Key regional challenges for hydropower – Alpine region

A revival for the first historical renewable flexible asset in an adapted European energy market design : potentials, challenges and barriers

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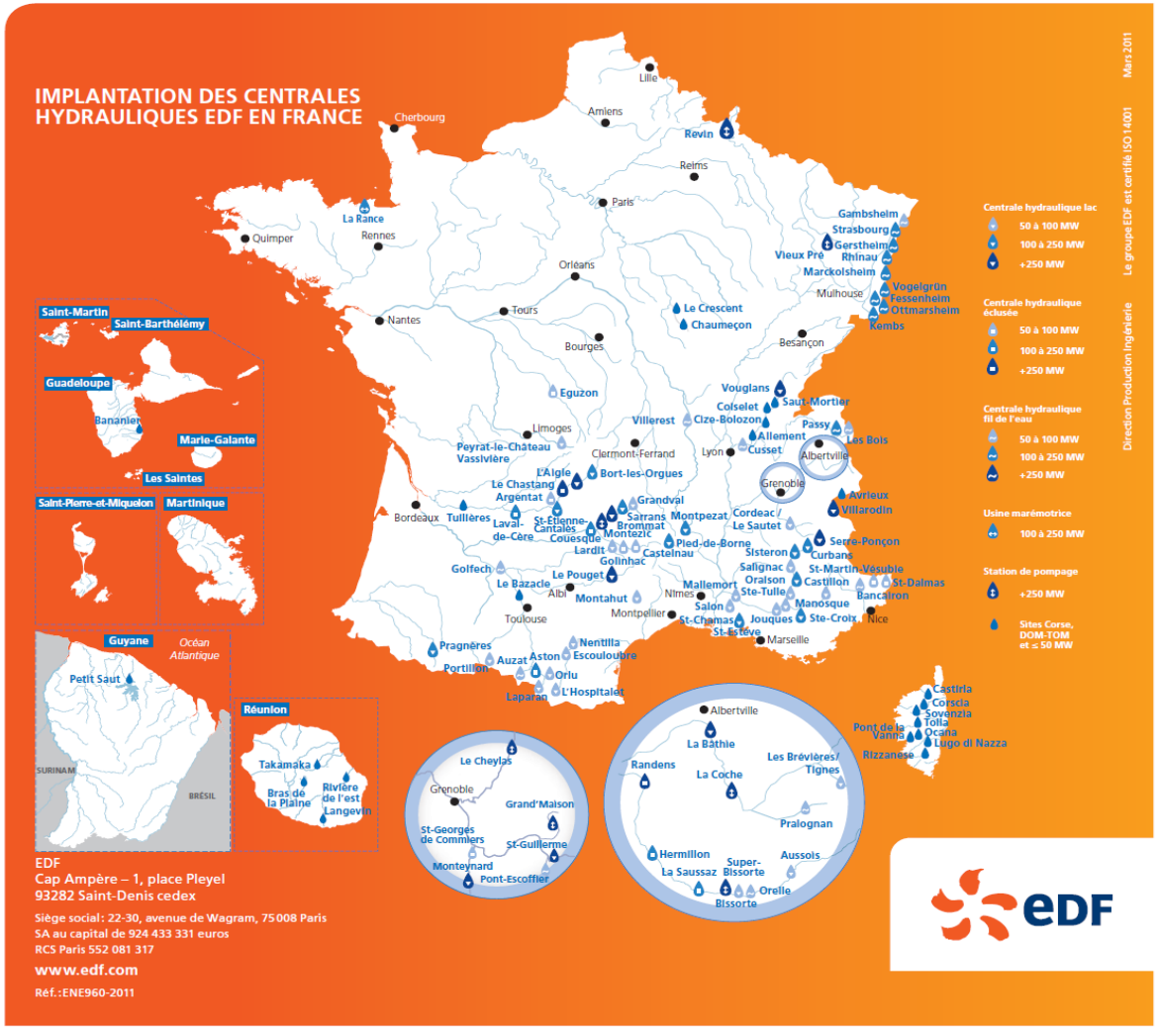
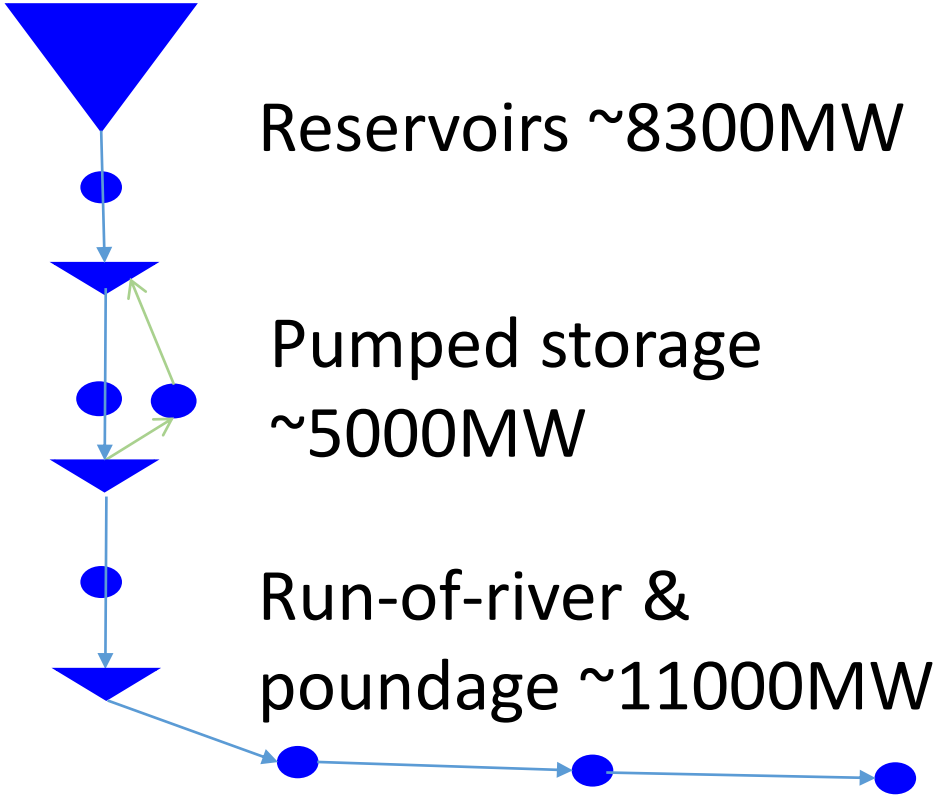
EERA Hydropower Kickoff - 09/09/2019

