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

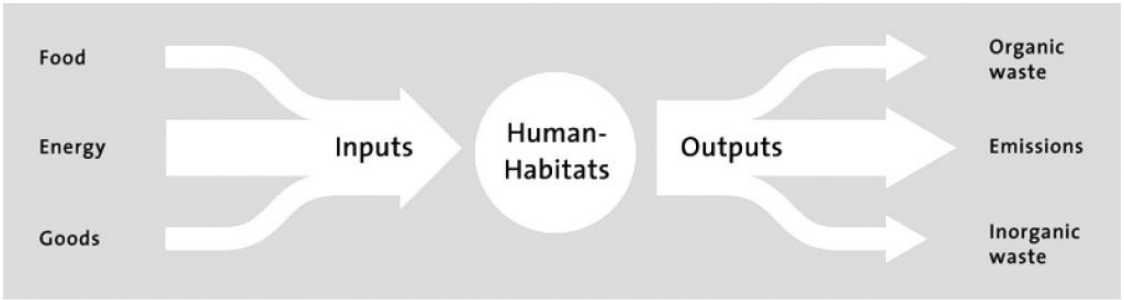
AGRO ENERGIE SCHWYZ

Programm

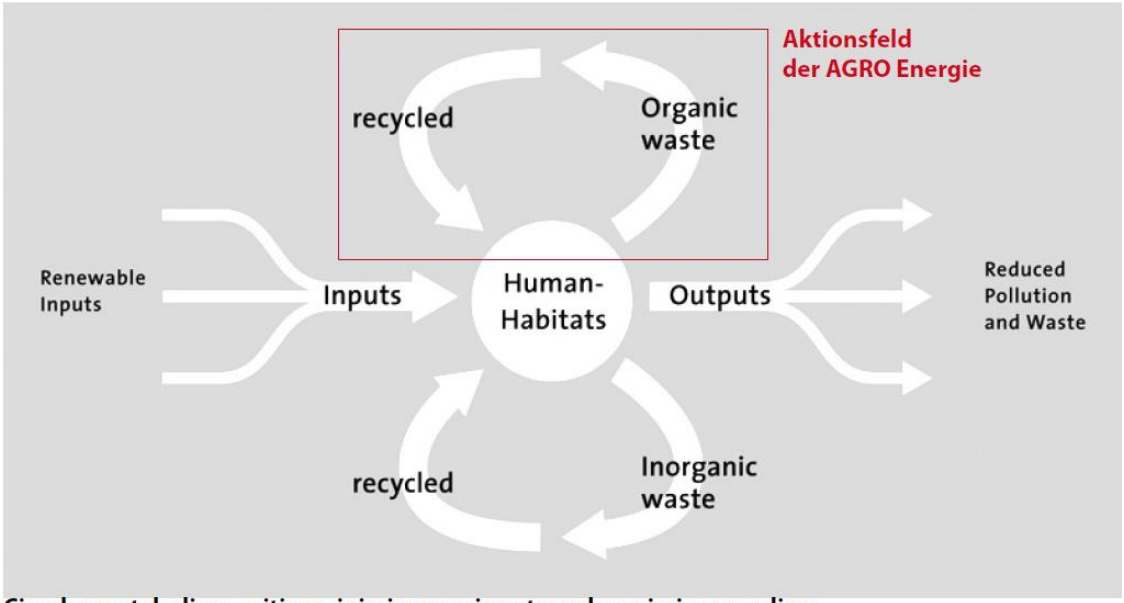
1. **Motivation**
2. AGRO Energie Schwyz AG
3. Biomass power plant
4. District heating
5. Economics
6. Heat accumulator
7. Agro Energie Rigi
8. Agro Energie Ausserschwyz
9. Non-technical barriers

Swiss Farm – Manure Production

Sustainability – think gobal, act local

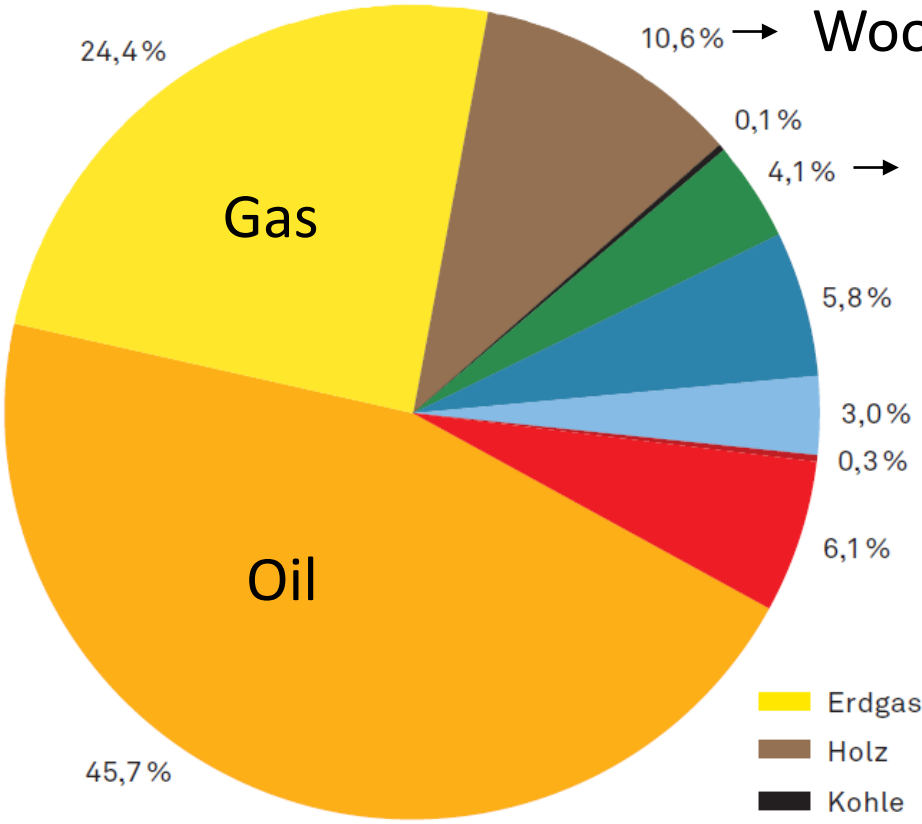


Linear metabolism – cities consume and pollute at a high rate



Circular metabolism – cities minimise new inputs and maximise recycling
Richard Rogers, Cities for a Small Planet, 1996

