Réseau de transport d'électricité

Energy transition – consequences for the system

The case of France

Thomas Veyrenc

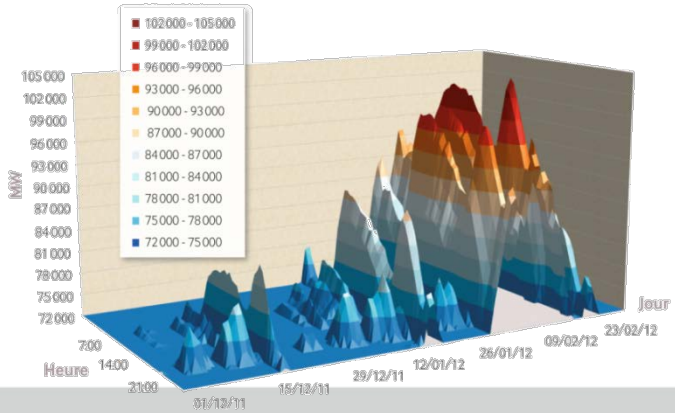
Already significant, structural challenges for power systems to reach the 20/20/20 goals...

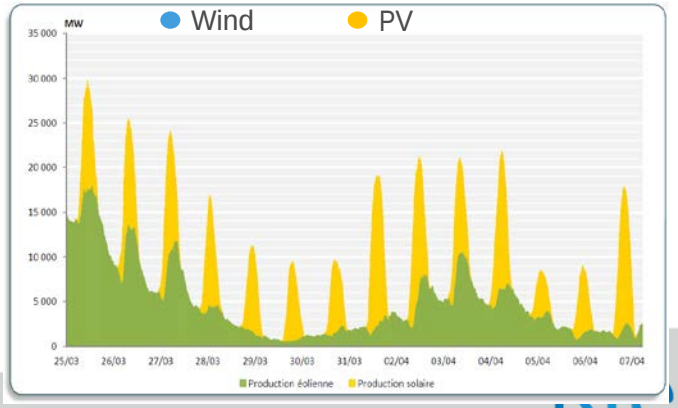
Energy Mix Evolution necessary to reach 20/20/20 objectives

French RES target:
19 + 6 GW – Wind
> 5,4 GW - PV

How to ensure SoS and economic efficiency in a context of growing intermittency ?

Intermittency is a growing concern in Europe
→ Peak load, RES, substitution of fuel for end-uses...





Peak load +30% /10y

Réseau de transport d'électricité

...which will be even bigger for a true energy transition

Current energy debate: many discussions and a large range of possibilities...	But for power systems, the same kind of consequences (only a question of magnitude / time)
About the best trend for energy transition (emission, energy consumption in 2017, 2020, 2025, 2050)	More renewables (in any scenario)
About the main scenarios (ADEME, Negawatt, Negatep, ANCRE, ...)	More grid (in any scenario)
About the right policies (support schemes for renewables, energy conservation, green taxation, ...)	More flexibility on consumption / changes in consumption patterns
About the costs and the way to finance them	An adequate « software » to make it work, ie market design (to its largest extent, i.e. with support schemes, etc.)

Not widely discussed for the moment (as ever)

...which will be even bigger for a true energy transition

Consequences for power systems	Typical times
More renewables	1 year to develop 9 GW of PV (Italy 2011)
More flexibility on consumption / changes in consumption patterns	3 years to develop 1 GW of demand response
An adequate « software » to make it work, ie market design	6 years to launch the market coupling France-Germany-Benelux
More grid	10 years+ to build a 400 kV line

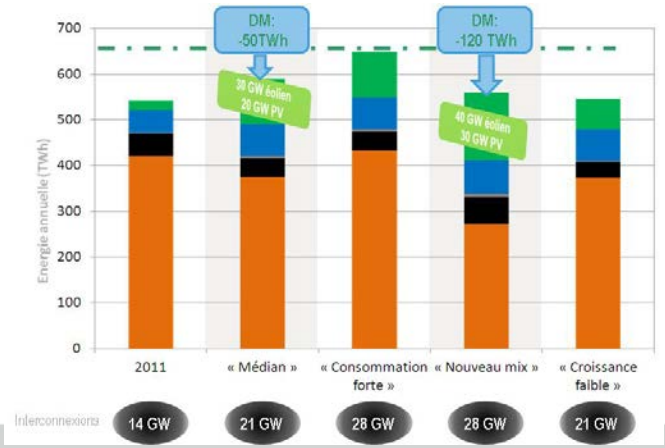
Time constraints are so different that questions arise about the dynamics

