THE LONGER TERM ROUTE TO DECARBONISE ELECTRICITY: REGULATION OR MARKETS?

FUTURE MARKET DESIGN

October 2014

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AGENDA

1. What are the policy options to deliver decarbonisation?
2. What issues arise under alternative market and regulatory approaches?
3. What is the best way forward?

POLICY AND MARKET DESIGN MUST EVOLVE TO DELIVER DECARBONISATION

Decarbonisation and market harmonisation objectives create a policy dilemma between re-regulation and liberalisation. Our multi-client study aimed to answer the following question:

What are the consequences of decarbonisation for future electricity market design?

Will the future energy sector be based on market principles or are we returning to regulated investments?

How will EU and national policy objectives be balanced in the future framework? How will emissions targets and renewables targets be balanced?

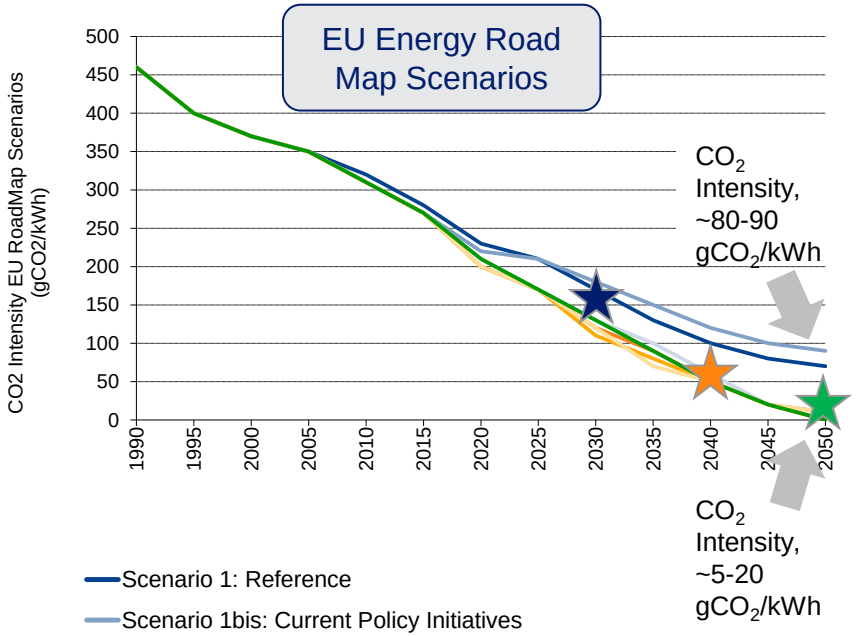
How will we ensure that investment is made in a timely and efficient manner?

What do we mean by decarbonisation?

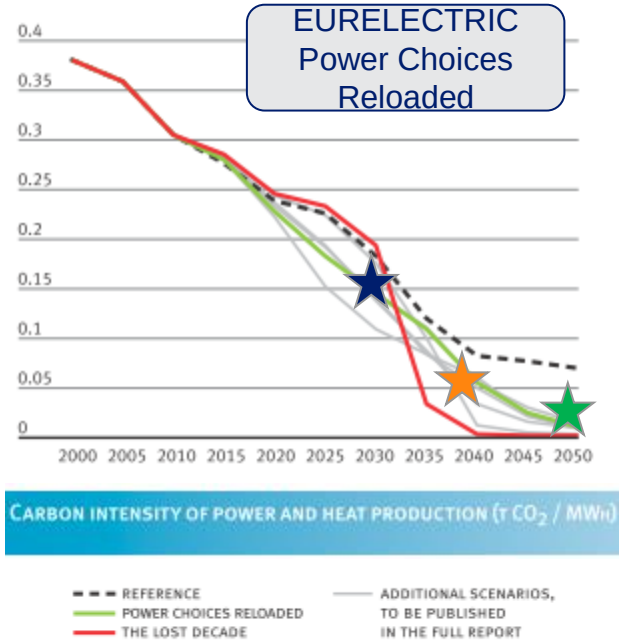
Pöyry Future Market Design study has defined it as delivering a carbon intensity of 20gCO2/kWh by 2050 within the power sector – consistent with EU Energy Roadmap decarbonisation scenarios

