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Departamento
Economía

Design of Support Schemes for Renewables

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BC3 Summer School

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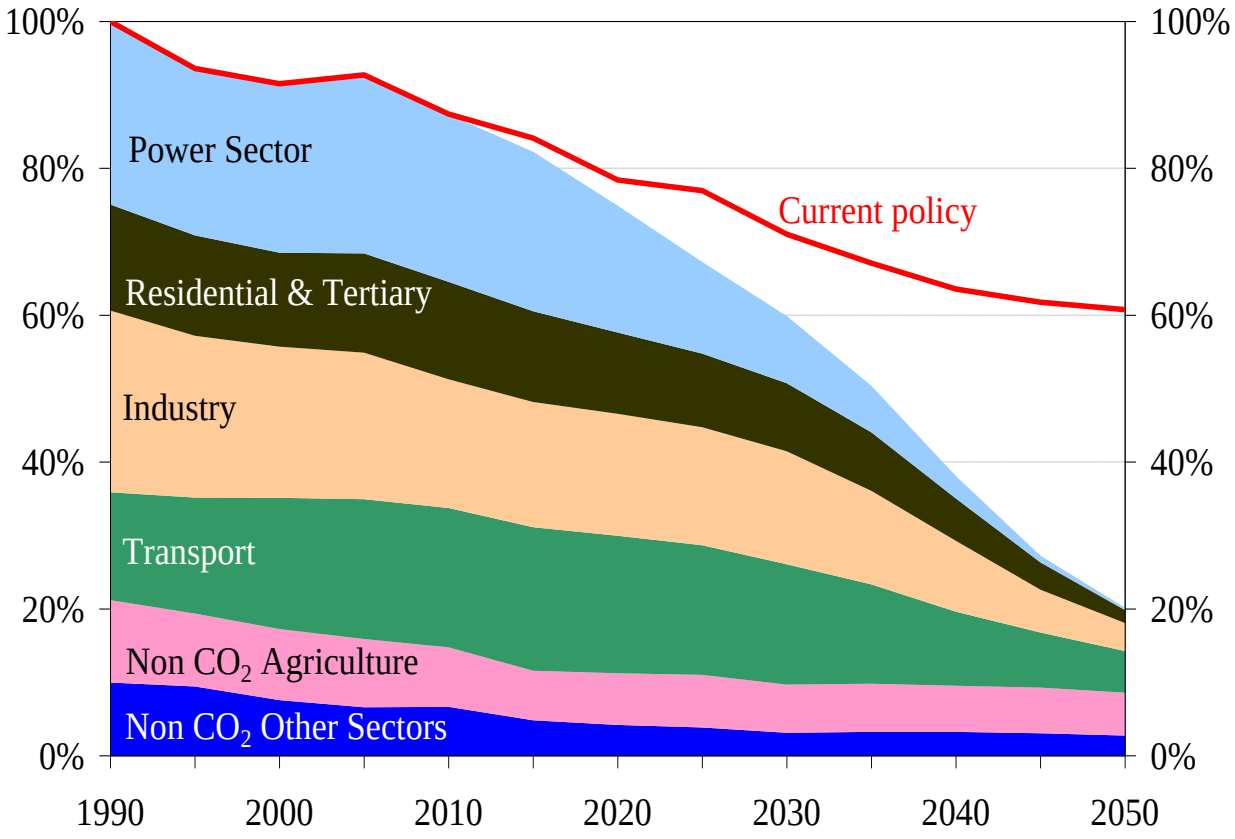
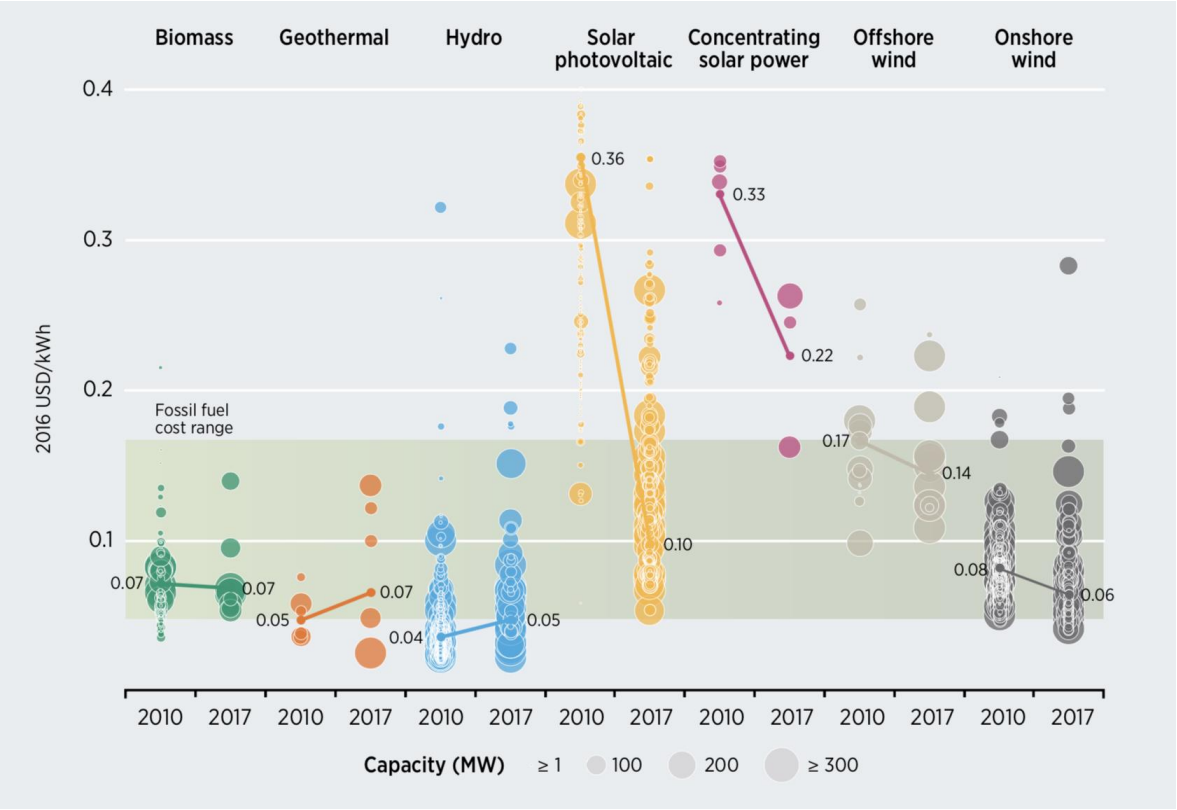
Decarbonising our economies



