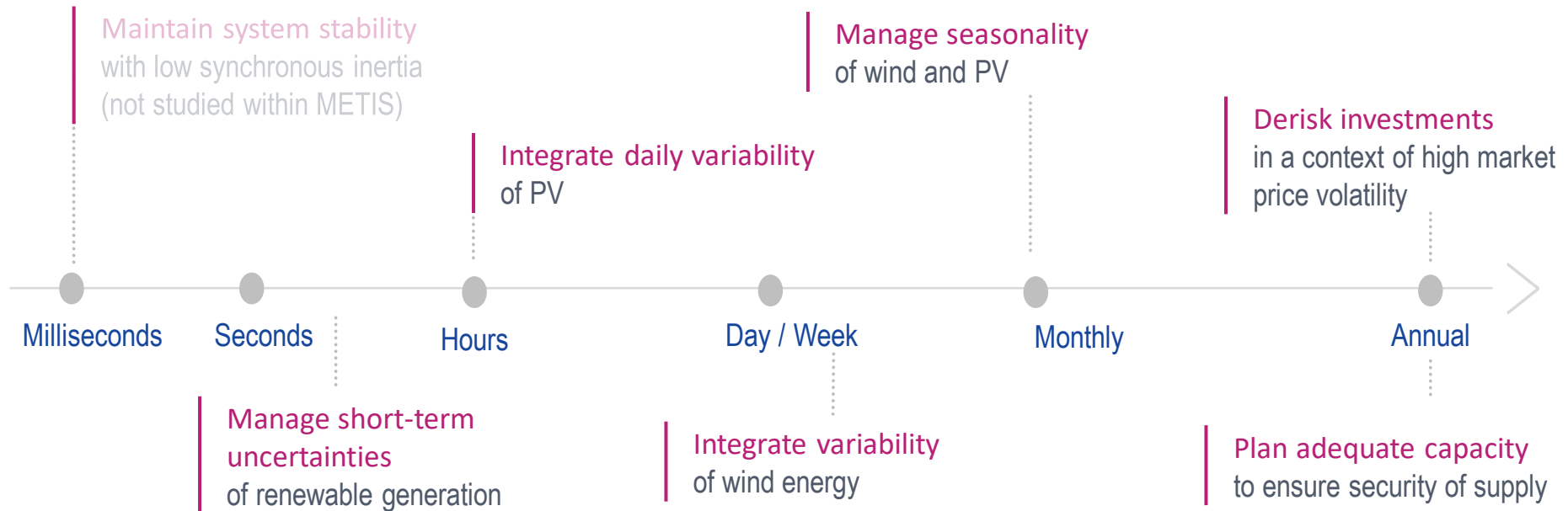


Session 4: Power markets between tomorrow and 2050

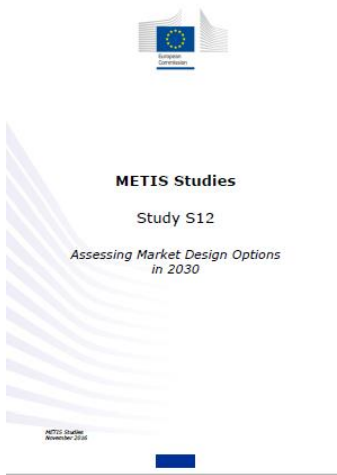
METIS 1 – Dissemination event

▣ METIS covers the whole chain of market issues related to RES integration (system stability and grid issues excluded)