Carbon intensity targets

EU Energy Road Map Scenarios



EURELECTRIC Power Choices Reloaded

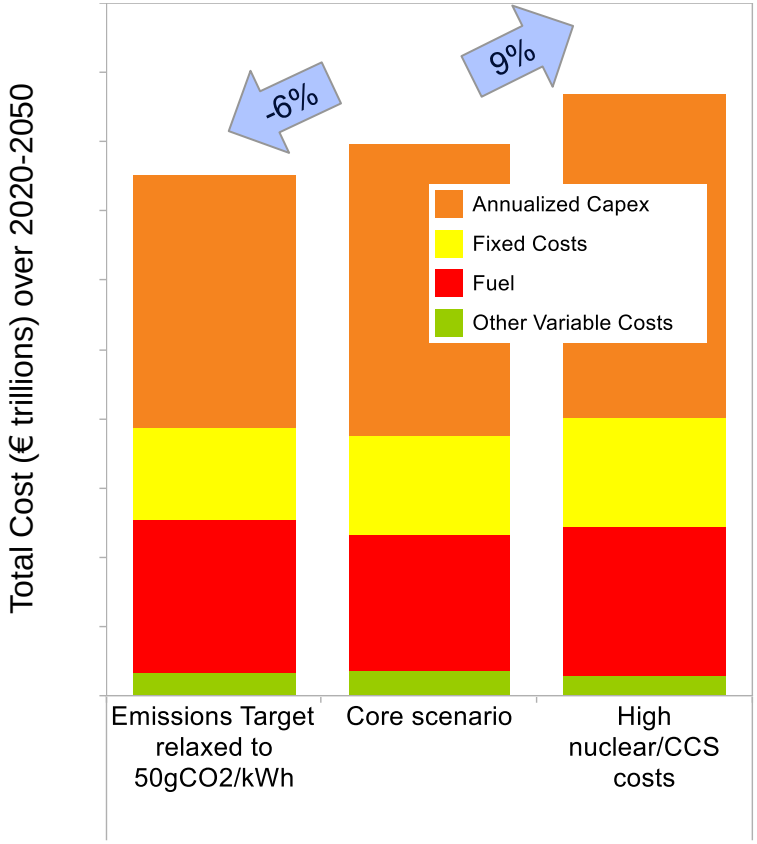


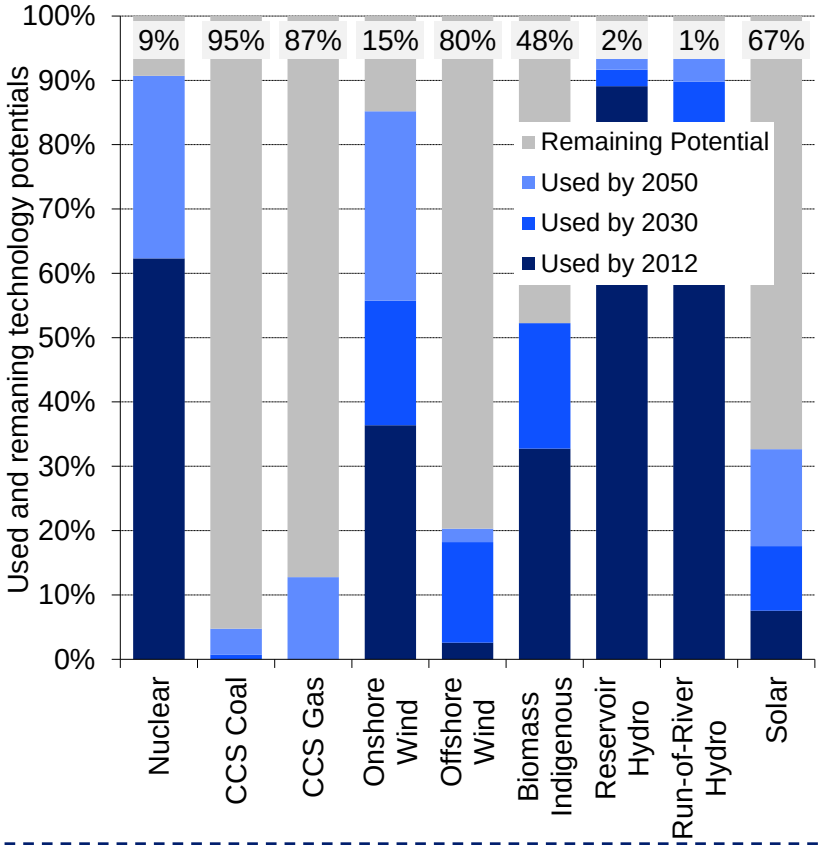
2030 – 150gCO_2/kWh
2040 – 50gCO_2/kWh
2050 – 20gCO_2/kWh

Decarbonisation is a major challenge whichever policy path is chosen

Overarching challenge of decarbonisation

1. The cost of decarbonising electricity is high and unevenly shared whichever path is taken
2. Costs vary strongly between technologies, and future capabilities are highly uncertain
3. Deployment of low carbon technologies is bound by political and resource constraints





Pathways to decarbonisation will depend heavily on policy choices

A number of policy scenarios covering carbon pricing, out-of market low carbon support, trans-national coordination and approach to security of supply can be envisaged

Absolute Market

- **Decarbonisation is delivered through pure market solutions**
- Carbon price drives low carbon investment
- Scarcity rent (linked to system margin) in the electricity price incentivises sufficient generating capacity needed to maintain security of supply

Building National Solutions

- **National intensity targets, support payments and electricity market designs**
- Support regimes designed to deliver national carbon intensity targets drive low carbon investment
- National solutions to maintaining security of supply

Coordinated European Planning

- **Targets, support payments and capacity mechanisms are coordinated across EU**
- Low carbon investment via support regimes for EU RES and carbon intensity targets
- A common EU-wide capacity mechanism exists to ensure security of supply
- Coordinated transmission build planning

Dual Support

- **Delivering decarbonisation through tempered market solutions plus residual low carbon support payments**
- Carbon price drives low carbon investment in first instance, supplemented by support payments if needed
- Strategic reserve delivers security of supply

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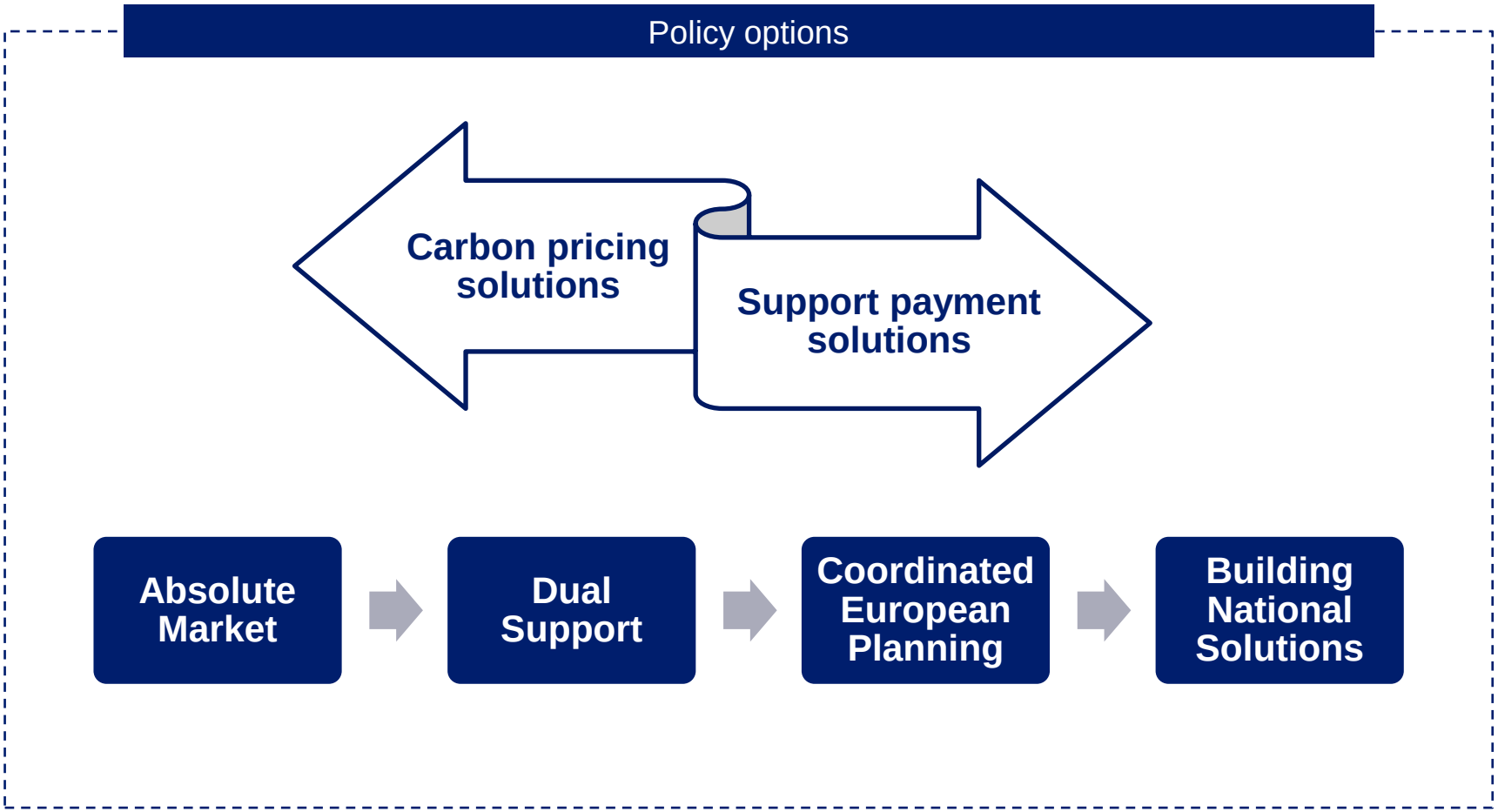
The key choice is to decide where we should be sitting on the carbon pricing vs. direct low carbon support policy spectrum



