

Renewables working together: island, rural, city, national and regional approaches



MARRAKECH COP22|CMP12
UN CLIMATE CHANGE CONFERENCE 2016



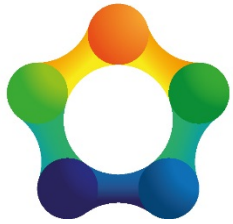
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14 November
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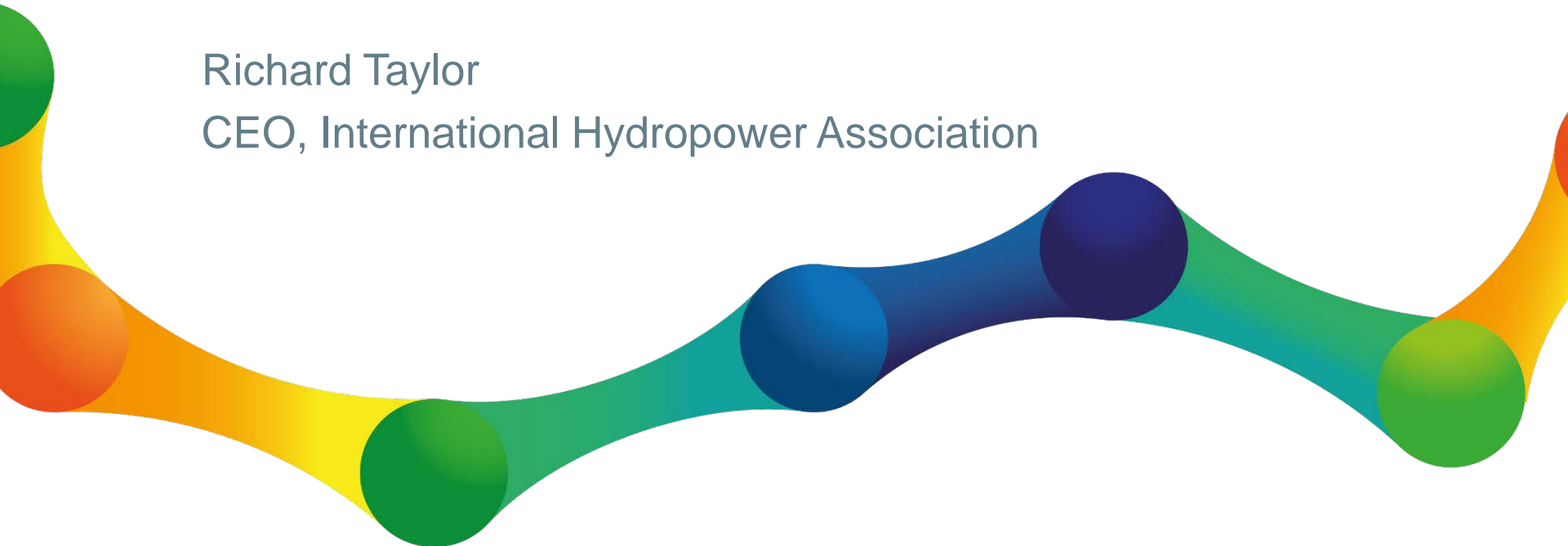


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Renewables working together at the national / system level

Richard Taylor

CEO, International Hydropower Association



IHA knowledge-building areas

- Clean energy systems** • Hydropower working together with other renewables
- Climate mitigation** • Quantifying hydropower's low GHG impact
- Climate resilience & adaptation** • Building resilience and adaptation services.
- Water footprint** • Quantifying the water footprint of hydropower
- Project benefits** • Quantifying the full range of benefits of hydropower
- Project financing** • New tools to finance hydropower projects
- Regional development** • Benefits of regional interconnections to hydropower
- Sediment management** • Demonstrating best practices in sediment management
- Operations & maintenance** • Showcasing best practices in O&M for hydropower

The role of hydropower in the energy mix

Frequency control

Balancing short-period system fluctuations

Providing firming capacity

Delivering power when variable renewables are not producing

Energy storage

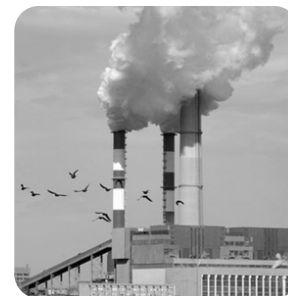
Absorbing surplus generation when supply exceeds demand

