“Poređenje razvoja obnovljivih izvora električne energije regiona jugoistočne Evrope i pogodno odabranih evropskih država”

“Comparison of the development of renewable electrical energy power sources between region of South-Eastern Europe and conveniently selected European countries”

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Introduction

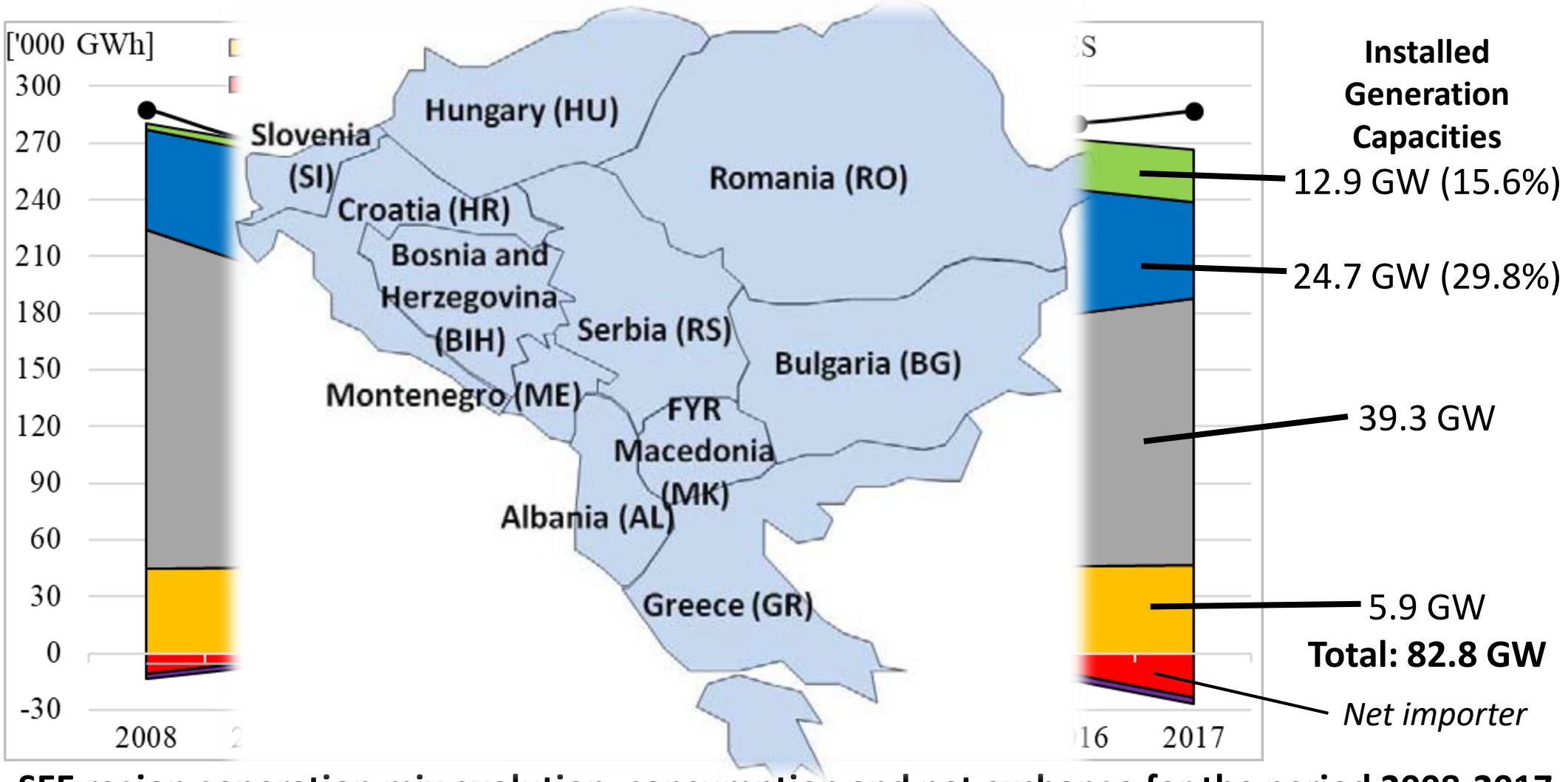
In absolute terms, **167 GW** of **R**enewable **E**lectrical **E**nergy **P**ower **S**ources (REEPS) capacity has been installed in the power sector in 2017 at a global level, reporting a significant increase of 8.3% over the previous year, underlining also a series of consecutive robust growth rates, amounting to 8% per year since 2010.

Renewable power generation record a new historical high, representing an estimated quarter of total worldwide power generation. In addition and in line with the rapidly decreasing renewable energy capital costs, wind and solar power comprise the dominant technologies, reporting new additions of **94 GW in solar** photovoltaics and **47 GW wind** power (out of which 4 GW offshore).

Some key recent renewable energy cornerstones in Europe include:

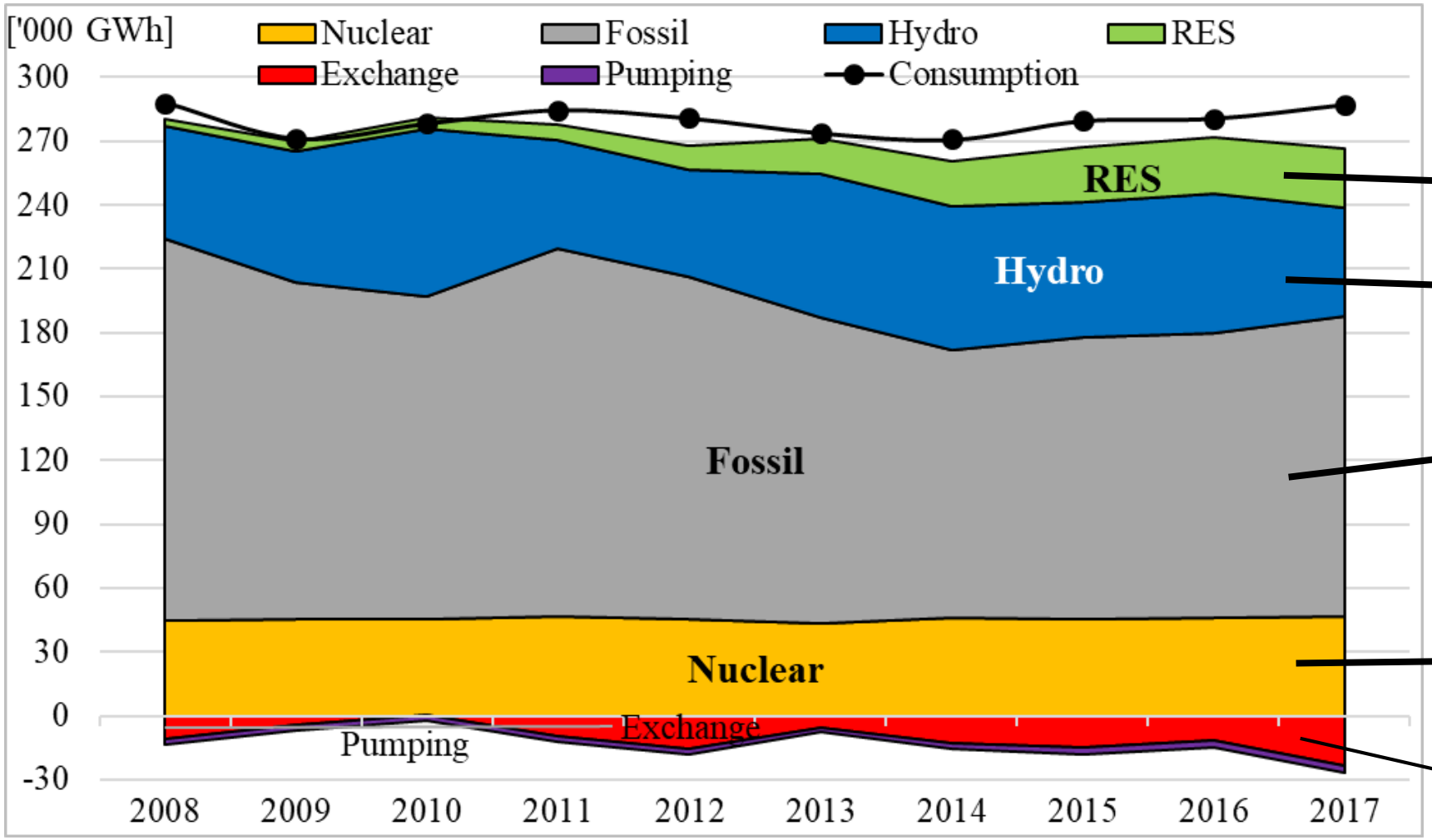
- **Denmark**, 2 September 2015: The Western Danish power system operates without centralized power generation for the first time,
- **Portugal**, 7-11 May 2016: Renewable energy, including conventional hydro, covers the equivalent of 100% of power demand for 107 consecutive hours,
- **Germany**, 8 May 2016: Wind and solar PV meet the equivalent of approximately 75% of power demand,
- **United Kingdom**, 2016-2017: Wind power exceeds for two consecutive years the hard coal-fired electricity generation.

