UNIVERSITY OF ZAGREB
FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE
DEPARTMENT OF ENERGY, POWER AND ENVIRONMENTAL ENGINEERING

Energy transition in Central and Eastern Europe

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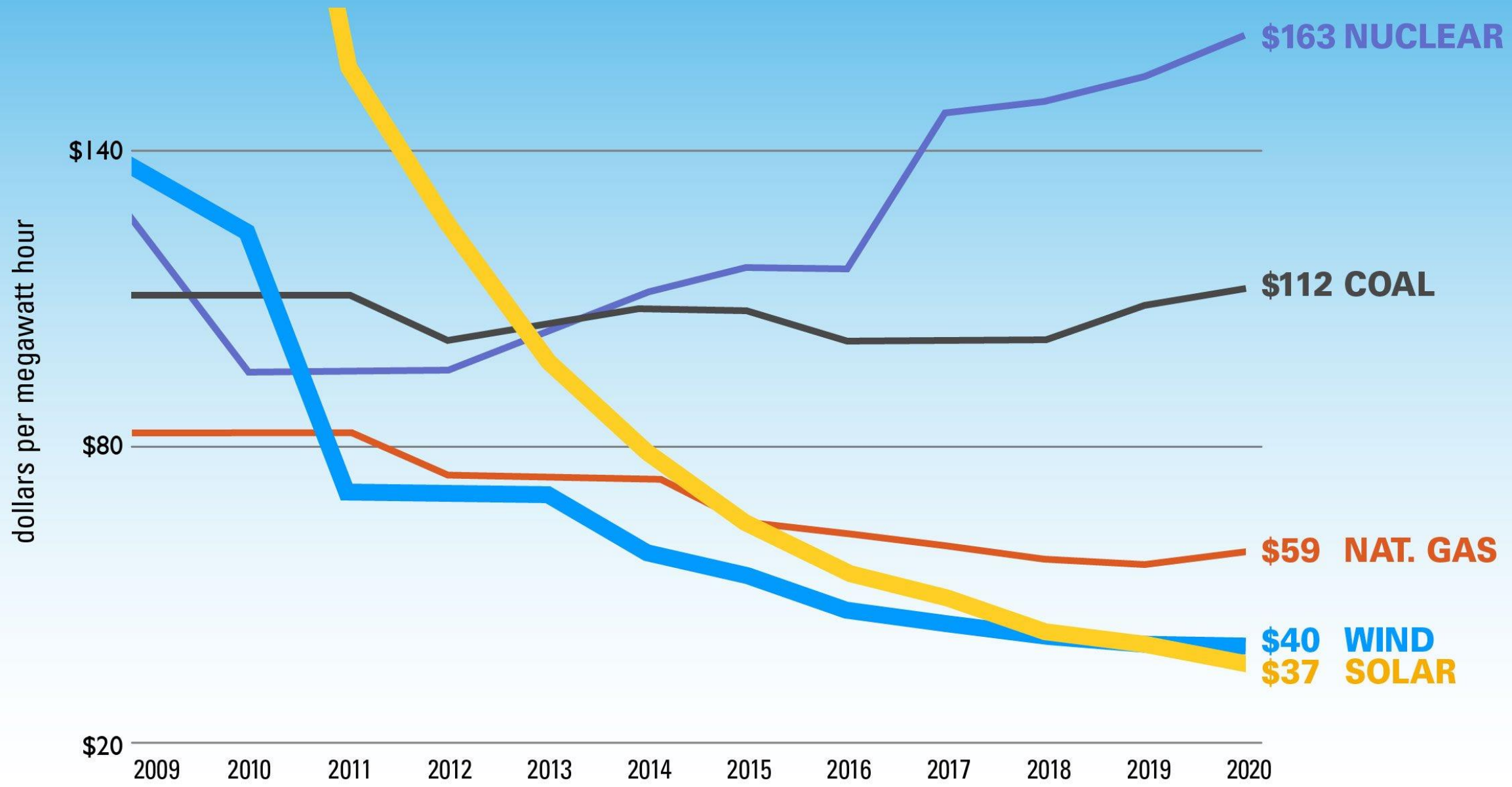
„*DEVELOPING CLIMATE CHANGE MAINSTREAMING POLICIES IN EAP REGION* “, Webinar, 30.11.2021

