Economic value of storage

Workshop on experiences and conditions for successful implementation of storage

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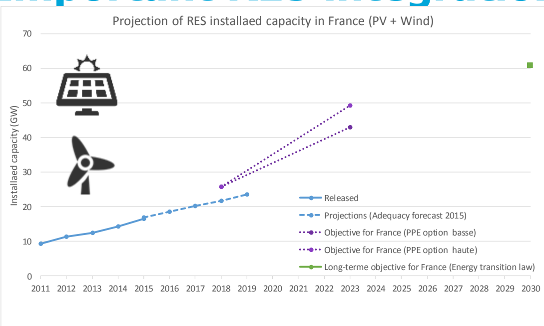
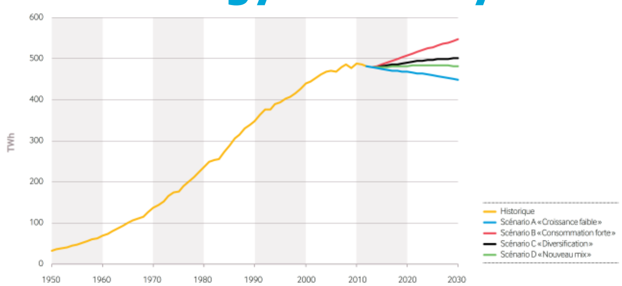
Energy storage technologies : solutions to face the challenges of power systems

Power systems are involved in ambitious energy transition and thus facing major challenges

Important RES integration

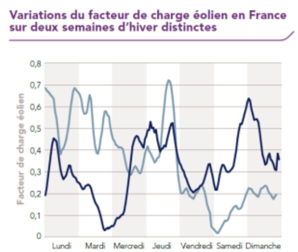


Energy efficiency

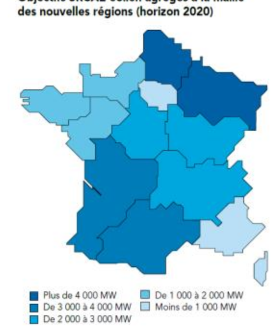


Major challenges :