Roadmap for moving to a competitive low carbon economy

Source: EC(2011)

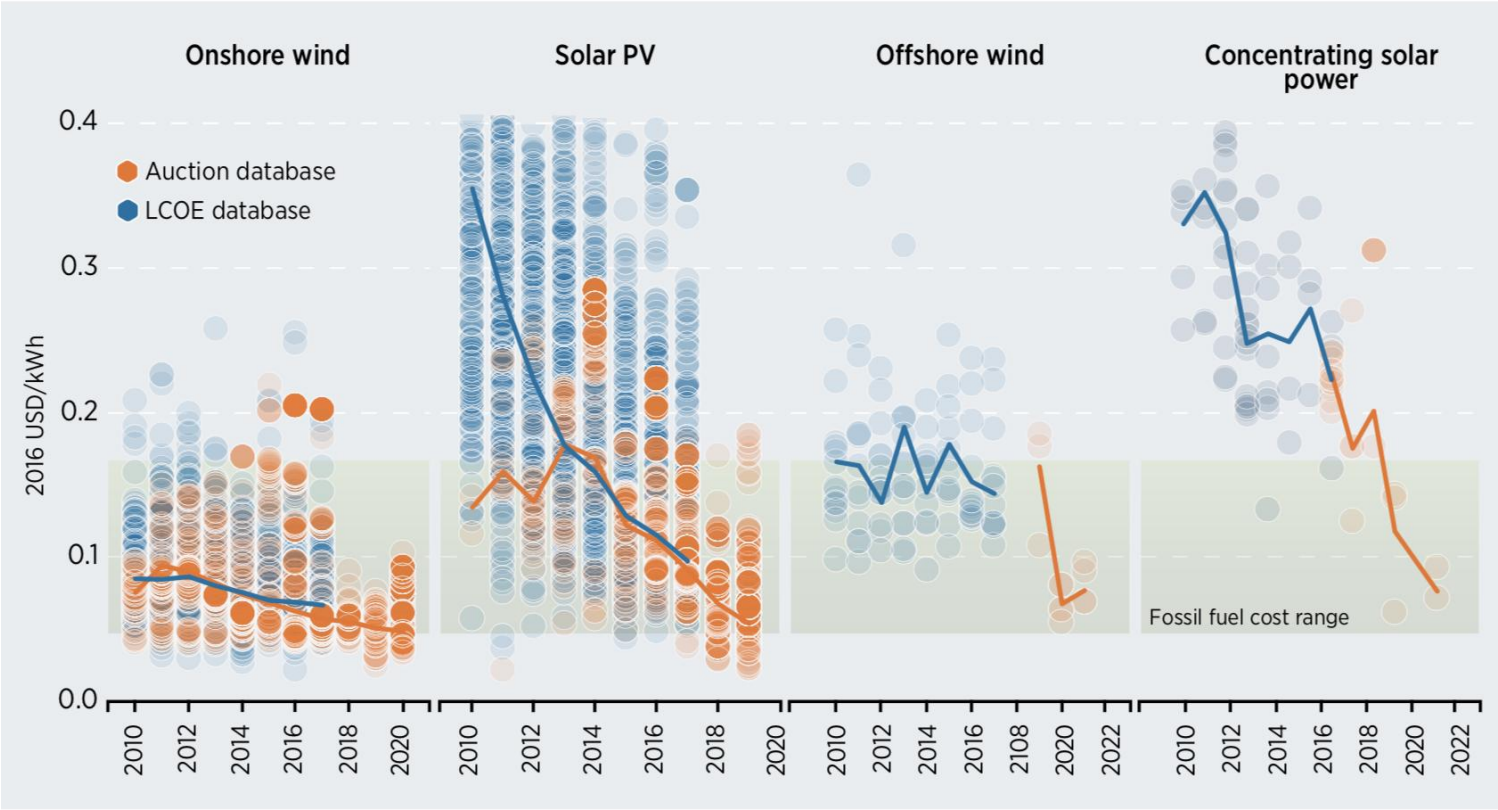
Electricity from renewables has become competitive with most fossil fuels



