

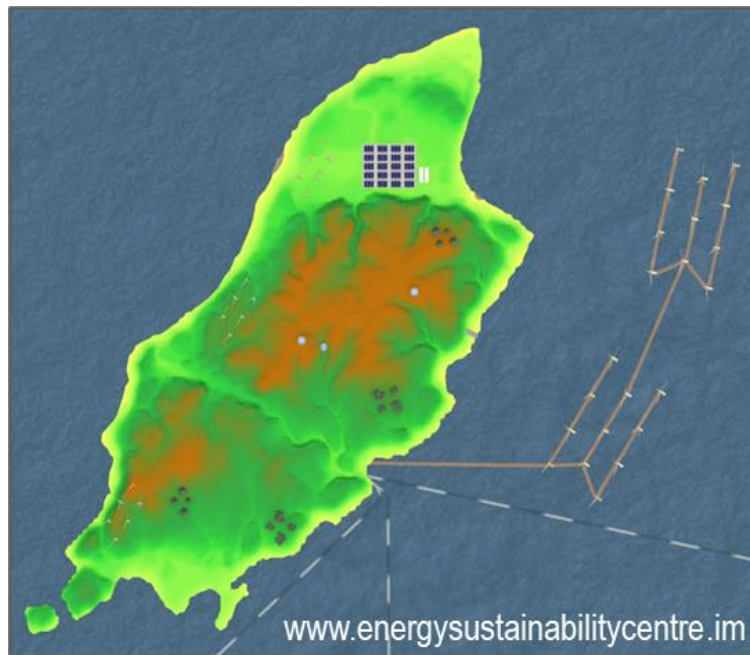
Will the Island sink, survive or thrive without fossil fuels?

Dave Quirk – DTU Offshore; Energy & Sustainability Centre IoM

Adrian Cowin & Ralph Peake - Energy & Sustainability Centre IoM

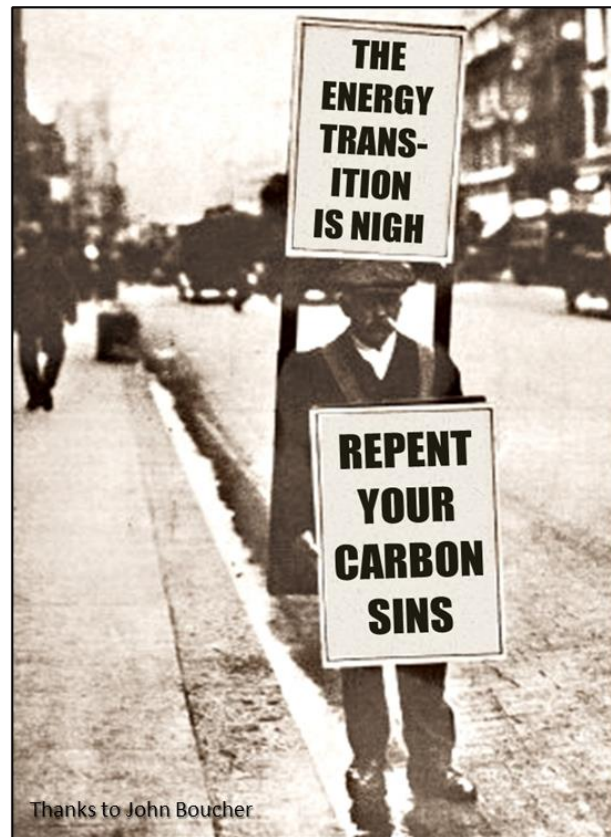
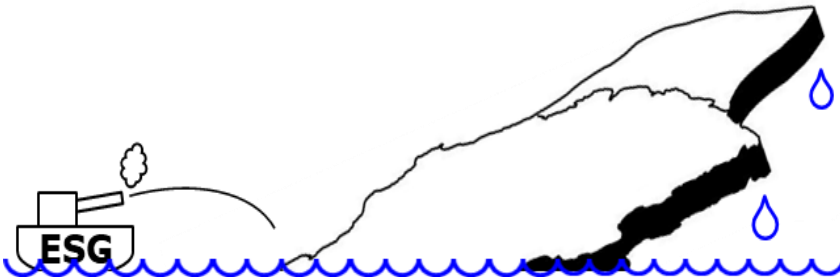
Lest I forget

- Thanks to:
 - Gail Corrin (15 Jan 2020)
 - Kimberley Moughtin
 - Rebecca Keeley
 - ESC sponsors:



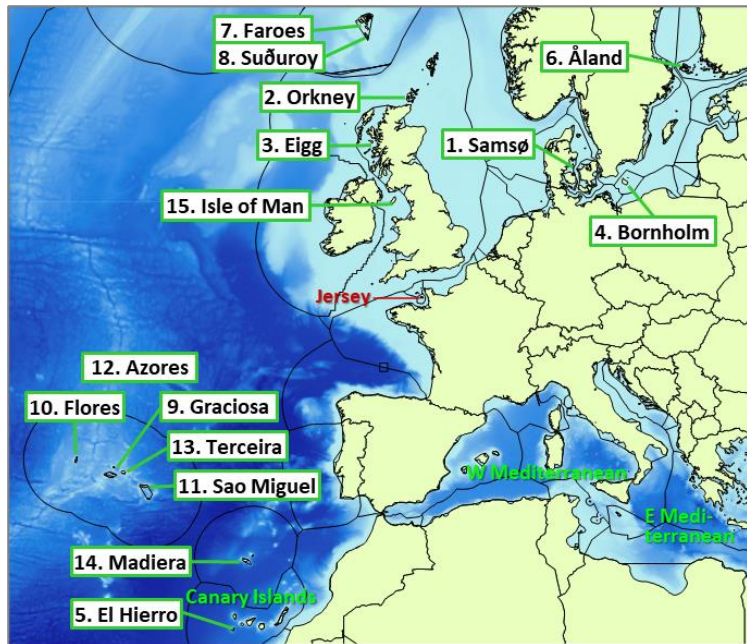
Which is the biggest threat: climate change or the green transition?

- In either case how will it affect the environment, the economy and our lives?

