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NEA – IFNEC workshop on financing of nuclear new build – Paris, 14/01/2021

Market design for financing capital intensive low carbon technologies

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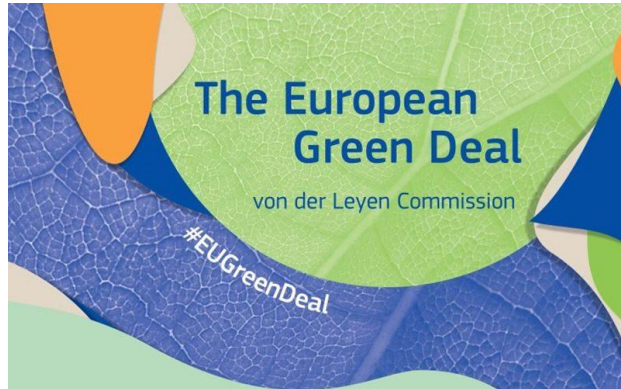
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- B. The interlinkages between market design / regulation and the cost of capital
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- D. Conclusions

A. THE EU DECARBONISATION AMBITION AND THE NEED FOR INVESTMENT IN CAPITAL INTENSIVE CLEAN TECHNOLOGIES

Context: the EU decarbonisation ambitions

EU Green Deal ambitions



EU post-Covid Recovery Plan



Following the Paris Agreement, the European Commission (EC) is considering setting more ambitious decarbonisation targets:

- The new von der Leyen Commission announced its **European Green Deal** in December 2019 proposing **more ambitious decarbonisation targets for 2030 (50-55% emissions reduction) and carbon neutrality in 2050.**
- In the context of the COVID-19 crisis and the resulting economic crisis, the EC proposed in May 2020 an **economic recovery plan** that reinforces the green transition strategy of the EU:
 - Financial support to Member States **conditional on investments aligned with the Green Deal**
 - Potential introduction of a **carbon border tax**

Enel Foundation study - faster and deeper decarbonisation of the EU power sector is achievable but requires to step up investment in capital intensive technologies

ENEL Foundation study: Sustainable paths for EU increased climate and energy ambition

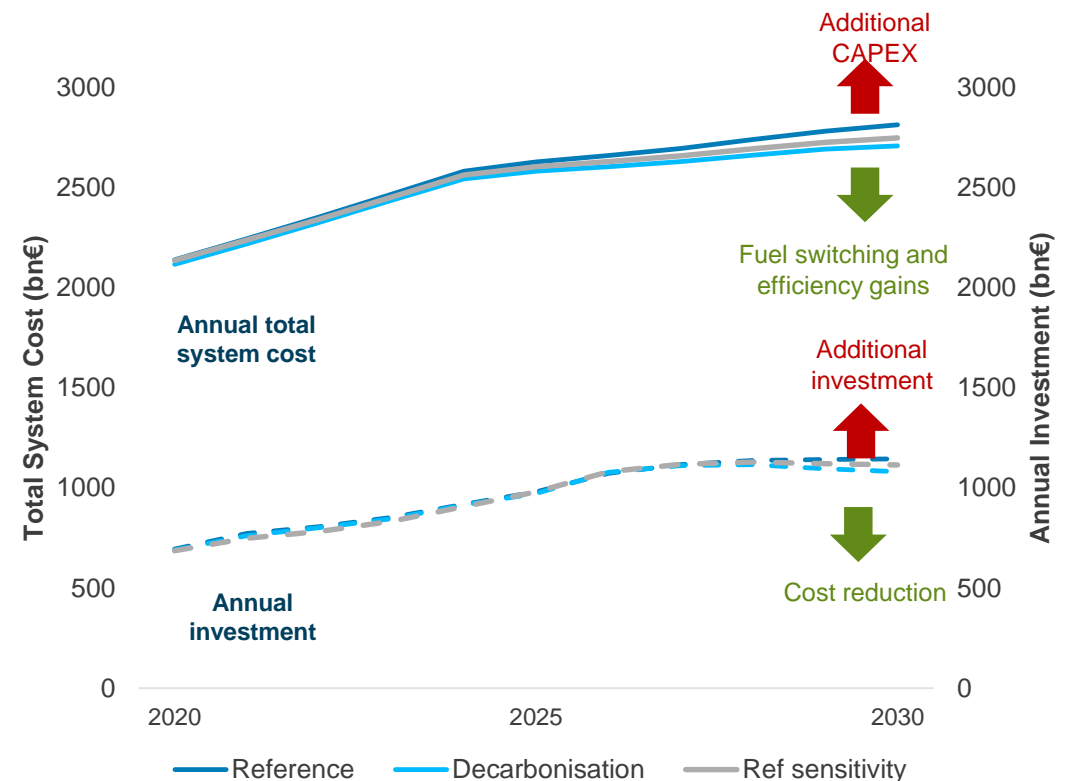


The study is available on the ENEL Foundation website: [Link to the study](#)

Increased ambition in 2030 can be reached with slightly reduced system cost and comparable investment

- Annual investments in the Reference scenario increase by 65% between 2020 and 2030.
- Despite the increased ambition in the Decarbonisation scenario and greater emission reductions in 2030, annual investments remain similar thanks to the cost reductions in RES technologies and batteries.
- Total energy system costs in the Decarbonisation scenario are slightly lower than the Reference scenario, thanks to energy efficiency gains and fuel switching.

Annual total system costs and annual investments (bn€) in Reference, Decarbonisation and Reference sensitivity scenarios, 2021-2030



- Annual investments : CAPEX on a yearly basis excluding power network costs
- Annual total system costs : annualised CAPEX + OPEX + fuels costs (including network costs) on a yearly basis
- Capital expenditures are accounted for in the system costs as annuity payments. A discount rate of 5% is applied for all sectors to annualise the capex.