Alternative policy choices present different challenges for delivering carbon intensity targets

Key issues with carbon pricing approach

A. A successful carbon-only regime must balance democratic obligations with long-term investment needs

B. The basis for investment is the market wide (future) carbon price, with no project-specific support

C. The carbon price ultimately becomes high, volatile and very sensitive to technology costs – diminishing returns from carbon price after a 'tipping point'

D. Generators face high revenue volatility even if carbon price is known (price and volume risk), which may increase the cost of capital

E. Wealth transfers between countries will be significant and market driven

F. No price discrimination (banding), which can lead to high 'producer surplus' for the cheapest low carbon technologies (e.g. existing nuclear and onshore wind), and higher costs of energy to customers

Key issues with support payment approach

G. Support regimes require central planning to varying degrees, risking high deployment costs through decisions on location, technology choice and payment – evidence shows that these are major issues

H. Support regimes are subject to political variation and other national policy objectives, which raises policy reliance and the degree of (counterparty) policy risk and threatens stability of investment programmes

I. Existing support mechanisms distort price and dispatch and still leave volume risk, which becomes an ever greater issue under production based schemes – alternative mechanisms will be needed

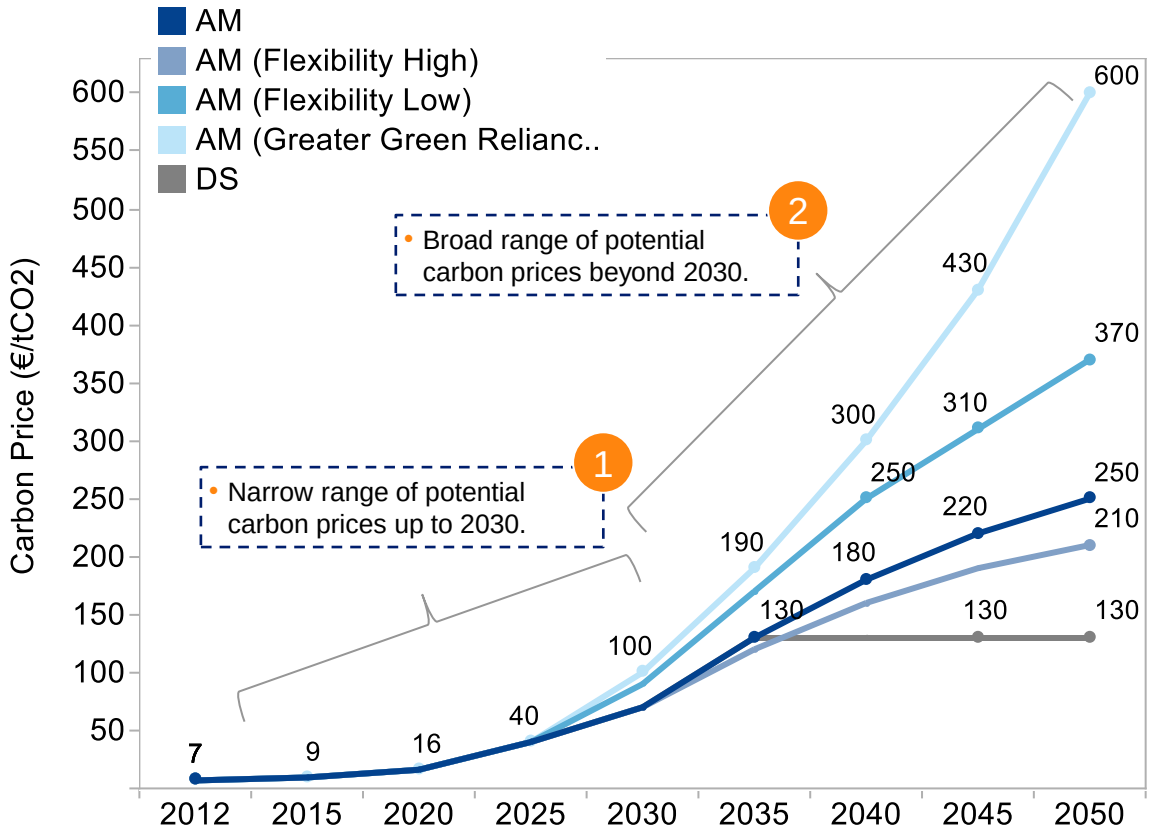
J. Linking support payments to RES targets or similar technology-specific targets can have a distortionary impact on CO_2 price and other carbon abatements

K. Support payment approach can lead to price divergence between markets and moves away from the principle of a single price for electricity

In future, the required carbon price to drive further decarbonisation becomes high, uncertain and sensitive

The range of potential carbon prices required to drive investment widens over time, posing uncertainty and concerns regarding bankability of the trajectory