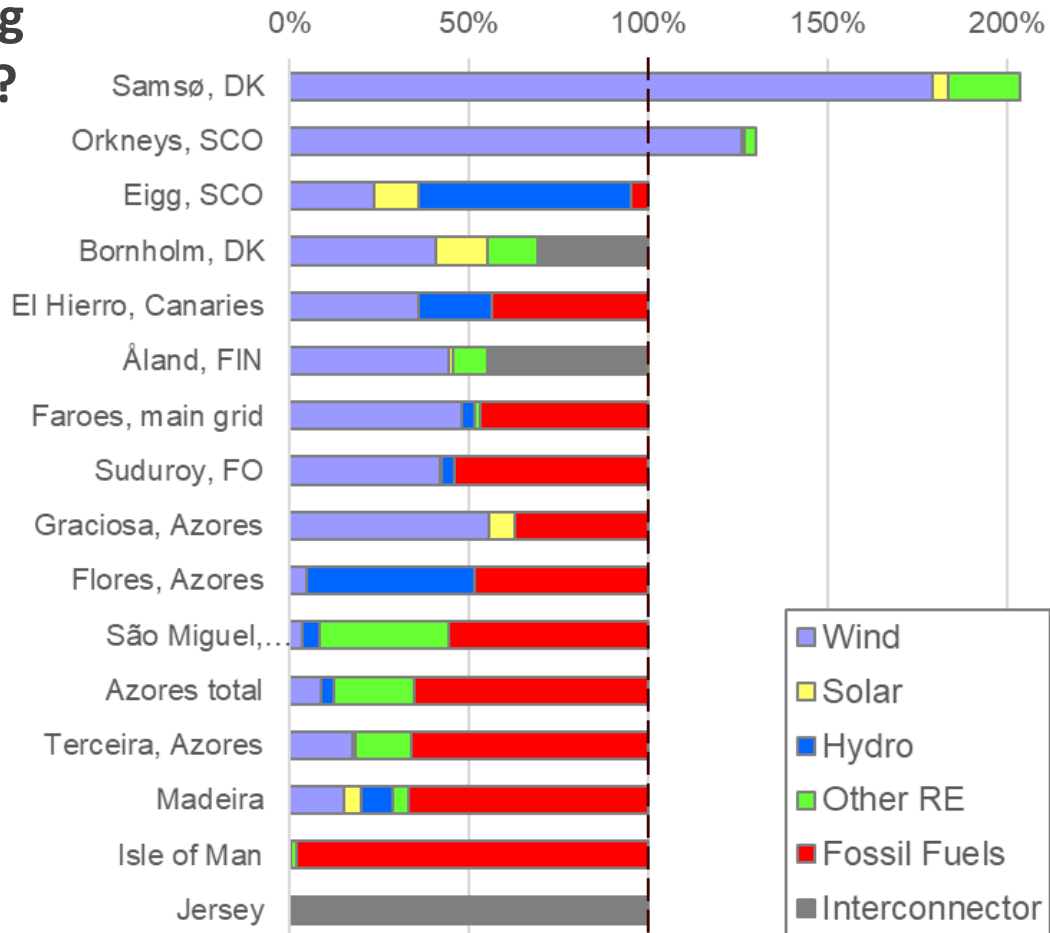


Thanks to John Boucher

What are other islands doing to get to net zero emissions?



Locally generated power relative to electricity demand



Bornholm power system (2022)

Interconnector

Submarine Cable to Sweden

Net import
57.500 MWh

⚡ Export 14.500 MWh
⚡ Import 72.000 MWh

Heatplant Hasle
🔥 51.000 MWh

BOFA Waste Incineration
🔥 50.000 MWh

Powerplant Rønne
⚡ 45.000 MWh
🔥 103.000 MWh

Diesel

Biogasplant
⚡ 16.000 MWh
🔥 13.000 MWh

Large Wind Turbines
⚡ 82.500 MWh

Heatplant Østerlars
🔥 18.000 MWh

PV Plants
⚡ 21.000 MWh

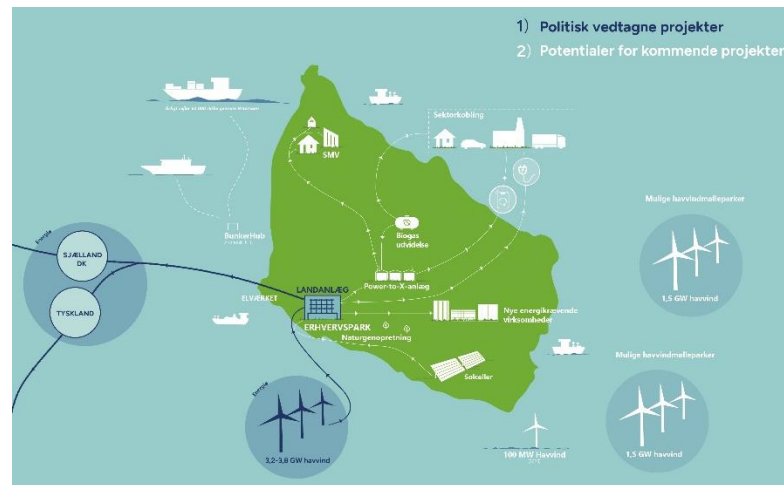
Heatplant Aakirkeby
🔥 19.000 MWh

Heatplant Nexø
🔥 57.000 MWh

Small Wind Turbines
⚡ 700 MWh

Small Rooftop PV
⚡ 10.000 MWh

Heatplants are powered
with local straw & woodchips

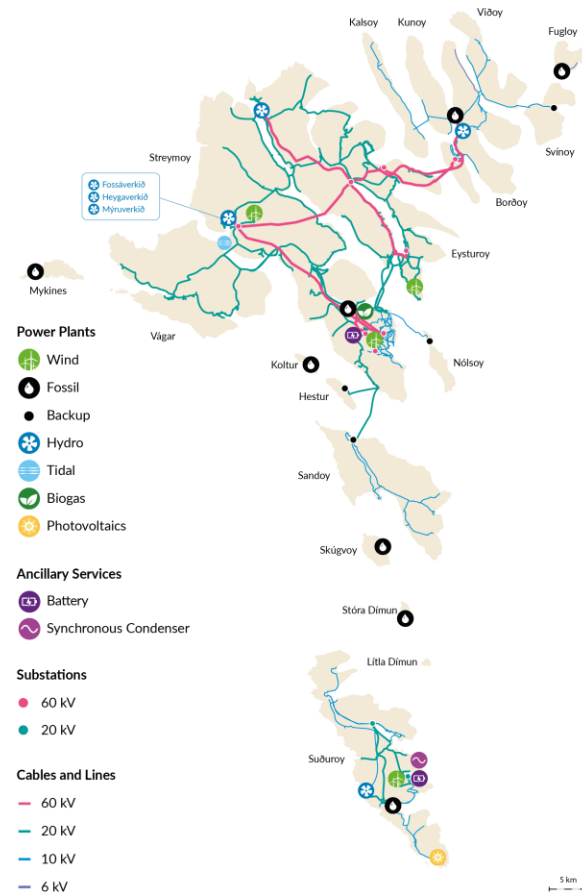
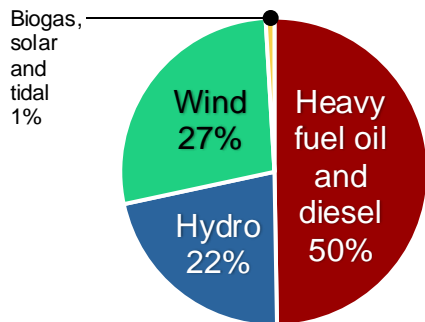


→ Baltic Energy Island

Faroes power system

- Public-owned power company SEV
- 2014 commitment to net zero emissions - 100by2030
- Expansion in wind, solar and energy storage (+ tidal)
- Suðuroy runs frequently on 100% wind after installing batteries & synchronous condenser

Production 2023
458 GWh, 80% Sev



Can the Isle of Man rediscover its innovative spirit?



