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DI TORINO



# MED & Italian Energy Report 2020

## Presentazione del 2° Rapporto Annuale



Speaker

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**WEBINAR | 22 luglio 2020**

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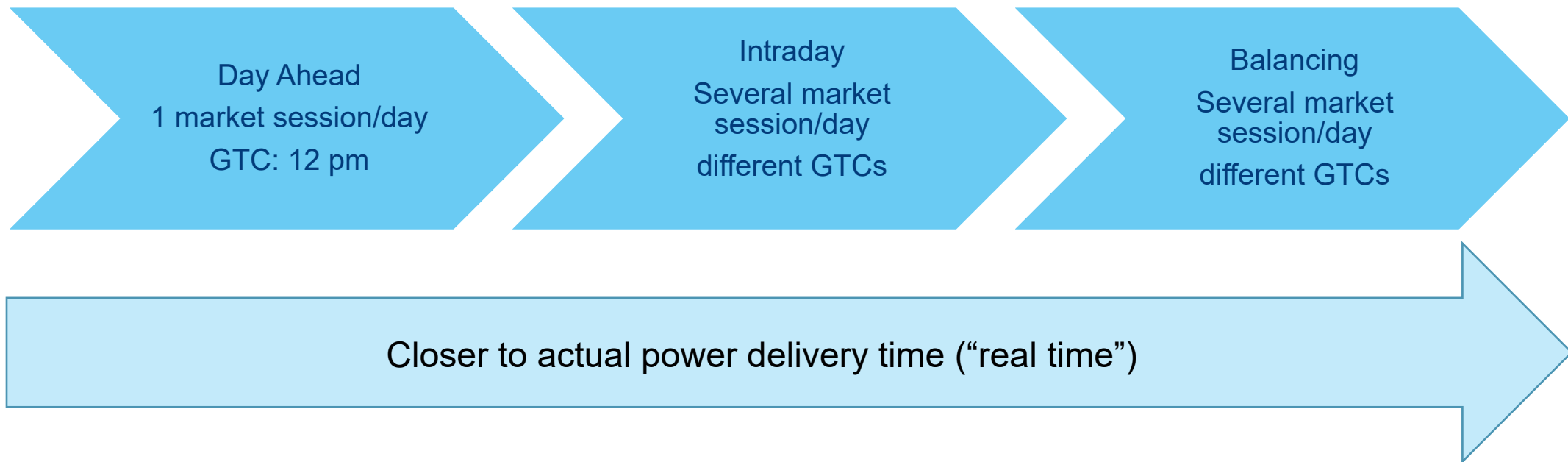
Joint Research Centre, European Commission



