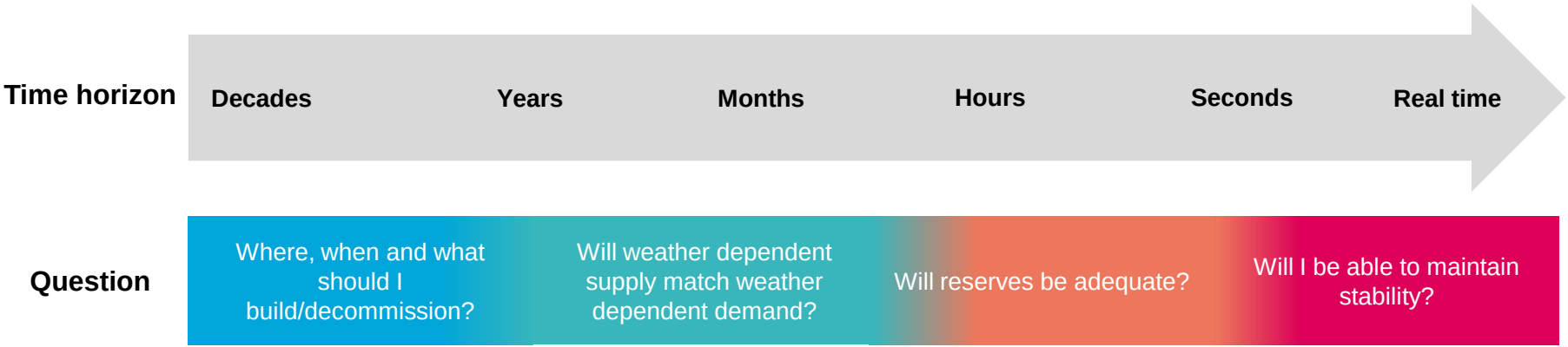
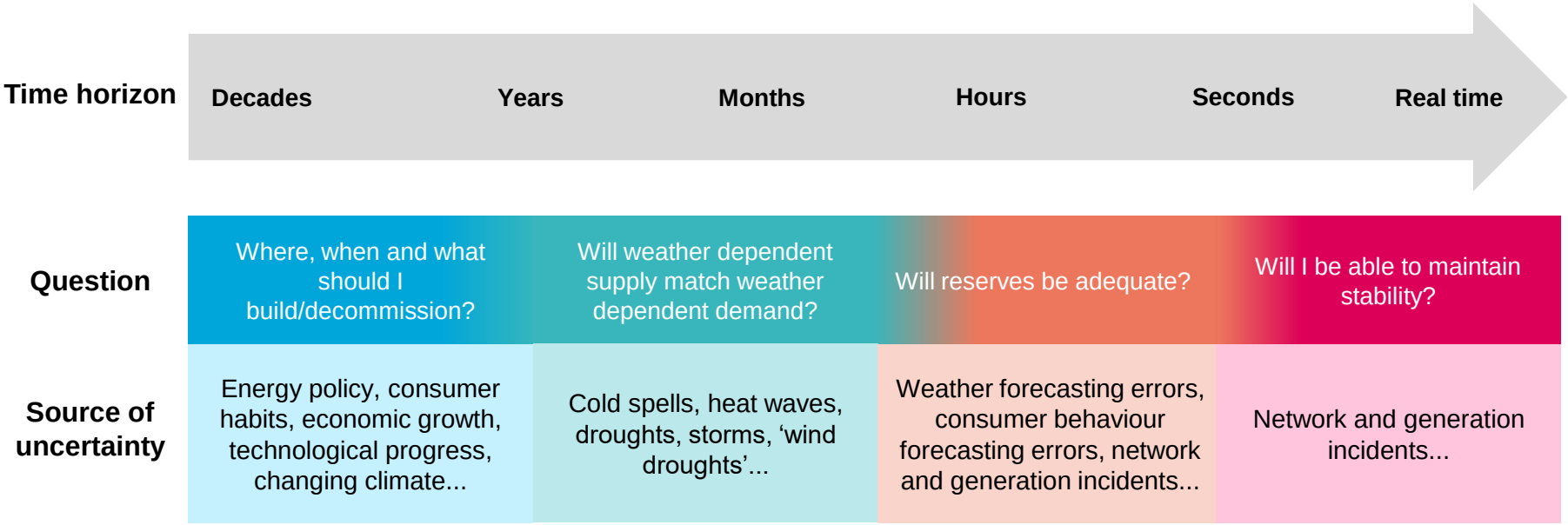
Accounting for uncertainty in power system planning - The OSMOSE approach