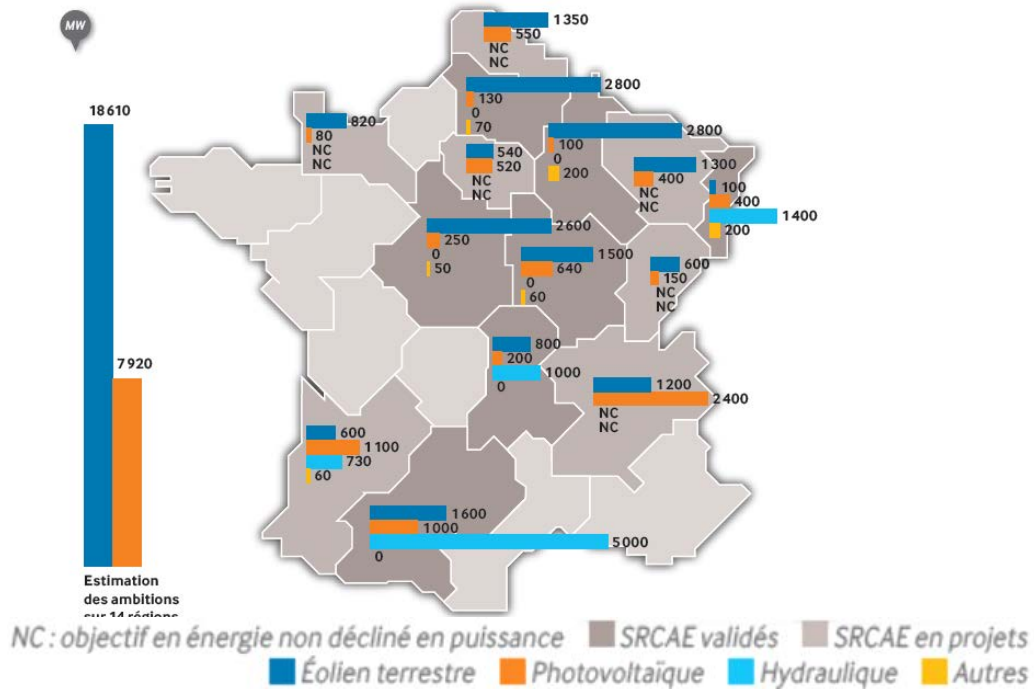
Grid infrastructure: local objectives for RES penetration already challenging

As an example, local energy plans in 14 out of 22 regions alreday amount for more than 2020 national targets

In France, any scenario of energy transition will require significant change in power infrastructure