REEPS in electric power systems of *SEE countries*



SEE region generation mix evolution, consumption and net exchange for the period 2008-2017

REEPS in electric power systems of *SEE countries*



Installed Generation Capacities

12.9 GW (15.6%)

24.7 GW (29.8%)

39.3 GW

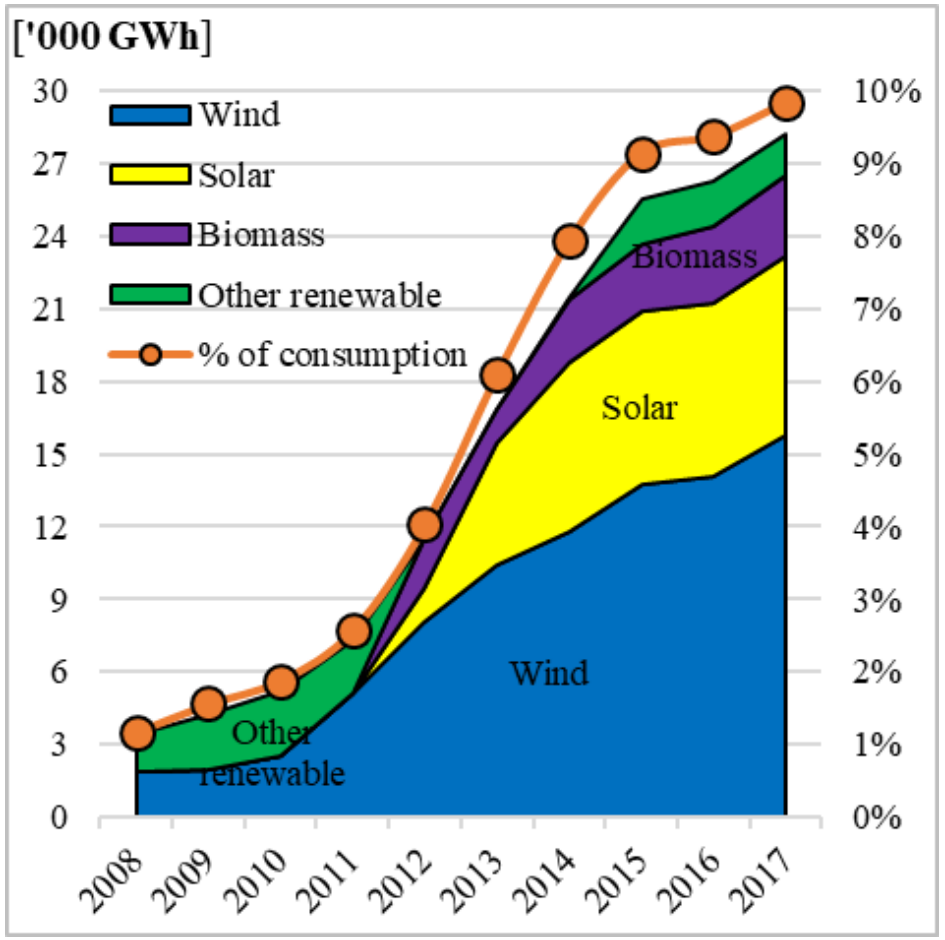
5.9 GW

Total: 82.8 GW

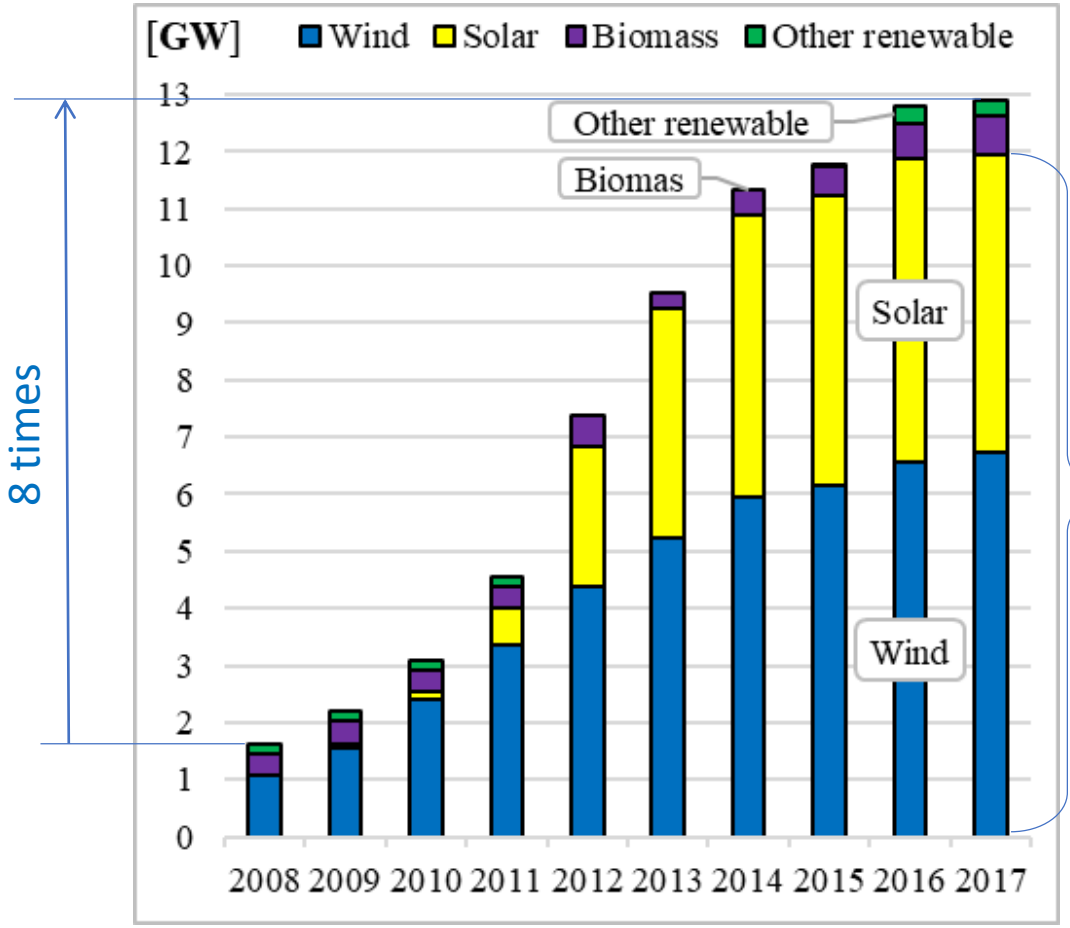
Net importer

SEE region generation mix evolution, consumption and net exchange for the period 2008-2017

