|s|g |s |w |

Sankt Galler Stadtwerke

Lawrence Livermore National Laboratory

sgsw
Sankt Galler Stadtwerke

Wolfgang Korosec, CIO, St. Galler Stadtwerke

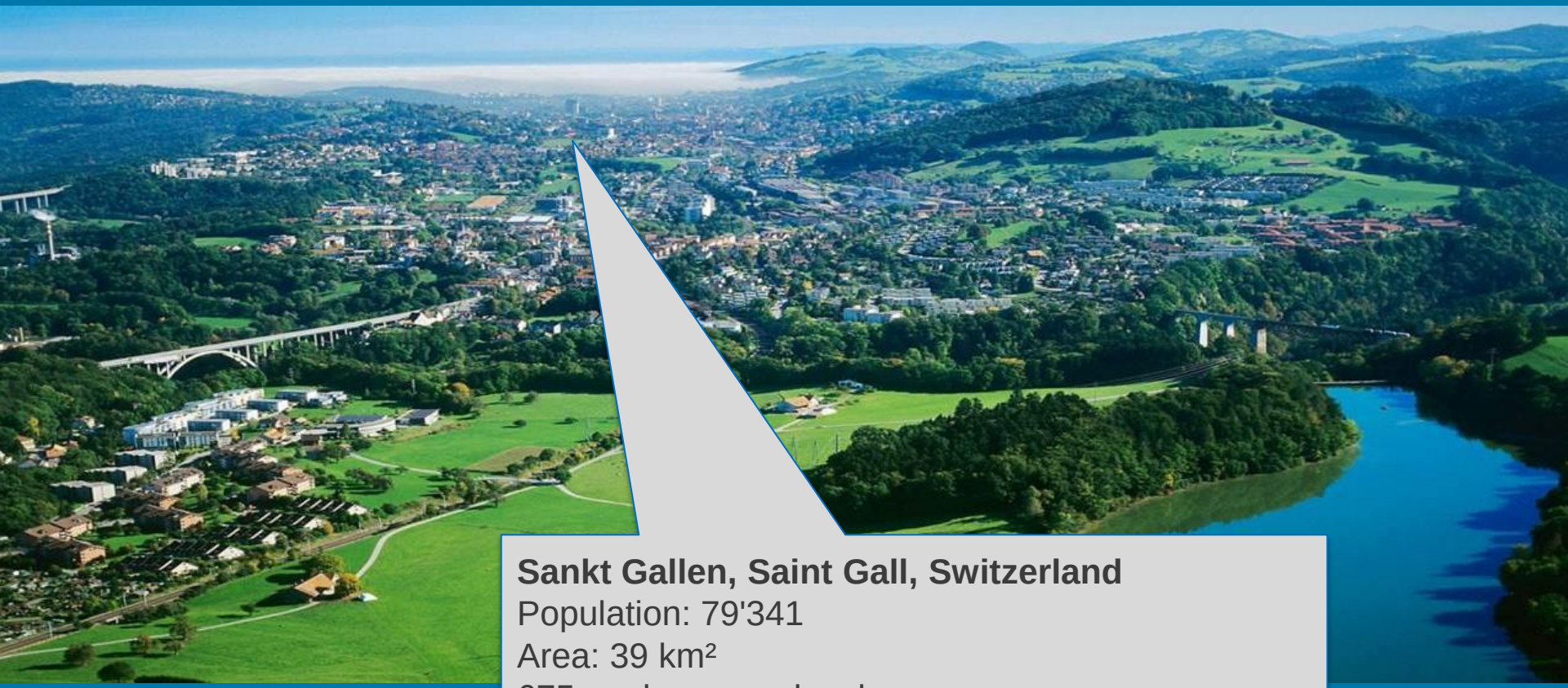
Perspectives from a Swiss Electricity Provider for Large Customers

Stadt St.Gallen

Elektrizität | Wasser | Erdgas | Wärme | Glasfaser

Agenda

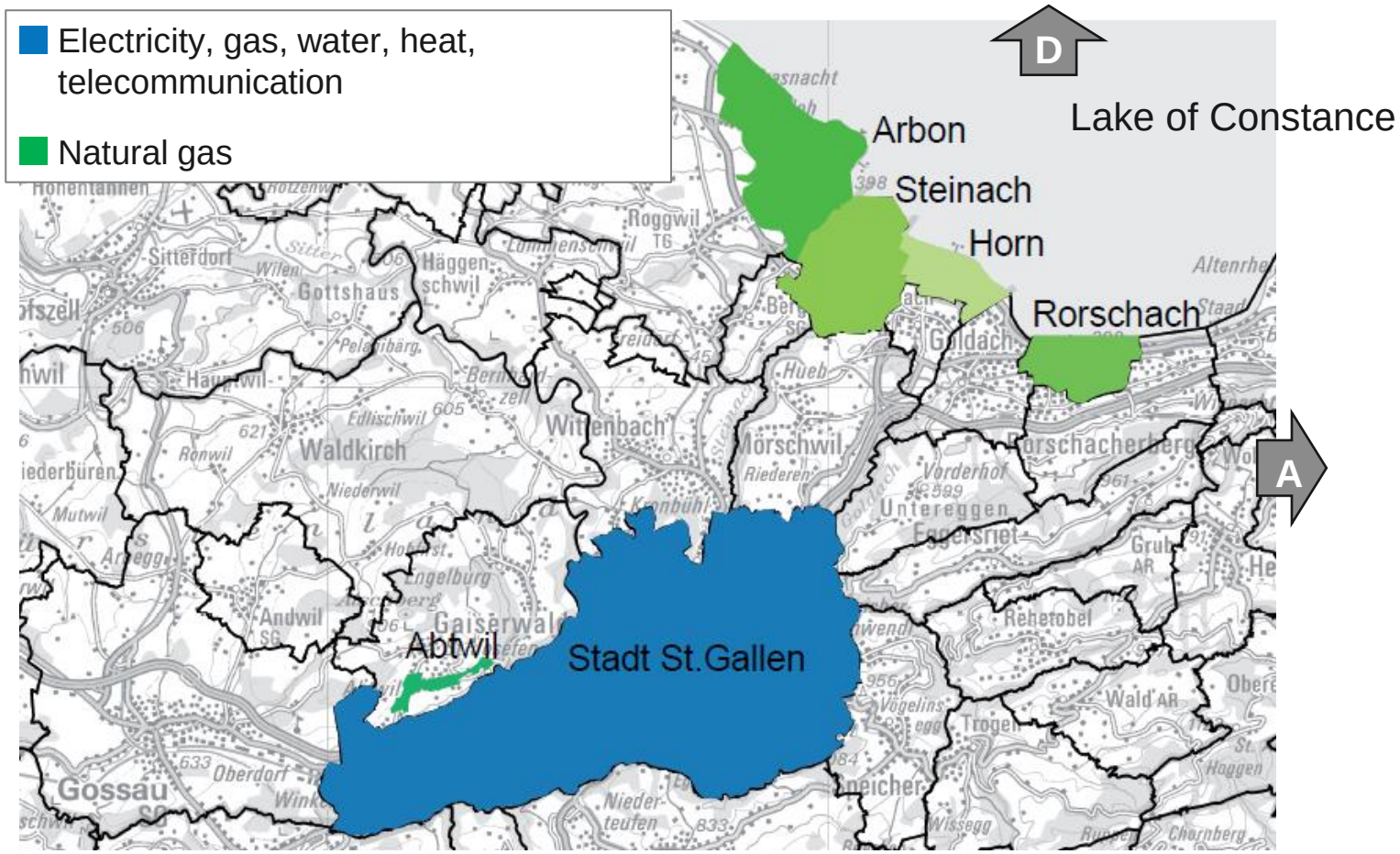
- Company & services
- Data center as a customer
- Grid & Operation
- Energy market
- Options and recommendations



Sankt Gallen, Saint Gall, Switzerland
Population: 79'341
Area: 39 km²
675 m above sea level
Source: Wikipedia

1% of Switzerland from an energy perspective !