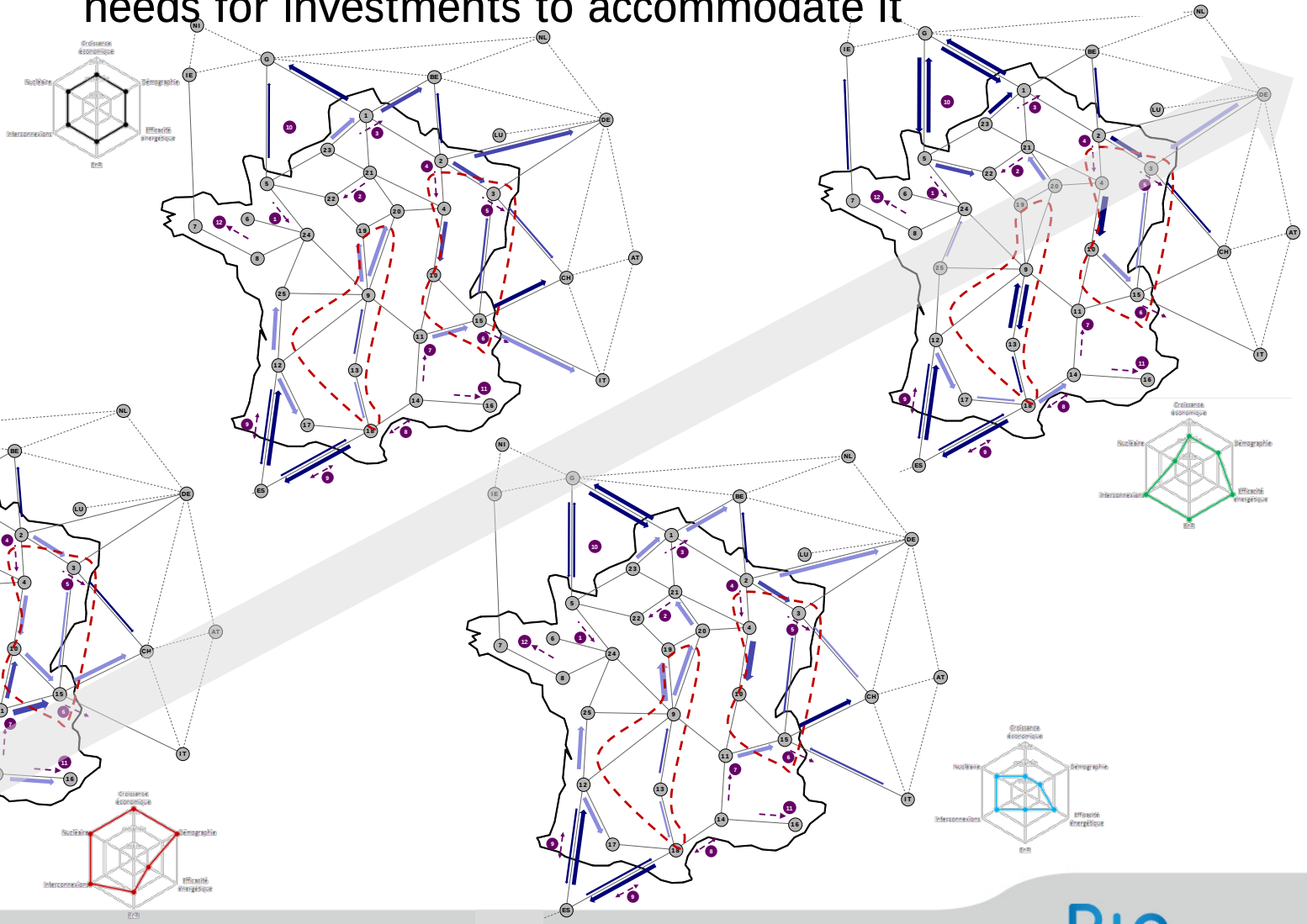
RTE 's adequacy forecast based on 4 scenarios for 2020