SFEN study – The contribution of the French nuclear fleet to the EU energy transition



SFEN – Horizon 2050, garantir un futur bas carbone

Scénarios 2050 – Etude de la contribution du parc nucléaire français à la transition énergétique européenne

Conclusions de l'étude pour la SFEN

30 Mars 2020

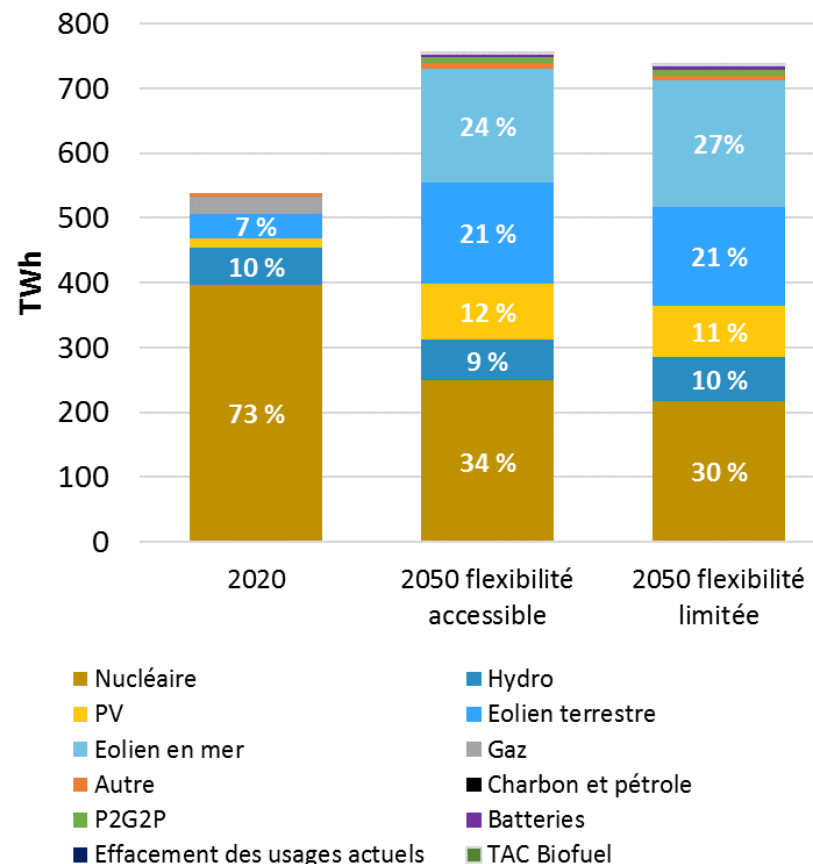


The study is available on the SFEN website: [Link to the study](#)

Keeping some nuclear in the French mix has an insurance value in the context of uncertain deployment of RES and flexible technologies

- We model two scenarios with and without renewal of part of the French mix (representing about 30% of the mix)
- We combine this with two sets of assumptions on the pace of learning and cost reductions for key flexible technologies (batteries, and P2G)
- In both flexibility scenarios, nuclear supplies a base of 30-35% low carbon generation, reducing the need to develop alternative flexibility solutions and allowing to diversify the low carbon generation mix:
 - Nuclear contributes to the flexibility of the power system, especially in summer
 - Power-to-Gas-to-power and/or alternative seasonal storage solutions enhance nuclear generation value for the system during the periods of low residual demand (summer): this explains the lower nuclear generation share in the limited flexibility scenario featuring lower P2G2P capacity.

French generation mix in 2050 in high nuclear scenario

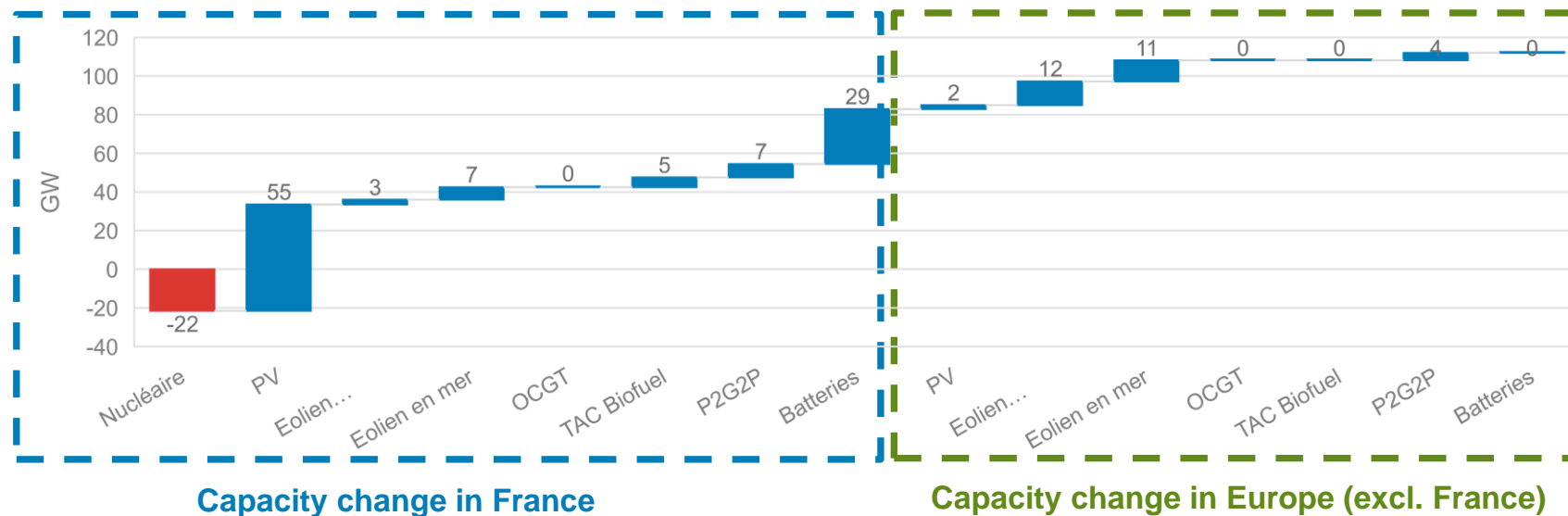


XX % Generation share

Without the nuclear option, challenges associated to RES and flexibility sources development are amplified