Isle of Man was pioneering with electricity more than 130 years ago

17 kWh energy from Snaefell \equiv 8 hours total power for 1 Manx person



≥ 1500 Laxey Wheels needed to power the Island

Risk taken by private enterprise

Why change?



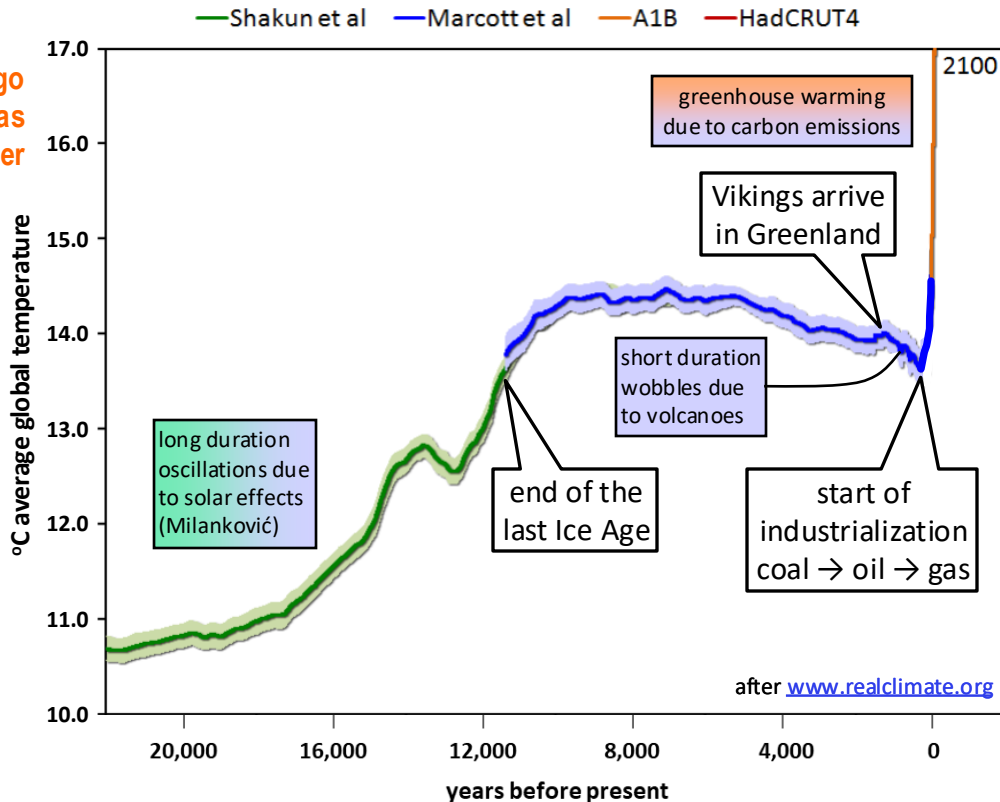
- Lifestyle of an average Manx person produces 18 tonnes CO₂ each year
 - same volume as 54 avg houses
 - the amount of CO₂ absorbed by 1800 trees (~3 Ha, ~7 acres)
 - maturing forest >5x area of IOM
- Pretty bad for a biosphere!
- Error in IOM greenhouse gas inventory?
www.netzero.im/resources/understanding-emissions/

Copenhagen, 2 July 2011 - 150 mm rain in 3 hours



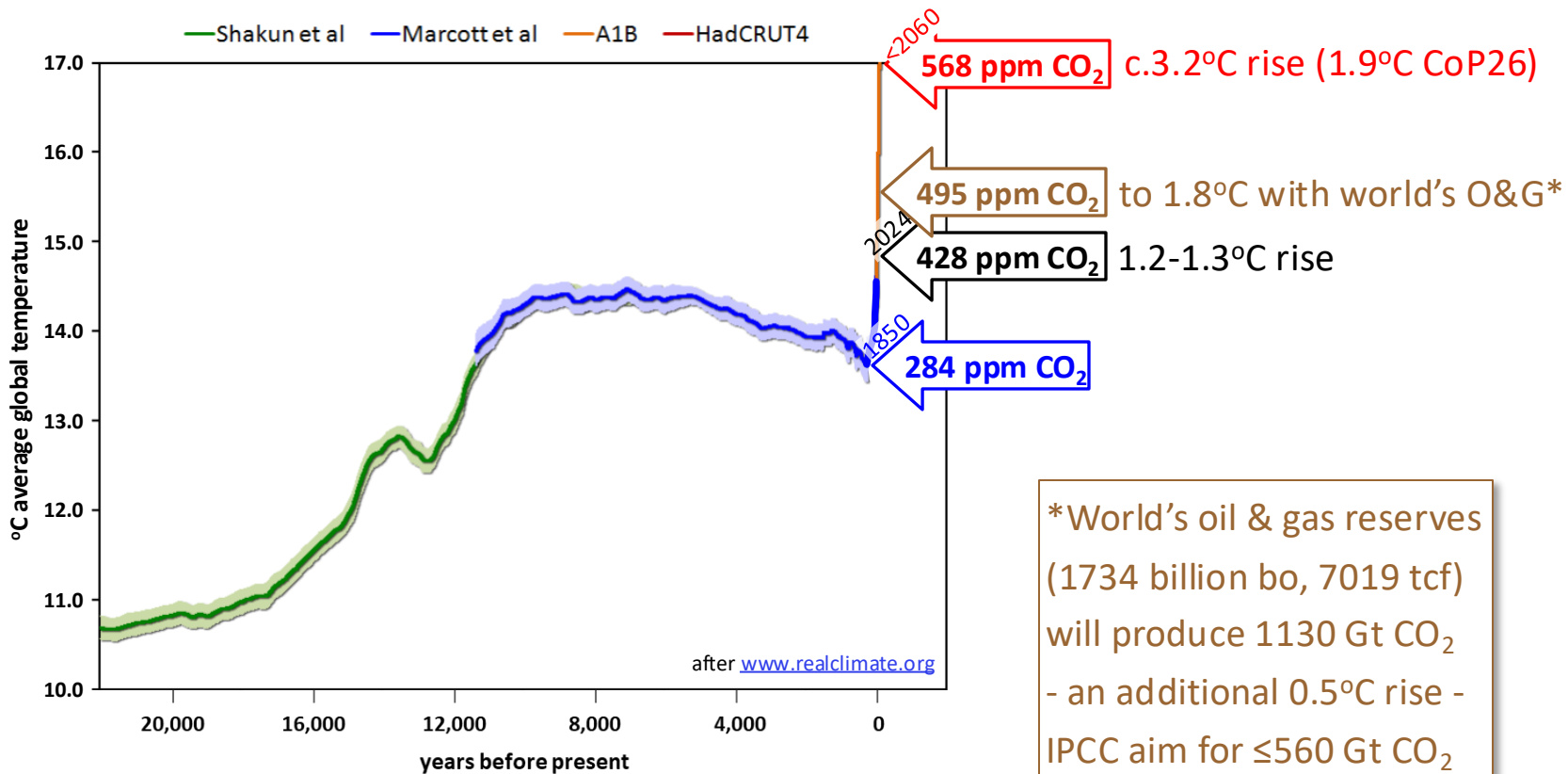
Historical change in global temperature + future projections