12th of August 2020

Power system planning involves asking different questions



Power system planning involves asking different questions



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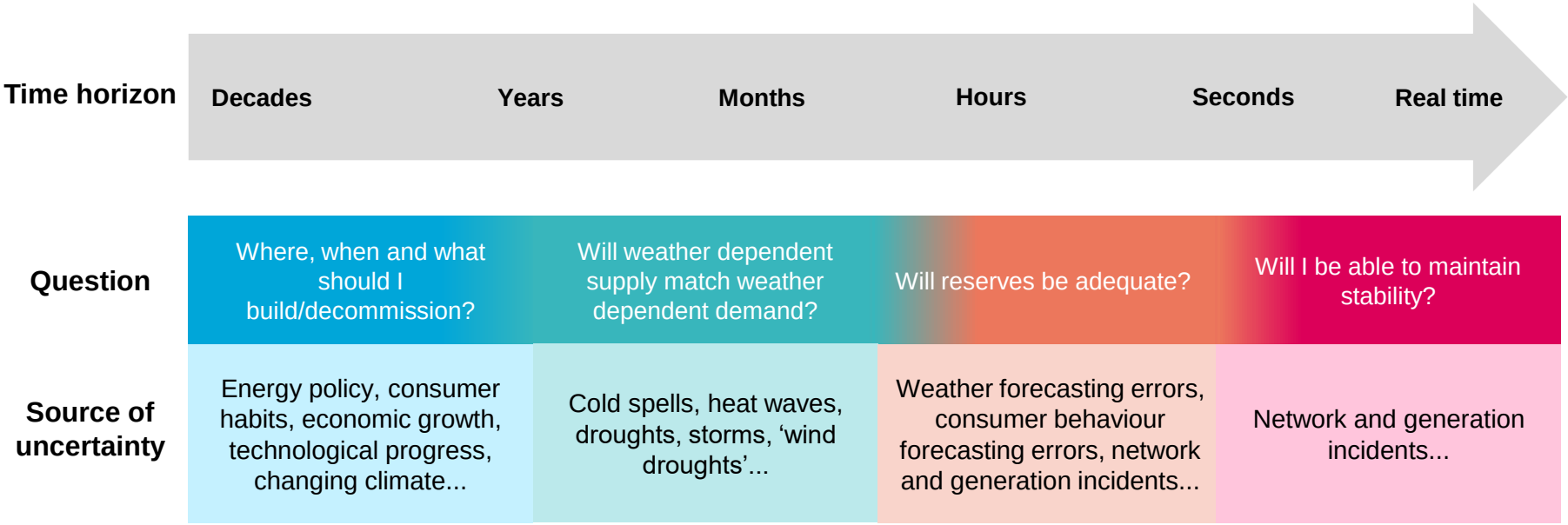
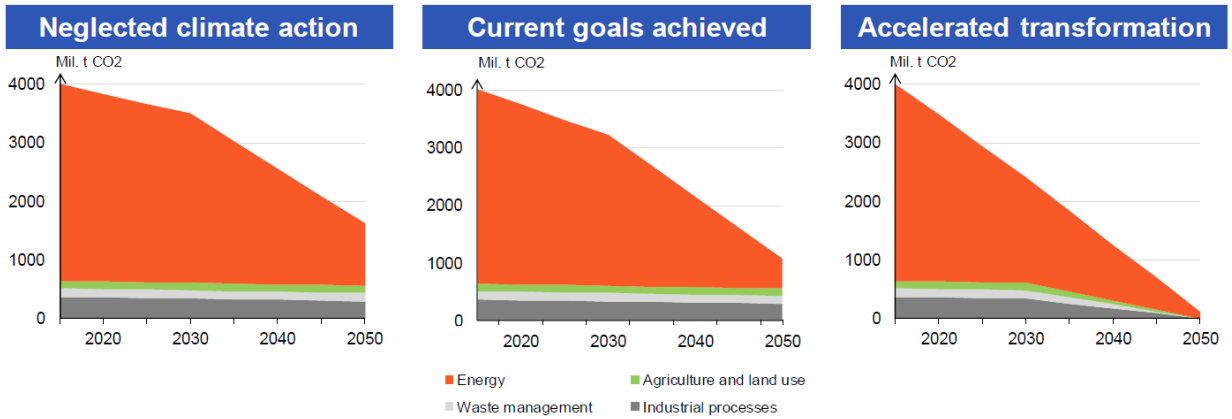