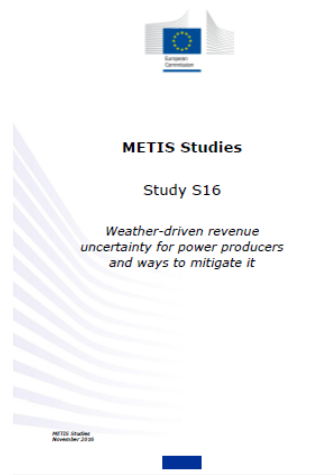
METIS studies

METIS Study S12



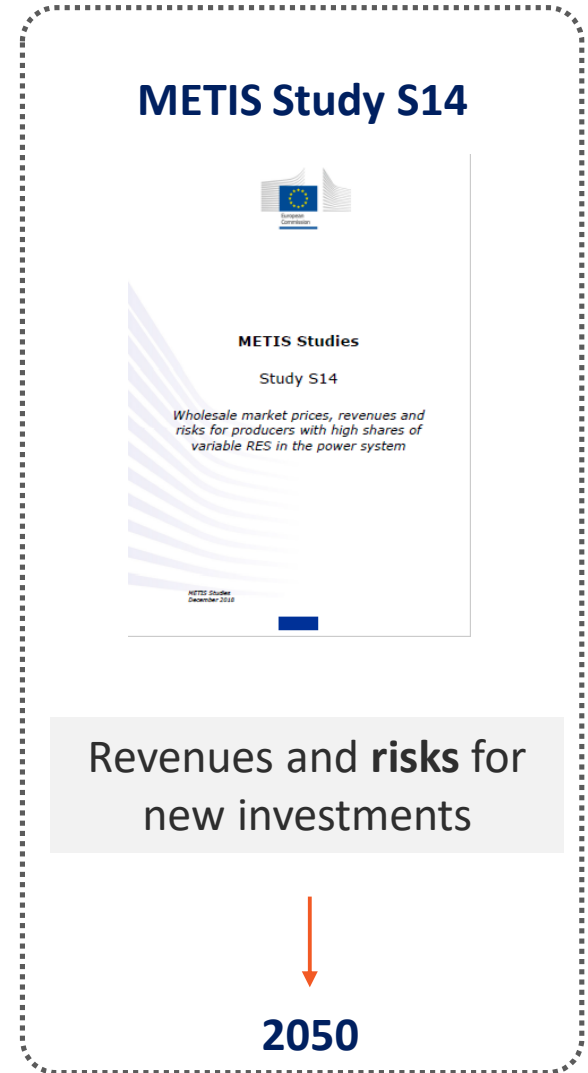
From **day-ahead** to **balancing** markets

METIS Study S16



Benefits of cooperation for **CRMs**

METIS Study S14



Revenues and **risks** for new investments

2030

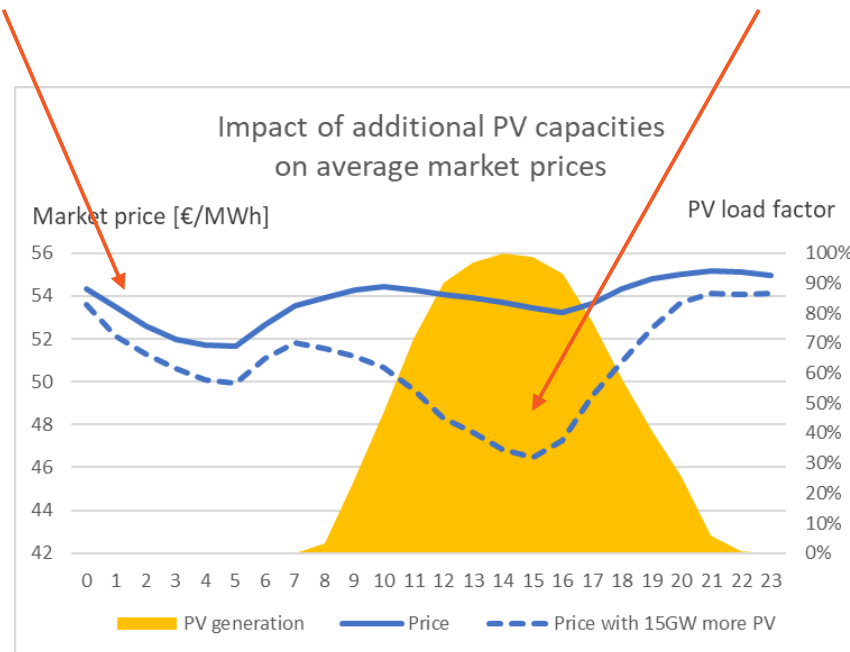
2050

Peak & mid-merit prices

- | Fuel costs & carbon price
- | Units efficiency
- | Retirement of coal capacities

Off-peak prices

- | RES deployment
- | Nuclear capacities
- | System flexibility



Yearly demand

Power demand by usage
(incl. **EVs** and **heat pumps**)
Hydrogen demand

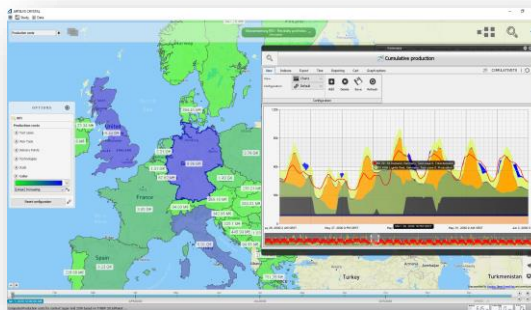
Zero-carbon generation mix

RES capacities (80%)
Nuclear capacities
Biogas price

Flexibility options (CAPEX & potential)