REEPS in electric power systems of *SEE countries*

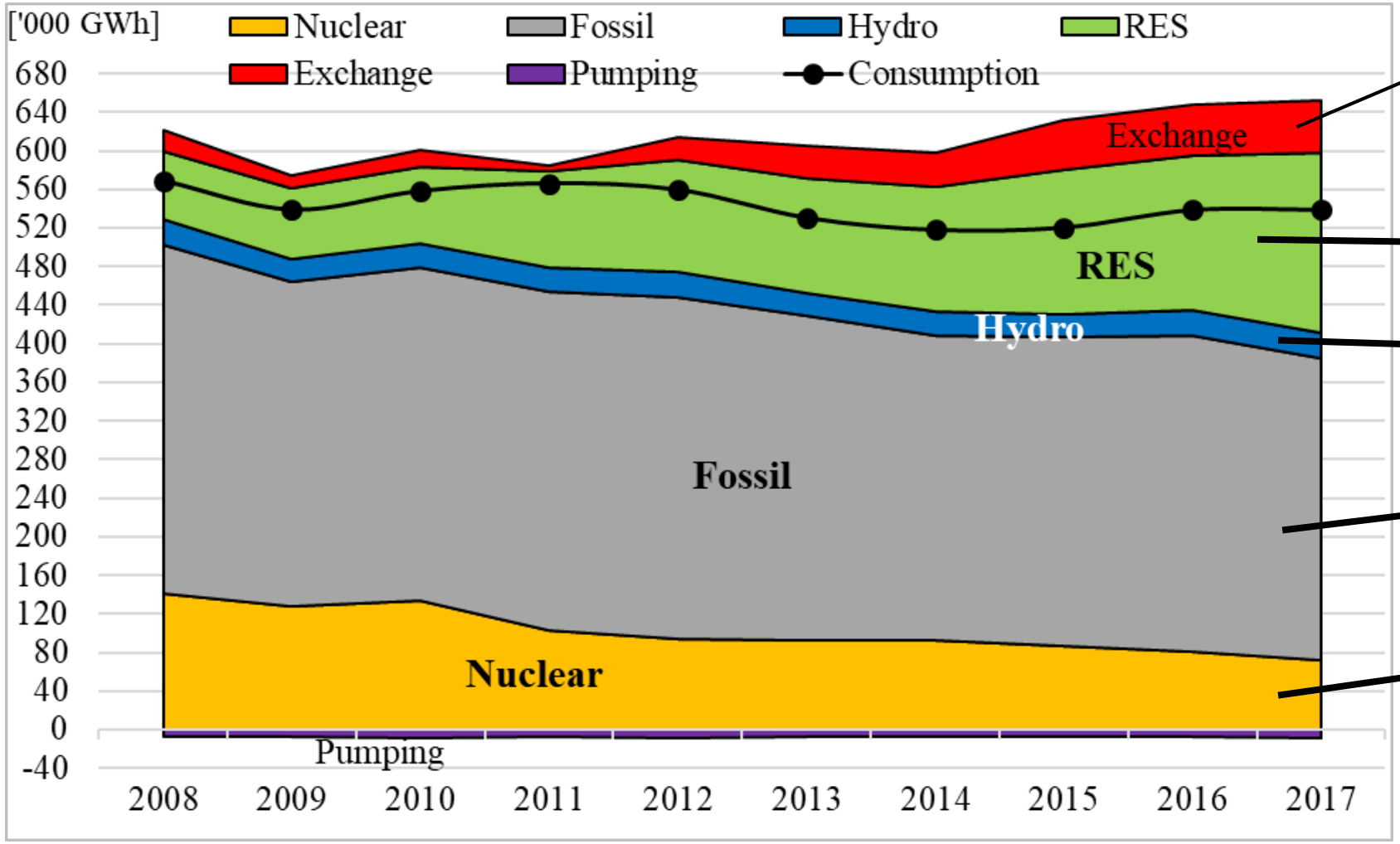


SEE region renewables' generation mix evolution and percentage of consumption covering for the period 2008-2017



SEE region renewables' installed generation capacity evolution per technology type for the period 2008-2017