WP1 – Energy system wide scenarios

- The scenarios are not forecasts, but “benchmarks against which new policies can be assessed”.
- Key scenario driver: GHG emissions. These impact rates of electrification and generation portfolios.
- Also vary final energy demand and fuel prices.



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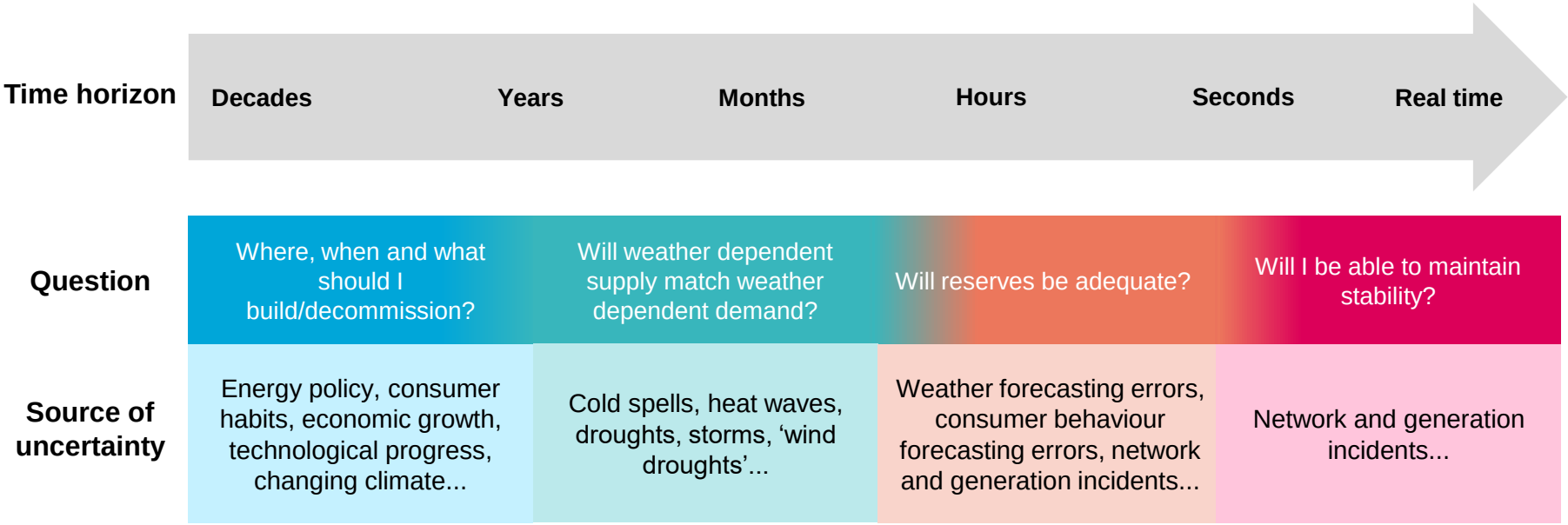
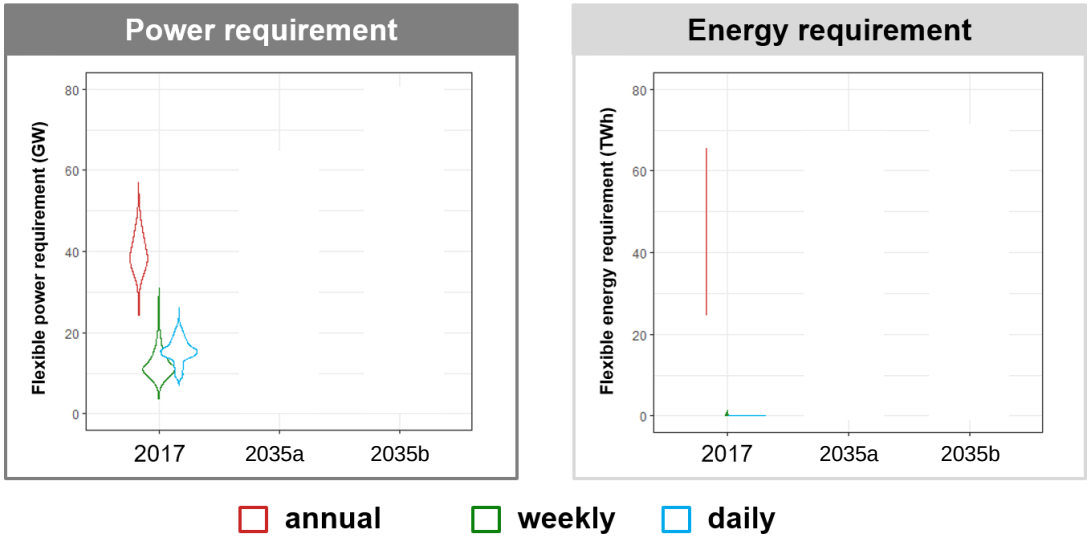