Swiss heat production



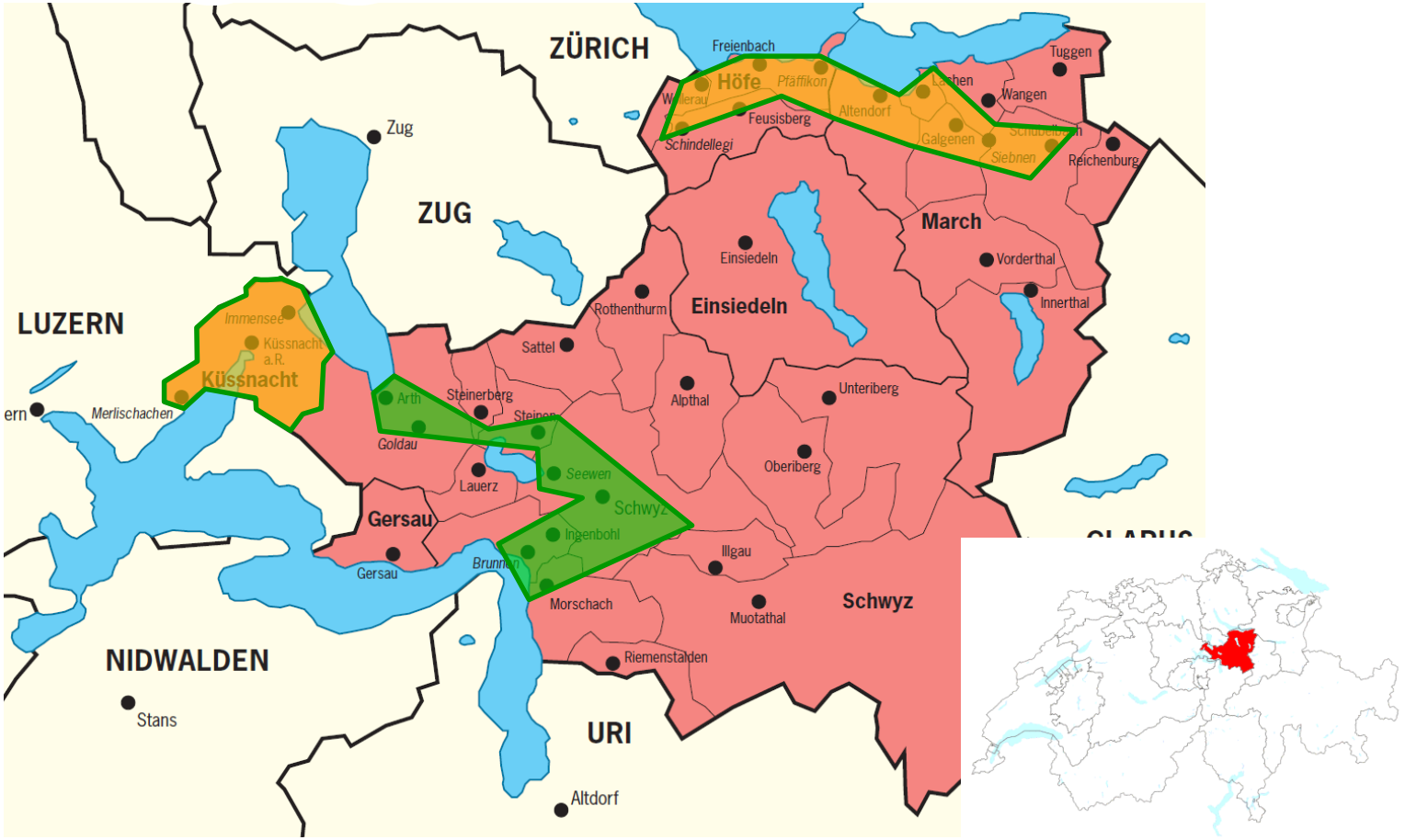
→ Wood – new record!

→ District heating w/o wood

Erdgas
Fernwärme
Solar
Holz
El. Widerstandsheizung
Umgebungswärme
Kohle
El. Wärmepumpen
Heizöl

Quelle: Prognos 2016

Agro Energie DH in the canton of Schwyz



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

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 independece, 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