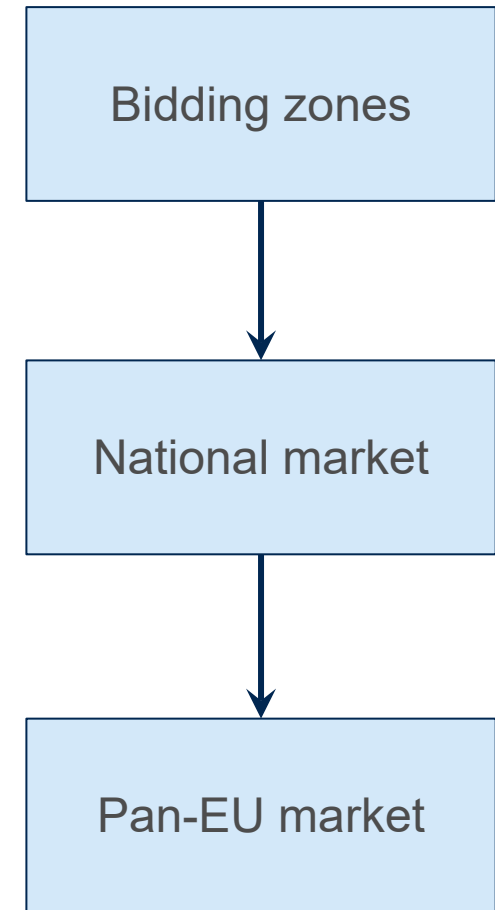
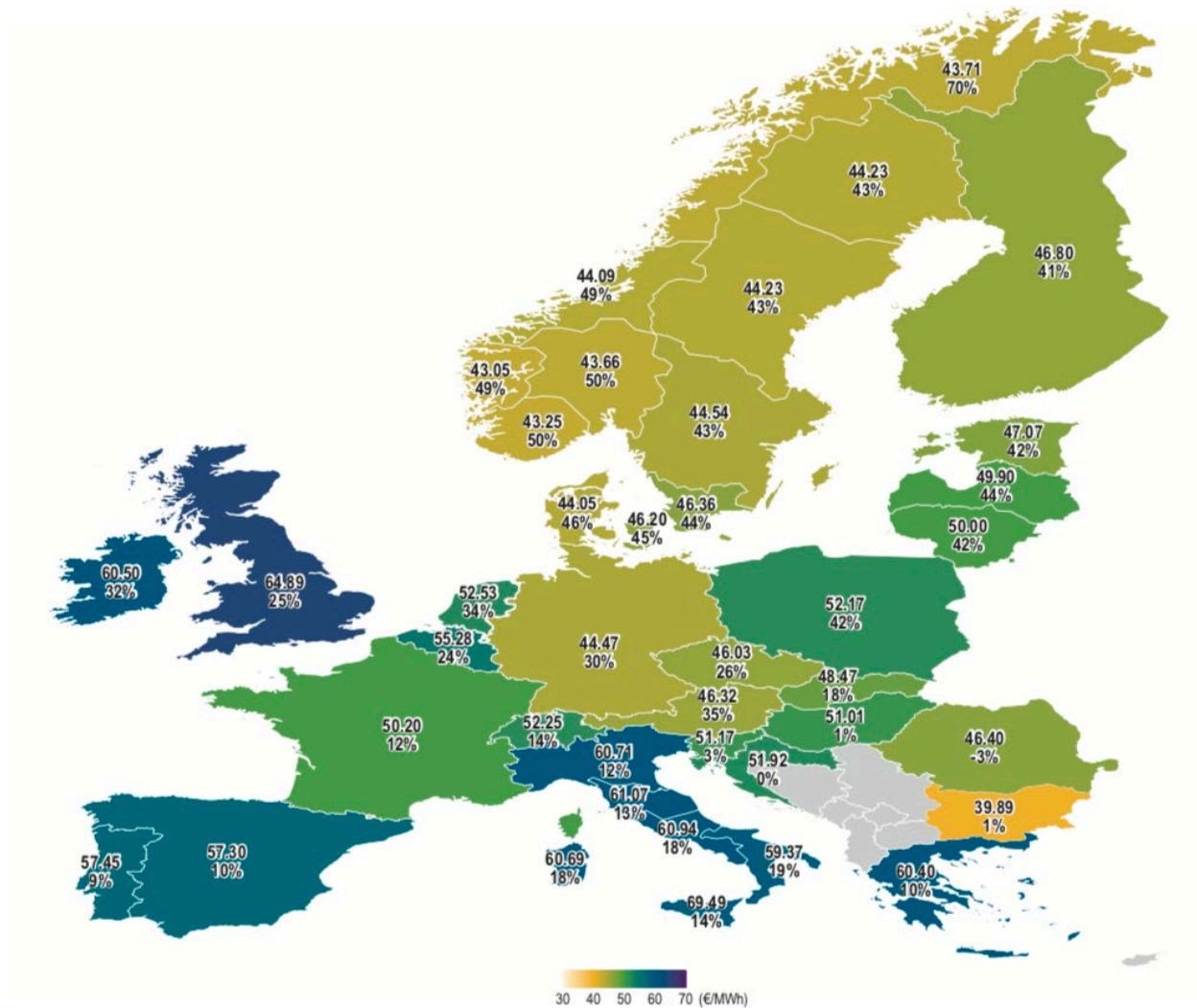
# ELECTRICITY EXCHANGES BETWEEN NORTH AFRICA AND THE EU POWER SYSTEMS AND MARKETS