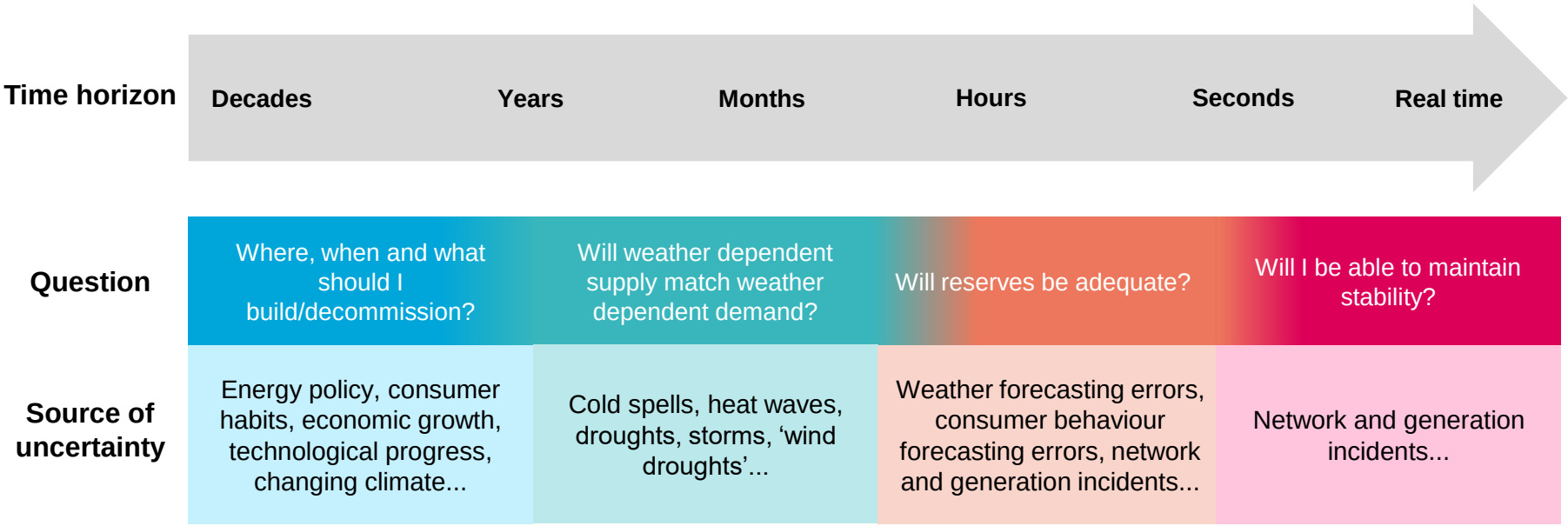
WP1 – Many weather years expressing correlations