Conventional systems

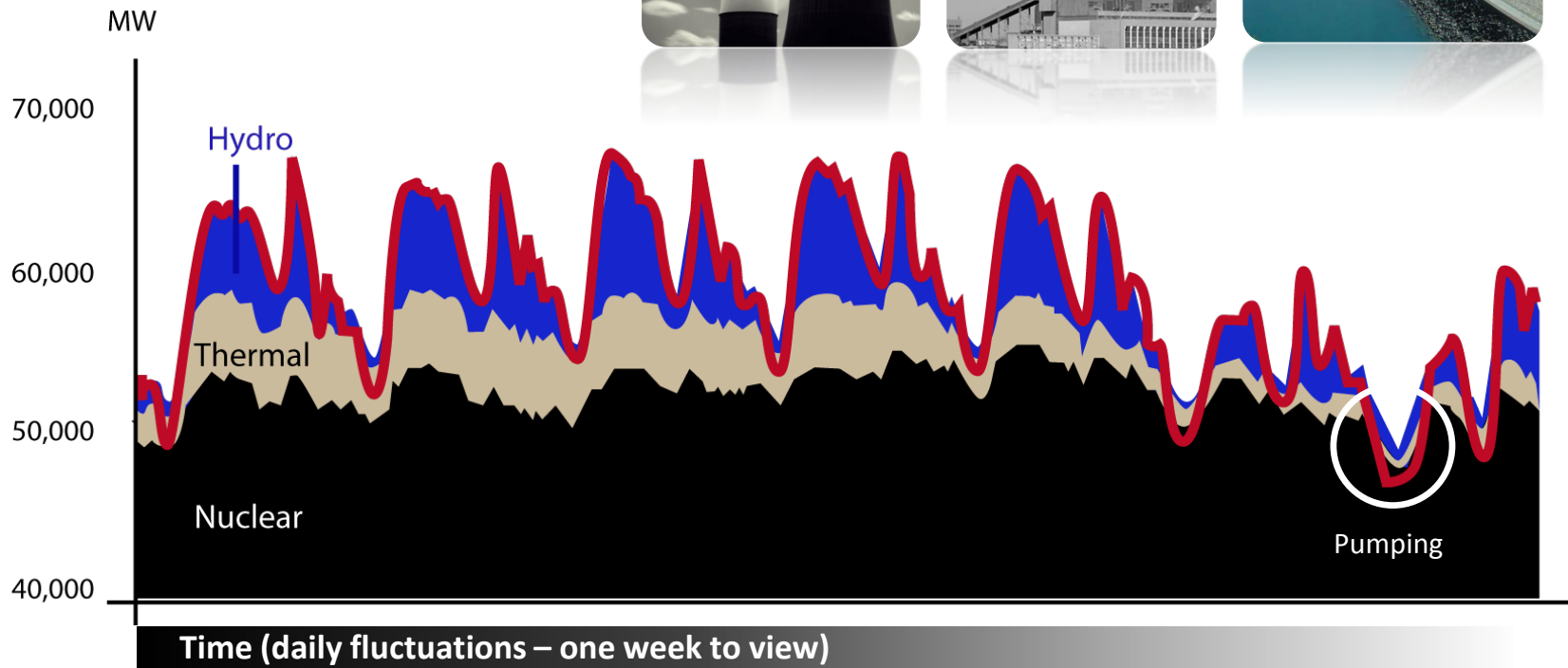
Nuclear



Thermal

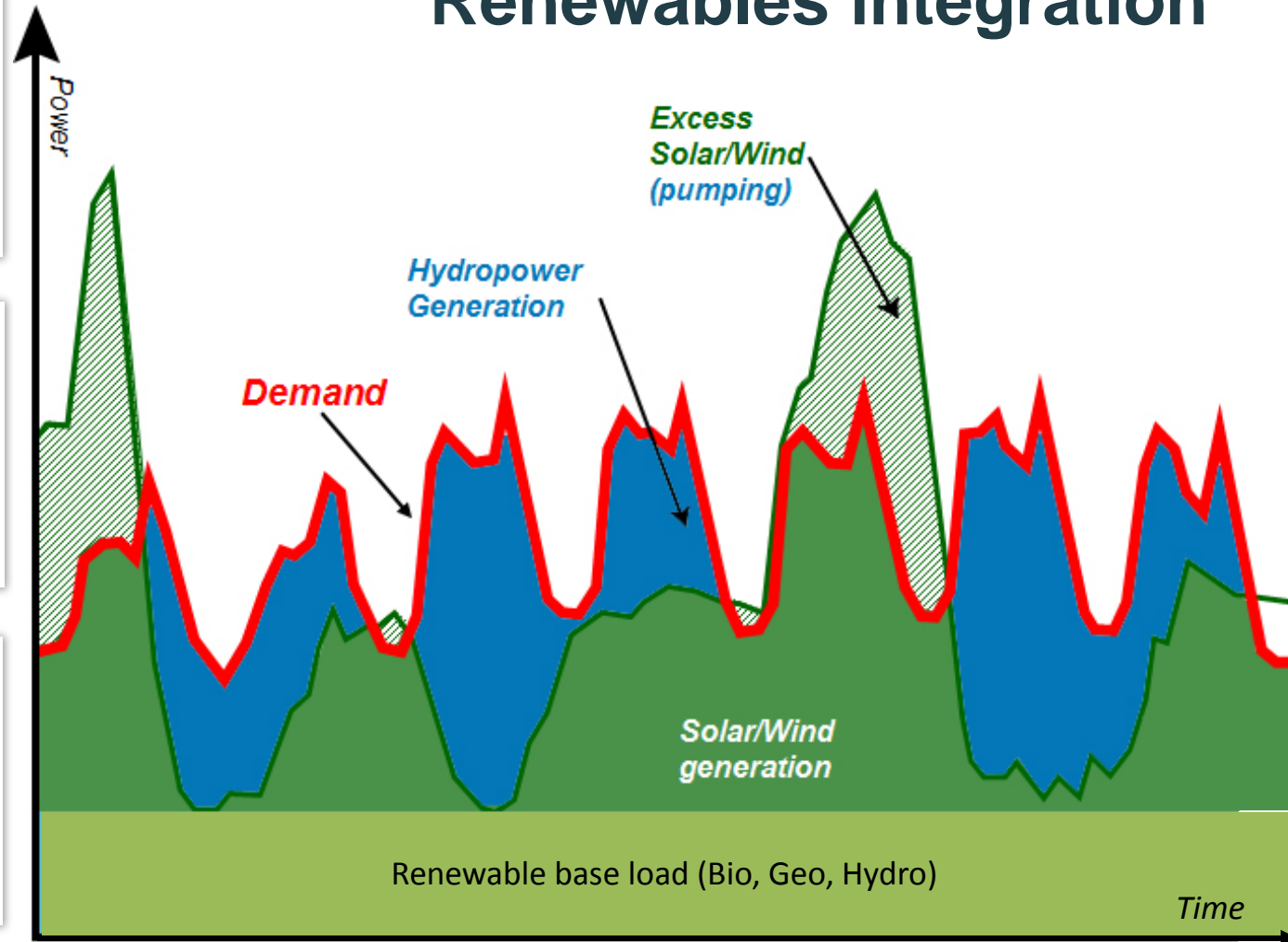