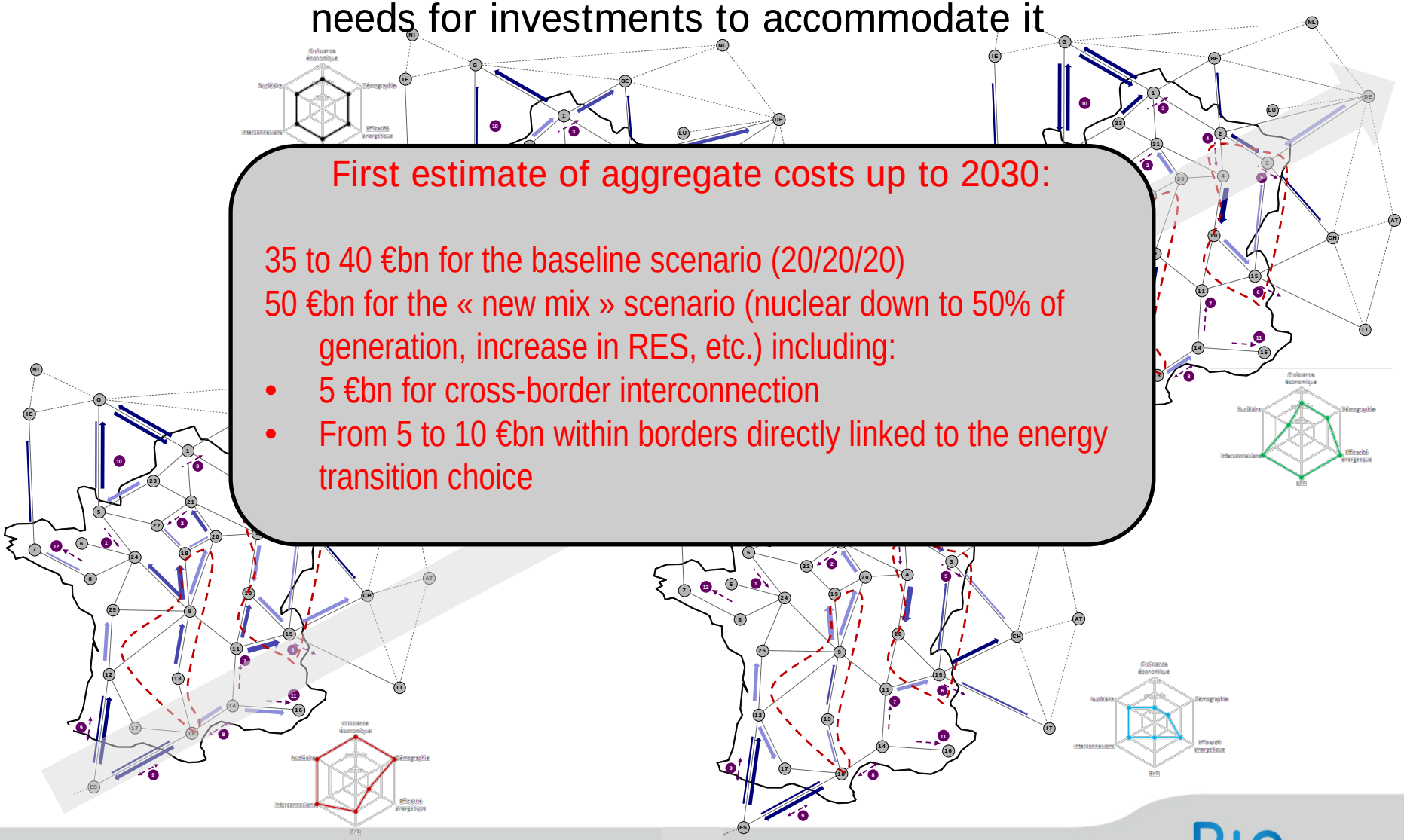


Septembre 2012
Source : RTE

Depending on political choices on the pace/depth of energy transition, different power flows patterns with needs for investments to accommodate it



Depending on political choices on the pace/depth of energy transition, different power flows patterns with needs for investments to accommodate it



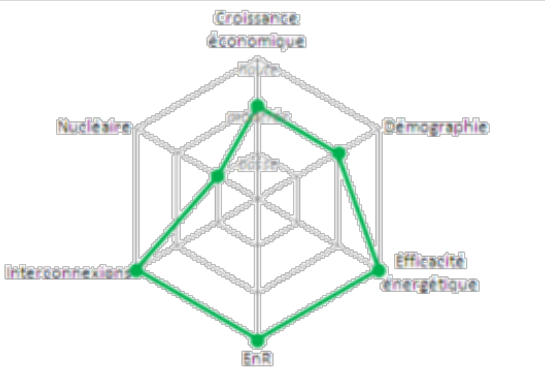
First estimate of aggregate costs up to 2030:

35 to 40 €bn for the baseline scenario (20/20/20)

50 €bn for the « new mix » scenario (nuclear down to 50% of generation, increase in RES, etc.) including:

- 5 €bn for cross-border interconnection
- From 5 to 10 €bn within borders directly linked to the energy transition choice