REEPS in electric power system of *Germany*



Net exporter

Installed Generation Capacities

105.7 GW (50.8%)

10.6 GW (5.1%)

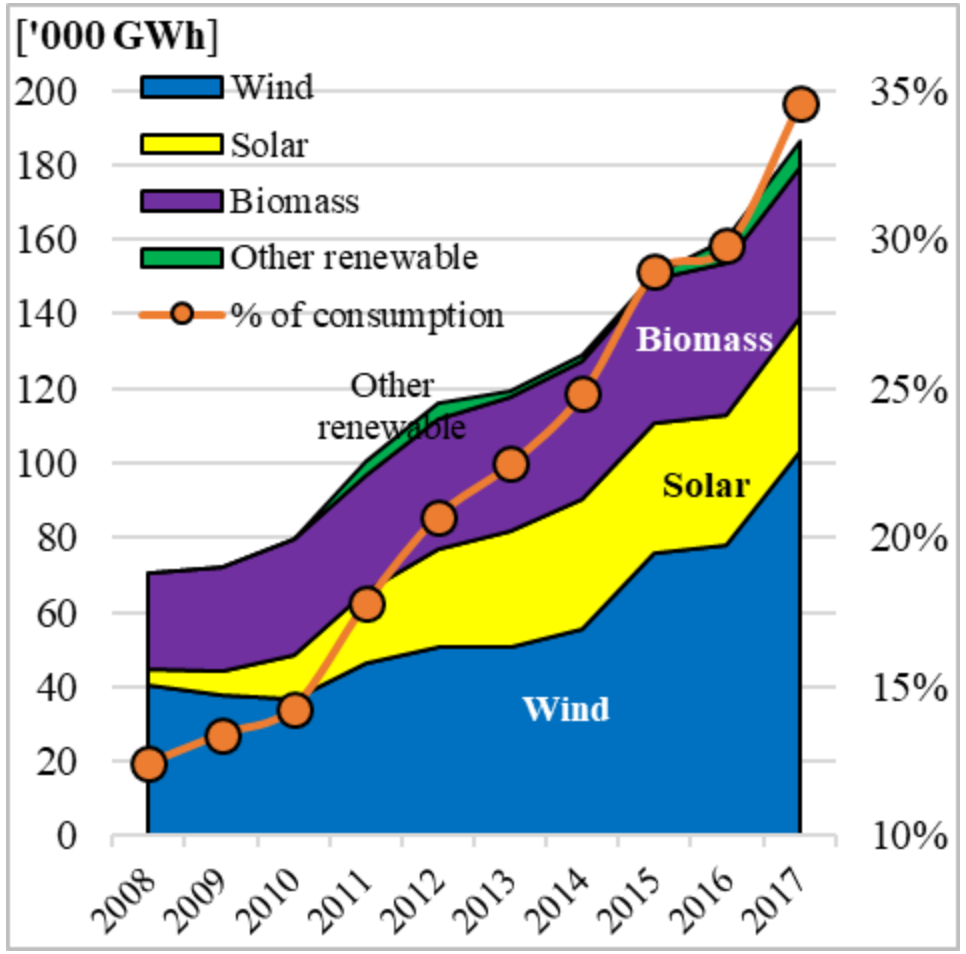
81.6 GW

9.5 GW ↘

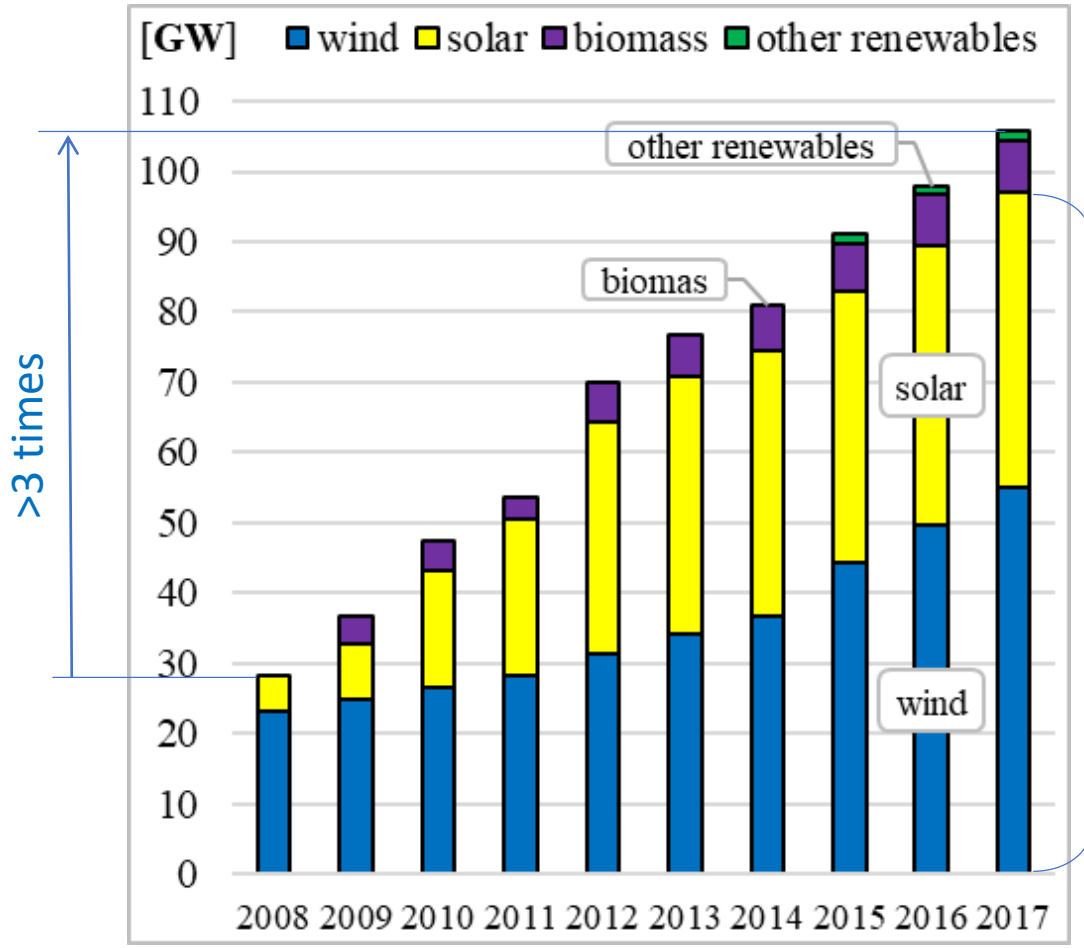
Total: 208.2 GW

Germany's generation mix evolution, consumption and net exchange for the period 2008-2017

REEPS in electric power system of *Germany*

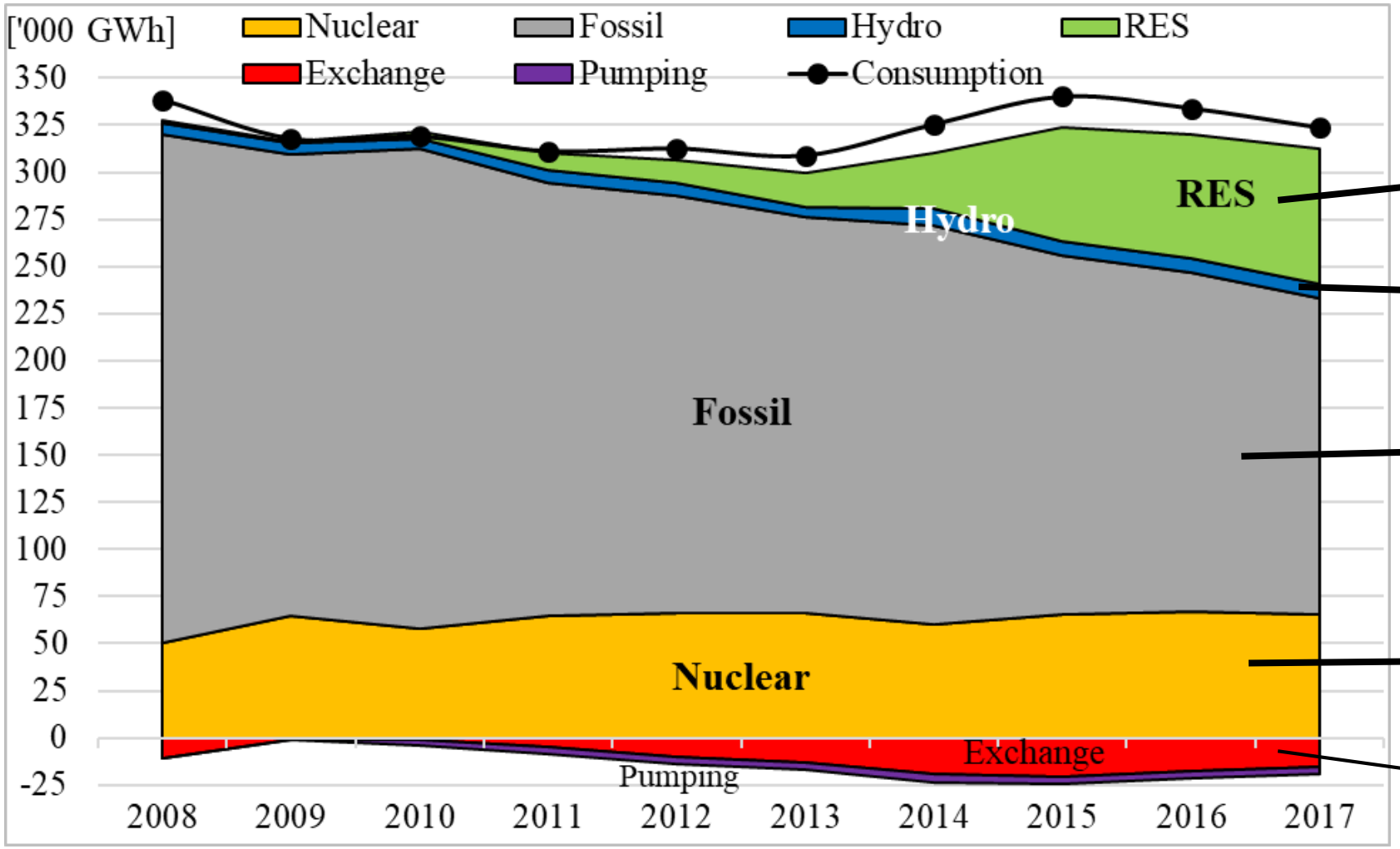


Germany's renewables' generation mix evolution and percentage of consumption covering for the period 2008-2017



Germany's renewables' installed generation capacity evolution per technology type for the period 2008-2017