- Generation pattern and variability



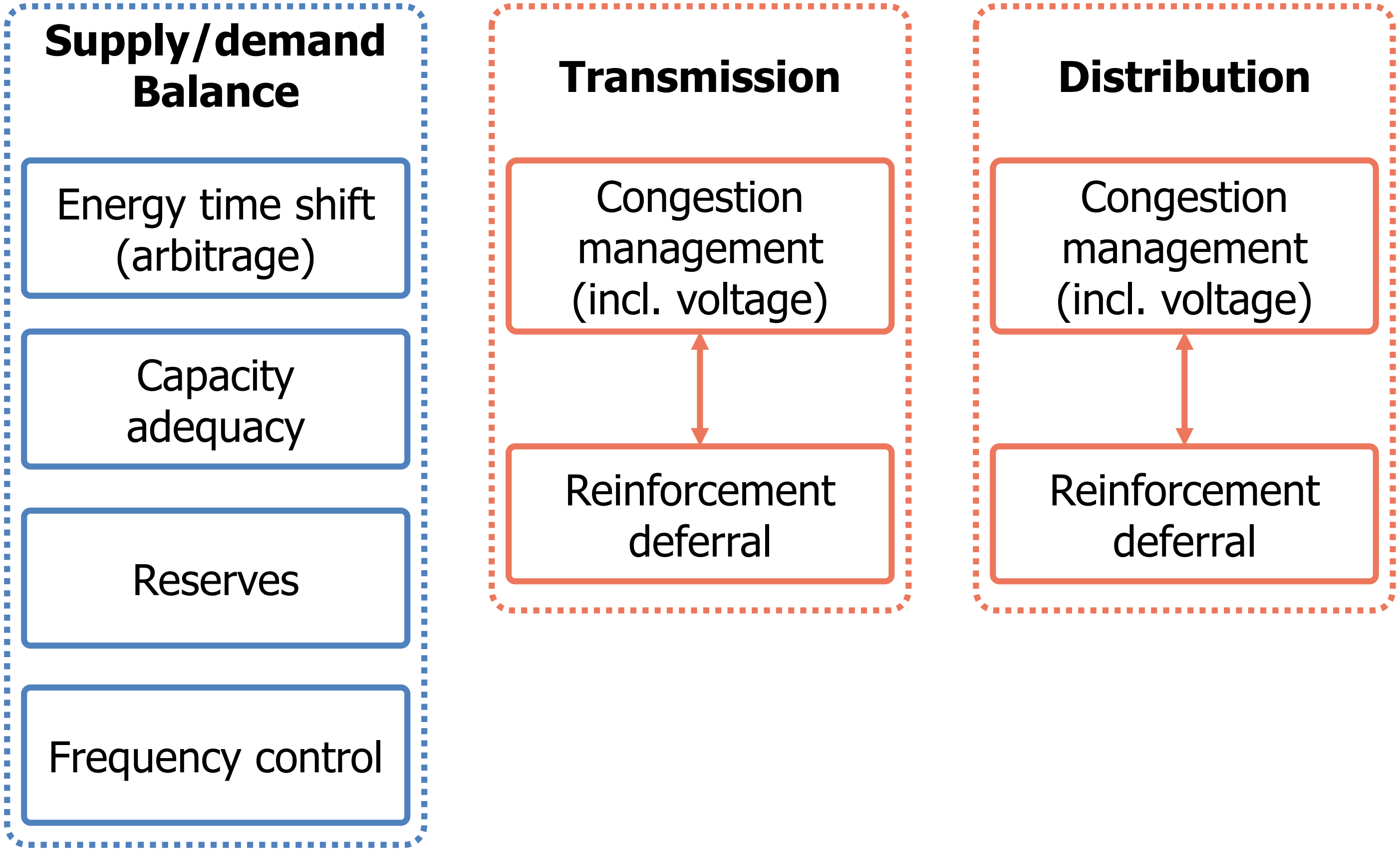
- Generation location



- Adaptation of networks
- Back-up capacities
- Short-term flexibility

Storage can provide solutions for the challenges of power systems

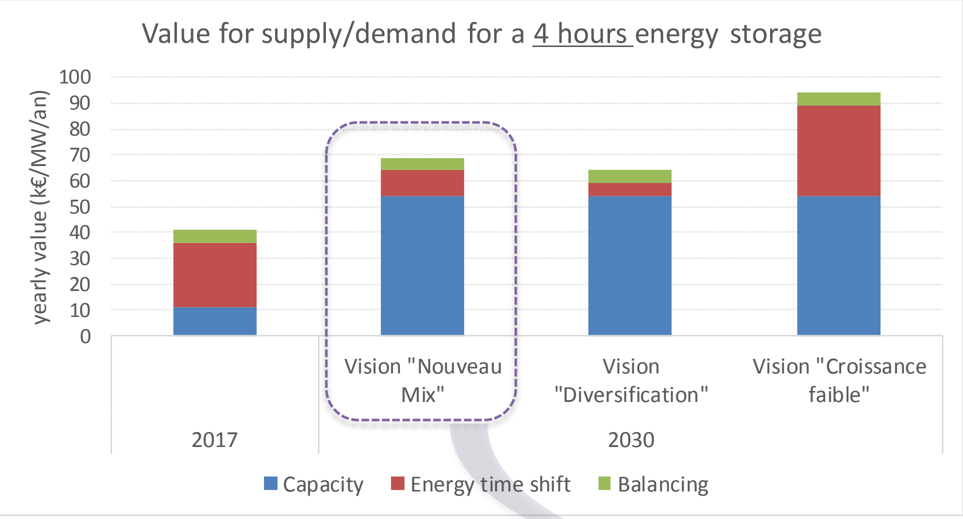
Main services provided by energy storage technologies