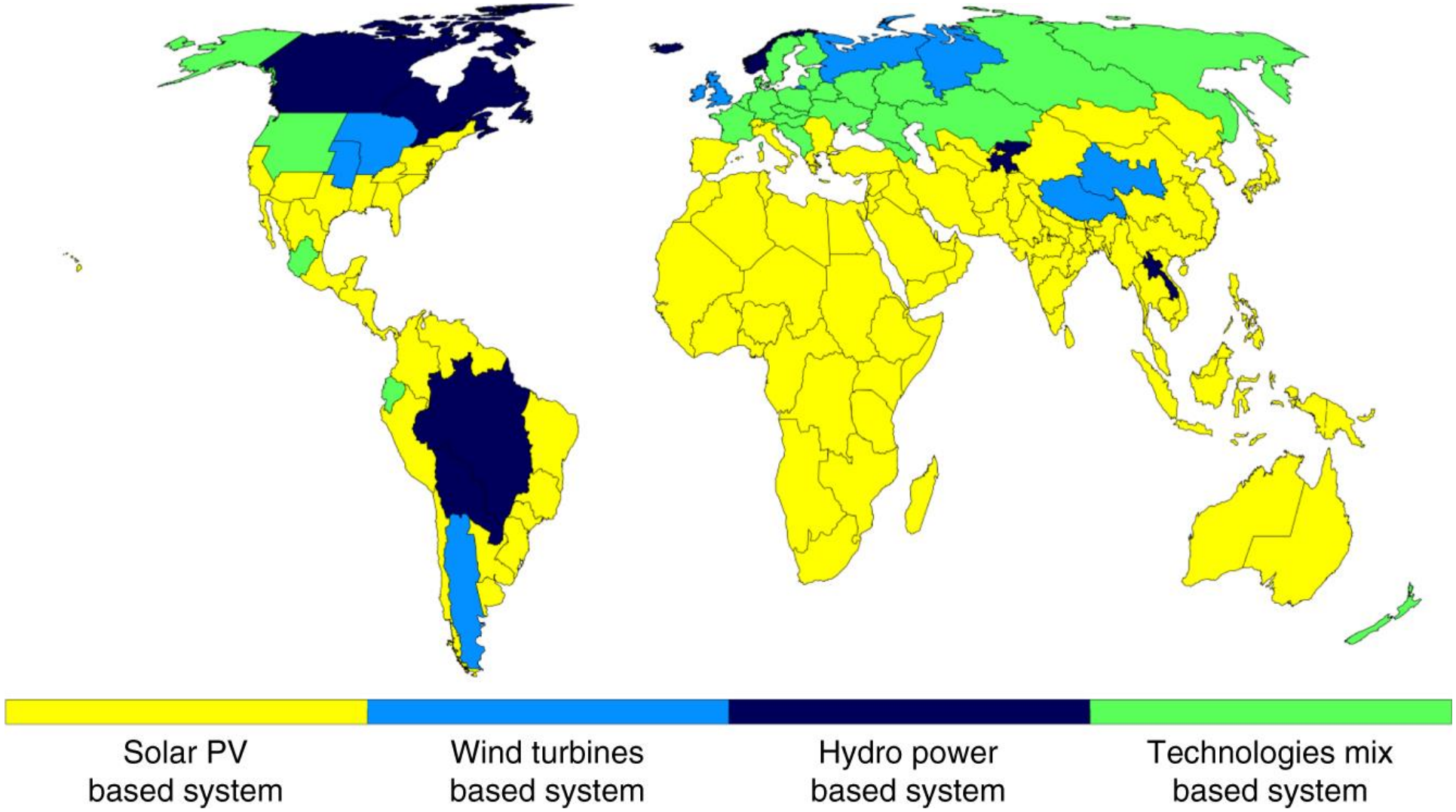
EU fit for 55%

- 55% lower GHG emissions by 2030
- 32% RES by 2030
  - EC proposal 40%
- 32.5% less energy demand by 2030
  - NZEB -> ZEB
  - ETS -> Electrification of transport and heating
  - District heating and heat pumps