REEPS in electric power system of the *United Kingdom*



Installed Generation Capacities

33.3 GW (36.0%)

3.8 GW (4.1%)

46.1 GW

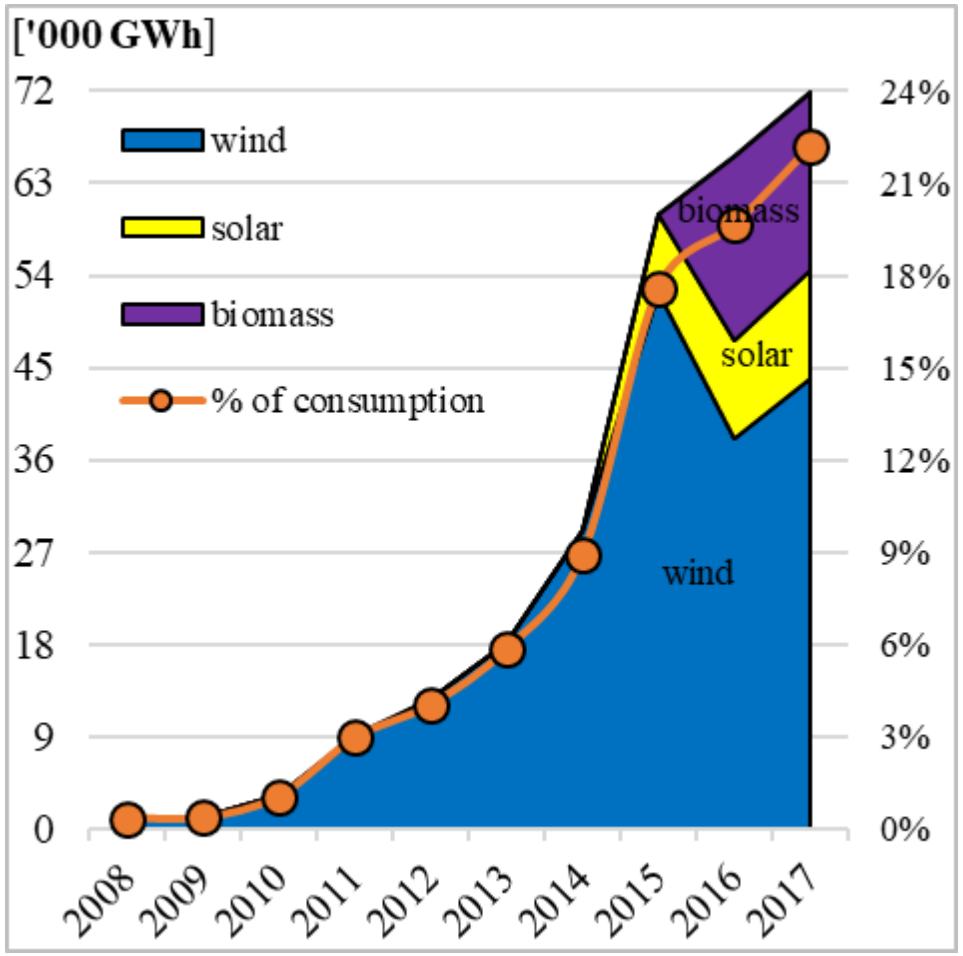
9.2 GW

Total: 92.6 GW

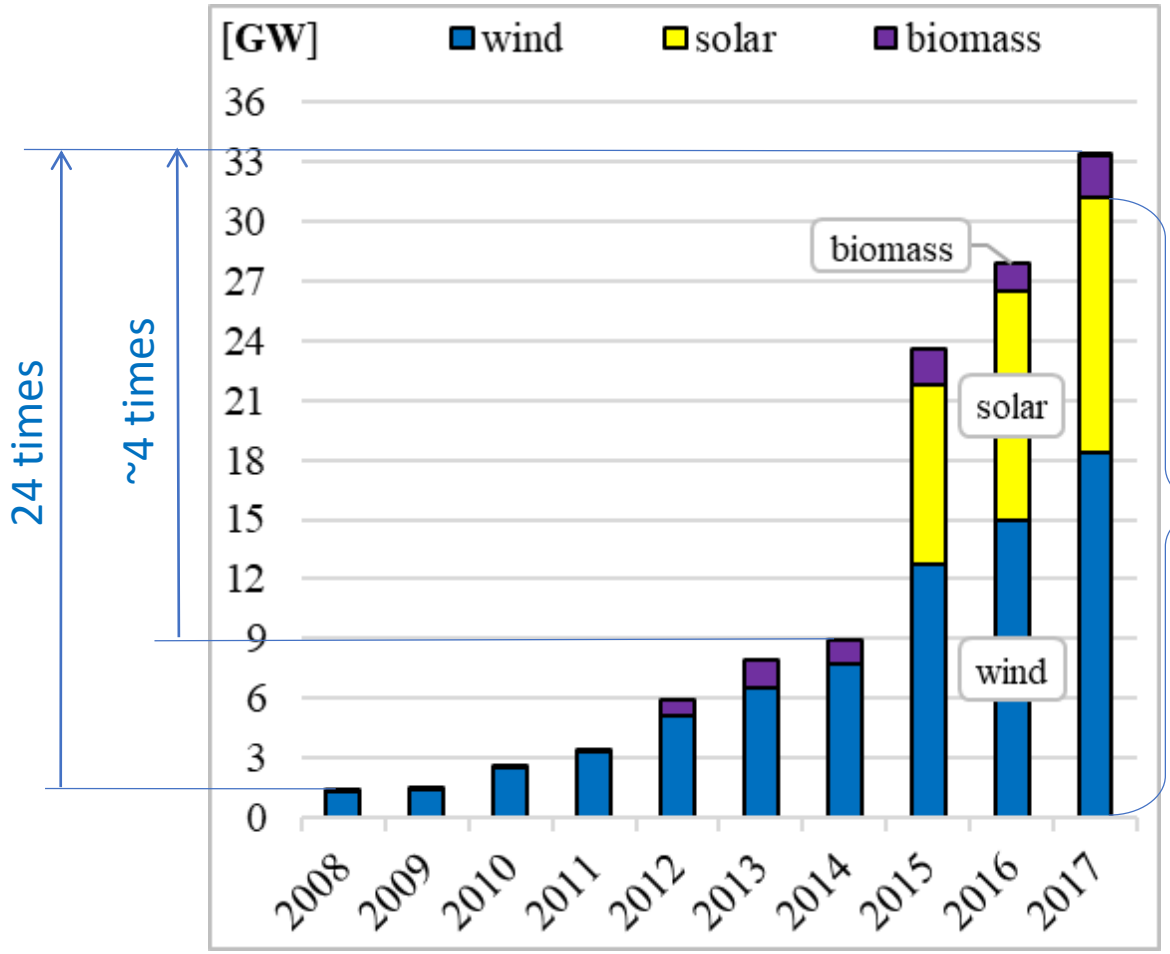
Net importer

Generation mix evolution, consumption and net exchange of the UK for the period 2008-2017

REEPS in electric power system of the *United Kingdom*



Renewables' generation mix evolution and percentage of consumption covering in the United Kingdom for the period 2008-2017