Multi-utility - supply and service area

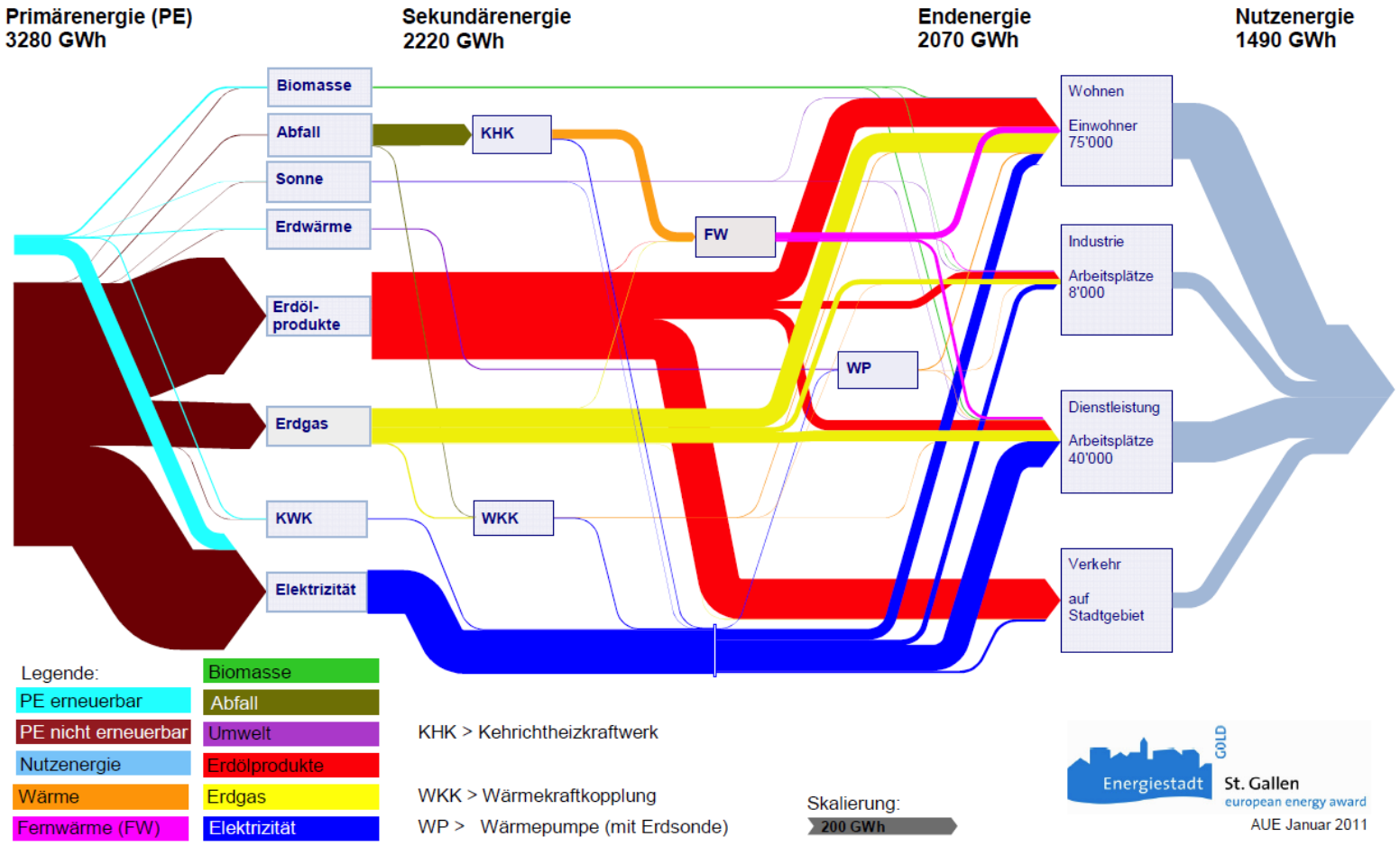


Facts & Figures

Customers	45’340
Employees (FTE)	258
Revenue	CHF 210 Mio.
Electricity	506 GWh
Natural Gas	946 GWh
Heat	68 GWh
Water	6.05 Mio. m^3
FTTH Optical Termination Outlets/Buildings	24’125 / 4930

Energiefluss Stadt St.Gallen EnK [3]
2010

Stadt St.Gallen
Umwelt und Energie

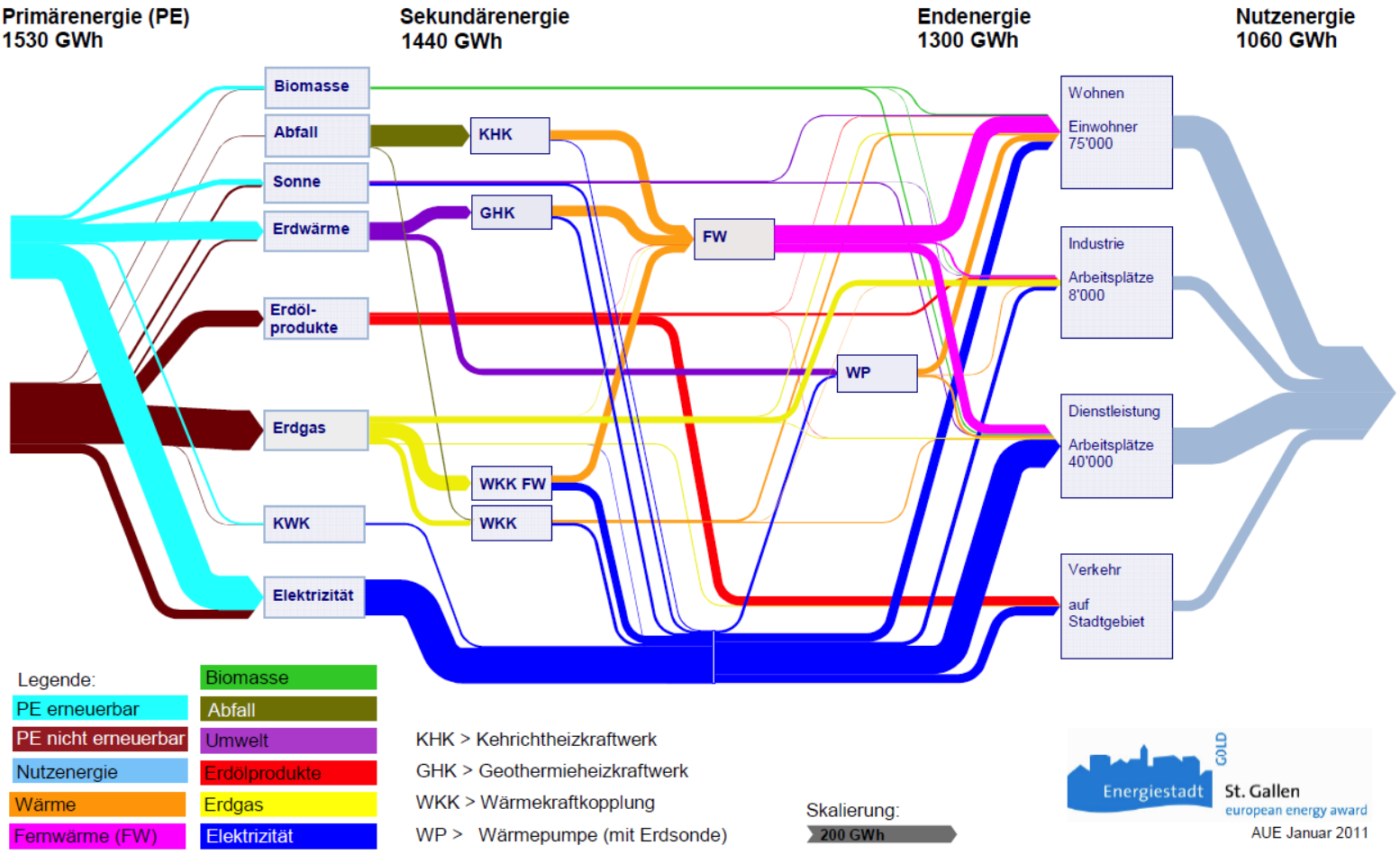


Energiestadt GOLD
St. Gallen
european energy award
AUE Januar 2011

Energiefluss Stadt St.Gallen EnK [3]

