



# Which electricity storage needs for 2030, 2050 in France?



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- **Public establishment under the joint authority of the Ministries in charge of :**

- *Ecology, sustainable development and Energy*
- *Research*

- **Areas of activity:**

- *Waste management*
- *Transport & mobility*
- *Sustainable city*
- *Energy & Climate*
- *Energy efficiency*

- **Budget:**

- *590 M€, in 2014*
- *3 300 M€, for the « Invest for the future »*

- **ADEME's objectives**

- *Forerunner for the energy & environmental transition*
- *Generalizer of good practices*
- *Expert of the energy & environmental transition*

- **How many, where?**

- *Around 1000 employees*
- *Head offices (Angers, Paris, Sophia Antipolis)*
- *17 regional Directorates*



PARIS2015  
 UN CLIMATE CHANGE CONFERENCE  
 COP21-CMP11



- **Study of energy storage installation potential :**
  - Time horizon: 2030
  - Area: Metropolitan France + Islands
  - Sectors: heat (industry, district heating), electricity

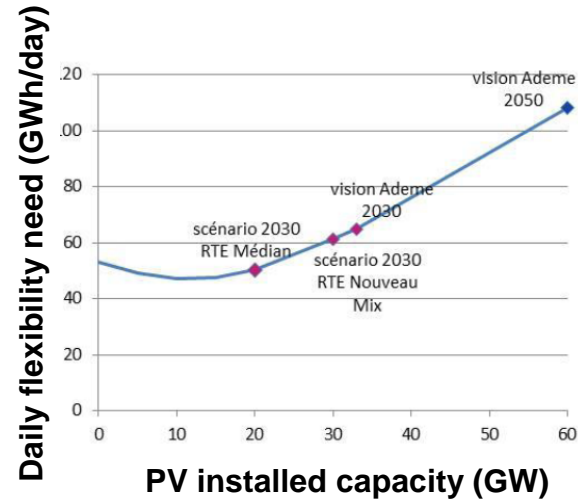
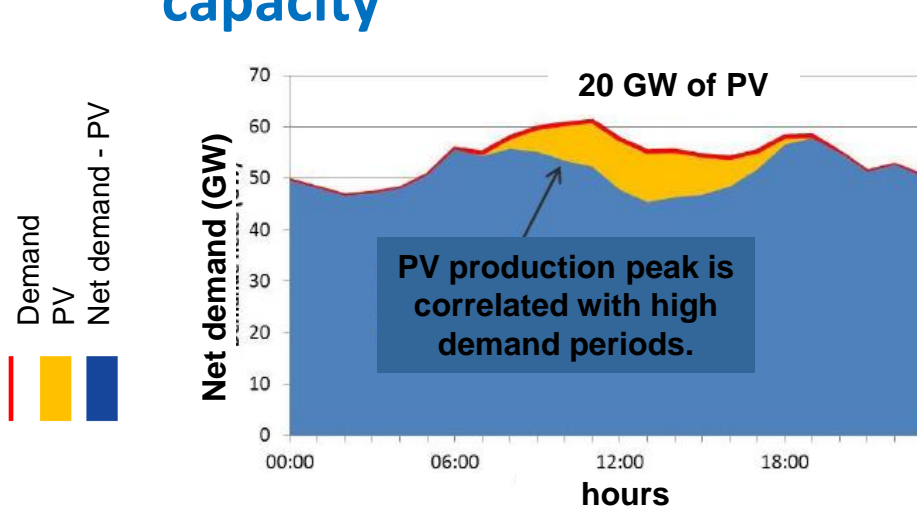


- **A 100% Renewable electricity mix? Analyses & optimisations:**
  - Time horizon: 2050
  - Area: Metropolitan France
  - Sectors: electricity

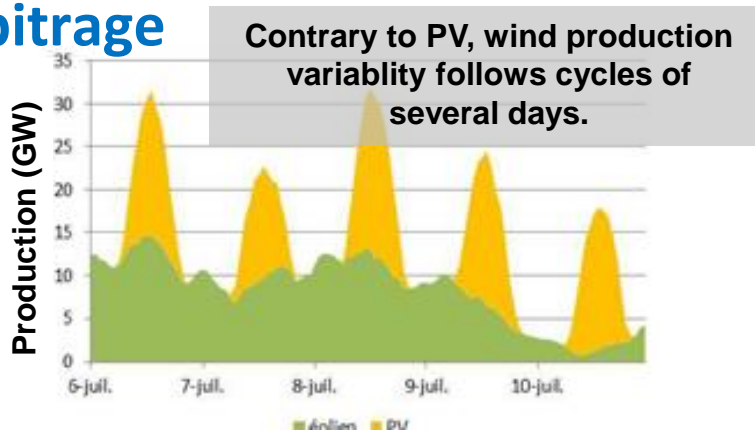


- **In both cases, social welfare approach:**
  - Benefits are calculated for the community as a whole

