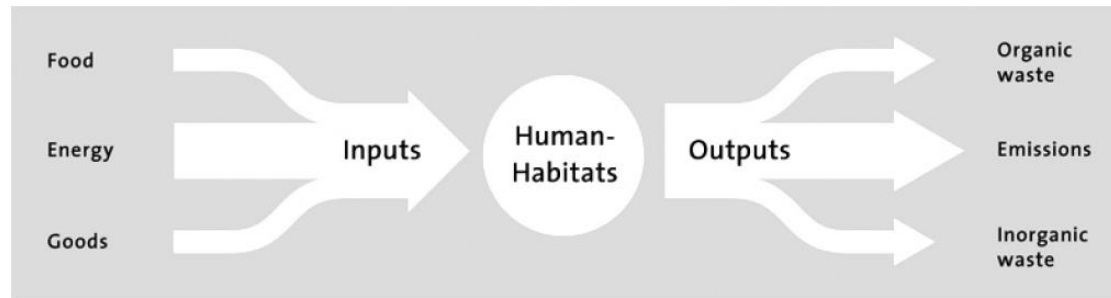
Programm

1. **Motivation**
2. AGRO Energie Schwyz AG
3. Biomass power plant
4. District heating
5. Economics
6. Heat accumulator
7. Agro Energie Rigi
8. Agro Energie Ausserschwyz
9. Non-technical barriers

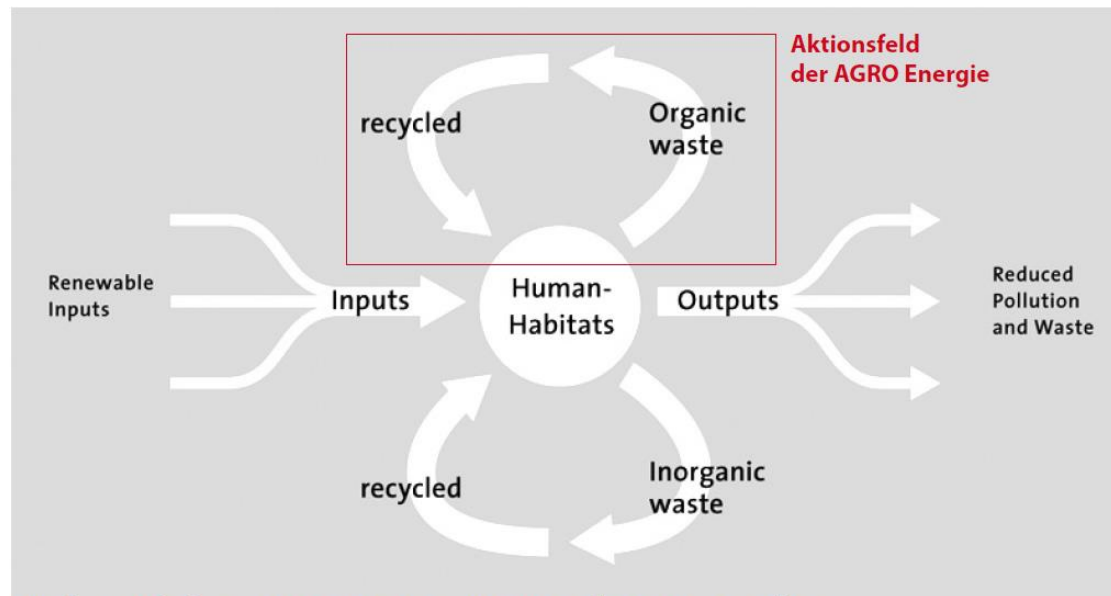
Swiss Farm – Manure Production



Sustainability – think global, act local



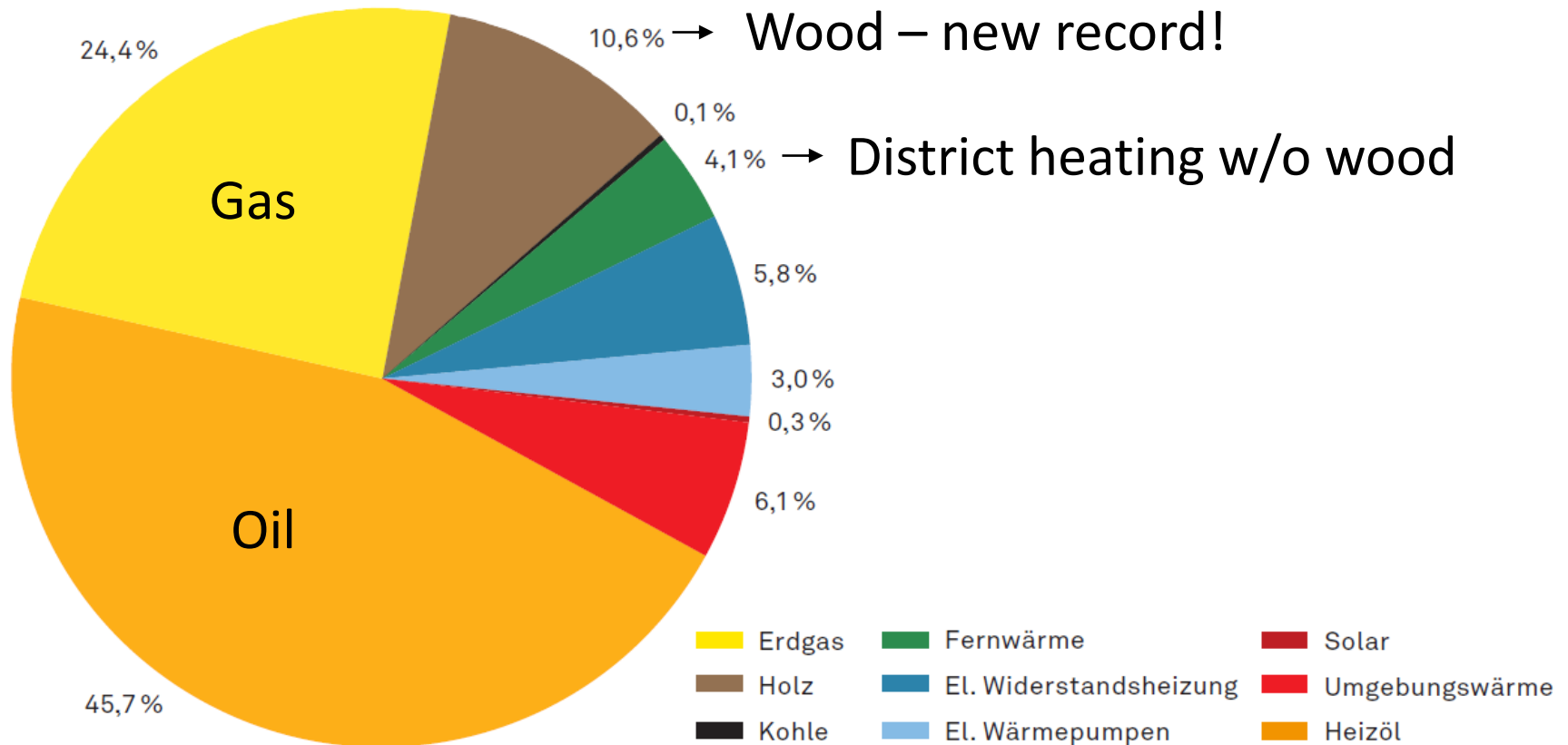
Linear metabolism – cities consume and pollute at a high rate



