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ENERGY IRELAND®

Making the case for supporting renewable electricity

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Delivering Ireland's energy transition

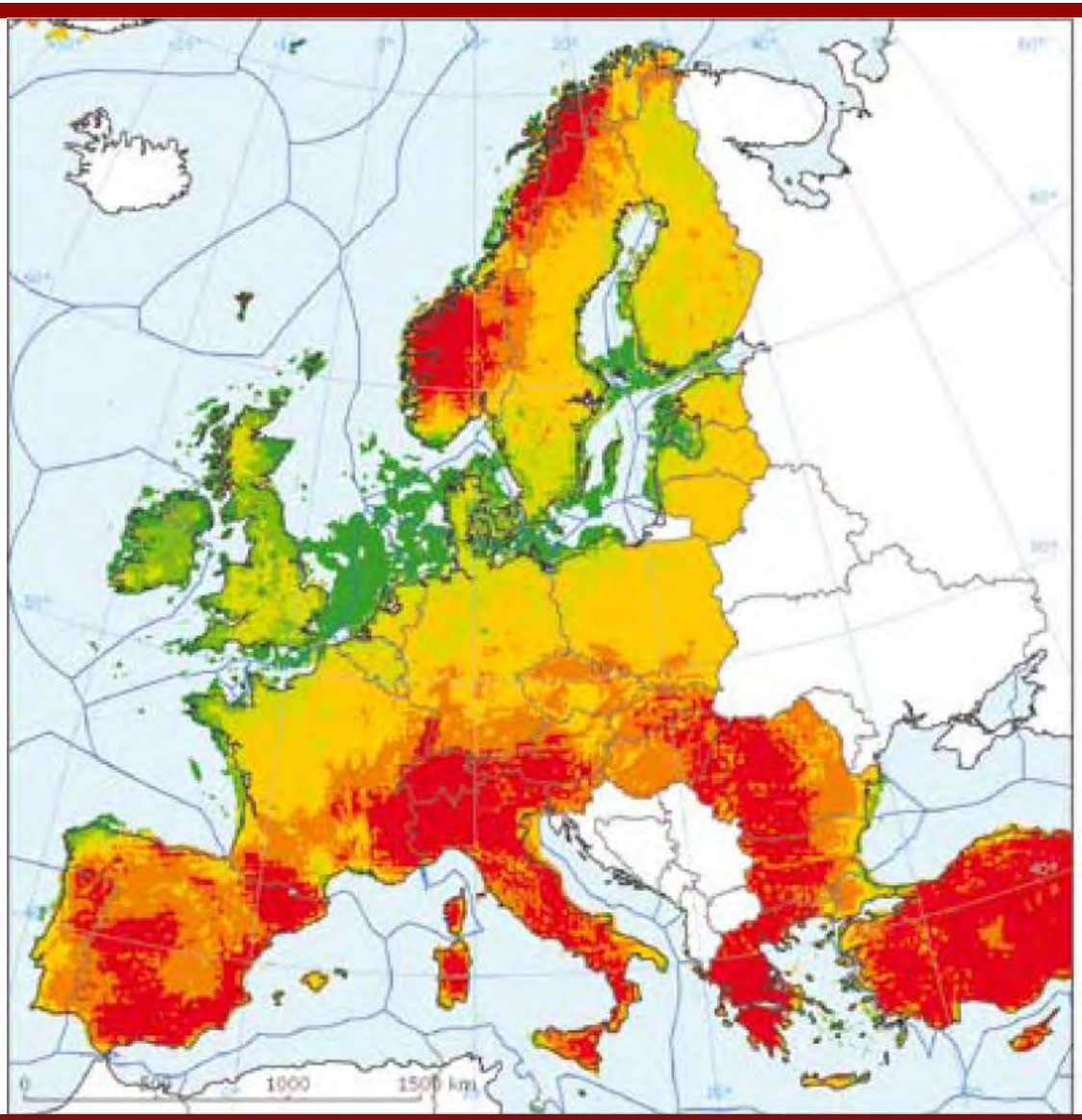
Croke Park, Dublin • 20-21 June 2019

* Deputy independent member of the SEM Committee, speaking purely in a personal capacity and not necessarily representing SEMC's views

Outline

- Why support renewables?
- How best to support renewables?
  - Get the carbon price right
    - If not make up shortfall
  - Learning externalities require capacity support
  - Auctions are better than bureaucrats
  - DS3 to address wind variability
  - Interconnectors key to high RES penetration

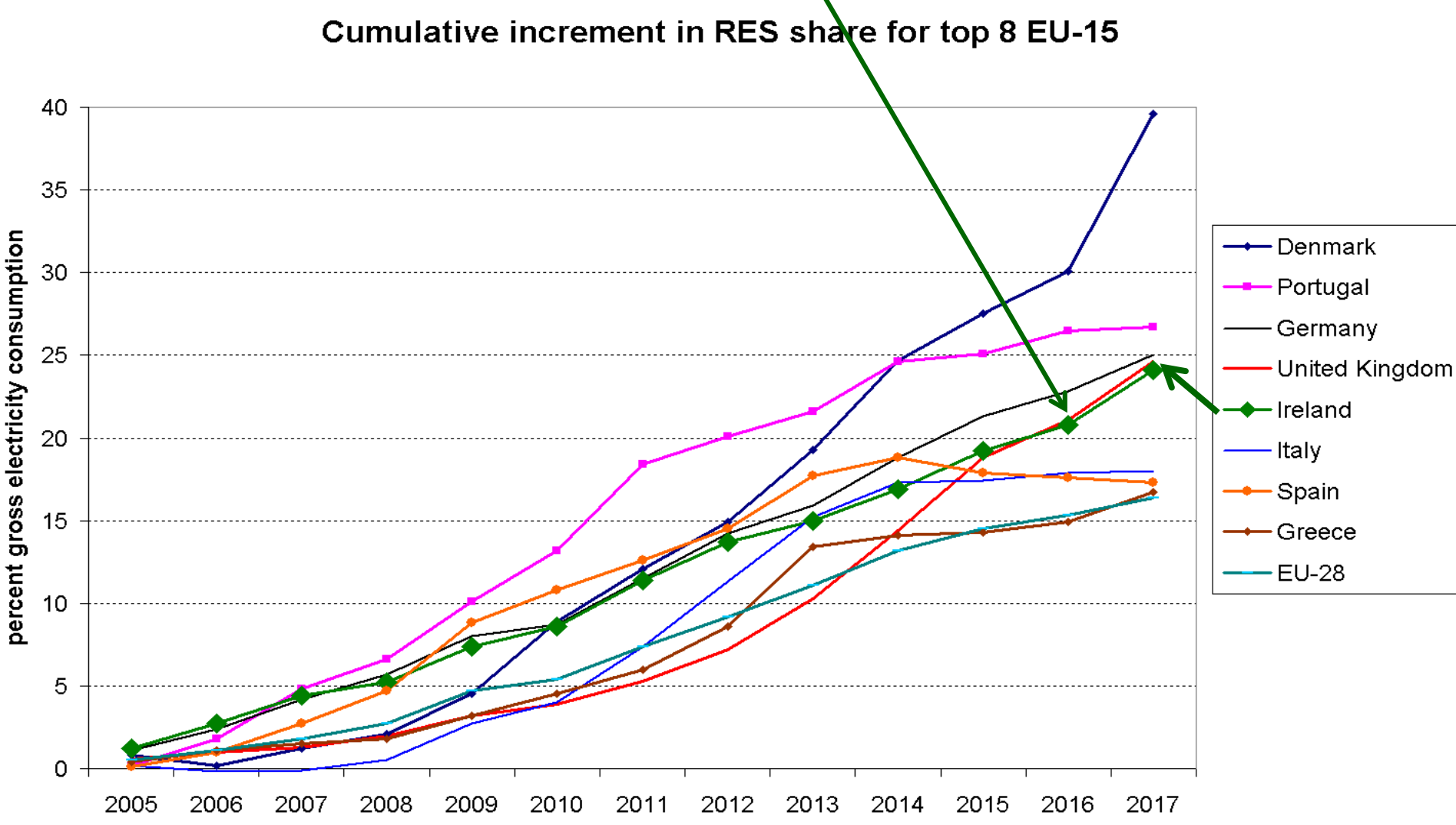
Green is good, red poor
Island of Ireland well-endowed



EEA Technical report No 6/2009 at https://www.energy.eu/publications/a07.pdf

Wind resource up to 50m depth, hub ht 80m onshore, 120m offshore

Ireland among the top four in EU for RES share



Why support renewables?