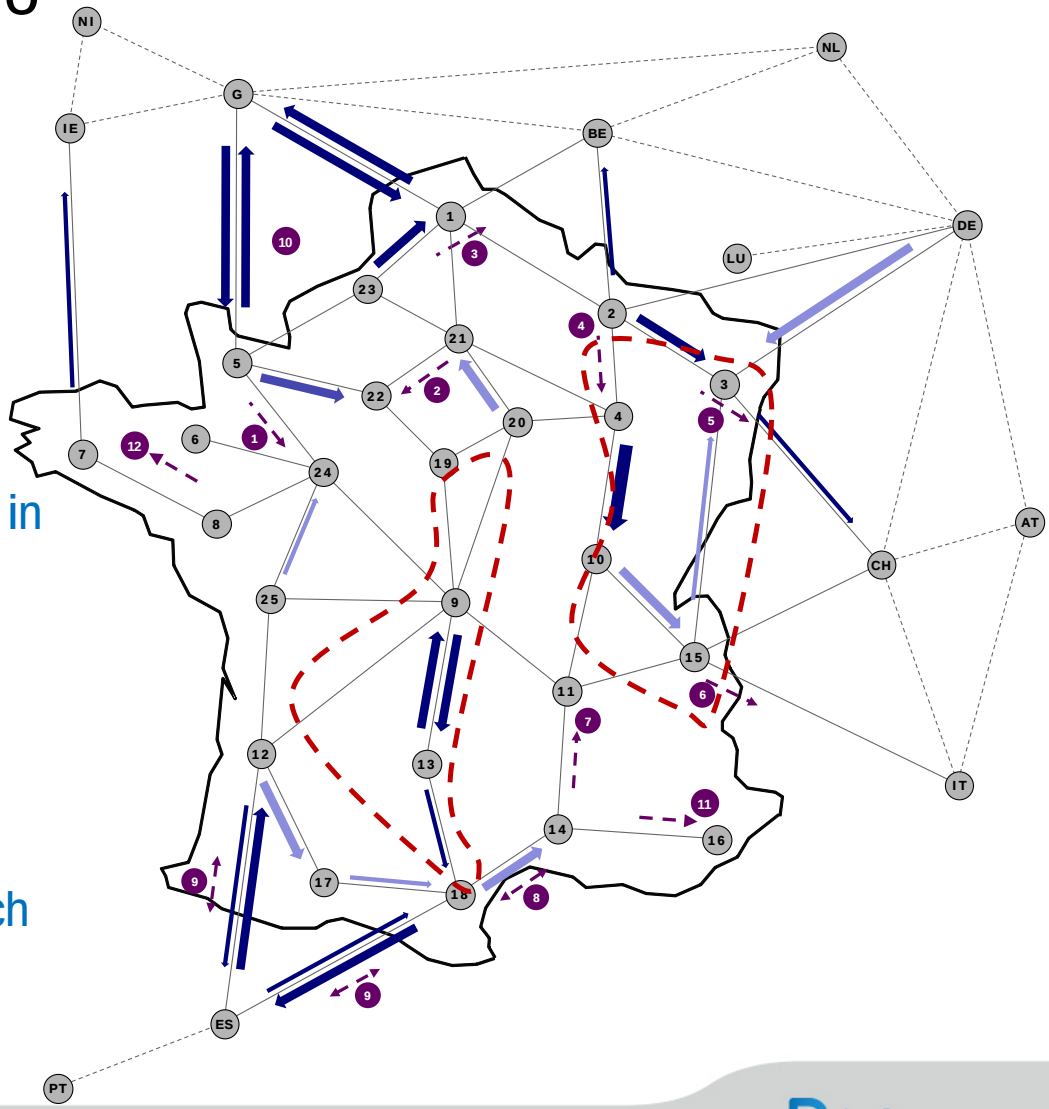
Zoom on power flows evolution in « New Mix » scenario



More important and volatile power flows in the « New Mix » scenarios compared to other scenarios

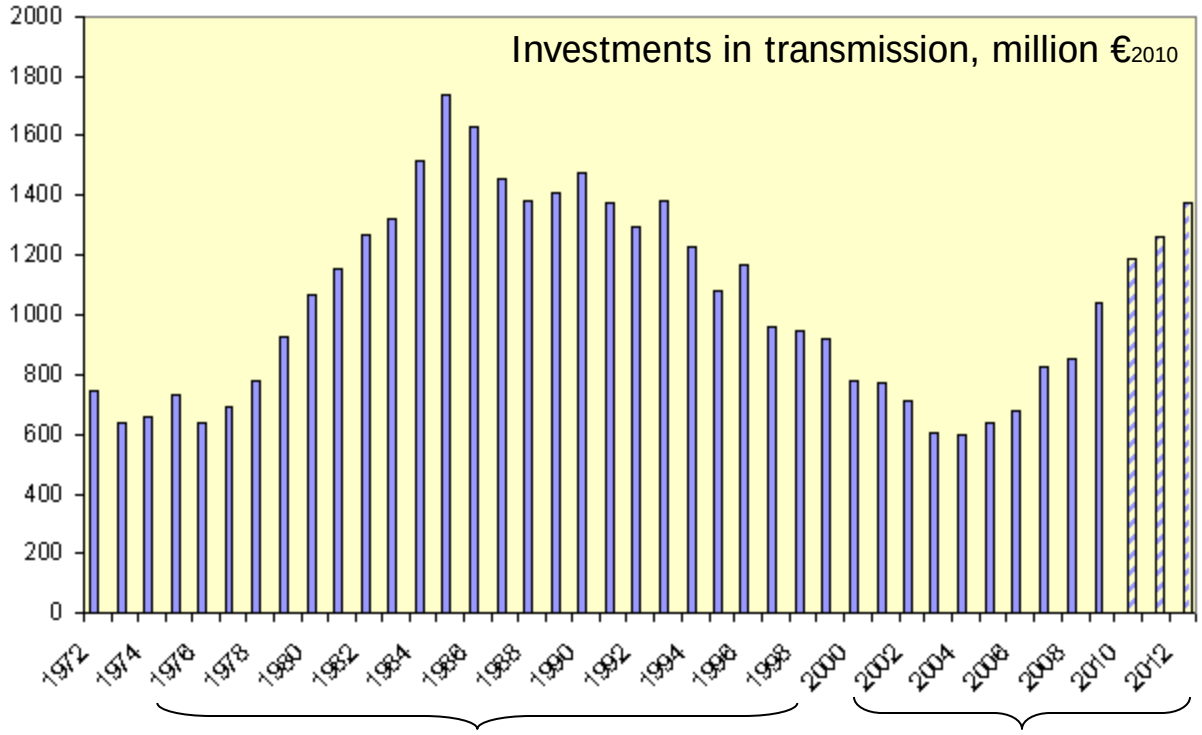
- « Massif Central »
- Wider Eastern France
- Normandy
- Cross-border interconnections

