Global Interconnected System
Contribution of CIGRE C1.35 & C1.44

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Webinar – 7 June 2021

Q: Can **interconnections** and **a global grid** mitigate climate change? and how?

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TOP 20 for electricity exports/imports in 2018

IAE source

Rank	Country	Electricity - exports (million kWh)
1	Germany	78,860
2	Canada	73,350
3	France	61,410
4	Paraguay	41,130
5	Switzerland	30,170
6	Sweden	26,020
7	Czech Republic	24,790
8	Netherlands	19,340
9	Austria	19,190
10	China	18,910
11	South Africa	16,550
12	Norway	15,530
13	Bulgaria	14,830
14	Spain	14,180
15	Russia	13,130
16	Uzbekistan	13,000
17	Mozambique	12,880
18	Poland	12,020
19	Romania	11,220
20	Slovakia	10,600

* 15% of demand

Rank	Country	Electricity - imports (million kWh)
1	United States	80,660
2	Italy	43,180
3	Brazil	34,640
4	Switzerland	34,100
5	Germany	28,340
6	Austria	26,340
7	Netherlands	24,260
8	Finland	22,110
9	Spain	21,850
10	France	20,790
11	United Kingdom	19,700
12	Hungary	17,950
13	Denmark	14,980
14	Belgium	14,650
15	Thailand	14,410
16	Sweden	14,290
17	Poland	14,020
18	Czech Republic	13,820
19	Slovakia	13,250
20	Uzbekistan	13,000

* 2% of demand

The main active interconnections worldwide:

- in North-America (between Canada and USA),
- in South-America (between Brazil and Paraguay)
- in Africa (South-Africa and Mozambique),
- in Europe (between all European countries).

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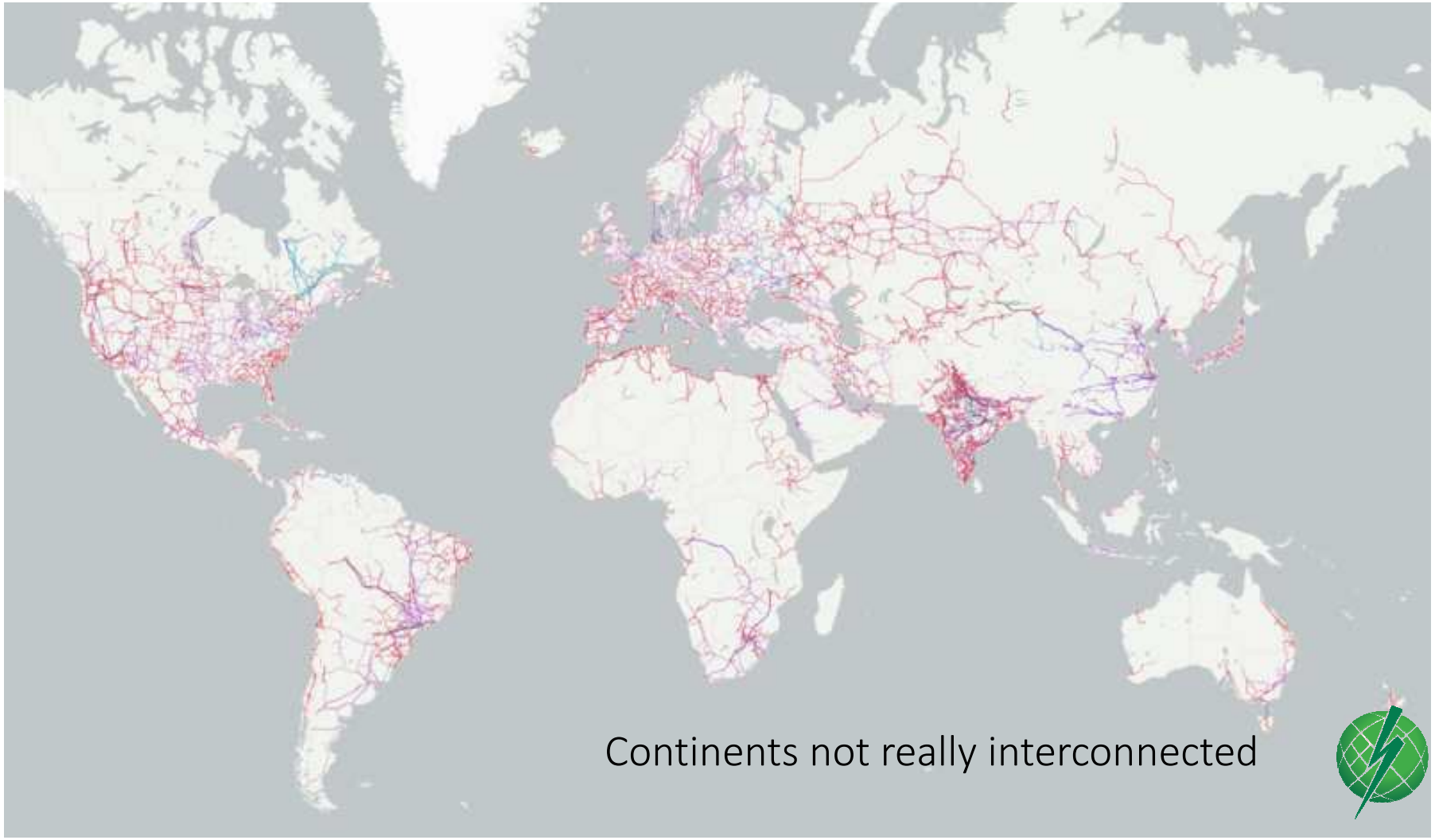
Present global network