2050

Stadt St.Gallen
Umwelt und Energie



Energiestadt GOLD St. Gallen european energy award
AUE Januar 2011

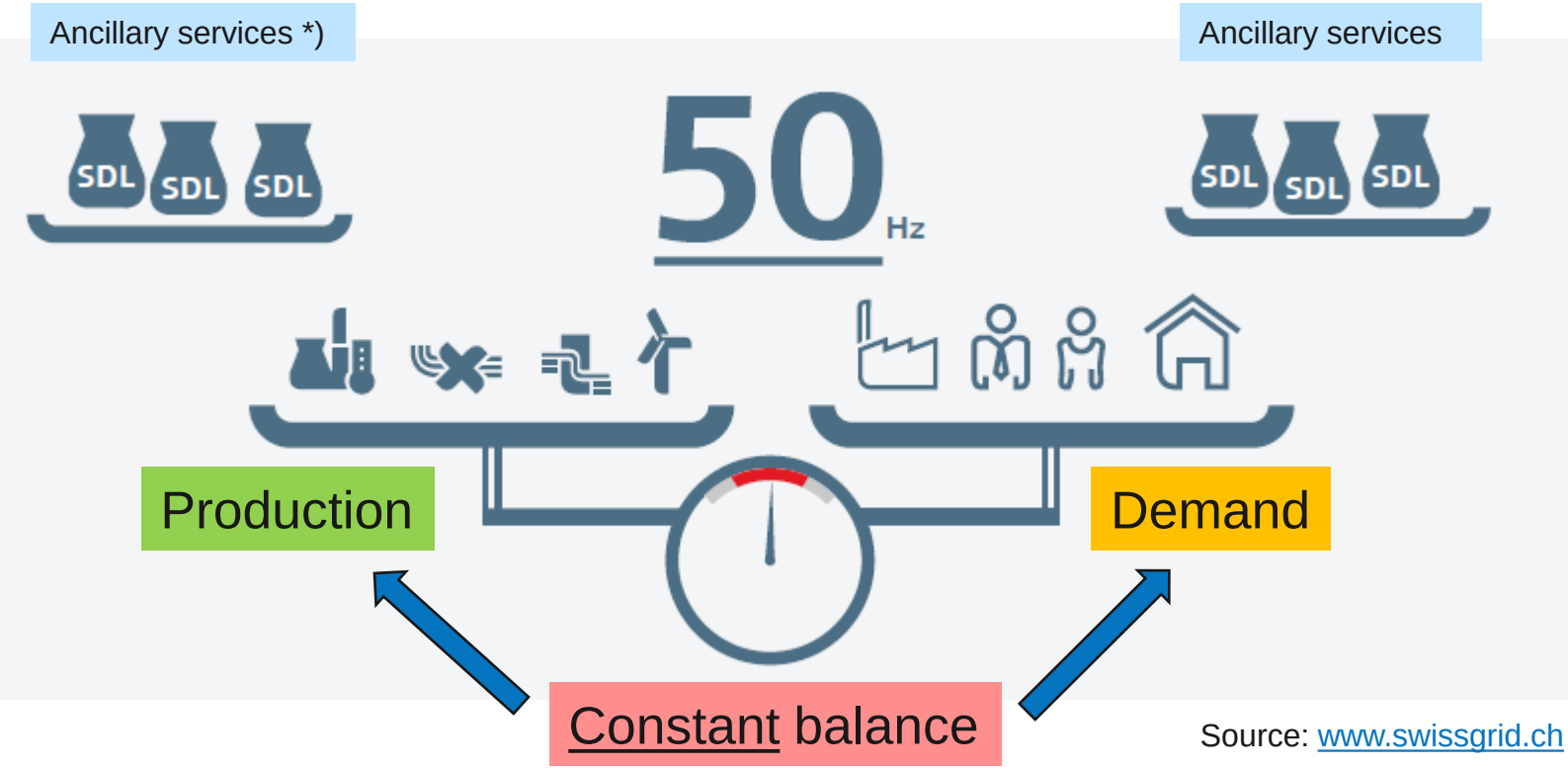
Geothermal Power Plant Project St.Gallen