- The absence of nuclear renewal amplifies the need for development of renewable capacity by 2050 :**
 - 65 GW of additional RES (+35%) in France and 25 GW in the rest of Europe
 - This requires to reach the maximum French RES potential in 2050 and increase the annual installed capacity from 5.1 GW/year (with nuclear option) to 7.2 GW/year (without nuclear option), compared with 1.8 GW/year over the last decade
- The absence of nuclear renewal requires further flexibility sources development :**
 - 36GW of additional storage capacities (29GW of batterie and 7GW of P2G2P) and 5 GW of additional biofuel OCGT

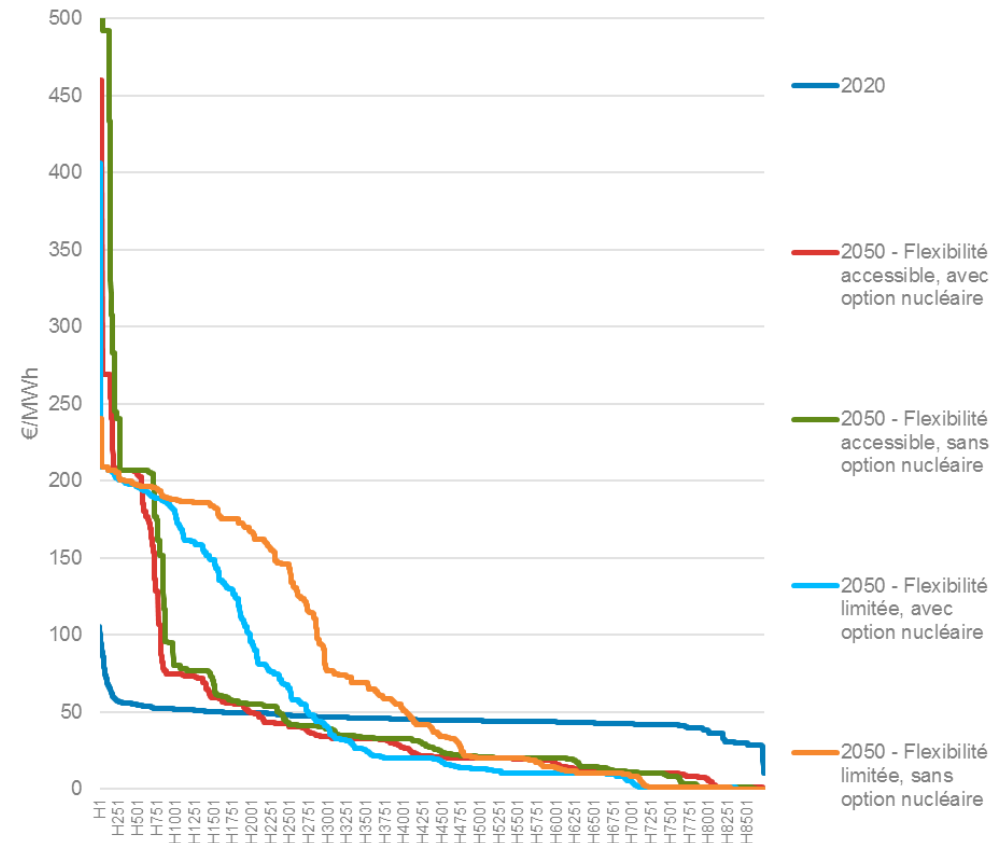
Installed capacity difference in 2050 (without nuclear option & accessible flexibility – with nuclear option & accessible flexibility)



The projected increase of power price volatility will put into question the sustainability of the current market design

- By 2050, given the significant increase of RES, there will be several hours when they will be marginal: the power price will then be zero during these hours.
- Conversely, during periods of low RES generation, the flexibility sources with a high variable cost or opportunity cost will be marginal thus generating **peak prices**.
- This brings the question of **the sustainability of the current design of the wholesale power markets** given the associated risks for investors.

