

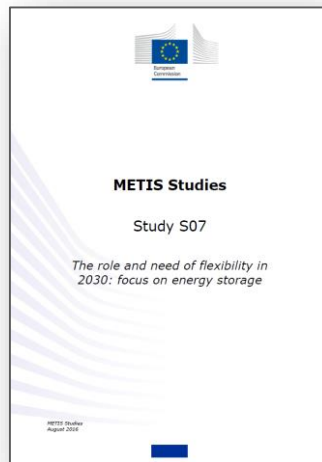
A background image of a blue sky with white clouds, transitioning from a dark blue at the top to a lighter blue at the bottom. A horizontal bar with colorful segments (purple, orange, green, blue, purple, grey, orange, blue) is positioned above the main text area.

# Session 2: The future role of flexibility

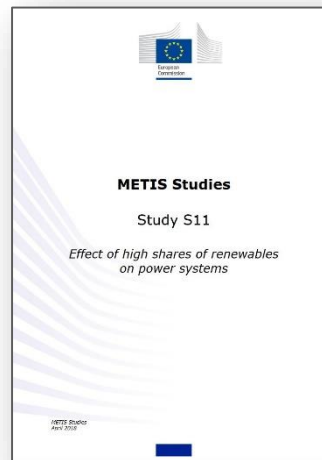
## METIS 1 – Dissemination event

## Articulation of the three studies presented today

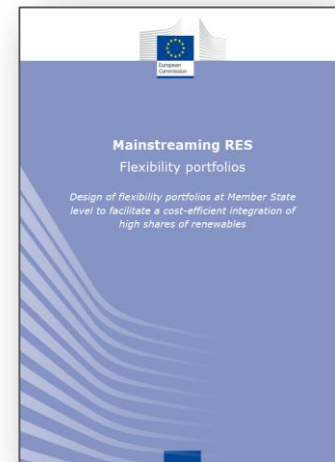
### METIS Study S07



### METIS Study S11



### Mainstreaming RES



What are the **needs** for flexibility, how do they **evolve**, what are the key **providers** of flexibility?



What are the **optimal portfolios** of flexibility solutions?

# THE FUTURE ROLE OF FLEXIBILITY

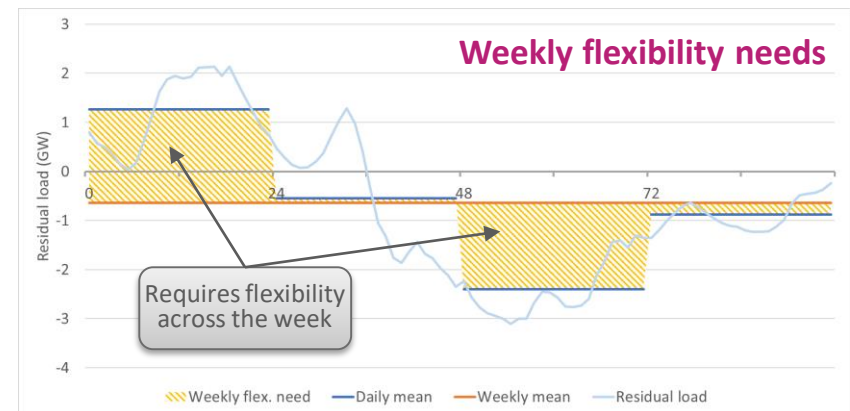
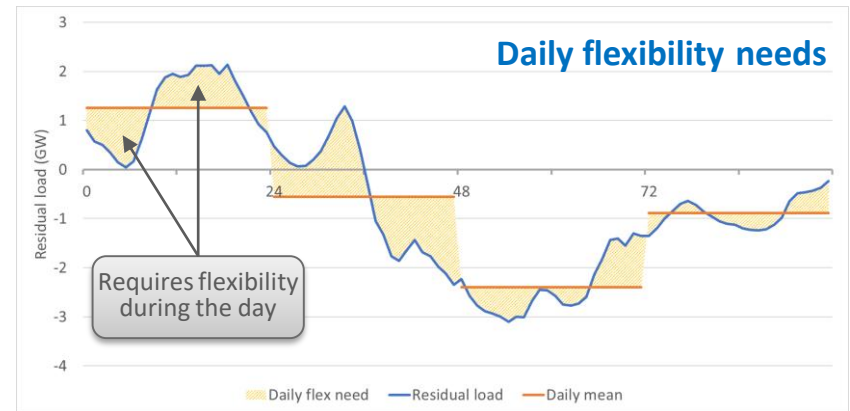
- 1. Evaluation of flexibility needs, on a range of timescales**
2. Identification and characterisation of local flexibility solutions
3. Optimisation of the flexibility portfolio at Member State level

## How to systematically assess flexibility needs?

Defined indicators that measure national **flexibility requirements on various timescales** based on the **residual load**.