- Low carbon price => correct with **carbon tax**
- join GB in establishing Carbon Price Support
  - Corrects trade distortion with GB electricity
  - Raises revenue
- second best: **subsidy** €/MWh for CO_2 displaced

  ⇒ Shortfall @ €20/t CO_2 => **CCGT displaced €9/MWh**

Corrective taxes better than subsidies

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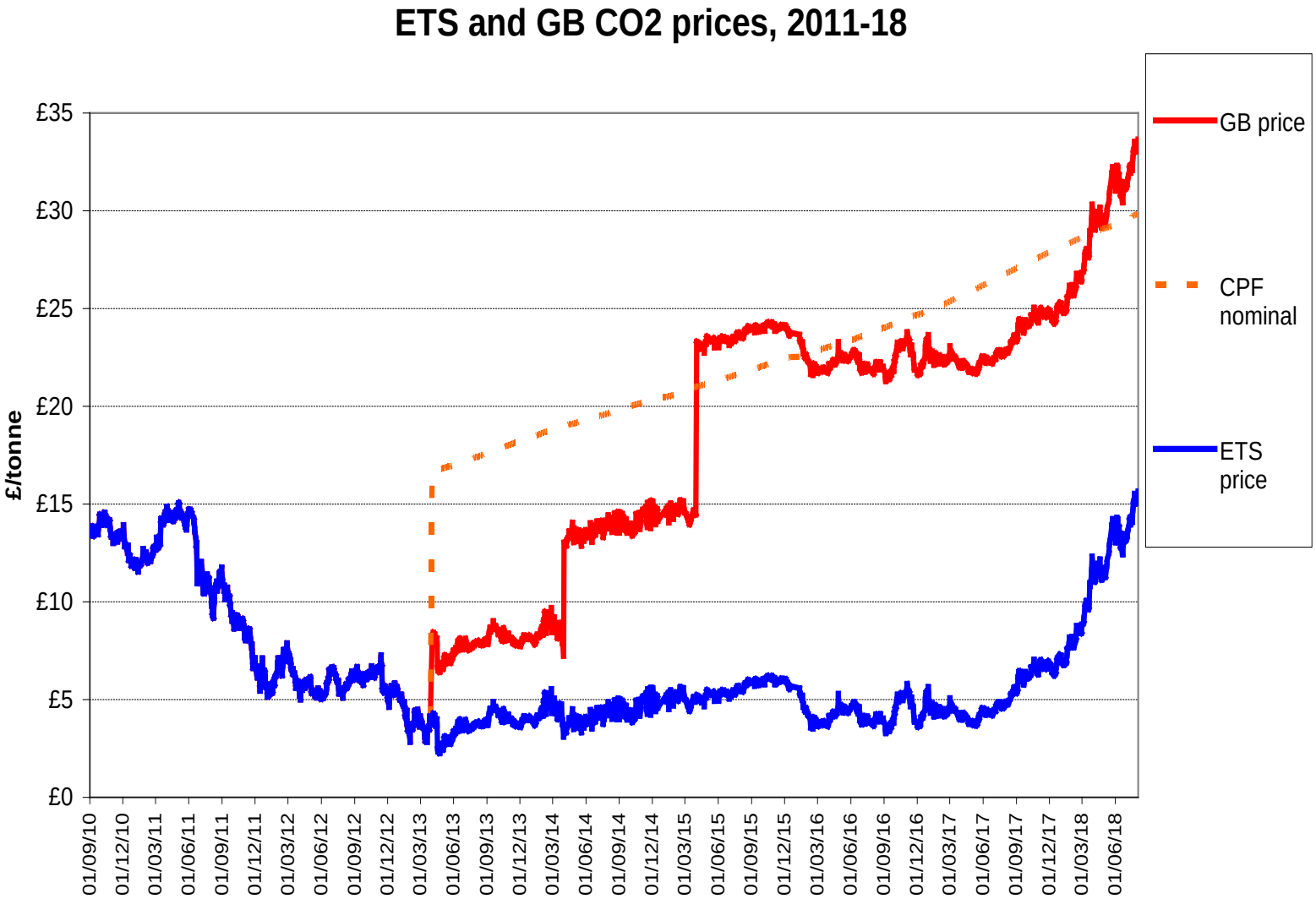
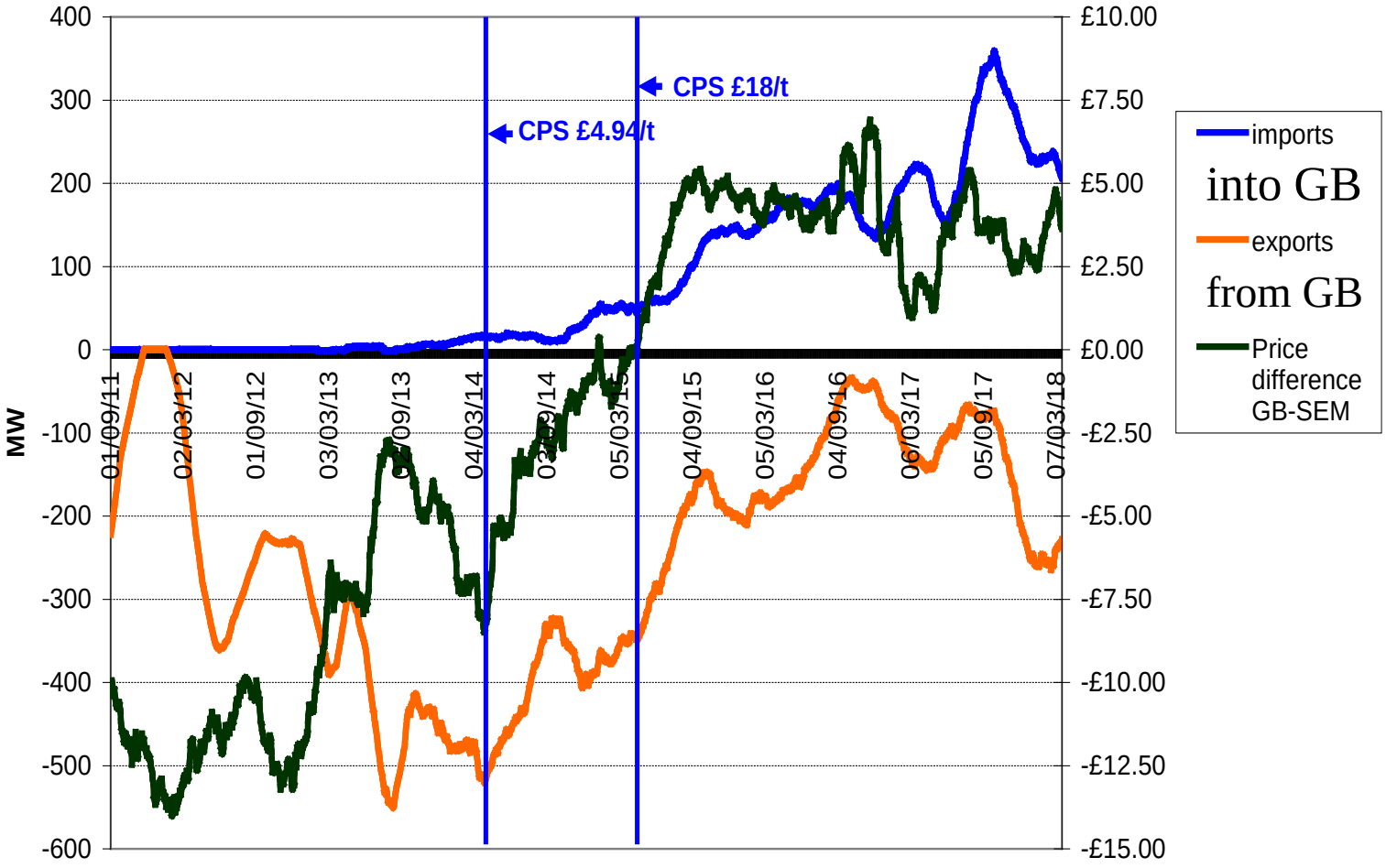
Combined impact of GB carbon tax (CPS) and ETS