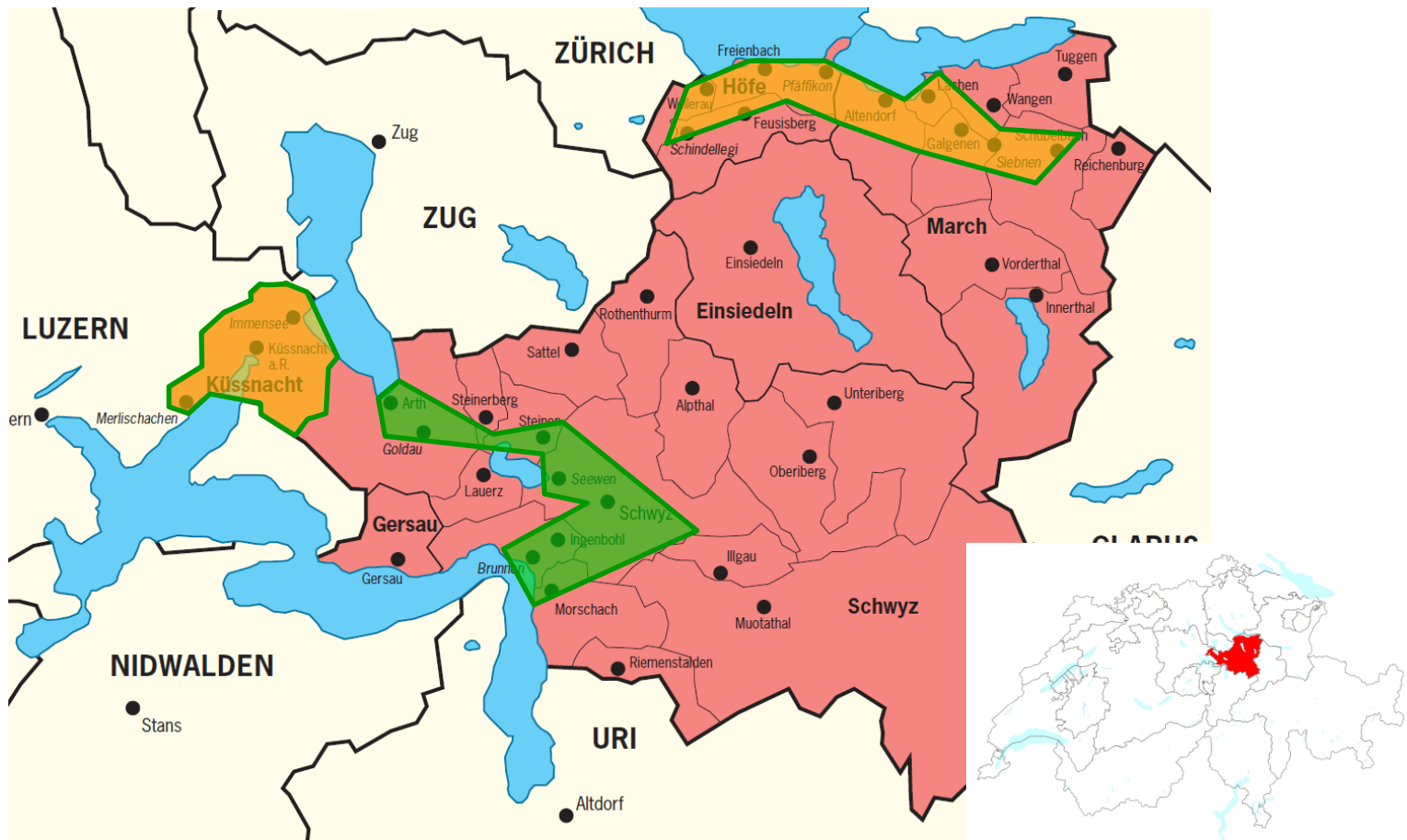
Circular metabolism – cities minimise new inputs and maximise recycling

Richard Rogers, Cities for a Small Planet, 1996

Swiss heat production



Agro Energie DH in the canton of Schwyz



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Who is Agro Energie Schwyz AG?

AGRO Energie Schwyz AG provides heat and power to the region of Schwyz by using renewable and local resources in doing so fostering the region by increasing its independence, adding value, facilitating jobs and promoting sustainability.



Company

- 2006 founding of AGRO Energie Schwyz AG
- 2009 commissioning of the plant
- Founding shareholders
semi-public: OAK, EBS, Genossame Schwyz
private: Baptist Reichmuth, Georges Schelbert
- Shareholders since 2016: pension fund (Profond Vorsorgeeinrichtung), Genossame Schwyz, Baptist Reichmuth, Georges Schelbert