Interconnections
O/CCGT (fuelled with biogas)
Storage
Power to gas

METIS



Joint stochastic optimisation of the investments and of the hourly electricity dispatch



Flexibility option capacities

Hourly dispatch

Wholesale market prices

Asset revenues

Country clusters and exemplary countries



Country	Q1	Meån	Q3 *	hours > p<1	Solar	Wind	vRES
BG	9	83	145	936	24%	40%	63%
CY	1	74	145	2195	68%	35%	103%
ES	8	70	100	846	40%	40%	80%
GR	8	80	145	1931	50%	56%	106%
MT	145	144	145	561	18%	10%	27%
PT	8	70	96	434	22%	48%	70%
DE	8	76	120	1434	26%	67%	94%
FR	8	73	118	903	17%	43%	60%
GB	8	78	145	1248	2%	65%	67%
IE	8	75	145	1725	3%	90%	92%
RO	21	85	145	780	14%	49%	63%
DK	43	75	98	818	2%	95%	96%
EE	43	74	90	371	0%	76%	76%
FI	43	70	86	238	0%	23%	23%
LT	43	74	90	331	9%	42%	51%
LV	43	74	90	381	8%	53%	61%
NO	43	70	82	387	0%	10%	10%
SE	43	68	82	357	0%	28%	28%
AT	40	84	138	655	17%	29%	46%
BA	43	99	145	433	0%	12%	12%
BE	34	81	145	939	23%	37%	60%
CH	42	84	138	569	6%	2%	8%
CZ	38	84	145	13	11%	16%	27%
HR	43	89	145	556	41%	37%	78%
HU	42	89	145	544	21%	24%	45%
IT	35	86	145	1703	45%	31%	77%
LU	13	78	120	980	12%	12%	24%
ME	44	100	145	433	0%	10%	10%
MK	43	94	145	476	0%	2%	3%
NL	31	80	145	1103	5%	74%	79%
PL	53	99	145	328	1%	40%	41%
RS	43	99	145	433	0%	13%	13%
SI	42	89	145	647	19%	7%	26%
SK	40	83	138	13	2%	2%	4%

