SCCER CREST
Swiss Competence Centers for Energy Research
Competence Center for Research in Energy, Society and Transition

Universität Basel
Wirtschaftswissenschaftliche Fakultät

WWZ

FoNEW
Forschungsstelle für Nachhaltige Energie- und Wasserversorgung

Strategic reserve for Switzerland:
Is it needed and (how) would it work?

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Session 2A: Electricity I – Capacities

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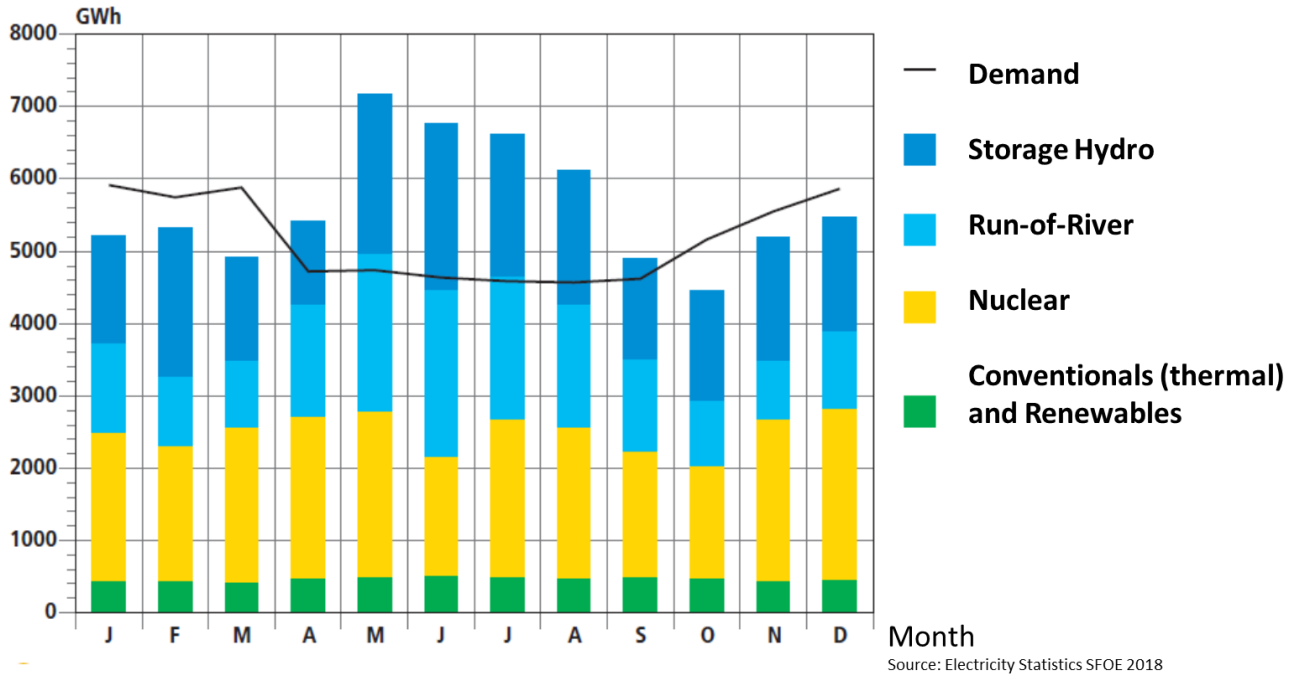
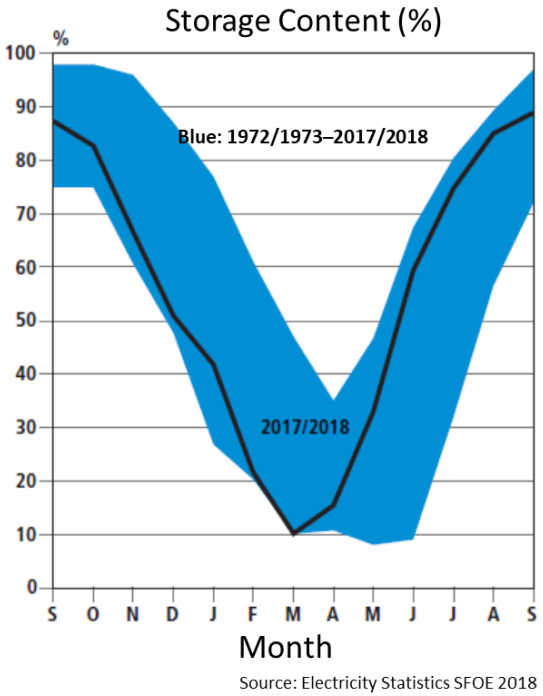
Swiss Electricity System