Continents not really interconnected

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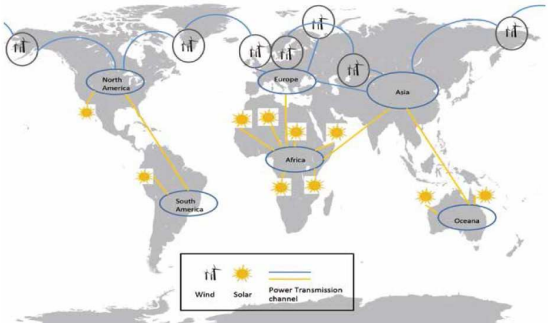
Scope of the CIGRE C1.35 feasibility study

To carry out the first known feasibility study for the concept of a global electricity network.



INTERCONNECTION

- Supports a balanced coordination of power supply of all interconnected countries.
- Enables clean energy transition.
- Take advantage of diversity of clean energy.

Priority to clean energy

The study has to

- The study has to adopt one reference long term scenario for consumption and supply volumes, covering now and the year 2050.

Data and scenario 2050 *(External sources)* → Simulations *(CIGRE C1.35)* → Which Global Grid? *(CIGRE C1.35)*

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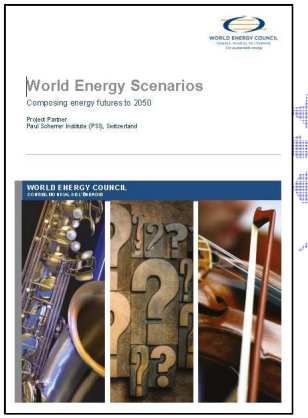
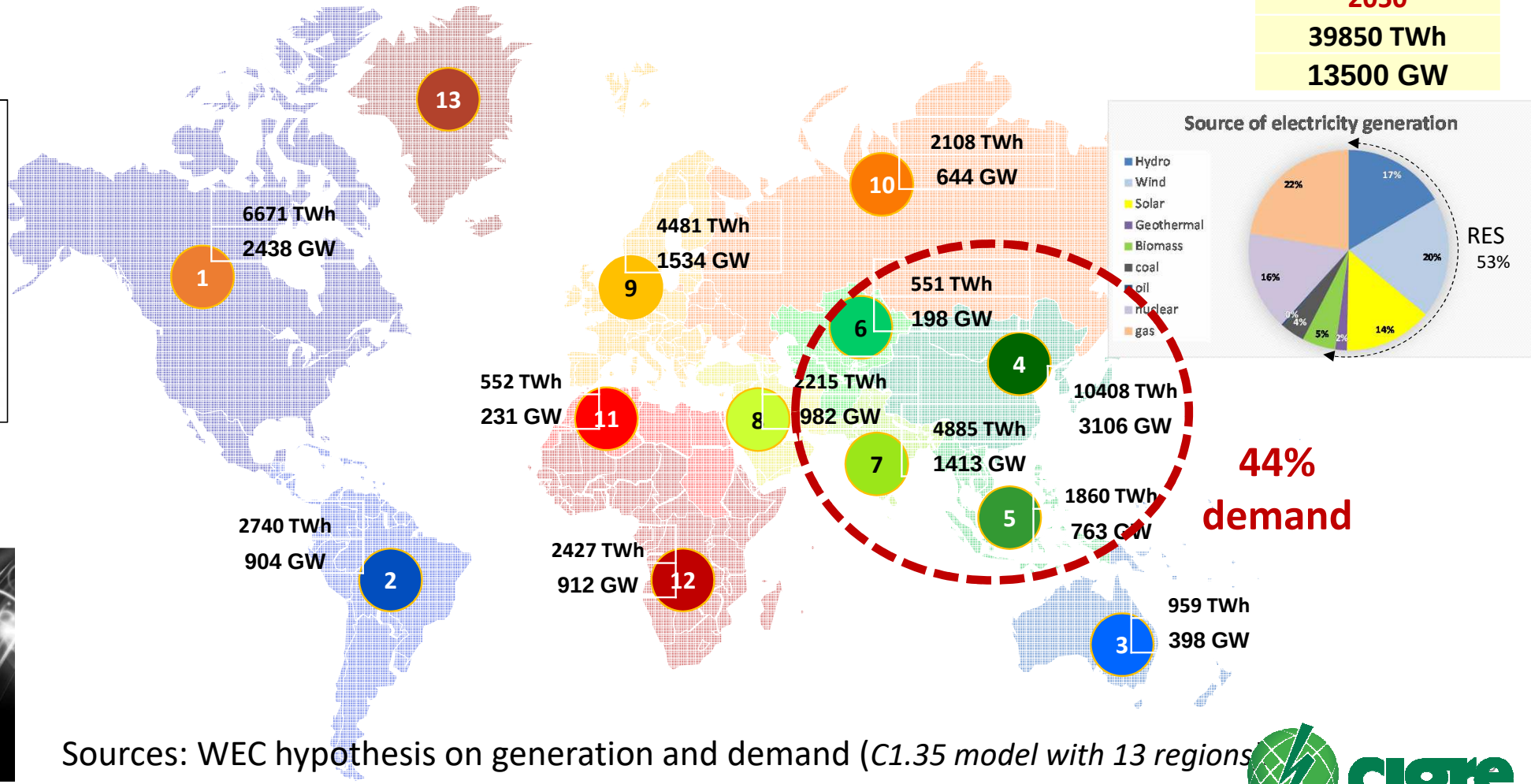
Input data for electricity generation: forecast by 2050