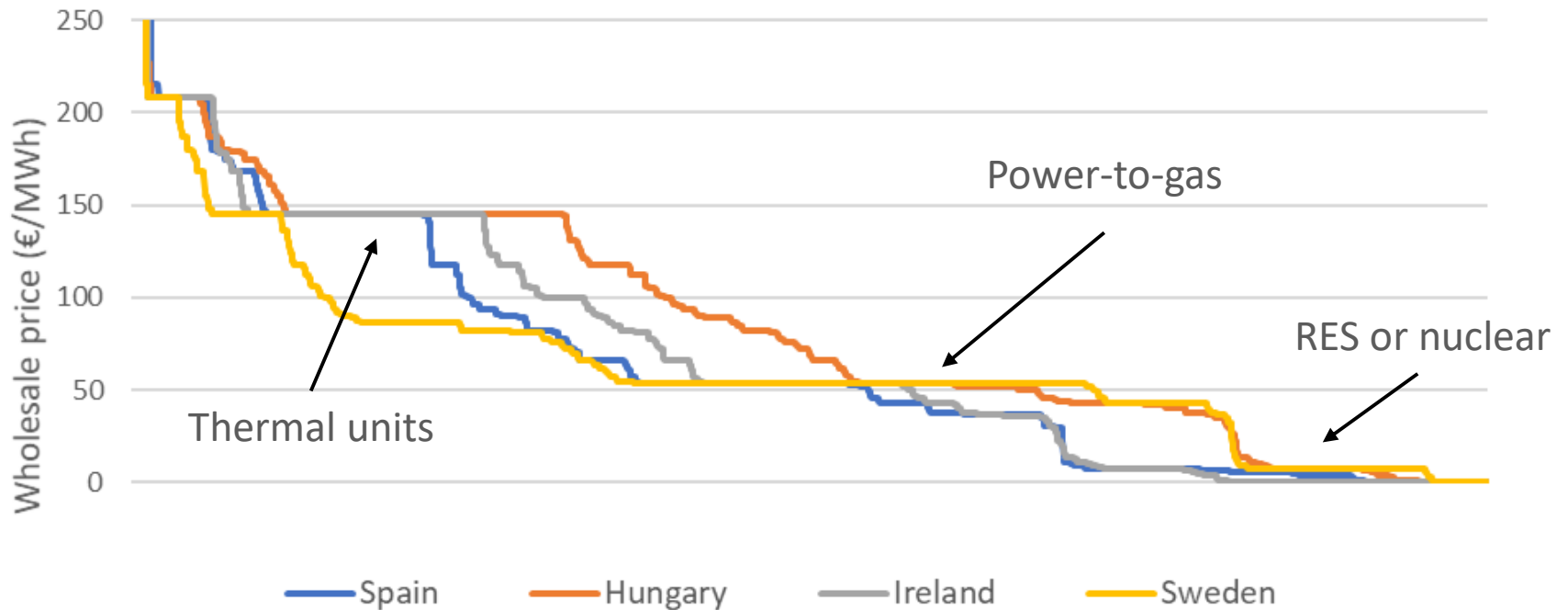
SUNNY
WINDY
NORDIC
OTHERS

* share in national electricity demand

NB: CO₂ price has no impact any more due to full decarbonisation

I Reference countries: Spain, Ireland, Hungary, Sweden

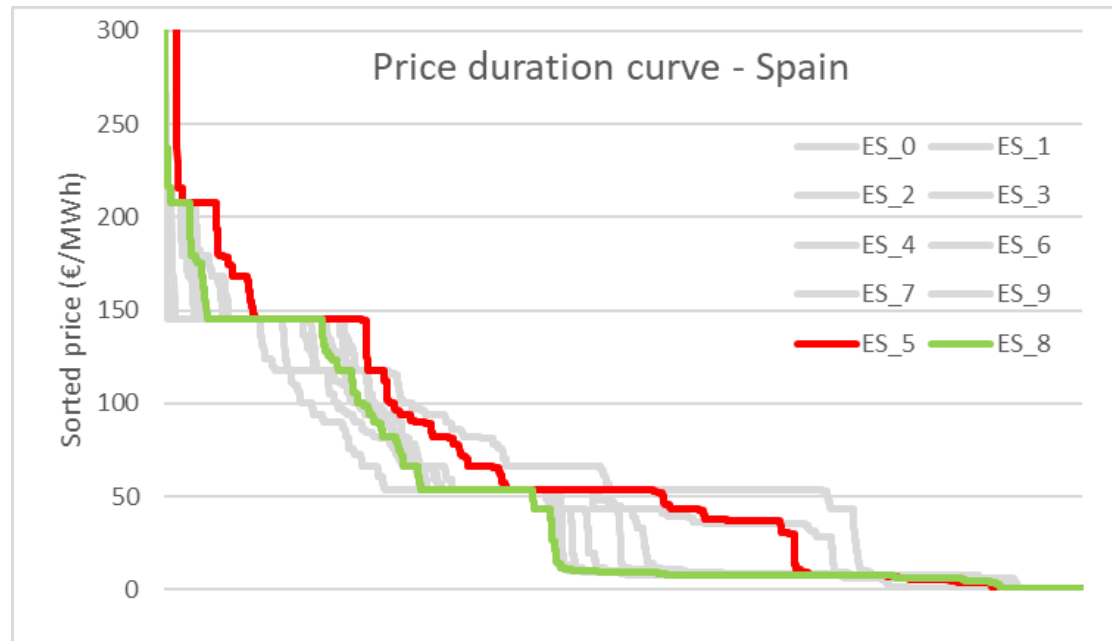
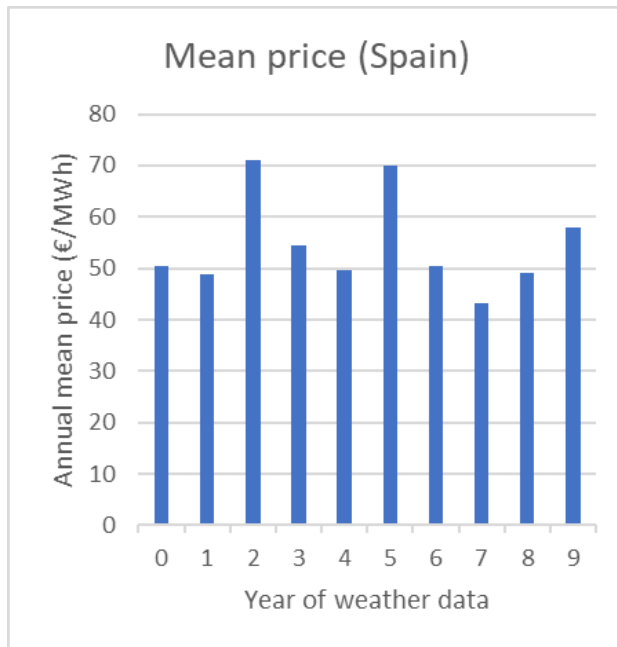
Price duration curve (2050) for the 4 reference countries



