



Case Study Workshop

CS3: Need for flexibility. Storage

16.01.2023



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 835896

Scope of the study and approach followed

- Analysis of the impact on the system operation, the transmission network development, the level of use of the several flexibility sources, and wholesale electricity prices of local energy communities (LECs)
 - Assessing to what extent the flexibility provided by LECs would be a substitute for that to be provided by centralized storage (batteries, or pumped hydro) and the grid
- The introduction of LECs is only considered within the Spanish and the Norwegian systems, which are represented with a higher level of detail (several areas per country and more detailed modelling of storage management)
 - The rest of the European system is only represented at an aggregate level (single node per country and more simplified management of storage)
- Only the development of transmission grid is affected by an increase in the penetration of LECs
- TechnoFriendly Scenario considered: high environmental awareness, bottom-up societal revolution, and top-down technology revolution
- Static planning: 1 year (2030 horizon) with hourly resolution

Results

Management of energy by Local Energy Communities in Norway and Spain

- In both countries, no significant investments into local battery storage due to synergies and electricity exchange within the local energy community and limited economic incentives provided by the electric prices.
- In Norway, electric consumption increases from the further penetration of battery electric vehicles in rural areas (the most dominant type of LEC in Norway) and the fact that switching from direct electric heating systems to heat pumps is limited and not sufficiently incentivized by electricity prices.
- In Spain, the investment in Solar PV leads to decreasing electricity consumption even though heat pumps electrify the heat supply.
- In general, regional differences can be observed between the two countries, Norway and Spain, and among regions within countries.
- In sum, the penetration of LEC can lead to an increase or decrease of electricity consumption depending on local characteristics.
- The management of energy within LEC seem to take place predominantly in the daily (from exchanges among participants and management of load of EV) and seasonal (from the deployment of PV and heat pumps in different seasons) timeframes

Results

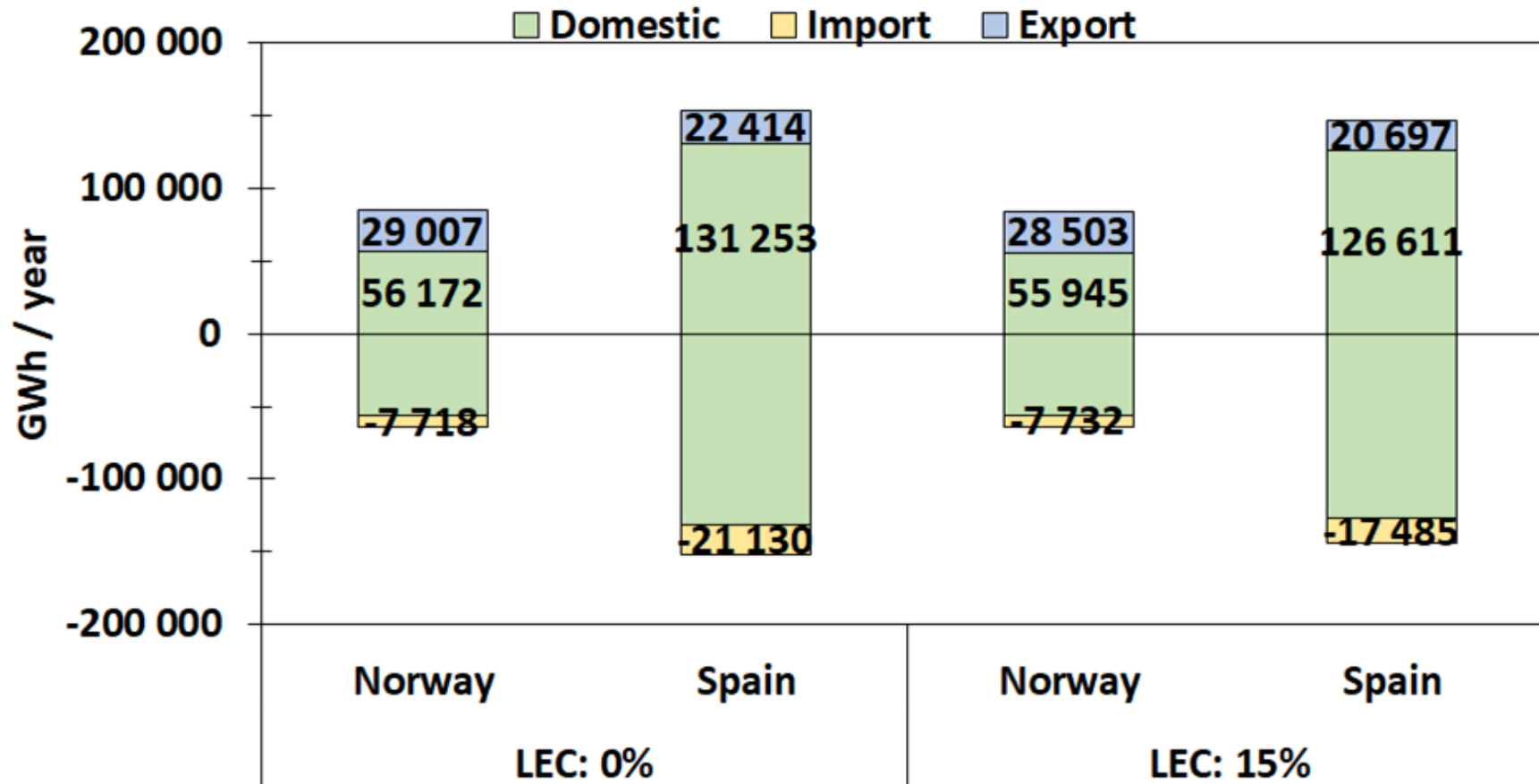
System Operation: impact of 15% penetration of LEC in Norway and Spain [GWh annually]