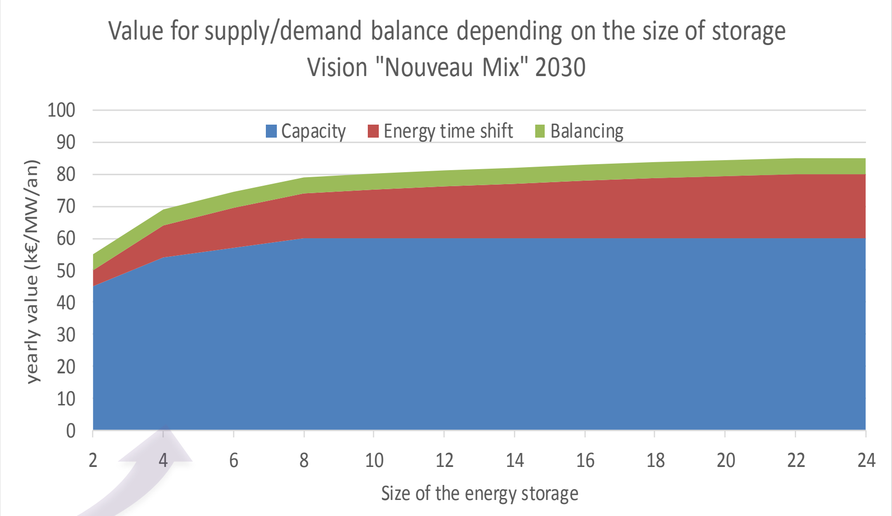


- **What is the value of theses services for the power system ?**
- **Could it cover the costs ?**

Value for supply/demand balance

Capacity, energy time shift, tertiary reserves





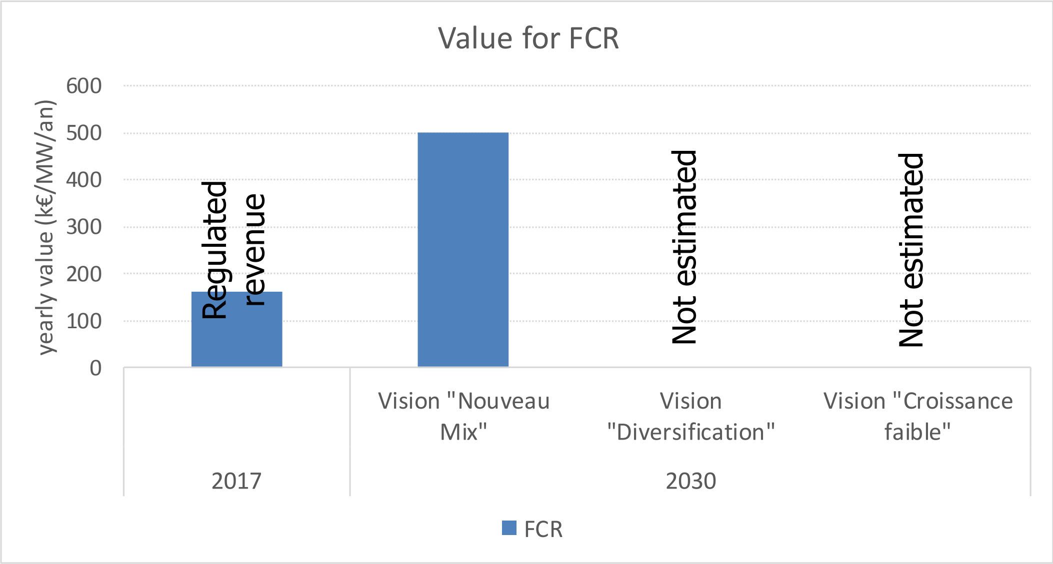
- In the long run, most of the value for storage is the capacity value (Peak unit avoided)
- Arbitrage value depends strongly on the energy mix and fuel costs (and CO2)

Hypothesis :