Flexibility requirement quantification for the French power system

Electricity balancing is increasingly dependent on weather conditions. We need to consider more cases than previously, and express correlations within data.

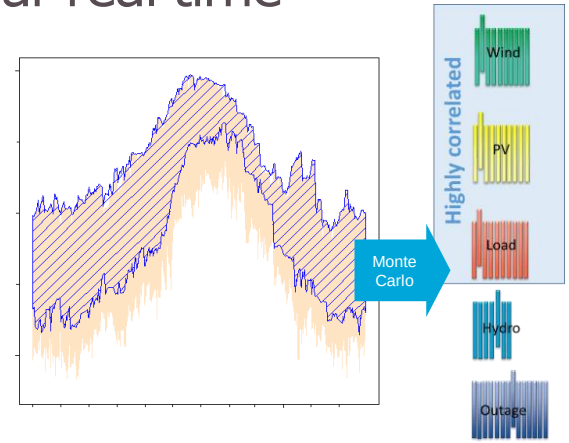
Power system planning involves asking different questions

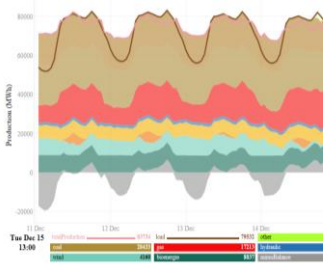


WP2 – effects of uncertainty near real time

Monte-Carlo dispatch (WP1)

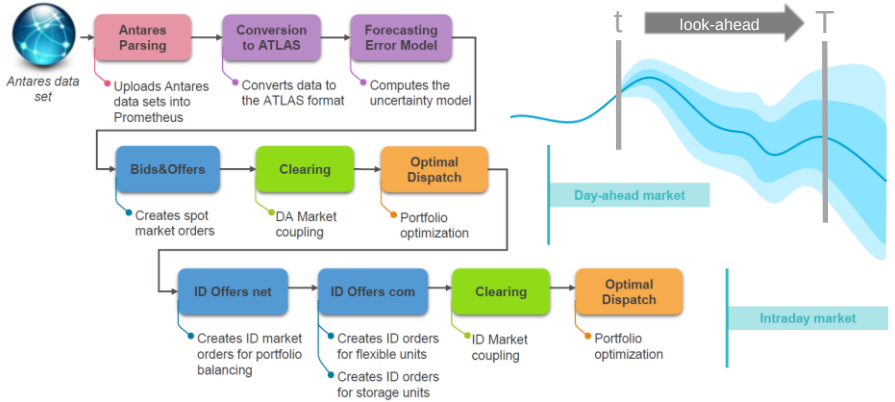
- What is the optimal flexibility mix with:
  - Medium term uncertainty ?
  - Full availability of flexibility levers ?
  - Centralised optimisation





Agent-based simulation (WP2)

- Consequences of:
  - Short-term/RT uncertainty on forecast ?
  - Limited availability of flexibility levers due to activation times ?
  - Market/Operation rules to « get there » ?