		Norway	Spain
Energy Available	Hydrogen Discharge	-0.1	-801.6
	Battery Discharge	-0.6	-28.6
	Reservoir	372.1	8.9
	RunOfRiver	0.0	0.0
	Pumped Storage Discharge	0.0	-3,789.8
	Wind	0.0	0.0
	PV	0.0	0.0
	Nuclear	0.0	-481.5
	Bio	-1.7	-41.8
	Coal	0.0	-52.2
	Oil	0.0	-77.4
	CCGT	0.0	-203.3
	OCCGT	0.0	-0.5
	Sum production	369.8	-5,467.8
	Curtailment and Spillage	-141.7	7,227.1
Net import	550.0	-1,732.0	
Available	1,061.5	-14,426.9	
Energy Use	Gross Consumption	1,079.5	-7,619.3
	Hydrogen Charge	0.2	-2,102.8
	Battery Charge	-0.6	-32.8
	Pumped Storage Charge	0.0	-4,746.5
	ENS	15.7	-76.0
	Total use	1,063.3	-14,425.3



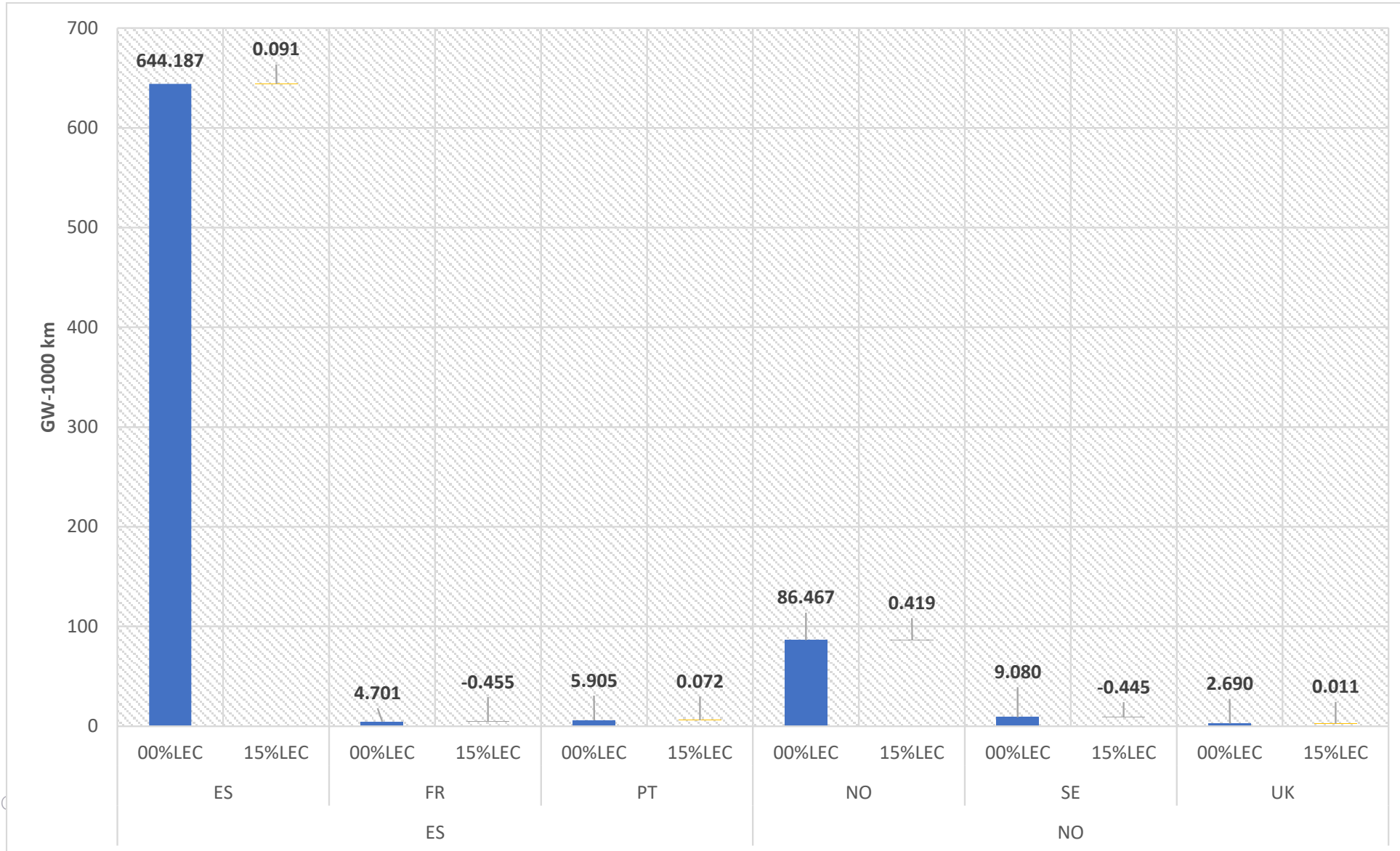
Results

Transmission Network Use over a year for Spain and Norway [GWh]



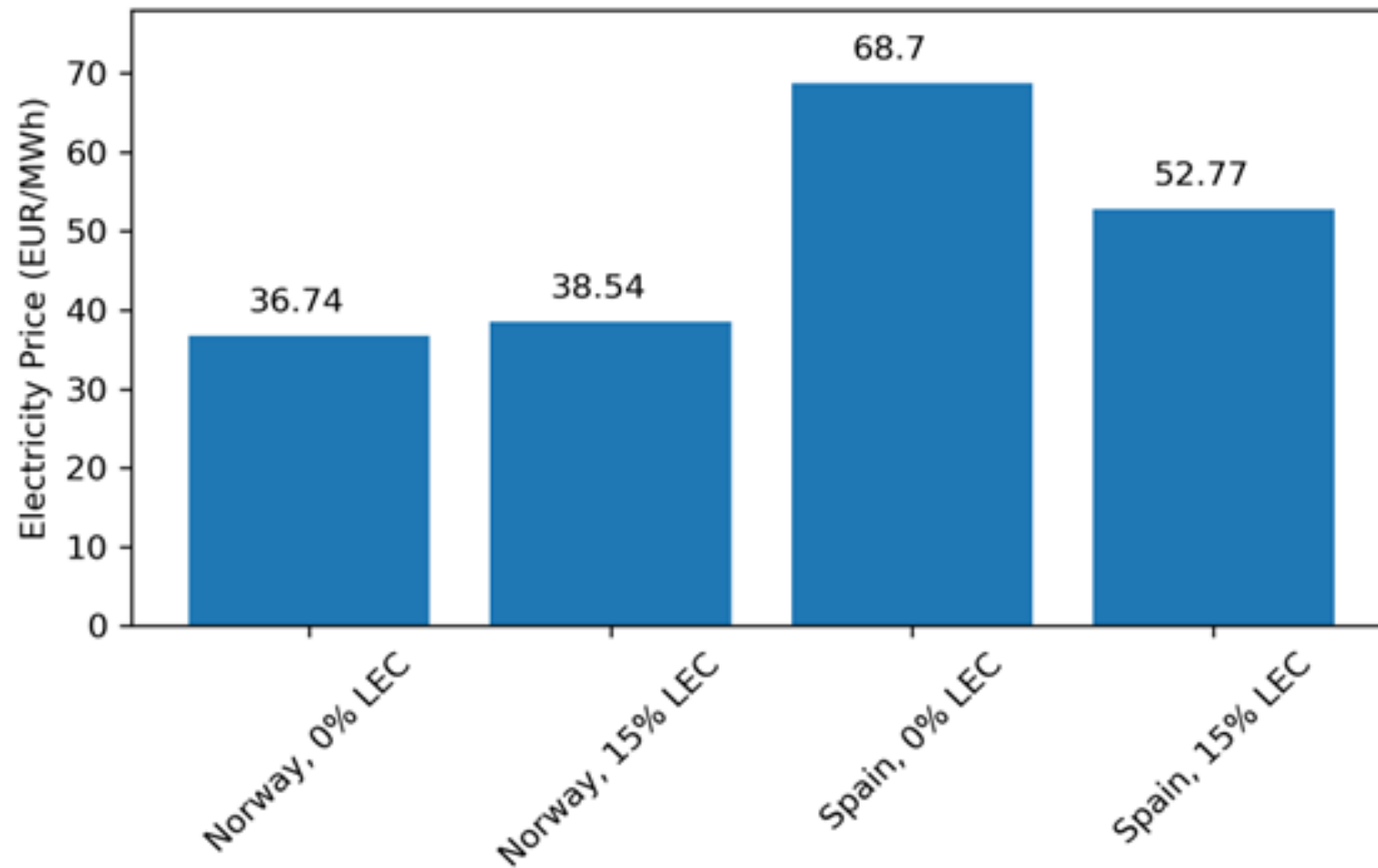
Results

Overall transmission network size in Spain and Norway in 2030 and impact on this of LEC