GB carbon tax has reversed direction of GB-SEM trade

Flows and price difference GB-SEM, lagged quarterly moving averages



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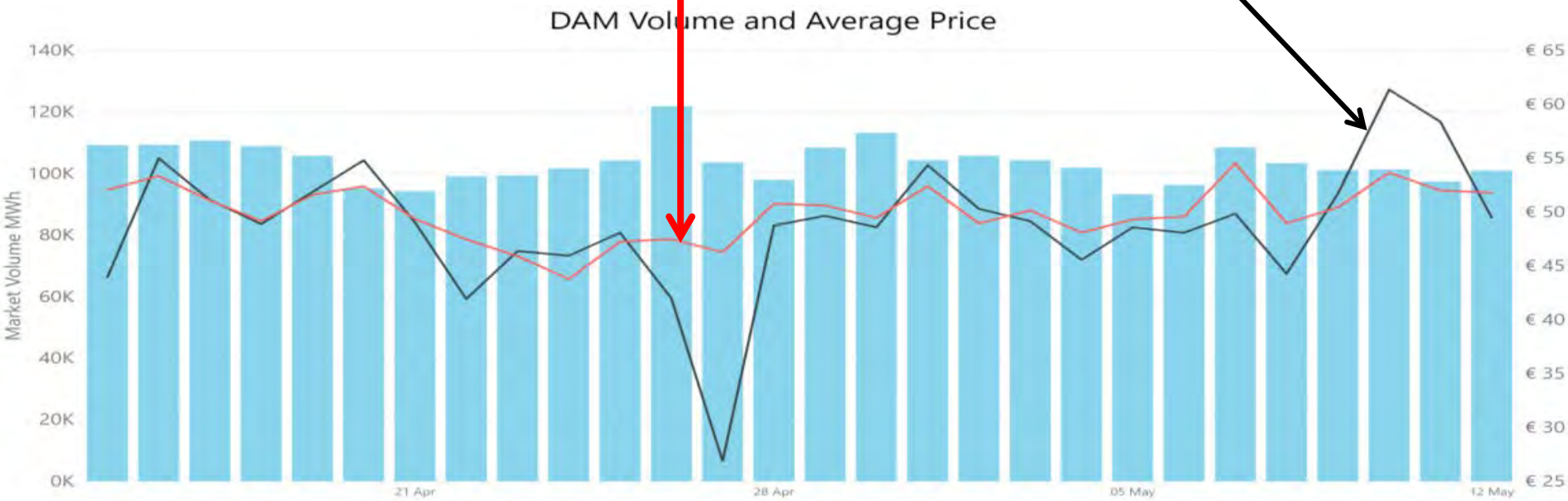
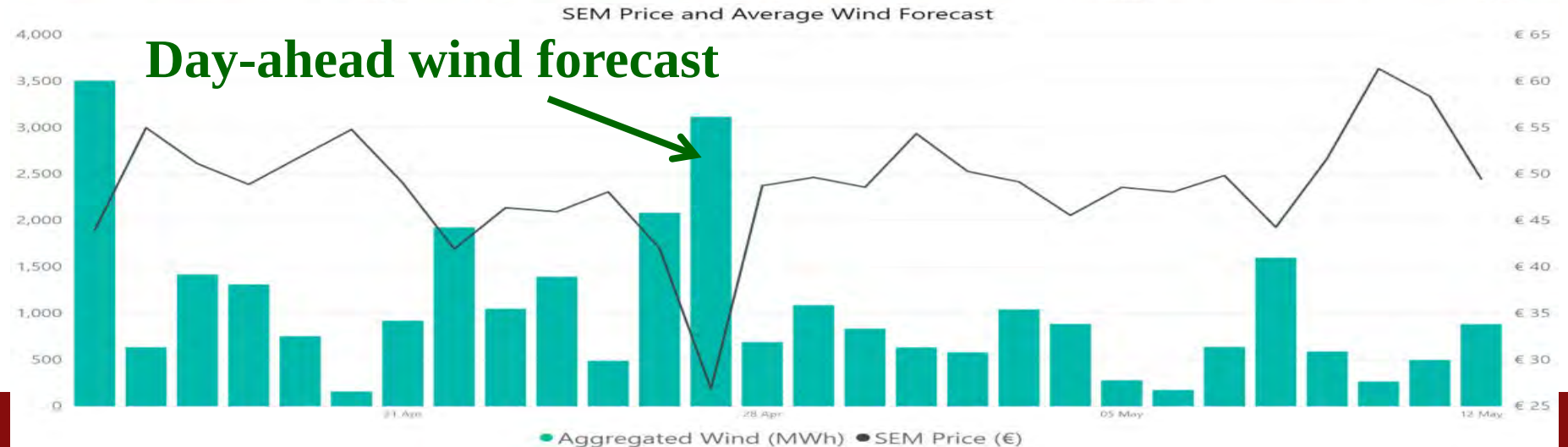
SEM DAM prices track GB prices except for high wind days





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The case for a SEM carbon tax on generation

- In GB **only 60% of CPS passed through** in higher wholesale prices (fossil generators bear rest)
- ISEM: generators free to offer into energy-only EU auction platform (except for balancing)
- Bidding up or above GB prices?
- **SEM carbon tax would likely not raise SEM wholesale prices much**
- **Reduce subsidies to renewables paid for by consumers?**

Carbon tax on generation for 2030 vision?

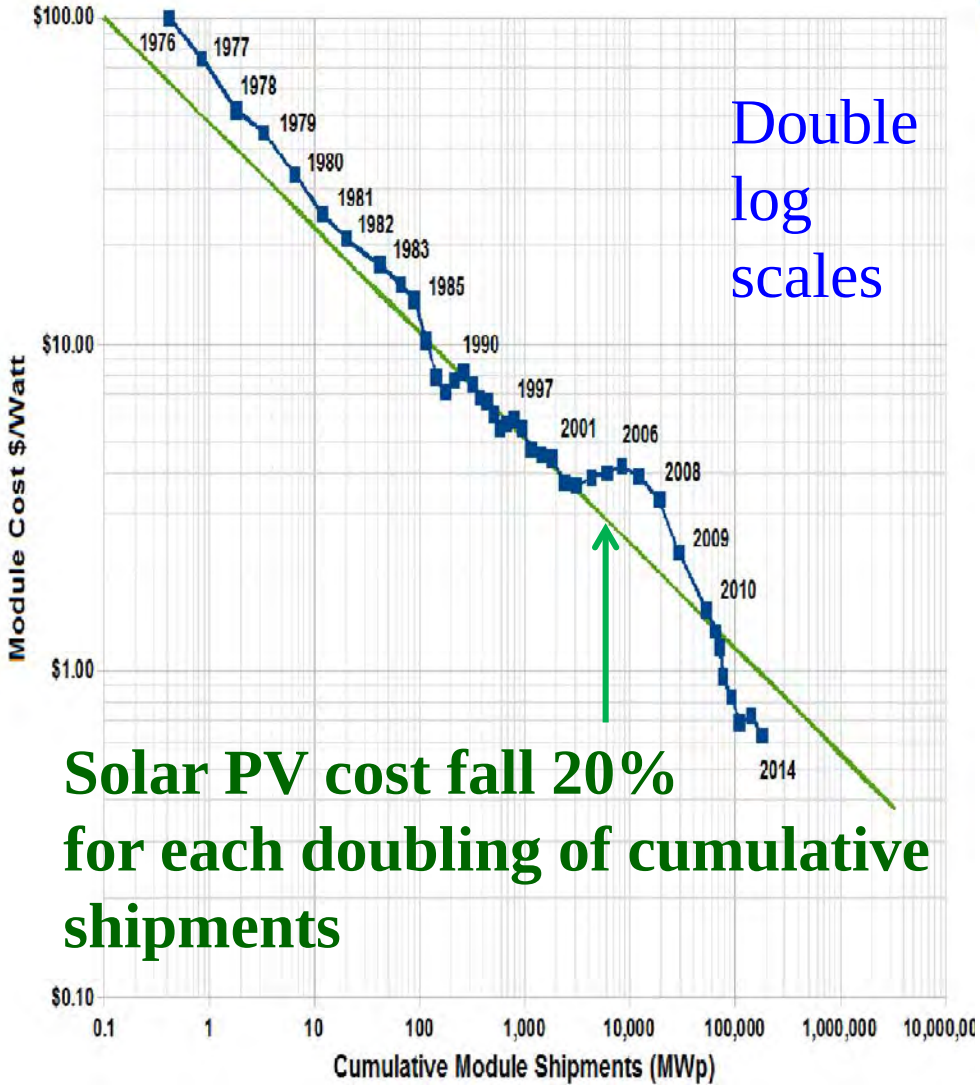
Why support renewables? Learning spillovers