# RES in the EU electricity market

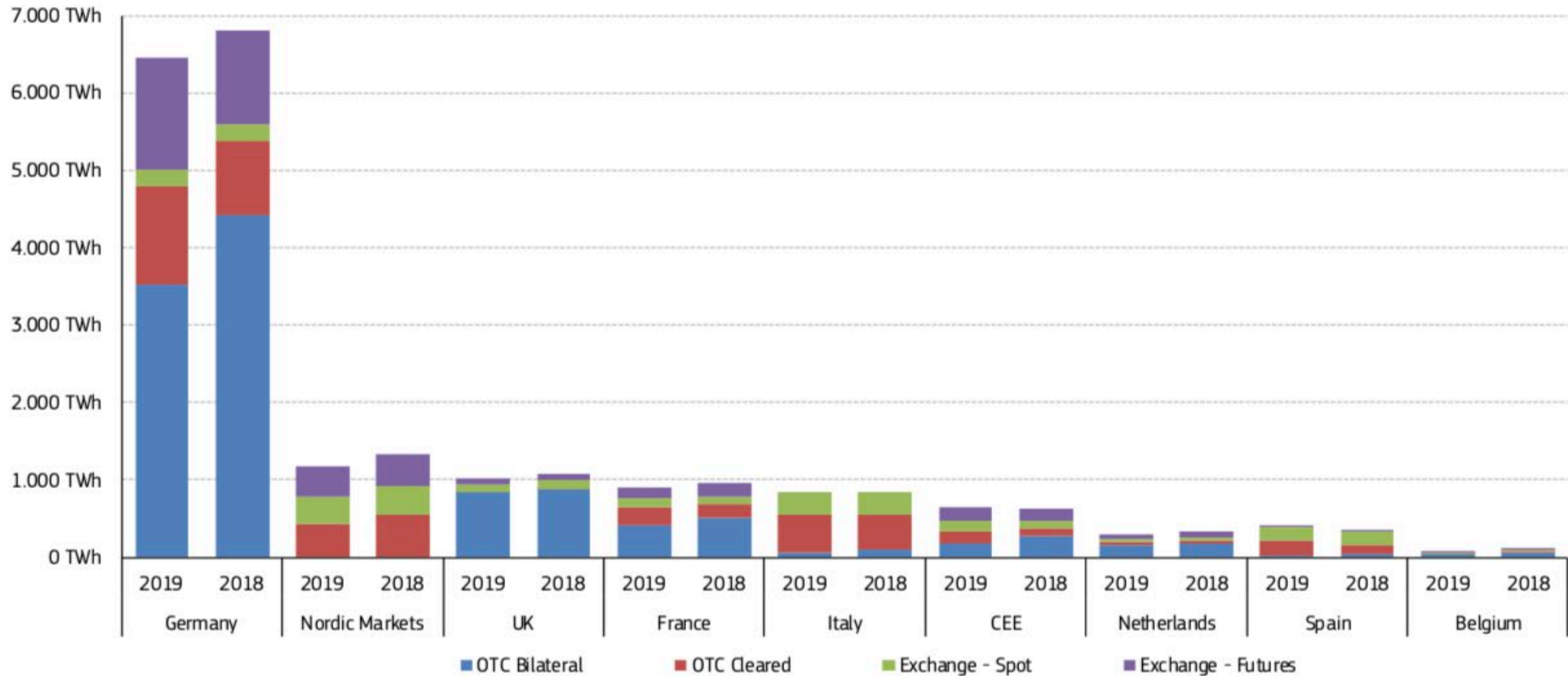
- Interconnected national/regional markets