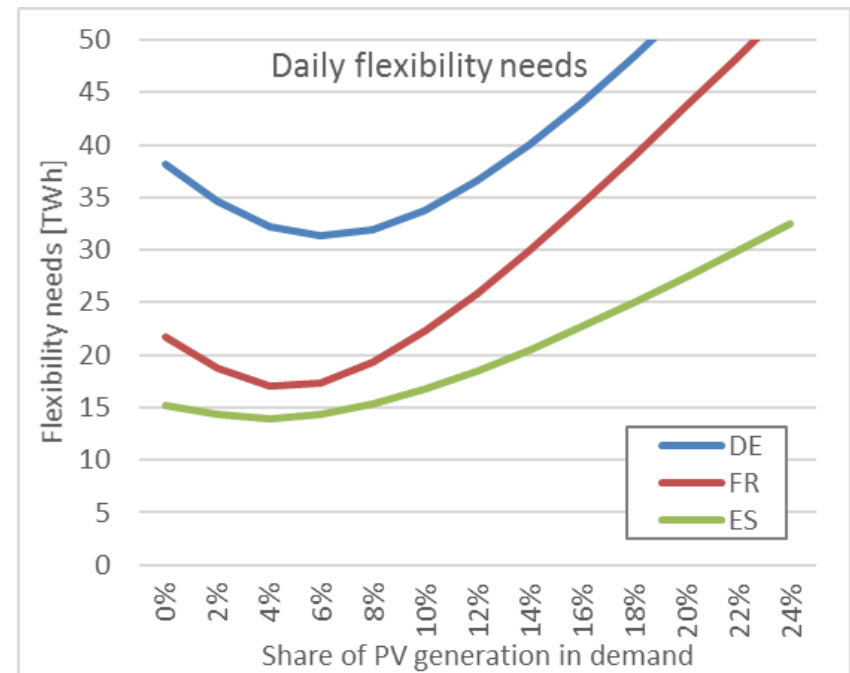
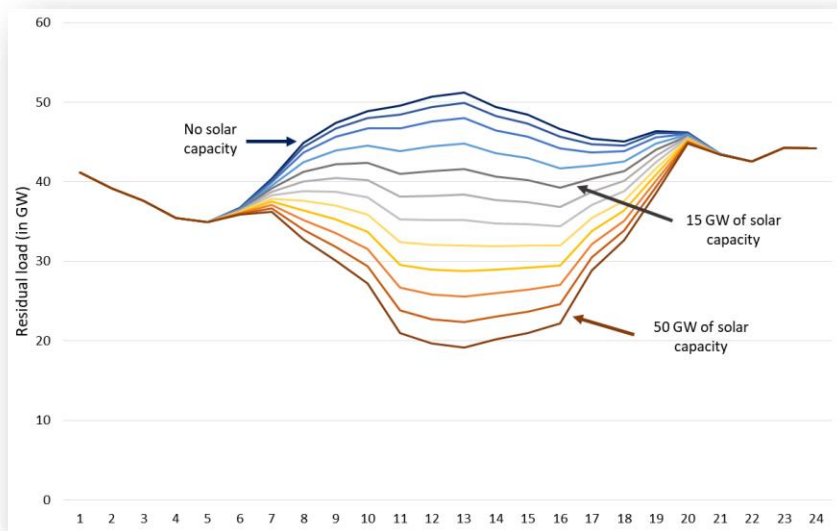
The **daily flexibility needs** equal the difference between the residual load and its daily average (sum of coloured areas).

Similar calculations can be performed for **weekly** (and annual) **flexibility needs**, based on the comparison between the daily/weekly averages with the overall average across each week/year.