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

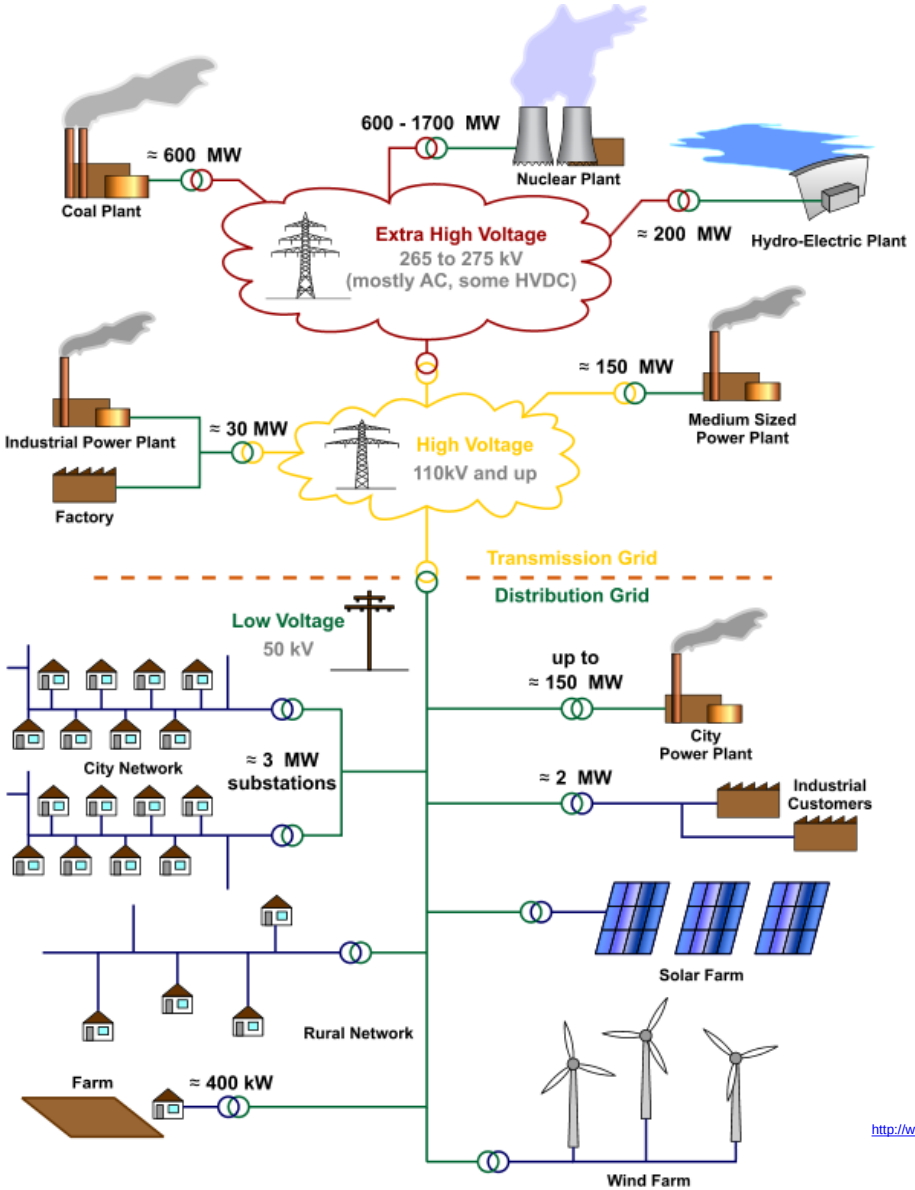
Basics

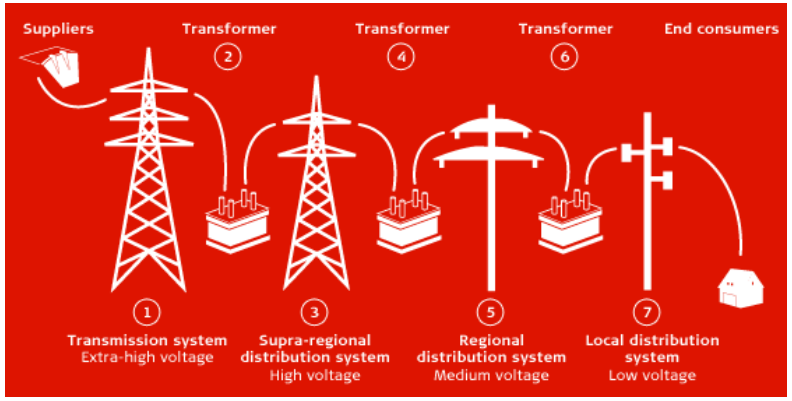


Source: www.swissgrid.ch

*) 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

Electric power supply system - Structure





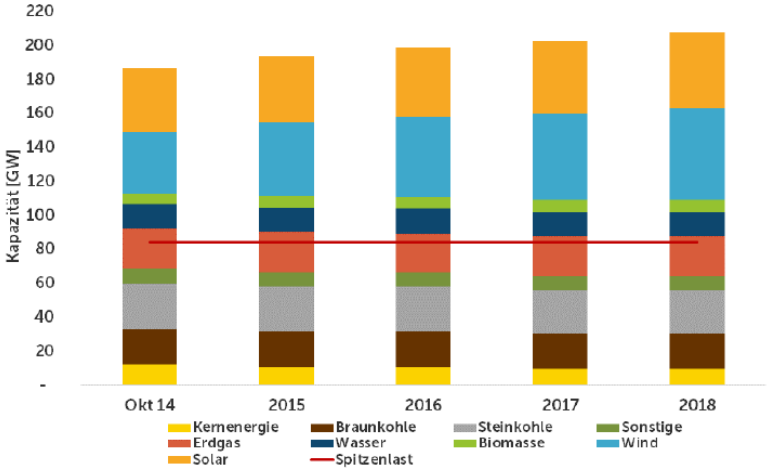
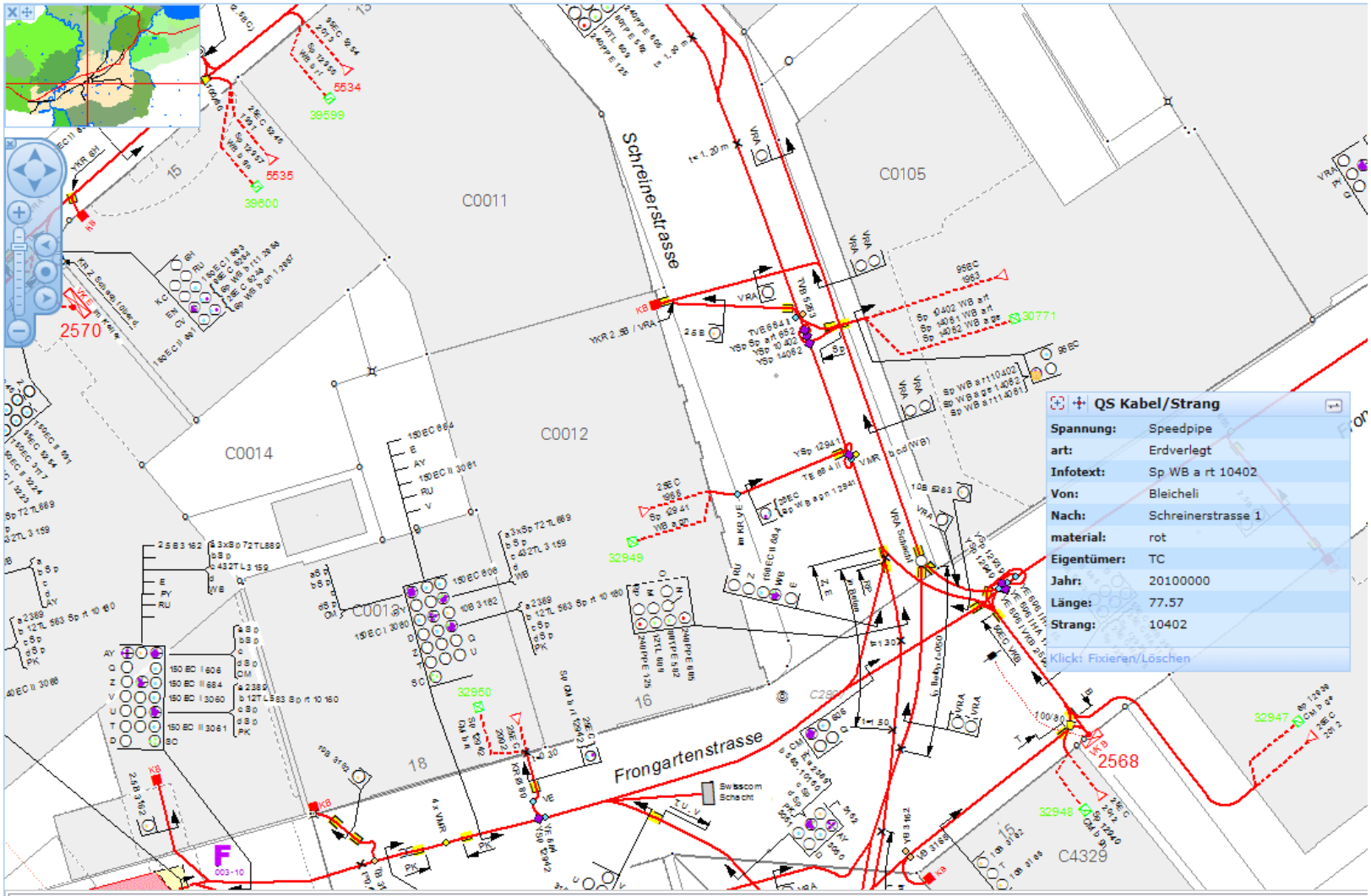


Abbildung 2: Entwicklung der Erzeugungskapazitäten und Spitzenlast in Deutschland.
Quelle: Eigene Darstellung nach BNetzA (2014a), BNetzA (2014b), BNetzA (2014c).

http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/leitstudie-strommarkt-2015,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

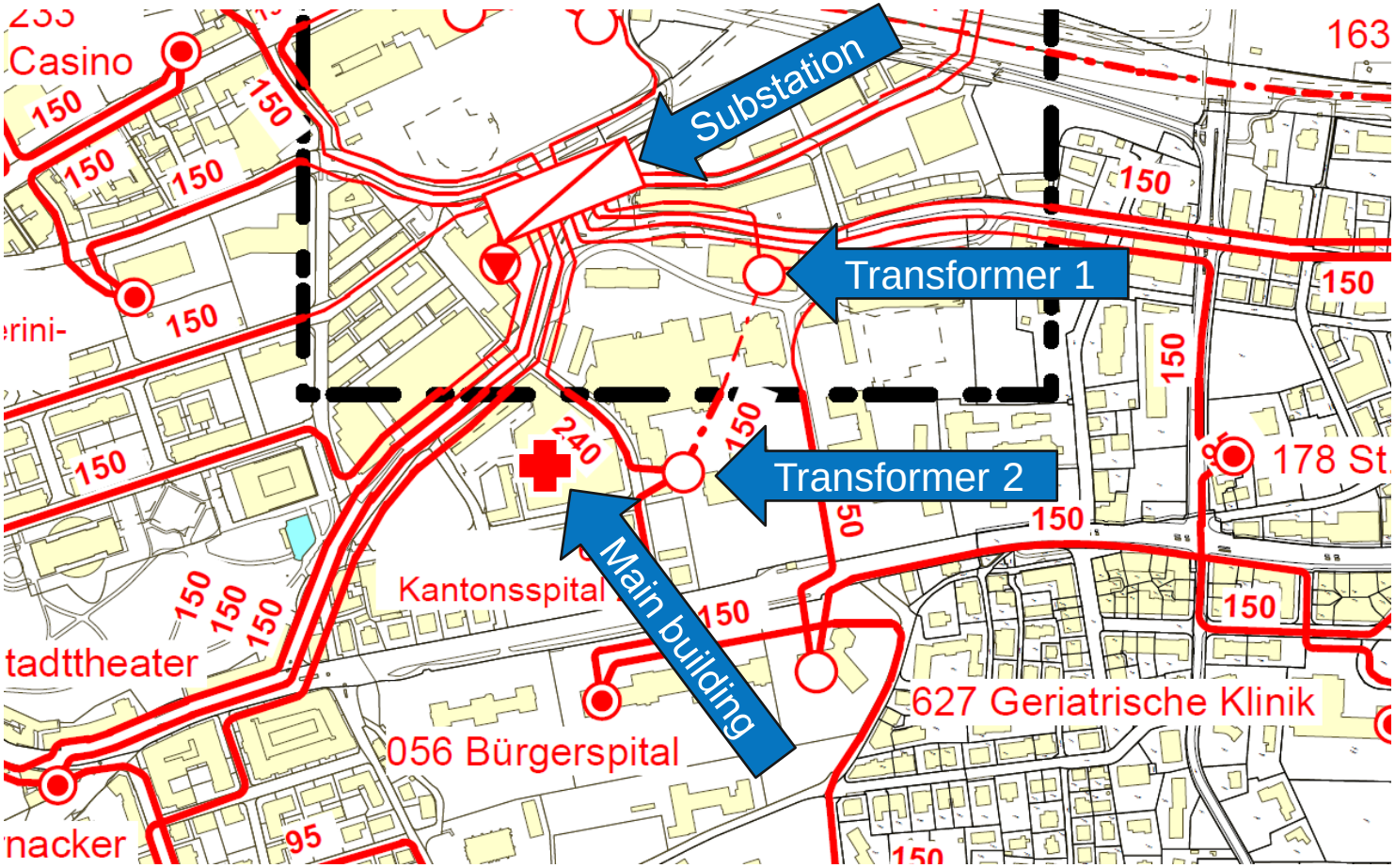

QS Kabel/Strang
Spannung: Speedpipe
art: Erdverlegt
Infotext: Sp WB a rt 10402
Von: Bleicheli
Nach: Schreinerstrasse 1
material: rot
Eigentümer: TC
Jahr: 20100000
Länge: 77.57
Strang: 10402
Klick: Fixieren/Löschen
Schreinerstrasse
Frongartenstrasse
C0011
C0012
C0014
C0105
C4329
2570
2568
5534
5535
39599
39600
30771
32949
32950
32947
32948
Ergebnisliste von QS Kabel/Strang