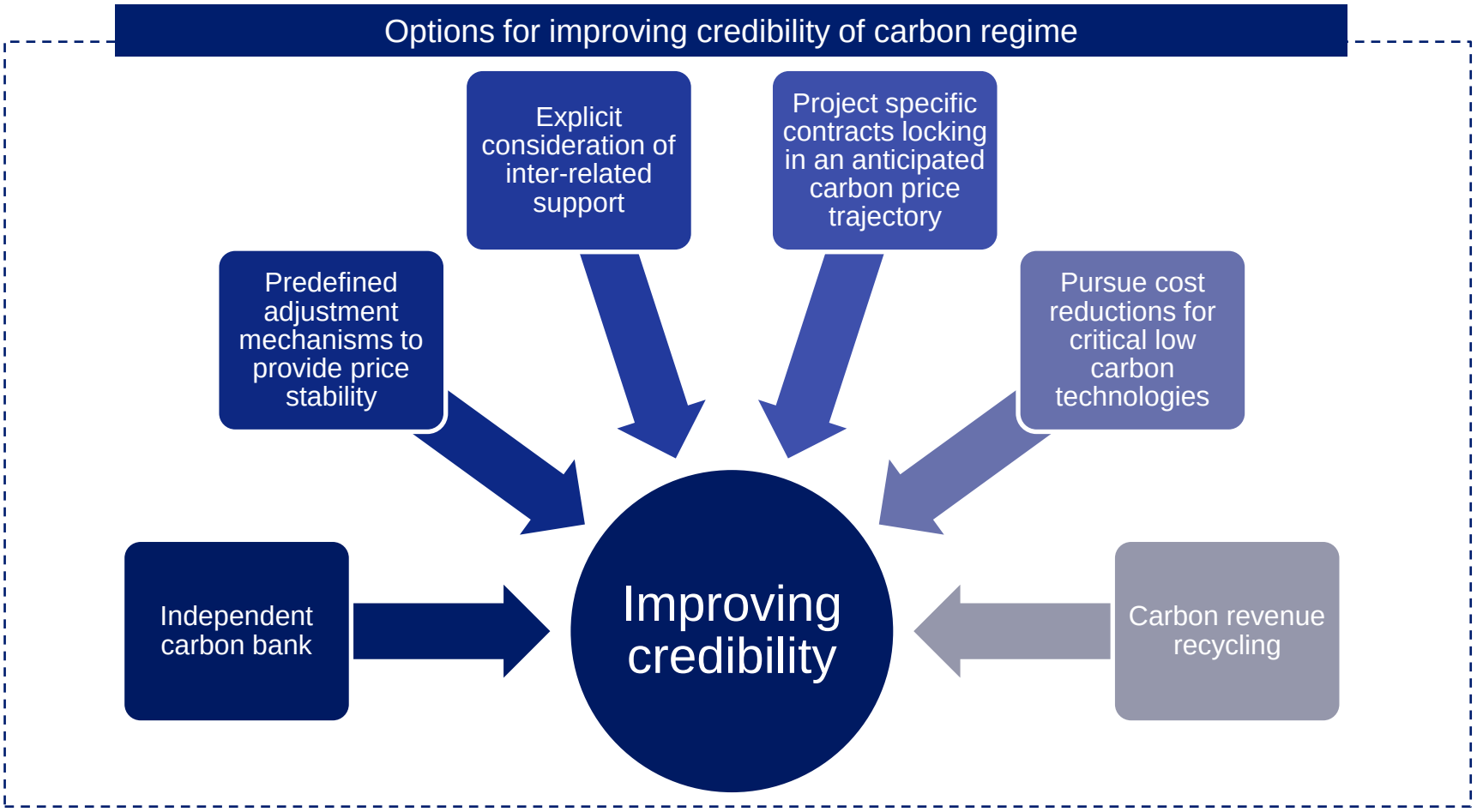
Carbon price trajectory under markets Cases and 20gCO_2/kWh Sensitivities



- Delivering low carbon investment beyond 2030/35 requires a high and rising carbon price, due to diminishing returns from incremental increases as carbon falls out of the wholesale price
- The spread of potential carbon prices broadens from 2030/35 across the sensitivities, creating uncertainty for investors regarding the anticipated carbon price over the economic lifetime of a project.

Credibility of carbon regime can be improved by reducing political involvement and pursuing cost reductions for critical technology

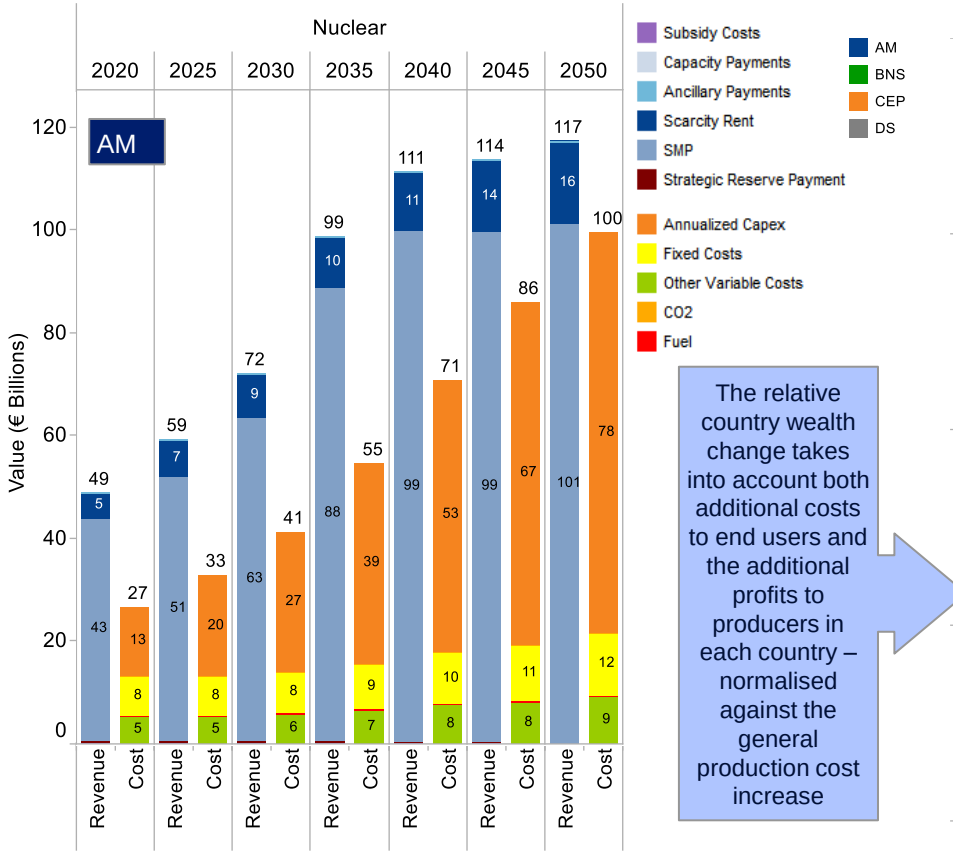
The range of potential carbon prices required to drive investment widens over time, posing uncertainty and concerns regarding bankability of the trajectory



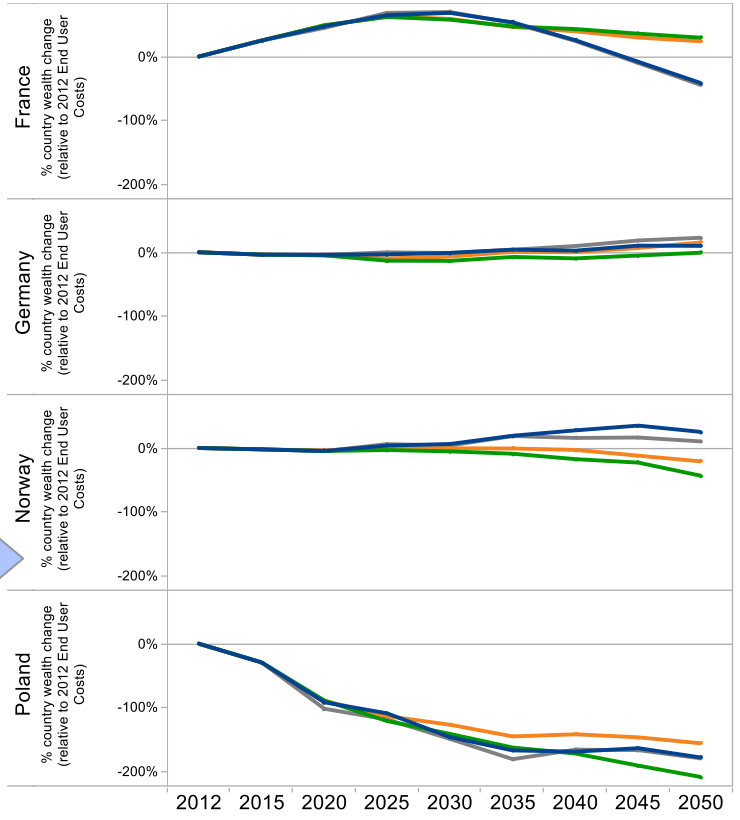
Wealth transfers can take place both from country to country and between consumers and producers