Power price duration curve - 2020 vs 2050

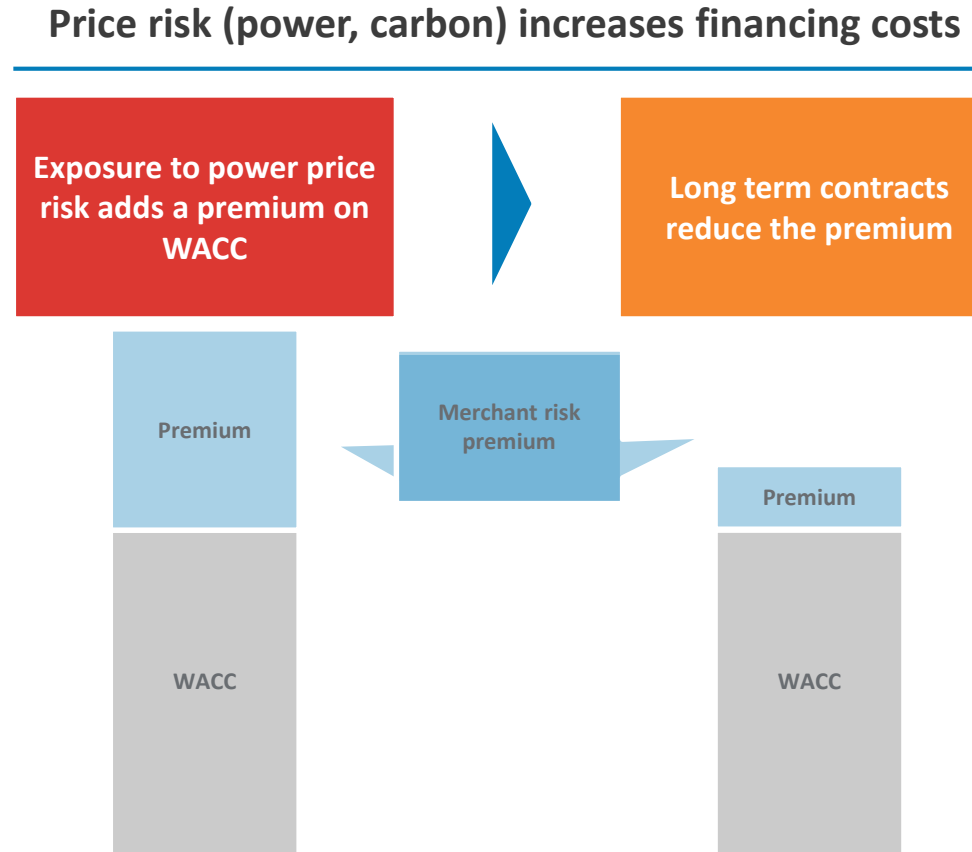


Dans le scénario avec flexibilité accessible et sans option nucléaire, le prix de l'électricité est supérieur à 500 €/MWh pendant 32 heures.

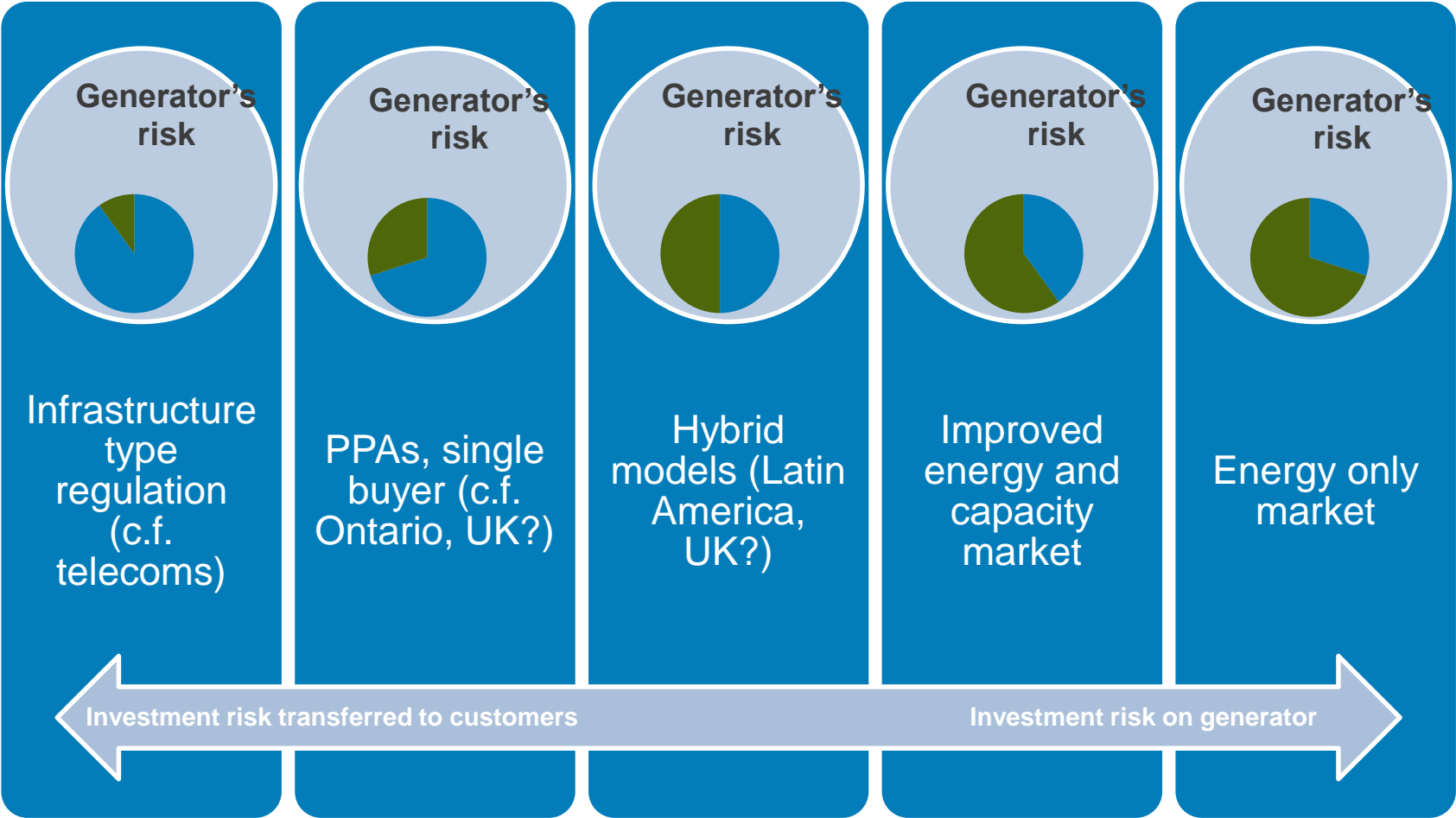
B. THE INTERLINKAGES BETWEEN MARKET DESIGN / REGULATION AND THE COST OF CAPITAL

Power price risk increases risk premiums and financing costs

- Renewable energy projects under long term contracts currently enjoy low cost of capital and access to a wide range of investors due to being considered quasi regulated assets with low risk profiles, **greater exposure to power price risk** (“merchant risk”) would:
 - Increase the risk premium** required by investors
 - Reduce the pool of investors** willing to fund projects
- Literature review/benchmarking** – we reviewed a range of studies that suggested that power price risk could add around **3-5% at least onto the WACC for power plant investments**.