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Biomass Power Plant



20 MW_{th} wood-fired boilers



boiler 1: 3.2 MW_{th}

boiler 2: 6.4 MW_{th}

boiler 3: 9.9 MW_{th}

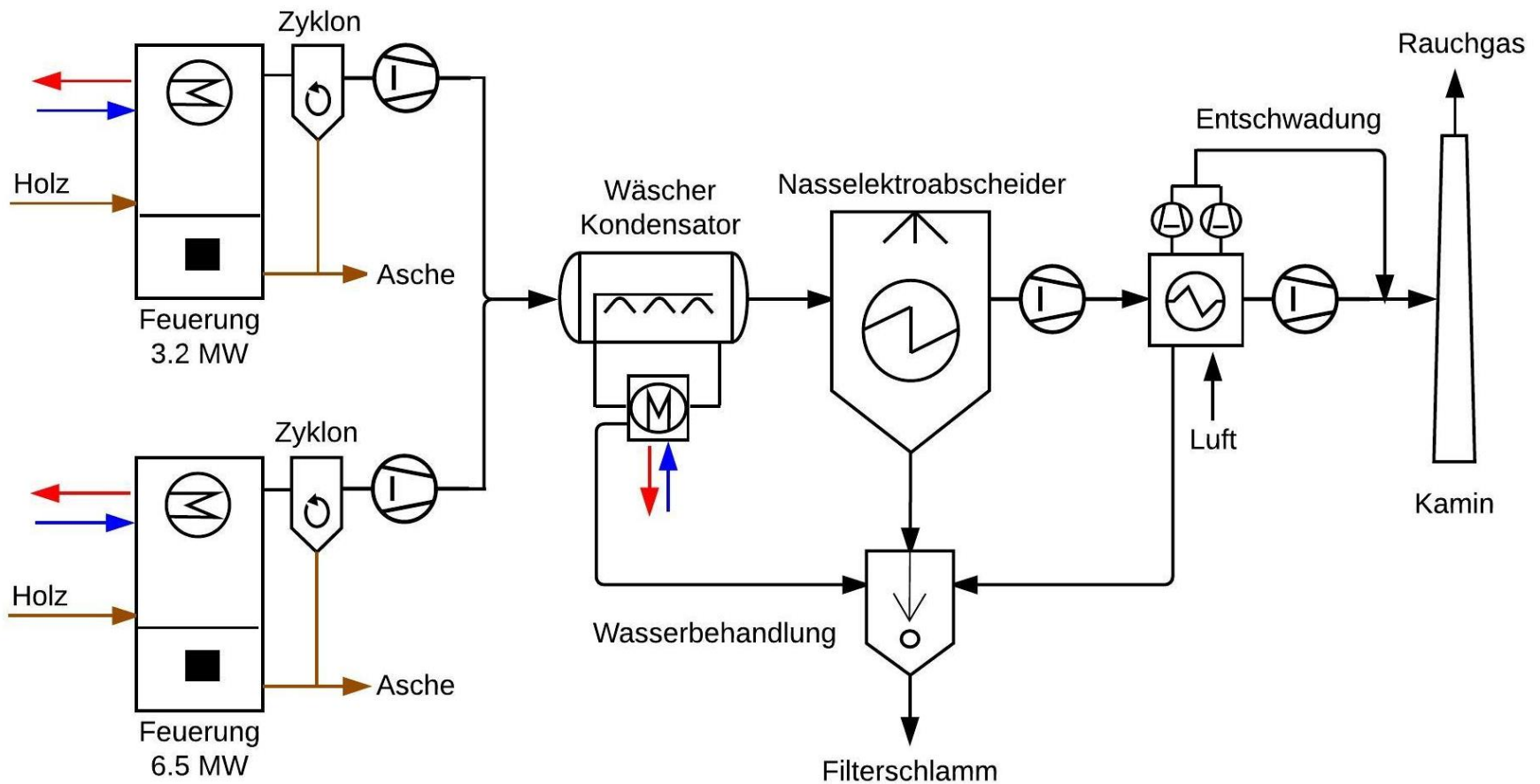
ORC: 1.5 MW_{el}

Biogas fermentation plant

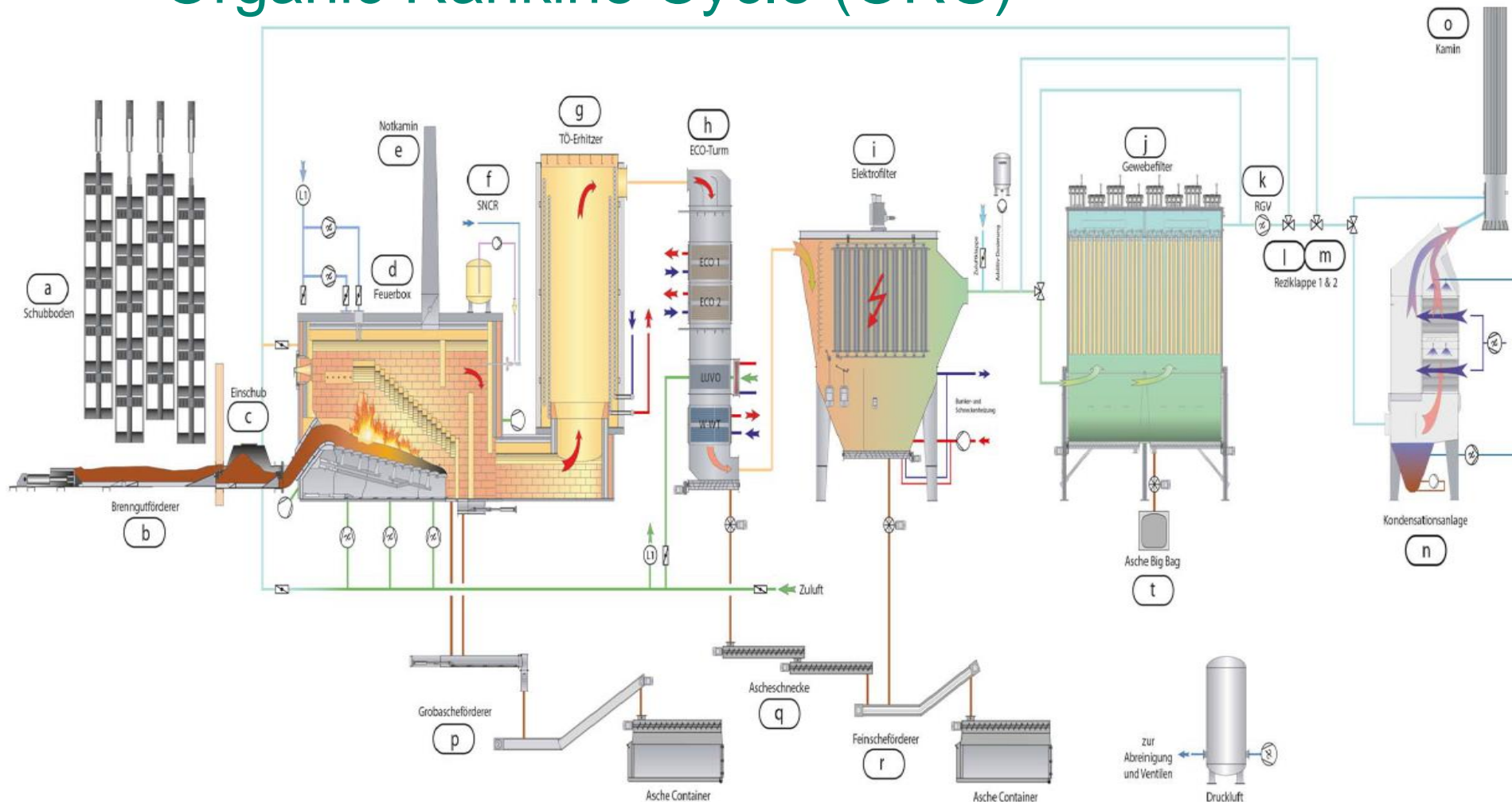


anaerobic fermentation, 26'500 t/a, 526 kW_{el} CHP

