Role of openTEPES in the FLEXENER project

Team:

Andrés Ramos, Michel Rivier, Teresa Freire &
Stefanía Gómez S

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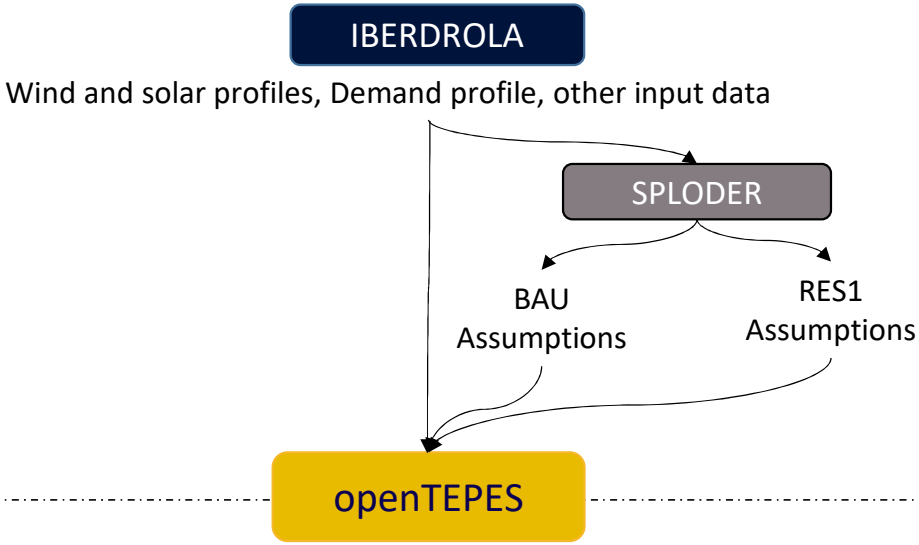
FLEXENER

New 100% renewable, flexible and robust energy system for the integration of new technologies in generation, network and demand

Task A1:
Construction and assessment of a BAU (Business As Usual scenario) and RES1 (high renewables penetration scenario).



Assessment of BAU and RES1 by 2030, considering a single node representation of the operation problem with hourly representation

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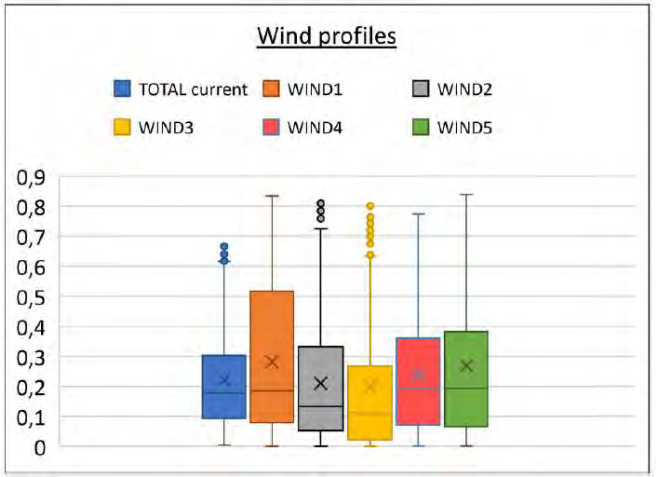
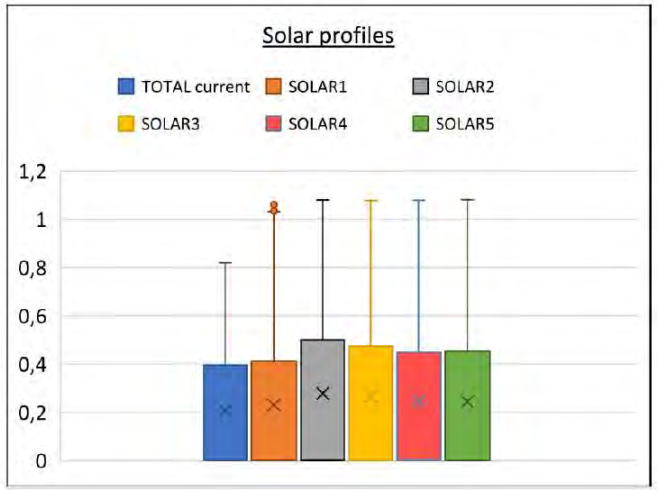
Main assumptions