→ Need for important upgrades in French power grid and in cross-boder interconnection



Réseau de transport d'électricité

Is there really a change in magnitude for investments?



1st peak (centralized, nuclear, national) + improvement in quality

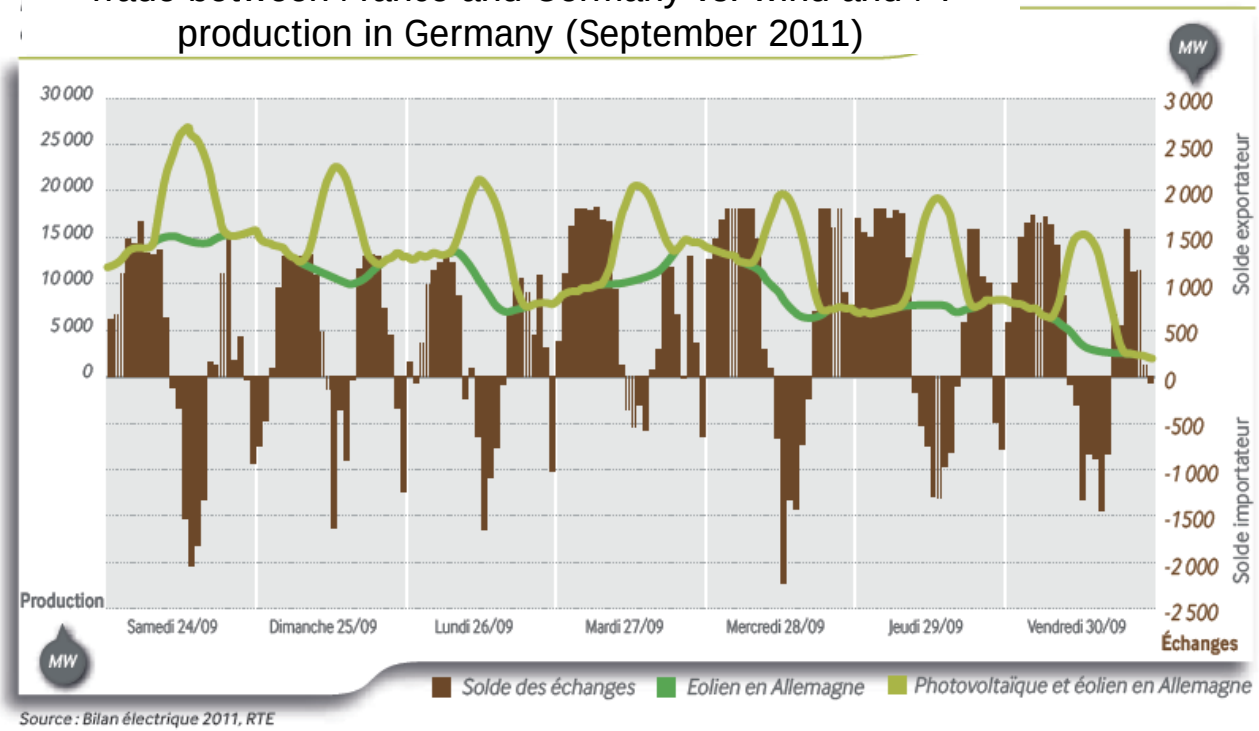
New peak: energy transition (RES, new power flows, some CCGT, most new lines underground and more expensive, longer times to build lines)

- Investments: a change of purpose compared to the 1980s...
  - 1st peak (1980s): to connect centralized generation (mostly nuclear in France) under vertically integrated monopoly
  - Now: to connect renewable, intermittent generation under competition in generation and supply
- But not of scale (until now?)
  - Annual investments x2 in three years, will amount for more than 1.5 billion € a year by 2012

Réseau de transport d'électricité

Markets: 10 years of efforts to build competitive day-ahead markets in Europe...