2050
39850 TWh
13500 GW

WEC2013



WEC2016



Sources: WEC hypothesis on generation and demand (*C1.35 model with 13 regions*)

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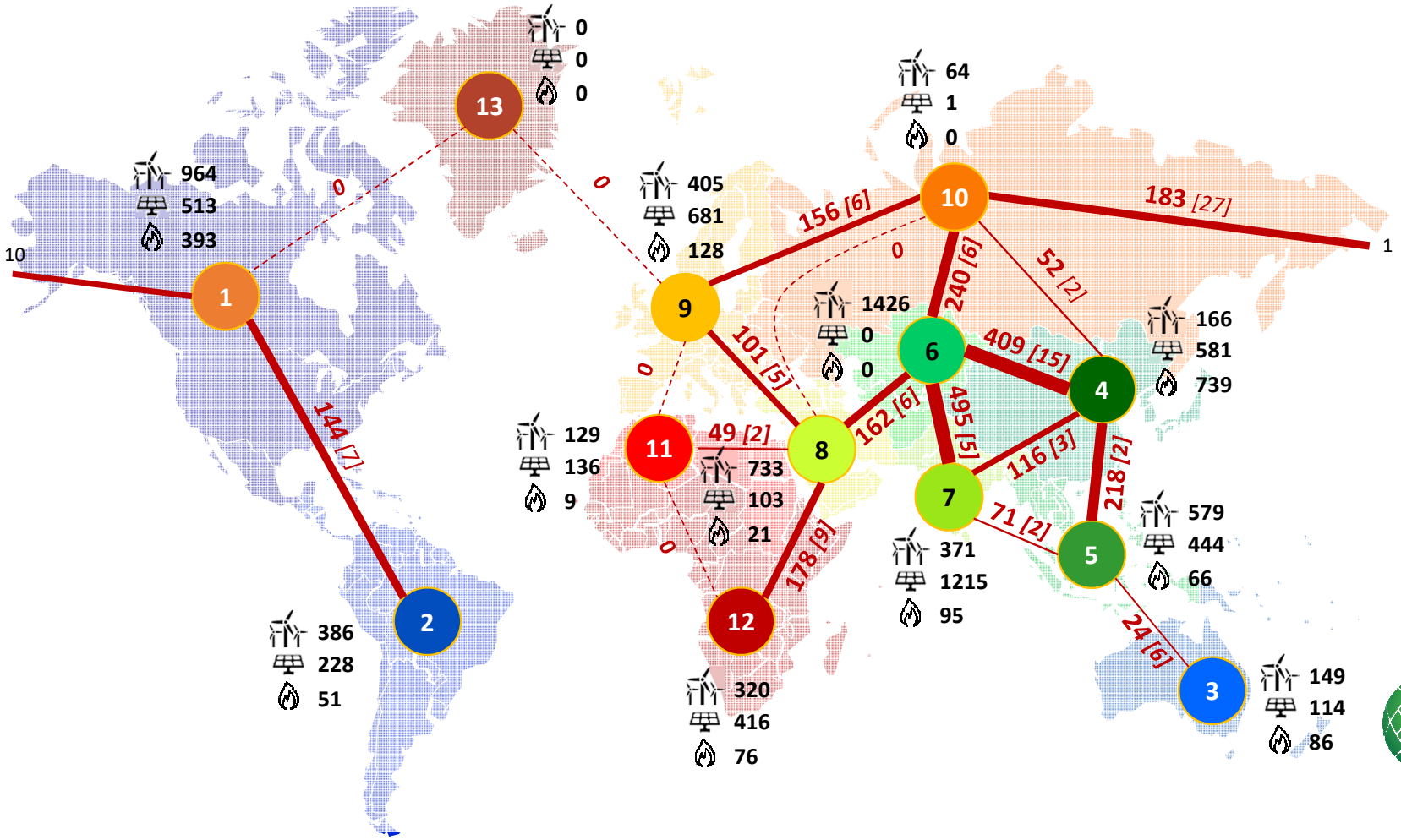
Reference case with interconnections