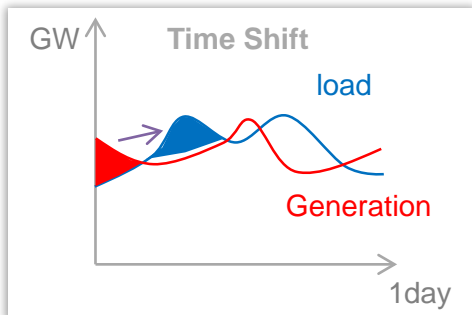
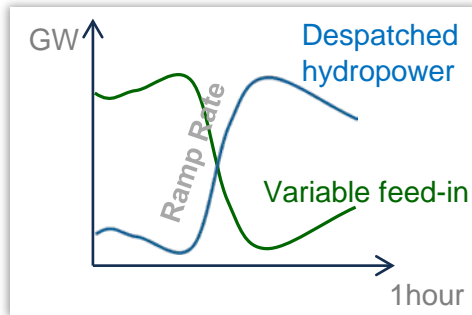
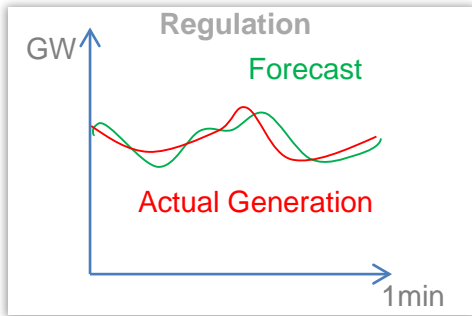