# EU internal electricity market



# Traded electricity in European markets



# Study of interconnection EU-North Africa

- Effects: 1) electricity costs; 2) CO2 emissions

Interconnector	Total Capacity (MW)
<i>Algeria to Spain</i>	1000
<i>Algeria to Italy (Sardinia)</i>	1000
<i>Egypt to Cyprus</i>	2000
<i>Libya to Greece</i>	2000
<i>Morocco to Spain</i>	2100
<i>Morocco to Portugal</i>	1000
<i>Tunisia to Italy (central)</i>	2000
<i>Tunisia to Italy (Sicily)</i>	1200
<i>Tunisia to Malta</i>	250
<b>Total Capacity from North Africa to Europe</b>	12550

*Capacity of interconnectors between Europe and North Africa used study*

# JRC model

- 36 countries, 55 power nodes
  - Morocco, Algeria, Tunisia, Libya and Egypt are added as one node per country
- Data publicly available, different sources
- Based on PLEXOS, power market simulation software
  - Optimizes the day-ahead generation dispatch and provides an asset performance valuation in terms of electricity prices
  - Constraints: availability and operational characteristics of generating plants and energy storage, fuel and CO<sub>2</sub> prices, power transmission constraints of cross-zonal interconnectors, and availability of RES
  - For each scenario, the economic dispatch is performed for a one-year period at an hourly time step.



# 2040 scenarios

- **Electricity Generation**

1. **RES low**, power generated from RES is used only for fulfilling the electricity demand of North African countries
2. **RES medium**, besides the fulfilment of the North African electricity needs, a surplus of electricity is available for trans-Mediterranean exchanges between Europe and Africa
3. **RES high**, assuming a significant surplus of electricity available for trans-Mediterranean exchanges

- **Electricity Demand**

1. **Reference**, total final energy/electricity consumption values in 2040 projected based on the best fit of the historical data
2. **High Electrification**, same for the total final energy consumption and electrification rate in all the North African countries at 50%