Global levelised costs of electricity for large-scale renewables 2010-2017

Source: IRENA (2017)

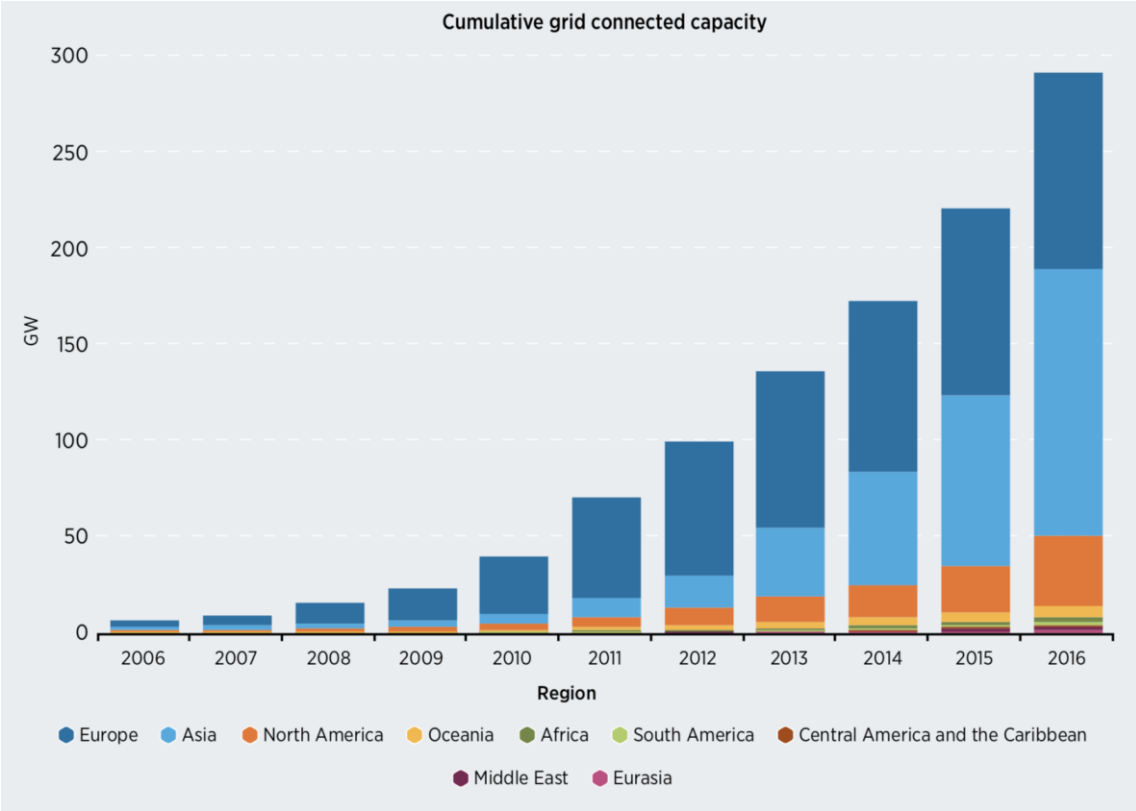
Future costs reductions expected



Levelised costs of electricity for wind, solar and concentrating solar, 2010-2020

Source: IRENA (2017)

