

Norconsult 

Renewable energy in Angola 2022

Solar, wind and hydropower, hybrid solutions – Hege Iversen, SVP Norconsult AS

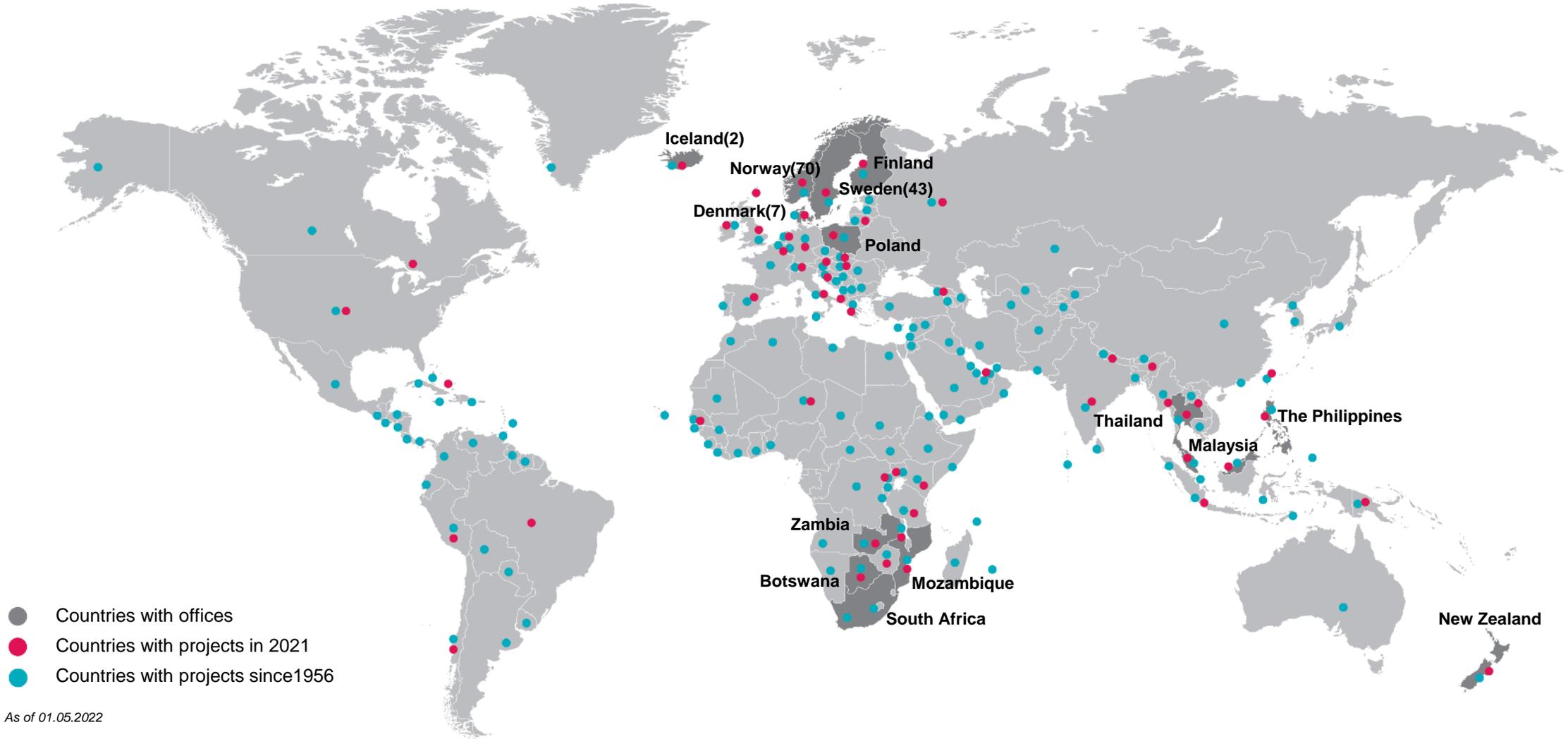


Key figures Norconsult

- ▶ **5 200** Employees
- ▶ **133** Offices
- ▶ **11** Business areas
- ▶ **20 000** Projects
- ▶ **7,4** Billion NOK revenues*



122 offices in 14 countries



Hydropower

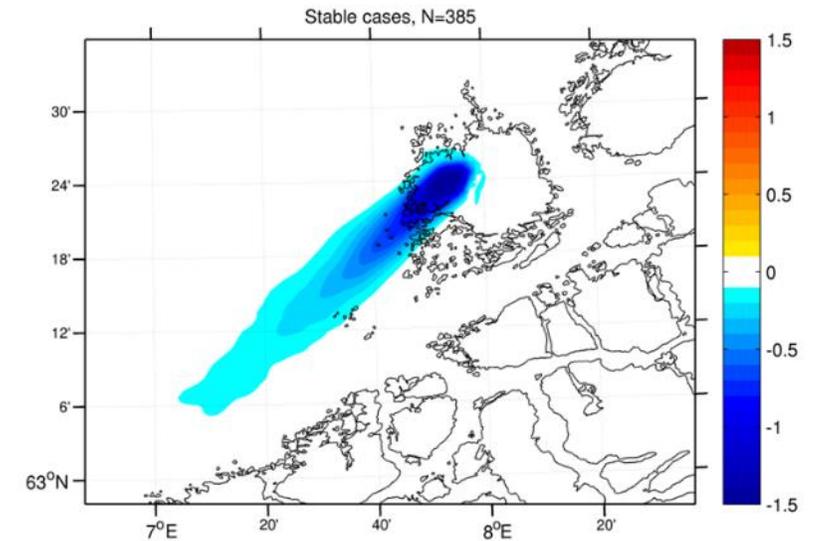
- ▶ 90 years of experience, full life cycle services - from early phase planning and design through construction to condition assessment and life extension analysis
- ▶ In forefront of developing the industry in digital engineering / BIM - with paperless design/digital engineering of hydropower projects