Lazard levelized cost of energy analysis: 2020



Breyer: optimal mix



https://www.nature.com/articles/s41467-019-08855-1

Wind Atlas

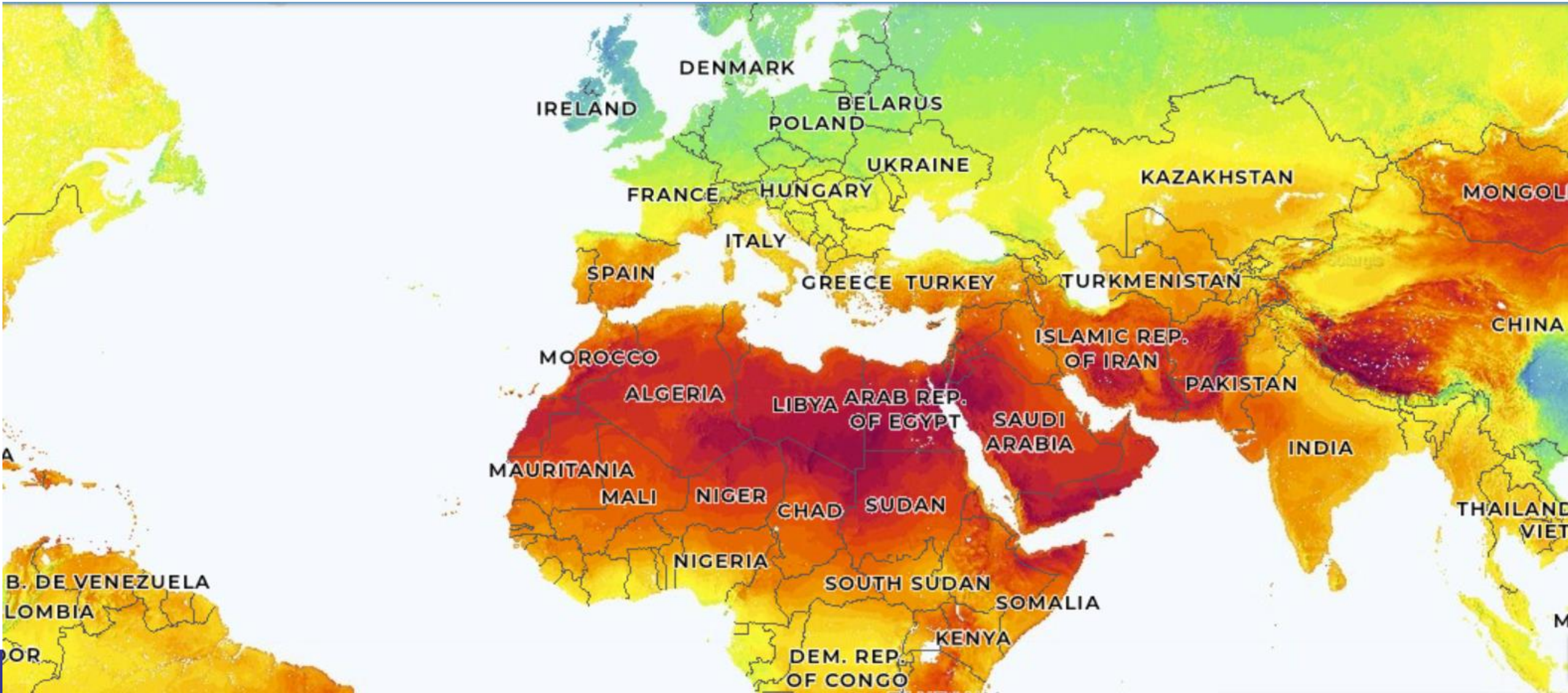
- Excellent wind potential in northern part of CEE
- Good locations in SEE and Caucasus