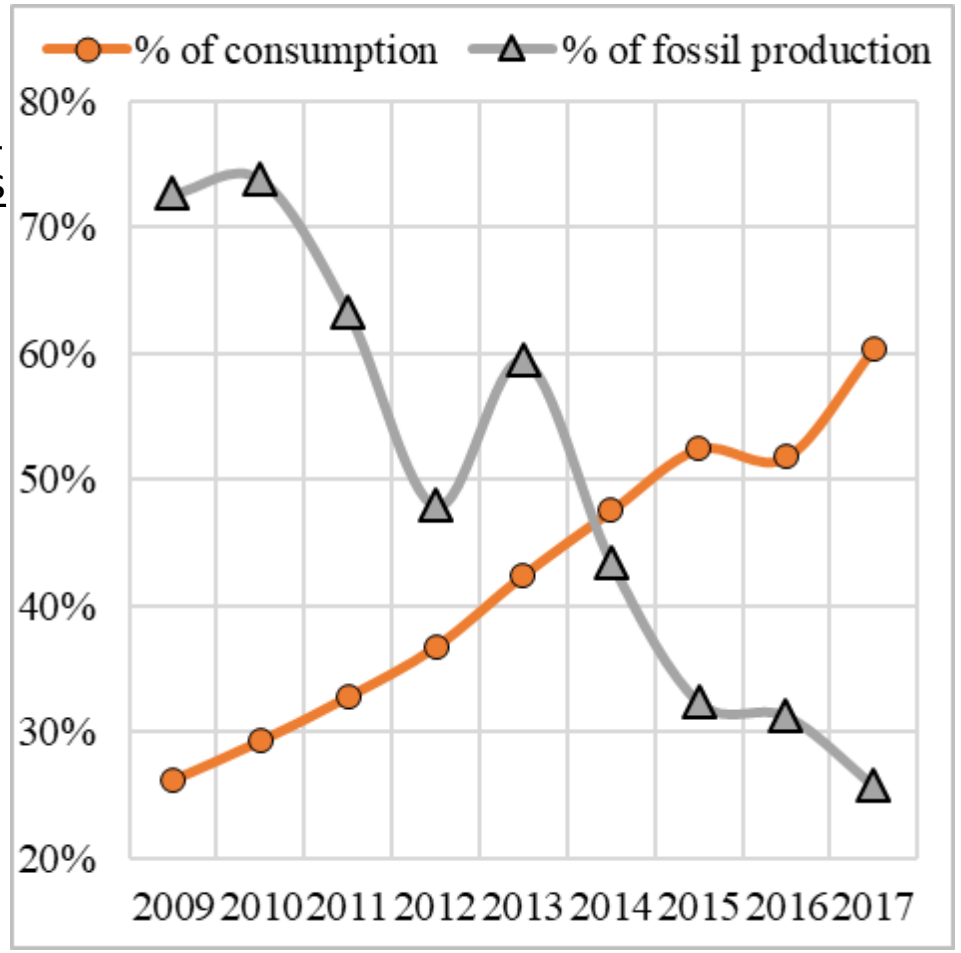


Renewables' installed generation capacity evolution per technology type in the United Kingdom for the period 2008-2017

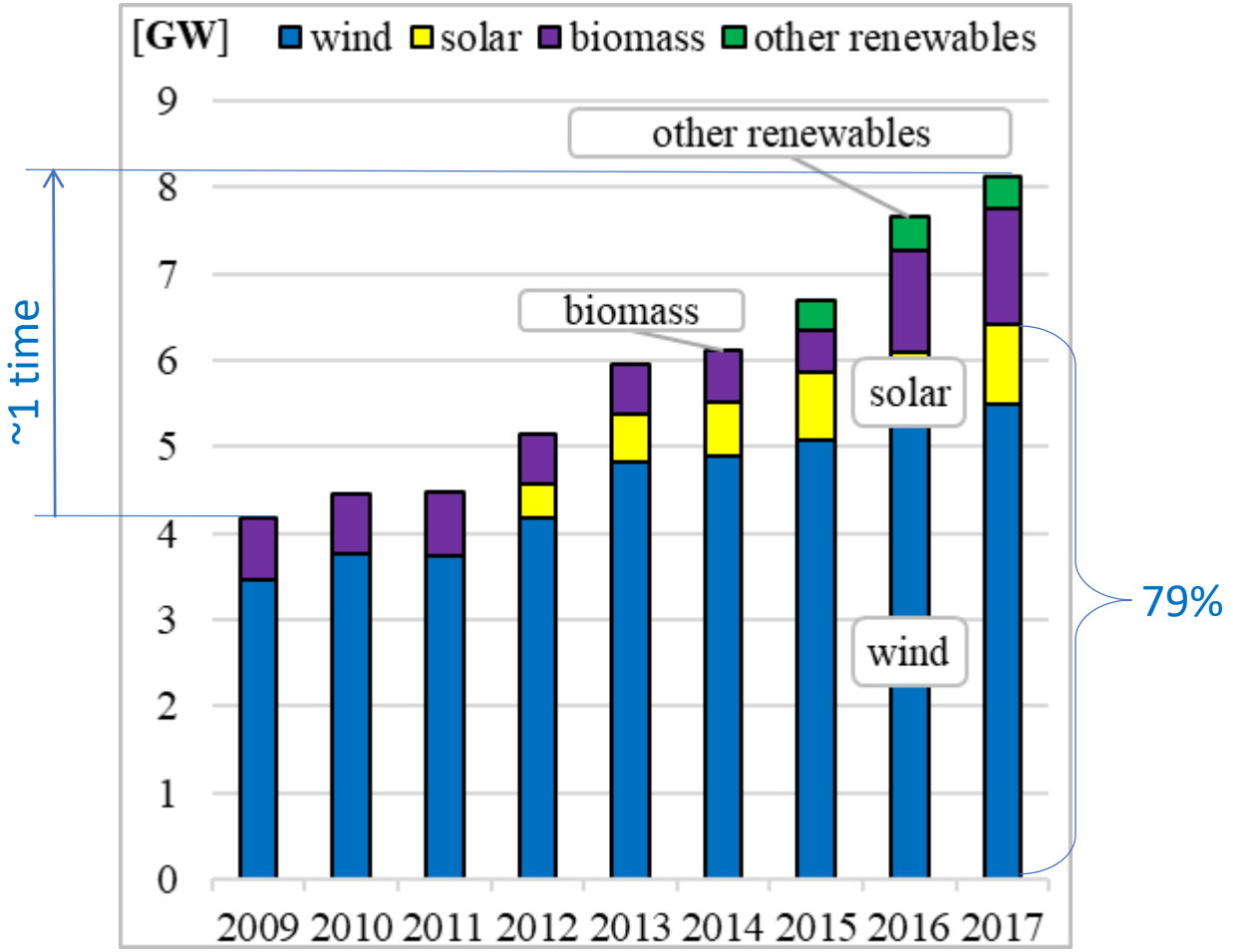
REEPS in electric power system of *Denmark*

Power system characteristics

- No nuclear
- Negligible hydro
- ~17% of consumption covered by imports in last 3 years