Hydropower



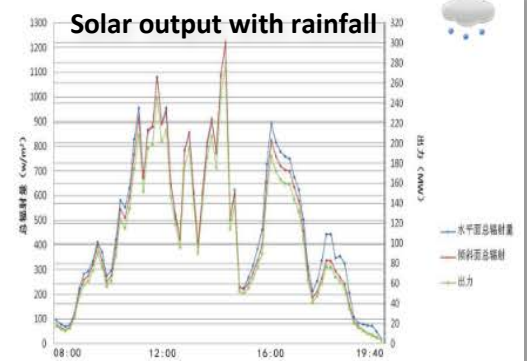
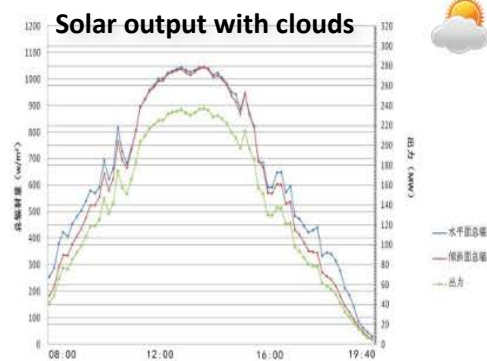
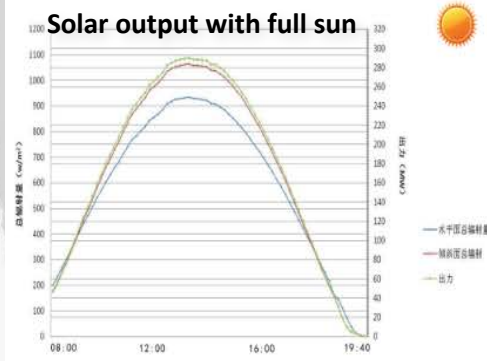
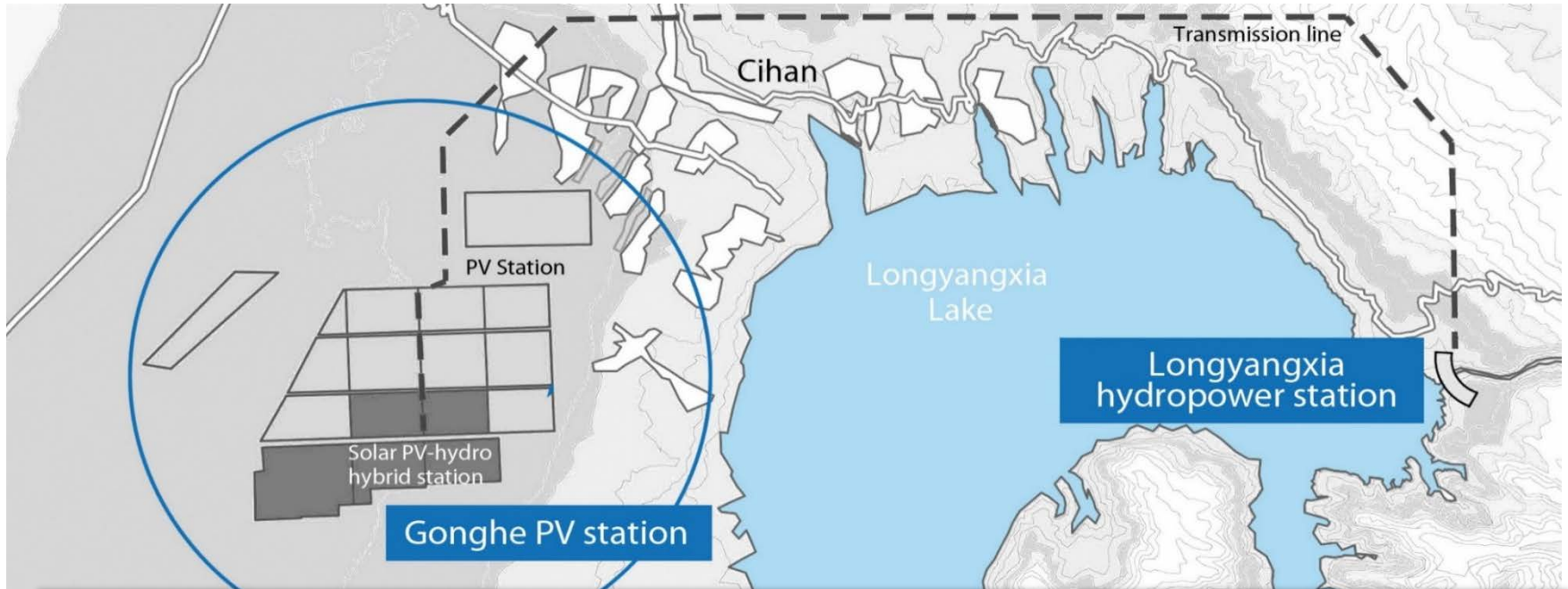