Installed capacities in GW and costs [G€/y] for interconnections



Wind
Solar
Gas

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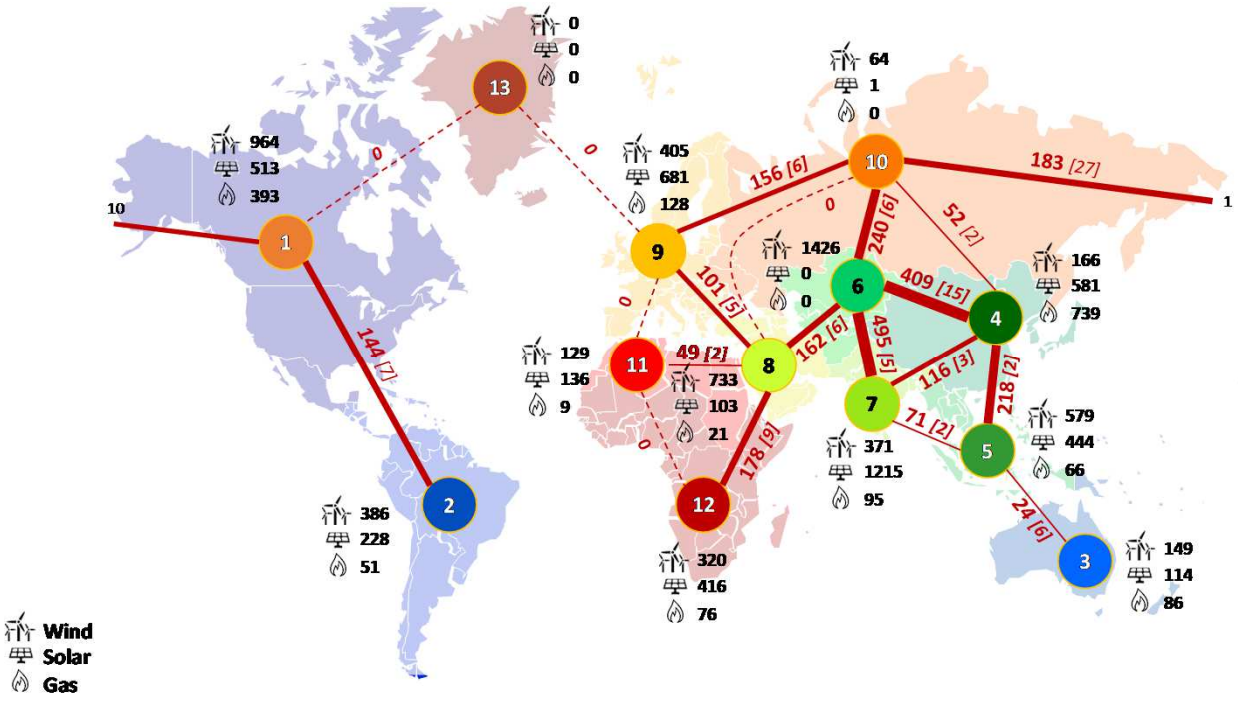
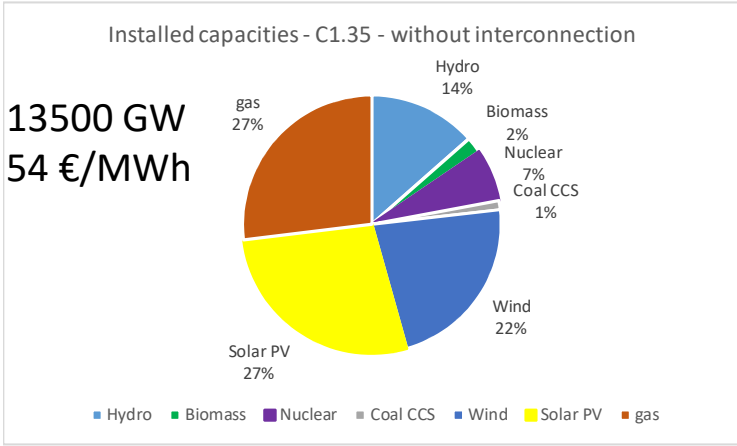
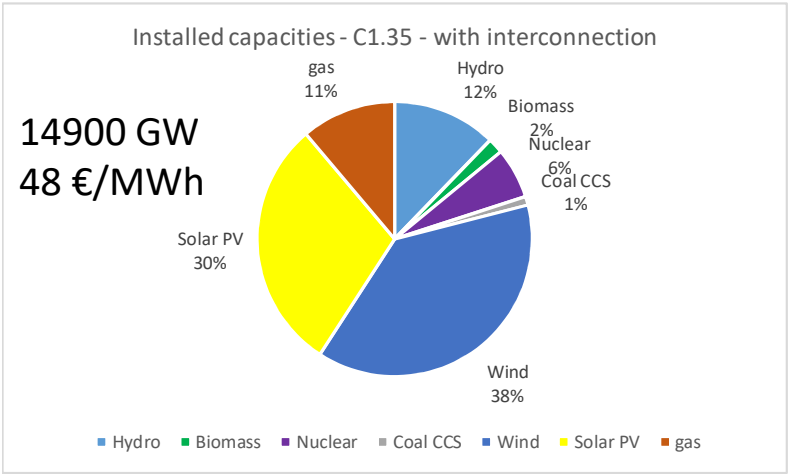
C1.35- key figures