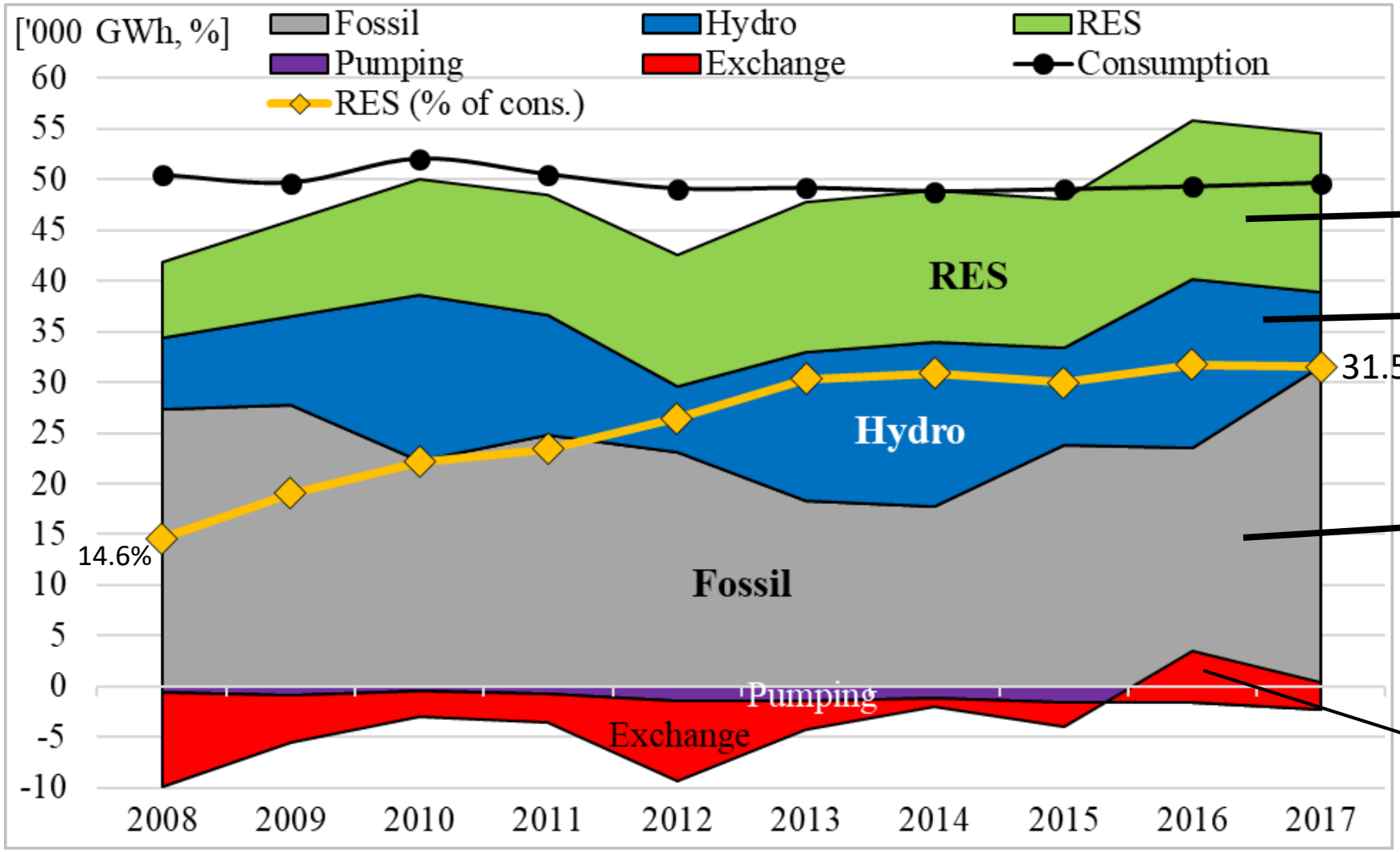


Percentage of renewables' and fossil fuels' production to the total electricity consumption of Denmark during the period 2009-2017