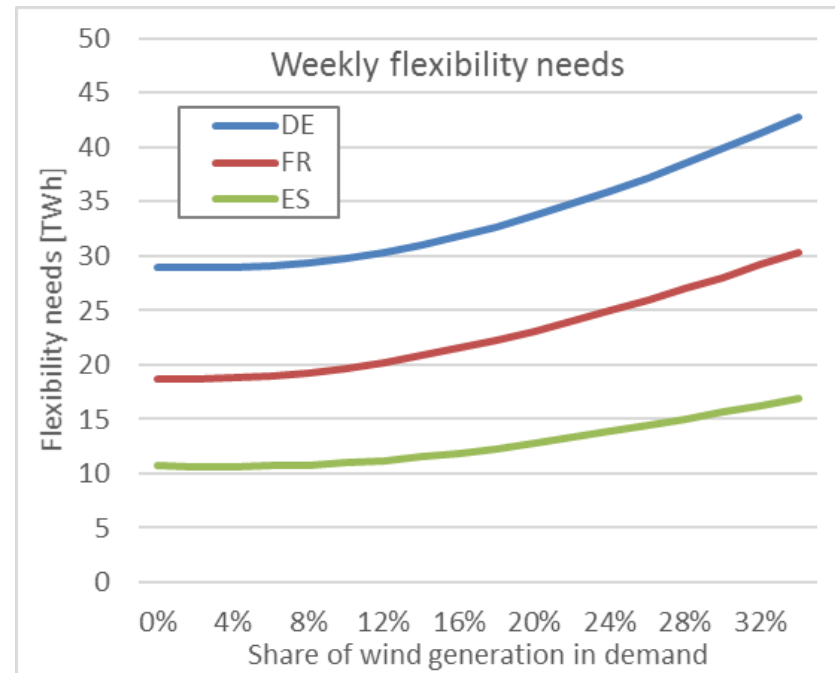
## Daily flexibility needs

- They tend to increase in most countries
- Primarily driven by **PV deployment**, due to its daily production cycle
- For relatively low PV shares, **PV production coincides with midday demand**, resulting in a smoothing of the residual load
- For higher PV shares, the daily flexibility needs increase, creating a **U-shaped curve**



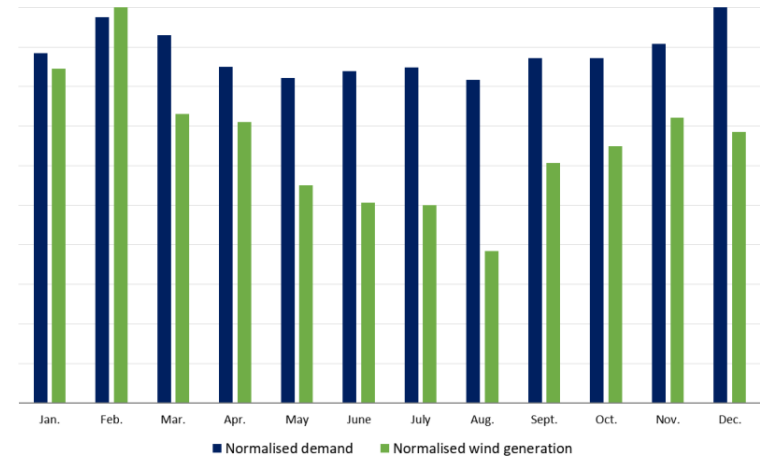
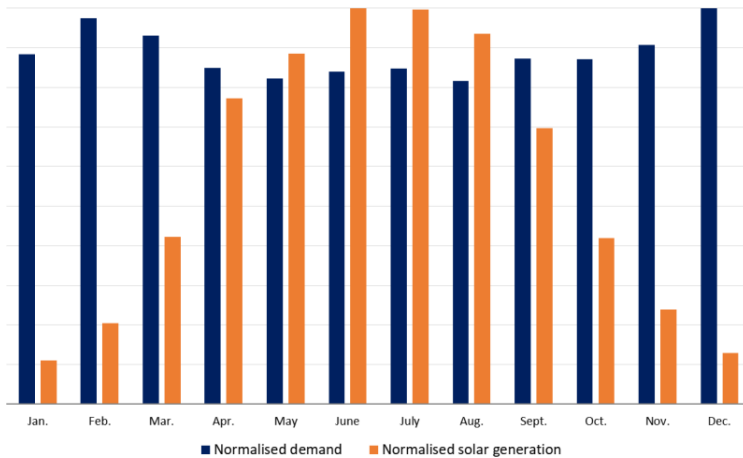
## Weekly flexibility needs

- Primarily **driven by wind deployment** (wind regimes tend to last several days)
- In countries with **low wind energy shares**, weekly flexibility needs are primarily driven by lower levels of demand during weekends (depending on the structure of the economy)