Renewables are growing everywhere



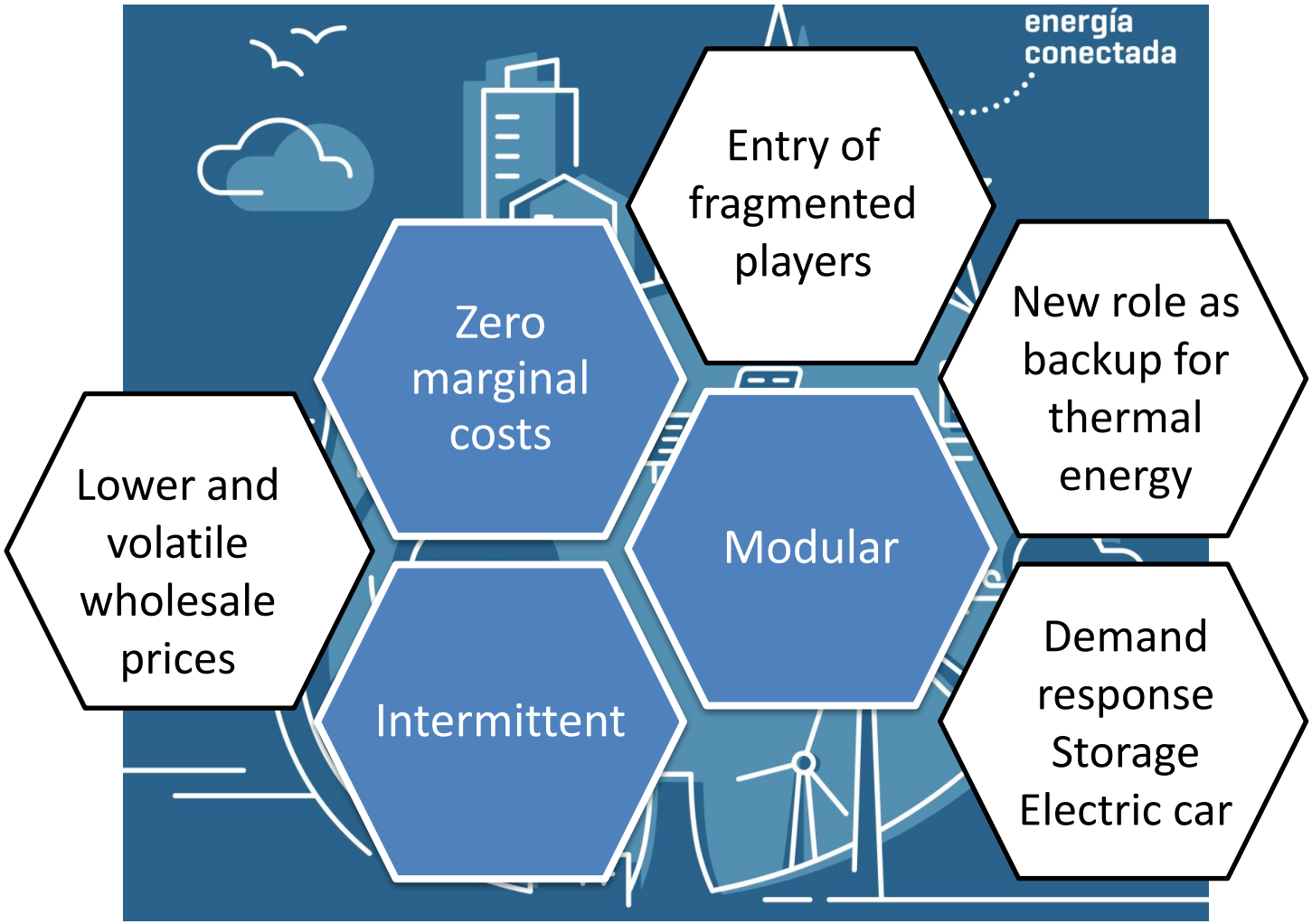
Cumulative solar PV capacity by region, 2006-2016

Source: IRENA (2017)

This Talk

- Renewables: a game changer
- The need for a new market design
- The renewable auction revolution
- Support schemes for renewables
  - Auctions
    - Design options
    - Case studies: Germany and UK
- Conclusing remarks
- [References]