Introduction - HydroPower in France



Intalled capacity 2019 France

(source RTE)

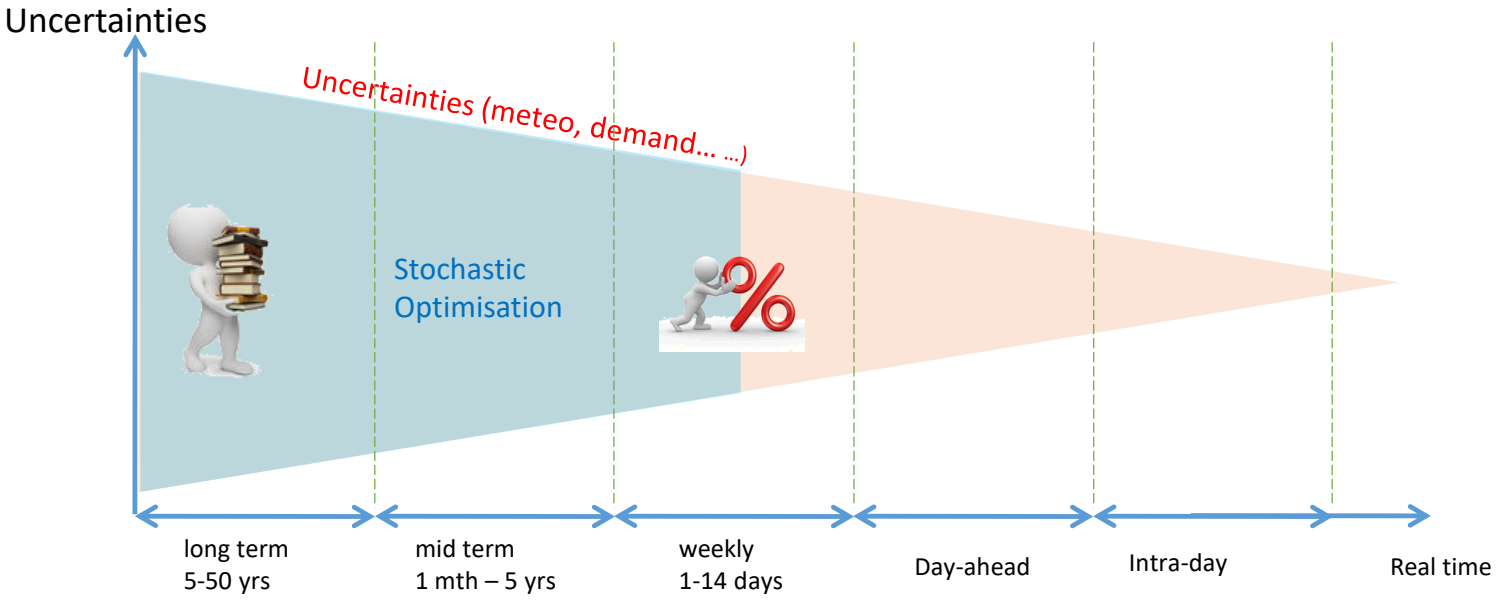


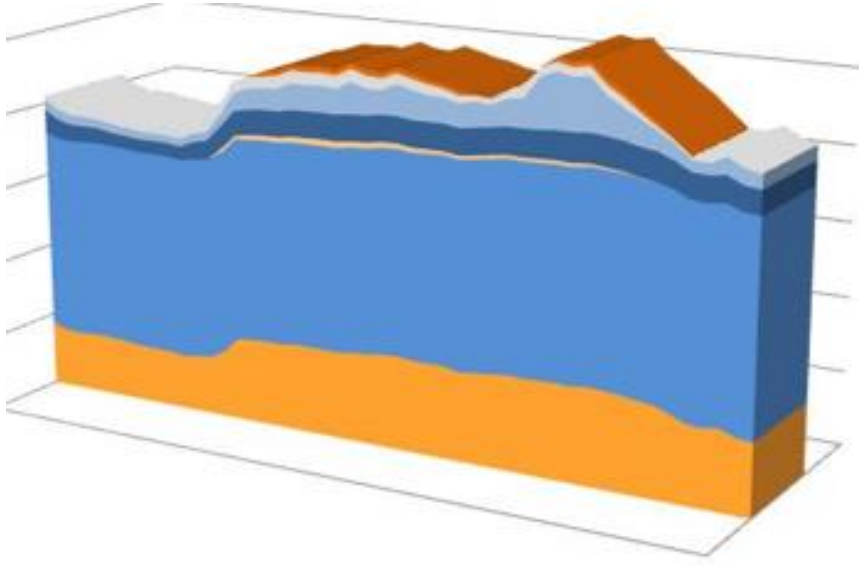
Reservoirs ~8300MW

Pumped storage ~5000MW

Run-of-river & poundage ~11000MW

An overview of current flexibilities provided by Hydropower