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

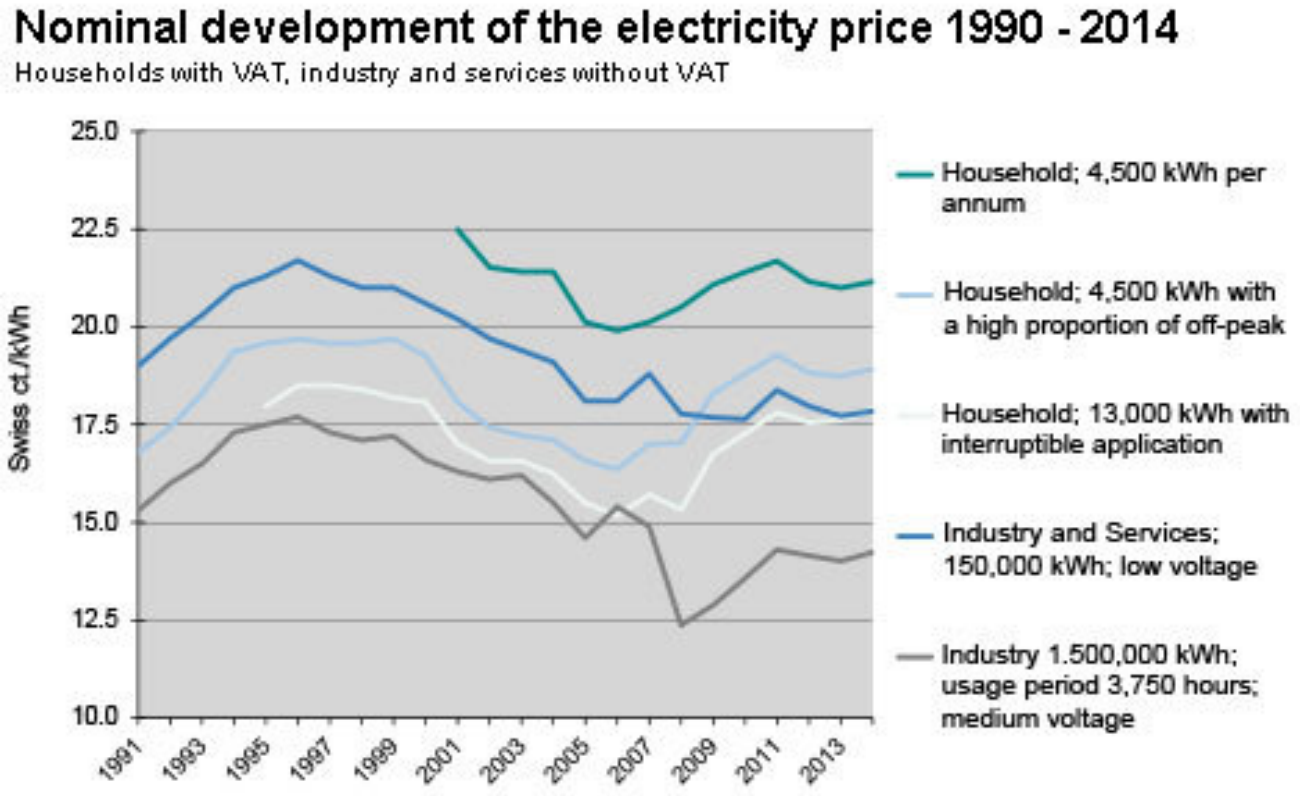
- Respect N-1 rule (and Murphy's law)
- Power from at least two transformers / cables
- Test your emergency power system on a regular basis
- Stay in personal contact with your utility
- Use the produced heat (if possible)
- Emergency power generators can be part of a virtual power plant

ENERGY MARKET

Basics

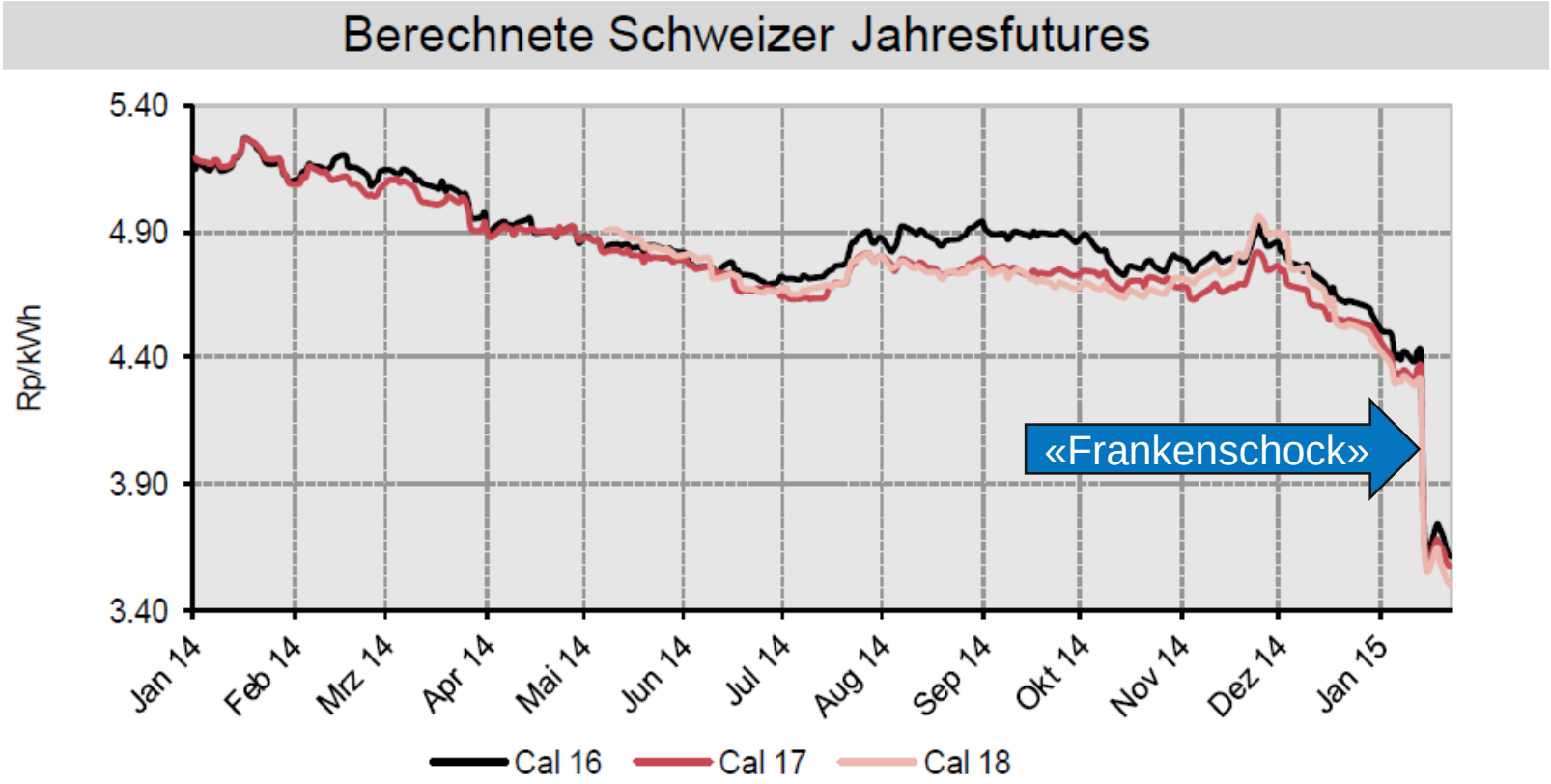
- Customers are free to chose their energy supplier
- The price for electric energy is not constant over time
- Customers can buy a «mix» of energy (renewable, fossile, nuclear)
- The reference price for electric power is fixed on the market
  - Forward- and Futuresmarket (OTC, EEX)
  - Spotmarket (standard products, hourly)
  - Intradaymarket (1/4 hourly)
  - Control energy market (primary, secondary, tertiary)
  - Market for CO_2 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/