Trade between France and Germany vs. wind and PV production in Germany (September 2011)



Source : Bilan électrique 2011, RTE

Over the last 10 years, competitive day-ahead markets have emerged and been progressively interconnected (market coupling).

→ We now have an excellent tool for short term optimization (example between France and Germany)

Réseau de transport d'électricité

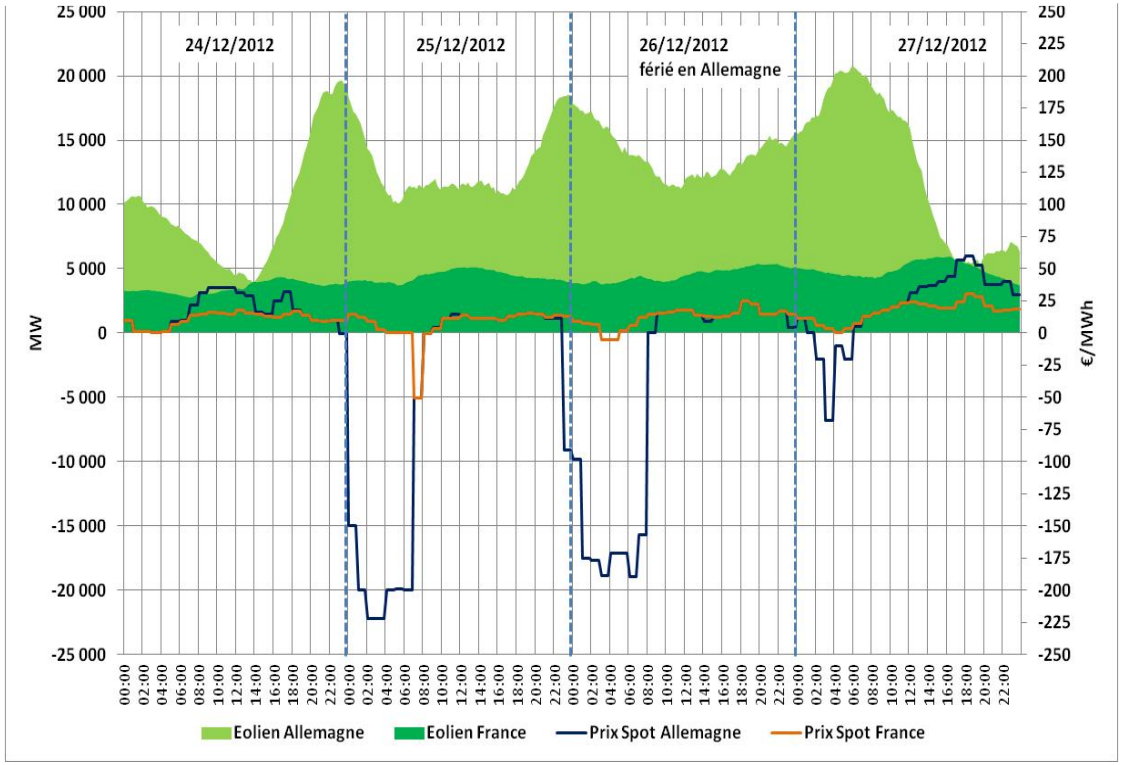
...for which results as regards investments?

Some objectives for energy transition	What is actually happening
Replacing old, GES-emitting generation units by more recent, low-emission ones	Brand new CCGTs are being mothballed all over Europe (including in France), large switch towards coal-based generation (UK, Italy, ...)
Providing flexibility in consumption in order to mitigate thermosensibility effects	France : 30 GW increase in peak demand over the last 10 years, with almost no new investment to cover it and a decrease in demand-side management participation (potential stabilized as from 2010 but still half of pre-liberalisation levels)
Giving incentives to develop new flexibility tools (such as storage)	New storage projects stopped in the Alps

General objectives energy policy	What is actually happening
Relying on the principles of markets in order to drive investments on the right amount, time and location	Massive penetration of renewables by using out-of-the market support schemes + demands from other technologies to benefit from support (reserves, capacity) = increased reliance on subsidies for all technologies !