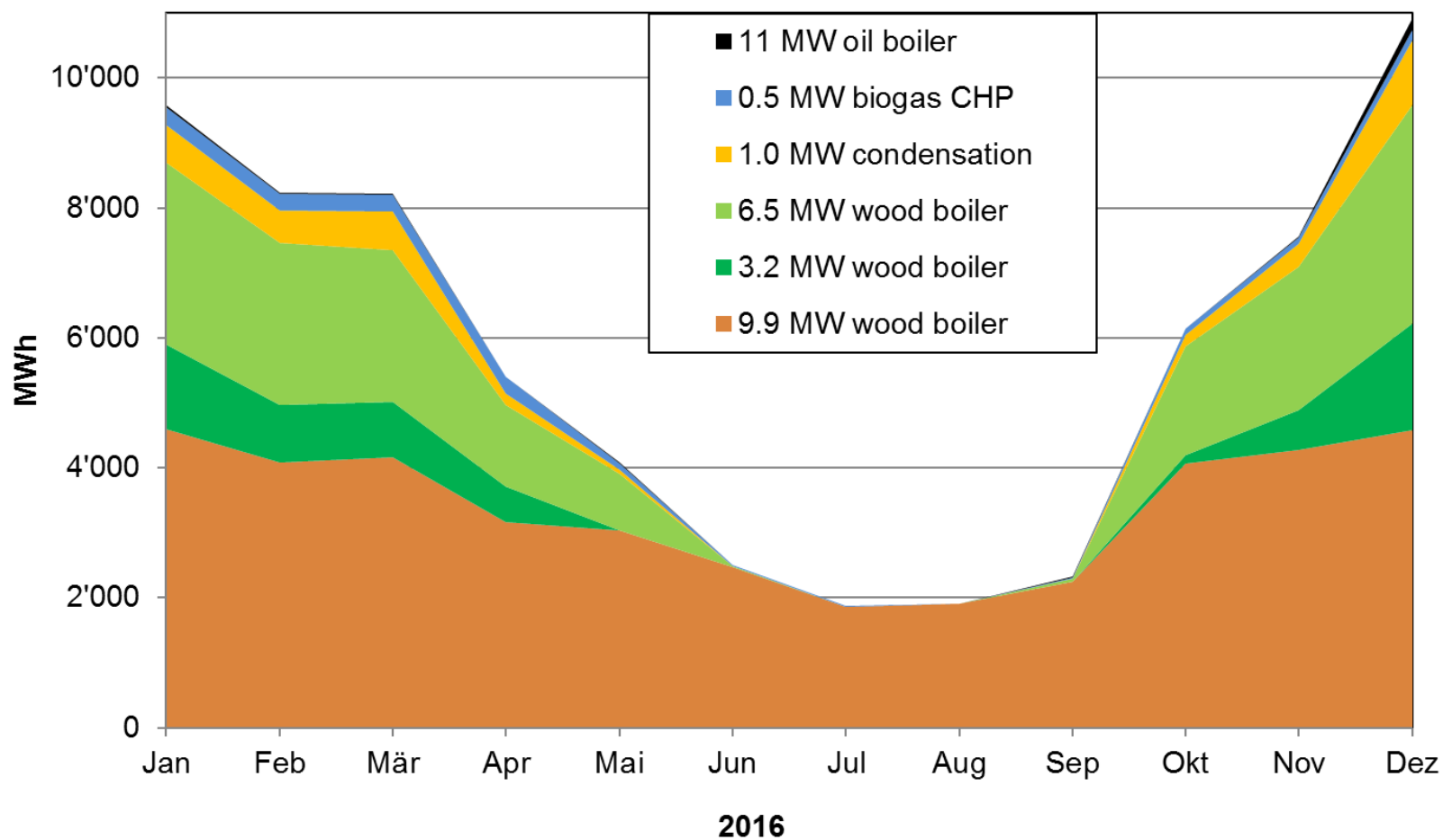
Flue gas treatment



Organic Rankine Cycle (ORC)



Heat demand 2016



Resources

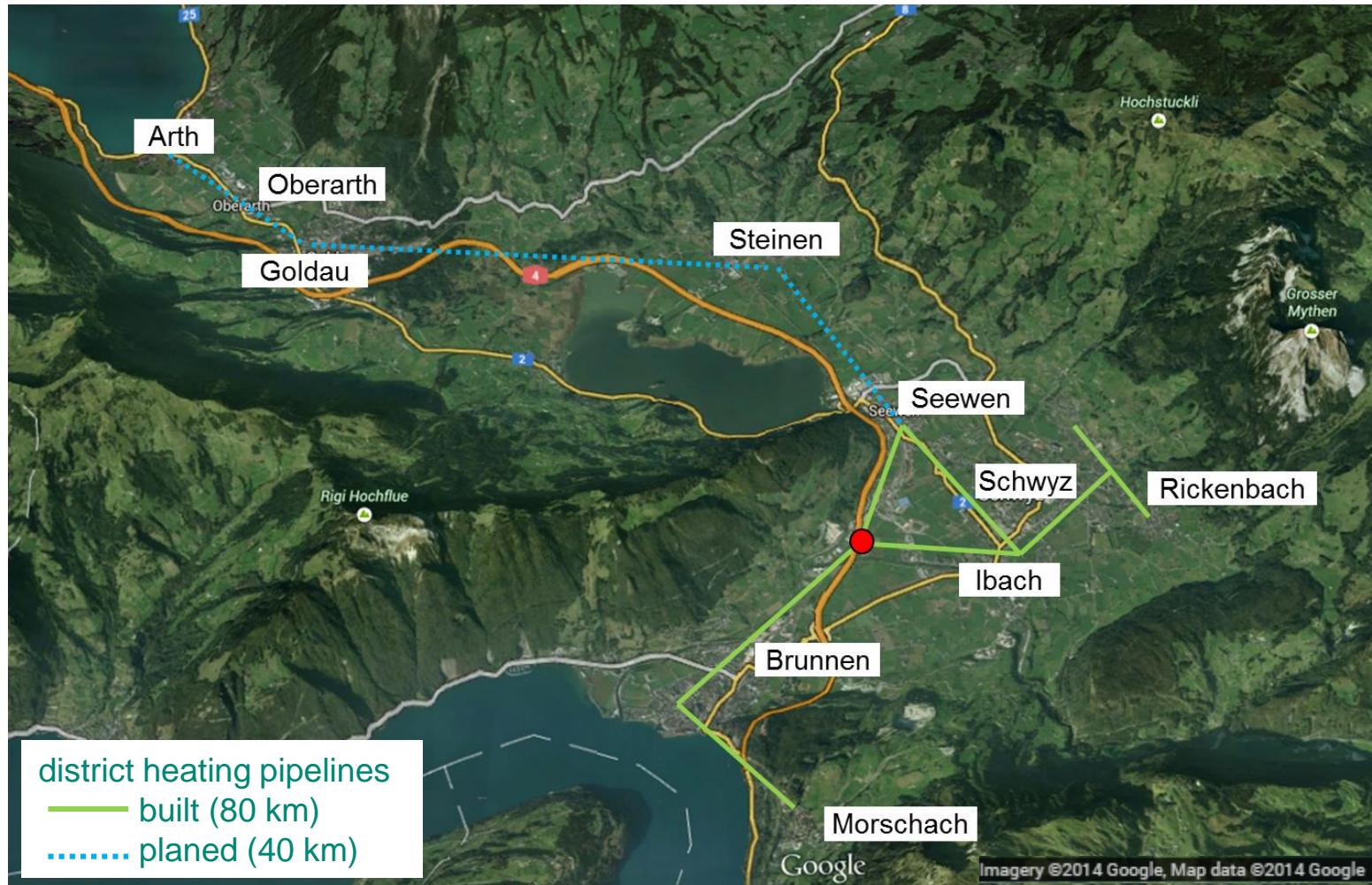


2016	weight
	[t]
wood chips (wet)	3'400
urban waste wood (dry)	19'800
Total wood	23'200
solid digestate	2'700
wet digestate	24'100
total digestate	26'800