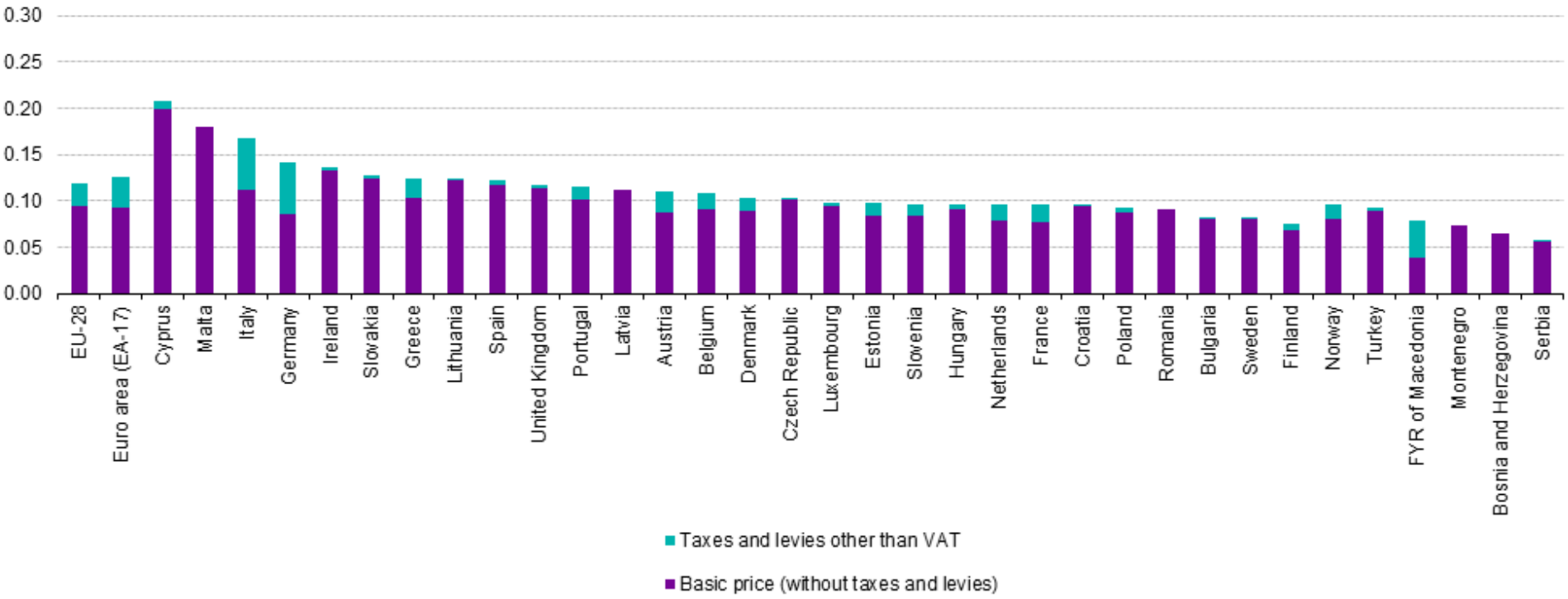
Spot market price / futures



Source: www.energieplattform-ag.ch

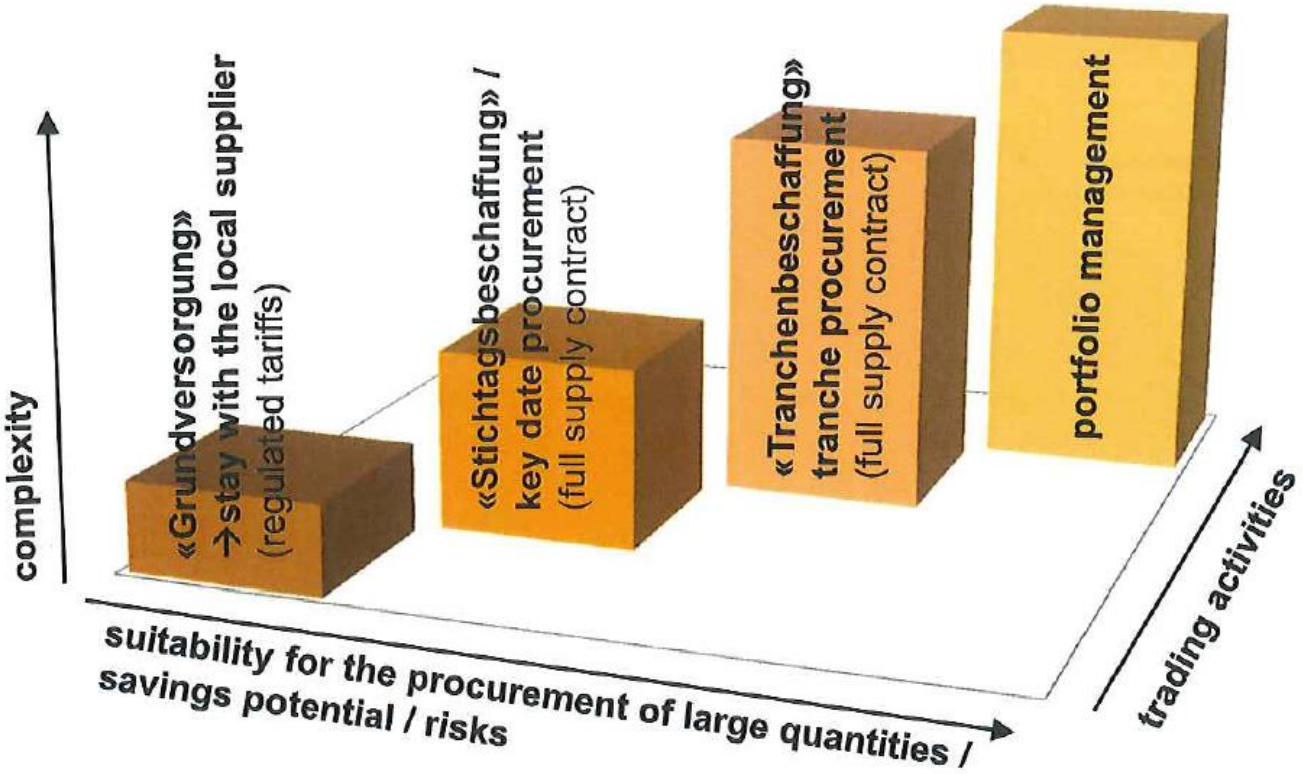
Electricity prices for industrial customers, June 2014

(EUR per kWh)

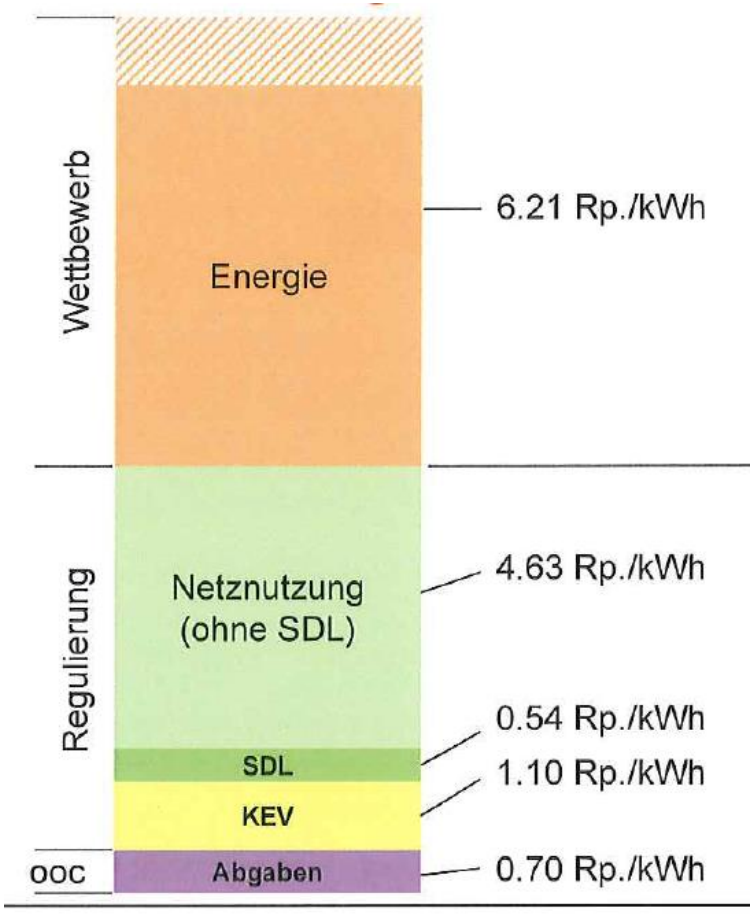


([1]) Annual consumption: 500 MWh < consumption < 2 000 MWh. Excluding VAT.
Source: Eurostat (online data code: nrg_pc_205)
http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_price_statistics

Procurement model for large customers



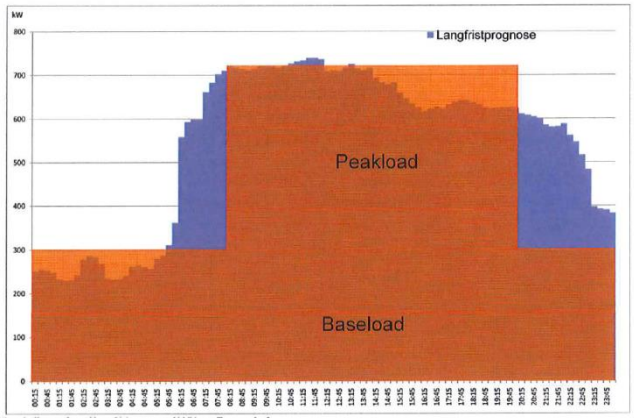
Cost components (large enterprise)



ETH | EEH | Power Market | Gastreferat: Strombeschaffung Migros

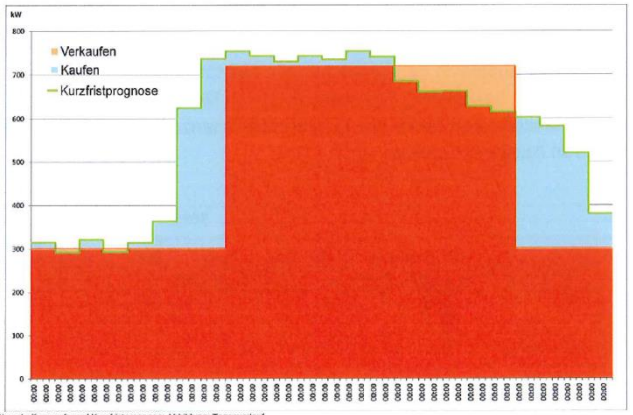
Phases

Long-Term



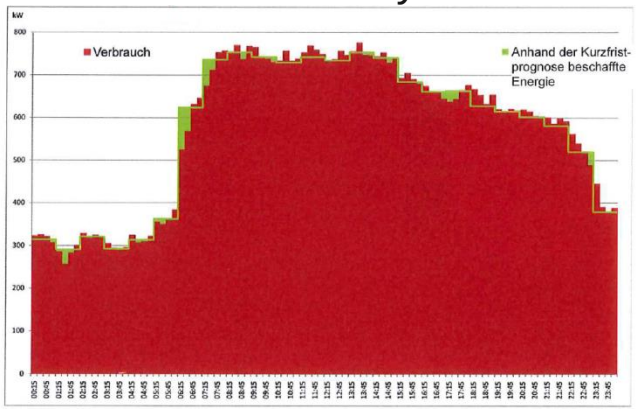
Langfristbeschaffung aufgrund Langfristprognose; Abbildung: Tagesverlauf