- **Learning-by-doing** creates unrewarded spill-overs that reduce later costs
  - Justifies quite large subsidy for solar PV
  - Rather less for wind (larger base, lower learning rate)
- The **larger the coalition** of the willing the more spill-overs are internalised

⇒***Mission Innovation*** – 22 countries pledge to **double** clean energy R&D

⇒ subsidize ***installation, not output***

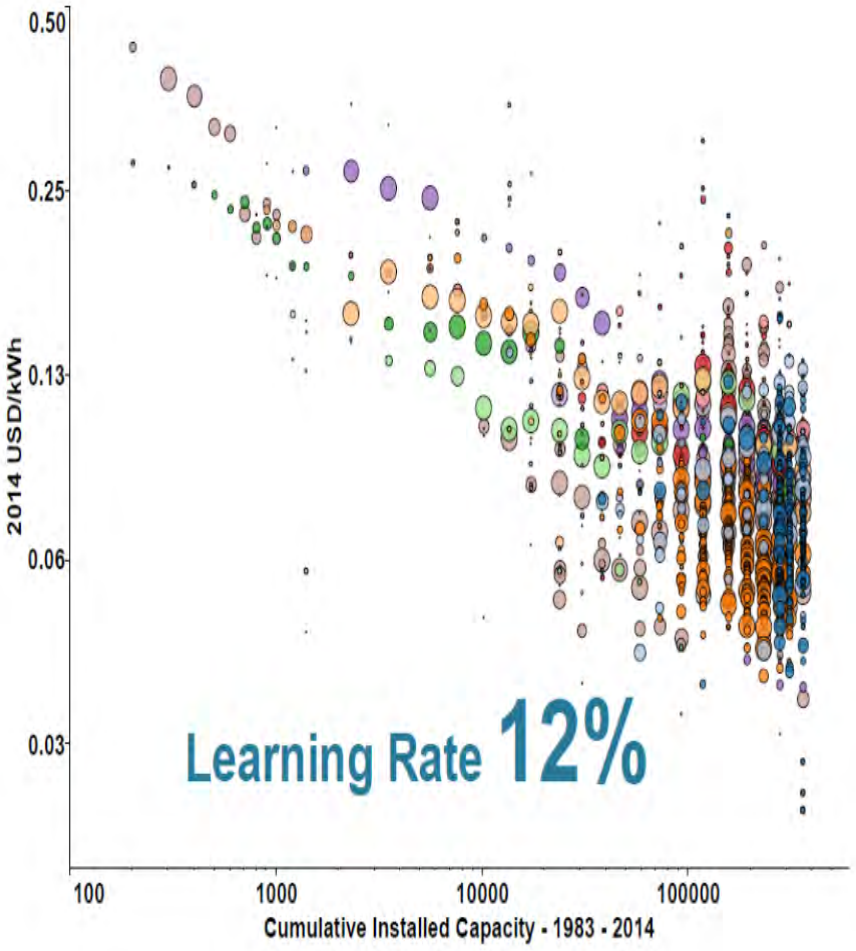
Learning justifies support, mostly in production and deployment



Double log scales

Solar PV cost fall 20% for each doubling of cumulative shipments

FIGURE 8: IRENA ONSHORE WIND LEARNING RATE



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Quantifying the spill-over benefit

					GWp cumulative		
Country	2010	2011	2012	2013	2014	2015	shares
China	0.8	3.3	6.8	19.7	28.2	43.5	19%
Germany	17.4	24.9	32.5	35.8	38.2	39.8	17%
Japan	3.6	4.9	6.6	13.6	23.3	34.2	15%
USA	2.5	4.4	7.3	12.1	18.3	25.6	11%
Italy	3.5	12.8	16.5	18.1	18.5	18.9	8%
UK	0.1	0.9	1.9	3.4	5.1	8.9	4%
France	1.2	3.0	4.1	4.7	5.7	6.6	3%
subtotal	29.1	54.1	75.6	107.3	137.2	177.5	76%
Global cumulative capacity	*47.0*	*78.0*	110.0	144.0	184.0	234.0	100%
spillover per kWp	$822	$740	$664	$595	$531	$472	

Table Spillover contributions by country					total $ million/yr			
Country	2010	2011	2012	2013	2014	2015	cumulative	share
Germany	$14,276	$5,536	$5,049	$1,964	$1,292	$737	$28,855	21%
China	$657	$1,849	$2,324	$7,681	$4,499	$7,234	$24,245	18%
Japan	$2,973	$958	$1,141	$4,142	$5,148	$5,120	$19,482	14%
USA	$2,078	$1,372	$1,918	$2,858	$3,291	$3,454	$14,970	11%
Italy	$2,878	$6,883	$2,420	$963	$205	$219	$13,568	10%
UK	$63	$612	$662	$878	$916	$1,799	$4,930	4%
France	$989	$1,309	$741	$382	$492	$438	$4,352	3%
subtotal	$23,915	$18,519	$14,255	$18,869	$15,842	$19,001	$110,402	80%
range +/-	$7,323	$5,266	$3,727	$4,480	$3,360	$3,522	$27,678	