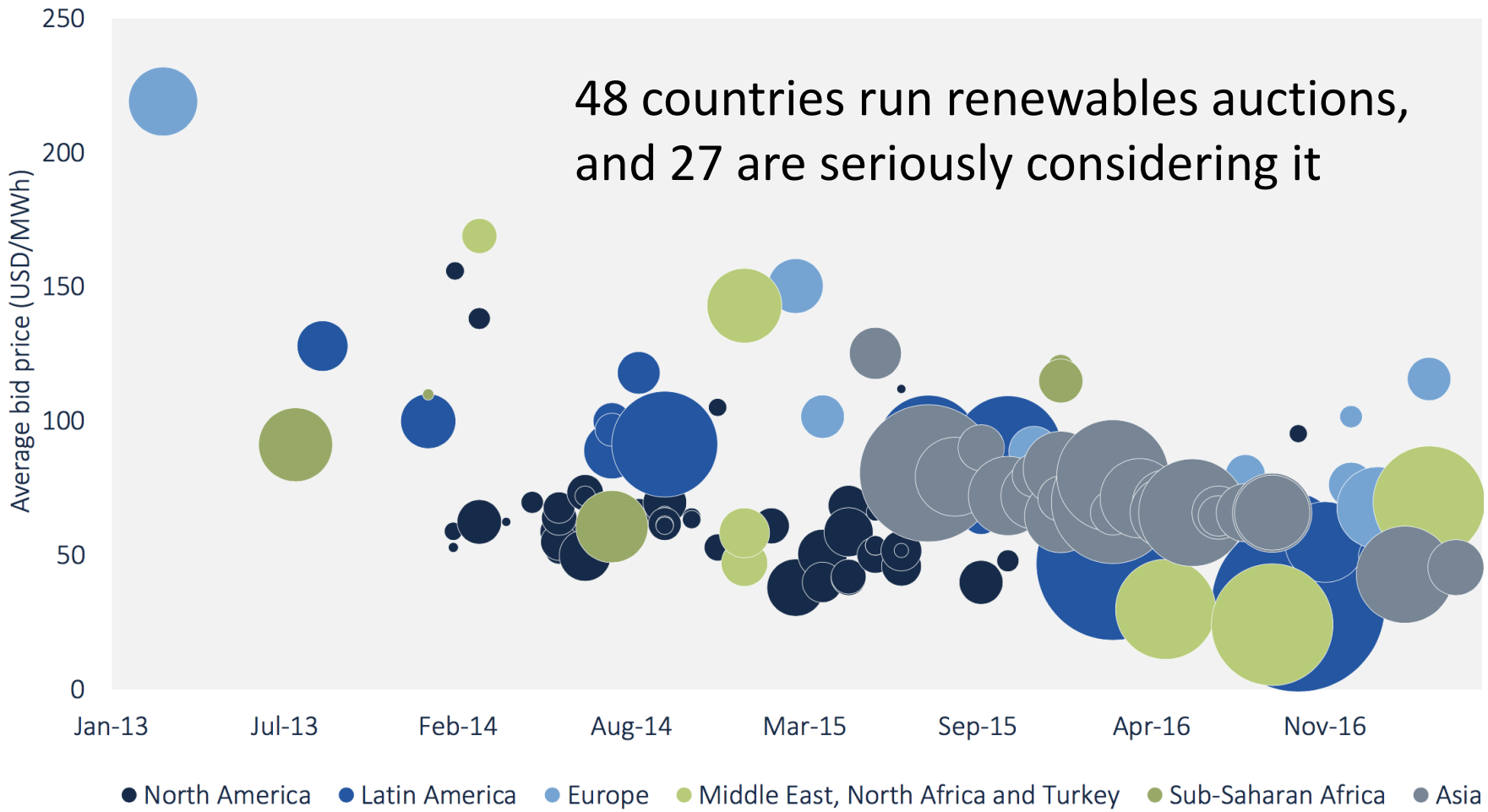
Renewables: a game changer



Need to re-think market design

- Shift of focus from the short to the long-run
- Need to de-risk investments
- **Auctions for long-term contracts**
  - **Renewable energy**
  - Back up capacity
- Liquid spot markets
- Important role for System Operators
- Market integration through interconnections