Short-Term

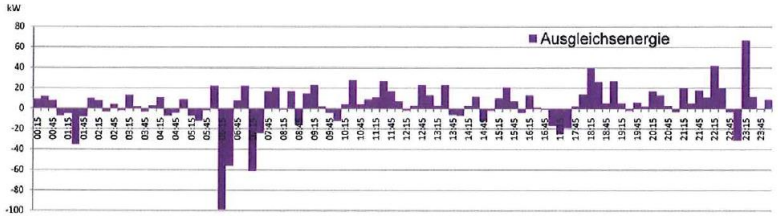


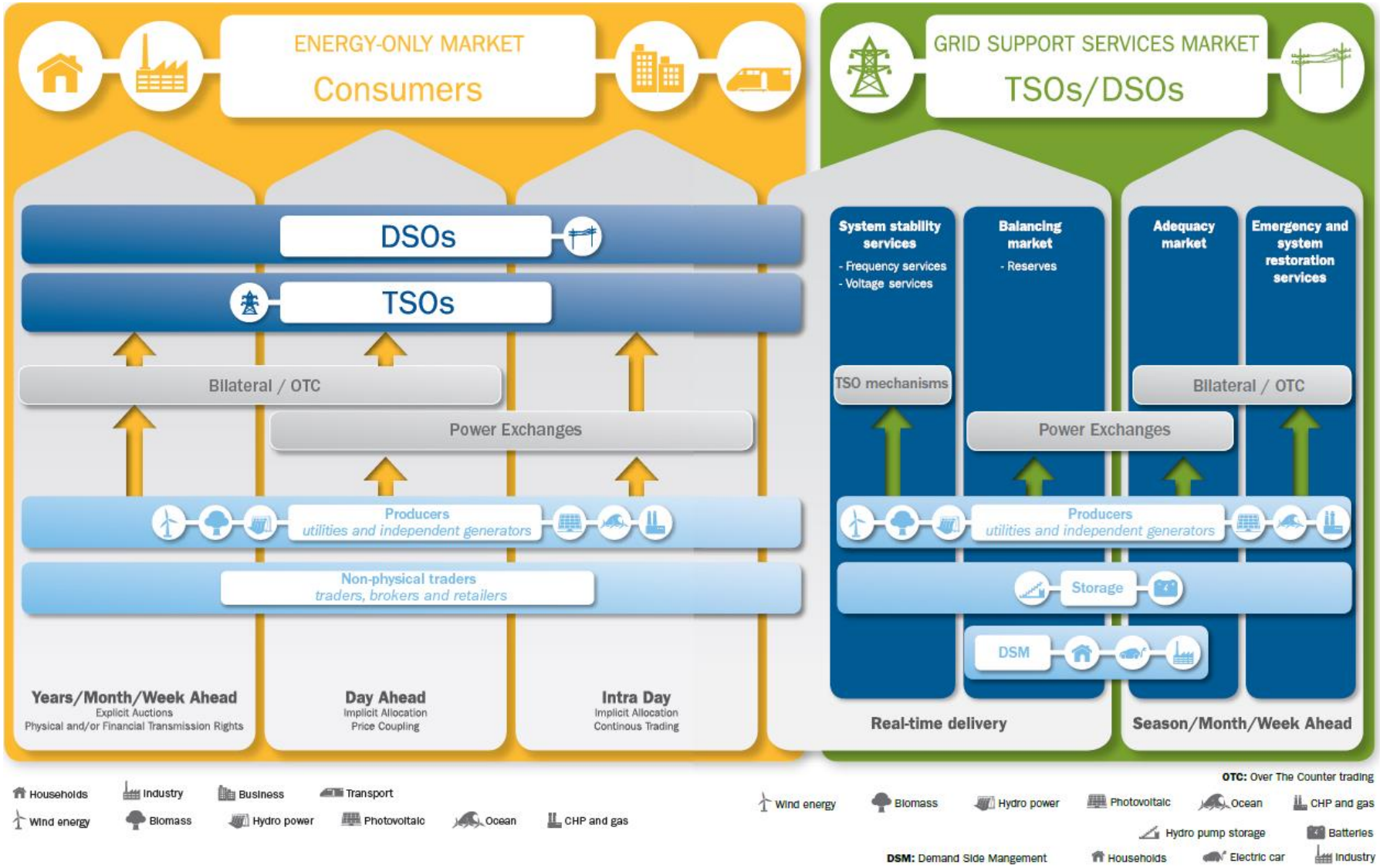
Kurzfristbeschaffung aufgrund Kurzfristprognose; Abbildung: Tagesverlauf