## Annual flexibility needs

- Primarily **driven by seasonal variation** in PV power production and power demand
- Wind power production can reduce flexibility needs, as production is higher during winter season and coincides with high demand in Northern countries. In Southern countries, PV can reduce the need for annual flexibility as its production coincides with the use of air conditioning

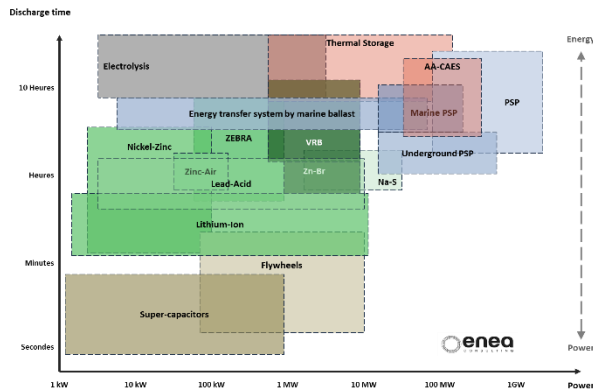


# THE FUTURE ROLE OF FLEXIBILITY

1. Evaluation of flexibility needs, on a range of timescales
2. **Identification and characterisation of local flexibility solutions**
3. Optimisation of the flexibility portfolio at Member State level



## Storage technologies (with different discharge times)



## Demand-response

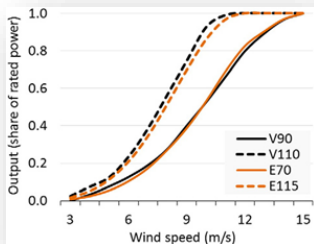
### Industry

- Refrigeration
- Industrial processes
- ...

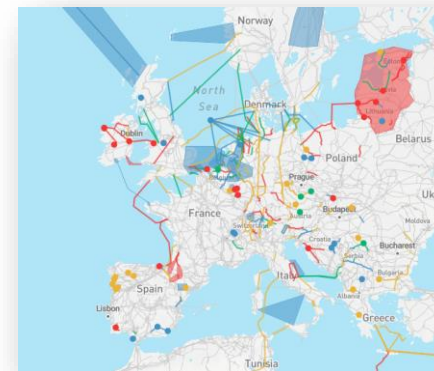
### Tertiary/residential

- Electric vehicles
- Warm water heating
- Heating and cooling
- ...

## System-friendly technologies



## Interconnectors



# THE FUTURE ROLE OF FLEXIBILITY

1. Evaluation of flexibility needs, on a range of timescales
2. Identification and characterisation of local flexibility solutions
3. **Optimisation of the flexibility portfolio at Member State level**

### Description

**Name:** CCGT medium efficiency\_FR  
**Description:**  
**Type:** CCGT fleet  
**Location:** 47.051°;-0.189°  
**Tags:** RESERVE\_PRODUCTION PRODUCTION