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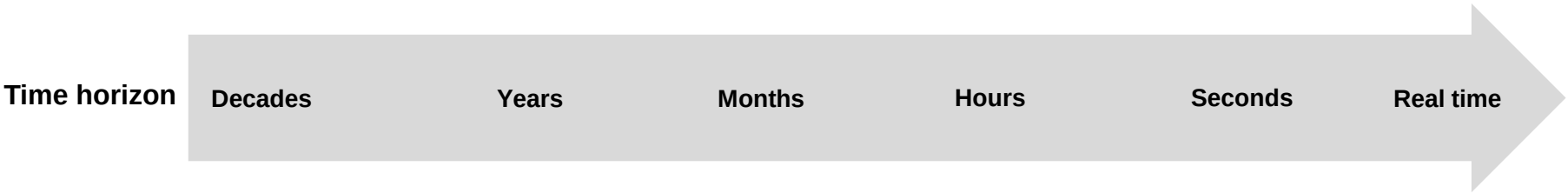
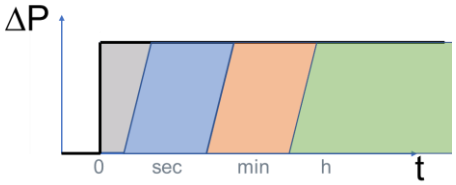
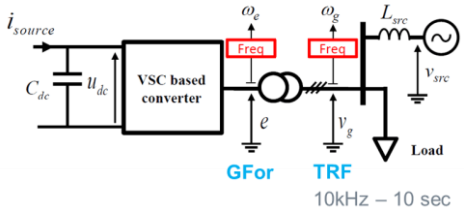


Question	Where, when and what should I build/decommission?	Will weather dependent supply match weather dependent demand?	Will reserves be adequate?	Will I be able to maintain stability?
Source of uncertainty	Energy policy, consumer habits, economic growth, technological progress, changing climate...	Cold spells, heat waves, droughts, storms, 'wind droughts'...	Weather forecasting errors, consumer behaviour forecasting errors, network and generation incidents...	Network and generation incidents...
Modelling approach	Scenarios	High number of Monte Carlo years	Agent-based simulation for near RT uncertainty	Grid-forming will do the trick!

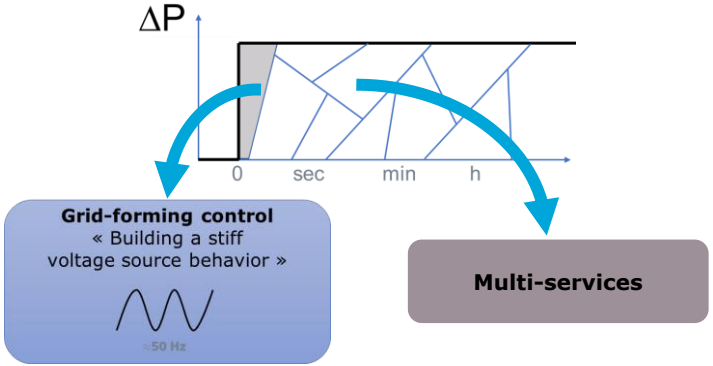
WP3 - Build foundations for flexibilities with Grid-forming control



***Historically**: short term stability mainly ensured by natural inertia (rotating masses)*



***H2020 Migrate project**: stability in a power system mainly supplied by power electronics connected VRES sources not anymore a blocking issue thanks to grid forming control*



***OSMOSE WP3**: proposed technical solutions to be tested in situ with other multi-services*

Historical assumption: long-term issues drive power system development, the rest will follow

Time horizon	**Decades**	**Years**	**Months**	**Hours**	**Seconds**	**Real time**
Question	Where, when and what should I build/decommission?	Will weather dependent supply match weather dependent demand?	Will reserves be adequate?	Will I be able to maintain stability?		
Modelling approach						

OSMOSE: build feedback loops between models

Time horizon

Decades | **Years** | **Months** | **Hours** | **Seconds** | **Real time**

Question

Where, when and what should I build/decommission?	Will weather dependent supply match weather dependent demand?	Will reserves be adequate?	Will I be able to maintain stability?

Modelling approach

Additional remarks on Q&A

Can Power-to-gas be considered as a long-term "super-battery"?