125,000 yrs ago
sea-level was
6-9 m higher



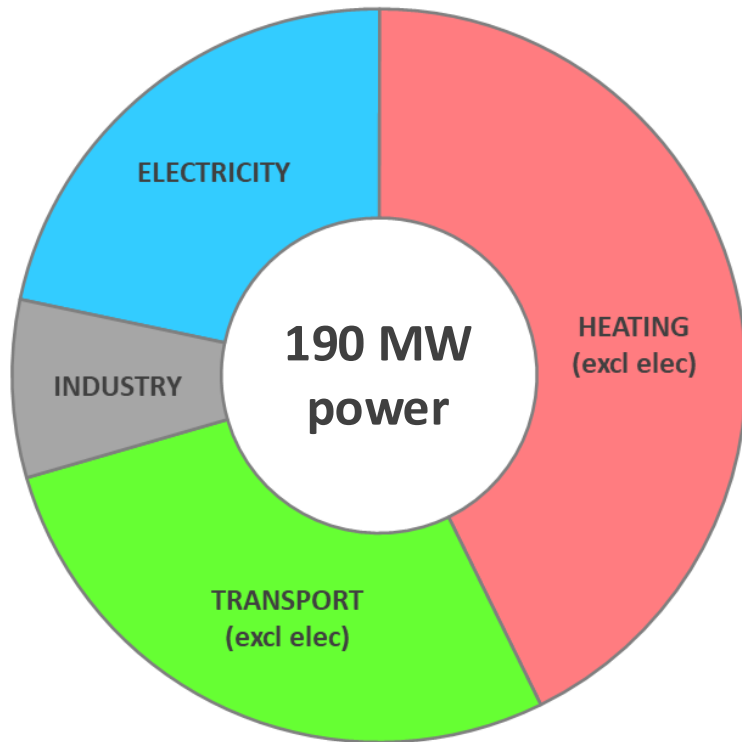
Quirk, D.G., 2021 (www.energysustainabilitycentre.im/knowledge-hub)

Historical change in global temperature + future projections



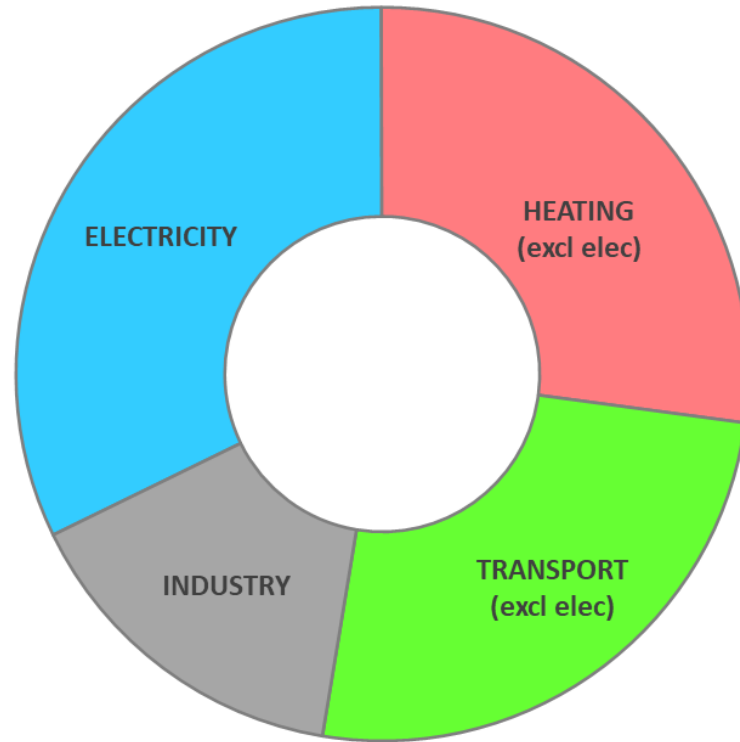
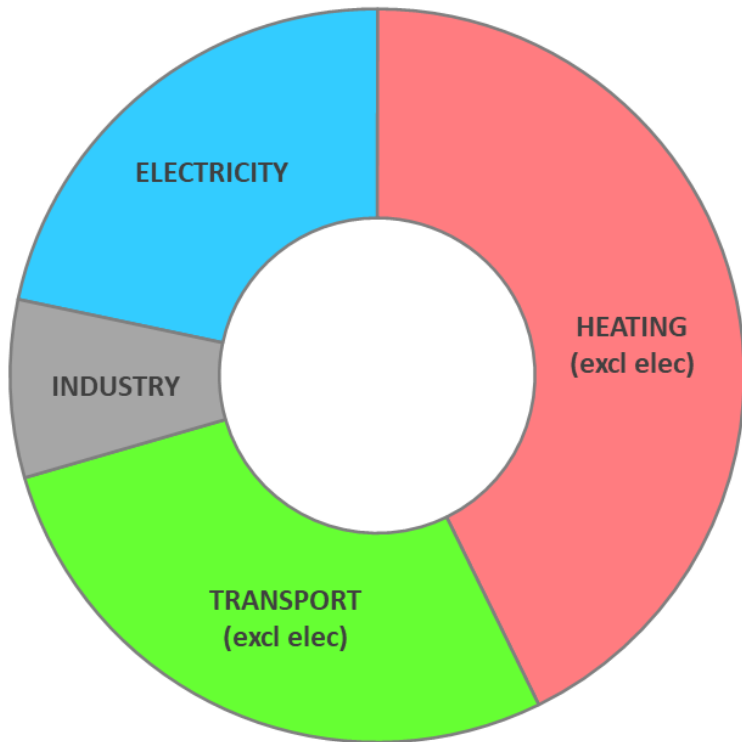
Quirk, D.G., 2021 (www.energysustainabilitycentre.im/knowledge-hub/)

IoM energy consumption – 97% from oil & gas (550,000 t CO₂e/year)