Capacity (MW)	BAU	RES1	RES1 -BAU
Nuclear	3050	0	-3050
Combined cycle	24560	24560	0
Cogeneración	3745	3745	0
Solar Thermal	2299	2299	0
Biomass	2146	2146	0
Hydro	16250	16250	0
Pumped hydro	3329	3329	0
Solar PV (utility)	8372	8372	0
Wind (on shore)	25553	25553	0
Batteries	1347	1347	0
WIND1	8860	12485	3625
WIND2	2213	4979	2766
WIND3	788	1774	986
WIND4	608	1367	759
WIND5	1746	1746	0
Sto_8h_1	1000	1000	0
Sto_20h_1	2000	2000	0
Sto_20h_2	0	5800	5800
Sto_40h_1	800	800	0
Sto_40h_2	600	600	0
Sto_60h_1	1500	1500	0
Solar1	177	194	17
Solar2	4314	10410	6096
Solar3	21419	42518	21099
Solar4	3680	7957	4277
Solar5	581	980	399





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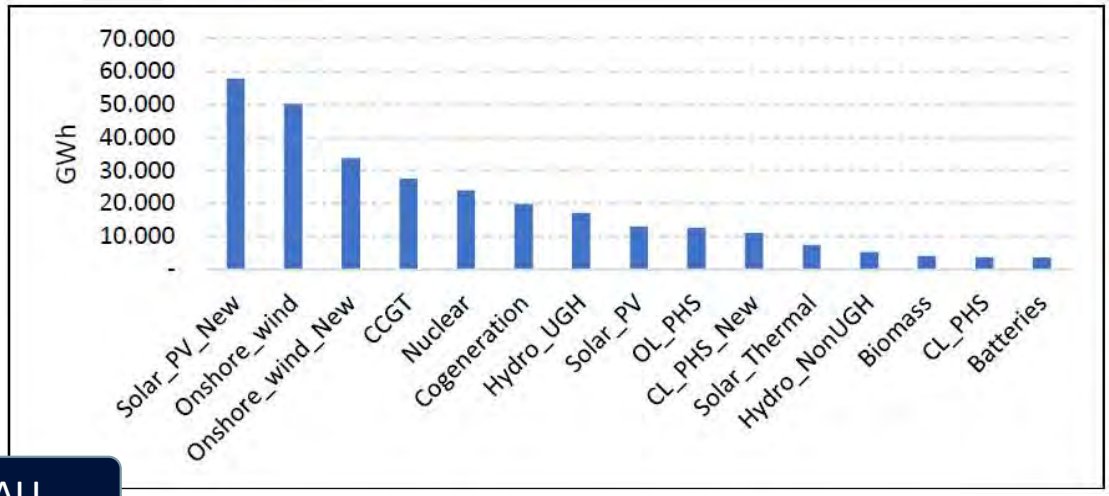
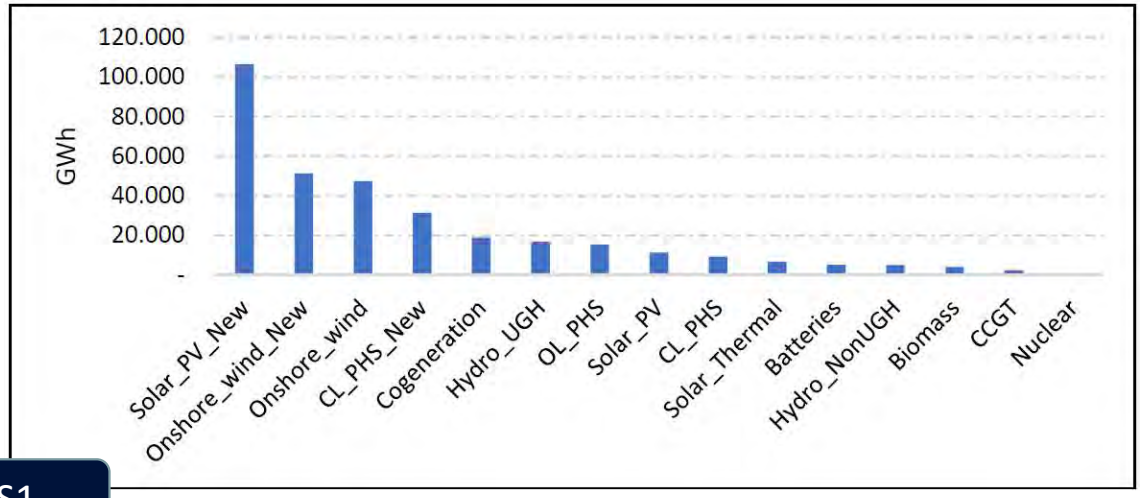
Results