The renewable auction revolution

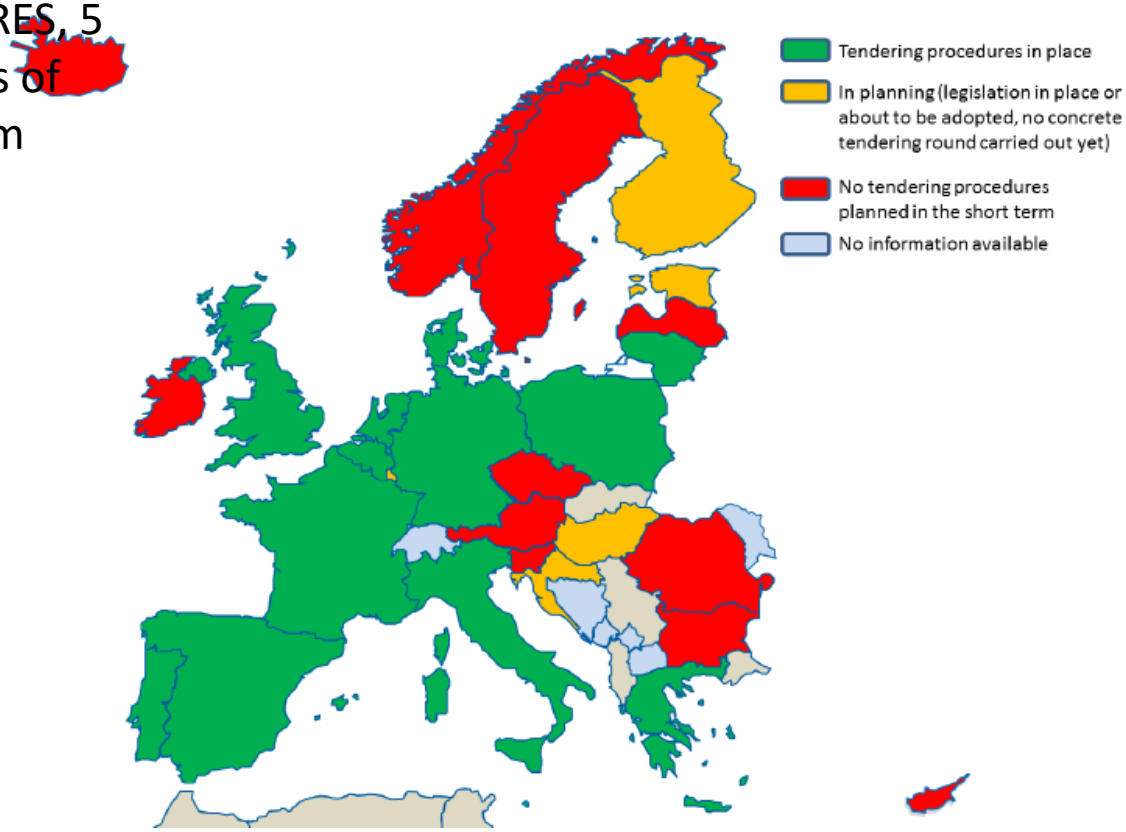


Global Tendered Projects by Bid Price and Capacity, 2014-2016

Source: GTM Research

The renewable auction revolution

In Europe, 13 countries use auctions for RES, 5 are in the process of implemeting them



Approaches setting support schemes

Objective: set cost-efficient support for RES

- **Administrative approach**
- **Competitive process:**
  - Certificate (quota) schemes
  - Auctions

Administrative approach

- price/quantity set by the administration

Challenges:

- **Asymmetric information**
  - Investment and operational costs
- **Specificities of each plant**
  - Location, maturity, etc.
- **Adjustment over time**
  - As costs of renewables go down
- **Credibility**
  - Vulnerable to retroactive cuts

Quota system (green certificates)

- Quantity based support scheme:
  - Demand side obliged to buy certificates
  - Supply side can sell certificates for every RES projects
  - Certificates can be traded bilaterally or through an exchange

Challenges:

- not very successful (UK, Italy, Poland… have abandoned it)
  - regulatory risks, leading to excess volatility and high capital costs
    - Newbery (2016): in the UK, move from ROCs to auctions reduces cost of capital from 6% to 3%, saving GBP 2.25billion/year
  - overcompensation for lower-cost technologies if technology neutrality

Design of Renewables Auctions

Design criteria:

- **Eligibility of technologies:** technology-neutral vs. technology-specific
- **Contract design:**
  - payment per KW + market price, or
  - payment per kWh (Feed-in-Tariffs, Fixed premia, Floating premia, CfDs)

Other Design Criteria

Auction design options

- **Pricing rule:** pay-as-bid or uniform pricing
- **Selection criteria:** winning bidders are
  - **Price-based tenders:** those offering lowest prices
  - **Multi-criteria tenders:** combination of multiple criteria (volume, location, environmental impact, etc.)
- **Price caps/price floors:** max/min bid level
- **Frequency:** periodic versus ad-hoc
- **Volume to be tendered**

Other Design Criteria (cont.)

Eligibility criteria

- **Participation:** size, type of candidates, national vs. cross-border
- **Prequalification:** financial securities, technical requirements such as building permits, land use planning

Others

- **Penalties for non-compliance** (or delays)
- **Tradability of support entitlements**

Technology neutrality vs. Technology specificity

- In technology neutral auctions, different RES compete against each other, with the aim of determining the most cost-efficient one.
  - In EEAG framework: default bidding scheme
  - Technology specific tenders only allowed under specific conditions: lack of competition or need to ensure diversity of RES technologies.
- Problems with tech-neutral auctions:
  - Over-compensation
  - Fail to support the long-run cost-efficient technologies
  - high concentration of RES installations in the same area (congestion)

Fixed vs Floating premia

Fixed premia:

- RES receives a fixed premium over the reference market price (€/MWh)
- Potentially combined with a capacity payment (€/MW)
- Certainty over the level of support
- Uncertainty over the level of total payment

Floating premia:

- The premium is inversily proportional to the market price
  - CfDs: premia can be negative
- Uncertainty over the level of support
- Certainty over the level of total payment

Fixed vs Floating premia

Main arguments in favour of fixed premia:

- Incentives to perform better
- Leveled playing field wtr conventional technologies

Main arguments in favour of floating premia:

- Because RES producers face little price variatna, costs of capital are reduced
- Newbery (2016) estimates this has saved the UK system 2.5B GBP