Σ Interconnections = 2600 GW

Scope of the C1.44

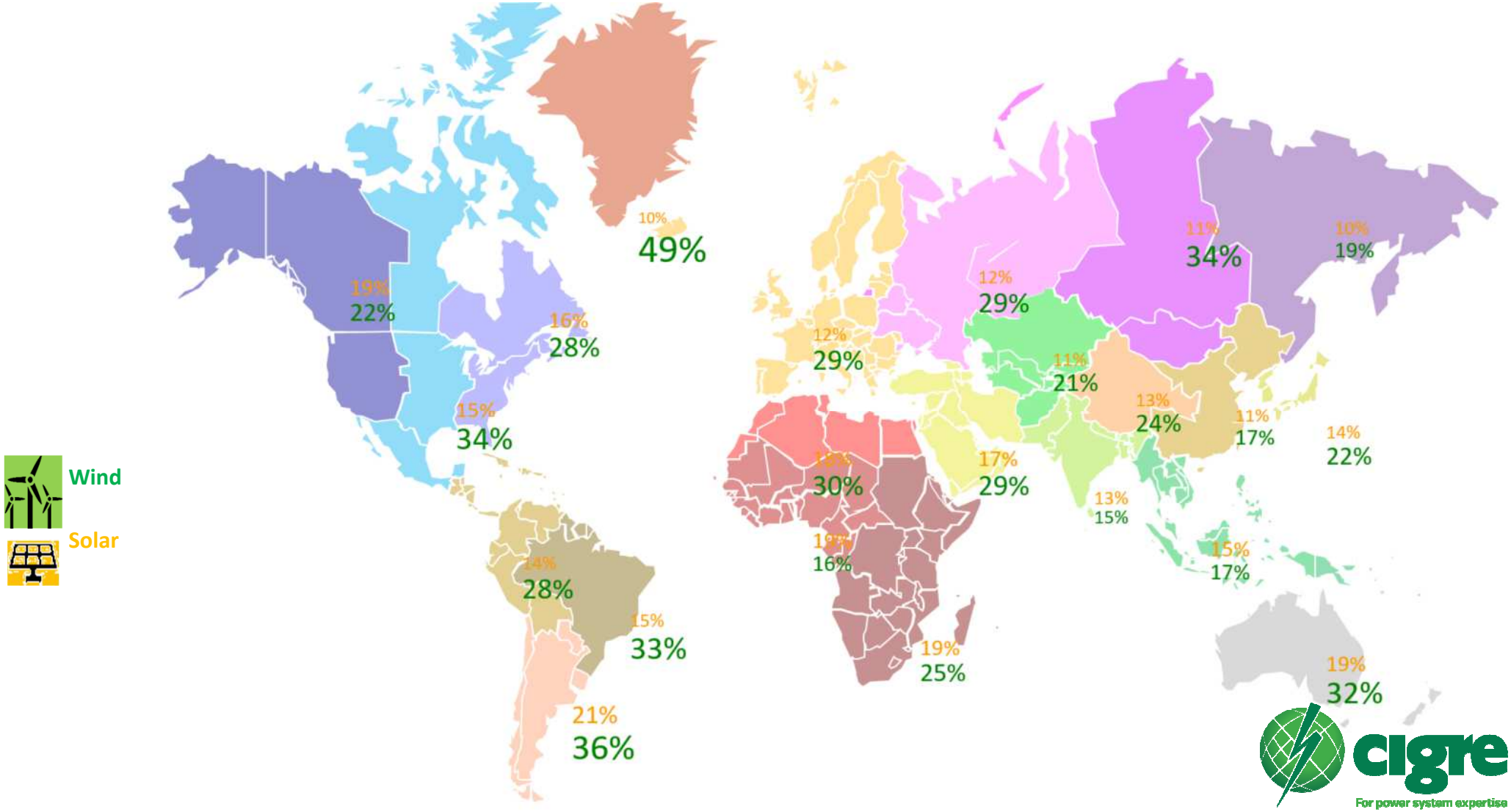
The objective of WG C1.44 is to **extend the results** of WG C1.35 and **make them more robust**, by considering different **storage** options, **demand response**, transmission within continental regions, and **trading rule and governance** questions of a global grid.