From regulation to energy only markets – implications for investors exposure to market risks



Efficient allocation of risks for generation investment according to economic theory

Economic theory suggests that risks should be allocated to those parties best able to manage them – Implications for power investments

Planning and licensing risk

=> Ensure predictable and credible energy policy, streamline planning and licensing procedures

Construction risk

=> To be managed by investor / passed on to EPC contractor

Operation risk

=> To be managed by plant operator

Market risk: 'Missing market' for long term electricity price risk hedging

- ⇒ Natural counterparty is supplier with 'sticky' customers, vertical integration and diversification of mix are usual hedging strategies
- ⇒ Design power market that does not rely purely on scarcity pricing and price volatility to stimulate investment
- ⇒ Consider additional risk transfer / hedging mechanisms to reduce hurdle rates and costs to consumers

Policy and regulatory risks: Assess impact of interventions to support specific technologies

Unpredictable merit order changes leading to fall in plant revenues because of policy intervention

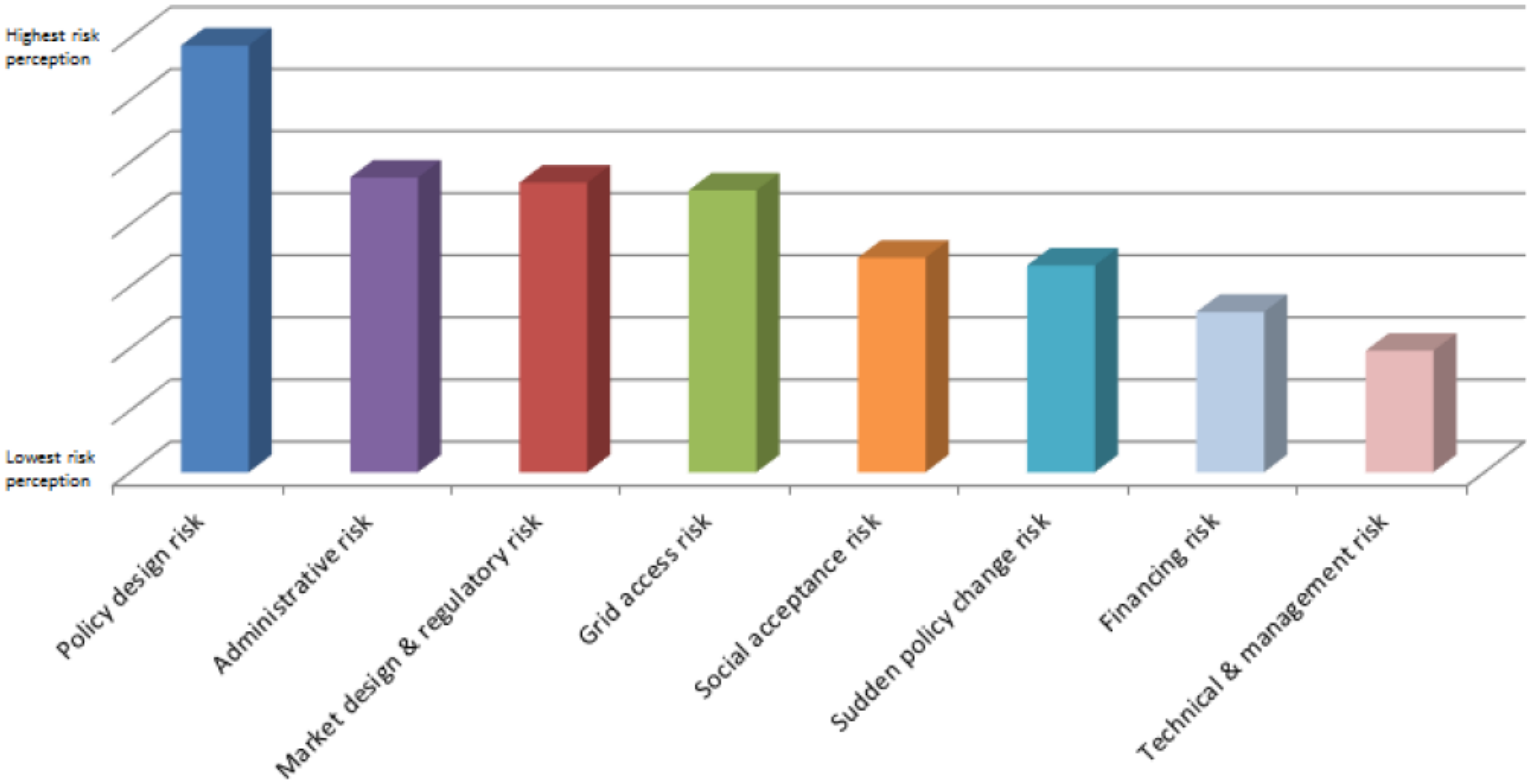
- ⇒ Ensure that deployment of clean technologies is predictable and at a pace compatible with amortization of other plants
- ⇒ Give visibility on CO2 policies
- ⇒ Develop coordination mechanisms to ensure that transition does not create stranded costs

Key sources of risks for investors in wind power in Europe - results of a survey

Which risk category do you consider most important?

Average Ranking of Risks across 24 EU MS

Following countries are missing due to lack of data: HR, IE, LU, MT



Source: DiaCore The impact of risks in renewable energy investments and the role of smart policies

Case study 1: Impact of the move to CfDs Compared to RO regime for RES on the WACC

- In case study 1, long term contracts in the form of contracts for difference (CfDs) provide a reference price guarantee.
- The net impact of the CfDs introduction on the post-tax EU-WACC is defined as an average over studies focusing on the UK experience, i.e. switch from RO regime to CfDs subsidies:

WACC reduction CfD/RO	DECC (IA)	DECC (White paper)	CEPA	NERA	Redpoint
CCGT + CCS	NA	-0,1%	NA	NA	-0,5% to -0,1%
Coal + CCS	NA	-0,4%	NA	NA	-0,7% to -0,4%
PV	-0,9%	NA	NA	NA	NA
Onshore wind	-0,5%	-0,3% to 0%	-0,4% to 0%	-1,7% to -0,9%	-0,3%
Offshore wind	-1,1%	-0,8% to -0,5%	-0,8% to -0,6%	-0,9% to 0%	-0,5 to -0,6%
Biomass	0%	-0,5%	NA	-1,2% to -0,4%	-0,7%
Nuclear	-0,8%	-1,5%	NA	NA	-0,2%

The reduction in WACC associated with a CfD compared to a RO (market risk) ranges from -0.3% to -0.9% depending on the technology.