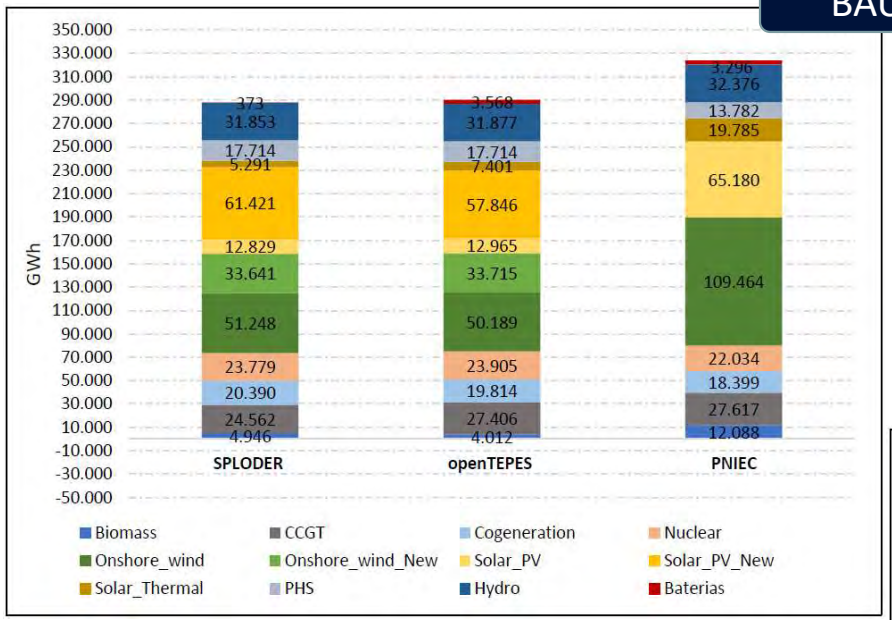
BAU



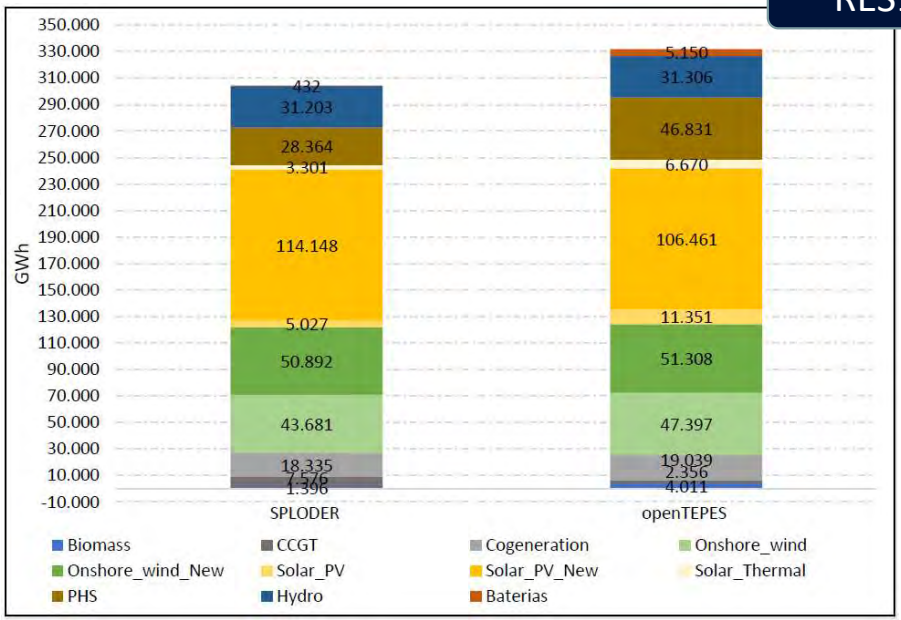
RES1

Results

BAU



RES1



openTEPES | Open Generation, Storage, and Transmission Operation and Expansion Planning Model with RES and ESS
"Simplicity and Transparency in Power Systems Planning"

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Concluding remarks

i. openTEPES verifies the operability of the expansion in BAU and RES1 scenarios. Similar operating results are evident for the BAU scenario in both models and some differences in the RES1 scenario, which are mainly explained by the temporal granularity considered in the operation of each model, openTEPES considers a more detailed operation with an hourly representation and SPLODER for his part considers 672 hours (4 representative weeks).

ii. A share of 100% renewable production is technically possible, although it considerably increases the annual investment cost and increases the spillage. On the other hand, in the proposed RES1 scenario, CC is still used as backup technology so that costs do not increase even more.

iii. In general, the scenarios considers higher investment in solar than in wind. This is due to the economic competitiveness of this technology.

Thank you for your attention

Stefanía Gómez Sánchez.
sgomez@comillas.edu

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Stefanía Gómez Sánchez.
sgomez@comillas.edu

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IIT INSTITUTO DE INVESTIGACIÓN TECNOLÓGICA

Break 10 min

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Inputs