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

Biomass Power Plant

20 MW_{th} wood-fired boilers

boiler 1: 3.2 MW_{th}

boiler 2: 6.4 MW_{th}

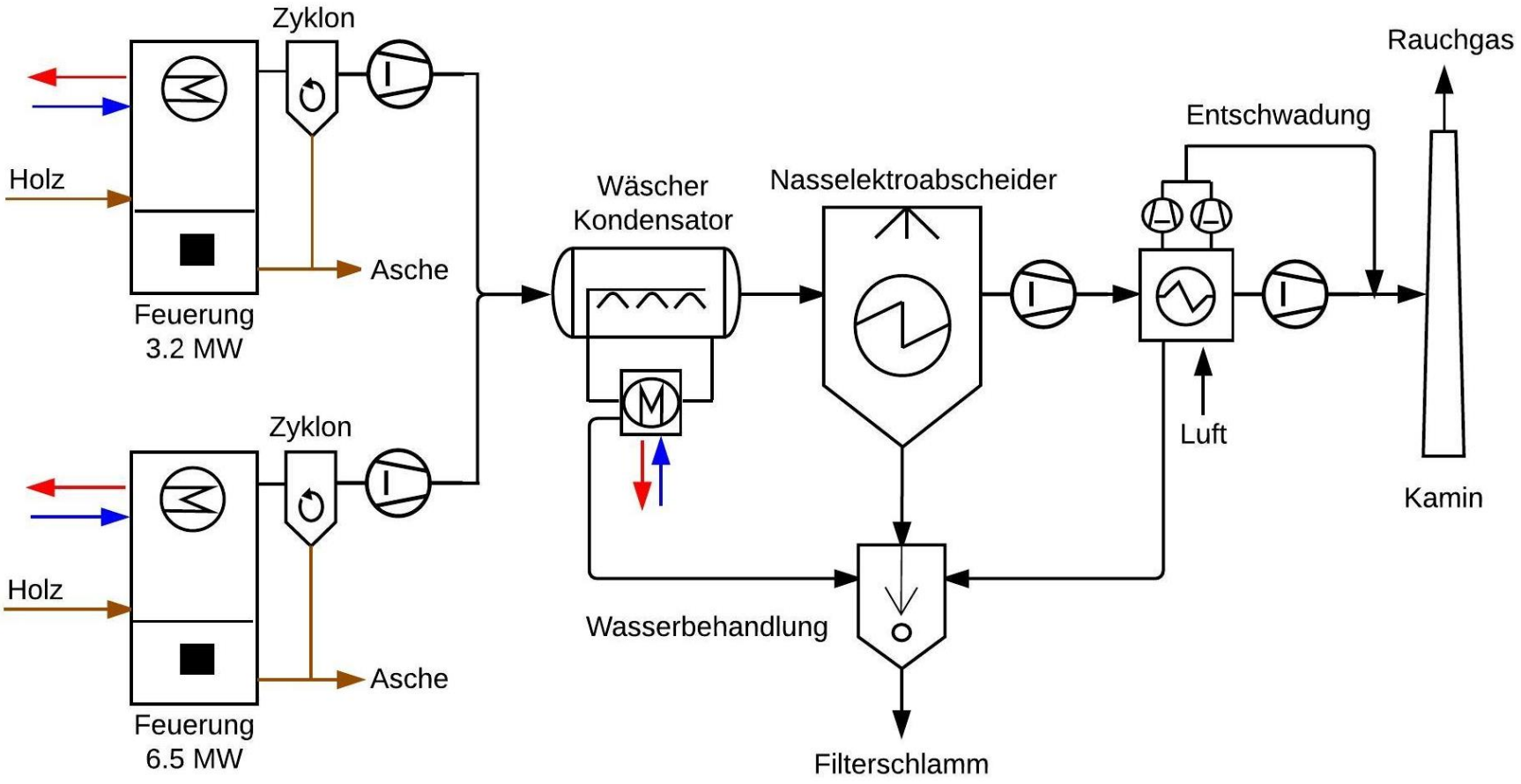
boiler 3: 9.9 MW_{th}

ORC: 1.5 MW_{el}

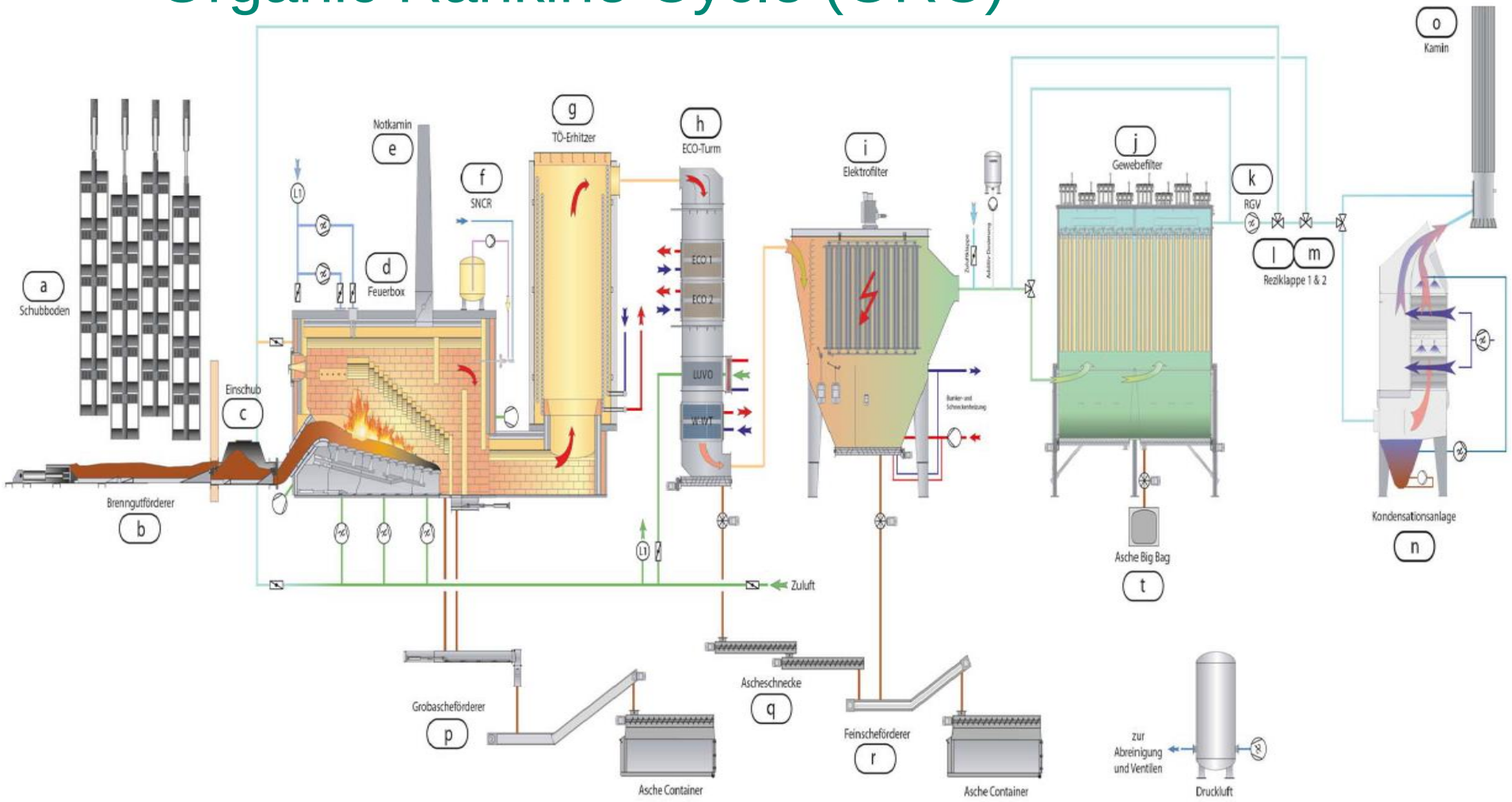
Biogas fermentation plant

anaerobic fermentation, 26‘500 t/a, 526 kW_{el} CHP

Flue gas treatment

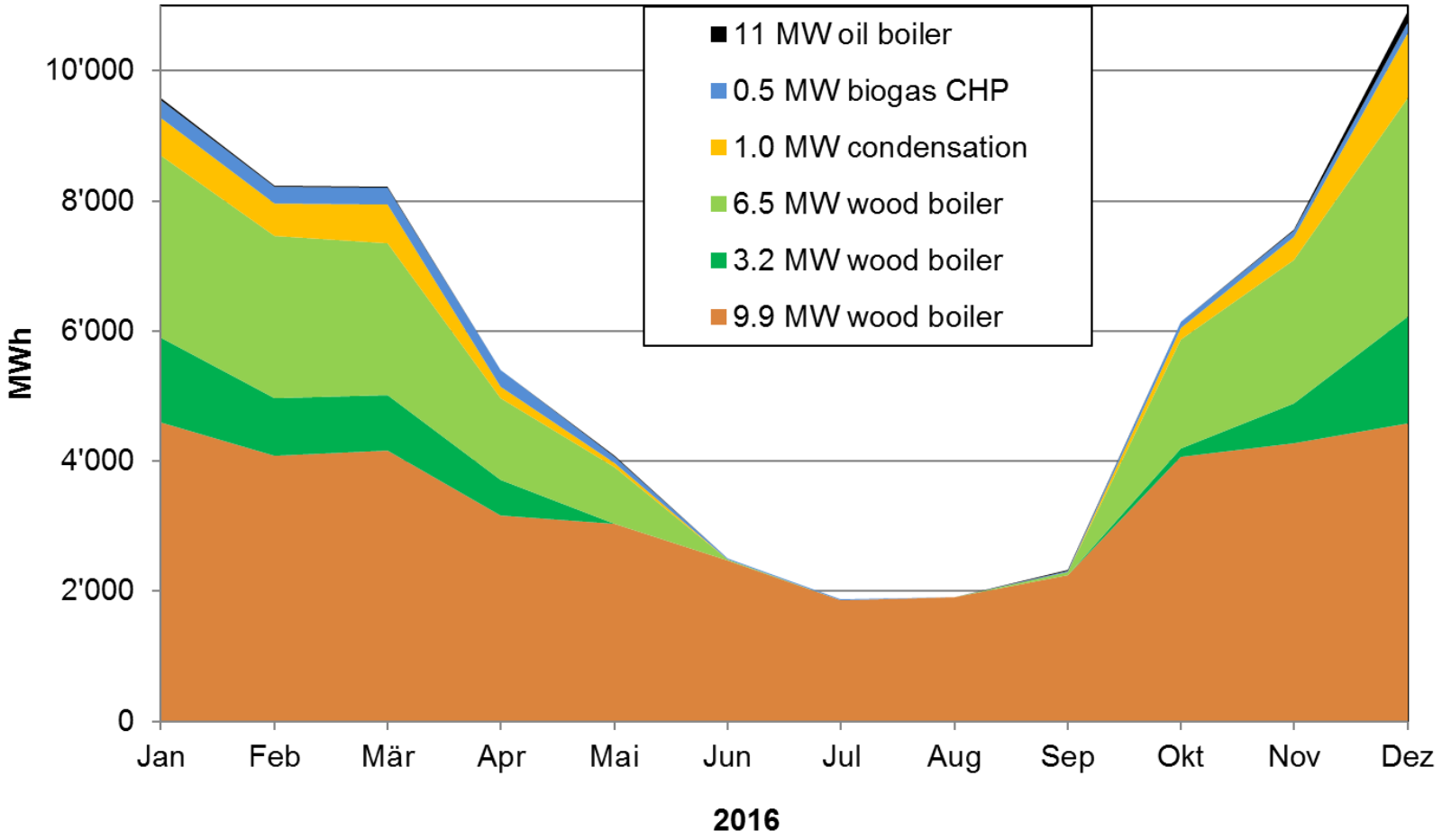


Organic Rankine Cycle (ORC)