The tasks/results *(in comparison with the previous C1.35)*

Item	C1.35	C1.44
Data: Generation/Demand	WEC 2050 assumptions	No change
Model: Nb regions	13	22
Model: Selection of corridors	20 corridors	35 (new regions + review)
Model: Storage + Demand Response	n.c.	**New**
Simulation: Tool	ANTARES ©	PLEXOS ©
Simulations	Finished in 2019 (TB 775)	Start in 2021

C1.44

RES Power factors



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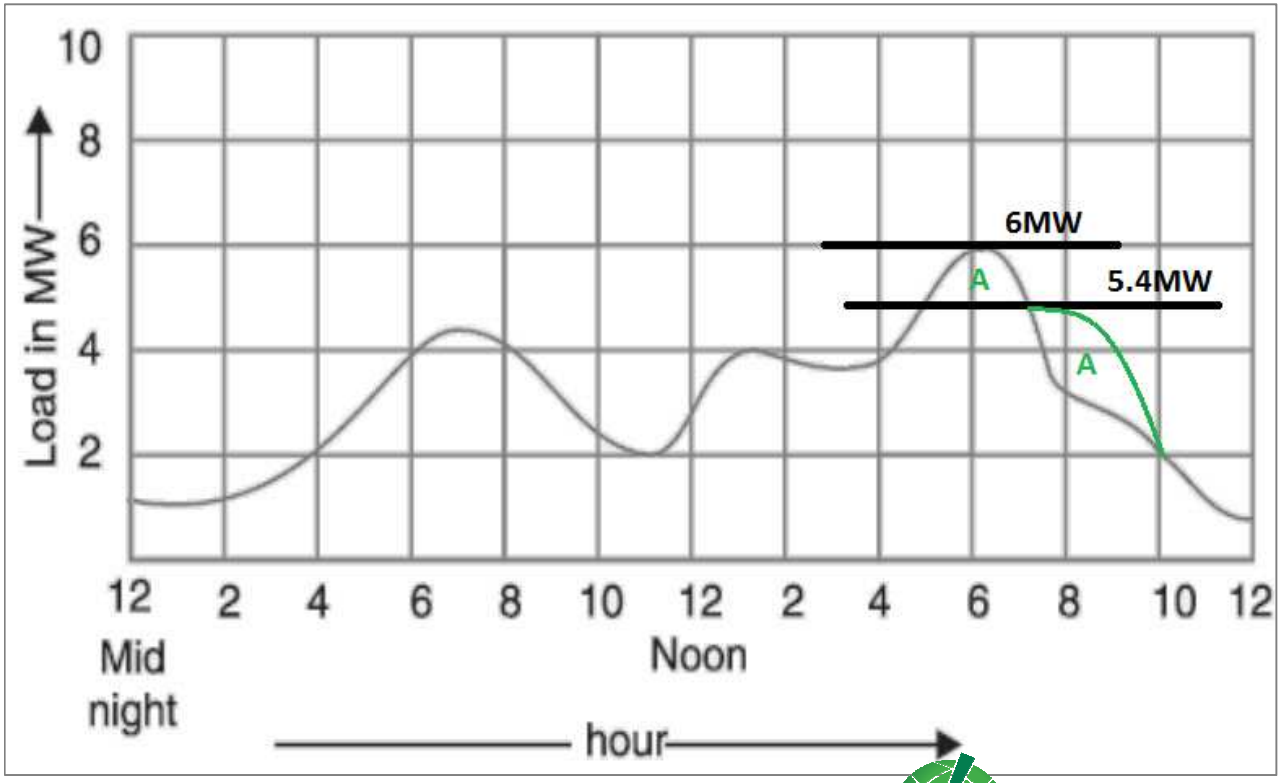
Demand Response

- Set all DR for all region 10% of peak load shaving.
- Load shifting - The energy used (A MWh in the diagram) is shifted to the following hour after the peak.