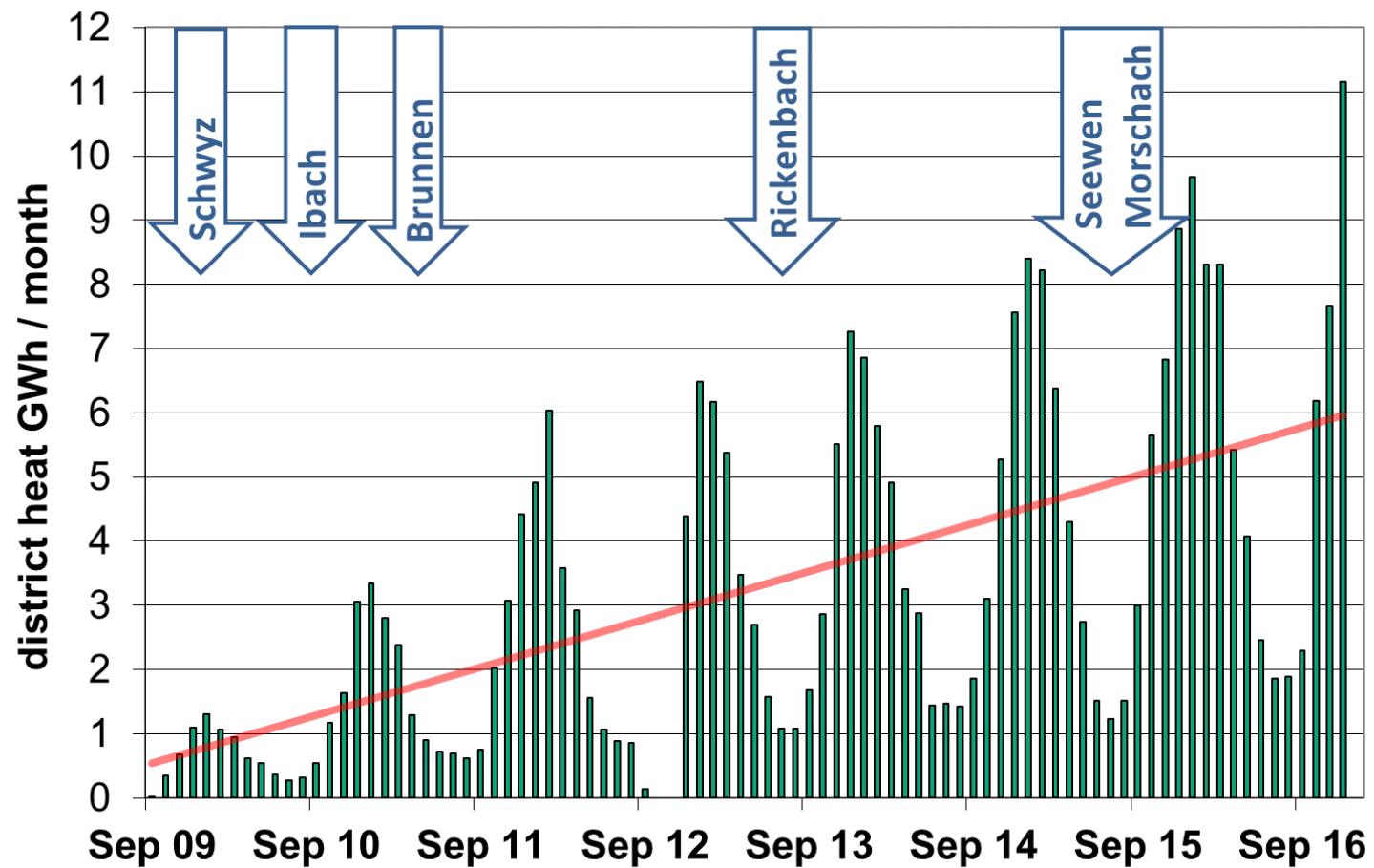
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26 MW district heating



Success story



Key clients

Spital Schwyz
850 kW



Kollegium
Schwyz
700 kW



Swiss Holiday
Park,
Morschach
1700 kW



Kloster
Ingenbohl
1100 kW



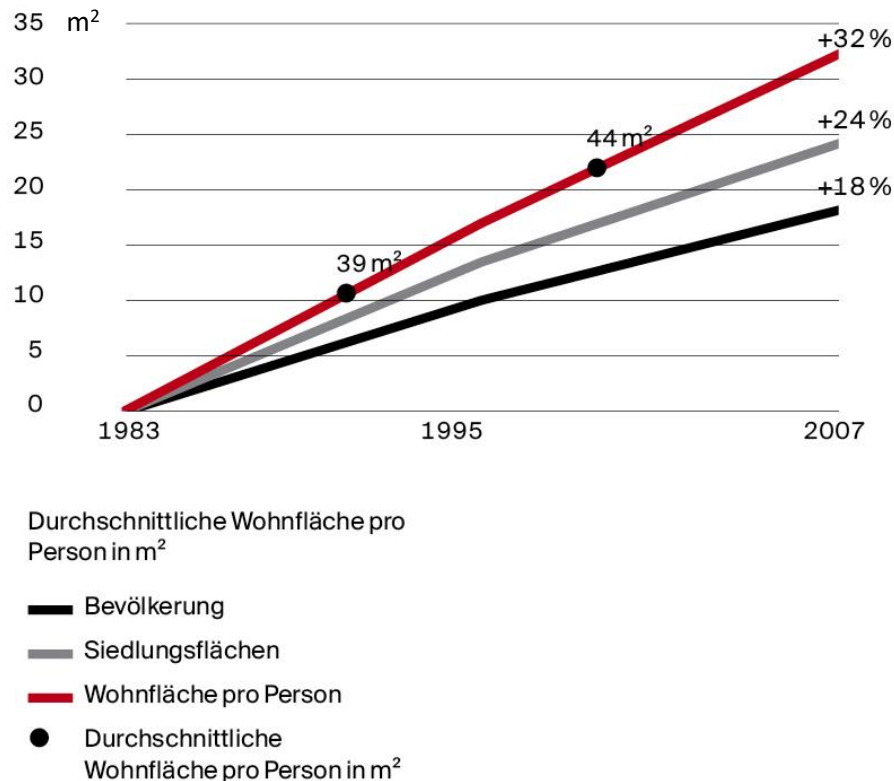
supply 95°C

return 50°C

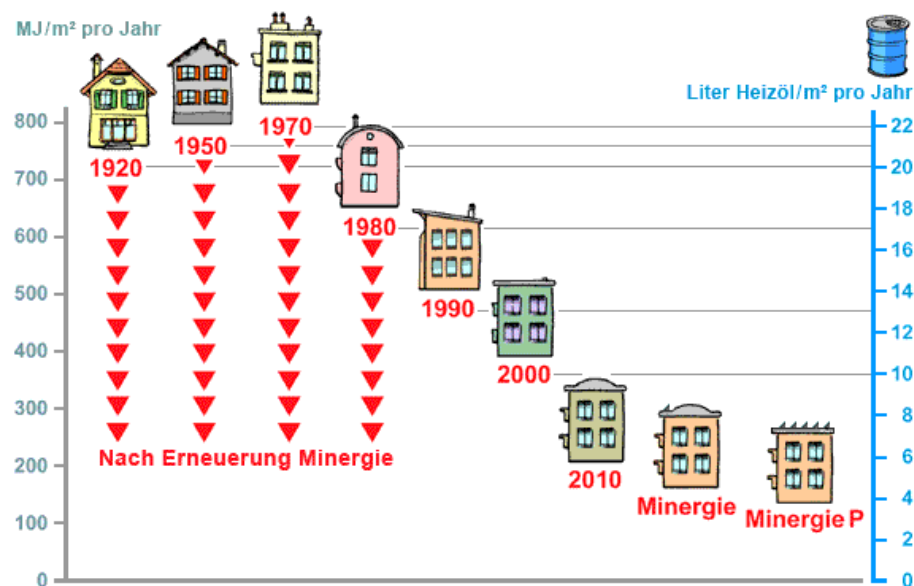
leak monitoring
pipe isolation cat III

Future heat demand?

Increasing living area m² per person!



