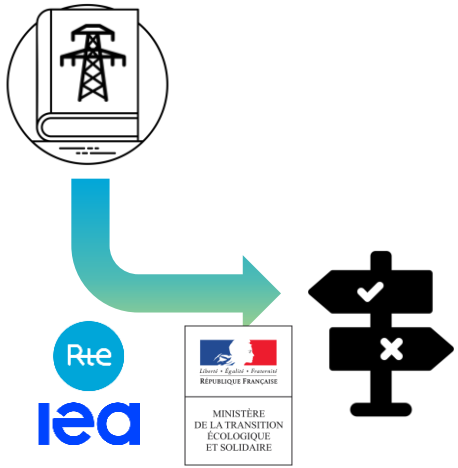
Opening statement for the session *"Future pathways depending on system contexts"*

Synchronous inertia: a R&D question but also a key aspect in the debate about technical feasibility of scenarios with high share of iRES

- **Inertia / power system stability** is the technical parameter on which conclusions will be the **most robust by mid-2020**, compared to all the other technical dimensions (security of supply, operational reserves, network adaptation)
- In particular, the solutions to ensure inertia which can be discussed today seem **less subject to climate change than other aspects of future power systems modelling**
  - Synchronous condensers with thermal-like power plants, possibly affected by climate change
  - Or power electronics providing for instance grid-forming



- A **wide scientific literature** exists on the topic, showing that it is a relevant **question even for shares of variable RES quite far below 100%**
- There seems to be a **consensus on the theoretical feasibility in principle but discussions on the precise way forward**
  - Evolution versus revolution compared to today's power system management (during European transition: synchronous condensers versus deployment of grid-forming?)
- It is **important to inform policy makers about options and trade-offs,** and to test the practicalities (demonstrators, pilot regions, network codes, economic conditions) and **fine-tune technical requirements and cost estimations**

Appendix

100% RES scenarios raise 3 main questions for any power system

- The **IEA-RTE study** should address the question of the **technical feasibility** of 100% RES scenarios which has not yet been fully covered in the French public debate

1 Technical feasibility

- Management and balance of the power system: operational margin, reserves, …
- Security of supply

2 Desirability

- Society willingness to commit to what a 100% RES scenario implies (way-of-life, environment, security of supply, …)

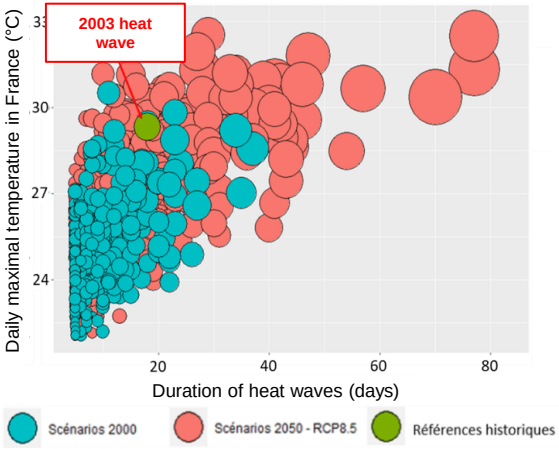
3 Affordability

- Social welfare
- Tariff setting and cost sharing

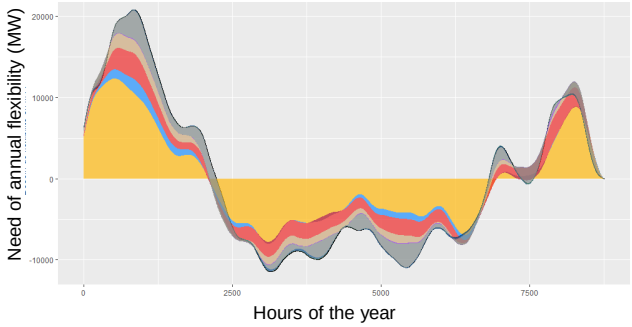
Security of supply will be significantly impacted by climate change and evolution of the mix

- **The question of security of supply in 2050 is now well established in the French public debate**, with numerous publications on this topic (Artelys-ADEME, Carbone 4...)
- In the long term, **the assessment** of security of supply and the **evaluation of long duration storage / flexibility needs will be substantially affected by different changes :**
  - Evolution of the mix and especially development of RES generation,
  - Climate change and major meteorological changes (more heat waves, less cold spells),
  - Evolution of consumers' expectations…

Heat waves



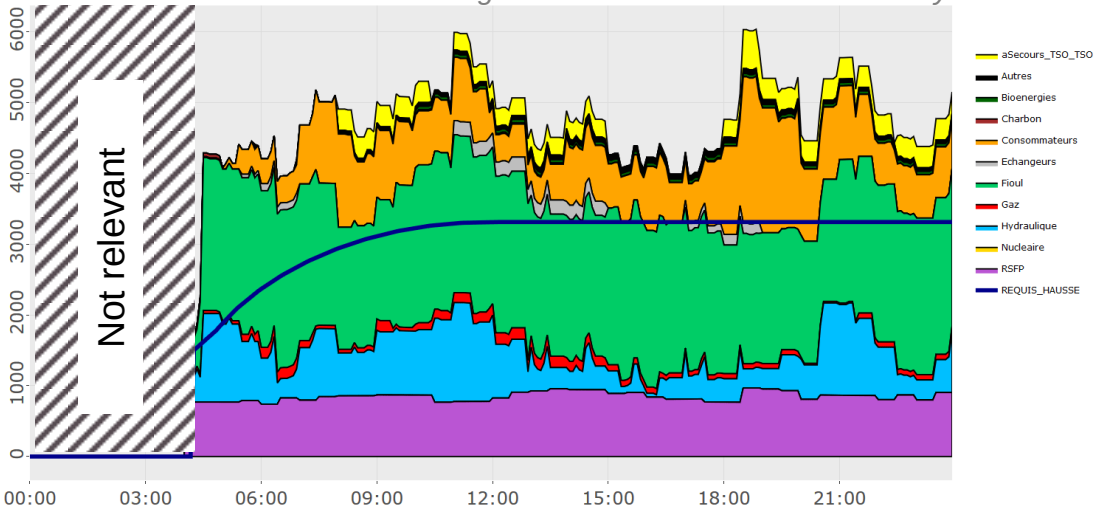
Annual modulation of generators and interco. (2015)



- Taking into account all these changes requires months of work to develop the modelling and include new meteorological data bases
- By mid-2020, the IEA-RTE study could provide intermediate results with **order of magnitudes about capacity needs and solutions** that could provide this service (distributed batteries in EVs, dedicated batteries, decarbonisation of the gas sector with or without sector coupling…)

Operational margins : a 100% RES scenario might also impact the sizing of operational margins and reserves

- **The impact of massive of RES integration on operational margins and reserves is seemingly not in the debate for now**, neither at the French nor at the European level
- The change of generation and flexibility mix as well as a possible increase of dispatchability of RES can substantially **change the available and required operational margins and reserves** (which might also be dependent on the analysis of security of supply, with addition of peakers)

- To date, **little or very specific international feedback** about this topic is available.
- Qualitative results should be available by mid-2020, with some orders of magnitude about :
  - Uncertainties about supply-demand balance from hours to minutes before real time
  - Margins needed to ensure balance of the system.

Available and required contingency margins as seen from 4 a.m. as of today