Reservoirs, Seasonal Storage

Weekly poundage and Pumped Storage

Day ahead Dispatch

Intra-day dispatch

Ancillary services: FCR & FRR

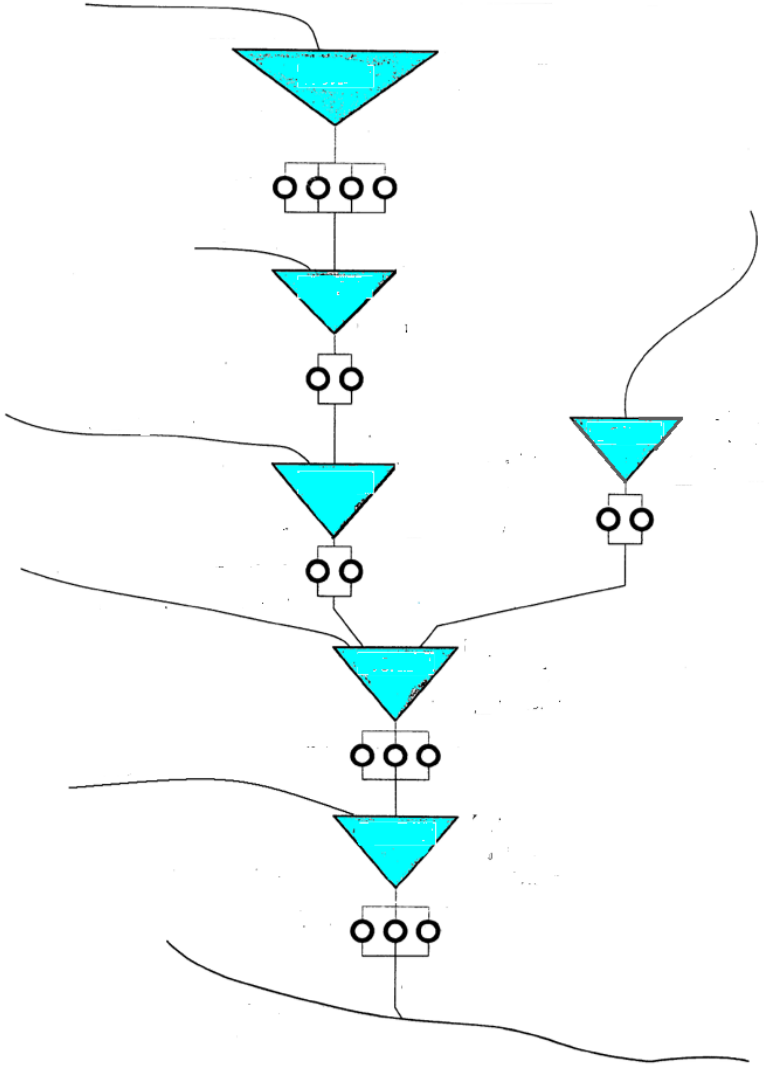
Some related Optimization Problems – still an active research topic