Renewables integration

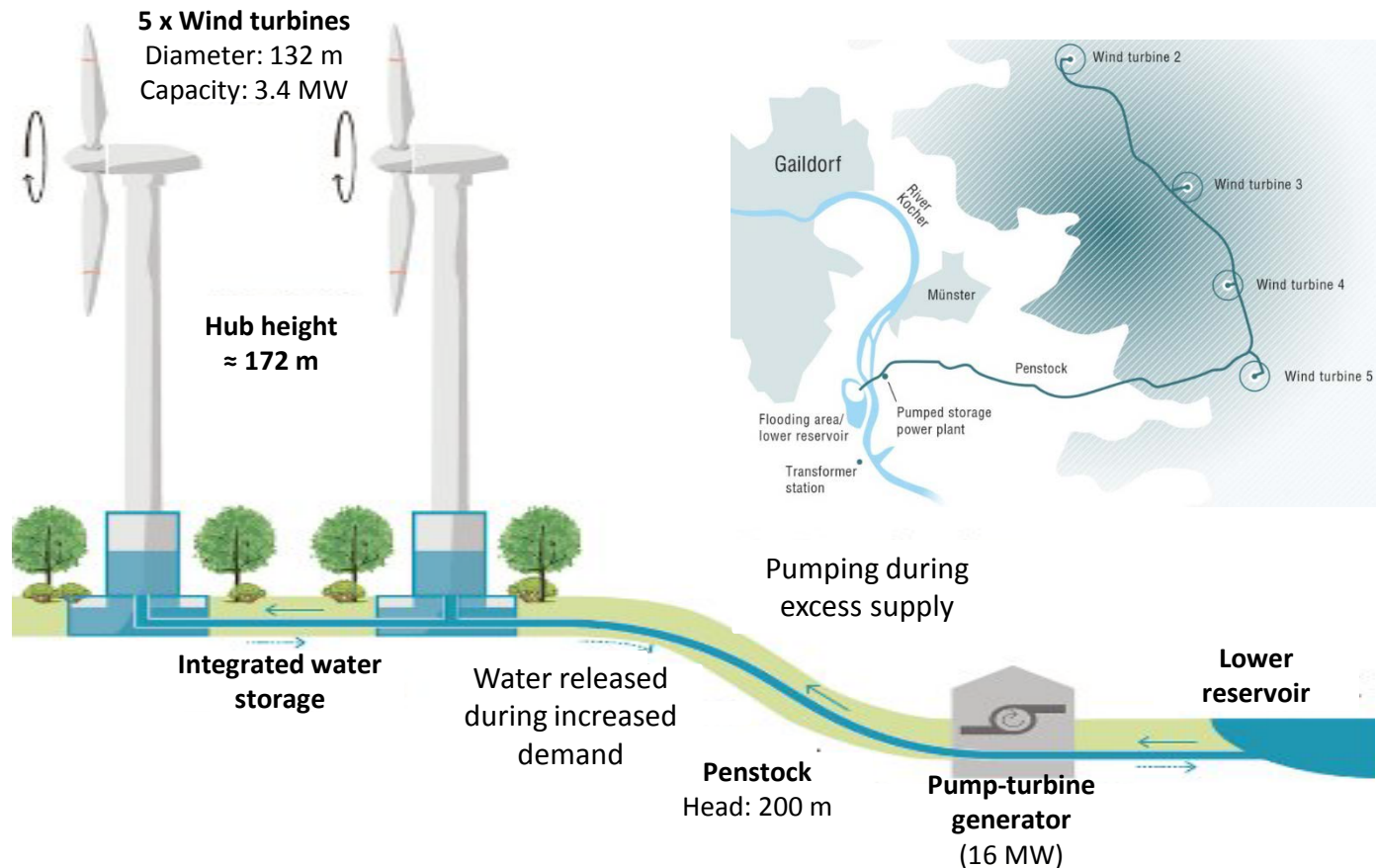




Hydro/solar hybrid



Naturspeicher: wind-pumped storage



Floating PV – ‘floatovoltaics’