Expected behaviour

- Short-term flexibility sources "cannibalized" by long-term ones ("trickle down" effect)

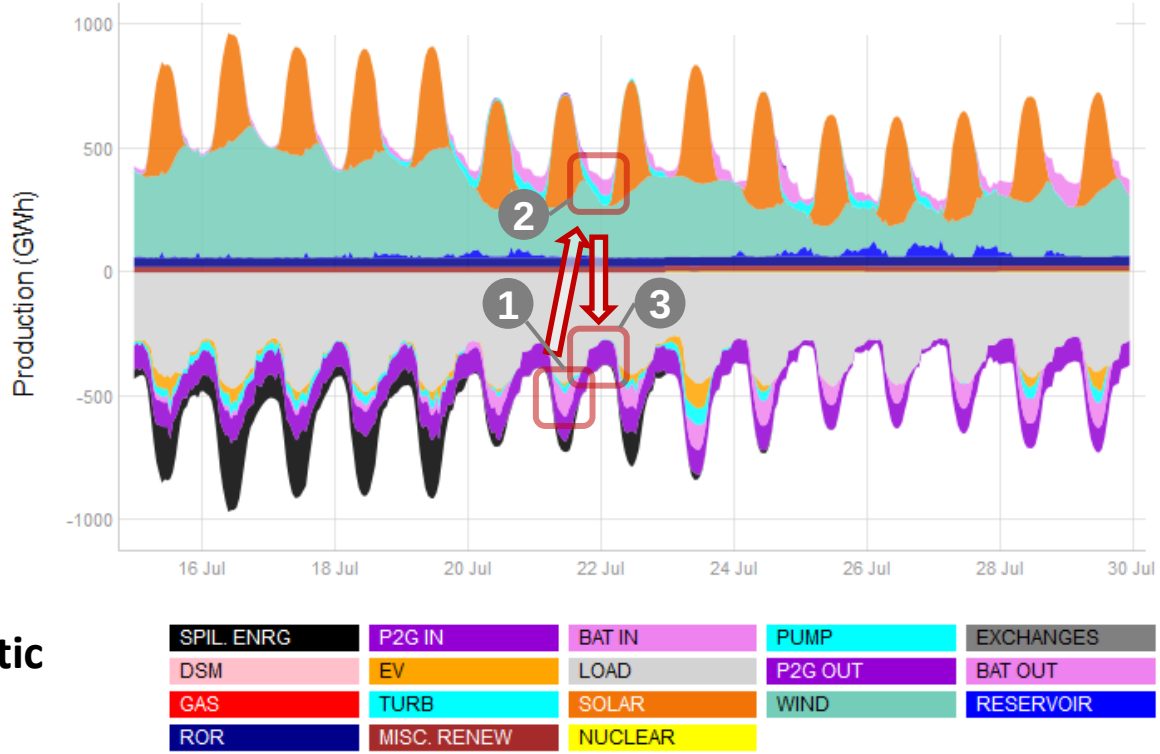
"Unexpected" flex. interplay

- Batteries and PSH used (daily cycle) to allow P2G to run outside sunny hours (seasonal storage)
- => LT/ST cooperation increasing P2G production without additional capacity

Major benefit of using an holistic approach of flexibility!

Hourly generation and load stacks

Current Goals Achieved 2050 - year number 11



Covid-19: how to take into account shocks in prospective studies?

- As a TSO, RTE in concerned by this crisis. In France, the decrease of national load due to Covid-19 was sharp.
  - link (in French) for further information:
    https://assets.rte-france.com/prod/public/2020-06/Analyse_preliminaire_hiver_2020-2021_-_VFinale-pdf.pdf
    https://www.strategie.gouv.fr/point-de-vue/impacts-de-crise-covid-19-systeme-electrique

- For RTE, the modeling of shocks in prospective studies is a new field of study.
- This approach has already been tested in a POC cross-sectorial adequacy study (gas-electricity), to assess the impact on the Loss Of Load of a geopolitical crisis affecting the supply of natural gas to Europe.