High consumer to producer transfers can be seen under carbon pricing, particularly for nuclear around 2030-2040 when carbon emissions reach around 100gCO_2/kWh

Costs vs. revenues for nuclear (AM) & Relative country wealth change (selected countries)



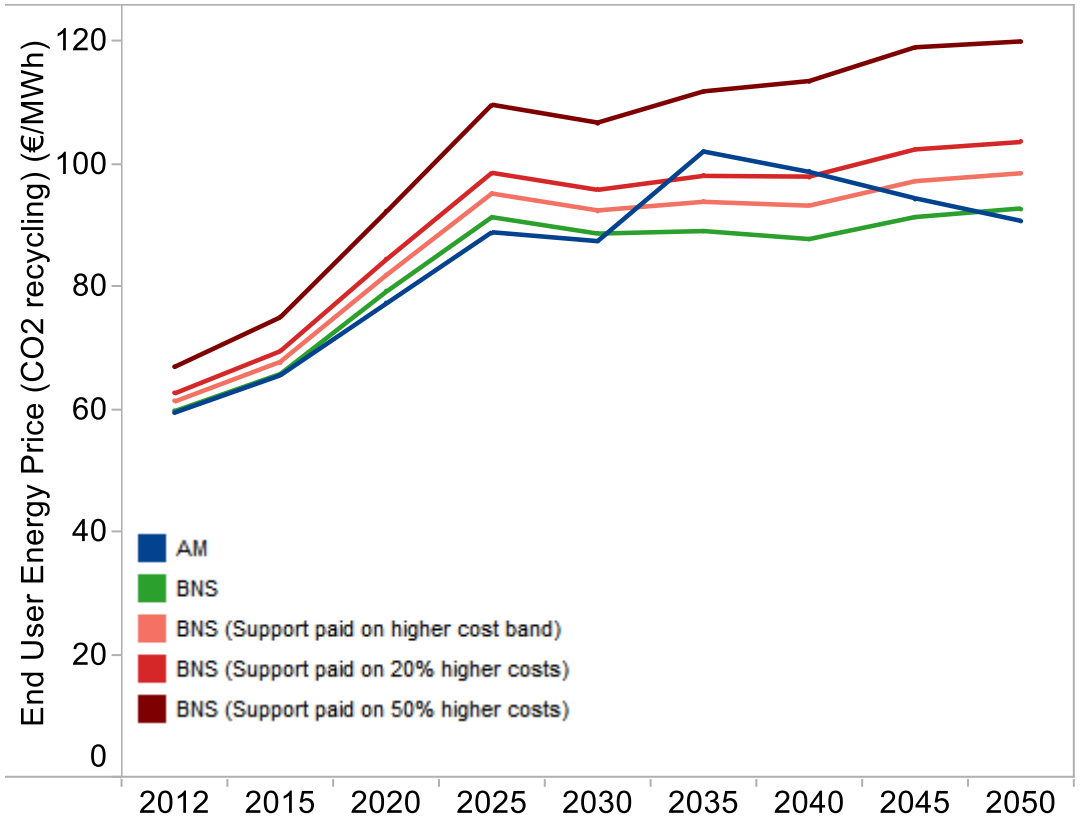
The relative country wealth change takes into account both additional costs to end users and the additional profits to producers in each country – normalised against the general production cost increase



All support regimes require central planning to varying degrees and history shows that this is a major issue

These inefficiencies can arise through decisions on location, technology choice, and payment levels as well as reduced incentives for efficient plant operation.

End User Energy Cost under the AM scenario the BNS scenarios with different levels of efficiency

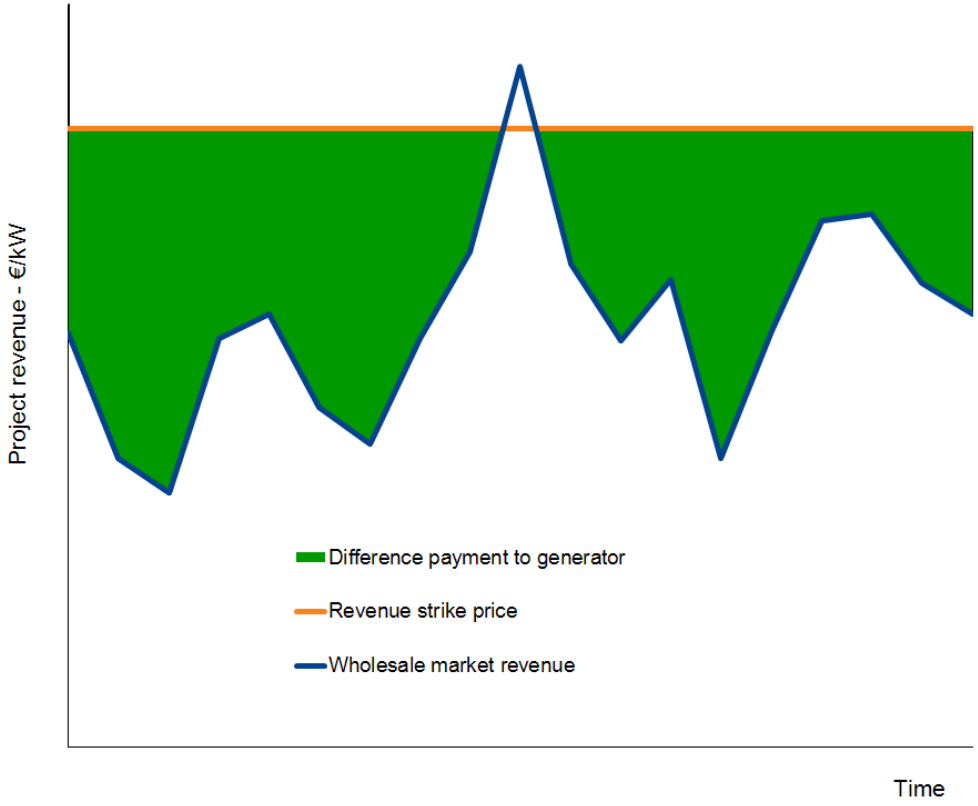


- Rising inefficiency in the support regimes can dramatically alter the cost to the end user.
- When the scheme is shown to be extremely efficient (BNS) then overall end user energy costs tend to be cheaper than the market scenario.
- However, higher cost assumptions arising from inefficiencies can push the regulated solutions much higher than the Absolute Market carbon pricing solution.