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### Scopes & Behaviors

**Scopes:** Simulation  
**Behaviors:** FUEL

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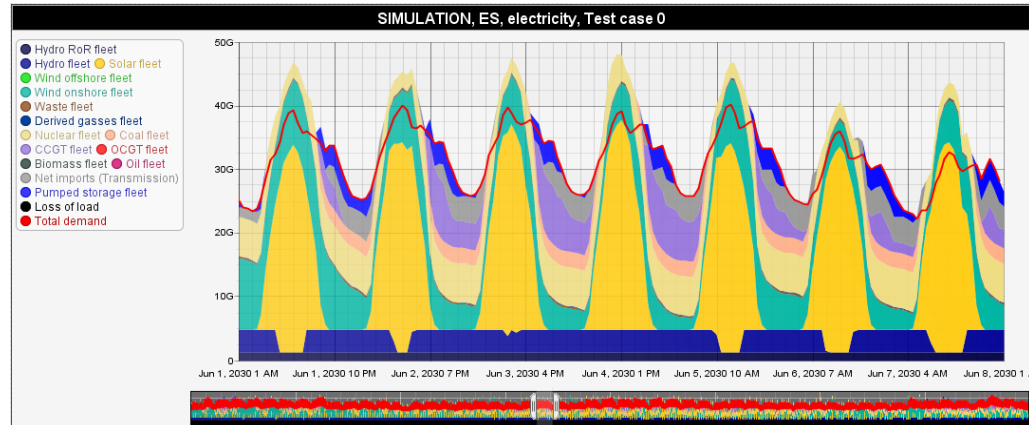
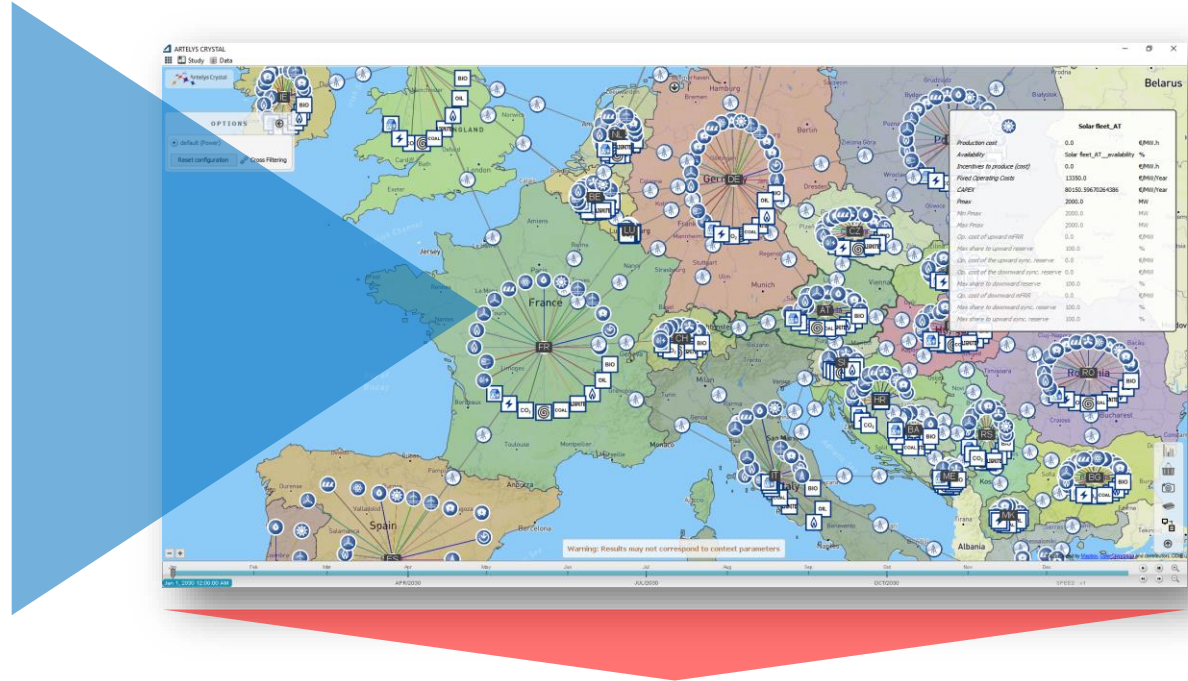
### In/Out

In		Out	
gas	FR	co2	FR
		electricity	FR

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### Parameters

Parameter	Value	Unit	Consiste...	Validation
CAPEX	72.900	€/MW/...		
Fixed Operat...	21.250	€/MW/...		
Pmax	4.194.62	MW		
Availability	CCGT medium efficiency_F...	%		
Variable cost	2	€/MW.h		
Fuel yield w...	0.58	MW.h/...		
Fuel CO2 emi...	0.24	t/MW.h...		
Fleet min load	0	%		



## Long-term scenarios

Demand, fuel and CO2 prices,  
weather scenarios

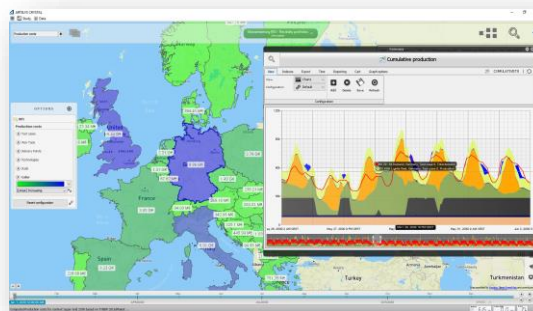
## Generation mix

Installed capacities, interconnection  
capacities, investment options to  
ensure adequacy