VAS Energy Systems GmbH, www.vas.co.at

Heat demand 2016



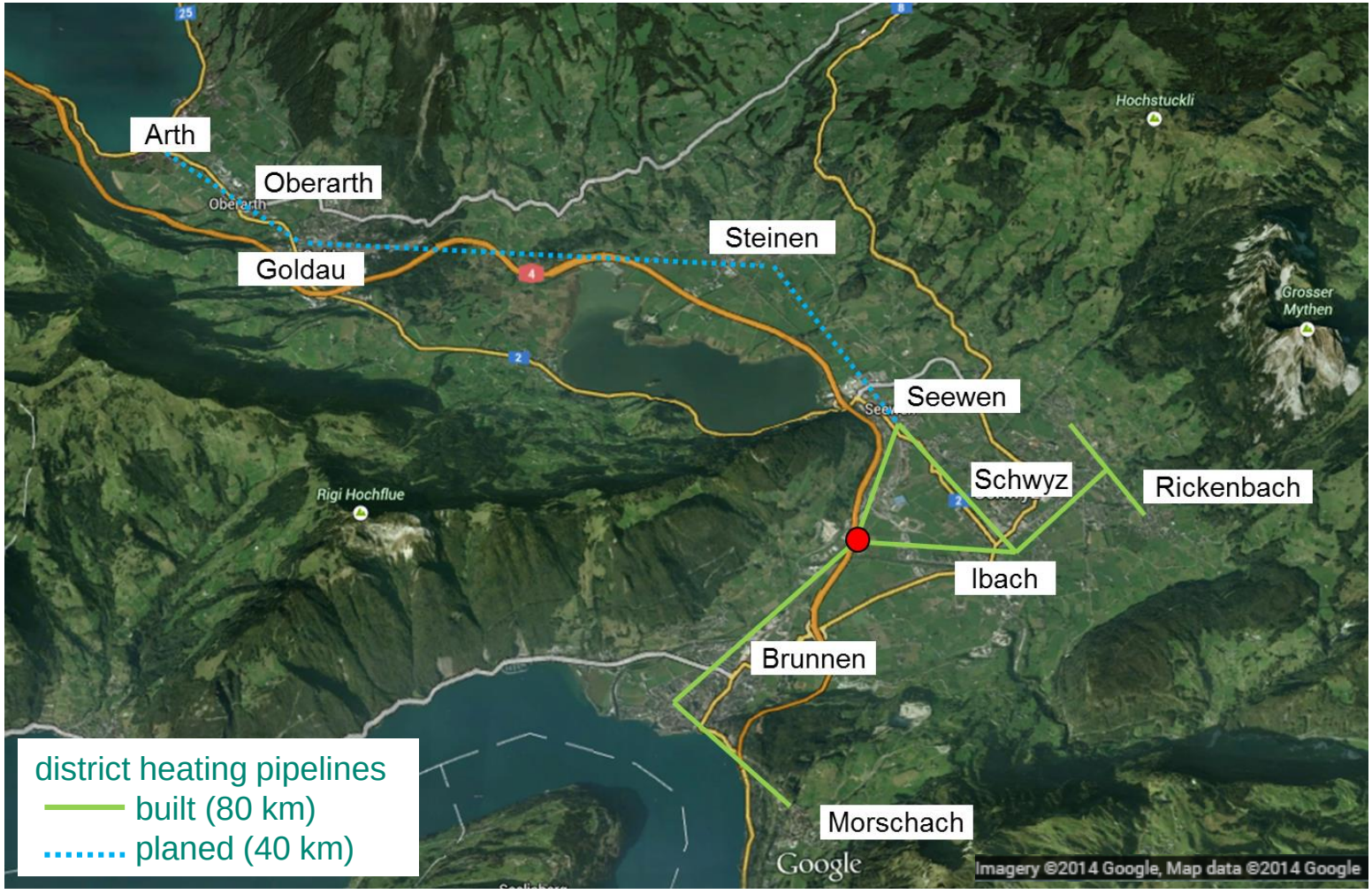
Resources

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**

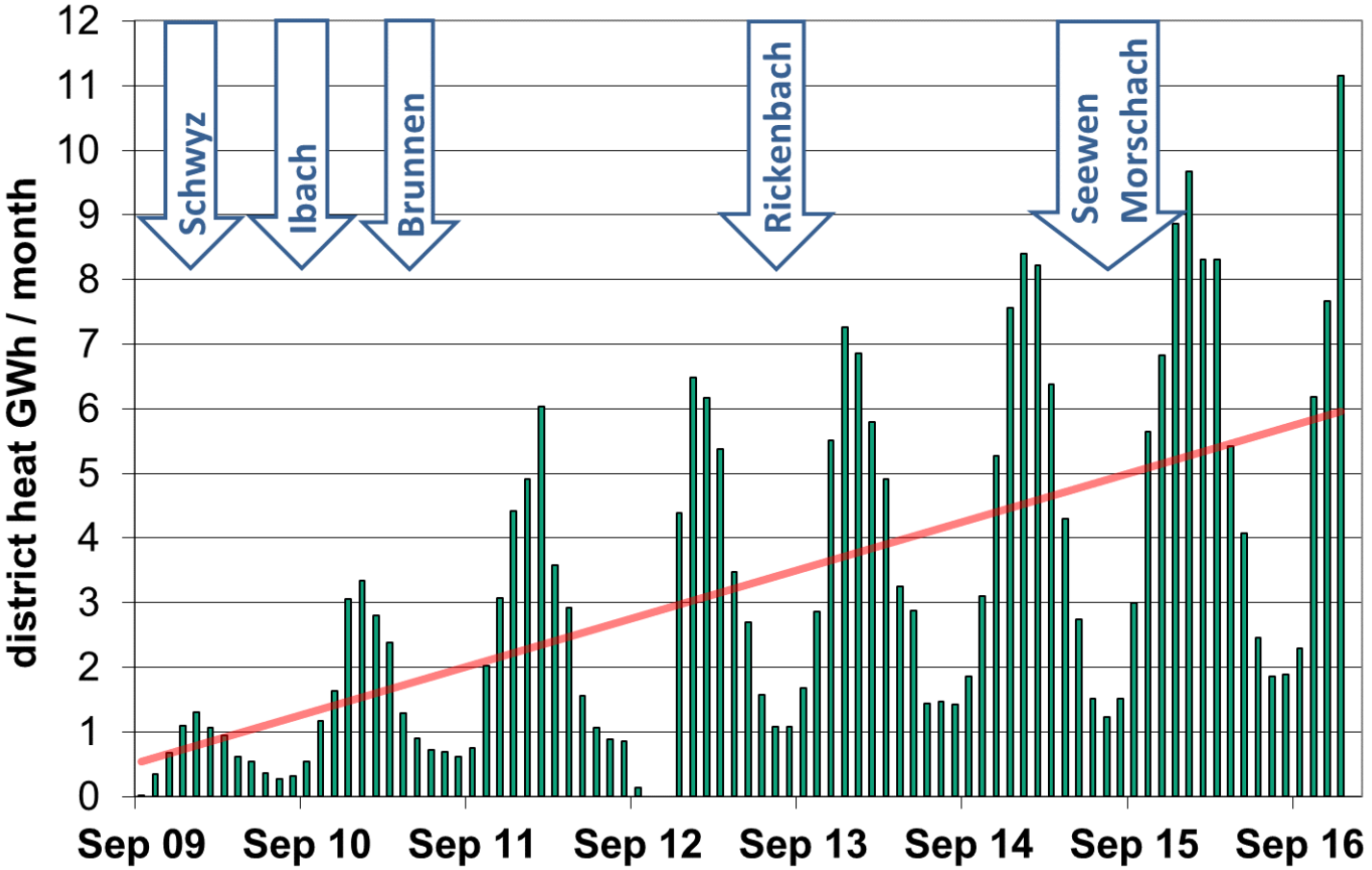
Programm

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

26 MW district heating



Success story



Key clients

Spital Schwyz
850 kW

Swiss Holiday Park, Morschach
1700 kW