Wind share in electricity demand 2020

Lithuania – 13%
Romania – 12%
Estonia – 11%
Croatia – 10%
Poland – 9%
Montenegro[19] – 8%
Bulgaria – 4%
Serbia – 3%
Bosnia and Herzegovina, Hungary, Latvia, Macedonia – 2%
Czechia, Kosovo*, Ukraine – 1%

EU – 16%
World[19] – 5%

Solar Atlas

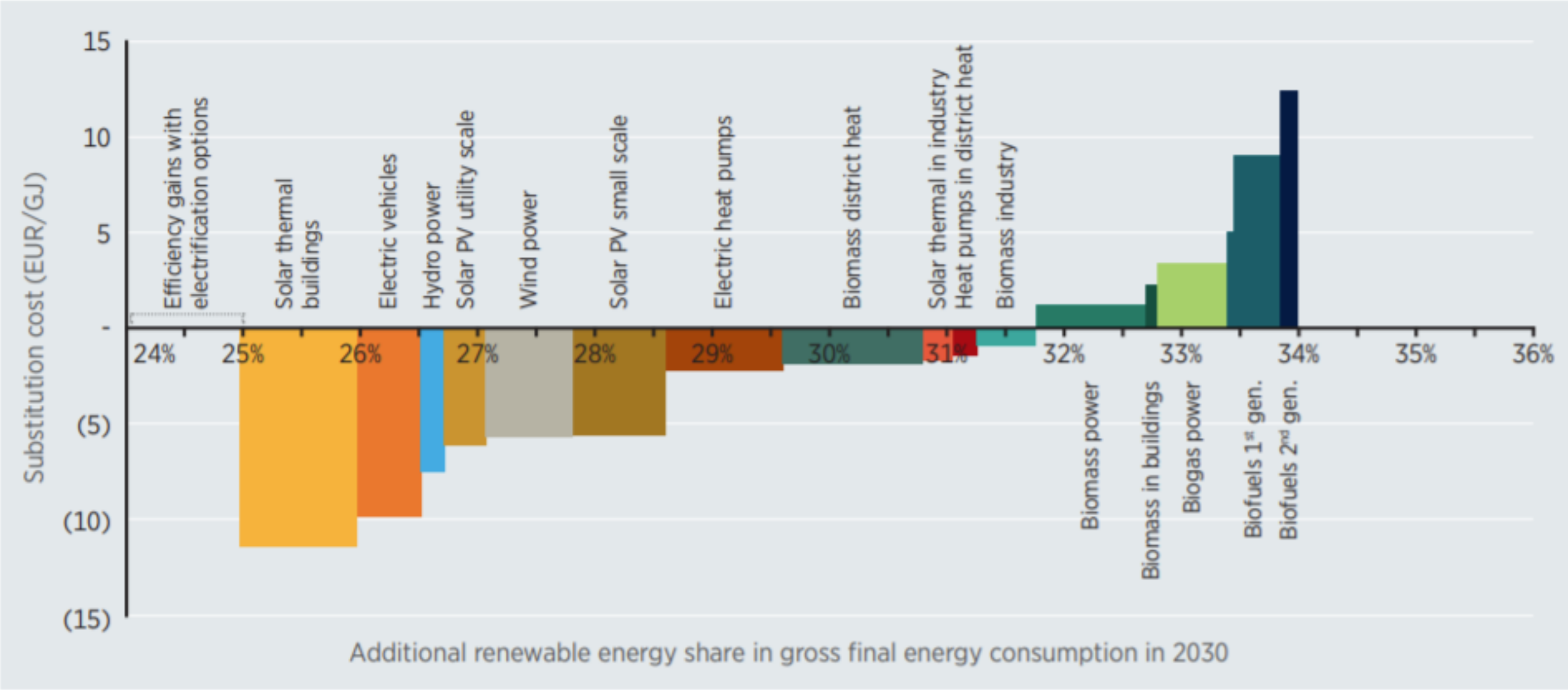

DENMARK
IRELAND
BELARUS
POLAND
UKRAINE
KAZAKHSTAN
FRANCE
HUNGARY
ITALY
SPAIN
GREECE
TURKEY
TURKMENISTAN
CHINA
ISLAMIC REP. OF IRAN
MOROCCO
ALGERIA
LIBYA
ARAB REP. OF EGYPT
SAUDI ARABIA
PAKISTAN
INDIA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
NIGERIA
SOUTH SUDAN
SOMALIA
KENYA
DEM. REP. OF CONGO
B. DE VENEZUELA
LOMBIA

Solar share in electricity demand 2020

Hungary – 5%
Bulgaria, Czechia[18] – 4%
Romania – 3%
Slovakia, Slovenia – 2%
Armenia[19], Ukraine – 1%
Albania, Croatia – 0.5%