Source: K-water

Floating PV

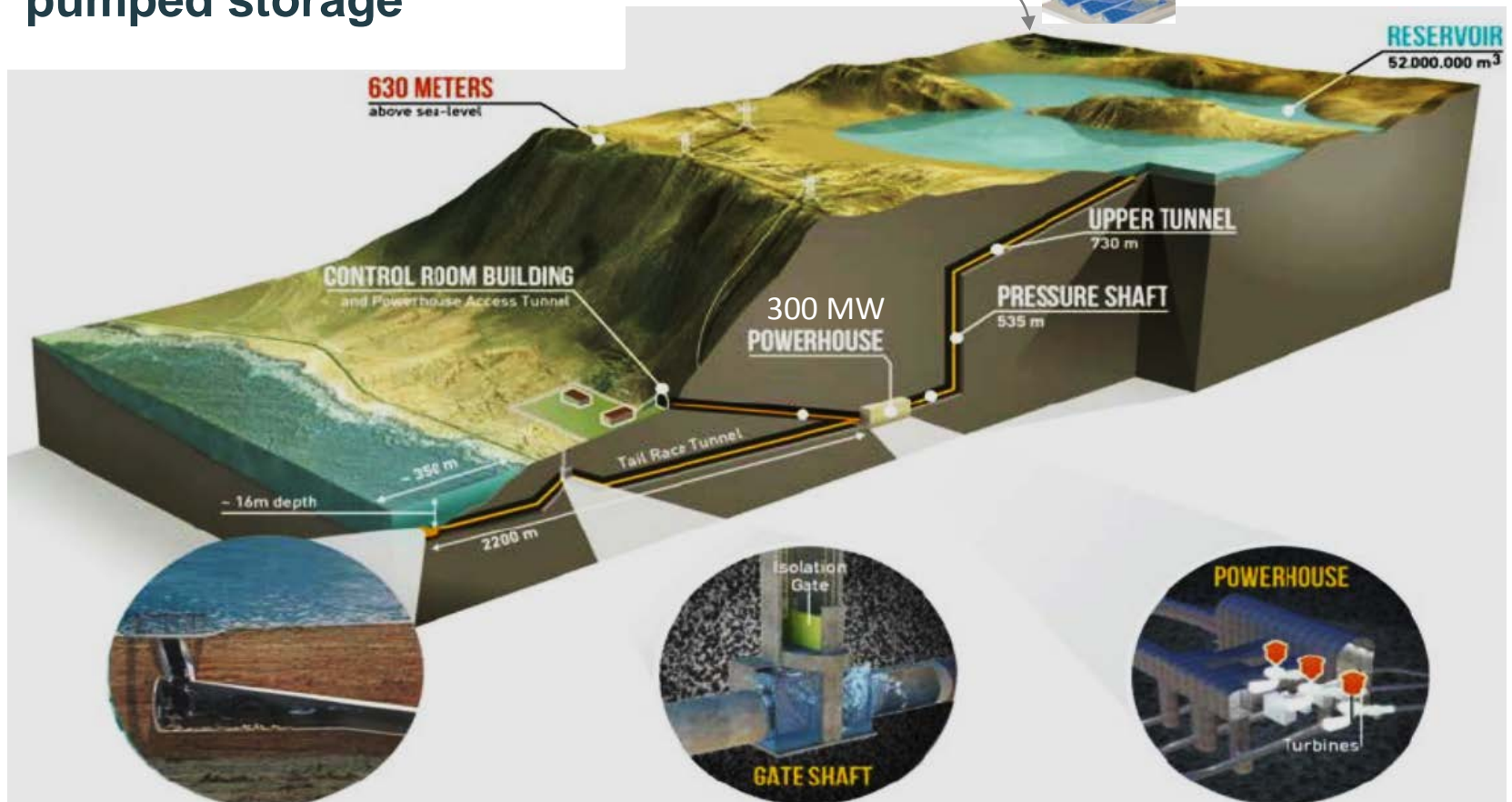


Benefits of 'floatovoltaics' within hydropower reservoirs

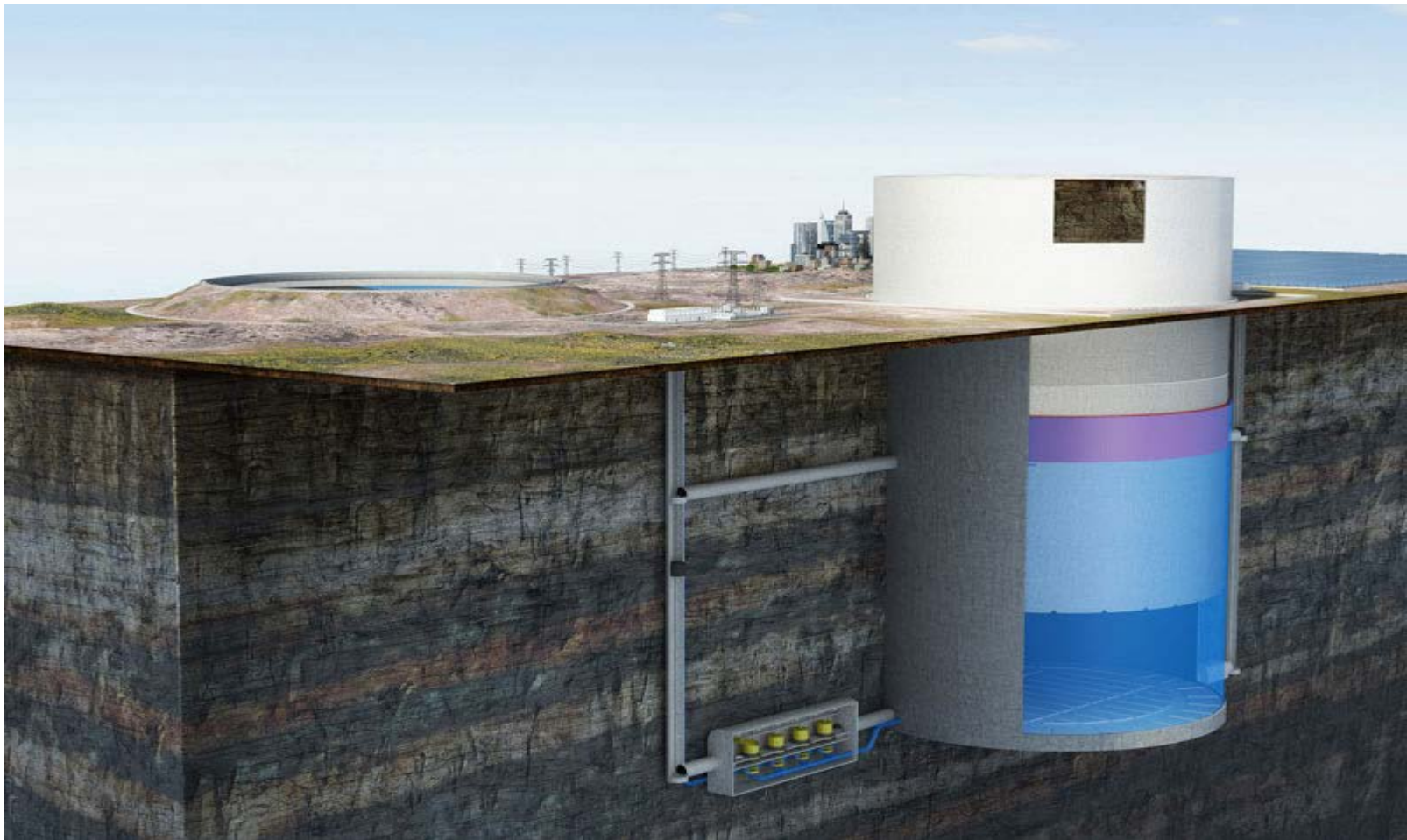
- Utilises existing transmission infrastructure
- Water helps cooling and increases PV efficiency (~10%)
- Potential to reduce evaporation and conserve water