→ 550,000 t CO₂e/year

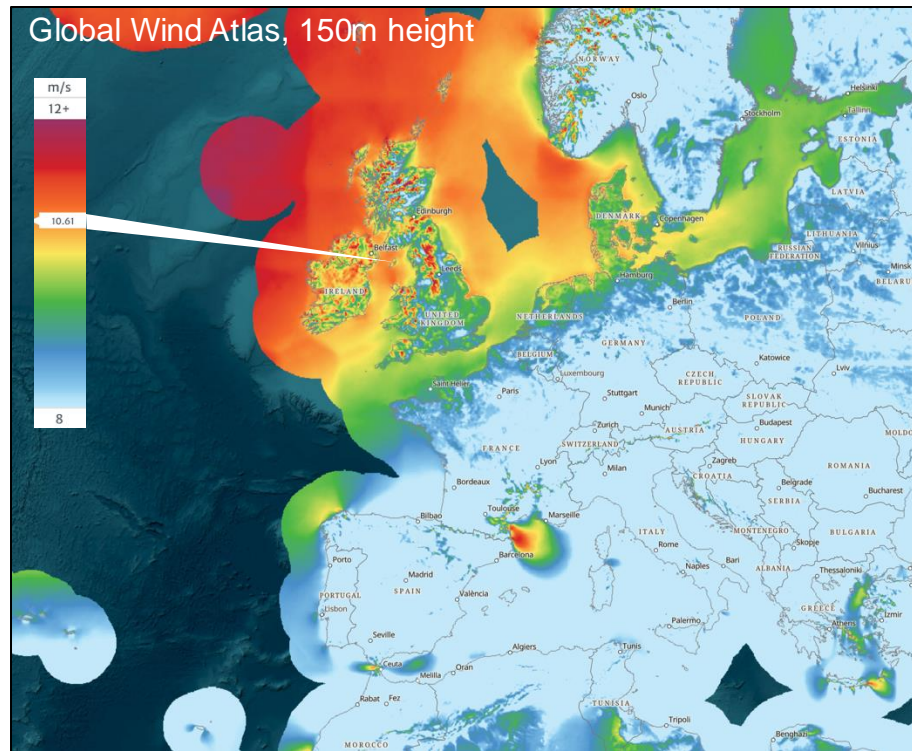
IoM energy consumption – 68% from oil & gas in Denmark



Why Manx renewables?

- Energy security
- Affordability
- Autonomy
- Size of resource
- Low maintenance
- Long lifespan
- Green economy
- Climate friendly

Choose clever = own resources



Beware the distractors – Paul Burgess, geothermal, gas, small reactors, bird strikes

Can wind turbines replace fossil fuels?

10 MW wind turbine compared to 4 MW oil



Statkraft



40% capacity factor

1.3 million bbl oil

- Over a period of 25 years
 - Equal electricity (900 GWh)
 - Oil: 550,000 t CO₂; Wind: <15,000 t CO₂
 - Oil: £90 million for fuel

The Burning Question: Why don't we run the island entirely on wind?

With new evidence of the value of wind power on the Isle of Man, could this natural resource meet all our needs? We asked the experts at ESC (Energy & Sustainability Centre Isle of Man) for their view.

Wednesday 15th May 2024 5:30 pm

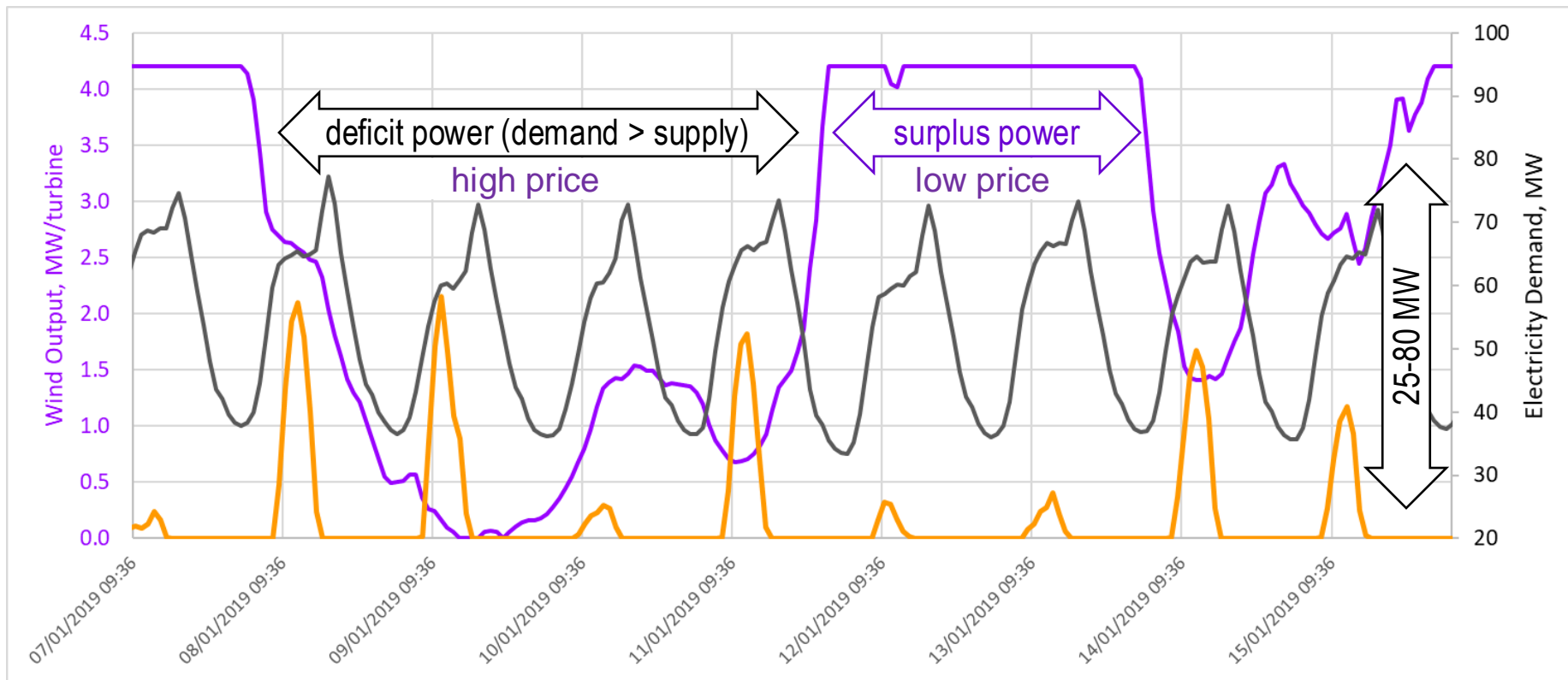
SHARE



(ESC)

www.iomtoday.co.im/-environment-news/the-burning-question-why-dont-we-run-the-island-entirely-on-wind-686746

