

EPFL



Grid and Flexibility Services: An Overview of the Swiss scenario

IEA HYDRO, Annex IX online workshop

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Presenter: Dr Elena Vagnoni, EPFL

- Swissgrid (Swiss system operator) organises the following ancillary services as part of its legal obligations:
 - ❖ Frequency control (primary, secondary and tertiary control)
 - ❖ Voltage support
 - ❖ Compensation of active power losses
 - ❖ Black start and island operation capability
 - ❖ System coordination
 - ❖ Operational measurement

- Switzerland is part of the European interconnected grid in accordance with the technical specifications of the European Network of Transmission System Operators for Electricity ENTSO-E (UCTE1).

- Swissgrid has been purchasing ancillary services since 1st January 2009. The contract scenario with the providers envisages signing a framework agreement following a technical and operational appraisal (prequalification) of providers and their power stations. On this basis, providers are then eligible to bid for the ancillary service in question.

Different Timescales of Power System Flexibility

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Flexibility type	Short-term			Medium term	Long-term	
Time scale	Sub-seconds to seconds	Seconds to minutes	Minutes to hours	Hours to days	Days to months	Months to years
Issue	Ensure system stability	Short term frequency control	More fluctuations in the supply / demand balance	Determining operation schedule in hour- and day-ahead	Longer periods of VRE surplus or deficit	Seasonal and inter-annual availability of VRE
Relevance for system operation and planning	Dynamic stability: inertia response, voltage and frequency	Primary and secondary frequency response	Balancing real time market (power)	Day ahead and intraday balancing of supply and demand (energy)	Scheduling adequacy (energy over longer durations)	Hydro-thermal coordination, adequacy, power system planning (energy over very long durations)
Status in Switzerland:	Defined products or mechanisms	Limited	Yes	Yes	Yes	
	Compensation	Partly	Partly	Yes	Yes	
	Hydro contribution	Limited	Yes	Yes	Yes	



Time Scales: Sub-Seconds to Seconds

Flexibility type	Short-term
Time scale	Sub-seconds to seconds
Issue	Ensure system stability
Relevance for system operation and planning	Dynamic stability: inertia response, voltage and frequency

Market	Grid Services / Products	Mechanisms
CH	Dynamic Stability: <ul style="list-style-type: none"> - No specific market services for short term flexibility (inertia); - No Fast Frequency control in continental Europe - Mandatory voltage control 	Voltage control: Contractually regulated in the company agreements. Every directly connected partner to the transmission grid is obliged to participate in voltage support. Remunerated: about 3 CHF/Mvar in 2019. About 13.5 TVArh per year.

✓ Hydro participates to inertia support and voltage control



Primary control:
0.5 min after outage

- Frequency measurement at power plants
- Automatically activated at the generator of the power plant
- Europe-wide



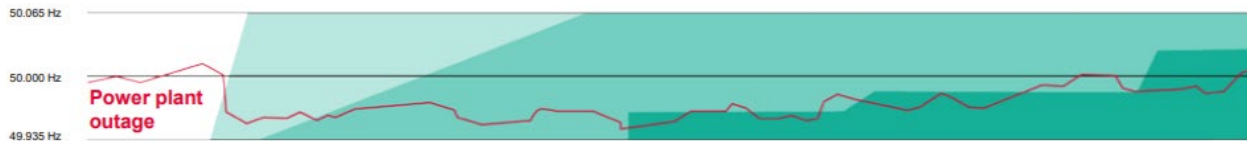
Secondary control:
5 min after outage

- Measurement at the Swiss border lines
- Activated by the central grid controller at Swissgrid
- Switzerland-wide



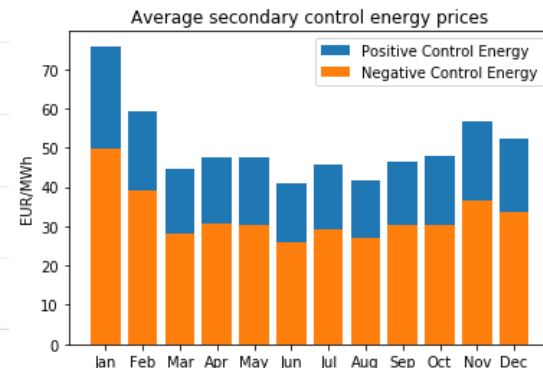
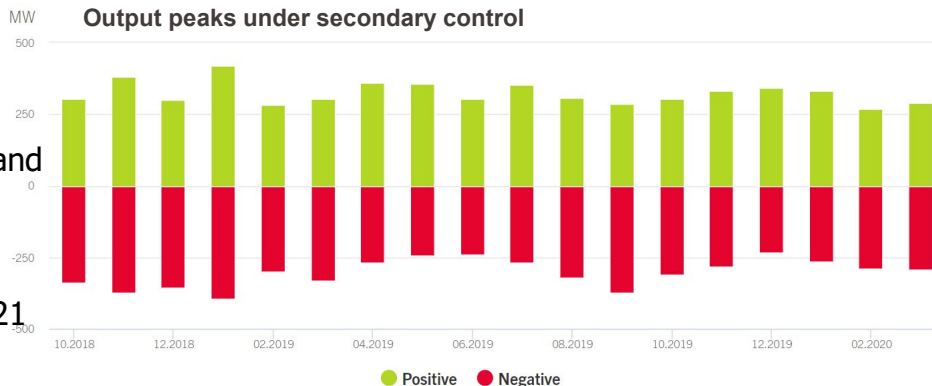
Tertiary control:
15 min after outage