Future support schemes must deliver revenue certainty, in the light of price and volume risk

Revenue support scheme based on revenue (not price) contracts for difference, with commercial exposure to wholesale market, offers a possible approach

Revenue CfD support scheme

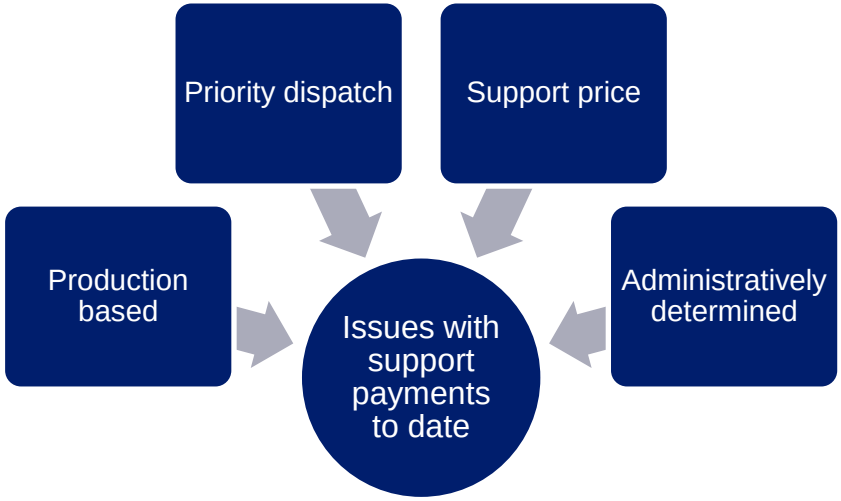


- An overall revenue requirement for each low carbon technology is agreed up front
- Wholesale market revenue expectations are determined ex-ante, potentially annually, for each low carbon technology based on fundamentals modelling
- The revenue support is set based on difference between revenue requirements and anticipated wholesale revenue
- Payment is not made based on production, which removes incentive to bid below SRMC and so reduces dispatch distortion
- The generator still trades through the wholesale market and has incentive to beat expectations – projects have a commercial interest in wholesale market operation

Current support mechanisms distort dispatch and address price risk but not volume risk, which increases with decarbonisation

These deficiencies mean that the basis for support payments must change

Updating the basis for support payments



- Assuming continuation of existing basis for support means current problems will intensify => locking in inefficient outcomes
- The basis for determining the value and allocation of support payments must change under future regimes

- Break link between production and support payments to address dispatch distortion
- Support for revenue (expected not actual), not price, albeit with exposure to wholesale market
- Support payment value and allocation determined by competitive forces