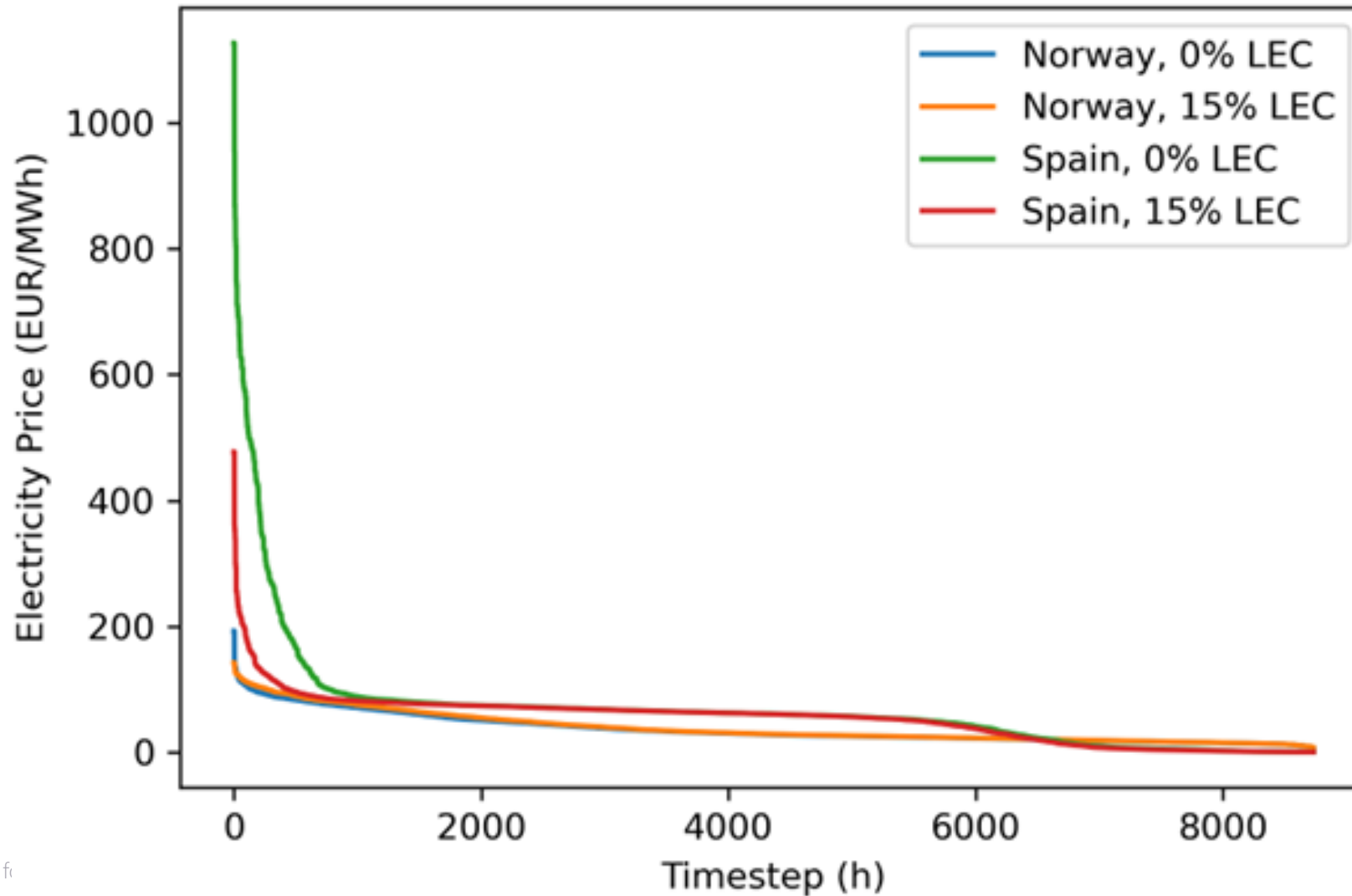
Results

Prices: Annual Average both without and with LECs



Results

Prices: Annual Duration Curve both without and with LECs





Thank you.

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