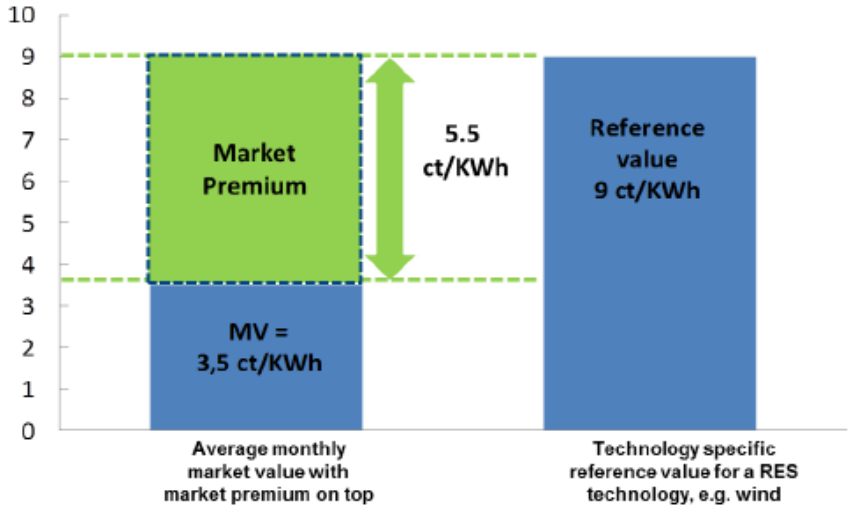
Pay-as-bid vs. Uniform pricing

- **Pay-as-bid**: winning projects paid according to their bid
- **Uniform pricing**: paid according to the highest bid
- If **competitive conditions**, both auctions are equivalent:
  - Pay-as-bid: bid close to the highest accepted bid
  - Uniform: bid at your cost, resulting payment equals highest cos
- Otherwise, if **strategic behaviour**:
  - Incentives to overbid: risk of not winning vs incresed market price for all winning bids
  - Winners' curse: winning is bad news as others believe future costs will be higher

European Experience

- Aucion-based schemes tend to lead to lower prices more than administrative fees
- Auctions have shown a strong potential to drive price reductions in new RES
- In Europe, most auctions have been:
  - pay-as-bid format
  - for premia (ether fixed or floating)
  - technology specific
  - restricted to national players

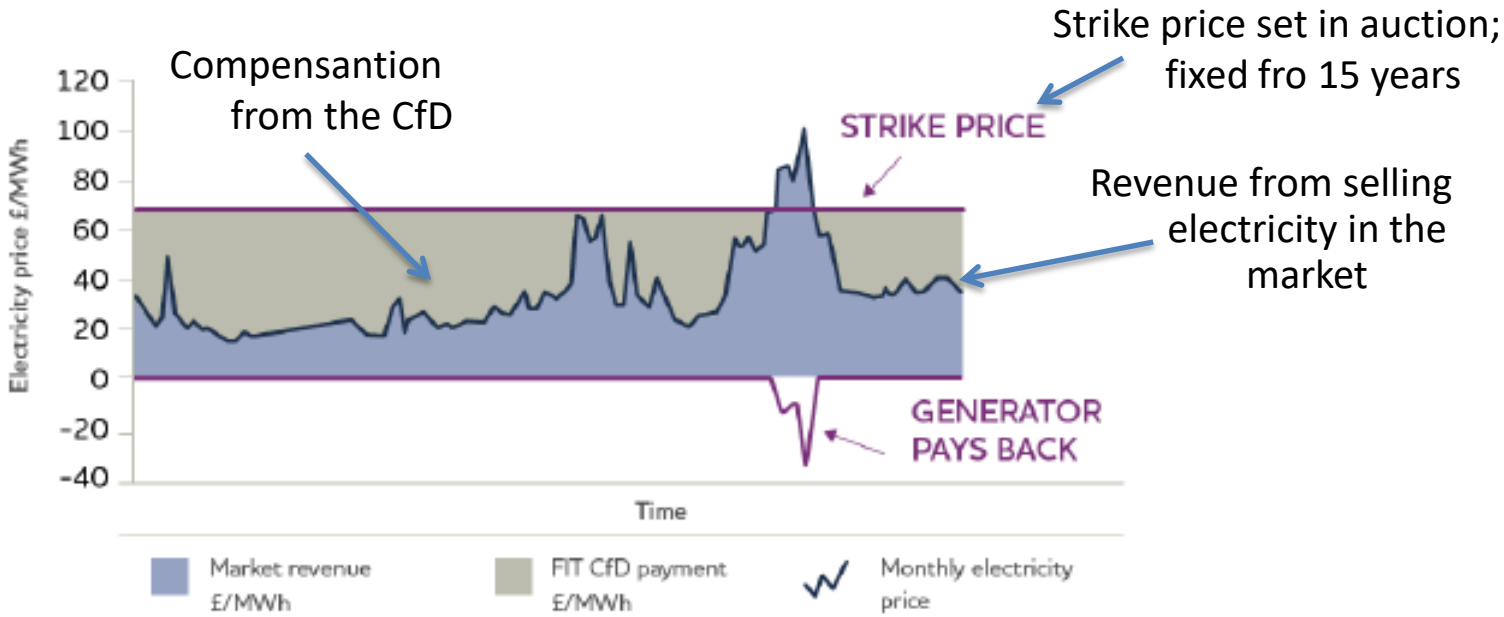
Case study: Germany



FITs with floating premia

- It applies to all installations above 100kWs if they intend t btain the premium
- Reference value: since 2017, set through an auction; fixed for 20 years
- Market Value (MV): technology specific weighted **monthly** average of market price
- One-way contract: if market price>reference price, investors do not pay back
- RES has balancing responsibilities