Nine days in January – electricity demand, wind power, solar power

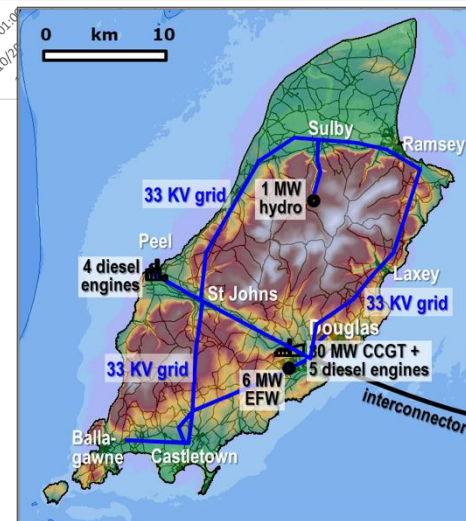


Supply/demand mismatch with 100 MW wind, 40 MW solar

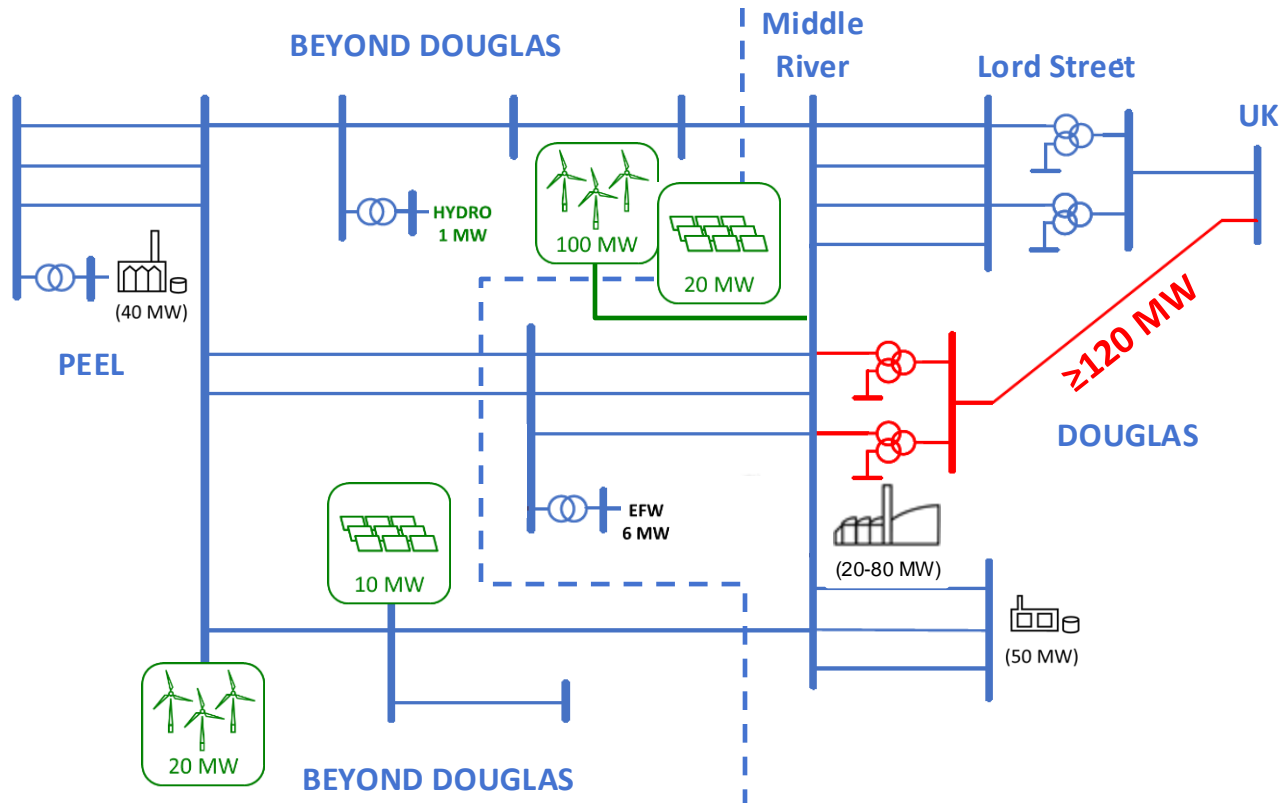
Exported electricity & imported electricity: Step 1D IoM EnergyPLAN model - 100 MW wind, 40 MW solar



Only 65% of renewable energy can be used when generated...
 if 120 GWh surplus is exported, 120 GWh has to be imported...
 whilst electricity grid is not built to transmit renewable energy
 - hence plan to import 70% of current electricity demand

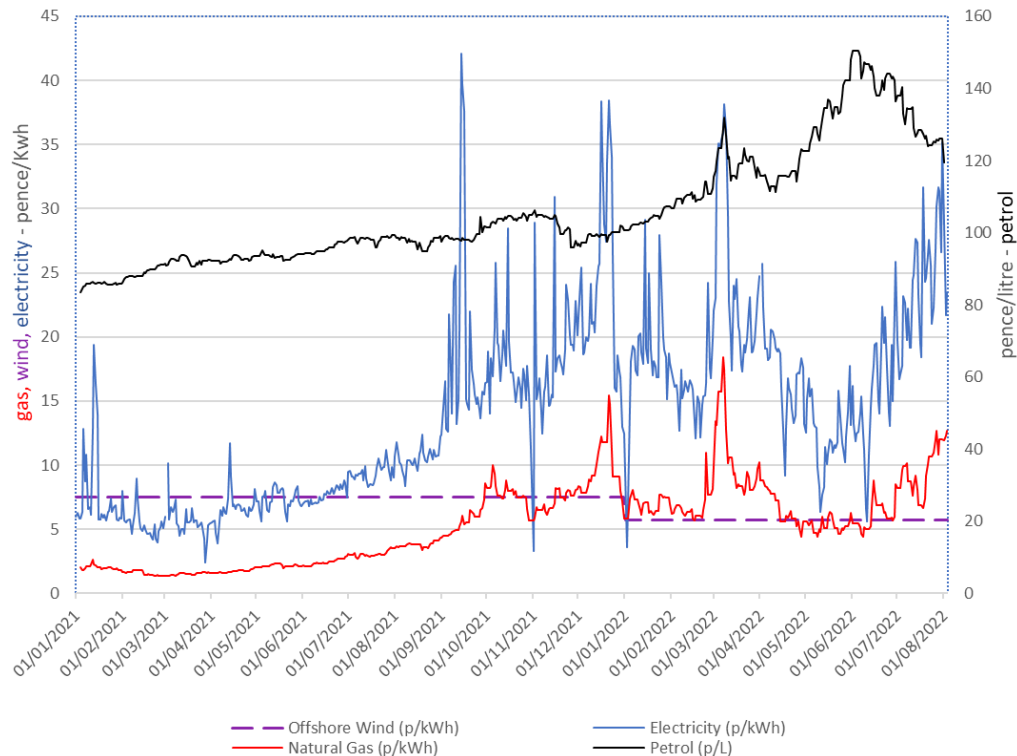


What an Island running on renewable energy could look like

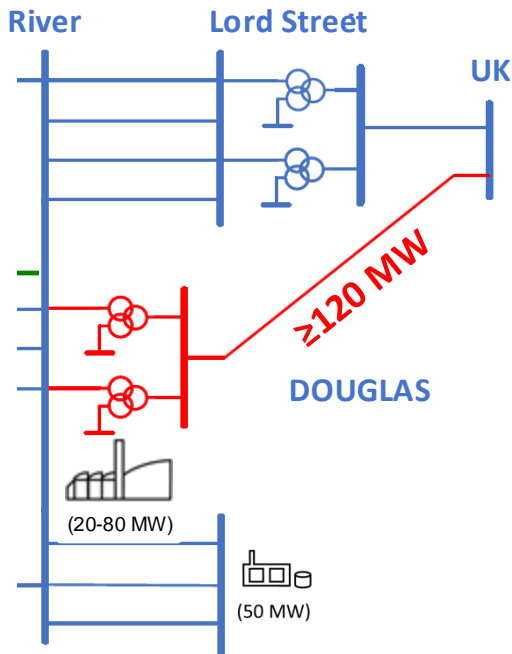


What an Island running on renewable energy could look like

Wholesale gas, wholesale electricity & petrol pump prices compared to wind, 2021-22