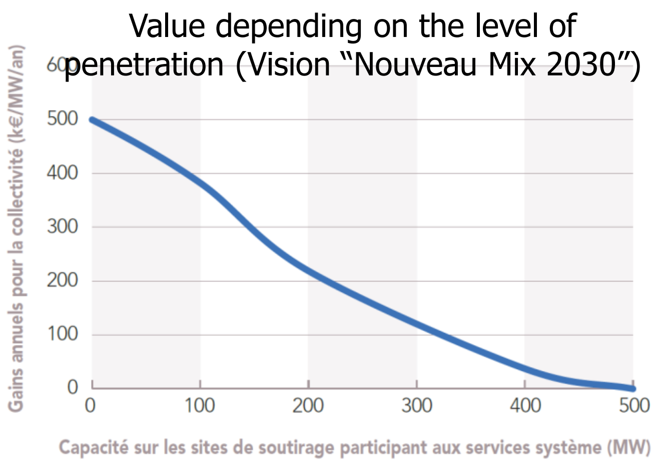
- Efficiency : 90%
- Marginal value
- Capacity value : peak units avoided (for the same SoS) :
  - Long-run : new units (CAPEX+OPEX avoided)
  - Medium run : existing units (OPEX avoided)

Value for supply/demand balance

Participation to frequency control reserve can provide a high value …

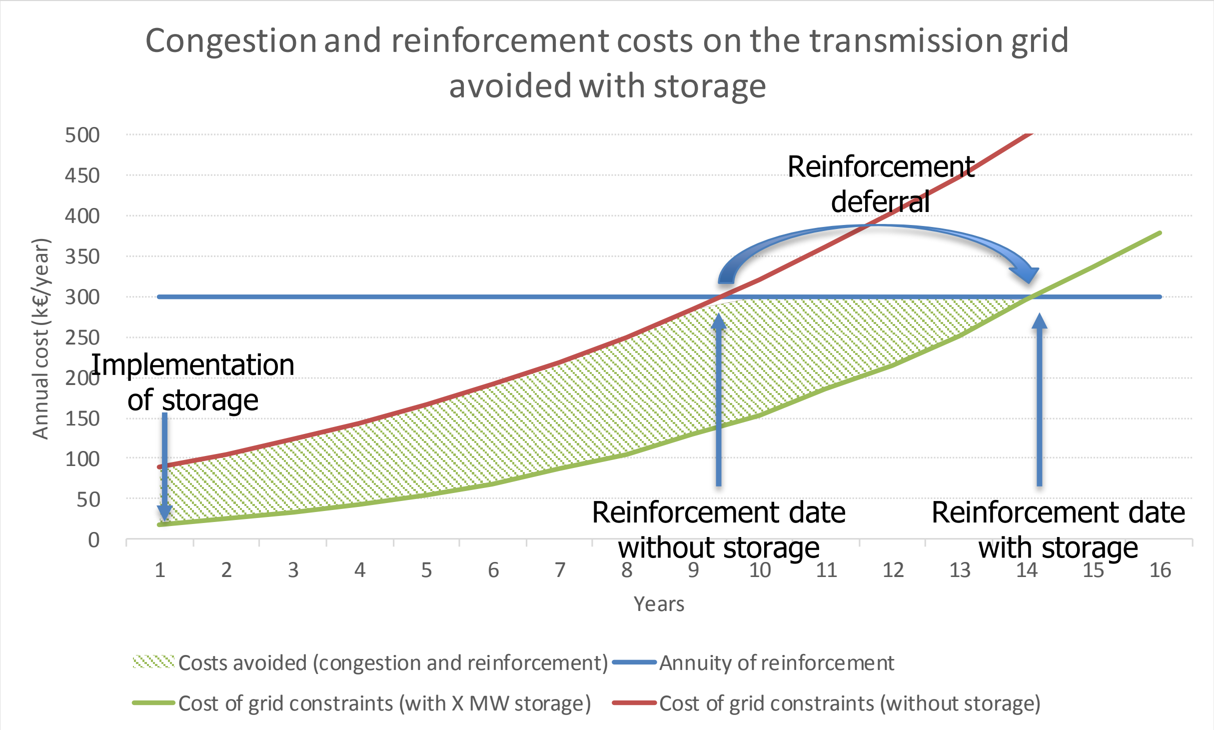


… but the market size is limited



Value for transmission infrastructures

Impact of storage on a typical reinforcement project



∑

\+ Annuities saved through Reinforcement deferral