EU – 5%
World[19] – 3%

Cost-supply curve of REmap options for the CESEC region

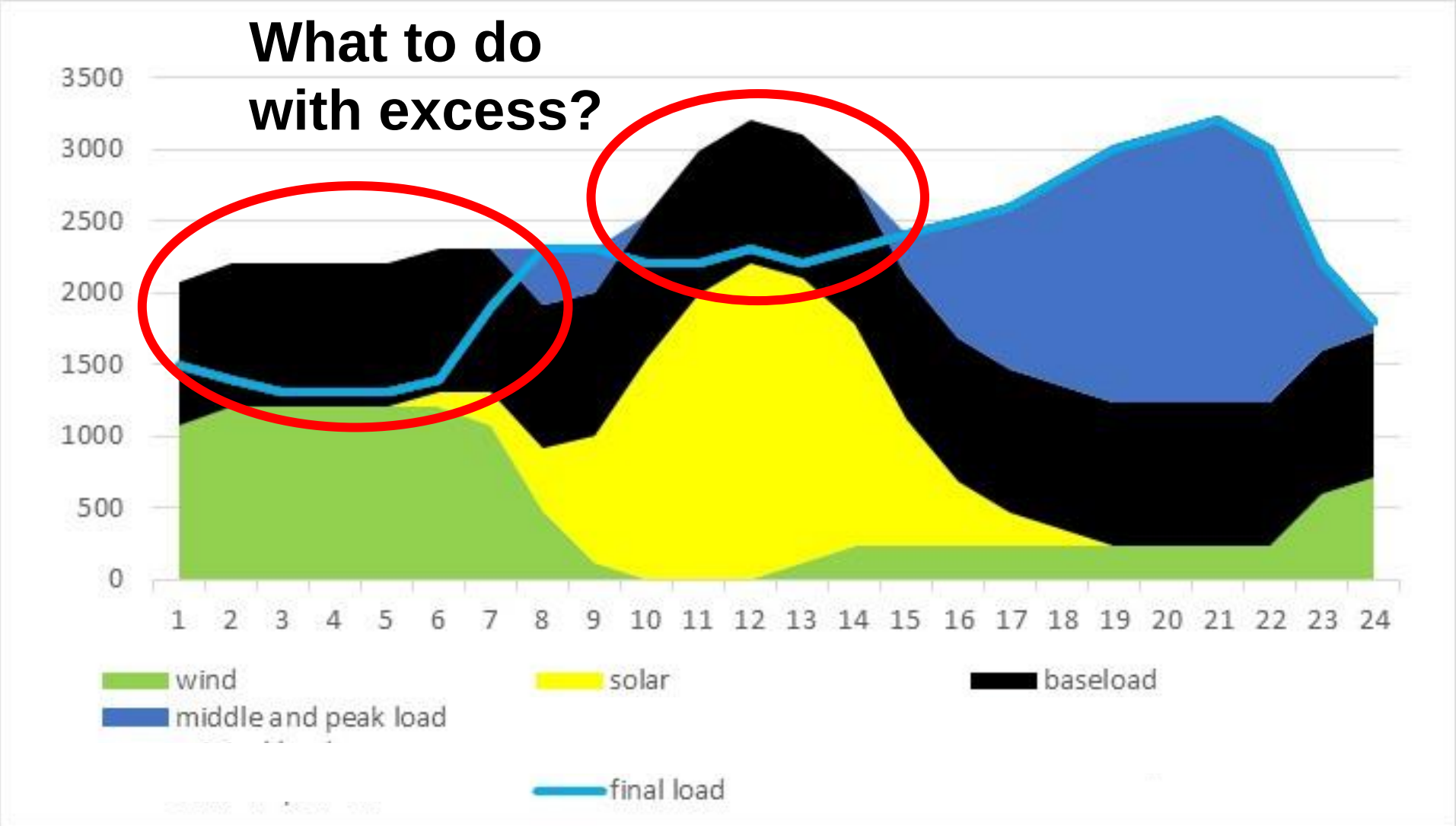


Based on IRENA analysis

Financial support mechanisms

- Feed-in-tarrifs – phase out in EU
- Quota obligation
- Feed-in-premiums – day ahead market necessary
- Contract for difference
- Auctions – a way how to control the investment pace
- Although renewables are cheaper, support is still necessary due to:
  - Removing barriers
  - Making projects bankable