Renewables' capacity expansion composition in Denmark for the period 2009-2017

REEPS in electric power system of *Portugal*



Installed Generation Capacities

6.2 GW (31.3%)

7.2 GW (36.3%)

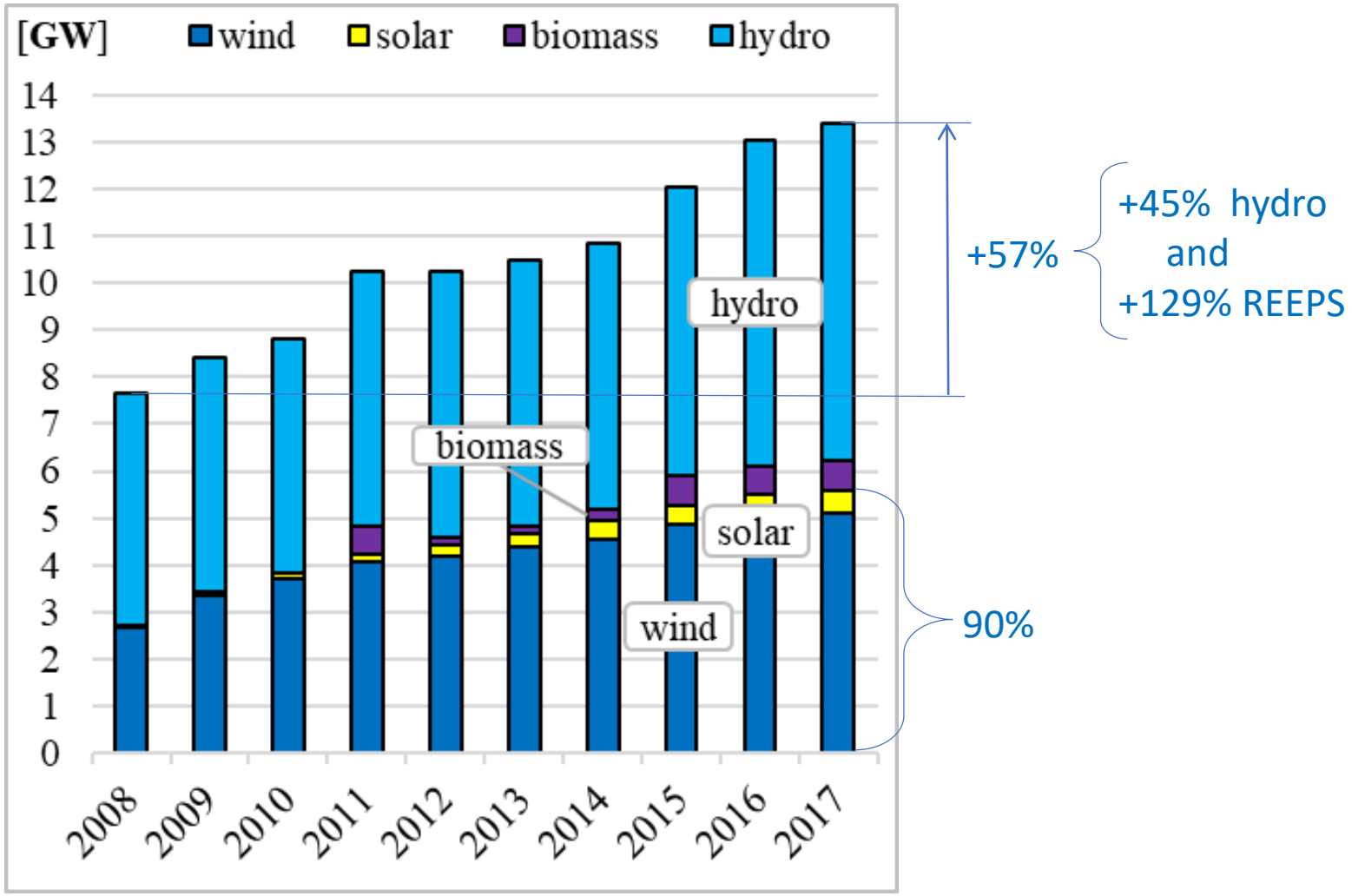
6.4 GW

Total: 19.8 GW

From net importer turned to net exporter

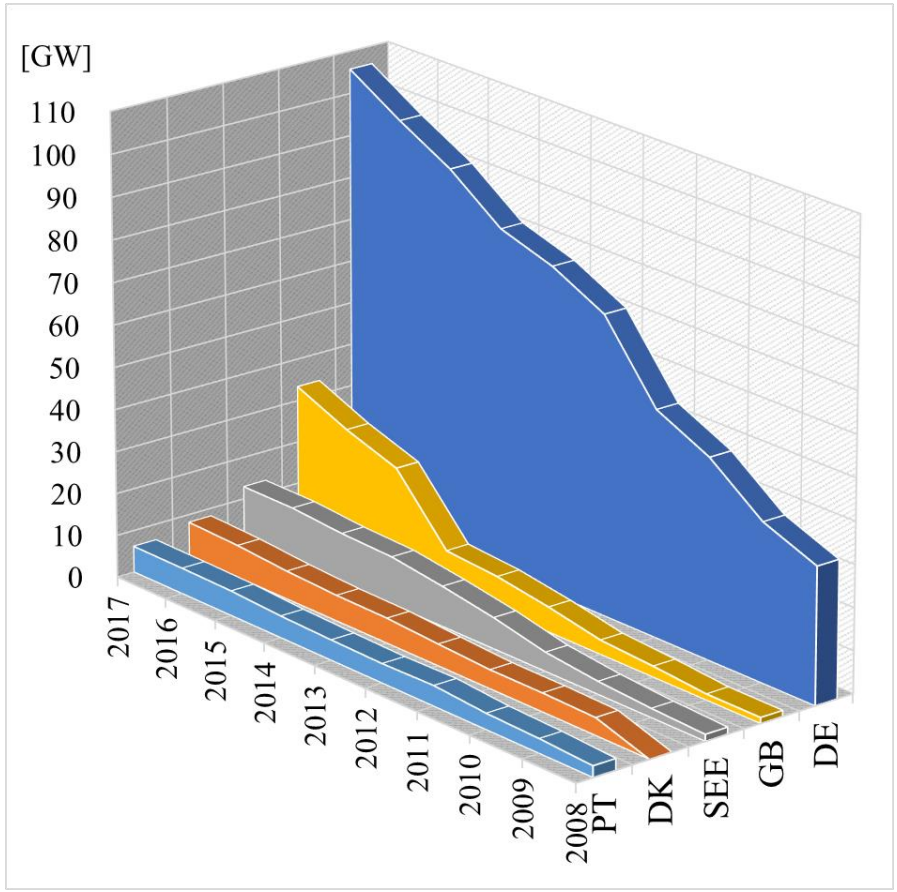
Generation mix evolution, consumption and net exchange of Portugal for the period 2008-2017

REEPS in electric power system of *Portugal*

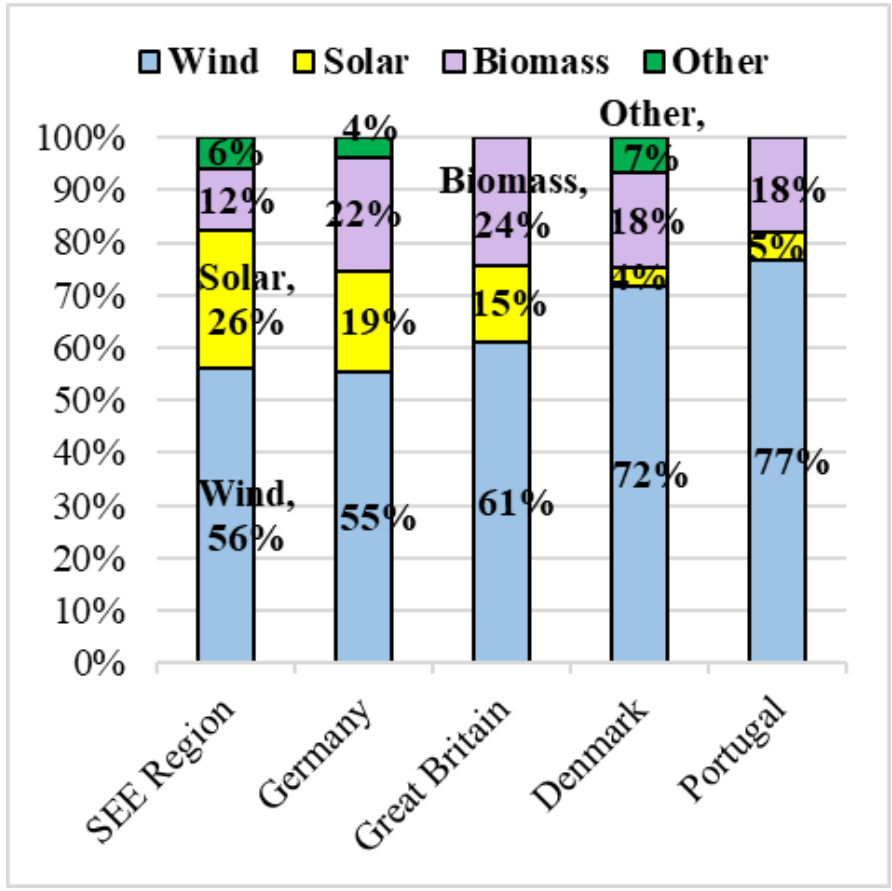


Renewables and hydro installed generation capacity composition in Portugal during the period 2008-2017

Comparative overview of REEPS in studied electric power systems / countries



Evolution of renewables installed generation capacities for the period 2008-2017



Comparative percentage of installed renewables generation capacities per technology type for year 2017

Comparative overview of REEPS in studied electric power systems / countries

Installed generation capacities for year 2017 [GW]

Country	Nuclear	Fossil	Hydro			REEPS without hydro					SUM Capacity	REEPS + renewable hydro
			total	non-renew.	renew.	total	Wind	Solar	Biomass	Other		
SEE region	**5.883**	**39.359**	**24.685**	*2.891*	*21.794*	**12.910**	*6.729*	*5.212*	*0.685*	*0.284*	**82.837**	42%
Germany	**9.509**	**81.577**	**10.615**	*6.282*	*4.333*	**105.708**	*55.072*	*42.020*	*7.250*	*1.366*	**208.229**	53%
UK	**9.248**	**46.144**	**3.821**	*0*	*3.821*	**33.349**	*18.350*	*12.900*	*2.098*	*0.001*	**92.562**	40%
Denmark	**0**	**7.609**	**0.006**	*0*	*0.006*	**8.124**	*5.497*	*0.908*	*1.349*	*0.370*	**15.784**	52%
Portugal	**0**	**6.403**	**7.193**	*0*	*7.193*	**6.204**	*5.090*	*0.490*	*0.624*	*0*	**19.800**	68%

Electricity production by technology type for year 2017 [GWh]

Country	Nuclear	Fossil	Hydro			REEPS without hydro					SUM production	REEPS + renewable hydro
			total	non-renew.	renew.	total	Wind	Solar	Biomass	Other		
SEE region	**46,400**	**141,331**	**50,670**	*2,535*	*48,135*	**28,211**	*15,776*	*7,412*	*3,338*	*1,685*	**266,611**	**29%**
Germany	**72,155**	**312,912**	**25,870**	*6,379*	*19,492*	**186,371**	*103,378*	*35,518*	*40,607*	*6,868*	**597,309**	**34%**
UK	**65,620**	**167,314**	**7,509**	*0*	*7,509*	**71,904**	*43,970*	*10,450*	*17,416*	*68*	**312,347**	**25%**
Denmark	**0**	**8,794**	**18**	*0*	*18*	**20,623**	*14,754*	*789*	*3,670*	*1,410*	**29,435**	**70%**
Portugal	**0**	**31,566**	**7,339**	*1,802*	*5,537*	**15,639**	*11,973*	*853*	*2,813*	*0*	**54,544**	**39%**

Conclusions:

The challenges that have yet to be addressed in order for the declared sustainability goals to be achieved include:

- enhancement of decoupling of economic activity with the produced CO_2 emissions,
- adaptation of large and vertically integrated utilities to newly established business models,
- elimination of price distortion in power markets in order to send the appropriate price signals to markets participants and potential investors for the required investments,
- further reinforcement of the flexibility potential in the power generating fleet,
- further exploitation of electricity trading in the context of the pan-European internal energy market,
- gradual decrease in the electricity bills paid by end consumers to become even more affordable.

Thank you for your attention!

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