Retrofitting rate of 0.8 % per year in Switzerland!



www.energie-umwelt.ch/haus/renovation-und-heizung/gebaeudeplanung/waermebedarf-und-geak

Increasing room temperature, living room > 23°C

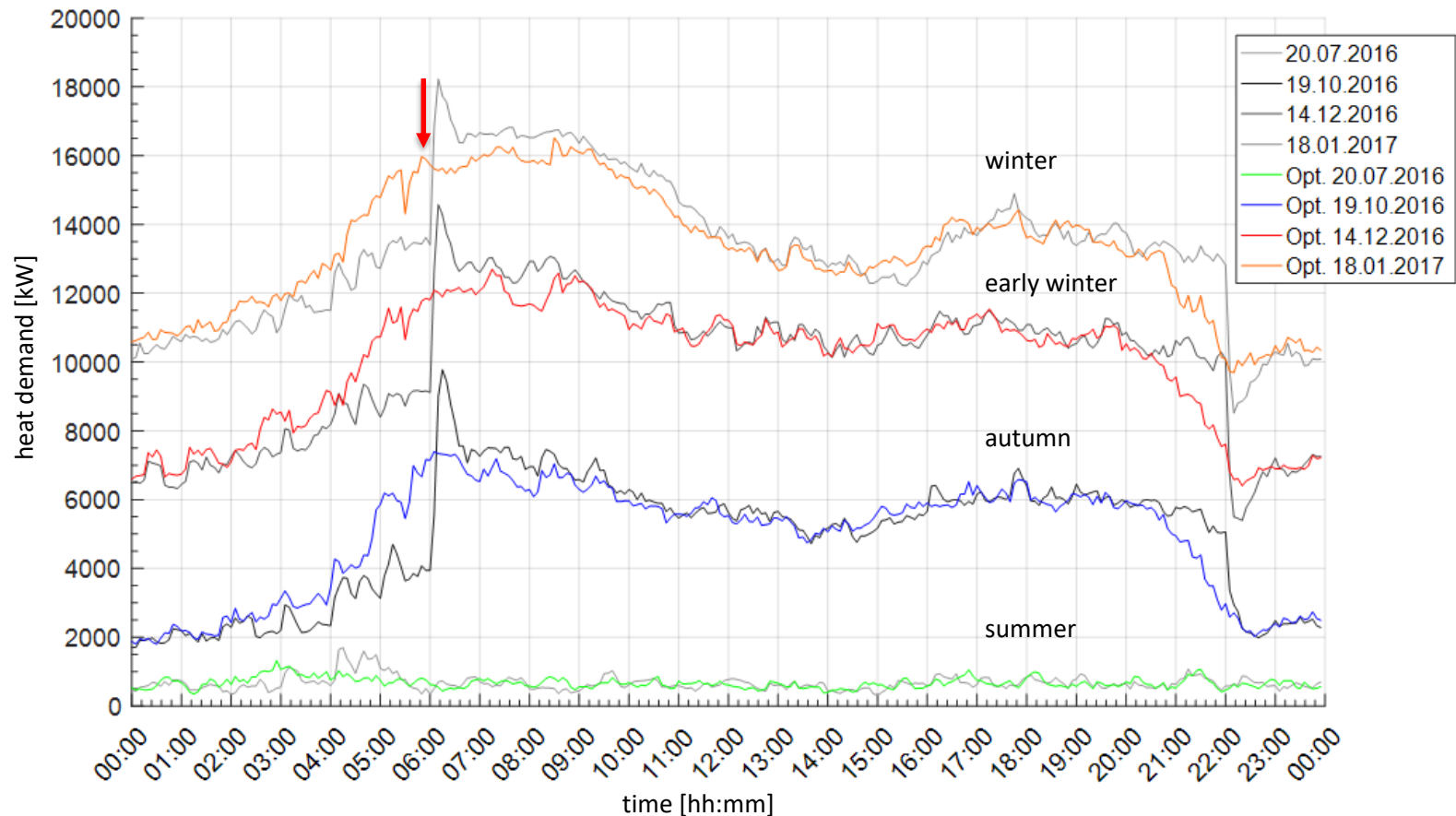
Renewable energy production 2016

- Heat production: 80 GWh (8000 average households)
- Power production: 13 GWh (3250 average households)



Optimisation of heat consumers

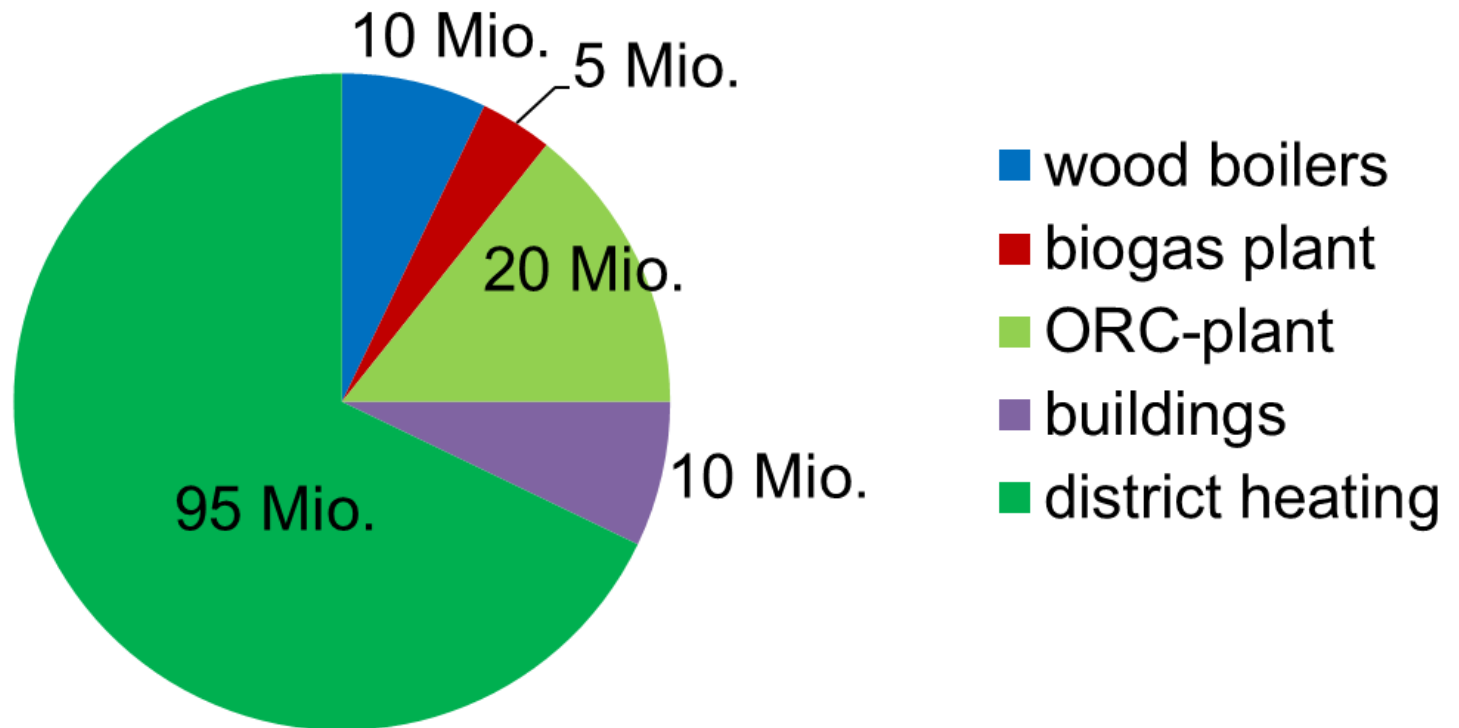
Simulation: peak reduction by time shifting of consumers and interruption of floor heatings



