Big heat storage for biomass power plant with district heating

SCCER BIOSWEEET – Lucern, 03.09.2019
Dr. Urs Rhyner, CFO
Programm

1. AGRO Energie Schwyz AG
2. Biomass power plant
3. District heating
4. Heat accumulator
5. Agro Energie Rigi
6. Agro Energie Ausserschwyz
7. Non-technical barriers
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
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Biomass Power Plant

Kessel 1: 3.2 MWth
Kessel 2: 6.4 MWth
Kessel 3: 9.9 MWth
ORC: 1.5 MWel
20 MW\textsubscript{th} wood-fired boilers

- boiler 1: 3.2 MW\textsubscript{th}
- boiler 2: 6.4 MW\textsubscript{th}
- boiler 3: 9.9 MW\textsubscript{th}
- ORC: 1.5 MW\textsubscript{el}
Biogas fermentation plant

anaerobic fermentation, 26'500 t/a, 526 kW_{el} CHP
Flue gas treatment
Organic Rankine Cycle (ORC)
Heat demand 2018

- 11 MW Ölkessel
- 1.0 MW Kondensation
- 6.5 MW Holzkessel
- 3.2 MW Holzkessel
- 9.9 MW Holzkessel mit ORC
- 0.5 MW BHKW
Resources

<table>
<thead>
<tr>
<th>2018</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood chips (wet)</td>
<td>14'500</td>
</tr>
<tr>
<td>Demolition wood (dry)</td>
<td>18'500</td>
</tr>
<tr>
<td><strong>Total wood</strong></td>
<td><strong>33'000</strong></td>
</tr>
<tr>
<td>solid digestate</td>
<td>8'000</td>
</tr>
<tr>
<td>wet digestate</td>
<td>22'000</td>
</tr>
<tr>
<td><strong>Total digestate</strong></td>
<td><strong>30'000</strong></td>
</tr>
<tr>
<td>Production total</td>
<td>[MWh]</td>
</tr>
<tr>
<td>Power</td>
<td>12'500</td>
</tr>
<tr>
<td>Heat</td>
<td>85'000</td>
</tr>
</tbody>
</table>
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32 MW district heating

district heating pipelines
- built (90 km)
- planed (30 km)
Success story
Key clients

Spital Schwyz
850 kW

Kollegium Schwyz
700 kW

Swiss Holiday Park, Morschach
1700 kW

Kloster Ingenbohl
1100 kW
3. District heating

- 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!

Increasing room temperature, living room > 23°C
Renewable energy production 2018

- Heat production: 87 GWh (8700 average households)
- Power production: 12.5 GWh (2800 average households)
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Heat accumulator - visualisation
Heat accumulator - visualisation
Situation heat accumulator
Heat accumulator – landscape integration

- Height: 50 m
- Diameter: 30 m
- Isolation: 0.5 m
- Water volume: 28’000 m³
- Capacity: 1300 MWh (90/50 °C)
- Pressure: atmospheric
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)
Pressure maintenance
Heat demand of district heating
Operation with/without heat accumulator
Project update – permission process

✓ 2012 first project attempt → rejected 2013
✓ 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 → objection
✓ 2018 autumn: objection solved → permission in spring 2019
✓ 2019 spring: building application
✓ 2019 summer: building permission
✓ 2019 autumn: start construction
o 2020 autumn: commissioning
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AGRO Energie Rigi – 20 MW$_{th}$
Construction zone: www.agroenergie-rigi.ch
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

Output

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

Power plant

- **Wood fired power station**
  - 20 MW\textsubscript{th} boiler
  - 4.5 MW steam turbine
  - Flue gas cleaning
  - Heat accumulator

Wood pellet plant

- **Conveyor drier**

Wood pellets

- 40'000 m\textsuperscript{3}/a
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AGRO Energie Ausserschwyiz – 20 MW$_{th}$

Input: 20 MW$_{th}$ (wood chips, urban waste wood)
Output: 12.0 MW$_{th}$, 4.0 MW$_{el}$
Power: 32 GWh (7000 households)
Heat: 96 GWh (9600 households)
Savings: 12 Mio. liter oil, 31’800 t CO$_2$
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!