## Policy decisions

RES and nuclear capacities, capacity  
adequacy criterion

## METIS



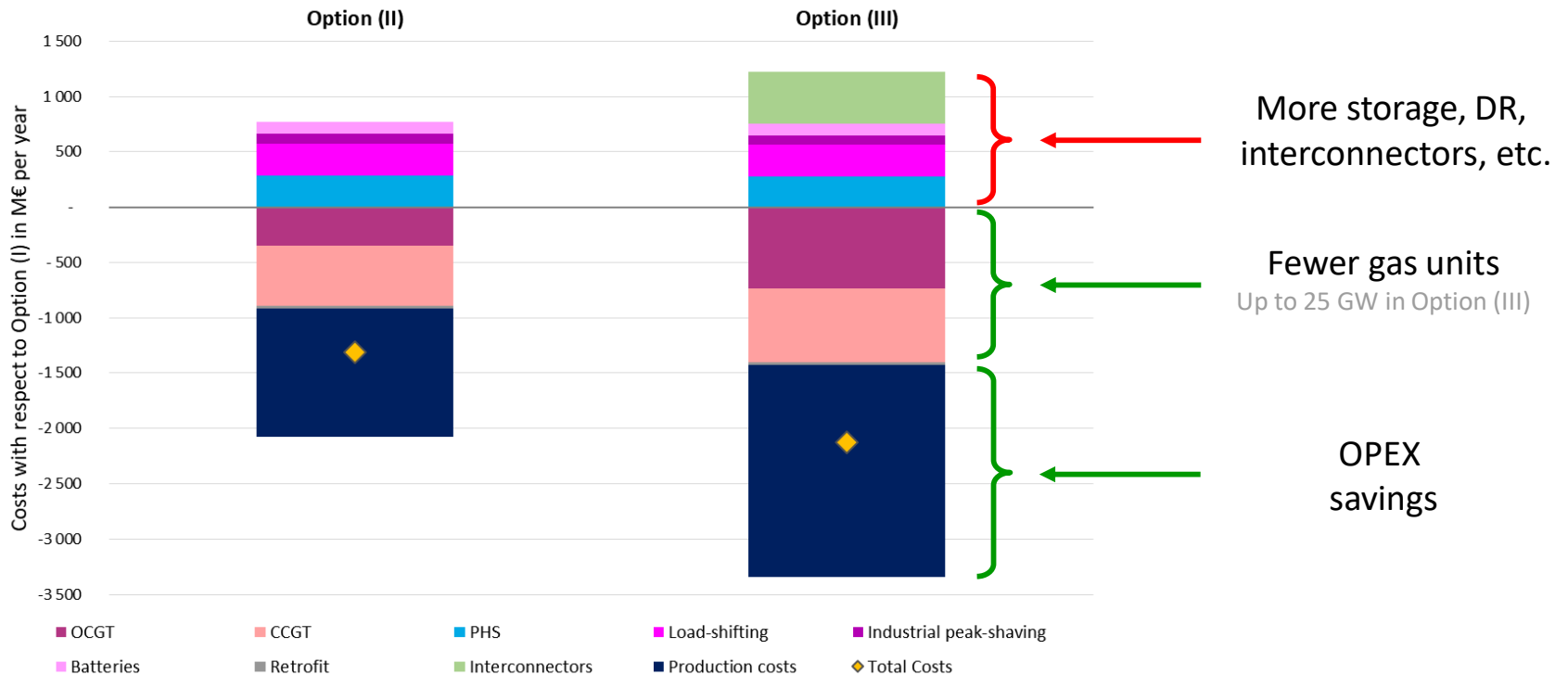
Joint stochastic optimisation of  
investments and of hourly  
electricity dispatch



- Installed capacities
- Hourly dispatch
- Production costs
- Electricity prices
- Revenues
- Social welfare
- CO<sub>2</sub> emissions
- RES curtailment
- ...