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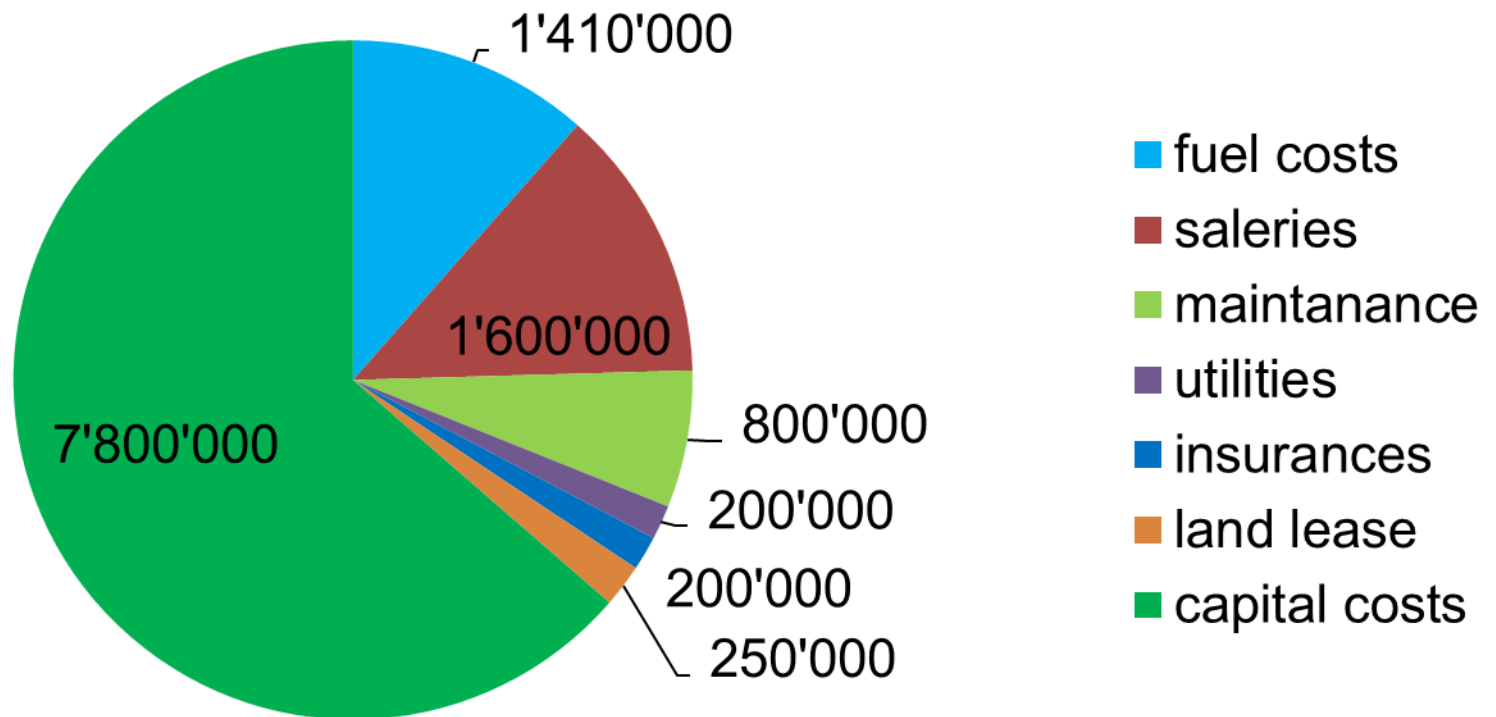
Investments [CHF]



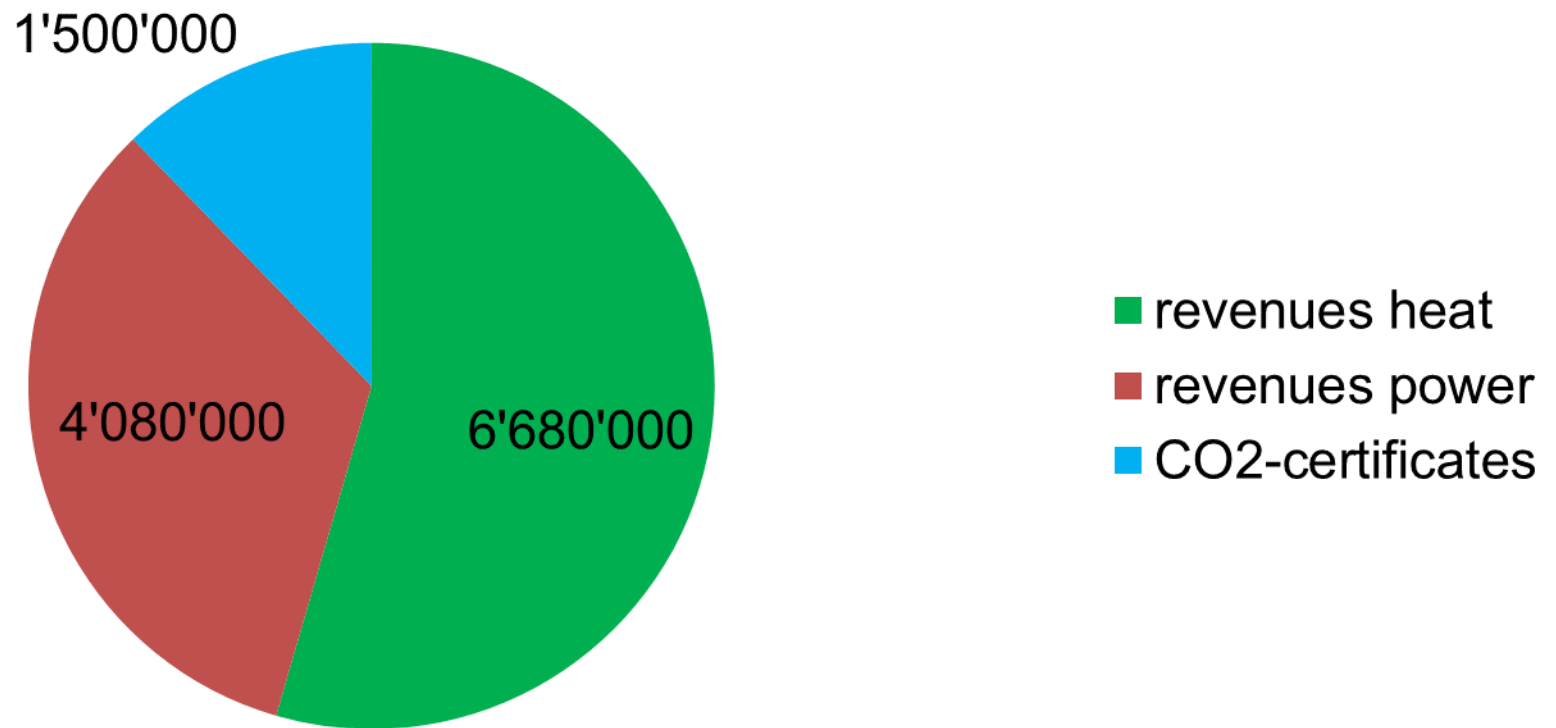
Total: CHF >140 Mio.