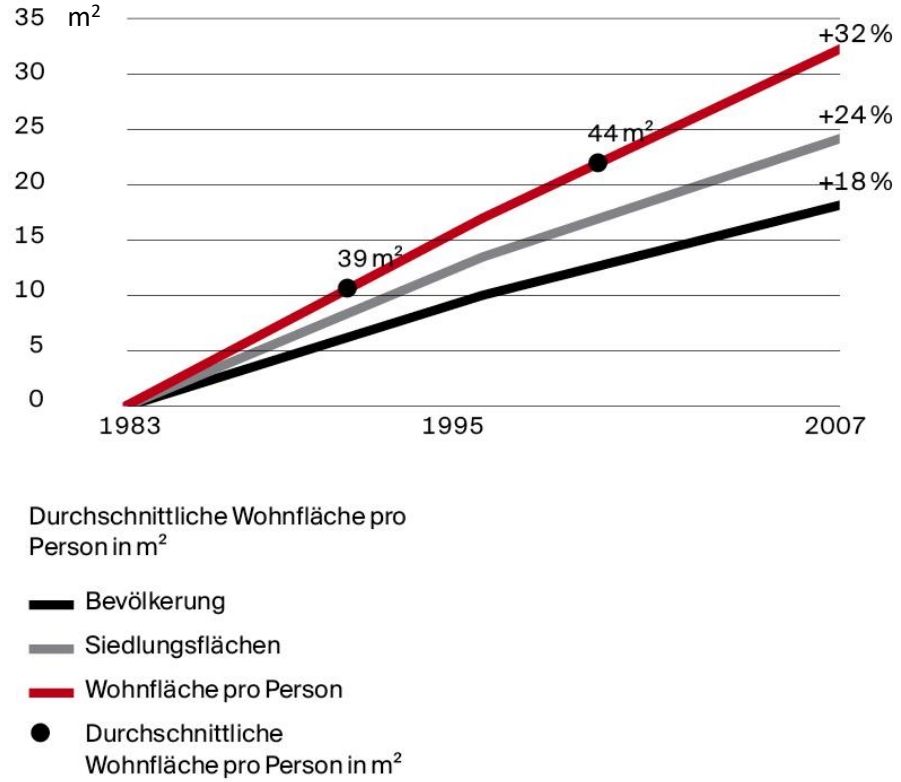
Kollegium Schwyz
700 kW

Kloster Ingenbohl
1100 kW

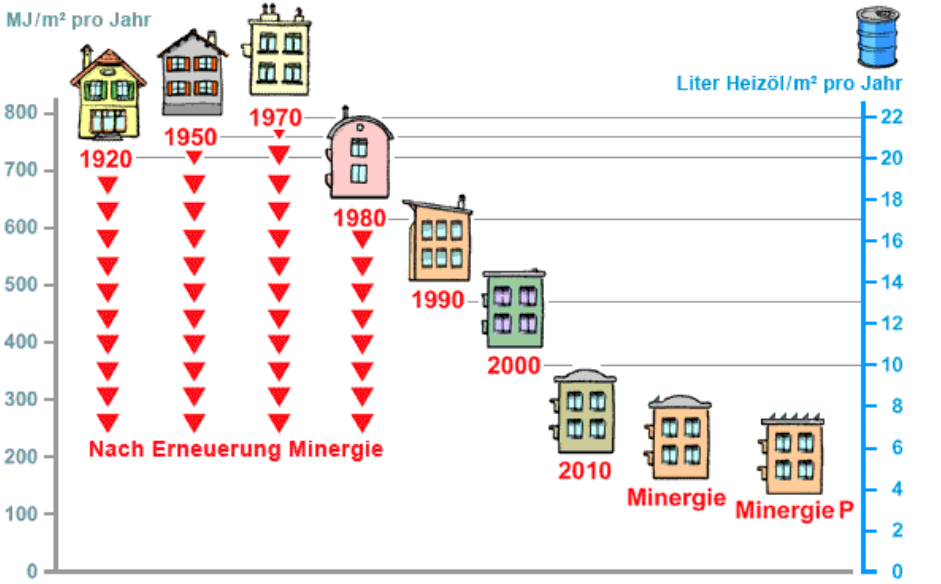

supply 95°C
return 50°C
leak monitoring
pipe isolation cat III

Future heat damand?

Increasing living area m^2 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

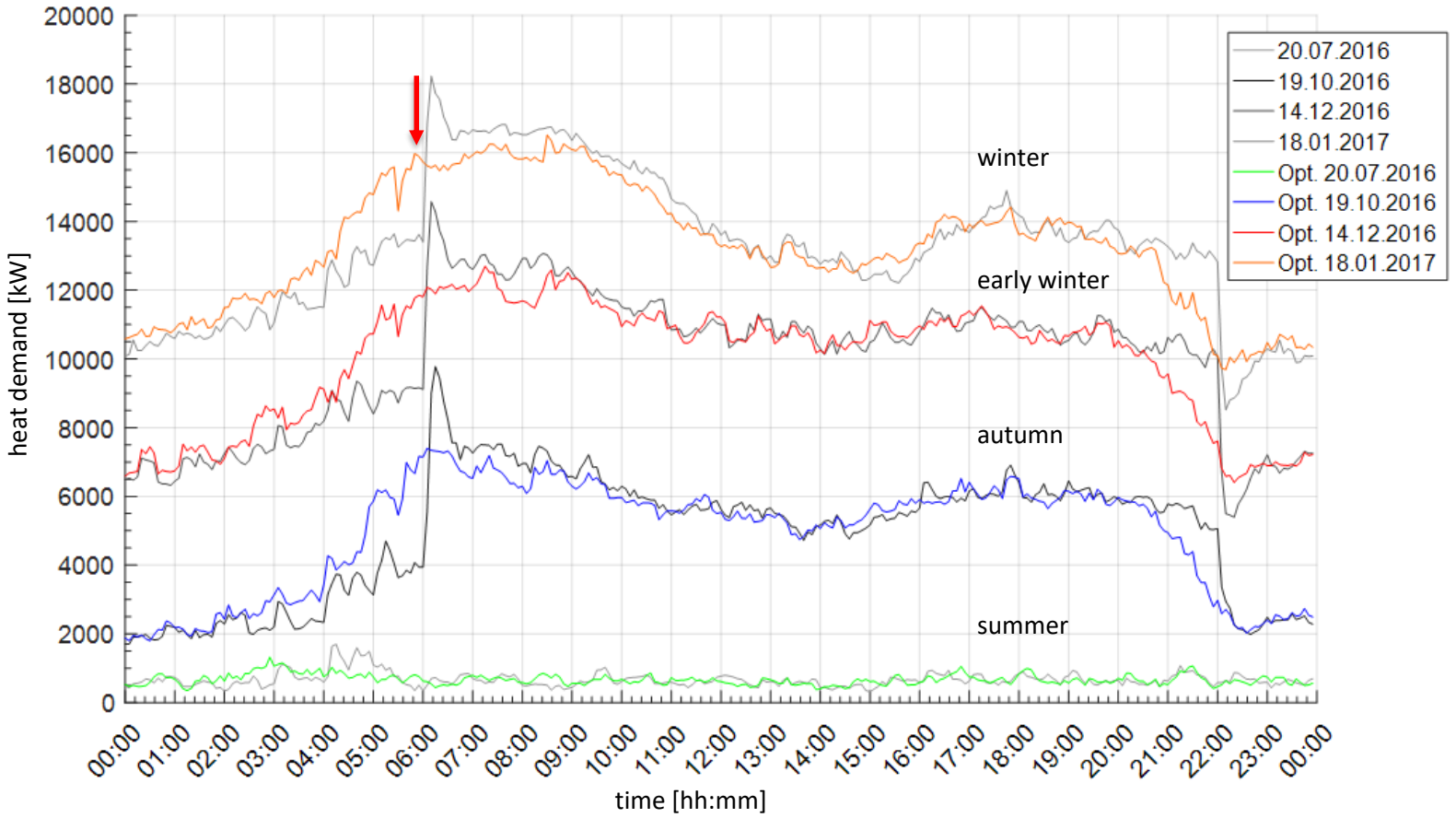
www.greenpeace.org/switzerland/de/News_Stories/Thoreau/Wohnen/