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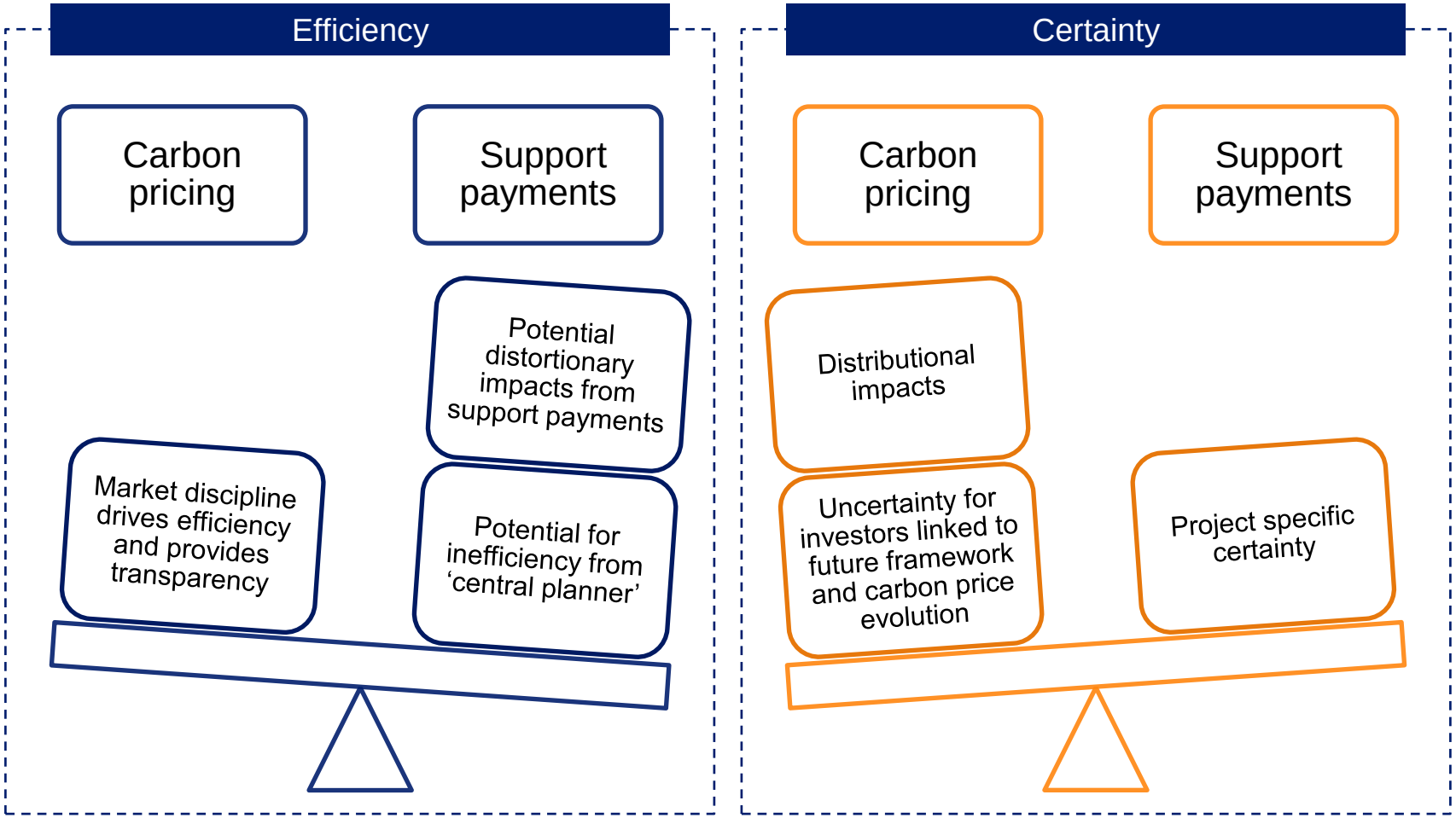
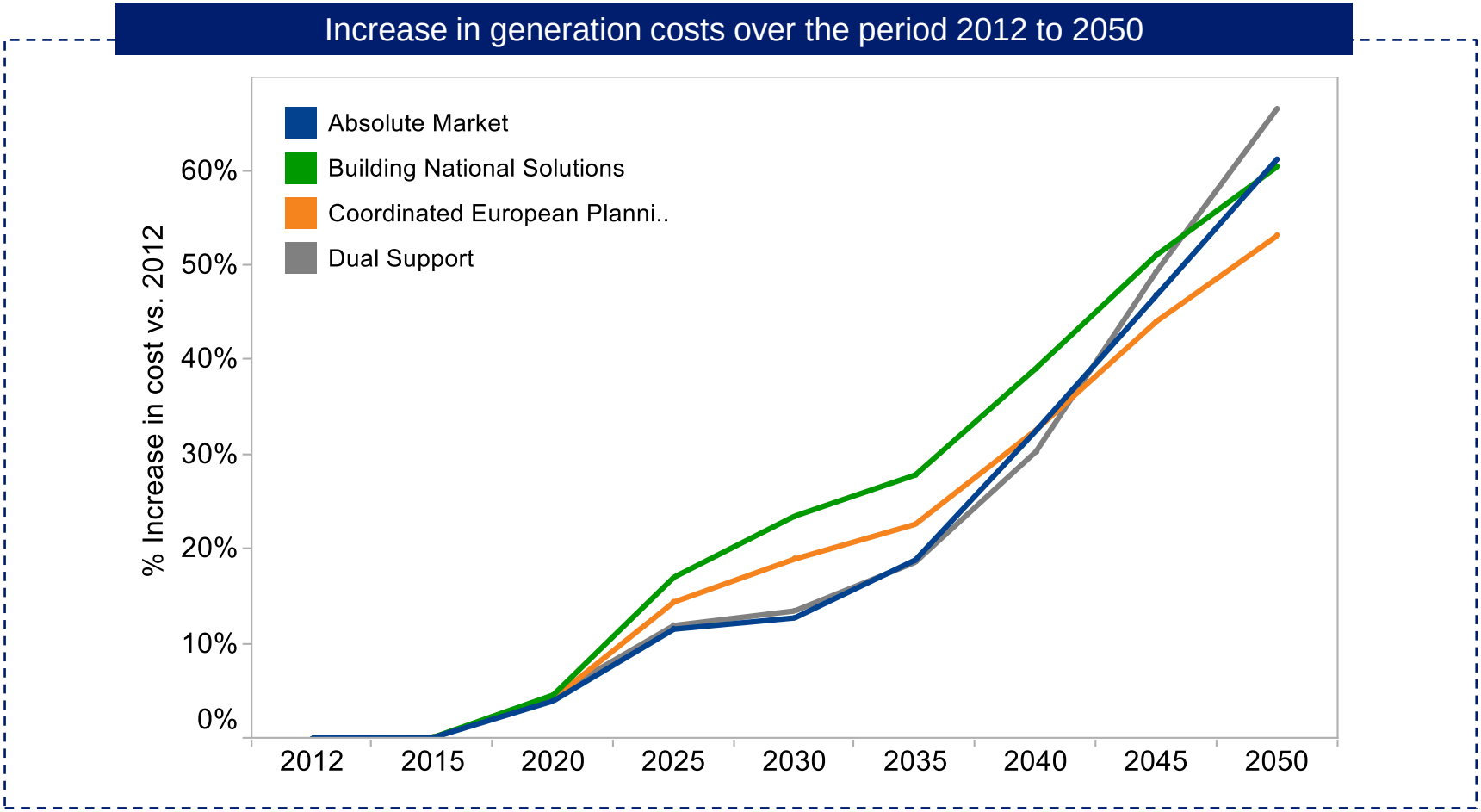
The alternative approaches offer a different balance between efficiency and certainty



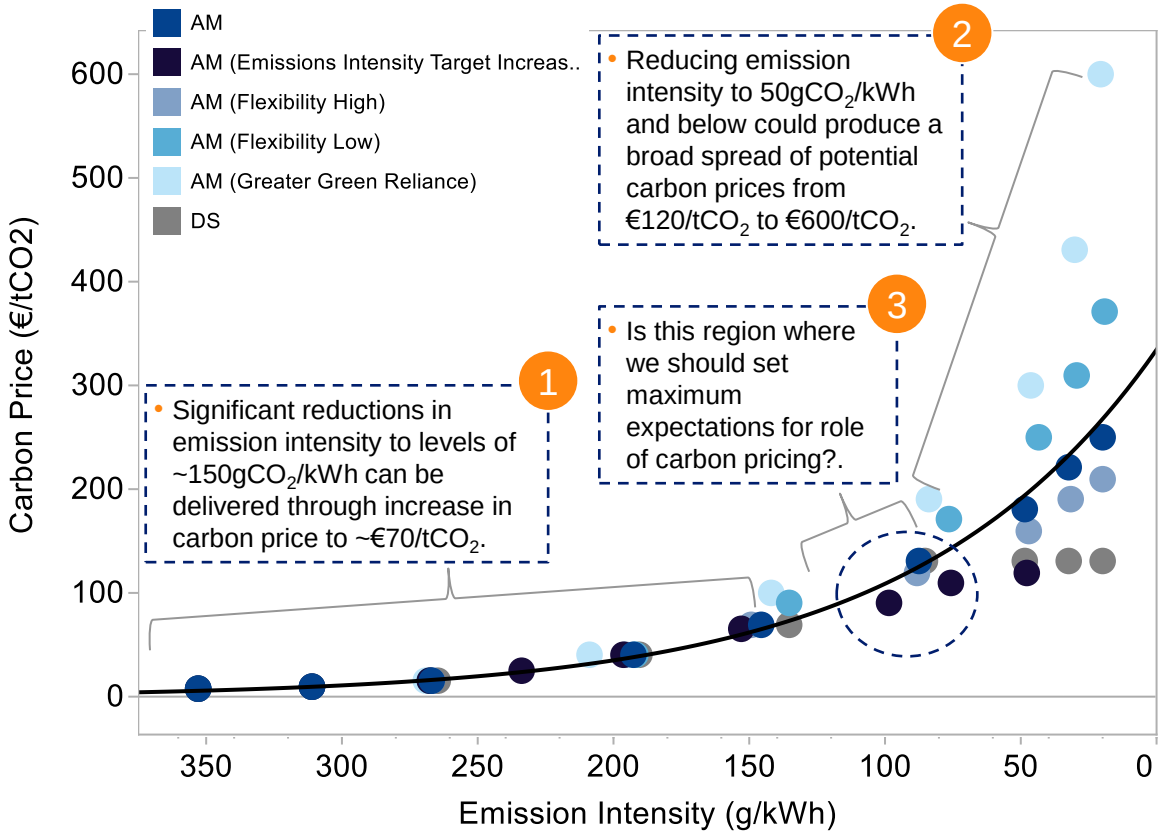
An evaluation of total generation costs illustrates the benefits of market based regimes in the short term in minimising costs…