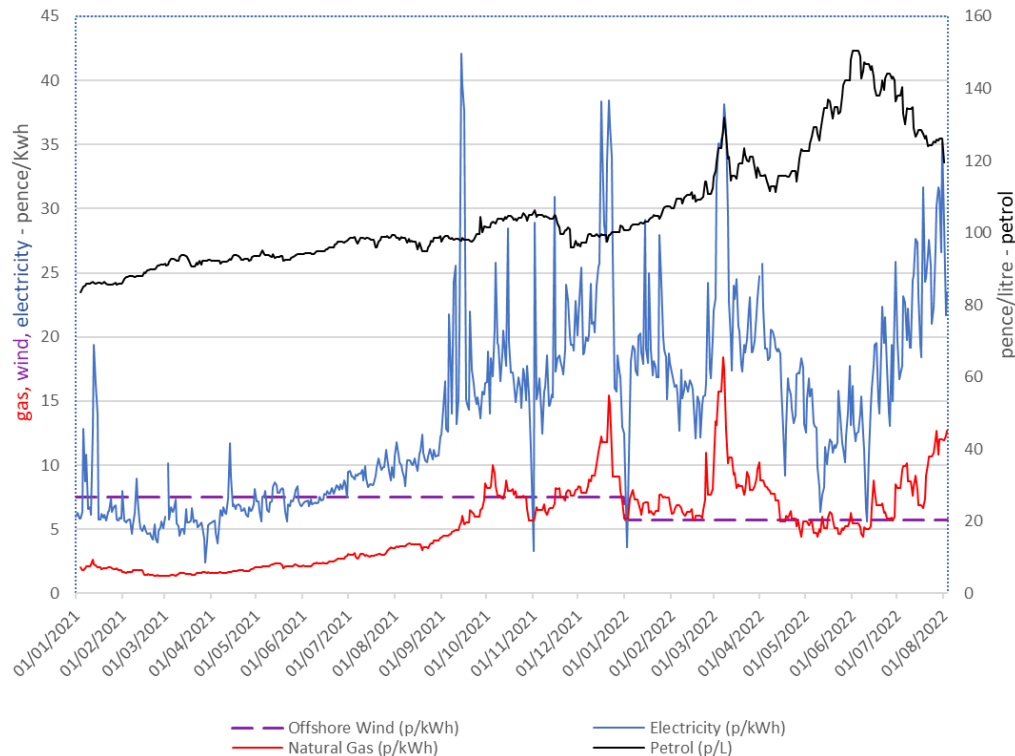


Middle

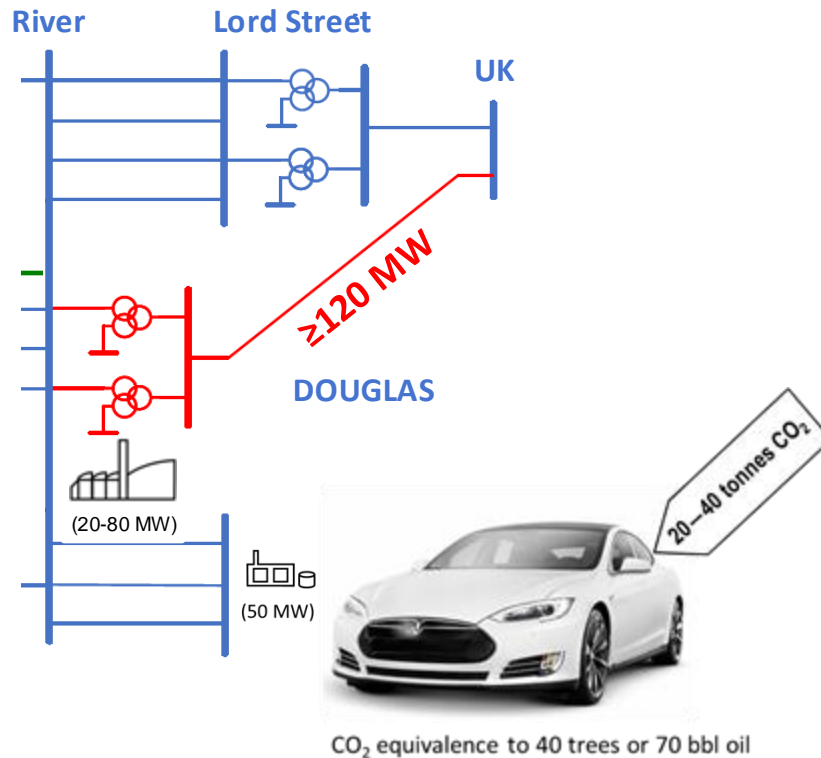


What an Island running on renewable energy could look like

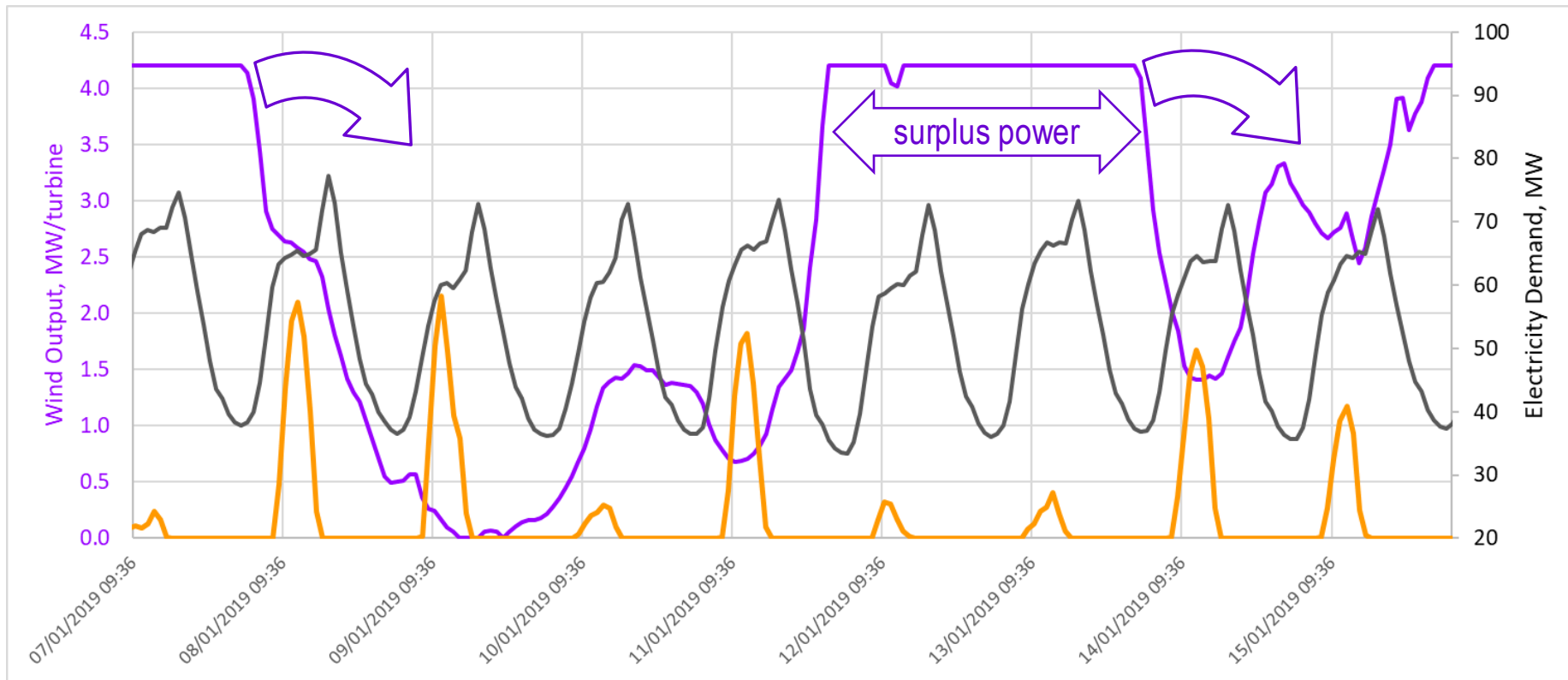
Wholesale gas, wholesale electricity & petrol pump prices compared to wind, 2021-22