Renewable energy production 2016

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

Optimisation of heat consumers

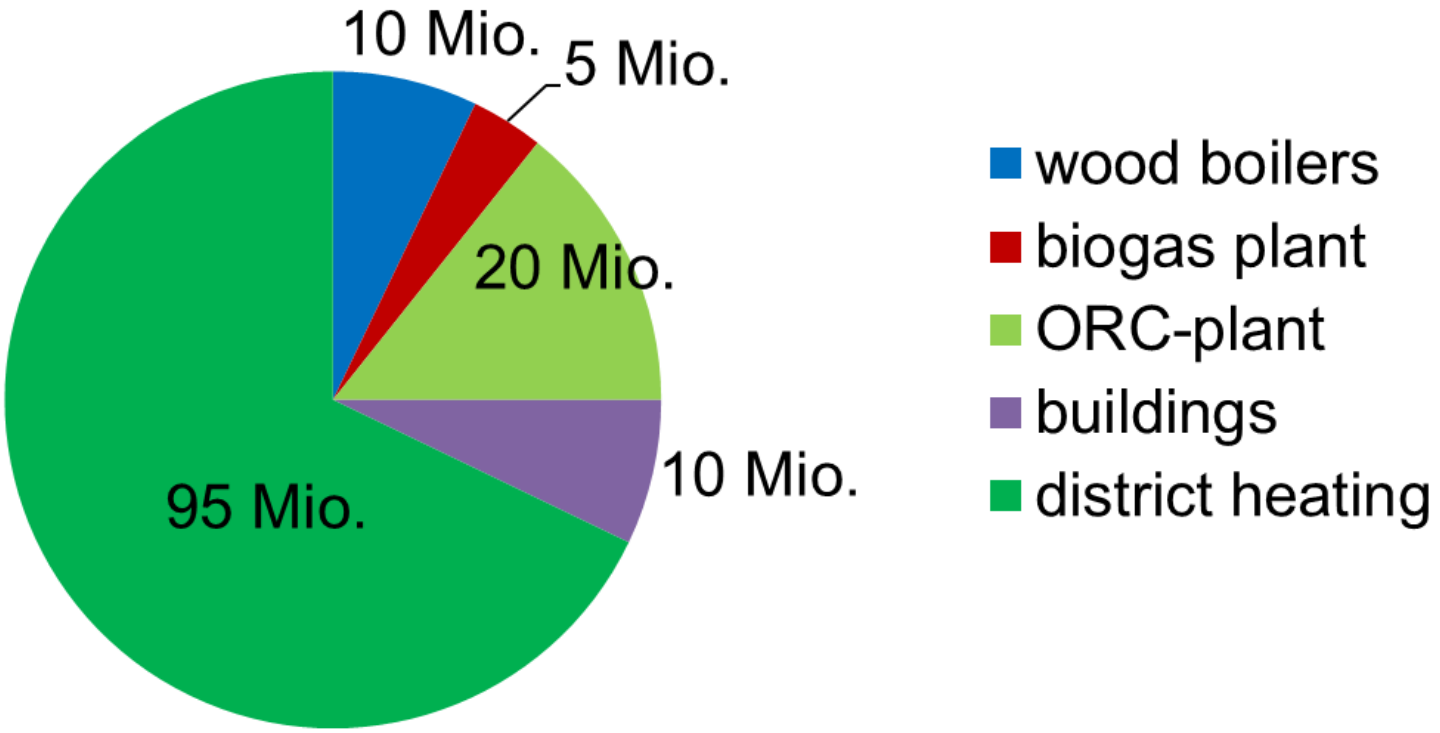
Simulation: peak reduction by time shifting of consumers and interruption of floor heatings



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

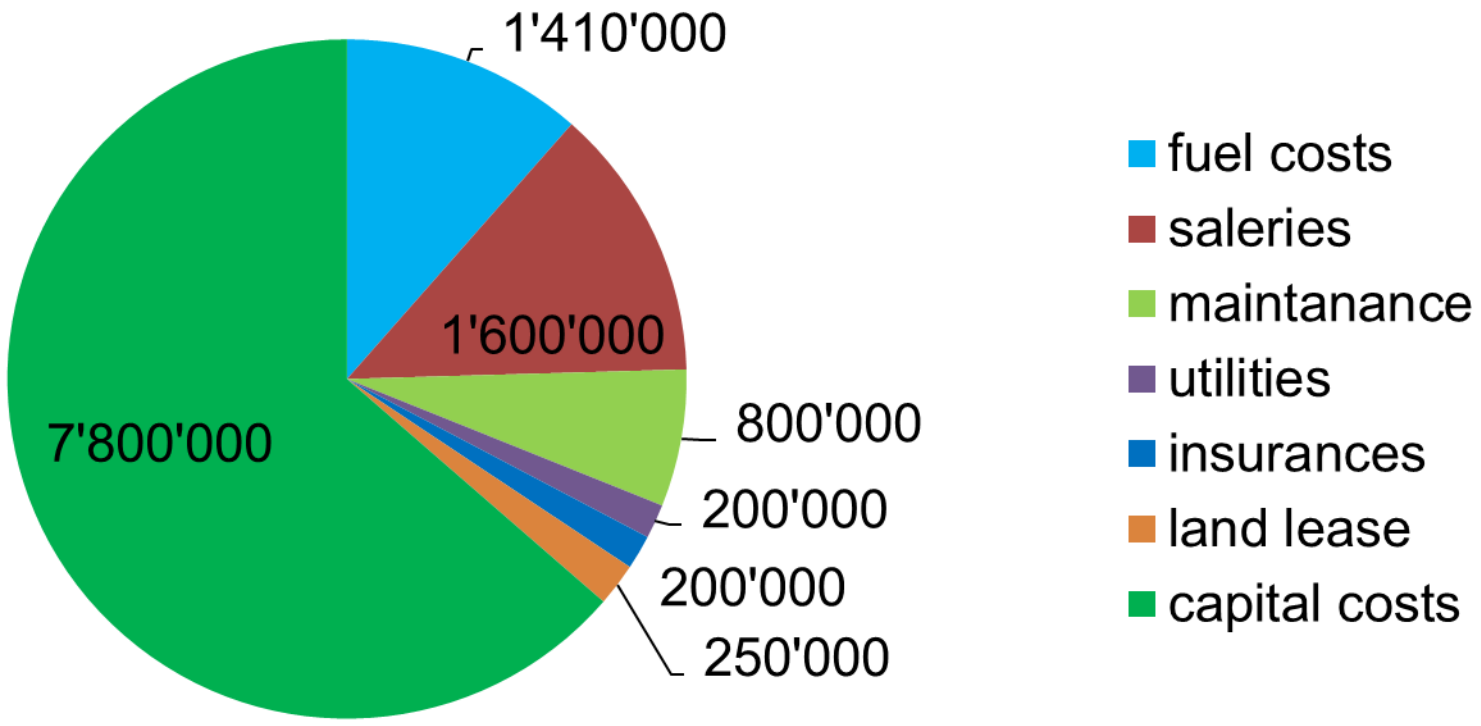
Investments [CHF]