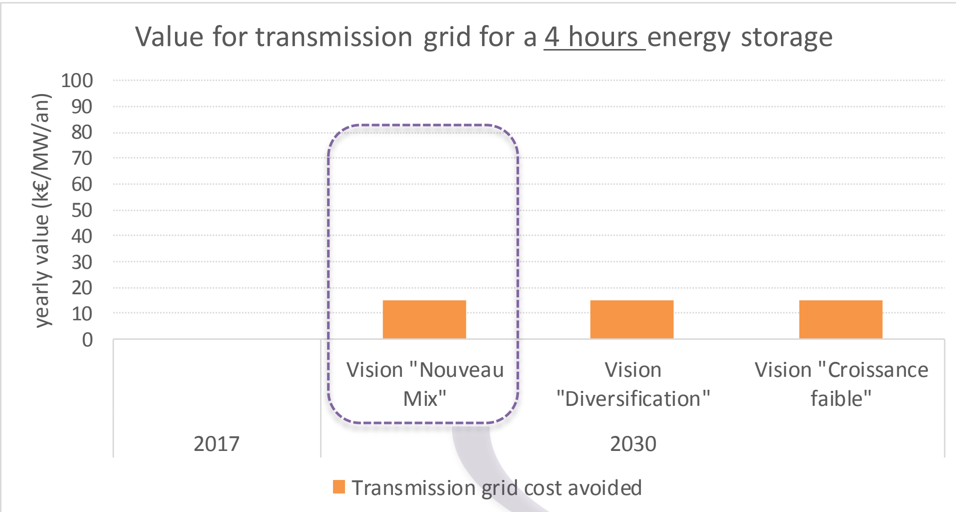
\+ Congestion costs (including VOLL, RES curtailment, …) avoided before initial reinforcement date

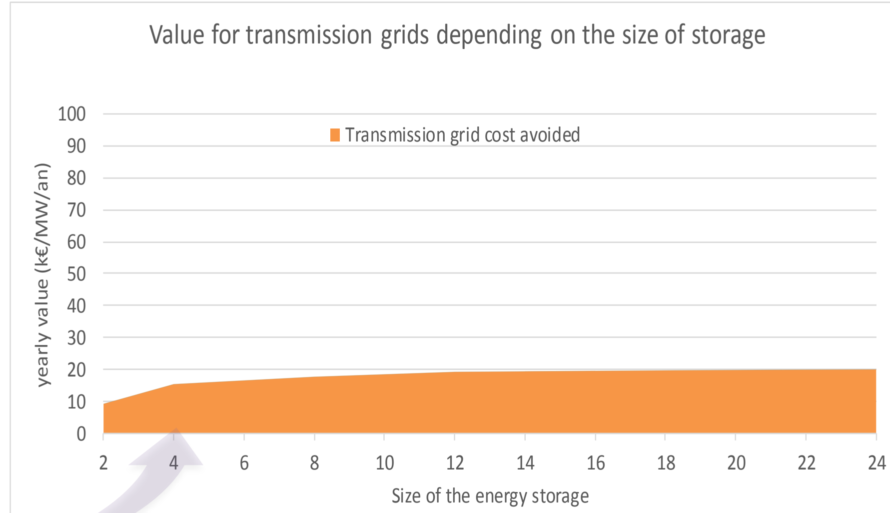
\- Congestion costs (including VOLL, RES curtailment, …) extended through reinforcement deferral

\- Cost of storage use for congestion : loss of opportunity on markets

\- Grids losses extended through reinforcement deferral

Value of a "well located" storage





- A well located 4 hours-storage car avoid about ≈15k€/MW/an transmission costs
- Value is location-dependant