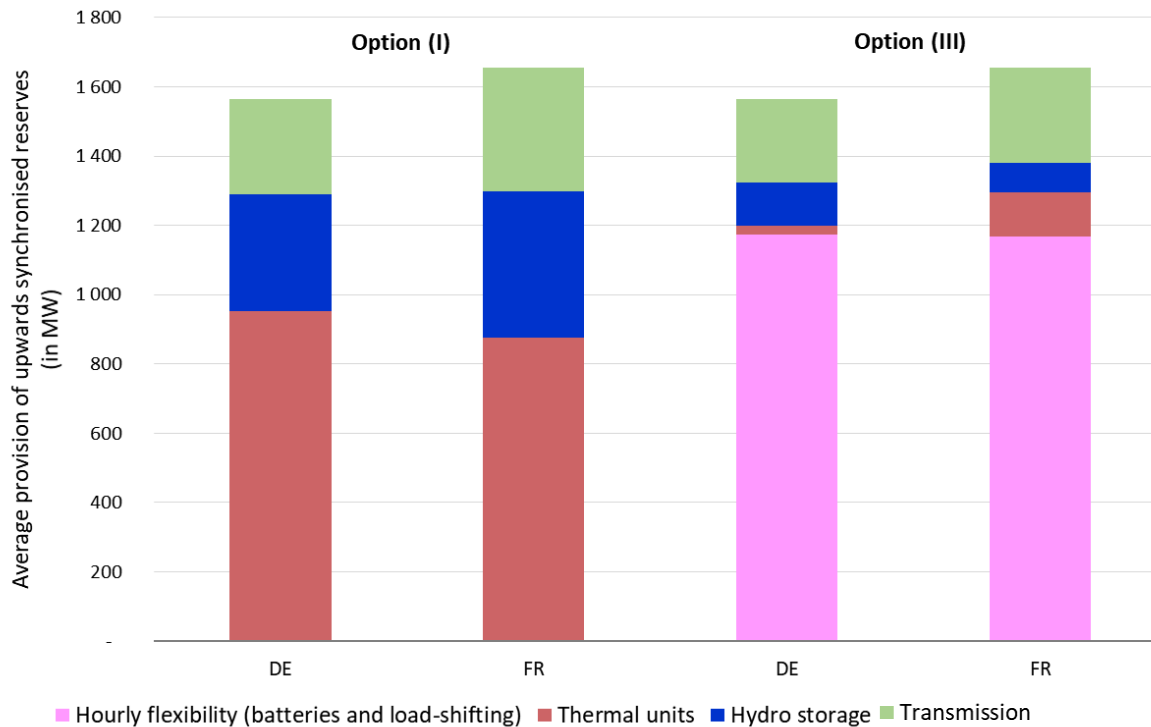
We have considered **three options** to illustrate the benefits of a diversified portfolio of flexibility solutions

	Option (I) Baseline	Option (II)	Option (III)
Available flexibility solutions	Gas-fired generation	Gas-fired generation <b>Demand-response</b> <b>Storage</b>	Gas-fired generation <b>Demand-response</b> <b>Storage</b> <b>Interconnectors</b>
Available flexibility improvements	Coal retrofits Gas retrofits	Coal retrofits Gas retrofits <b>Advanced onshore wind</b>	Coal retrofits Gas retrofits <b>Advanced onshore wind</b>