## Scenarios

- **A** / RES low + Ref
- **B** / RES Med + Ref
- **C** / RES high + Hi-Elec

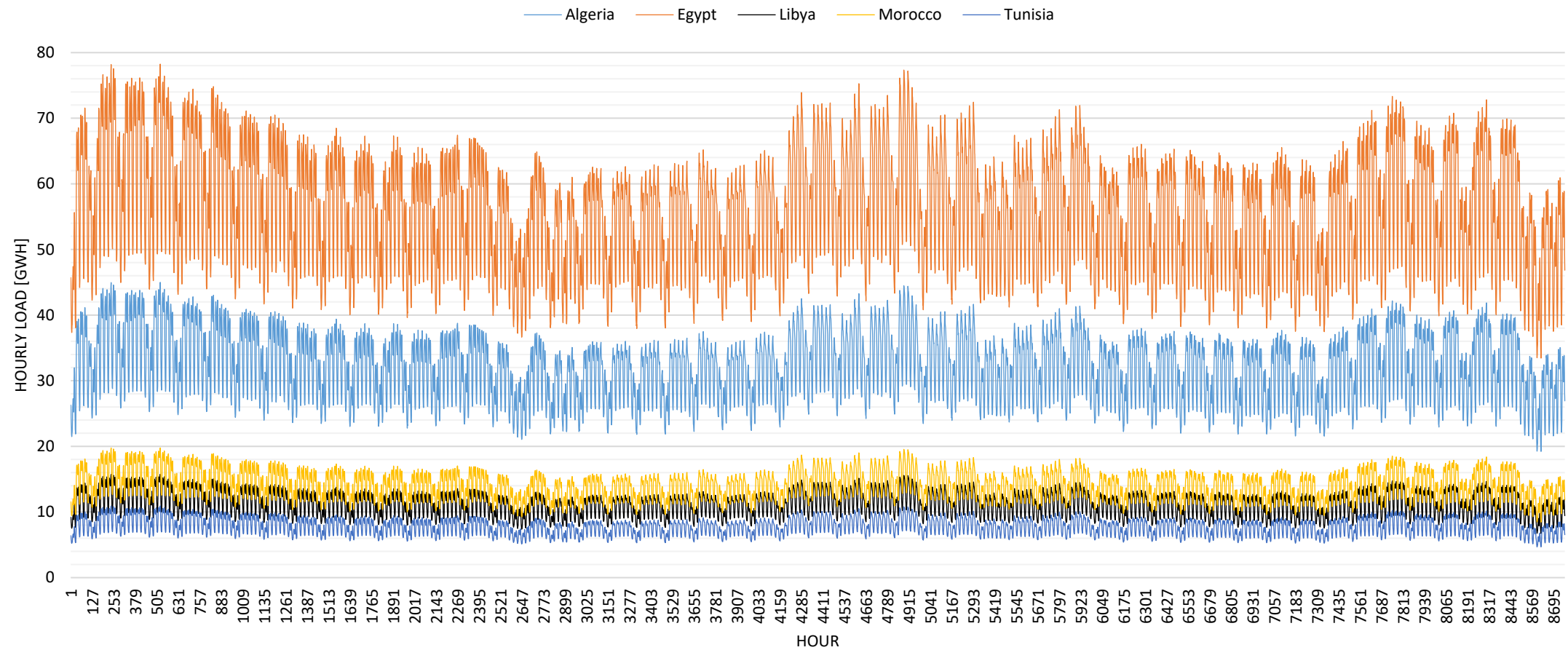


# Results of simulation

Country	Scenario A		Scenario B		Scenario C	
	Load	Surplus	Load	Surplus	Load	Surplus
<b>Algeria</b>	117	0	117	52	280	112
<b>Egypt</b>	216	0	216	77	487	194
<b>Libya</b>	29	0	29	30	98	40
<b>Morocco</b>	69	0	69	29	123	49
<b>Tunisia</b>	23	0	23	18	68	28
<b>TOTAL</b>	456	0	456	205	1056	423

*Annual load and available surplus by country and by scenario in TWH*

# Load in NA



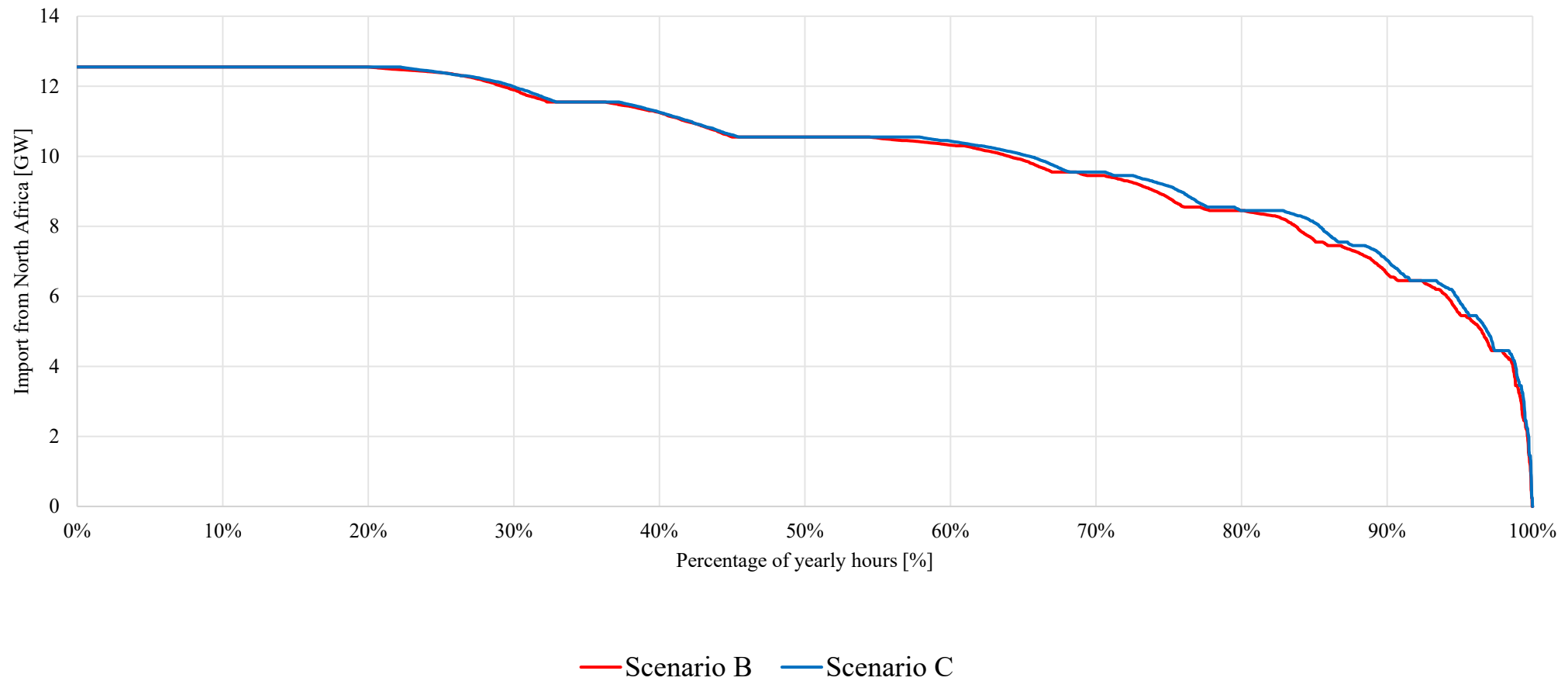
*Hourly load profile for North African countries – Scenario C*