Key message #1: Flexible demand will set the price more and more frequently

Price variations for different years of weather data

- | Scarcity prices only in cold days with low wind (as today)
- | Number of hours with near-zero prices vary from one year to another



Key message #2: Price volatility will increase significantly

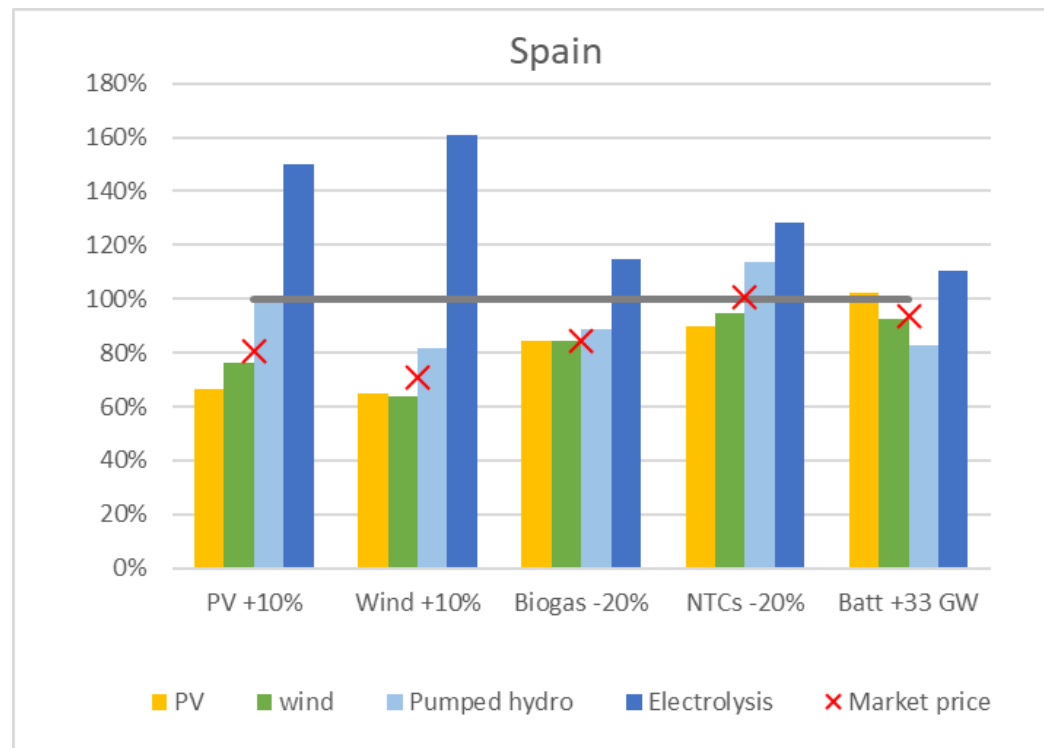
4 Stress cases

- | Impact of specific parameters (capacity mix remains unchanged)
- | Objective: assess if some technologies or asset portfolios are more resilient

Scenarios (TC 5)	Scenario variants		
	Low	Base	High
PV penetration		X	+10% (+65 GW)
Wind penetration		X	+10% (+88 GW)
Biogas price	-20% (-18 €/MWh)	X	
Interconnections	-20% (-30 GW)	X	
Batteries		X	+200% (+33 GW)*

*Increase in battery capacities according to ratio of RES capacities

- ⚡ Solar PV (and to a lesser extent wind) exhibits important cannibalisation effect
- ⚡ Pumped hydro raises surplus in less flexible systems
- ⚡ Electrolysis benefits from drop in prices



Impact of stress cases on market prices and asset surplus (compared to base case)

Key message #3: Flexible supply contract can offset RES revenue risks

- ▣ Price volatility will rise, prices will be set increasingly often by demand side

- ▣ Revenue risks
 - | **Solar PV** exhibits important cannibalisation effect
 - | **Electrolysis** benefits when generators suffer
 - | **Strong competition between flexibility solutions (interconnectors vs PHS or peakers, batteries between them)**

- ▣ Risk hedging strategies
 - | **Classical risk hedging strategies** (gas swaps or load following supply contract) do not work
 - | **Flexible supply contract** can offset RES revenue risks

Thank you for your attention!

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Interested in further information?

<https://ec.europa.eu/energy/en/data-analysis/energy-modelling/metis>