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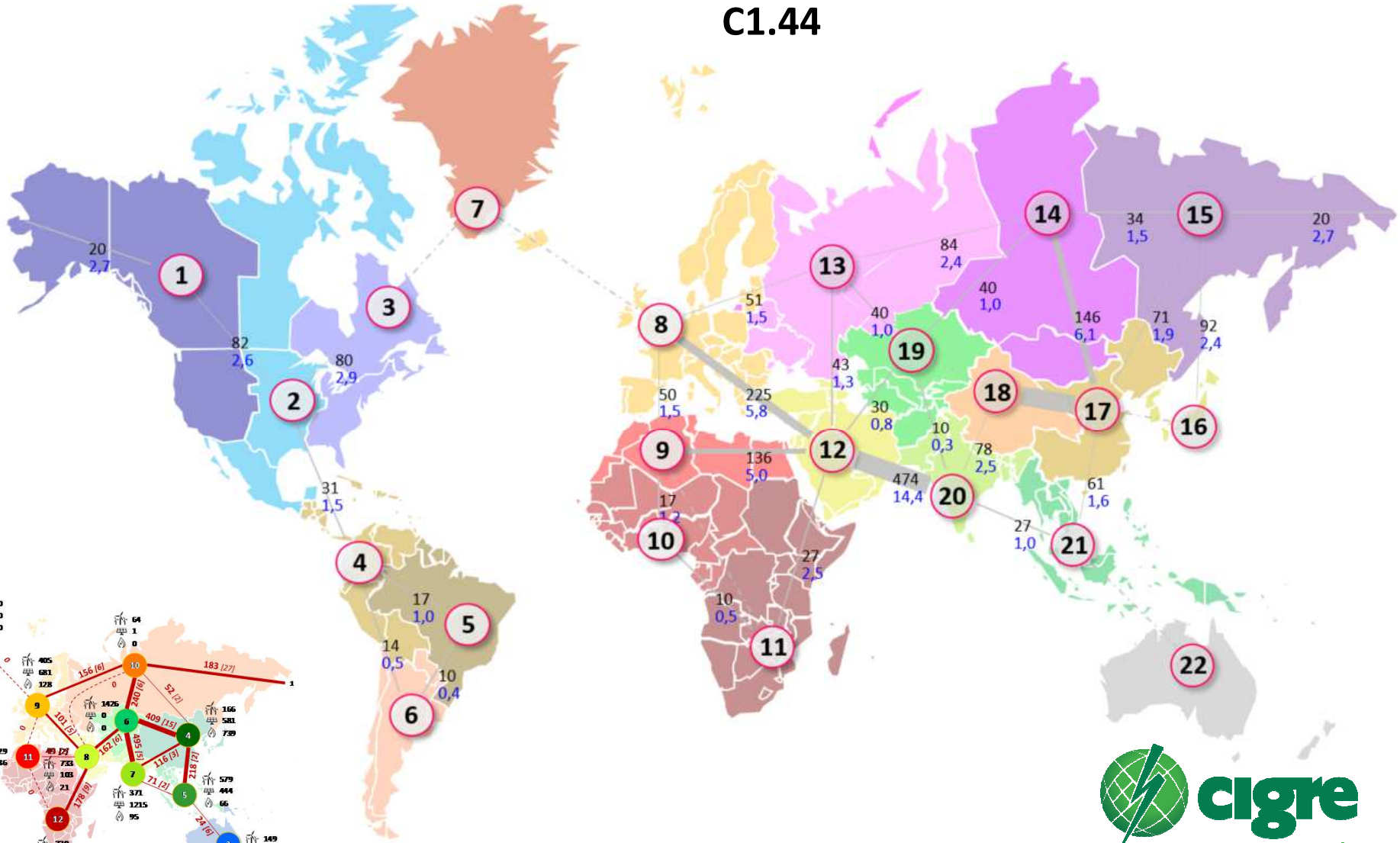
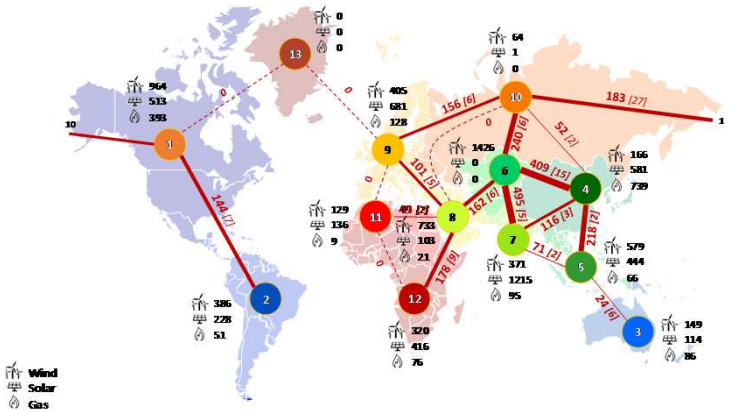
C1.44