# Electricity imports from NA

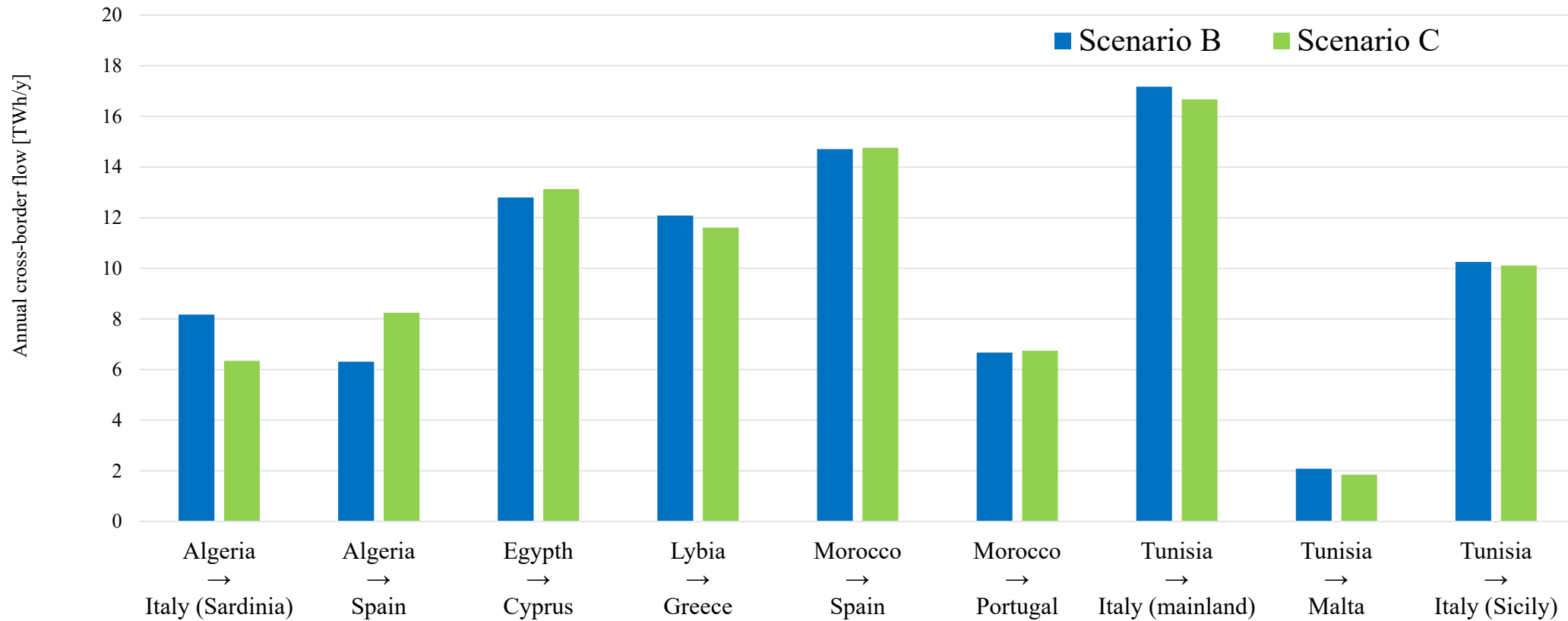
Electricity import from North Africa by scenario in 2040

