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Perspectives from a Swiss Electricity Provider for Large Customers
Agenda

- Company & services
- Data center as a customer
- Grid & Operation
- Energy market
- Options and recommendations
Sankt Gallen, Saint Gall, Switzerland
Population: 79'341
Area: 39 km²
675 m above sea level

1% of Switzerland from an energy perspective!
Multi-utility - supply and service area

- Electricity, gas, water, heat, telecommunication
- Natural gas
## Facts & Figures

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>45'340</td>
</tr>
<tr>
<td>Employees (FTE)</td>
<td>258</td>
</tr>
<tr>
<td>Revenue</td>
<td>CHF 210 Mio.</td>
</tr>
<tr>
<td>Electricity</td>
<td>506 GWh</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>946 GWh</td>
</tr>
<tr>
<td>Heat</td>
<td>68 GWh</td>
</tr>
<tr>
<td>Water</td>
<td>6.05 Mio. m³</td>
</tr>
<tr>
<td>FTTH Optical Termination Outlets/Buildings</td>
<td>24’125 / 4930</td>
</tr>
</tbody>
</table>
Energiefluss Stadt St. Gallen EnK³
2010

Primärenergie (PE)
3280 GWh

Sekundärenergie
2220 GWh

Endenergie
2070 GWh

Nutzenergie
1490 GWh

Legende:
- PE erneuerbar
- Biomasse
- Abfall
- Sonne
- Erdwärme
- Erdölprodukte
- Erdgas
- Elektrizität
- KHK
- FW
- WP
- KWK
- WKK
- WKK (> Wärmekraftkopplung)
- WP (> Wärmepumpe (mit Erdsonde))
- Skalierung: 2012 GWh

Wohnen
Einwohner 75'000

Industrie
Arbeitsplätze 8'000

Verkehr
auf Stadtgebiet

Dienstleistung
Arbeitsplätze 40'000

Geothermal Power Plant Project St. Gallen
Data center as a customer

- Large B2B customer (>1 GWh/y)
- Established channel, key account manager
- High standards regarding stability, quality, MTTR
- Potential partner/prosumer (district heat supply, emergency power generator, PV)
- Similar to: hospital, sport arena, factory
GRID & OPERATION
**Basics**

Ancillary services *)

**Frequency control** (primary control, secondary control, tertiary control)
- Voltage support
- Compensation of active power losses
- Black start and island operation capability
- System coordination
- Operational measurement

Source: [www.swissgrid.ch](http://www.swissgrid.ch)
Electric power supply system - Structure

- Coal Plant: ≈ 600 MW
- Nuclear Plant: 600 - 1700 MW
- Hydro-Electric Plant: ≈ 200 MW
- Industrial Power Plant: ≈ 30 MW
- Medium Sized Power Plant: ≈ 150 MW
- Factory: 110kV and up

Transmission Grid:
- High Voltage: 110kV and up
- Low Voltage: 50 kV
- City Network: ≈ 3 MW substations
- Rural Network: ≈ 400 kW

Distribution Grid:
- City Power Plant: 150 MW
- Industrial Customers: 2 MW
- Solar Farm
- Wind Farm

Suppliers: 1
Transformer: 2, 3, 4
End consumers: 5, 6
Transmission system: Extra-high voltage
Supra-regional distribution system: High voltage
Regional distribution system: Medium voltage
Local distribution system: Low voltage

Example: Hospital

12 GWh/y
Peak load: 3 MW
Emergency power: 500 kW, 520 kW, 900 kW
Combined heat and power units: 2 x 260 kW
Individual contract
Periodical personal contacts

http://www.kssg.ch/
Grid connections
Recommendations

- Respect N-1 rule (and Murphy’s law)
- Power from at least two transformers / cables
- Test your emergency power system on a regular basis
- Stay in personal contact with your utility
- Use the produced heat (if possible)
- Emergency power generators can be part of a virtual power plant
ENERGY MARKET
Basics

- Customers are free to choose their energy supplier
- The price for electric energy is not constant over time
- Customers can buy a «mix» of energy (renewable, fossil, nuclear)
- The reference price for electric power is fixed on the market
  - Forward- and Futures market (OTC, EEX)
  - Spot market (standard products, hourly)
  - Intraday market (1/4 hourly)
  - Control energy market (primary, secondary, tertiary)
  - Market for CO₂ and green certificates
Switzerland – electricity price

Source: Association of Swiss Electricity Companies (VSE)
Data basis: VSE 1990-2009, ElCom 2010-2014
https://www.strompreis.elcom.admin.ch/
Spot market price / futures

Source: [www.energieplattform-ag.ch](http://www.energieplattform-ag.ch)
Electricity prices for industrial customers, June 2014
(EUR per kWh)


Footnote: 1 Annual consumption: 500 MWh < consumption < 2 000 MWh. Excluding VAT.
Source: Eurostat (online data code: nrg_pc_205)
Procurement model for large customers

- Grundversorgung (stay with the local supplier, regulated tariffs)
- Stichtagsbeschaffung (key date procurement)
- Tranchenbeschaffung (tranche procurement, full supply contract)
- Portfolio management

Complexity

Trading activities

Suitability for the procurement of large quantities / savings potential / risks
Cost components (large enterprise)
Phases

Long-Term

Short-Term

Intraday

After-Day
Value chain for electricity procurement

- Long term forecasting
- Define hedging strategy
- Re-adjust hedge
- D-1 forecast
- Intraday forecast adjustment
- Balance energy by bidding
- Structure profile
- Liquidity cascading
- Adjust forecast
- D-1 hourly residual profile purchasing
- Intraday trading

Source: ETH Zürich, Power Systems Lab, Gaudenz Koeppel
Load profile – price curve

Price [EU/ kWh]

Load profile A

Load [kW]

Area = Energy

Load profile B

Load [kW]

Area = Energy

Energy A = Energy B
Costs A > Costs B
Typical load profile

Area below curve proportional costs of energy

Load peaks determine cost for net/grid usage

Time of day

Power [MW]
Recommendation

- The better your forecast the better your price
- Flexible loads can help to reduce energy costs
- (Price-) risk avoidance is not for free
- Try to get different offers and compare them in detail
Conclusion

- A datacenter is an important customer & partner of your local utility and your energy supplier
- The local utility plays an important role in your business continuity plan
- Today’s market for electric energy is very unpredictable – this will not change in the next years
Silicon Valley Study Tour May 9 - 13, 2016
Energy, ICT, Clean Tech
Q & A
Thank YOU !