Wind Power

- ▶ Wind measurements
- ▶ Weather modelling wind & icing
- ▶ Wind energy and energy yield assessment
- ▶ Design and engineering
- ▶ Construction supervision
- ▶ Post-construction performance analyses and forecasting
- ▶ Technical due diligence

How does your neighbour affect your offshore wind farm?



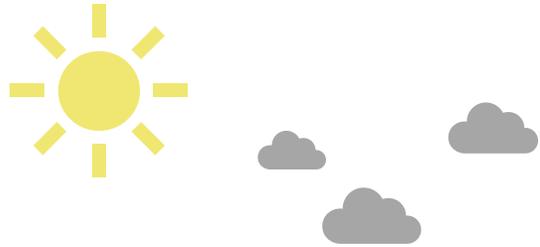
Solar Power

- ▶ A to Z support for all stakeholders, including
 - ▶ Solar measurements
 - ▶ Project development
 - ▶ Design and engineering
 - ▶ Tendering and construction
 - ▶ DD and other post-construction services
- ▶ For utility scale ground mount, rooftop, micro grids, floating PV and solar+ hybrids

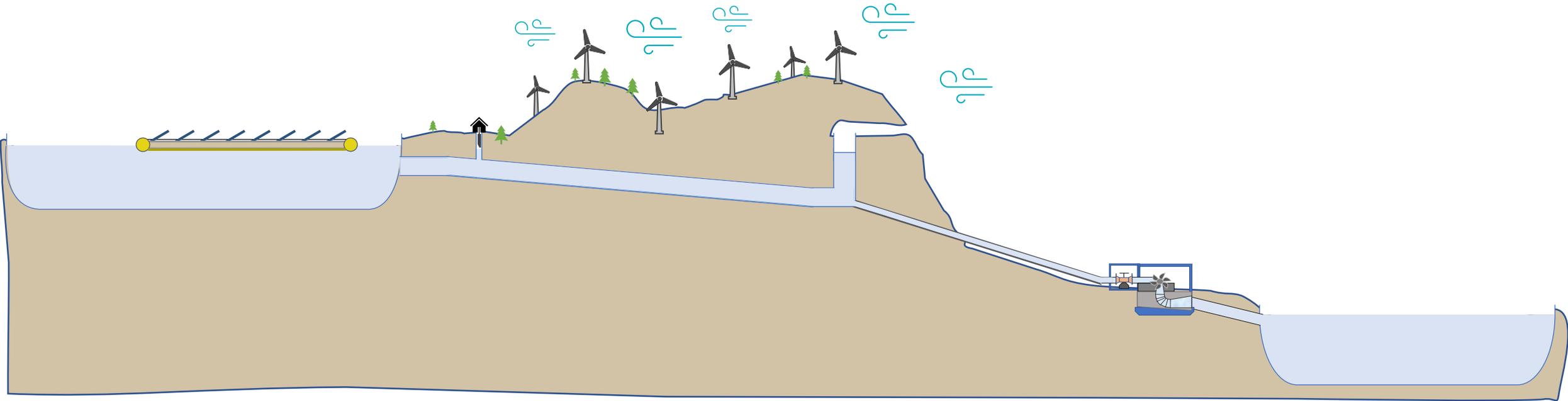
Governing the Weather Transients with Hydro Power

- ▶ Hydro a perfect match for solar and wind?
- ▶ Create a robust system
- ▶ Need to scale, design and verify a hybrid energy system to meet load demand, power system and technical or commercial requirements with fluctuating energy source availability

Time Domain in a Hybrid System



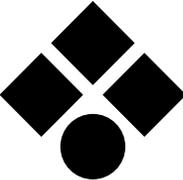
Metrology	Hydro	Hydrological Loss Factors		Inflow Forecast		Climate Change Forecast		
	Solar	Clouding		Solar Irradiance Forecast				
	Wind	High Frequency Turbulence	Mean Wind Speed, Turbulence & Direction	Wind Power Forecast				
Operation	Hydro	Power System Transient Analysis	Hydraulic Transients	Production strategy			Production Forecast	
	Solar		Power Electronics and Batteries Ramp Up/Down	Production Forecast				
	Wind							
Market	All	Frequency Containment Reserve (FCR)	Automatic Frequency Restoration Reserve (aFRR)	Manually Frequency Restoration Reserve (mFRR)	Intraday Trading	Medium Term Market Forecast	Long Term Market Forecast	
		0	0,5 sec	15 min	60 min	24 hr	365 days	30 yrs



Faroe island

- ▶ Goal 100% renewable by 2030 from 60% fossil fuel production
- ▶ Challenges:
 - ▶ Grid stability (island)
 - ▶ No seasonal water storage
 - ▶ Wind extremely variable
 - ▶ Summer: less wind and rainfall
- ▶ How to (almost) get there: pumped hydro, wind, solar and battery.



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Every day we improve everyday life