C1.35



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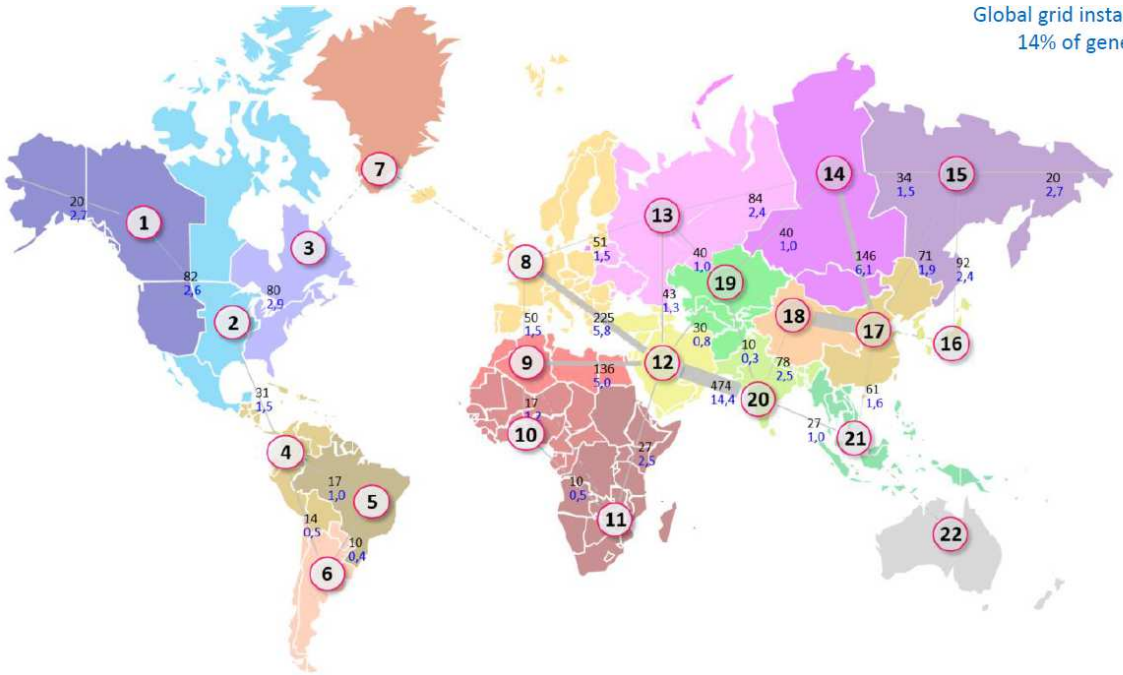
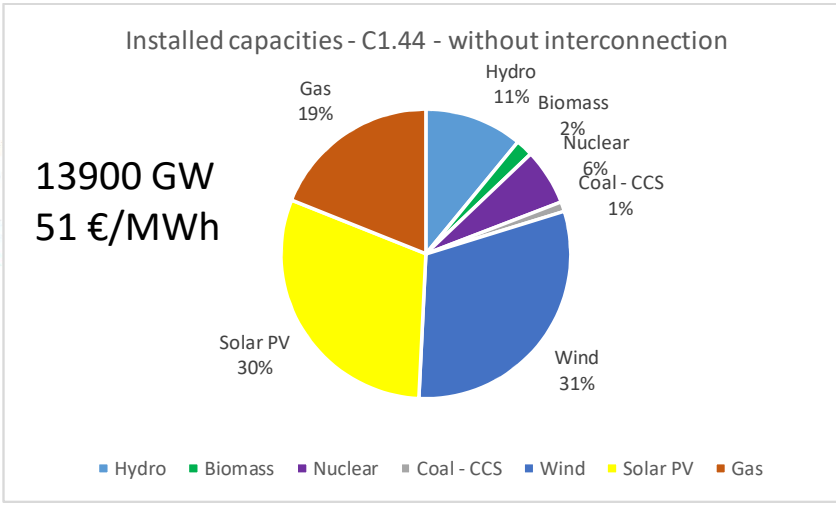
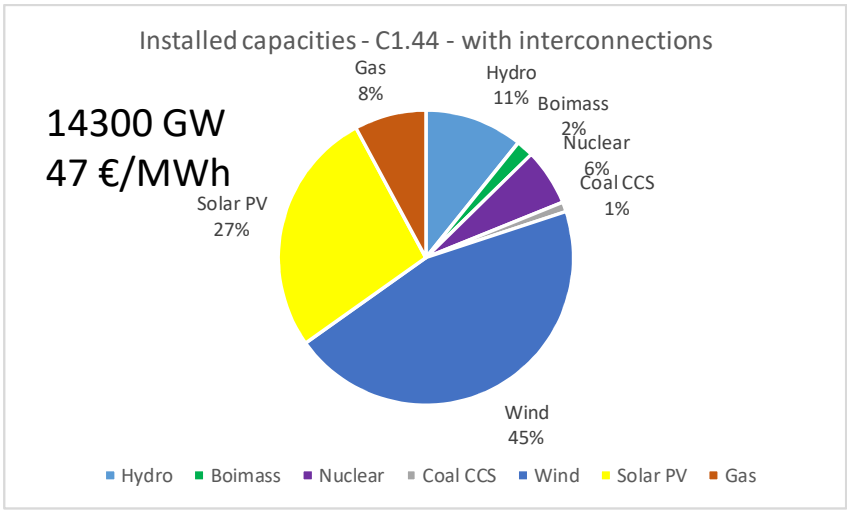
C1.44- key figures



Global grid installed capacity = 2 012 GW
14% of generation installed capacity

Global grid cost=68 G€
4% of yearly total cost





Key messages and questions

- Low impact of DR, and of Storage on the cost;
- Interconnections are more profitable;
- Strong impact of the CF (wind and solar);
- Unrealistic capacity for the interconnections;

↳ need to limit the capacity of each interconnection (50 GW?)

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Conclusion

Q: Can **interconnections** and **a global grid** mitigate climate change? and how?

A: **Yes,** but the most important pre-condition for step-by-step, region-by-region global interconnections is political support with a global or at least multilateral, **robust cooperation** approach and mutual trust.

Thank you for your attention