- The daily flexibility need highly depends on PV installed capacity



- Wind development creates new opportunities of weekly arbitrage



- **New services addressed by local storage:**
  - Congestion relief
  - Voltage support
  - Reduction of failure
- **Costs and constraints:**
  - Distributed storage more expensive than centralized storage
  - Local grid congestions limit national arbitrage opportunities
- **Most often, distributed storage is less profitable than:**
  - Local grid upgrade
  - Renewable peak shedding

... exceptions: islands....

- **The French electric system is already very flexible**
  - **13 GW Hydro + 4,3GW PHS**
  - **13-20 TWh of hot water heaters recharging daily dynamic management**
- **Which best opportunities for 2030?**
  - **1-2 GW of new PHS would be needed**
  - **200-400 MW of distributed storage in Islands**
  - **600MW of spinning reserve**

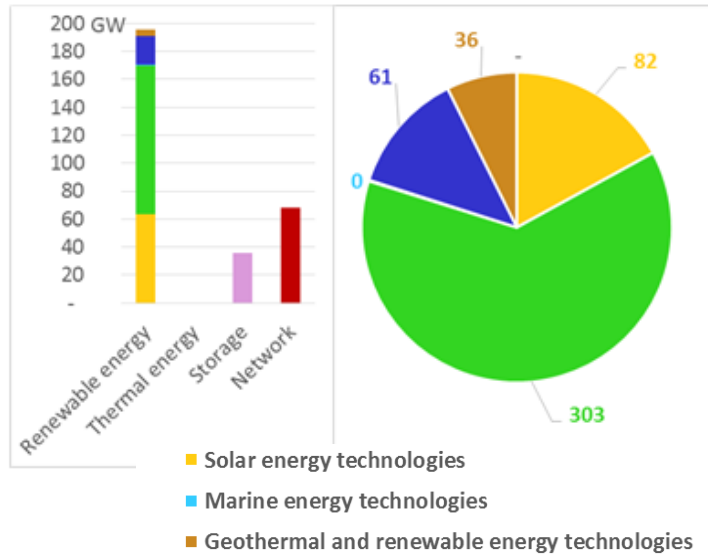
**Question: is it possible to increase the RE share to 80-100% in the French electric system (2050 or later...) ?**

1. How much will it cost ?
2. Which quantity of storage, grid interconnexion ?
3. Which share for each RE source and which distribution among regions ?

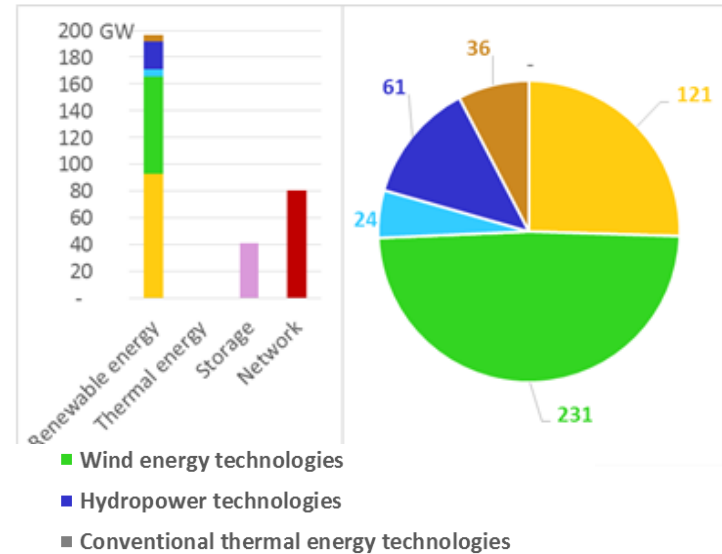
1. **Several mixes can maintain the balance between supply and demand on an hour by hour basis, under multiple constraints**
  - Always mainly based on PV and wind energies
  - Adequacy between supply & demand for 7 weather years, simulated at european level
2. **The overall electricity cost only slightly varies between 40% and 100% renewable,**
  - but mostly depends on demand-side management, social acceptance and technological progress.
3. **Demand flexibility and storage development are essential**
4. **Complementarity between technologies is key**
5. **The transmission network must be reinforced to pool potentials**