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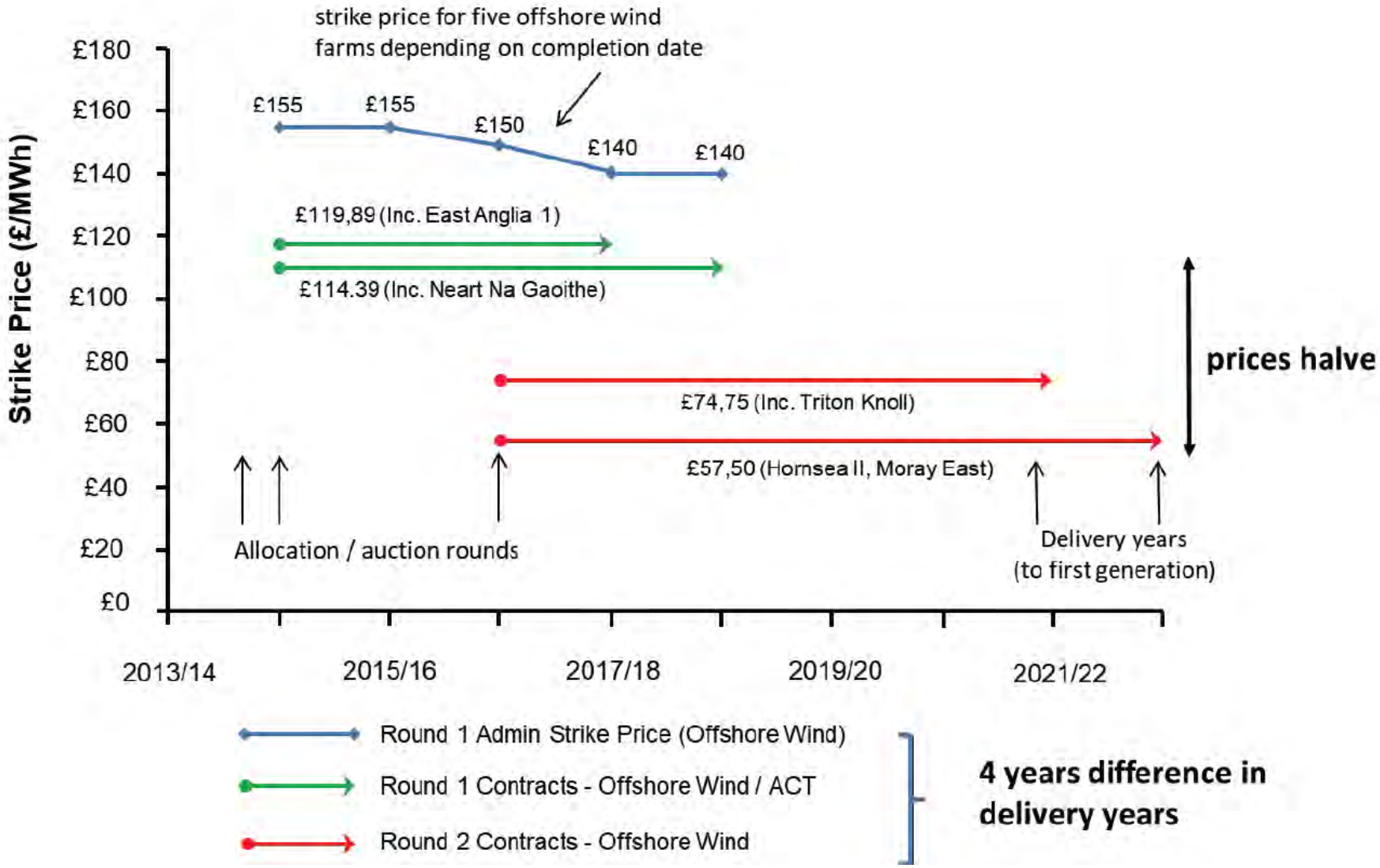
UK Off-shore wind auctions dramatically cut prices



Reforming RES-E support

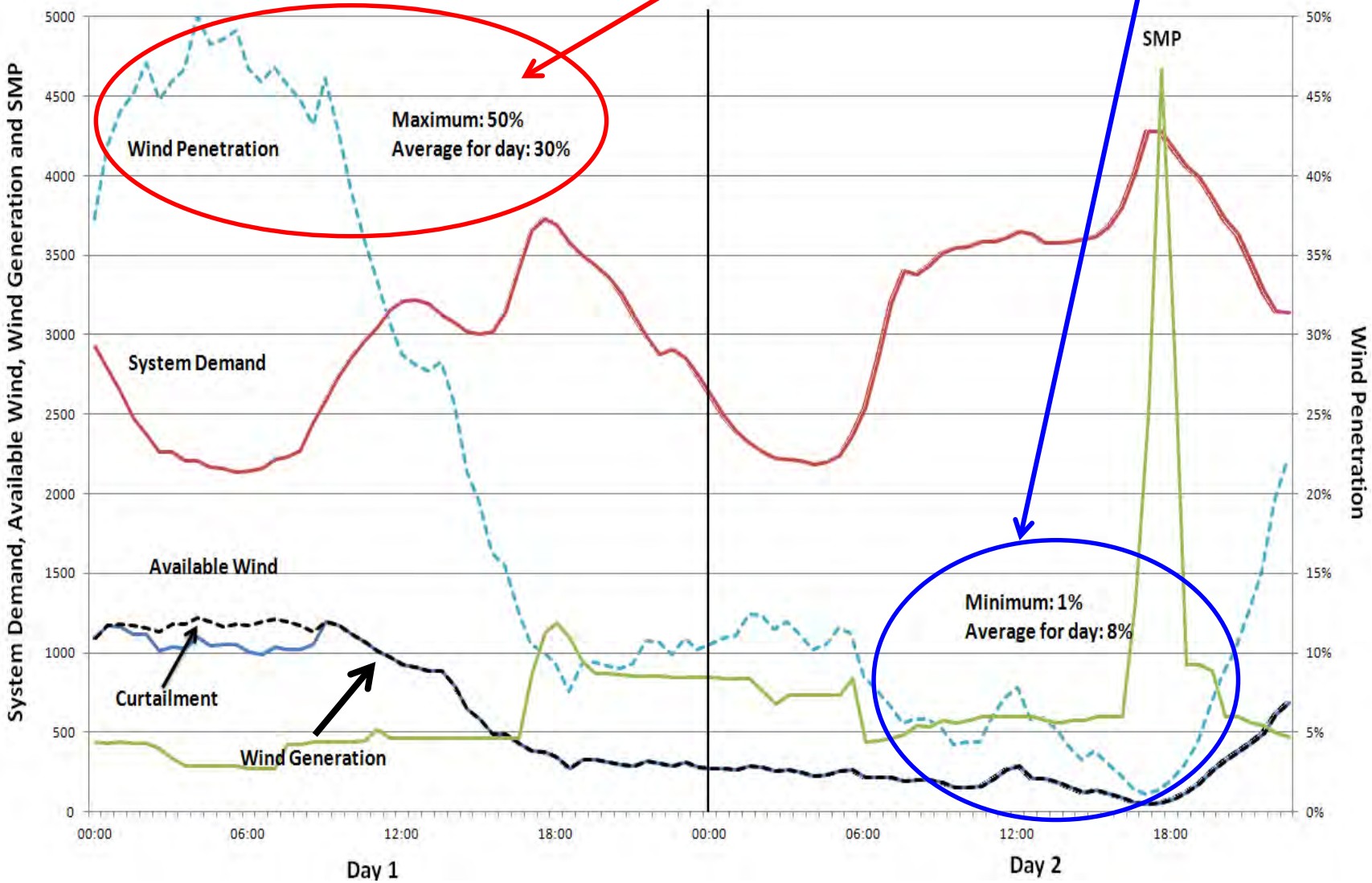
- Learning spill-overs need remuneration
  - Almost entirely from making and installing equipment

⇒ Contract €***X***/MWh for (e.g.) 30,000 MWh/MW, **auction** determines premium €***X***

Reasons:

- Subsidy targeted on source of learning = ***investment aid***
  - Reduces cost of capital and risk via debt finance
  - Ideally associated with CO_2 credit per MWh
- Does not amplify benefits of high wind/sun
  - **Not over-reward favoured locations with same learning**
- **Auction** better than bureaucrats at minimizing cost

Handling high and low wind in SEM: DS3 essential



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DS3 already delivering benefits; SNSP to 75%