Proposed solar/sea pumped storage

Tarapaca 600 MW Solar PV



Proposed gravity – pumped storage



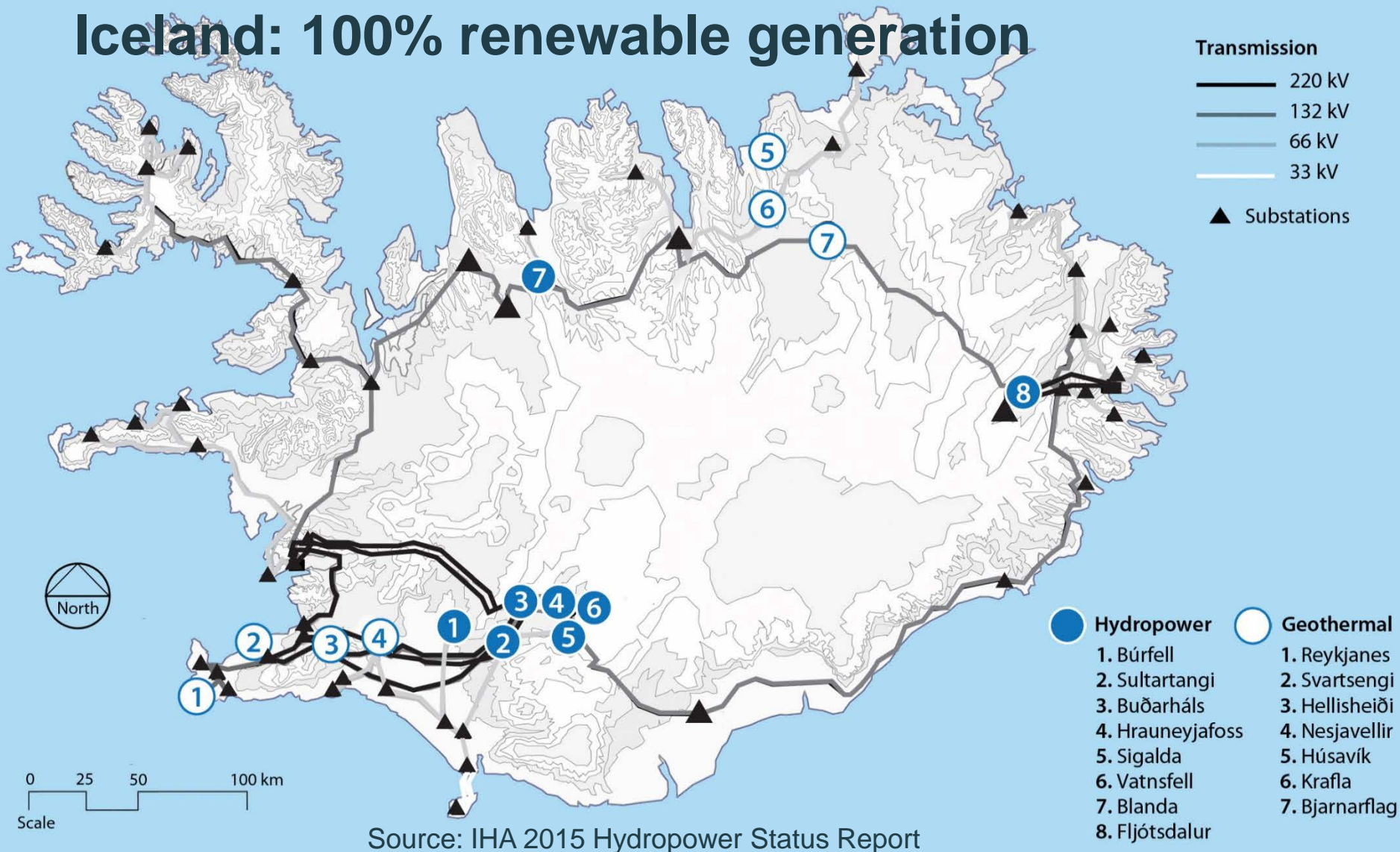
Wind – solar – hydro: integrated control system



Chuxiong advanced control system in Yunnan, China

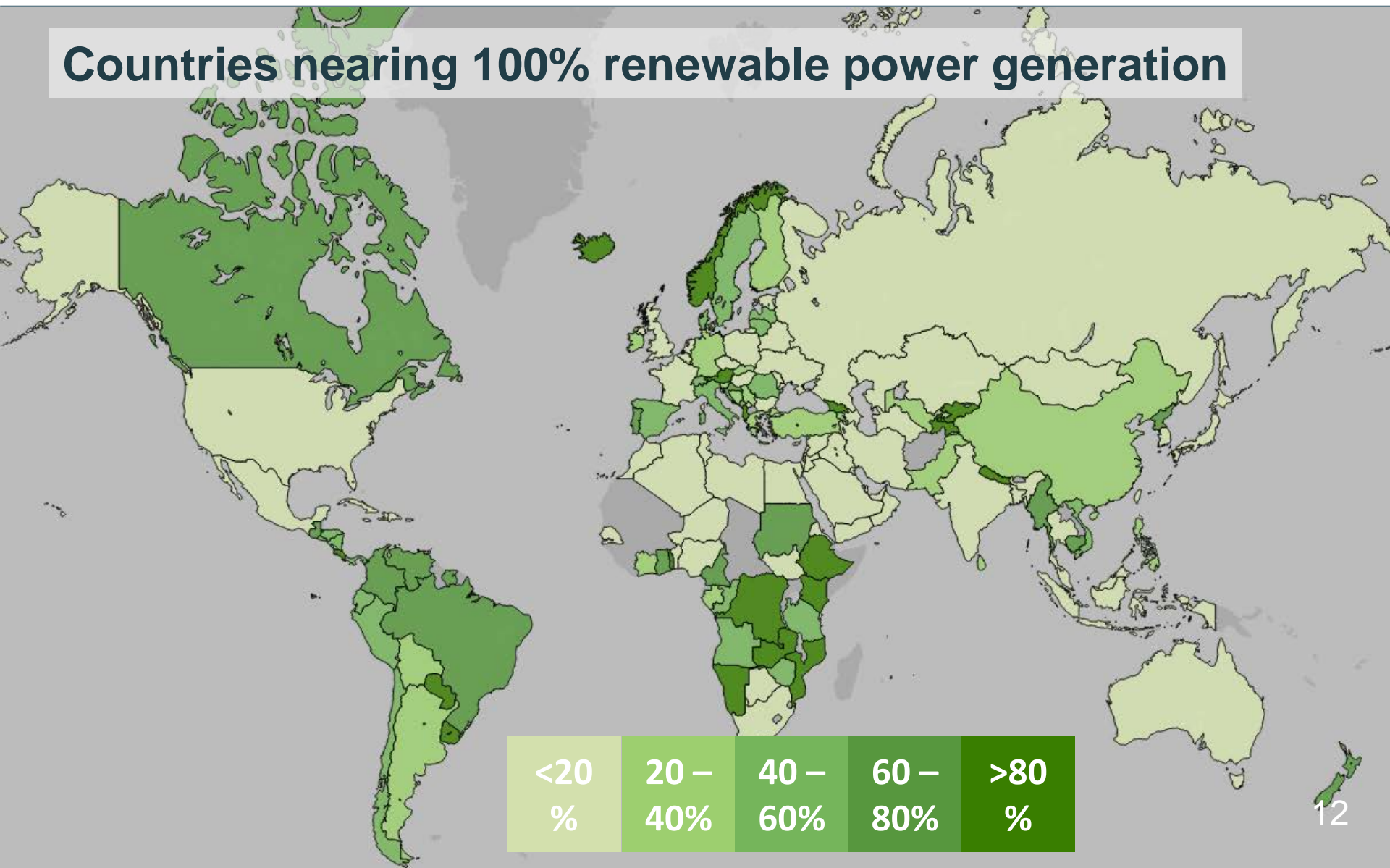
- 5 wind farms, 2 solar PV and hydropower totalling 879 MW
- Centralised dispatch control centre will optimise the three resources to ensure firm and steady power output.