Scarcity is increasingly located in available capacity... and this may well continue

Christmas 2012: strong generation from wind + low consumption



Technologies with important fixed costs but quasi-0 operating costs (wind, PV) will drive energy prices down when capacity is available regardless of support schemes
→ will undoubtedly questioning some conventional units' business plan

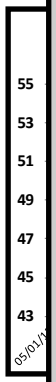
Current support schemes are making it worse by almost completely shedding RES from market signals, contributing to the creation of negative price, which in turn deteriorate further business case for other generators and thus give rise to calls for subsidies

Current market design seems to have reach its limits

The Energy Market does not deliver appropriate investment signals for energy transition

The ETS is no longer a credible tool to decarbonise the economy (3€/CO2ton)

Existing markets do not value what is needed for energy transition (capacity/flexibility, demand response, storage)



1/ Available tools are not sufficient to manage efficiently the energy transition

2/ Member States (France as well as others) react at their own level to implement their own energy transition, but should they be blamed for taking immediate actions to correct (even if incorrectly) market failures?

3/ If competitive markets remain the cornerstone of energy policy, need to define a new picture including re-designed energy markets (to tackle long term issues) and coherent administrative and regulatory interventions

Flaws in market functioning receive national answers: security of supply in France

Concern about security of supplies beyond 2017 (retirement of oldest fuel- and coal-based power plants, possible mothballing of CCGTs, no new investments except for subsidized RES)

Decision in 2011 to implement a capacity market, but which kind?

Administrative solutions (specific calls for tender, new reserves, targeted payments)	**Market solutions**
Tempting (easy to implement, address immediate issues, always possible to say it is “transitory”)... but rarely efficient (the worse would to to set capacity remunation based on what capacity need to reach the breakeven point: end of the market and back to direct regulation)	Clearly more complicated to implement (transaction costs) but allow to steer towards capacity objectives, and to avoid political intervention in the choice/timing of needed capacities

Flaws in market functioning receive national answers: security of supply in France

→ A somewhat not-so-French decision to address many challenges linked to the energy transition in the power system (concern over SoS, RES penetration, thermo-sensitivity) with a market solution (the capacity market provided for by the NOME law)

No public funding or State intervention	• Suppliers bear the financial responsibilities • No administrative capacity target
No specific advantage	• Technology neutral • A market price for the capacity which reflects its real value, no administrative price
No selective basis	• All capacities are taken into account including demand response • Foreign capacities are implicitly taken into account
No distortion of competition	The mechanism is market-based, market-wide and transparent
No administrative target on capacity imposed	• Suppliers can meet their obligation by implementing DSM (they have means to make their obligation lower)

Flaws in market functioning receive national answers: demand-side management in France

Compared to pre-liberalisation times, the volume of “dispatchable” demand-response has been split by a factor 2 in France (from 6 to 2, now 3 GW) whereas peak load has increased by 33% (30 GW)

Special committee in 2010 resulting in many provision in the NOME law to promote the use of DSM in markets

DSM participation to capacity markets	DSM participation to balancing / reserves	DSM participation to energy markets
Designed proposed by RTE and accepted by CRE/DGEC is thought to enable demand-side to participate to capacity market	Special (transitory) calls for tender to have back-up capacity on the balancing market Experiment on aggregated demand-response by households on balancing as	New mechanism to be implemented by the end of the year to allow explicit participation of DSM to energy markets

But still a difficulty to reach economic equilibrium in current market conditions → special subsidy provided for in the most recent energy law

Zoom: why participation of demand-response to the energy market may make sense?

Historically, demand for electricity has been considered very inelastic

- Consumers insensible to the system stress because of technical (lack of smart metering) and regulatory (regulated tariffs) constraints
- Even in a world where all technical barriers are gone (i.e. consumers can monitor precisely their consumption and adjust following market price) and regulated prices no longer exist, it is unlikely that most consumers will follow market price precisely → demand-side management implies that third parties (e.g. agregators) are on the loop

Participation of Demand-Response to the energy market, a new way to send economic incentives to consumers

- Provides economic incentives to the consumers providing their adaptability to the electricity system balance (extreme perspective: load follows generation)
- Implements in law general provisions of the energy efficiency directive pertaining to equal opportunities on market for DSM and generation
- Make markets more liquid and competitive

The development of new flexibility tools in a high RES (non controllable) penetration driven energy transition

THANK YOU FOR YOUR ATTENTION