Intraday

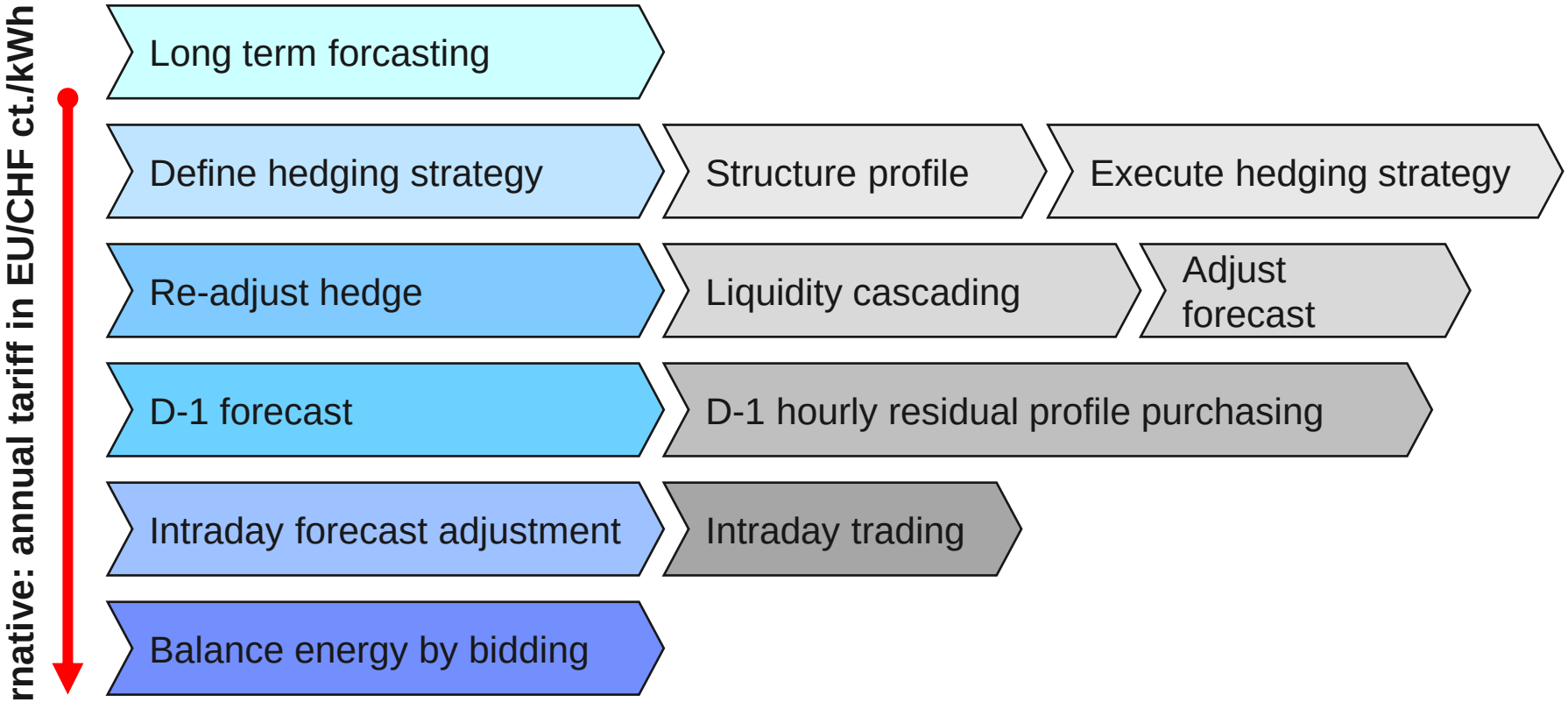


After-Day



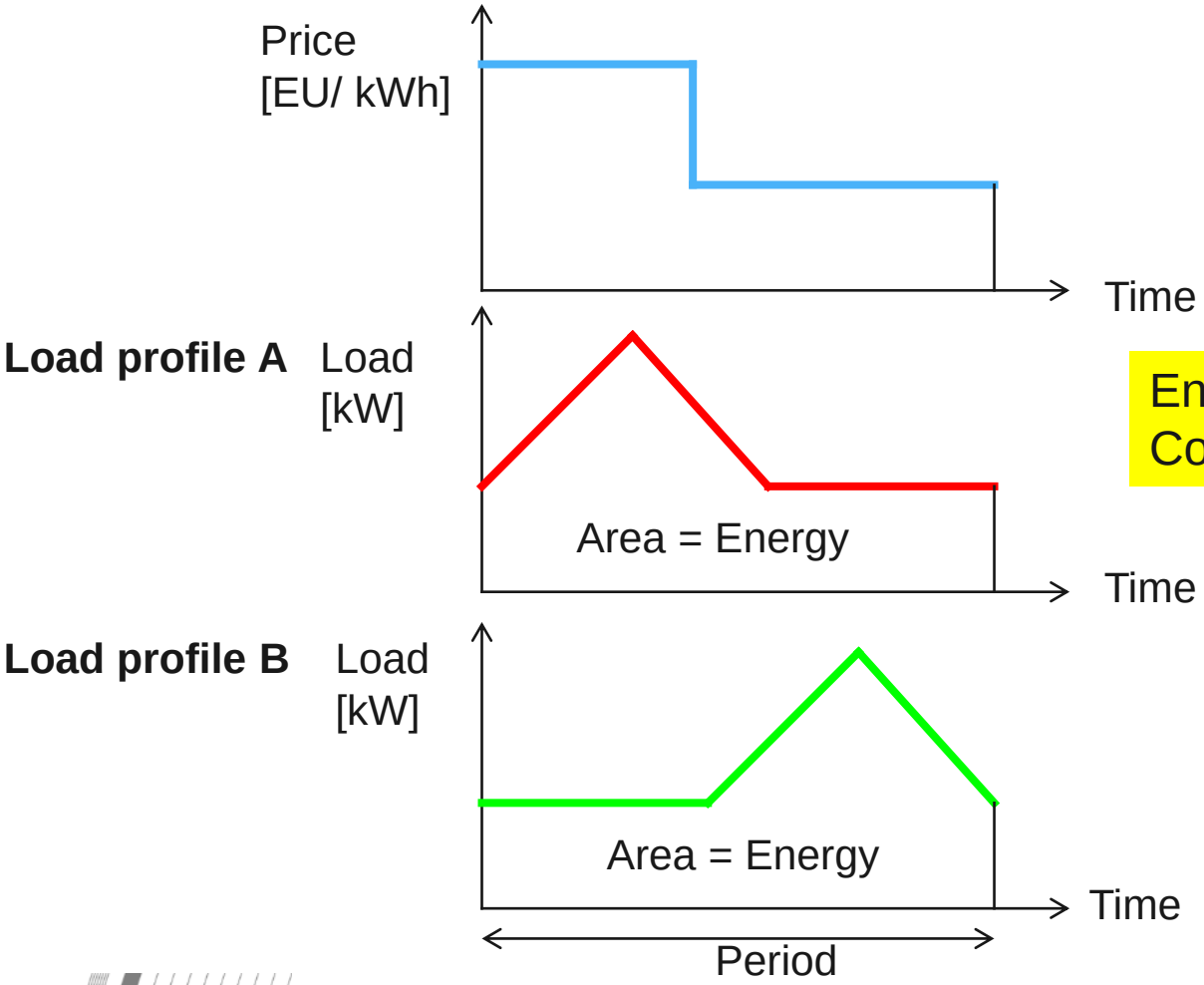

ENERGY-ONLY MARKET
Consumers
GRID SUPPORT SERVICES MARKET
TSOs/DSOs
DSOs
TSOs
Bilateral / OTC
Power Exchanges
Producers
utilities and independent generators
Non-physical traders
traders, brokers and retailers
Years/Month/Week Ahead
Explicit Auctions
Physical and/or Financial Transmission Rights
Day Ahead
Implicit Allocation
Price Coupling
Intra Day
Implicit Allocation
Continous Trading
System stability services
- Frequency services
- Voltage services
Balancing market
- Reserves
Adequacy market
Emergency and system restoration services
TSO mechanisms
Bilateral / OTC
Power Exchanges
Producers
utilities and independent generators
Storage
DSM
Real-time delivery
Season/Month/Week Ahead
Households
Industry
Business
Transport
Wind energy
Biomass
Hydro power
Photovoltaic
Ocean
CHP and gas
Wind energy
Biomass
Hydro power
Photovoltaic
Ocean
CHP and gas
Hydro pump storage
Batteries
Households
Electric car
Industry
OTC: Over The Counter trading
DSM: Demand Side Mangement

Value chain for electricity procurement



Source: ETH Zürich, Power Systems Lab, Gaudenz Koeppel

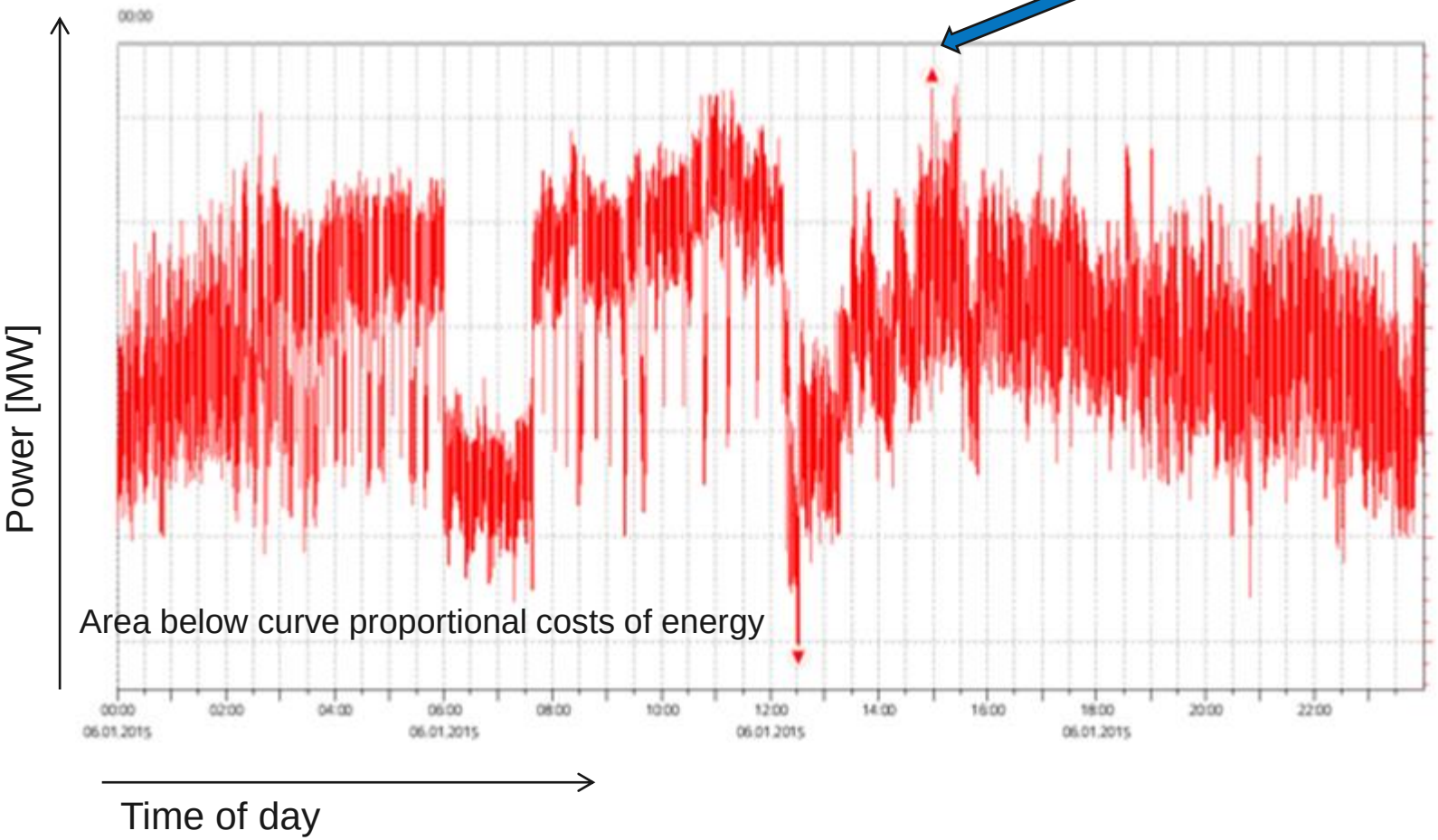
Load profile – price curve



Energy A = Energy B
Costs A > Costs B

Typical load profile

Load peaks determine cost for net/grid usage



Recommendation

- The better your forceast 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

Swiss Silicon Valley Association

Silicon Valley Study Tour May 9 - 13, 2016

Energy, ICT, Clean Tech

Q & A

Thank YOU !