Baseload + 25% wind + 25% solar

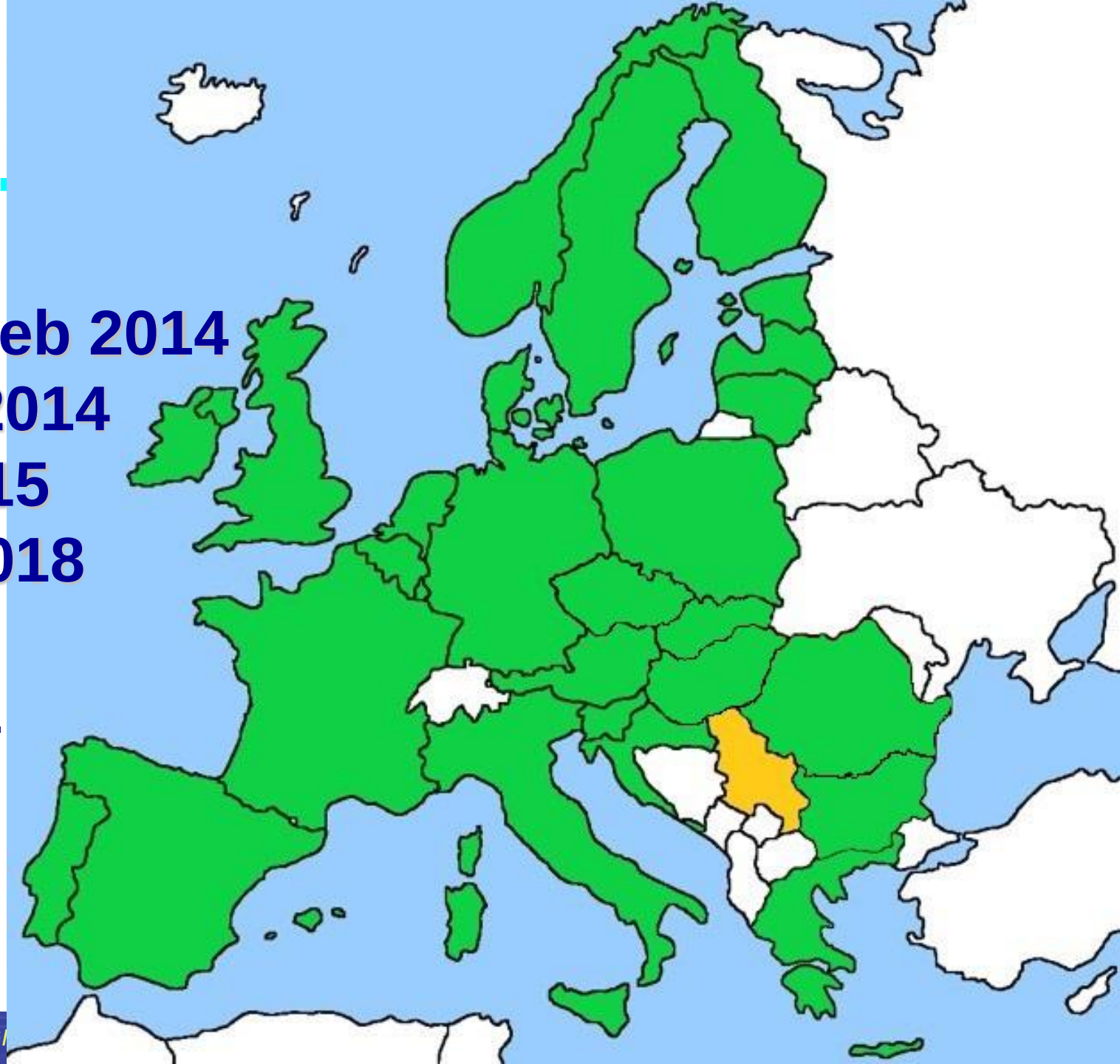


➢How to solve renewables variability/intermittency problem?

- More grid interconnection
- Flexibilisation of thermal power plants
- Wholesale markets coupling
- Demand response and integration of power, heating, cooling, transport and water systems – power-to-X
- Dedicated electricity storage

Go-live!