Mid-term =>Seasonal Storage Valuation

$$\min_{x \in \mathfrak{M}} \mathbb{E}\left[\sum_{k=1}^{n} C_k^{\pi}(\varepsilon_k, x_k)\right]$$

- *non anticipative decisions* $x_k = X_k(v_k, \varepsilon_k)$
- *dynamical constraints* $v_{k+1} = f(v_k, \varepsilon_k, x_k)$
- *Volumes constraints*
- *Ramping limits*
- *…*

Short-term => Day-Ahead Dispatch



Research challenges : Increasing Hydropower flexibilities

SoFLEXhy demonstrator

Virtual Power Plant including:

- Cascaded Hydro-plants (Durance river)
- Solar Farms

➡ ***Integration of stable renewable energy***

EDF

Research challenges : Increasing Hydropower flexibilities

XFLEX HYDROPOWER EXTENDING POWER SYSTEM FLEXIBILITY

Grand-Maison demonstrator

Simultanous use of pumps and turbine for enhanced flexibility services

➡ ***Provision of secondary reserve (aFRR)***

Research challenges : Increasing Hydropower flexibilities

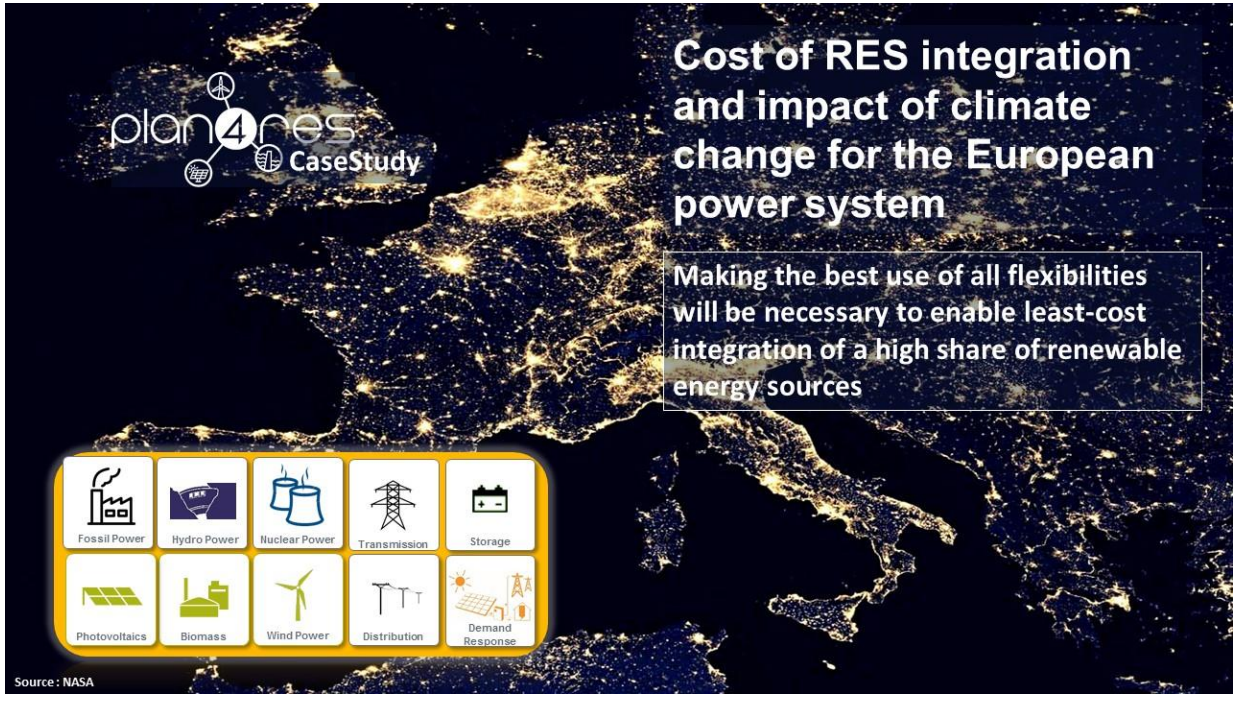
XFLEX HYDROPOWER EXTENDING POWER SYSTEM FLEXIBILITY

Vogelgrun demonstrator