Source: DEEC (2011, 2012), CEPA (2011), Ecofys (2014), NERA (2013), RedPoint (2010)

Case study 2: Impact of Infrastructure regulation on the WACC

- The reduction on the WACC is calculated as the difference between the current EU-WACC under the RO regime and the WACC of regulated power infrastructure operators, with adjustment for the gearing ratio.
 - Based on Exane financial data for European infrastructure companies in the EU power sector data, the EU-post tax WACC reduction is estimated at -3,7% (before adjustment to gearing ratio).

Gearing ratio	CEPA		NERA		Redpoint		Ecofys
	RO	CfD	RO	CfD	RO	CfD	RO
CCGT + CCS	NA	NA	NA	NA	75%	85%	60%
Coal + CCS	NA	NA	NA	NA	75%	95%	60%
PV	NA	NA	70% - 80%	75% - 80%	NA	NA	75%
Onshore Wind	70%-75%	75%-80%	70% - 80%	75% - 80%	90%	90%	75%
Offshore wind	60%	62,5%	65%	70%	75%-80%	90%-95%	75%
Biomass	NA	NA	NA	NA	75%	95%	75%
Nuclear	NA	NA	NA	NA	75%	95%	60%

Sources: DEEC (2011, 2012), CEPA (2011), Ecofys (2014), NERA (2013), RedPoint (2010)

The reduction in WACC associated with infrastructure type regulation is > 3%

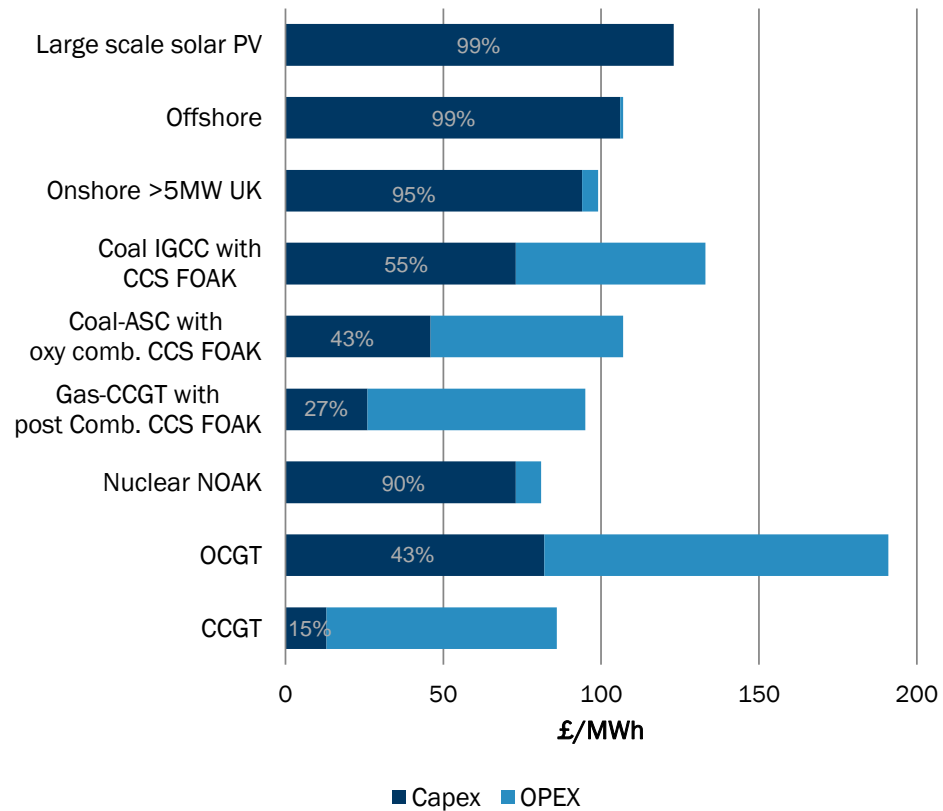
A horizontal bar with a grey section on the left, a small red section in the middle, and a blue section on the right.

C. THE NEEDED EVOLUTION OF MARKET DESIGN TO SUPPORT
THE DECARBONISATION OF THE POWER SYSTEM

A changing cost structure: capital intensive technologies dominate in the power sector

- The industry cost base is moving from 'OPEX' to 'CAPEX': should pricing follow and move from SRMC to LRMC?
 - The ongoing reforms contribute to aligning costs and revenues:
 - RES support schemes moving away from production based subsidies toward investment support (e.g. Spanish reform)
 - Capacity mechanisms for thermal plants
- ⇒ Spot power market prices remain key for operational/dispatch incentives
- ⇒ Investment decisions increasingly based on some form of long term contract / regulation