Faster more flexible responses needed with high renewables

Synchronous inertia – supplied by fossil generators, not by wind and PV

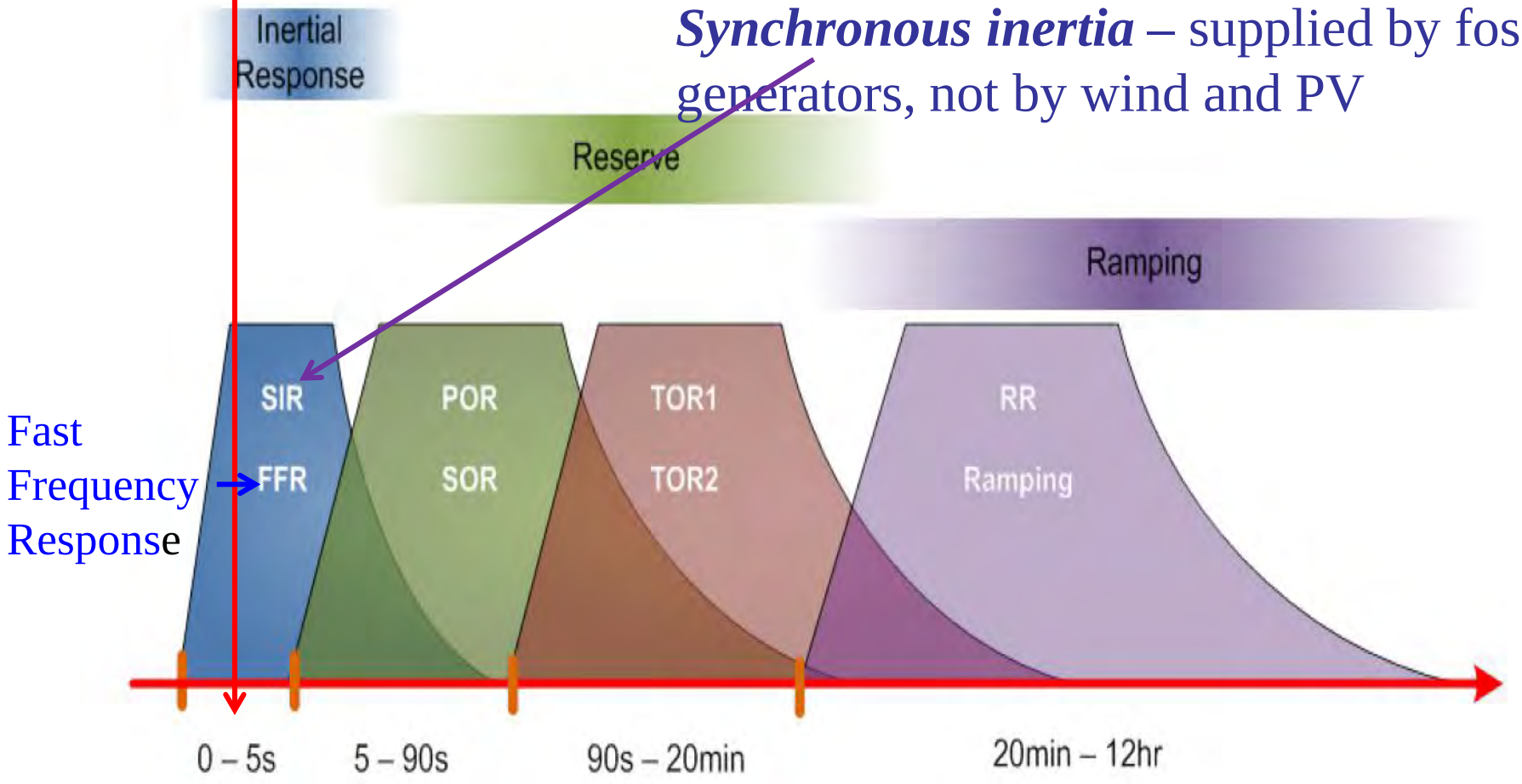
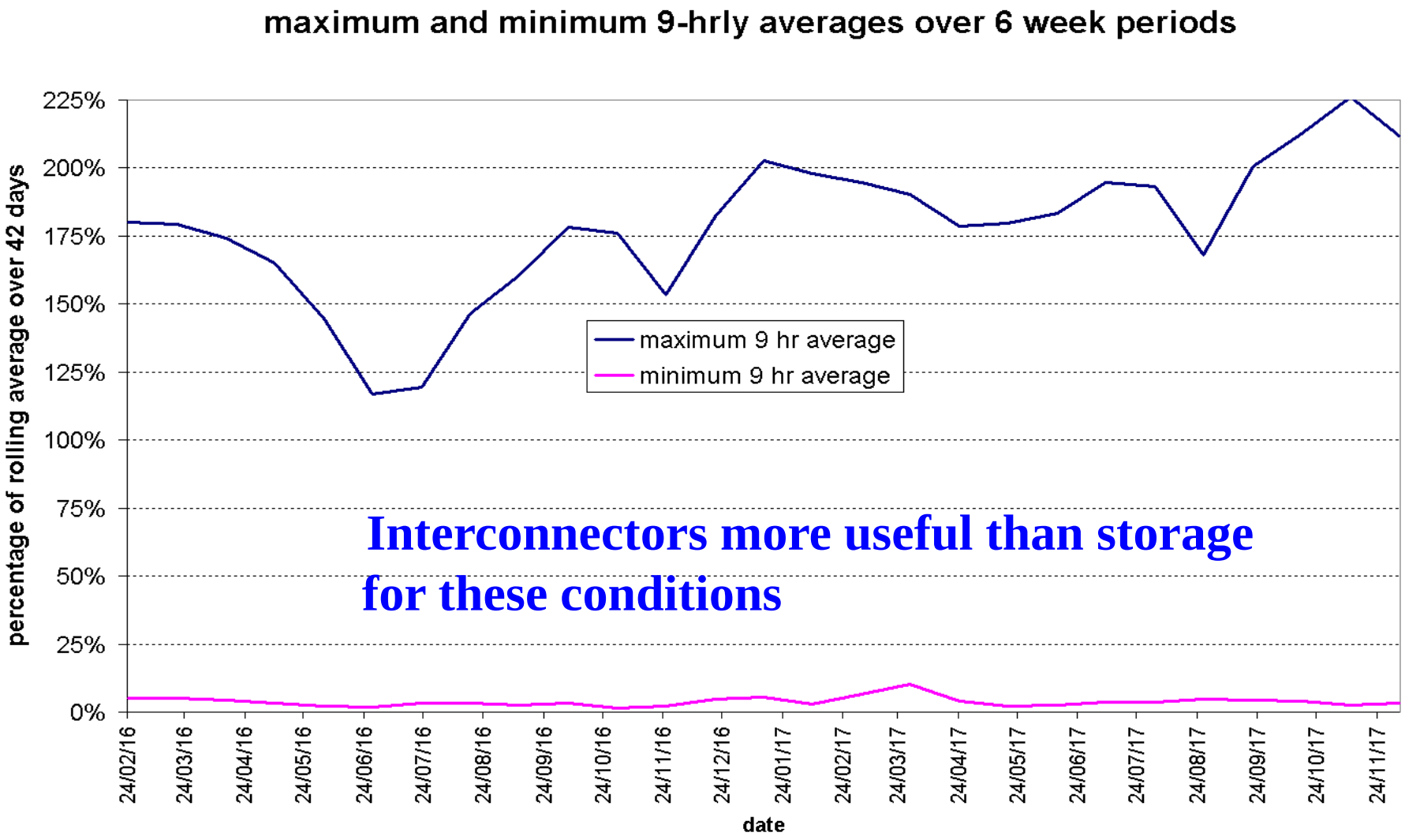


Figure 1: Frequency Control Services (Source: EirGrid)