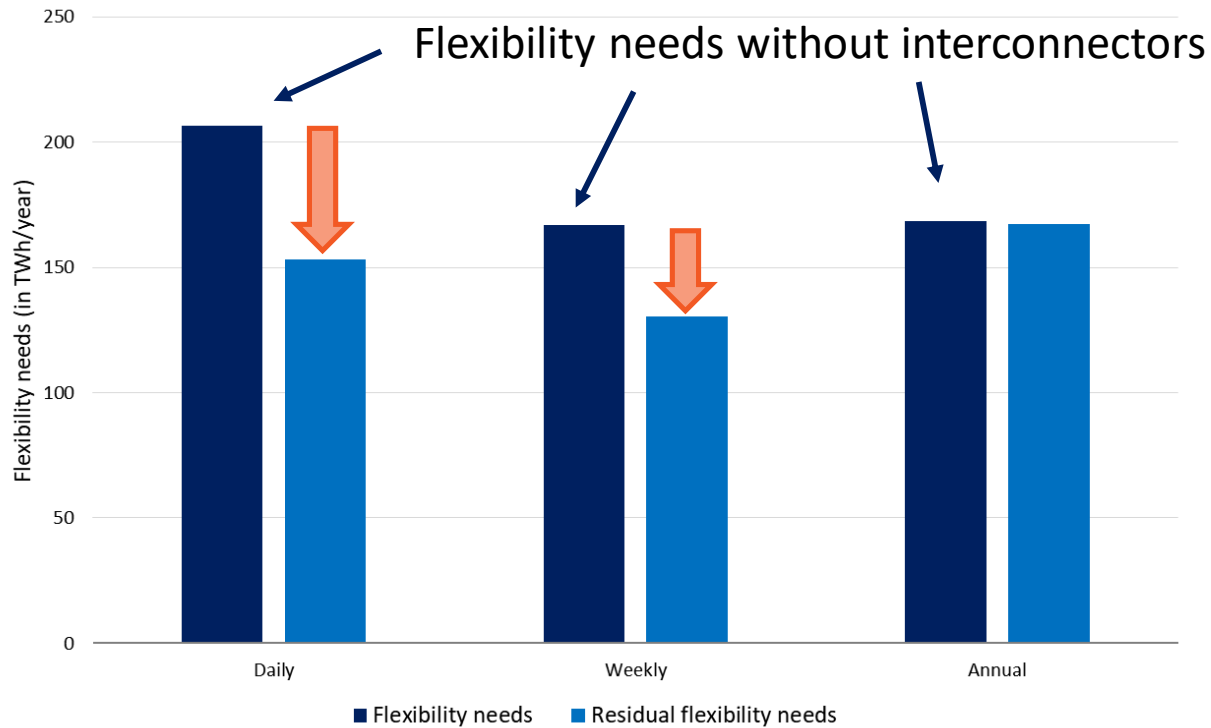
## Key message #1

Allowing storage, demand-response, system-friendly RES and interconnectors to participate in the provision of flexibility results in substantial economic benefits



### Key message #2

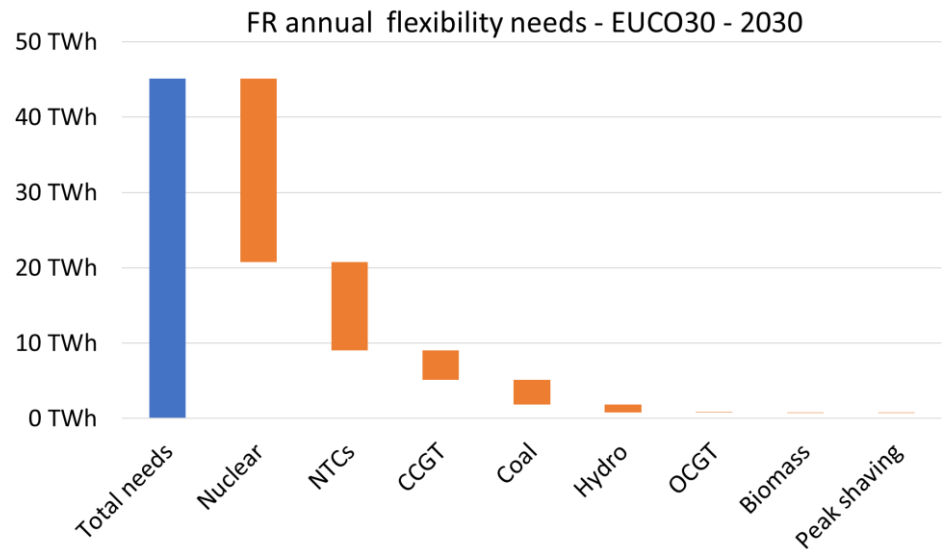
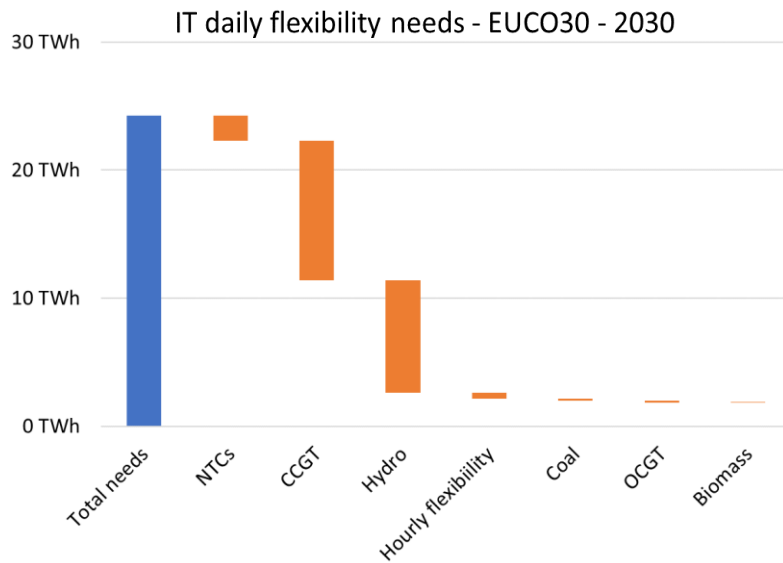
Short-term demand-response and batteries can advantageously replace thermal units to provide electricity balancing reserves



### Key message #3

Interconnectors contribute significantly to the provision of daily and weekly flexibility





**Key message #4**

More generally, a diversified portfolio of flexibility solutions is found to be favoured by the model

# Thank you for your attention!

## Contact

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ener-metis@ec.europa.eu

## Interested in further information?

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