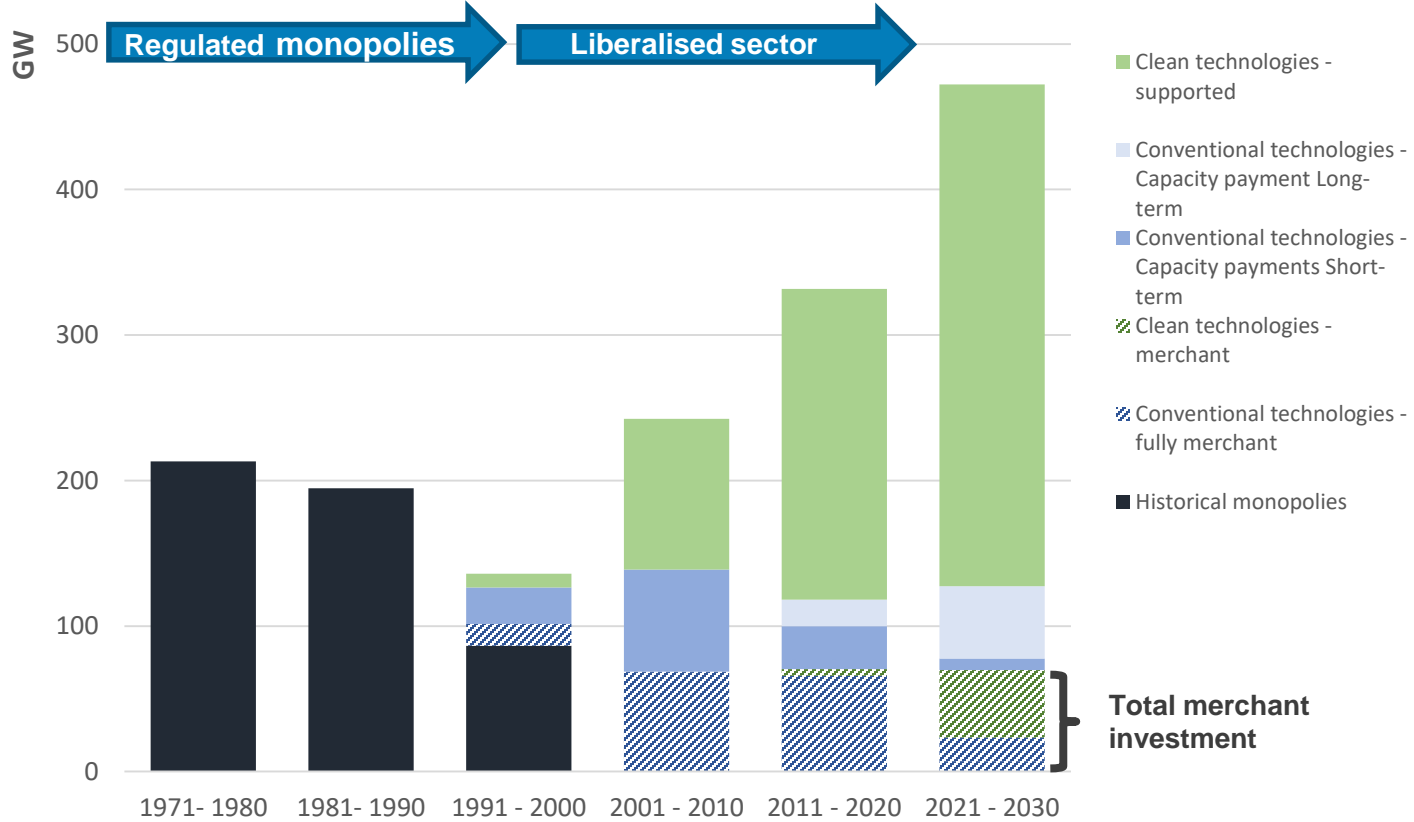
Levelised cost estimates for projects starting in 2019, 10% discount rate



Source: Electricity Generation Costs 2013
Department of Energy & Climate Change (UK)

Historically most EU investments in power generation were made under regulation or supported by long term contracts

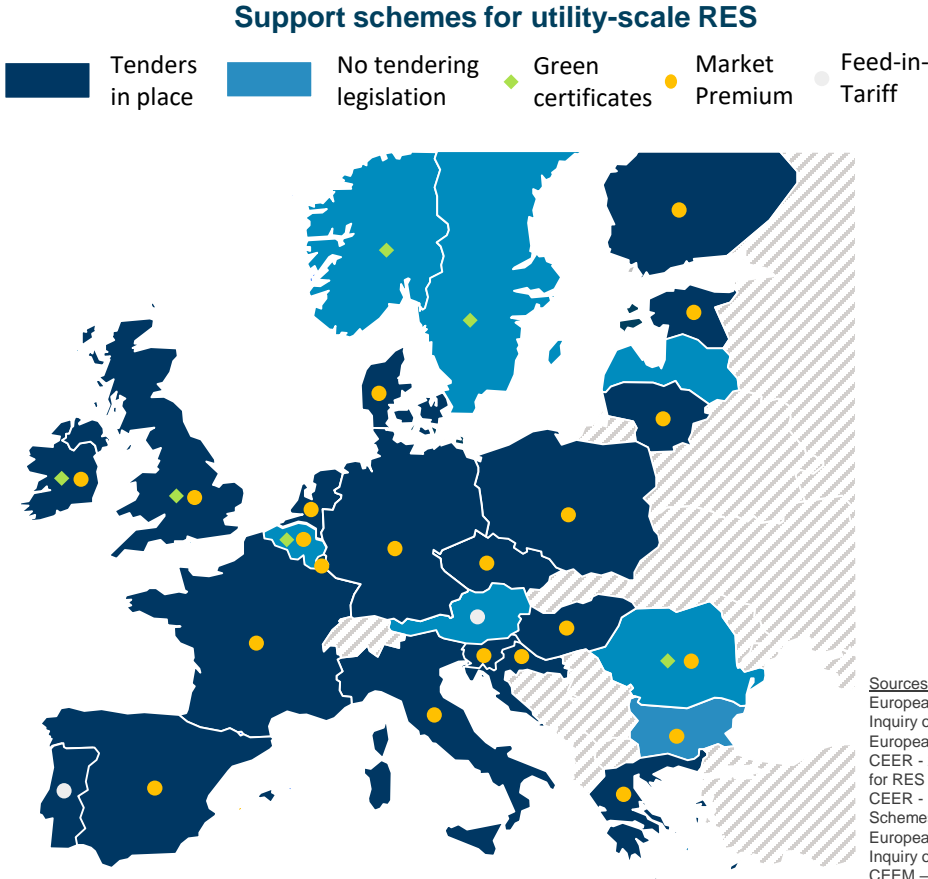
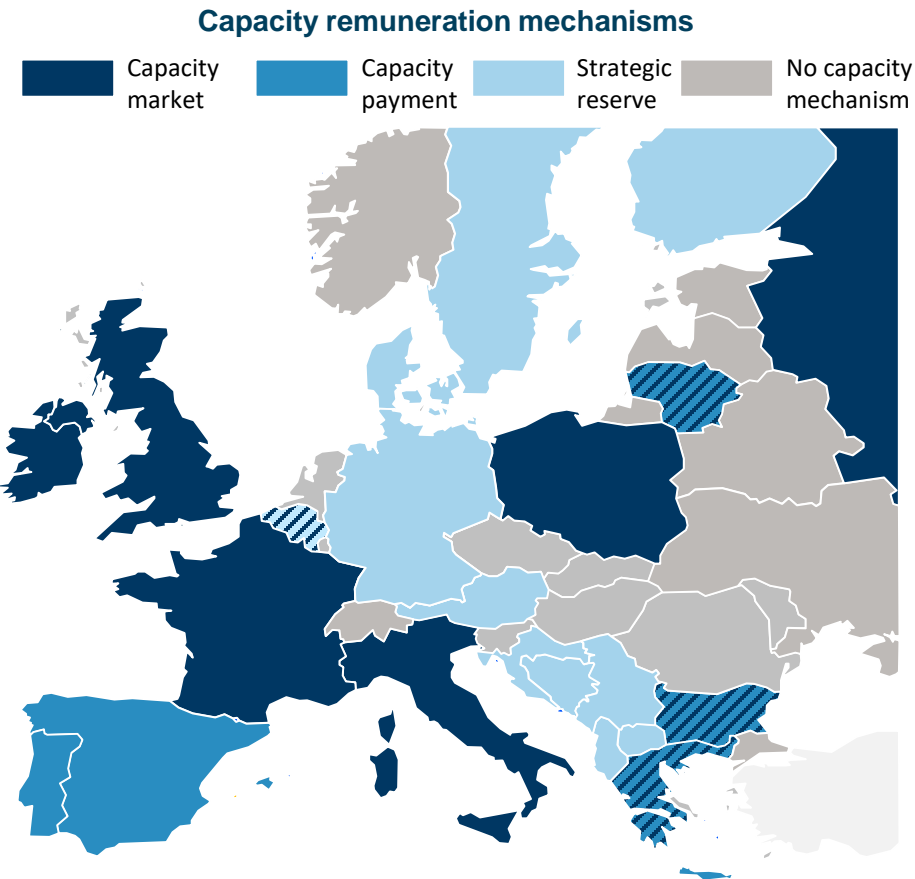
Capacity additions in Europe based on the regulatory framework when the decision was taken