Sustained high or low wind periods over six weeks



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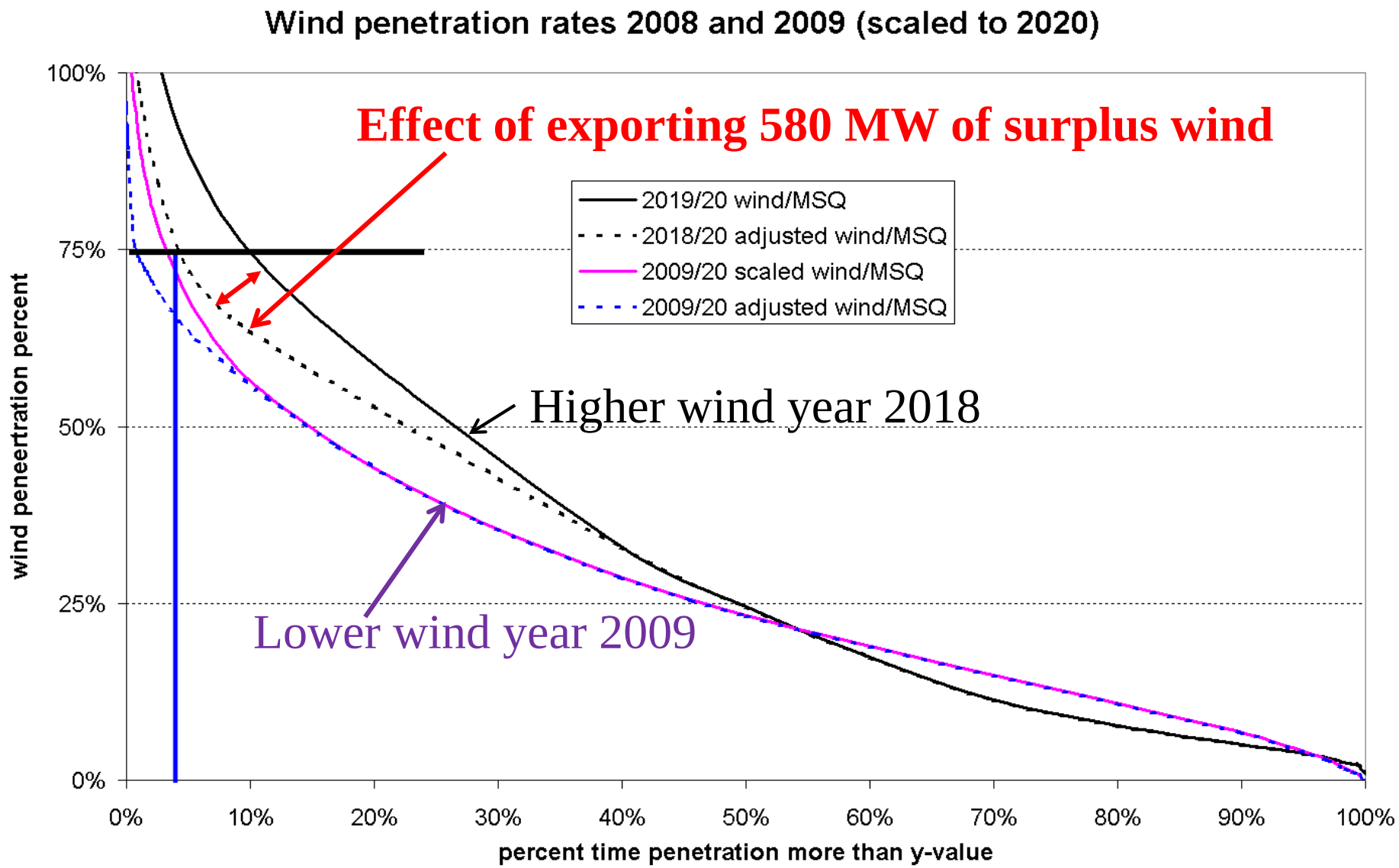
Exporting up to 580 MW reduces curtailment



Conclusions

- Island of Ireland has wonderful wind
- SEM/DS3 programme an excellent model
- Support for RES needs change
  - recognise **learning benefits** by **capacity support**,
  - **value CO_2 by carbon tax (failing which subsidy per MWh)**
  - needs better **location** and dispatch price signals

  => Pay for RES at time/place **energy value**
  - market responsive requires **auctions** and good network tariffs
- Interconnectors increasingly valuable now coupled
  - can buffer low and high wind penetration
  - But asymmetric carbon price reduces value

  => **align carbon taxes with GB**

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Acronyms and appendices

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Acronyms

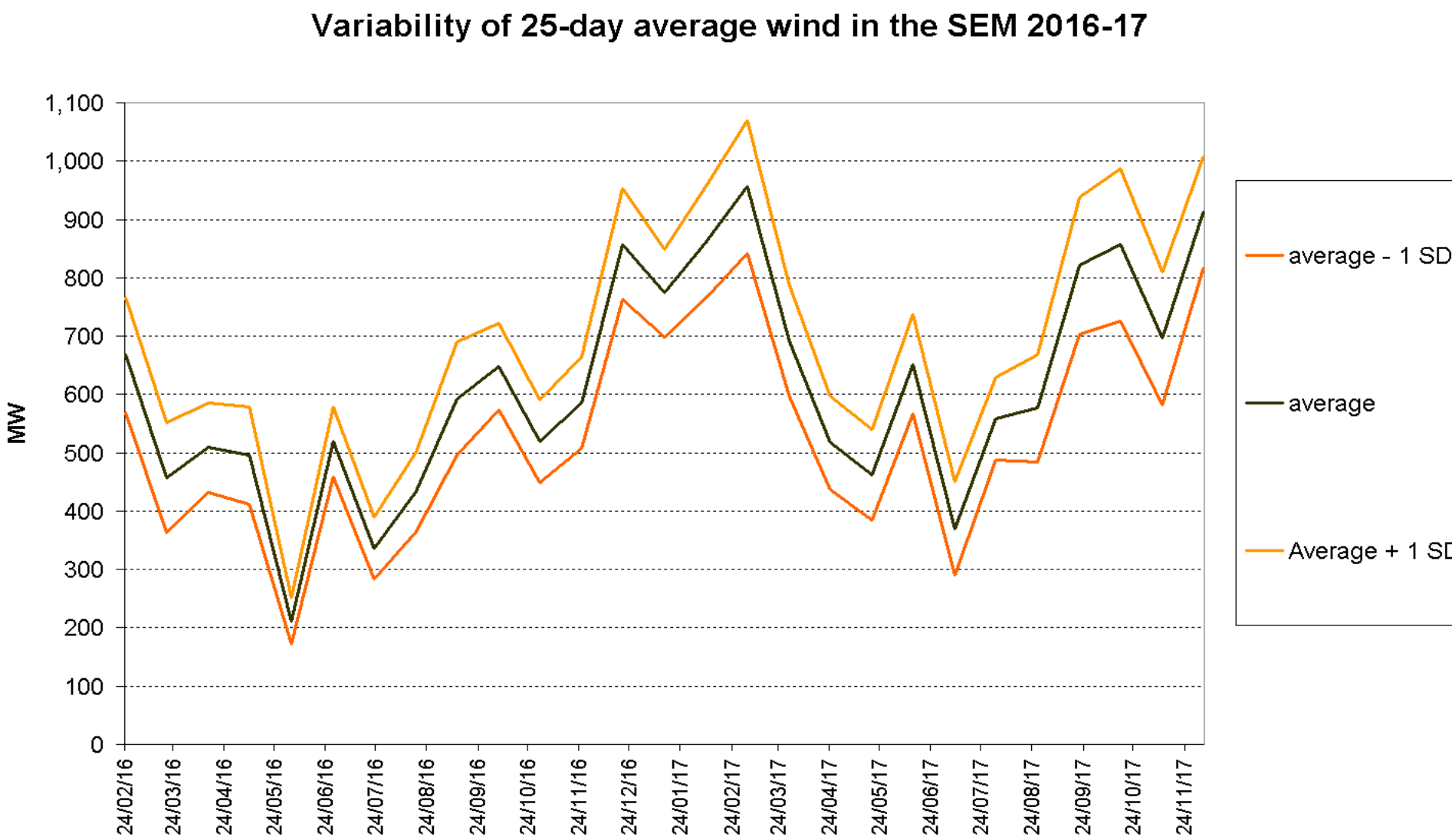
CfD	Contract for Difference
CPS`	Carbon price support = carbon tax
DS3	Delivering a Secure, Sustainable Electricity System
ETS	Emissions trading System
EV	Electric vehicle
LMP	Locational marginal price or nodal price
RES	Renewable electricity supply
ROC	Renewable Obligation Certificate
T	Transmission