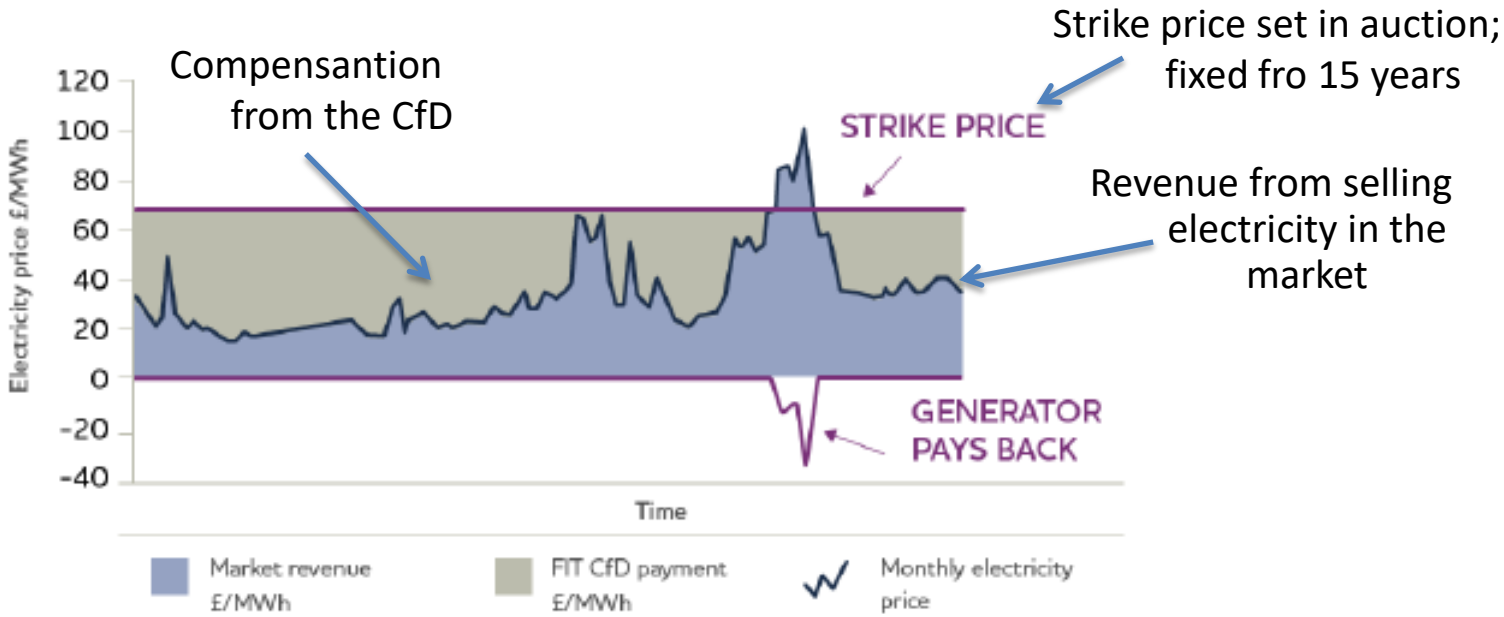
Case study: UK



FITs with Contracts for Differences (CfD)

- CfDs provide revenue certainty to RES investors
- Reduce the borrowing costs of financing RES projects
- Encourage competition both within and between generation technologies
- Improve the affordability for consumers (generator pays back if high market price)

Case study: UK



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Case study: UK

	Capacity (MW)	Admin Strike price 2014 (£/MWh)	Lowest auction clearing price Jan 2015	Maximum % saving
Large solar PV	72	£120	**£79**	**34%**
Onshore Wind	1162	£95	**£79**	**17%**
Energy from Waste CHP	95	£80	**£80**	**0%**
Offshore Wind	750	£140	**£114**	**18%**
Advanced Conversion Technologies	62	£140	**£114**	**18%**

Source: Simplified from Newbery (2016a, Table 1).

Comparison between administrative prices and prices set through the 1st auction for new RES

Concluding remarks

- For a least-cost energy transition, it is paramount to design market mechanisms to:
  - encourage cost reductions
  - Pass such cost reductions to consumers
- Auctions for renewables, that reduce risk exposure (FiTs, CfDs or FiTs with floating premia)…
  - Reduce costs of capital
  - Promote greater participation and competition

….eventually transforming current market arrangements

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Thank You for your Attention

More info and papers at
www.eco.uc3m.es/nfabra

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