Source: CL Energy analysis based on Platts, Country NECPs and CL Intelligence
 European Commission - Final Report of the Sector Inquiry on Capacity Mechanisms
 CEEM – Capacity Remuneration in power markets : an empirical assessment of the cost of production
 CEER - 2nd CEER Report on Tendering Procedures for RES in Europe

- Based on the current regulatory framework, only a small share of total generation investments in the next decade are expected to be merchant
- Some form of public support / de-risking mechanisms is needed to reach the EU policy targets

The current set of patchwork of national Capacity Mechanisms and RES support schemes lacks a coordinated and consistent investment framework



Sources :
 European Commission - Final Report of the Sector Inquiry on Capacity Mechanisms
 European Commission - RES Legal
 CEER - 2nd CEER Report on Tendering Procedures for RES in Europe
 CEER - Status Review of Renewable Support Schemes in Europe for 2016 and 2017
 European Commission - Final Report of the Sector Inquiry on Capacity Mechanisms
 CEEM – Capacity Remuneration in power markets : an empirical assessment of the cost of production

CL Intelligence

In practice most countries have put in place some form of tendering and/or long term contracts to support investment in clean technologies and/or dispatchable resources

Toward a new market model with ‘competition in two steps’ ?



A horizontal bar spanning the width of the slide, divided into three segments: a long grey segment on the left, a short red segment in the middle, and a long blue segment on the right.

D. CONCLUSIONS

Conclusion: need for a market design supporting efficient risk allocation and financing

Ongoing trend toward greater state involvement to support financing in capital intensive energy technologies – particularly in the power sector:

- Hybrid power markets with some form of public sector involvement of long term contracts backing observed in many jurisdictions

Key lessons from the different mechanisms for public intervention across hybrid markets:

- If well designed, state backing and long term contracts can reduce cost of financing...
... but careful design is needed to avoid substituting market failures by regulatory failures

An efficient allocation of risks is essential to underpin the investment framework for the decarbonisation of the power sector:

=> Coordination of planning of transmission, merchant generation and policy driven clean technologies

⇒ Risk sharing mechanisms such as long term contracts should play a role (e.g. PPAs)

⇒ **The debate on market design has not paid enough attention on the interface with the financing costs and investment constraints**

Conclusion: Global macro economic and policy context should trigger a debate in Europe about infrastructure financing

“At present there is a global and structural need for infrastructure investment of nearly 7 trillion dollars per year, taking into account the energy transition in addition to traditional investment requirements.

Paradoxically, the investment gap is growing at a time when governments can obtain long-term financing at very low, even negative, rates.”

Laurence Boone, OECD Chief Economist ([weblink](#))

Growing recognition among economists that **monetary policy is reaching its limits in stimulating economic growth... and that investment in infrastructure can be an efficient way to support the economy at times of low / negative interest rates**

Global trade experiencing a structural shift, with disputes over trade agreements, suggesting that way forward will rely on a commitment between like-minded countries to push ahead with policies supporting investment in infrastructure...which would in turn support economic growth

⇒ **New European Commission and revision of State Aid guidelines for energy sector investments represent an opportunity to revisit the role of states and private sector to scale up investments and deliver on Europe's climate ambitions**

Thank you for your attention

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