GB RES CfD 2015 auction better than bureaucrats

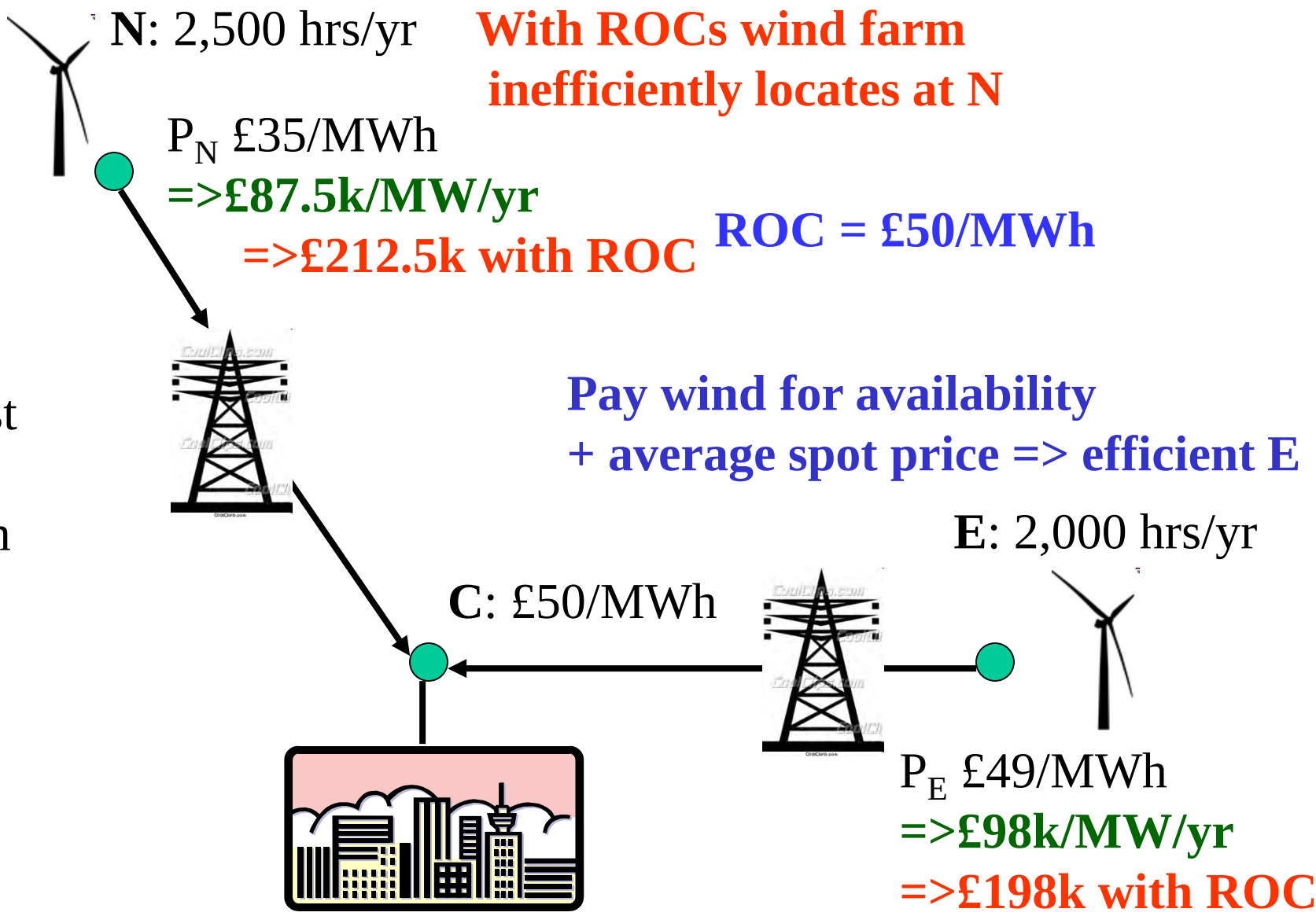
Technology		admin price	lowest clearing price	2015/16	2016/17	2017/18	2018/19	Total Capacity (MW)
Advanced Conversion	£/MWh	£140	£114.39			£119.89	£114.39	
Technologies	MW					36	26	62
Energy from Waste with	£/MWh	£80	£80				£80.00	
Combined Heat and Power	MW						94.75	94.75
Offshore wind	£/MWh	£140	£114.39			£119.89	£114.39	
	MW					714	448	1162
Onshore wind	£/MWh	£95	£79.23		£79.23	£79.99	£82.50	
	MW				45	77.5	626.05	748.55
Solar PV	£/MWh	£120	£50.00	£50.00	£79.23			
	MW			32.88	36.67			69.55

Source: DECC (2015)

Monthly variability of wind



Location choices under LMP and spot pricing for wind



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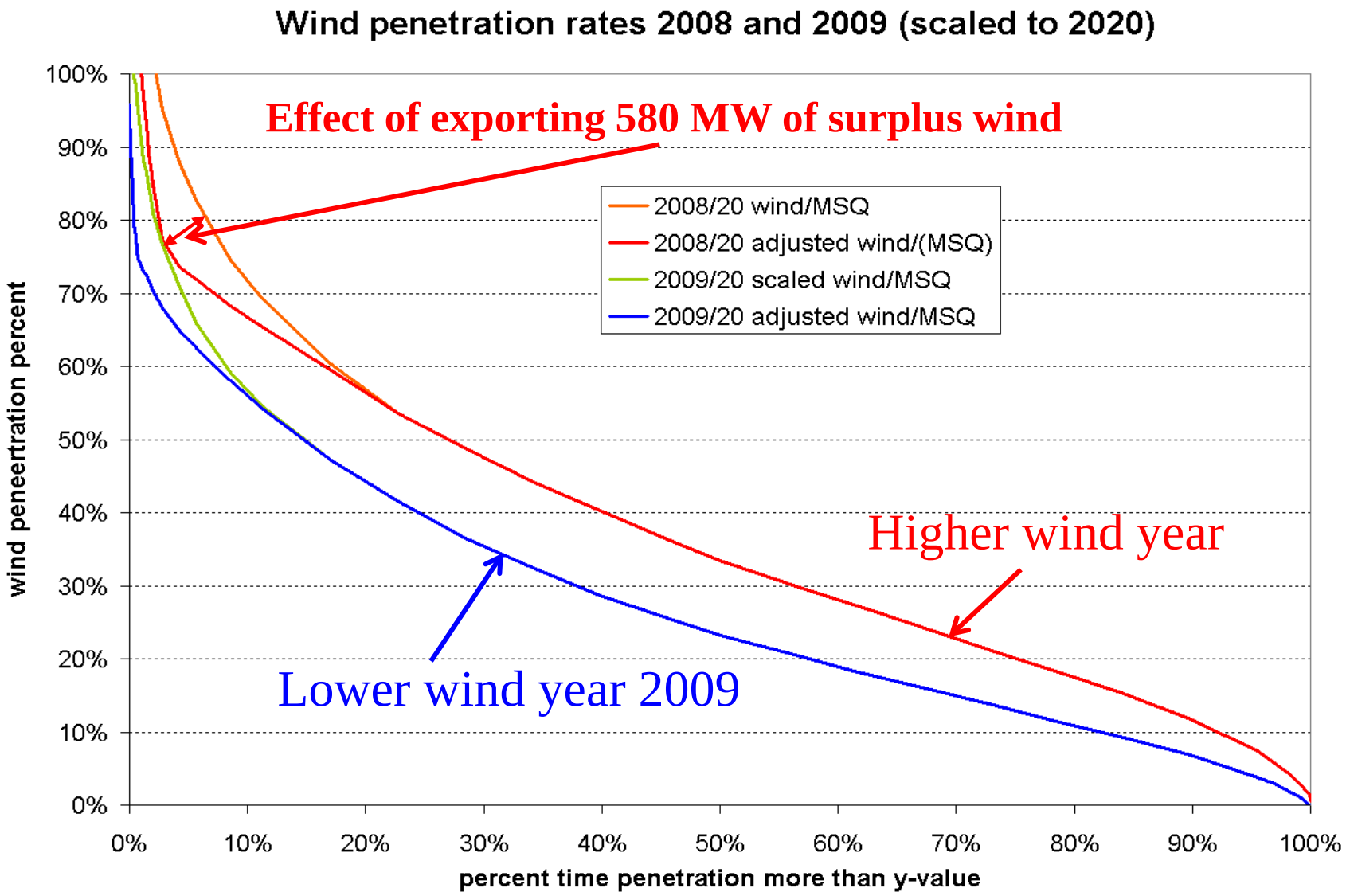

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