Hybridation of a run-of-river hydro unit with batteries

➡ ***Provision of primary reserve (FCR)***

HydroPower Flexibility valuation ‘in the system’



Integrated simulation models:

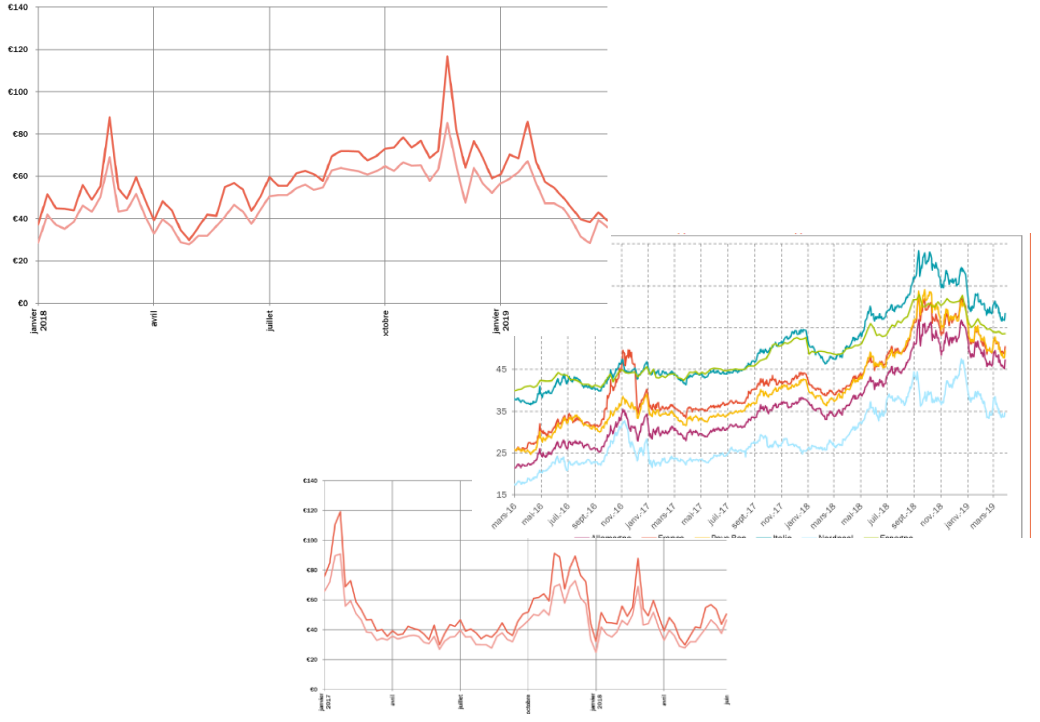
- Detailed (as much as possible) representation of assets
- Clustered transmission
- Simplified Representation of distribution grid
- Including all flexible assets

➡ ***To evaluate the benefits of different flexibilities to the system***

Hydropower Flexibility Valuation ‘in the Market’

Ongoing topics

- *How to value hydropower on markets?*
- *How to design market products that are adapted to the physical constraints of hydropower?*
- *How to design market products that allow long-term risk management for hydropower stakeholders?*



Conclusion

Technological Improvements
(turbines, control, telecom….)

+

Innovative Mangement of assets

+

Enhanced Optimization softwares

+

Adapted Marked Design

Enhanced Hydro flexibility provision for the system