Peak Load	= approx. 10GW
Installed Capacity	= approx. 20GW (approx. 16.5 GW without nuclear)



Source: Electricity Statistics SFOE 2018



Source: Electricity Statistics SFOE 2018

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Swiss Electricity Market Design

Current Market Design:

- Energy-only market

Swiss Electricity Market Design

Current Market Design:

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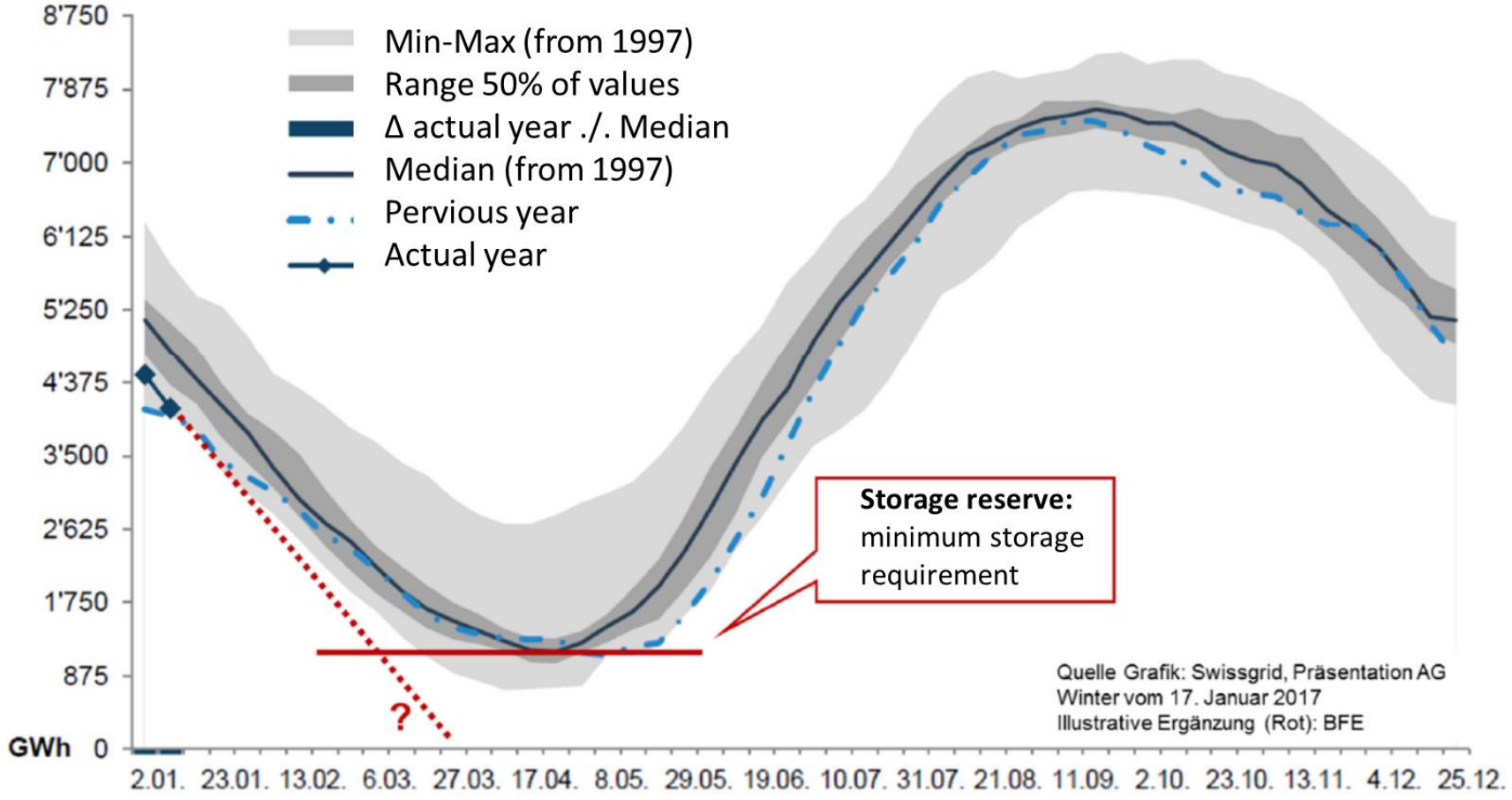
Market Design after 2020 (?):