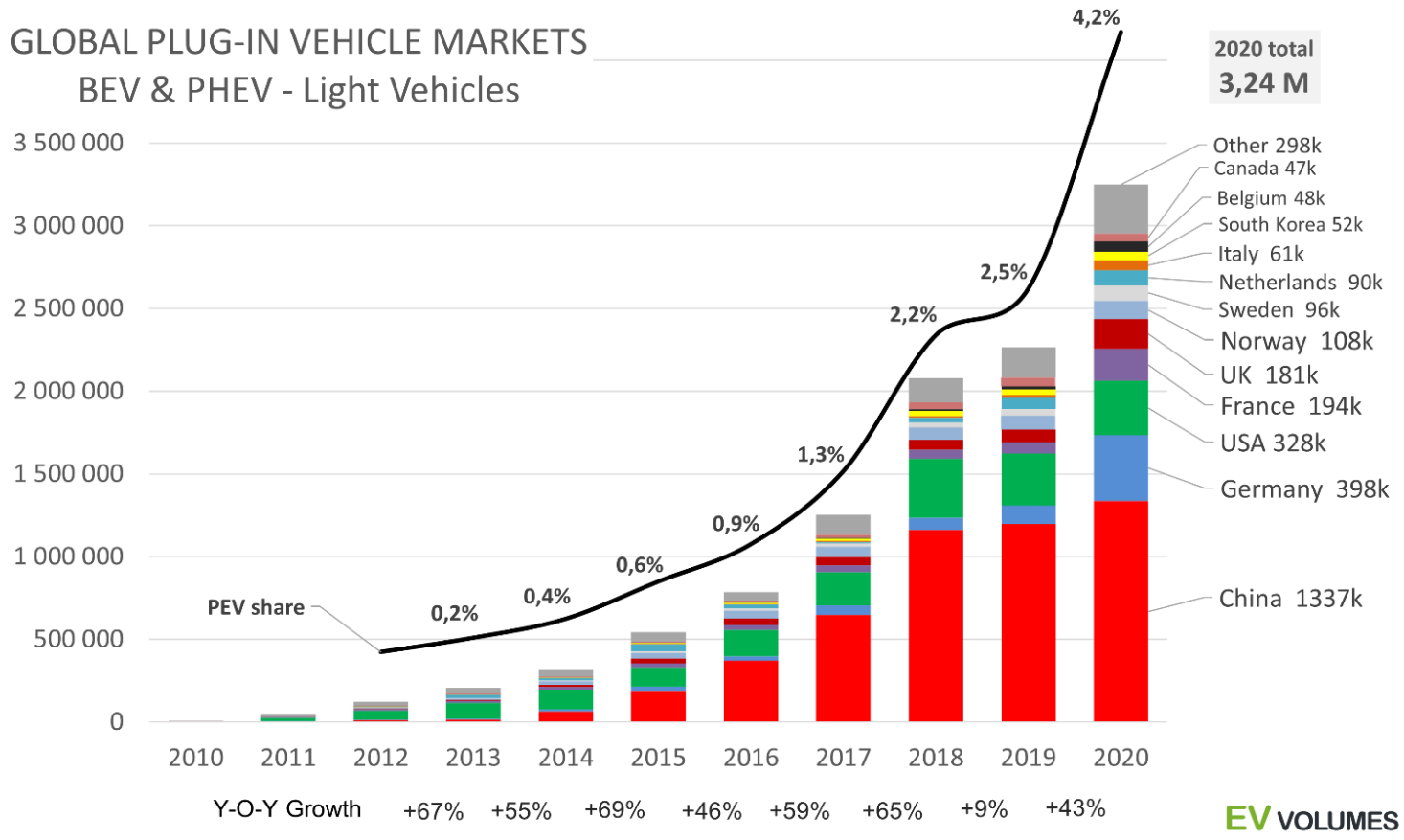
NWE+CWE coupled in Feb 2014
ES+PT coupled in May 2014
IT+SI coupled in Feb 2015
IE+HR coupled in Jun 2018
GR coupled in Dec 2020
BG coupled in May 2021
4M coupled in Jun 2021



Demand response – power-to-X

- 20th century energy systems: supply follows demand
- 21st century energy systems: demand follows supply -> smart energy systems

Transport electrification has started



Global light vehicles sales in 2020

- 3.2 mln EV
- 76 mln total
- 4.2% global sales
- 43% EV sales growth
- 20% cars sales fall

EU: 10.5% EV

HU: 5% EV

SI, LV, CZ: 3% EV

EE, RO, SK, PL, HR: 2% EV

LT: 1% EV

Issues on the way

- Road freight – maybe electrified roads
- Shipping, aviation cannot yet be electrified
- High temperature processes sometimes cannot be electrified
- Winter windless weeks
- It all makes up to 20% of energy demand
- If biomass is used only for the above it could cover half of the missing demand
- And the rest? Synthetic or e-fuels including hydrogen?

Conclusions

- Wind and solar are coming, but difficult to integrate
- They still need well designed support mechanisms
- Integration of power, heating, cooling, water and transport system necessary
- District heating, heat pumps, electric vehicles
- Smart energy systems – cheap and simple

Thank you for your attention!

Дзякую вас за ўвагу!

Благодарю вас за внимание!

Շնորհակալություն ուշադրության համար!

Diqqətinizə görə təşəkkür edirəm!

მადლობა გადაგიხადოთ თქვენი ყურადღება!

Дякую за увагу!

Neven.Duic@fsb.hr