Hypothesis :

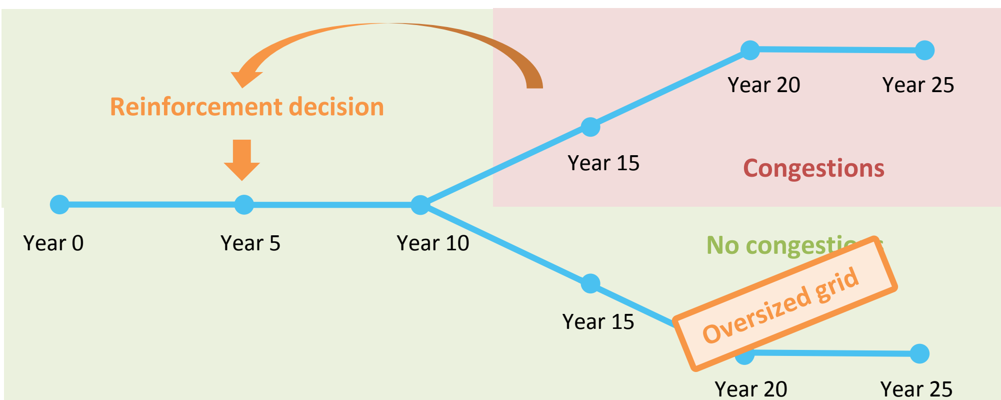
- Typical local reinforcement(63kV, 90kV, 225kV)
  - Reinforcement for RES penetration or demand growth
  - Value for the first tens of MW

Value for transmission infrastructures

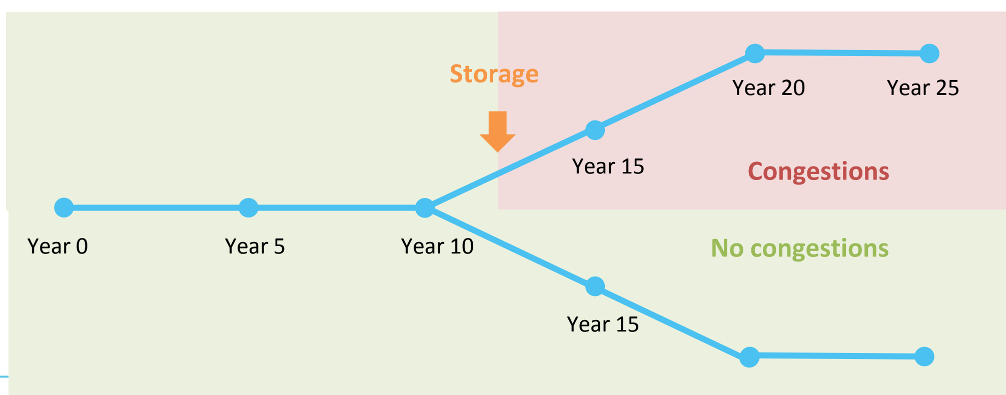
"Time value" of storage

- Transmission line construction time : ≈ 5-10 years
- Implementation of a storage asset : ≈ 1 year ?

Long-term uncertainties :
- Demand growth
- RES generation development
- Fossil generation decommisionning



Traditional network development strategy



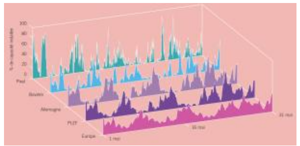
Traditional network + storage development strategy

Value for transmission infrastructures

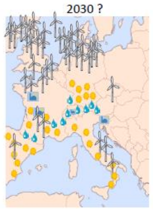
- **Storage could avoid or defer specific transmission network reinforcement …**
- **… but storage and transmission network are complementary**