- Energy-only market
- Strategic reserve:
    - Insurance for unforeseeable events, e.g.
        - Market failure
        - Political risk
        - Weather
        - Import restrictions

Strategic Reserve CH = Storage Reserve

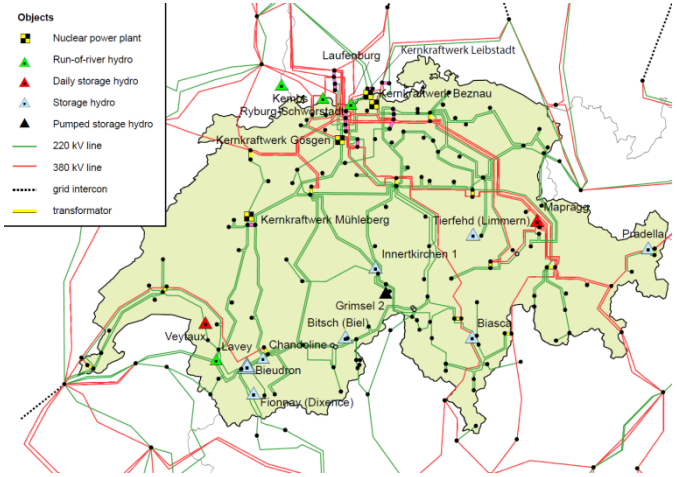


Research Question

Strategic reserve for Switzerland:

- Is it needed? Does it help?
- Design?

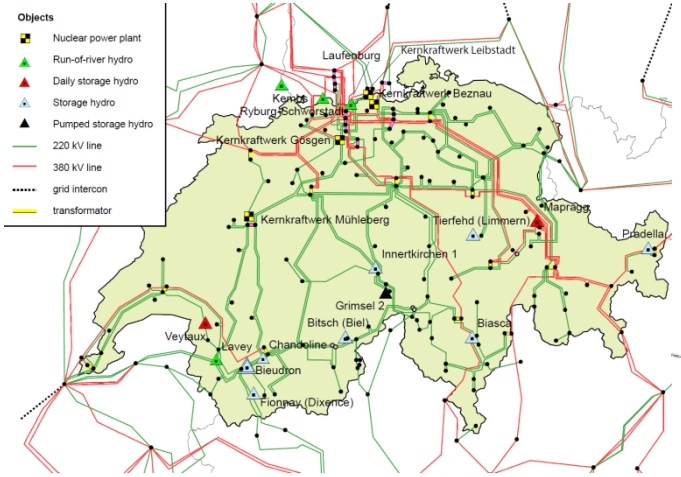
Swiss Electricity Market Model (Swissmod)

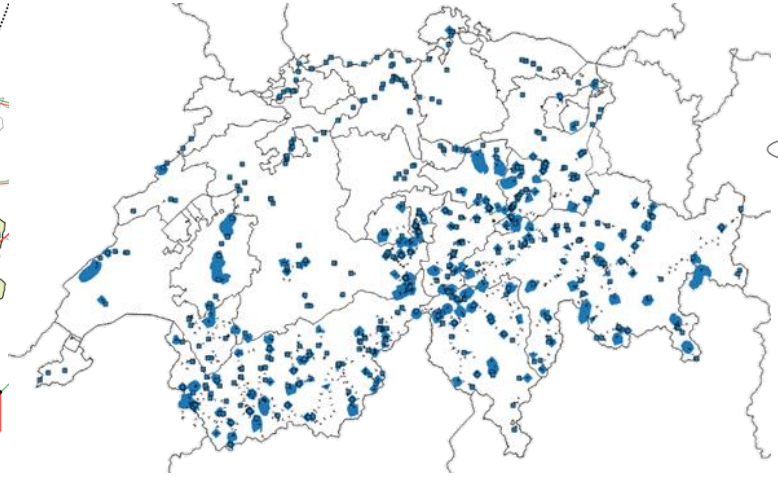


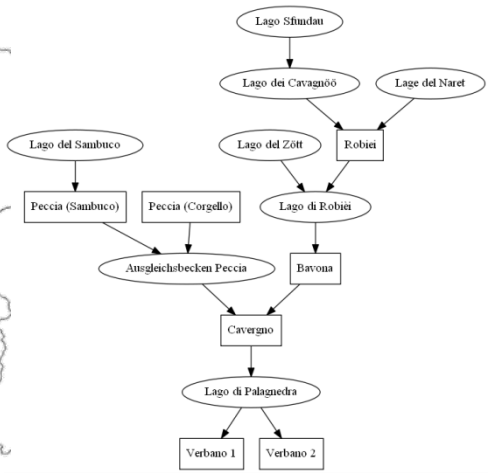
Transmission System Model:

- ca. 230 nodes
- ca. 400 lines
- Neighboring countries aggregated

Swiss Electricity Market Model (Swissmod)







Transmission System Model:

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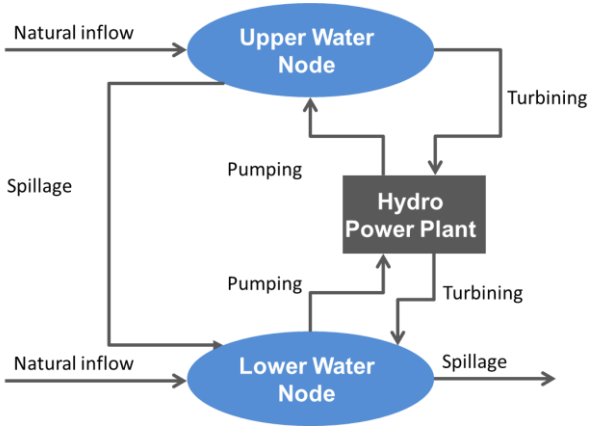
Hydro Structure:

- ca. 200 cascades with ca. 400 plants (>95% of production)
- Catchment specific inflows on monthly basis
- Endogenous operation



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Swiss Electricity Market Model (Swissmod)

Modelling of Storage Reserve:

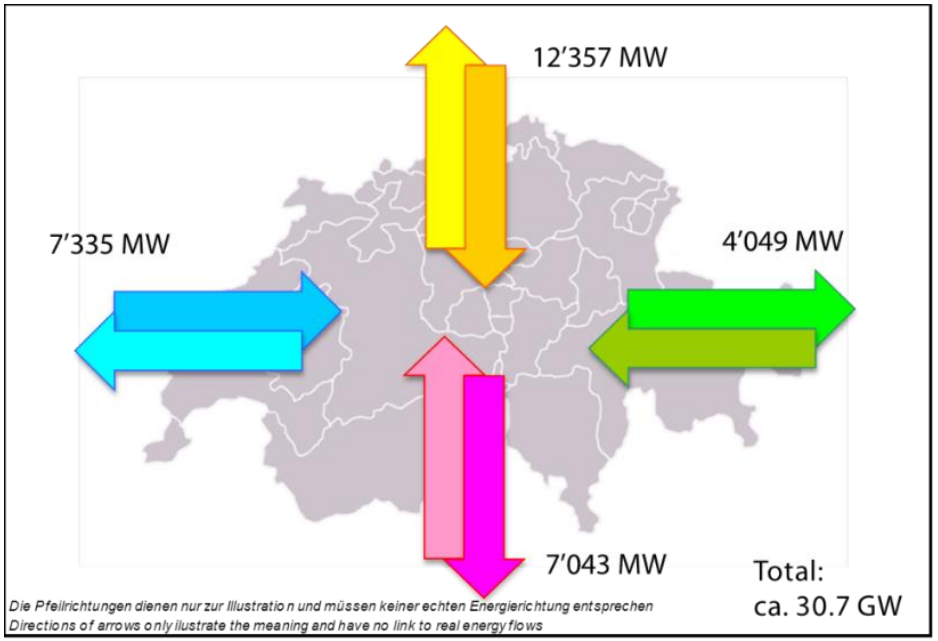
$$\sum_{wn} Reserve_{wn} \geq reserve\_size$$

$Storage_{t,wn} \geq Reserve_{wn}$	$\forall t, wn \; if \; prequalified$
$capacity_{wn} reserve\_hours \geq Reserve_{wn}$	$\forall t, wn \; if \; prequalified$

Scenarios for unforeseeable events

Autarky Situation:

- No imports possible for some time
- Critical time = March/ April



Results - Autarky

Overview:

Storage reserve (GWh)	Autarky Duration (hours in March/ April)	Lost Load (GWh)	Reserve price (EUR/MWh)
0	300	0	0
0	700	319	0
100	700	316	3.4
250	700	216	17.1
1’000	700	0	19.3

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- Short autarky = no storage reserve required

Results - Autarky

Overview:

Storage reserve (GWh)	Autarky Duration (hours in March/ April)	Lost Load (GWh)	Reserve price (EUR/MWh)
0	300	0	0
0	700	319	0
100	700	316	3.4
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1'000	700	0	19.3

- Long autarky = could lead to critical situations (realistic?)