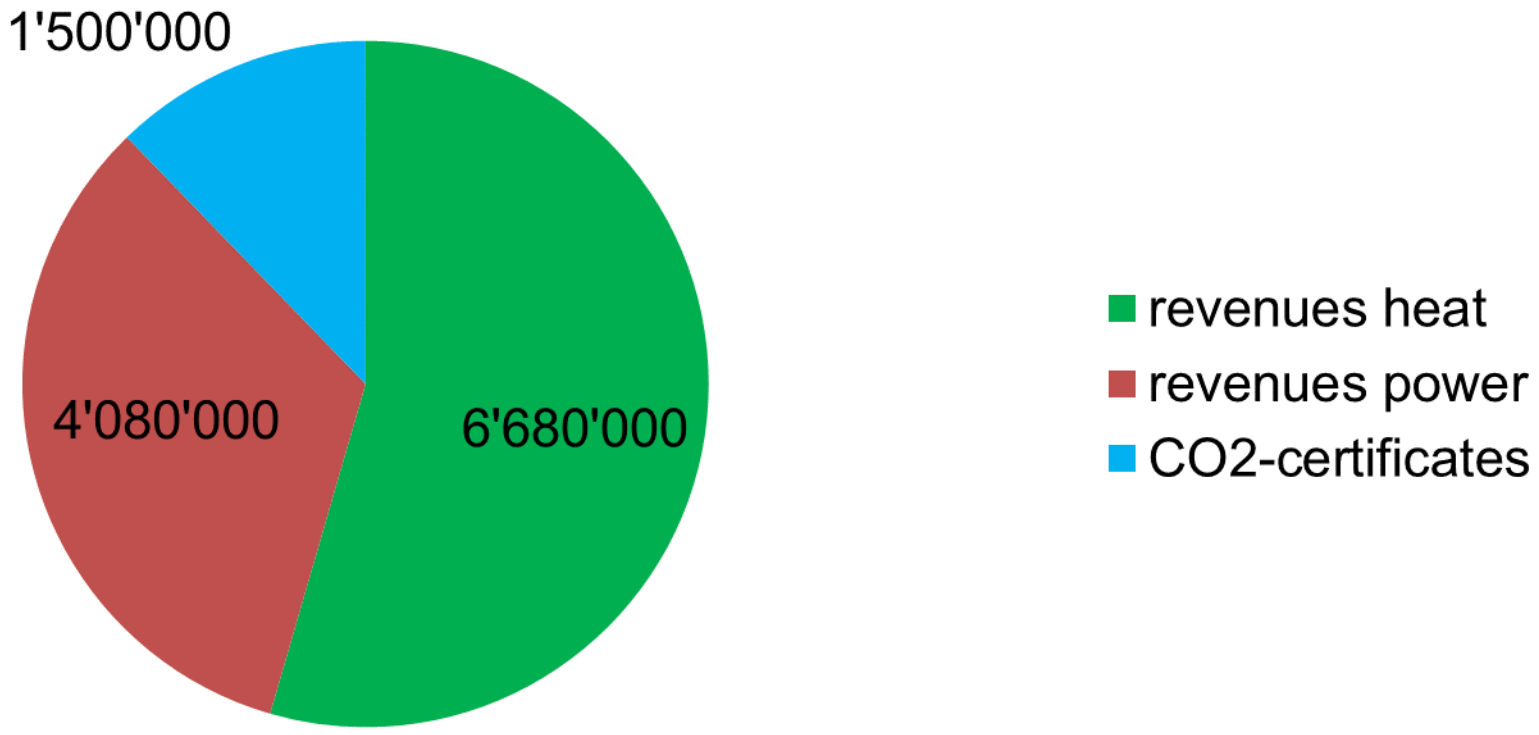
Total: CHF >140 Mio.

1 EUR = 1.15 CHF

Operating costs [CHF]



Revenues [CHF]



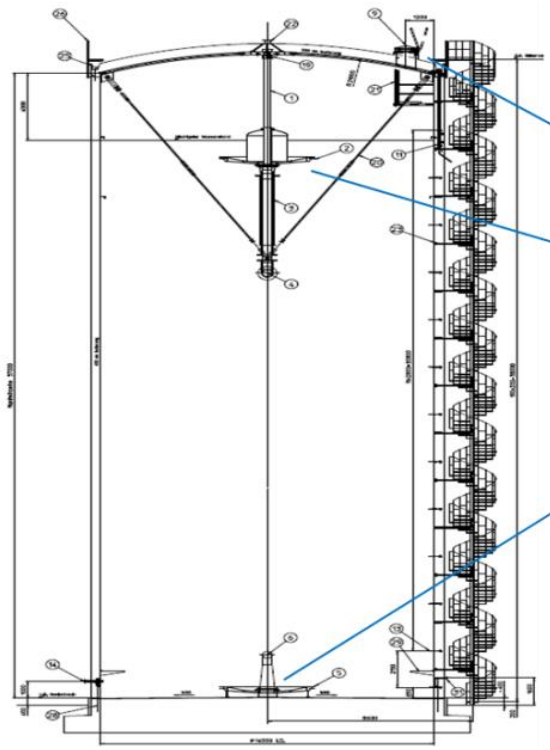
Programm

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

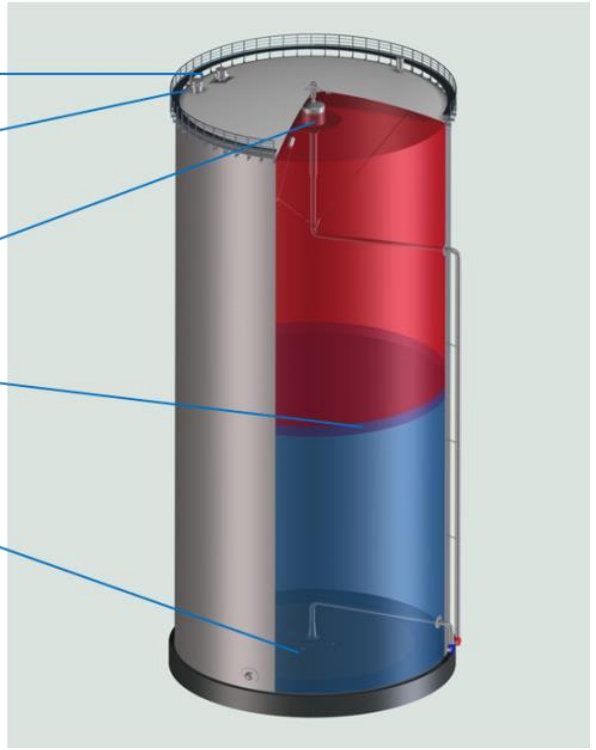
Heat accumulator as key technology

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

Sensible heat accumulator technology



- Wasserschloss
- Überdruckklappe
- Schwimmende Vorlaufdüse
- Temperaturgrenzschicht
- Rücklaufdüse



height: 50 m, diameter: 30 m, volume: 28’000 m^3, 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 steakholders
- ✓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