- With a constrained social acceptance, the 100% RE mix is different, with less wind, more rooftop PV and marine energies

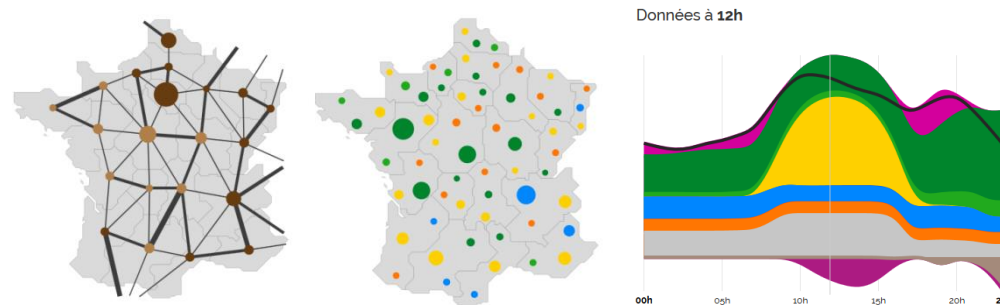
Baseline scenario – 100% renewable energy



100% renewable energy – moderate acceptance



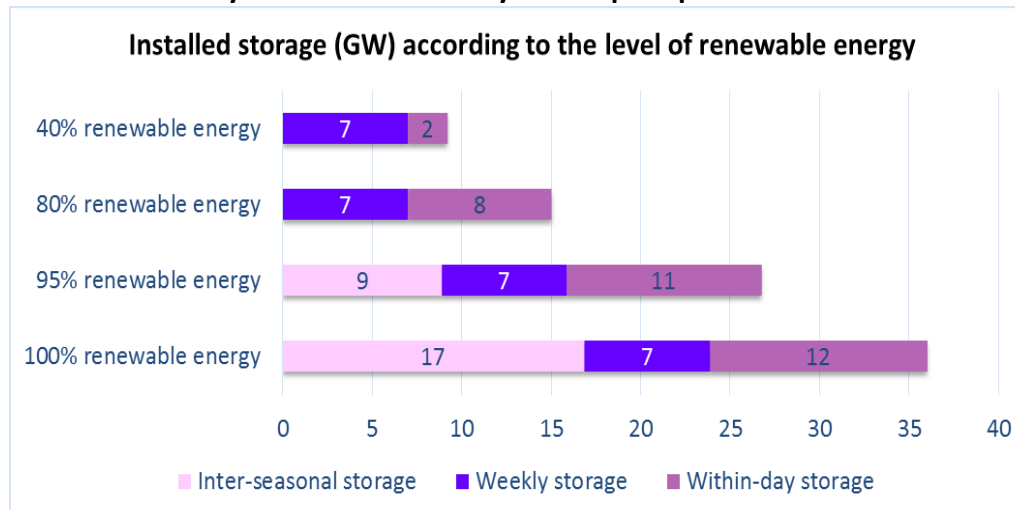
- The hourly balance between demand & supply / The regional distribution





- **The market share of each storage type depends on mix constraints:**

- **Short term storage share increases with PV capacity:** about 20% (8 GW) of PV capacity for mixes above 80% RE.
- **Inter-seasonal storage is not necessary under 80%RE share in the mix, if syngas is used only for electricity mix purpose**



- **Dynamic Demand Side Management and short-term storage provide the same services for the system**

- **High dependency of storage needs with different RE share**
- **Business models should try to aggregate value for most services**
- **Before 2030:**
  - **In metropolitan France, storage potential is quite small**
  - **Strong competition with final energy storage**
  - **Markets: PHS, islands, spinning reserve,**
- **For high share of renewables (>40%)**
  - **Competition between demand side management and daily storage, depending on costs**
  - **Interseasonal storage only necessary above 80 % RE**
- **Limits /other opportunities**
  - **Costs and values assessed from a collectivity point of view**
  - **Some projects could find a business model for specific actors**
  - **Better value for heat storage, eg district heating with CHP**

# Thank you for your attention

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2050 study main report is available on the ADEME website:

<http://www.ademe.fr/a-100-renewable-electricity-mix-analyses-and-optimisations>



A detailed breakdown in hourly intervals:

<http://mixenr.ademe.fr/en>