Results - Autarky

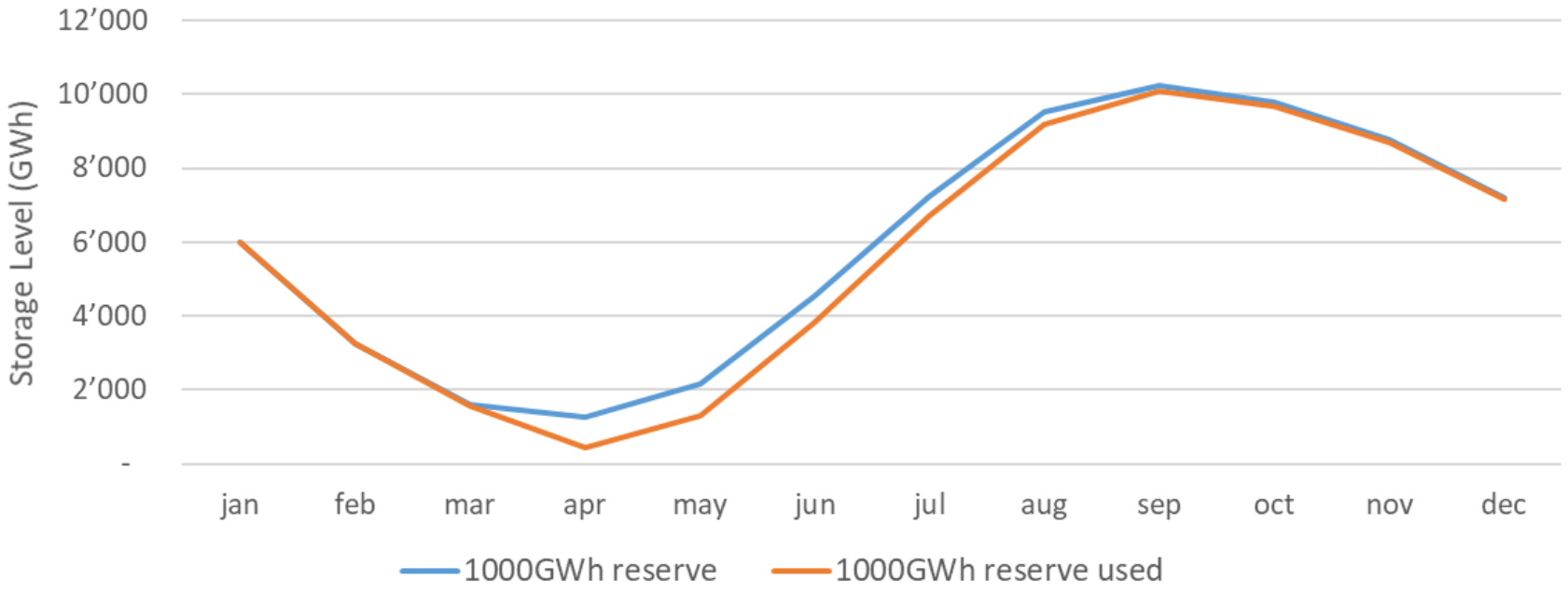
Overview:

Storage reserve (GWh)	Autarky Duration (hours in March/ April)	Lost Load (GWh)	Reserve price (EUR/MWh)
0	300	0	0
0	700	319	0
100	700	316	3.4
250	700	216	17.1
1'000	700	0	19.3

- Long autarky = storage reserve can help if properly designed

Results - Autarky

Storage Reserve 1000 GWh:



Conclusion

- **In general, storage reserve not needed for “realistic” scenarios**
- **Question: what are realistic unforeseeable events in which a storage reserve would be required?**
- **For e.g. long lasting import constraints, storage reserve can help**
- **Proper design (sizing) needed in relation to assumed ‘crisis’**
  → likelihood of large unused reserve

- Open points:
  - Impact of dry years and strategic behavior