…however there appears to be a tipping point for the role of carbon pricing as driver for decarbonisation

The next phase of power sector decarbonisation can be delivered with carbon price rising to €70/tCO$_2$, before issues of diminishing returns intensify

Relationship between carbon emission intensity and carbon price from market



- Increasing the power sector carbon price to €70/tCO$_2$ delivers a 200gCO$_2$/kWh reduction in carbon intensity.
- Realising the potential for carbon pricing to deliver this requires **binding political commitment now**.
- Option for structured transition to incremental support thereafter if risks and volatility too great

Beyond the tipping point we are may need to look again at direct support – and ultimately the effectiveness of alternative policy options is based on appropriately allocating risk

Assessment of policy regimes clearly highlights the differences between alternative market and regulatory models

Risk	Ideal allocation	Carbon regime	Carbon bank	Carbon regime plus put options	Fixed FIT	Green Certificate (non-banded, production based)	Ex ante revenue support	Single buyer
Construction and maintenance	Market	Market	Market	Market	Market	Market	Market	Market
Operational and short-term market	Market	Market	Market	Market	State	(Market)	Market	(Market)
Long-term market fundamentals and technology evolution	Market	Market	Market	(Market)	(State)	(Market)	State	State
Policy development	State	Market	Market	(State)	State	(Market)	State	State
Policy adaptability	State	Out of bounds	Carbon bank	(State)	State	(State)	State	State

Policy Recommendations: Need action now to reach commitment on a carbon pricing approach to drive next phase of decarbonisation

Mitigation measures may be required to boost credibility and acceptability

1 → **Commit now to a clear carbon pricing framework to deliver the next phase of power sector decarbonisation and pursue policies that support its effectiveness**

A strong carbon pricing regime can deliver significant decarbonisation through fuel switching and delivery of lower cost low carbon investment options

- may require improved institutional credibility (e.g. independent carbon bank, pre-defined adjustment mechanisms)
- may need re-distribution of impacts, e.g. through carbon revenue recycling

2 → **Build in option for structured transition to incremental support in future**

Potential tipping point in effectiveness of carbon pricing linked to diminishing returns from incremental carbon price increases and associated sensitivity

- requires clear triggers for transition to project-specific support regime for higher cost technologies
- investors will demand stability for projects that straddle the transition

3 → **Enhance support payments, balancing revenue certainty and short-term efficiency**

Production based subsidies have distortionary impact and do not provide investor certainty as volume and price risk increase

- option to switch to revenue support scheme, not paid on output, which improves longer-term certainty while providing commercial exposure to short-term operation of wholesale market

Security of supply must be delivered alongside decarbonisation

Security of supply

1. Scale of investment needed to deliver security of supply is overshadowed by investment needed for decarbonisation

Key issues with scarcity rent approach

A. Delivering security of supply in an energy-only market requires high levels of scarcity rent and acceptance of wholesale price spikes

Key issues with capacity mechanism approach

B. Designing an effective capacity mechanism is difficult. This challenging task falls to regulators to address – potential for regulatory risk.

Key issues with strategic reserve approach

C. Capacity must be appropriately ring-fenced from the market to avoid slippery slope issue and crowding out of market led investment

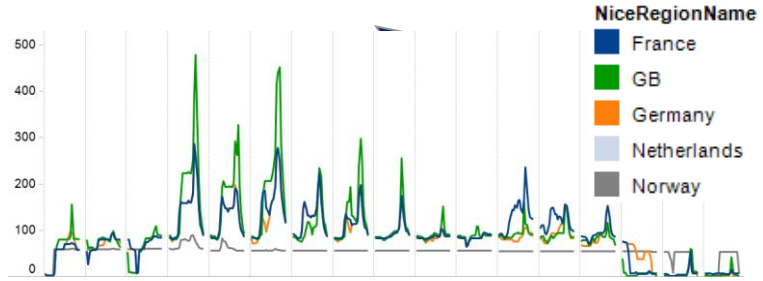
Further important questions for the implementation of new arrangements to reward flexible capability

European electricity markets must change (2014) to improve cross-border trading

What is the requirement for flexibility?

Decarbonisation increases need for flexibility

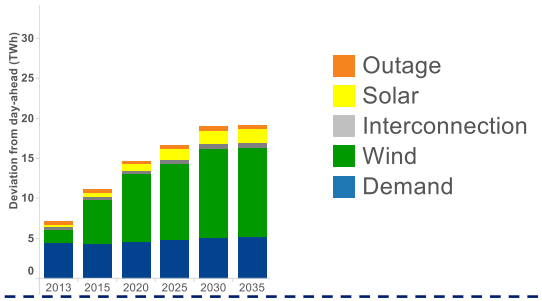
Projected 2030 wholesale electricity prices in Northern Europe



Who needs to buy flexible capability?

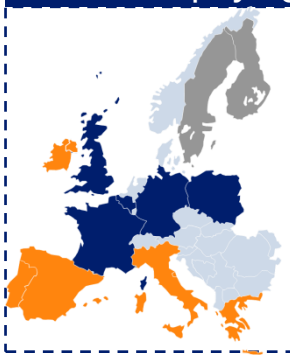
Greater balance responsibility, especially RES

Projected difference between day-ahead and out-turn (GB)



What is the impact of capacity mechanisms?

Risk paying for the wrong technology



- Existing 'wide' capacity mechanism
- Existing 'narrow' capacity mechanism
- Proposed capacity mechanism

How can flexibility be traded across borders?

Implementation of EU 'Target Model'

- How much cross-zonal capacity is available for sale in each timeframe?
- What are the mechanisms and rules for selling cross-zonal capacity?
- How much harmonisation of balancing and imbalance arrangements?

Capacity payments do not appear to be the answer for providers of flexible generation…

…tend to be a market intervention rather than a market-based solution	• often called for as a thinly-guised support for stranded assets
…introduce a new set of regulatory risks	• e.g. regular intervention in SEM to bring down the total payments • e.g. "will we, won't we" capacity payments in GB • e.g. separate payment (terms) for new and existing plants
…tend to bring forward pre-determined types of capacity (not need-driven)	• Do we need MW or flexibility? • Over what timescales? • How/when will this change?
…tend to emphasise long-term stability over short term efficiency	• therefore the pattern of cross border flows can be badly distorted • demand-side is usually excluded, or included in a clumsy way
…tend to be national rather than regional	• therefore the pattern of cross-border investment can be badly distorted

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