- Emergency assistance contracts with individual providers abroad
- Relief of the secondary control
- Activated by the Swissgrid dispatcher



Flexibility type	Short-term
Time scale	Seconds to minutes
Issue	Short term frequency and voltage control
Relevance for system operation and planning	Primary and secondary frequency response Voltage control

Market	Grid Services/Products	Mechanisms
CH	Primary frequency control (Frequency Containment Reserve: FCR)	Combined auction between from Belgium, Denmark, Germany, France, Netherlands, Austria and Switzerland (international tendering process). Swiss Contribution: ± 61 MW (required per year). Remunerated per capacity, no for energy.
	Secondary frequency control (Automatic Frequency Restoration Reserve aFRR);	Markets on a national level and coordinated internationally through the International Grid Control Cooperation (IGCC). Bid structure: Minimum output windows of ± 5 MW, multilevel bids permitted, each incrementally ± 1 MW at different prices (week-ahead and day-ahead, requests are continuous, centrally coordinated pro rata for proposed offers). Approx. ± 400 MW (year 2019).
	Extra-mandatory voltage support	Bilateral agreements in which the bidder undertakes to provide the contractually defined capacity of reactive power



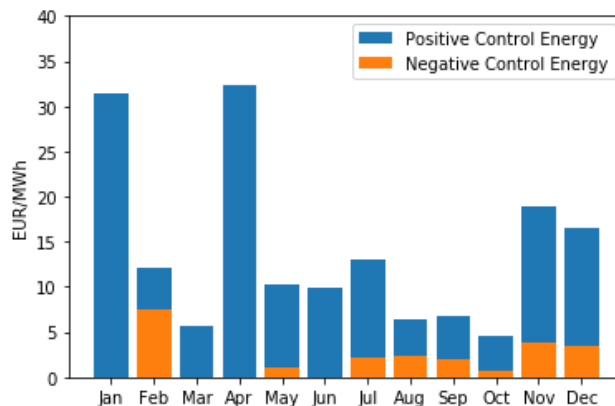
- ✓ Hydro partially participates to FCR and aFRR.
- ✓ New aFRR market platform in Europe: PICASSO by end 2021 (CH is evaluating to participate).

Time Scales: Minutes to Days

Flexibility type	Short-term	Medium term
Time scale	Minutes to hours	Hours to days
Issue	More fluctuations in the supply / demand balance	Determining operation schedule in hour- and day-ahead
Relevance for system operation and planning	Balancing real time market (power)	Day ahead and intraday balancing of supply and demand (energy)

Market	Grid Services / Products	Mechanisms
CH	Minutes to hours: - Tertiary control: Restoration Reserve (RR) - Black start	- RR: national tendering offers. Bid structure: Minimum output windows of +5 MW or -5 MW, multilevel bids permitted, each incrementally ±1 MW at different prices (week-ahead and day-ahead, requested by email or call); Energy request: integrated market for products that can be requested manually in the framework of TERRE platform. Bid structure: Minimum output windows of +5 MW or -5 MW, max 100 MW (hourly, requests are in accordance with proposed energy price each 1 hour prior to the delivery interval); Approx. +400 MW and -260 MW (year 2019). - Black start: Bilateral agreements and via an invitation to tenders.
	Hours to days: Energy balance	Call for tender (Day-ahead and intraday market). Approx. 650 GWh per year

- ✓ Hydro participates to RR, black start (if capable) and energy balance.
- ✓ New RR market platform in Europe and CH: MARI by end 2021 to cover manual FRR (12.5 - 15 min time framework).



Average tertiary control energy prices

Source: Swissgrid

Flexibility type	Long-term	
Time scale	Days to months	Months to years
Issue	Longer periods of VRE surplus or deficit	Seasonal and inter-annual availability of VRE
Relevance for system operation and planning	Scheduling adequacy (energy over longer durations)	Hydro-thermal coordination, adequacy, power system planning (energy over very long durations)



Market	Grid Services / Products	Mechanisms
CH	<ul style="list-style-type: none"> – Compensation for active power losses; – System coordination (grid management and control, coordination of international energy exchange programs, congestion management); – Balance group and compensation management; – Operational measurement 	<p>Call for tender (based on the daily active power loss forecast) with month-ahead delivery. It is issued monthly on the fourth Wednesday. Bids are accepted for each 5 MW delivery. Approx. 1000 GWh per year.</p>

- ✓ Hydro participates to compensation for active power losses and congestion management.



Summary

- ❖ A number of different products and mechanisms that provide system flexibility do exist across different times scales.
- ❖ Sub-second to second services lack of a dedicated market
- ❖ Specific markets for frequency control exist and new European energy markets are going to be launched by the end of 2021.
- ❖ Voltage control, black starts and long term energy balance are remunerated by following bilateral agreements.
- ❖ Hydropower is key player in Switzerland for grid support.

Many Thanks for
your Kind Attention!