Services provided by transmission networks

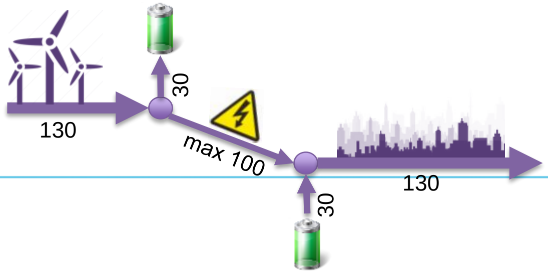
Geographical diversification of local uncertainties (load, RES generation, …)
⇒ limit back-up unit build and reserve sizing



Geographical optimization :
- Location of renewable (PV, wind, hydro)
- Dispatch of thermal units (according to variable costs)

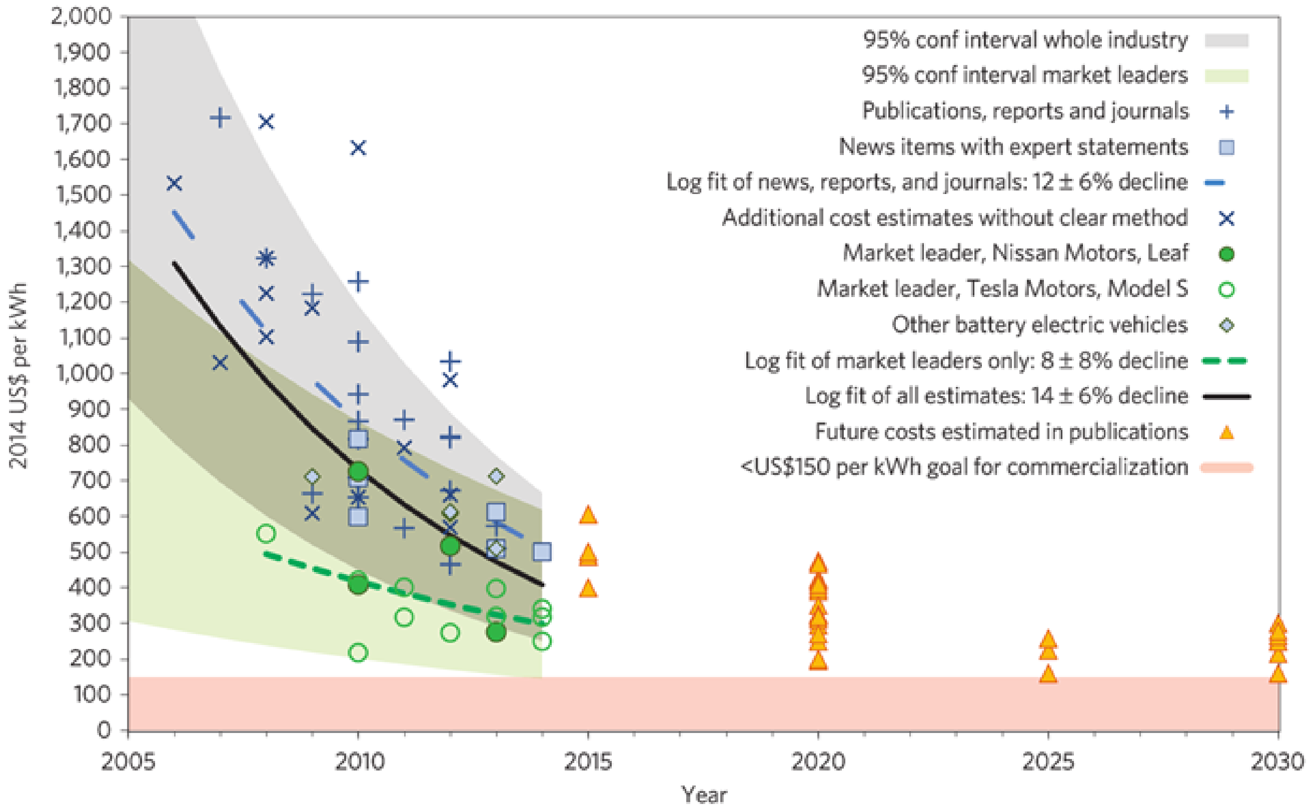


=> Optimum "mix" with traditional transmission network and storage assets



Costs

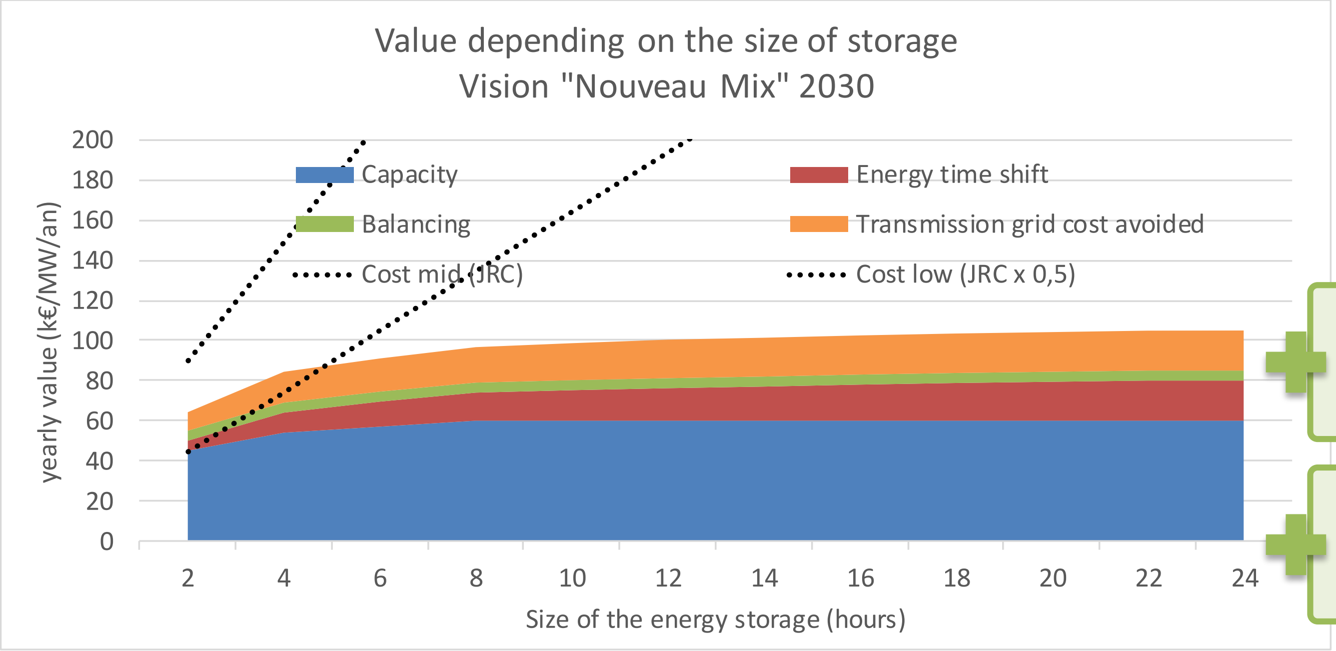
Costs of batteries are dropping quickly …



… although a stabilization around 100-200€/kWh could be expected

Conclusion

- **Development of storage will provide socio-economic welfare …**
- **… if costs continue to drop**
- **… and through the valuation of different services : global (supply/demand) and local (congestion management, …)**



Cost hypothesis :

- Batterie
- CAPEX : 100 – 200 €/kWh (targets 2030)
- Life duration : 10 years and 5000 cycles
- WACC 8% (on 10 years)
- OPEX : 3%/year of CAPEX

Time value for transmission network

Value related to distribution reinforcement deferral if located on distribution grid

- **Location is key to maximize the socio-economic welfare**

Next steps

Large scale implementation ?

- **Relevant level of deployment ? Dependency to future costs**
- **Interactions between storage and other flexibility solutions : foreclosure/competition effect ?**

More sensitivity analysis to energy contexts

- **RES penetration, fuel and CO2 costs, …**

Thank you for your attention!