Technologies	Lifespan	Remaining capacity 2030 (MW)	Firmness
Nuclear	60	3050	0,97
Coal	38	0	0,95
Open cycle GT	25	0	0,96
Combined cycle GT	25	24560	0,96
Cogeneration	-	3745	0,55
Solar thermal	25	2299	0,14
Storage hydro	80	15614	0,44
Run of the river hydro	80	636	0,25
Pumped-storage hydro	80	3329	0,9
Solar PV (utility)	25	8372	0
Wind (On-shore)	30	25553	0,07
Thermal renewable (Biomass)	20	2146	0,55

Inputs

	2030
CO2 price (€/tonCO2)	84,84[2]
Gas price (€/MMBTU)	6,36[2]

Technology costs 2030	Investment costs	Fix O&M	O&M Variable	Fuel	Taxes	Emissions
	[€/kW]	[€/kW-yr]	[€/MWhe]	[€/MWhe]	[€/MWhe]	[€/MWhe]
Nuclear	-	108,3		8.72	15,0	
Open Cycle GT	544,1	18,4	11,0	48,88	4,7	42,42
Combined cycle GT	845,1	19,3	2,0	32,58	4,7	28
Cogeneration	-	-	-	-	-	48,78
Hydro (All)*	-	68,8	3,0			
Solar PV (utility)	500→450	10→9	0			
Solar thermal	4396,6	49,6	0,46			
Wind (On-shore)	950→900	29→25	0			
Non supplied energy			1000,0			

Inputs: Storage technologies

			Charge hours	Discharge hours	Round trip Efficiency
Batt_cent	10	96	4	4	
Sto_8h_1			8	8	0,75
Sto_20h_1	80		20	20	0,75
Sto_20h_2	80		20	20	0,75
Sto_40h_1	80		40	40	0,75
Sto_40h_2	80		40	40	0,75
Sto_60h_1	80		60	60	0,75

Technología	Zona geográfica que representa
SOLAR1	Galicia y Asturias
SOLAR2	Valencia y Murcia
SOLAR3	Aragón, Cataluña, Extremadura, Madrid, C.Mancha, Andalucia
SOLAR4	C.Leon
SOLAR5	Cantabria,Pvasco, Navarra, Rioja

assumptions

- The discount r
- The annual de
- The existing e changed into 0,75
- Storage cycles are weekly, there is no storage available from one week to another.

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