	Scenario A		Scenario B		Scenario C		
	Value	p.u.	Value	p.u.	Value	p.u.	Variation w.r.t B [%]
Import from North Africa [TWh/y]	0.0	-	90.3	-	89.5	-	-0.9
Import from other areas [TWh/y]	111.3	1.00	108.1	0.97	108.2	0.97	0.1
<b>Total import [TWh/y]</b>	<b>111.3</b>	<b>1.00</b>	<b>198.4</b>	<b>1.78</b>	<b>197.7</b>	<b>1.78</b>	<b>-0.4</b>
Available surplus [TWh/y]	0.0	-	205.0	-	423.0	-	106.3
Maximum annual importable flow [TWh/y]	110.2	1.00	110.2	1.00	110.2	1.00	0.0
Annual European electricity demand [TWh/y]	3701.1	1.00	3706.0	1.00	3706.2	1.00	0.0
Ratio North Africa import / total import [%]	0.0	-	45.5	-	45.3	-	-
Ratio North Africa import /maximum import [%]	0.0	-	81.9	-	81.2	-	-
Ratio North Africa import /available surplus [%]	-	-	44.0	-	21.2	-	-
<b>Ratio North Africa / annual European demand [%]</b>	<b>0.0</b>	<b>-</b>	<b>2.4</b>	<b>-</b>	<b>2.4</b>	<b>-</b>	<b>-</b>

# Duration curve of power import from NA



# Annual cross-border import flows from NA



# Impact NA imports

Annual average electricity prices [€/MWh]			
Country	Scenario A	Scenario B	Scenario C
<b>Cyprus</b>	42.09	31.24	31.33
<b>Germany</b>	44.84	44.65	44.49
<b>Spain</b>	36.32	34.96	34.80
<b>France</b>	39.85	39.60	39.34
<b>Greece</b>	42.16	33.79	33.91
<b>Italy central north</b>	48.10	44.75	44.65
<b>Italy central south</b>	47.65	42.96	42.94
<b>Italy north</b>	49.09	48.43	48.34
<b>Italy south</b>	47.20	42.77	42.75
<b>Italy Sardinia</b>	47.05	42.57	42.55
<b>Italy Sicily</b>	47.17	42.71	42.69
<b>Malta</b>	53.72	36.18	36.26
<b>Portugal</b>	36.50	35.02	34.88

- Savings in terms of total system costs
  - Scenario B: EUR 3.9 billion
  - Scenario C: EUR 4.3 billion
- Reduction in CO2 emissions
  - 24 million Tons
    - total EU in 2017: 3209 million Tons

# Concluding remarks

- Imports from North Africa RES electricity can have positive economic and environmental effects
  - Priority: satisfying local needs, then export. No backdrop on NA countries
- Further studies:
  - Potential for further RES investments in North Africa
  - Positive social effects (jobs, social welfare, induced economic activity)
  - Technology transfer and technological alignment potential
  - But also:
    - Potential pressure on electricity prices
    - Conflicts export/local use





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**Grazie per l'attenzione**