1 EUR = 1.15 CHF

Operating costs [CHF]



Revenues [CHF]

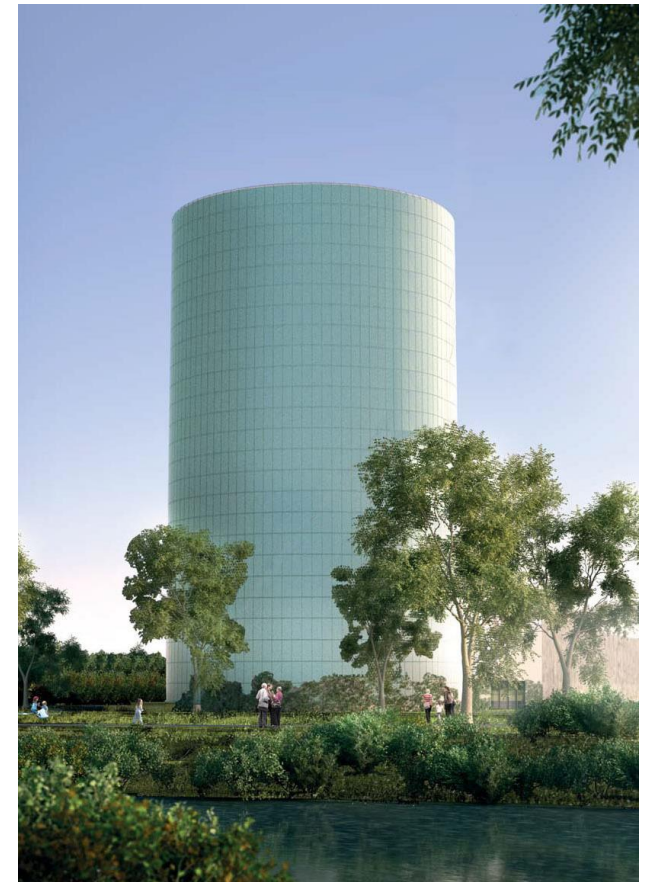


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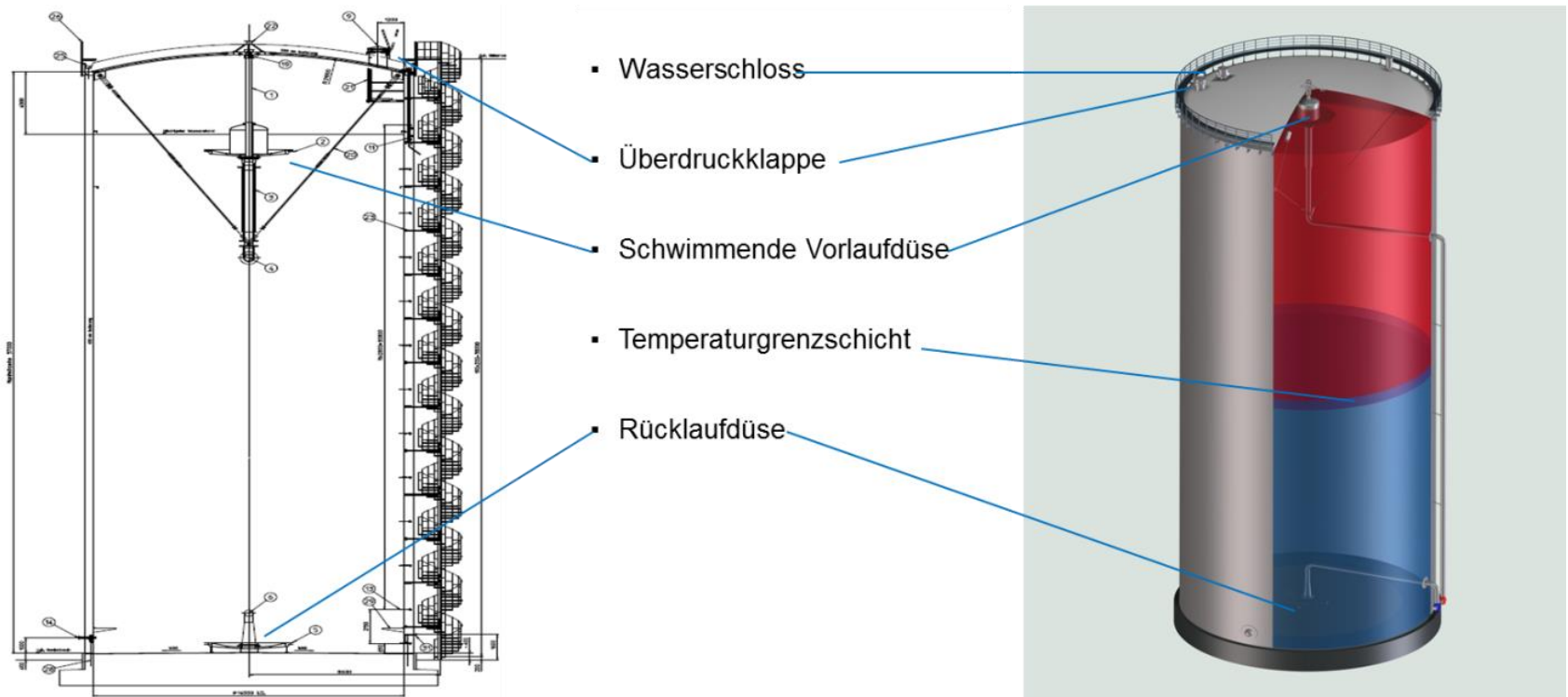
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Heat accumulator as key technology

- Security of supply
- Decoupling of heat and power production from heat consumption
- Liberalisation of power market
- Efficiency increase (emissions, pressure maintenance)
- competitive pricing position



Sensible heat accumulator technology



height: 50 m, diameter: 30 m, volume: 28'000 m³, isolation: 0.5 m, storage medium: water, capacity: 1300 MWh (95/55 °C)

Visualisation



Project update – permission process

- ✓ 2012 first project attempt → rejected 2013
- ✓ 2013 second project attempt
- ✓ 2014/2015 round table discussions with stakeholders
- ✓ 2016 start of permission process → objection
- ✓ 2017 objection solved
 - 2017 13th Dec: community assembly
 - 2018 4th March: voting for new building law
 - 2018 summer: land development plan → permission in autumn
 - 2018 winter: building application
 - 2019 spring: building permission
 - 2019 start construction
 - 2020 commissioning

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AGRO Energie Rigi – 20 MW_{th}



Wood power plant next to a saw mill

Synergies in regards of:

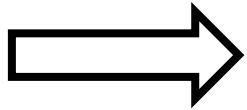
- Supply / demand of wood and bark
- Transportation of wood chips / urban waste wood
- Heat production / consumption
- Saw dust disposal / wood pellets production



Input

Wood resources

- 51 % saw mill residues
- 41 % urban waste wood
- 8 % wood chips



Saw dust

- 100 % Restholz

Power plant

Wood fired power station

- 20 MW_{th} boiler
- 4.5 MW steam turbine
- flue gas cleaning
- Heat accumulator



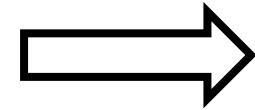
Wood pellet plant

- Conveyor drier

Output

Energy

- 32 GWh power
= 8000 households
- 64 GWh heat
= 6000 households



Wood pellets

- 40'000 m³/a

Environment-friendly

Saving:

12.5 Mio. liter oil

33'000 t CO₂

Heating oil

45.8 UBP

Die Umweltbelastung verschiedener
Heizsysteme im Vergleich

Umweltbelastungspunkte (UBP/MJ Wärme)

Quelle: ESU-services Ltd. Zürich

Natural gas

34.0 UBP

Heat pump

25.5 UBP

AGRO Energie Rigi AG

8.1 UBP



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AGRO Energie Ausserschwyz – 12 MW_{th}



Input: 12 MW_{th} (wood chips, urban waste wood)

Output: 8 MW_{th}, 1.8 MW_{el}

Power: 3200 households

Heat: 6400 households

Savings: 8 Mio. liter oil, 21'200 t CO₂

District heating Ausserschwyz



- Inhabitants: 80'000
- Households: 25'000

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Non-technical barriers

- Financing
- Building permit
- Competition
- Regulation / subsidies
- Individual energy concepts



**Thank you for
your attention!**