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

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 recources

- 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

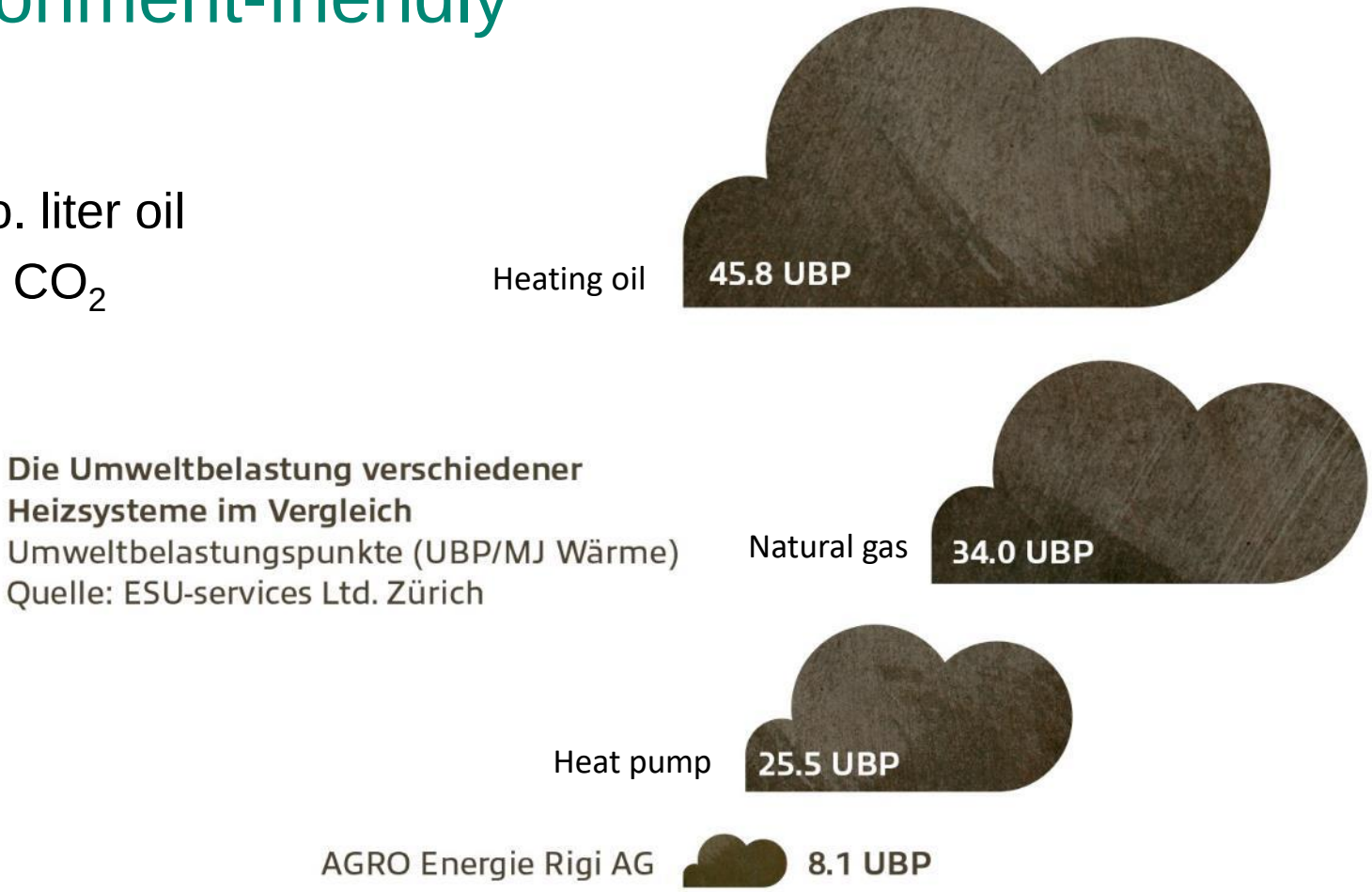
- 40’000 m^3/a

Environment-friendly

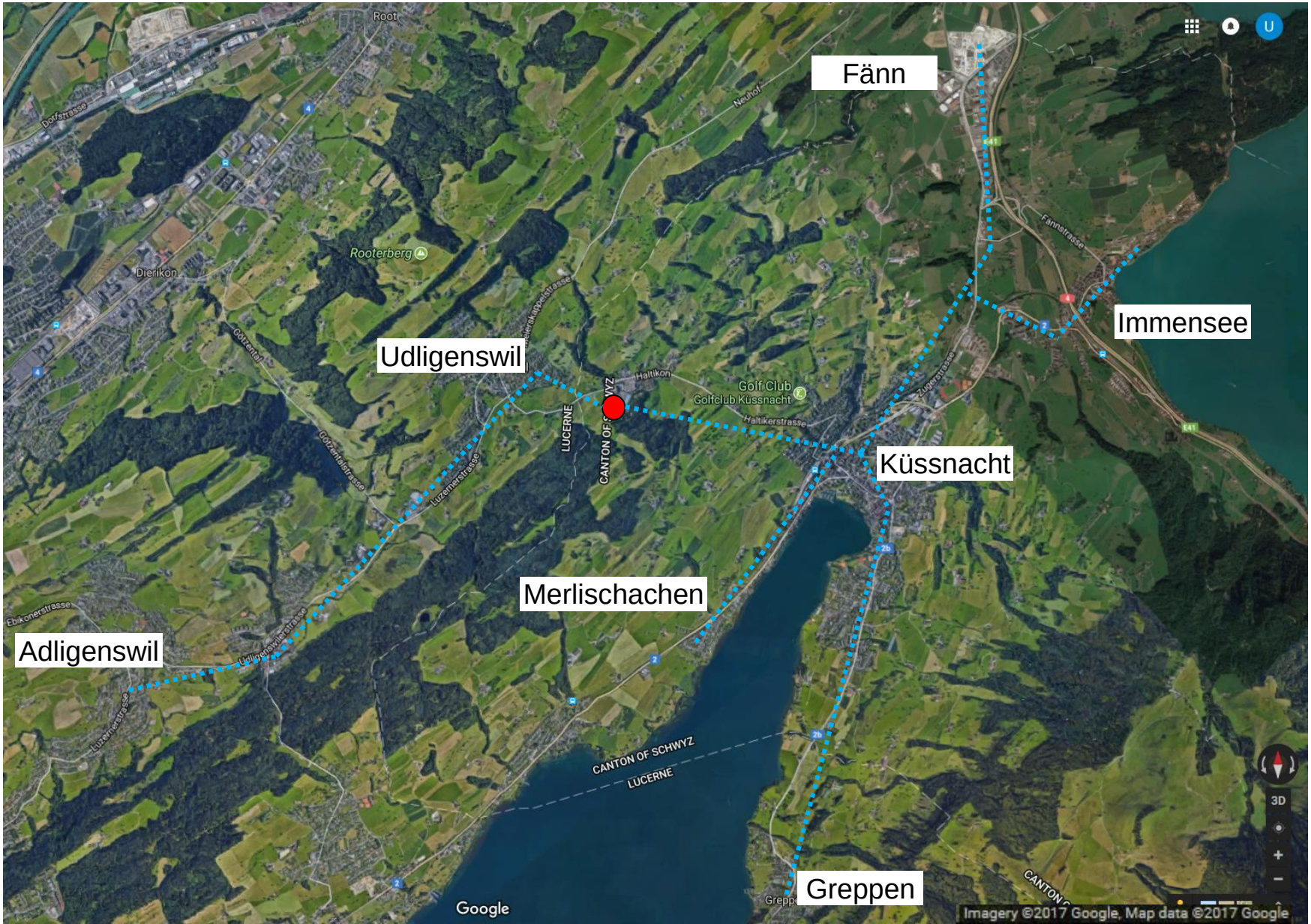
Saving:

12.5 Mio. liter oil

33’000 t CO_2



Die Umweltbelastung verschiedener Heizsysteme im Vergleich
Umweltbelastungspunkte (UBP/MJ Wärme)
Quelle: ESU-services Ltd. Zürich


Fänn
Immensee
Udligenswil
Küssnacht
Merlischachen
Adligenswil
Greppen
Root
Rooterberg
Dierikon
Golf Club
Golfclub Küssnacht
CANTON OF SCHWYZ
LUCERNE
Google
Imagery ©2017 Google, Map data ©2017 Google

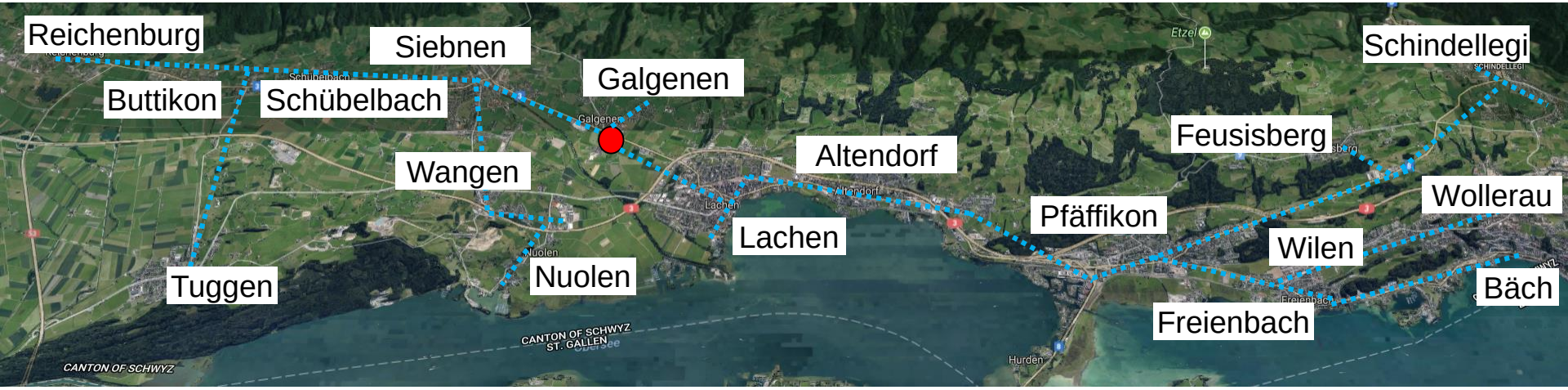
Programm

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

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 CO_2

District heating Ausserschwyz



- **Inhabitants: 80’000**
- **Households: 25’000**

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**

Non-technical barriers

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

Thank you for your attention!

AGRO
ENERGIE SCHWYZ