Iceland: 100% renewable generation





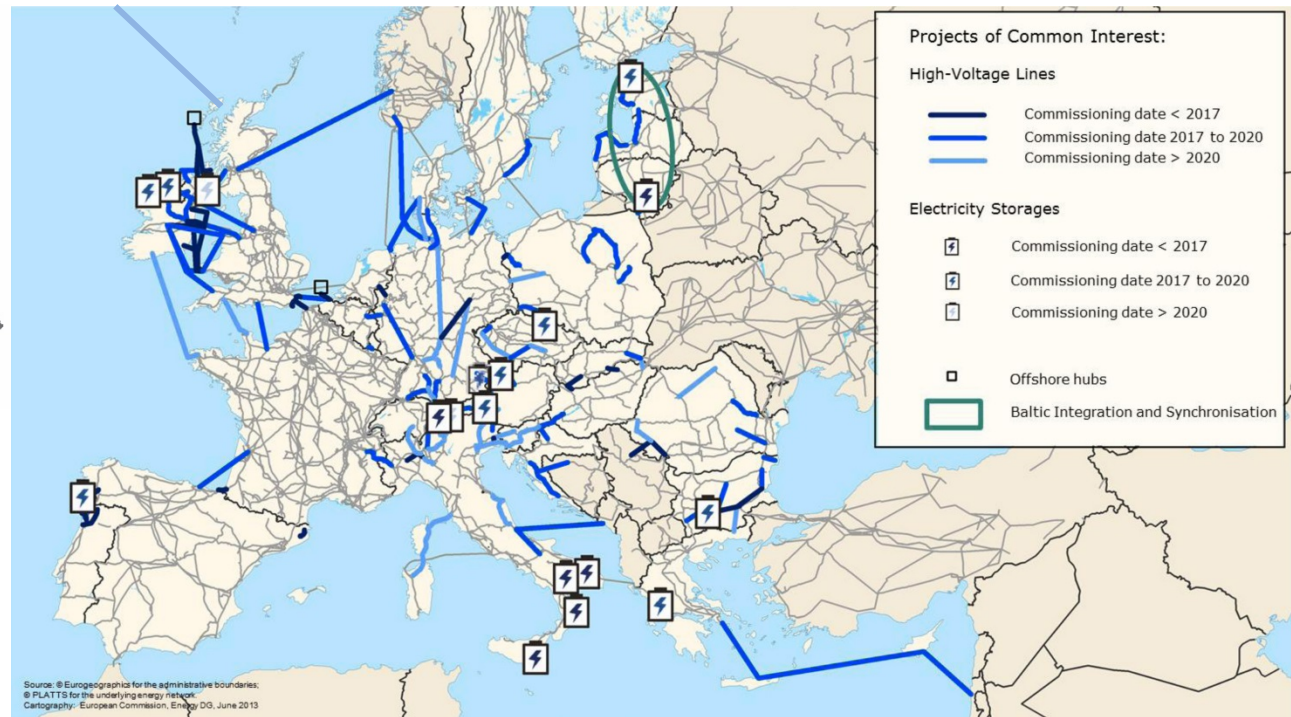
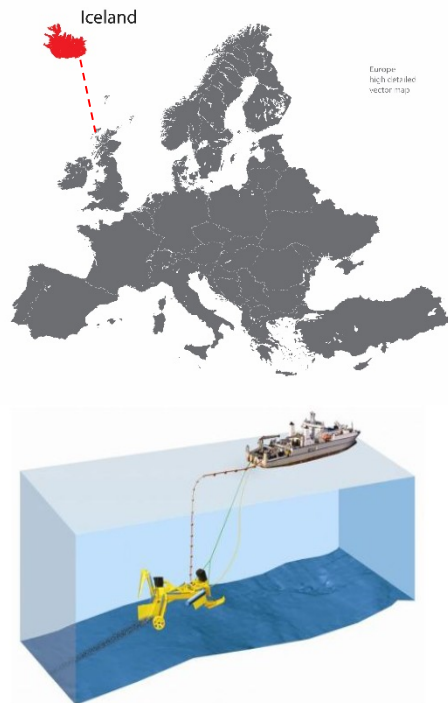
Countries nearing 100% renewable power generation



<20	20 –	40 –	60 –	>80
%	40%	60%	80%	%

Interconnecting renewables for greater security

Regional level Projects of Common Interest, Europe (2014-2020)



- Increasing pumped storage capacity (Bulgaria, Estonia, Austria, ...)
- New HVDC interconnection (for ex. Norway-Germany, Norway-UK...)

Thank you!

www.hydropower.org



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