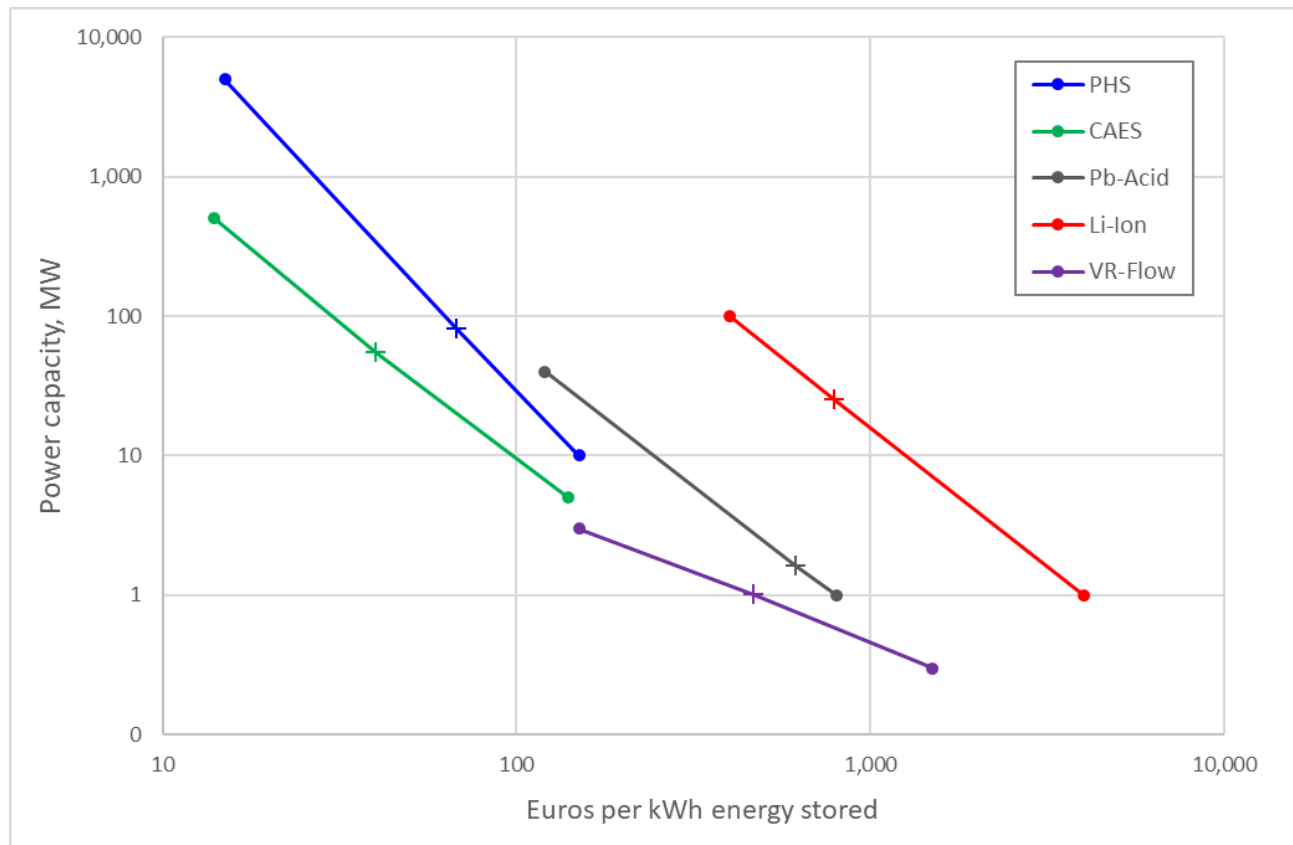
Middle



Nine days in January – electricity demand, wind power, solar power



Energy storage options – power versus cost per kWh



Pumped Hydro Storage
Compressed Air Storage
Lead Acid Batteries
Lithium Ion Batteries
Flow Batteries

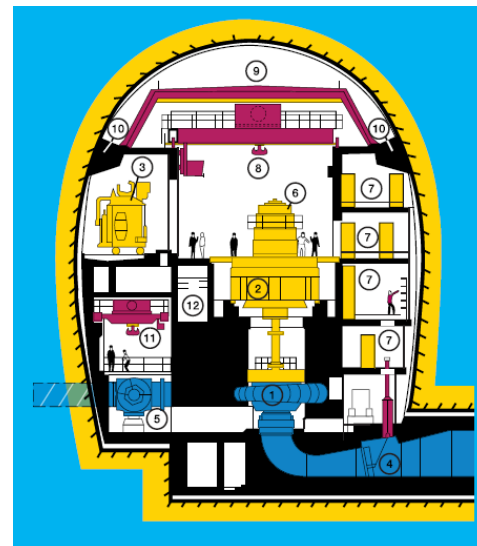
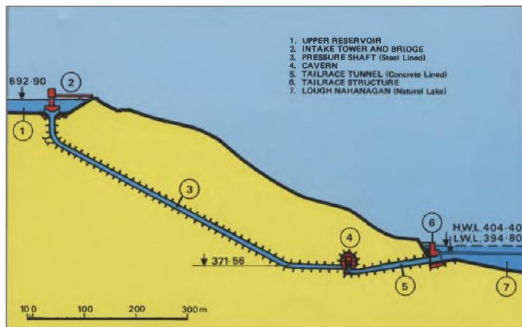
Turlough Hill – Ireland's main energy storage facility since 1974



**292 MW for 6 hrs,
286m head, 6 turbines
2.6 million m³ water
75% roundtrip efficiency
DKK 1.9 billion motoday**

**Currently working with
4 islands on pumped
hydro storage solutions**

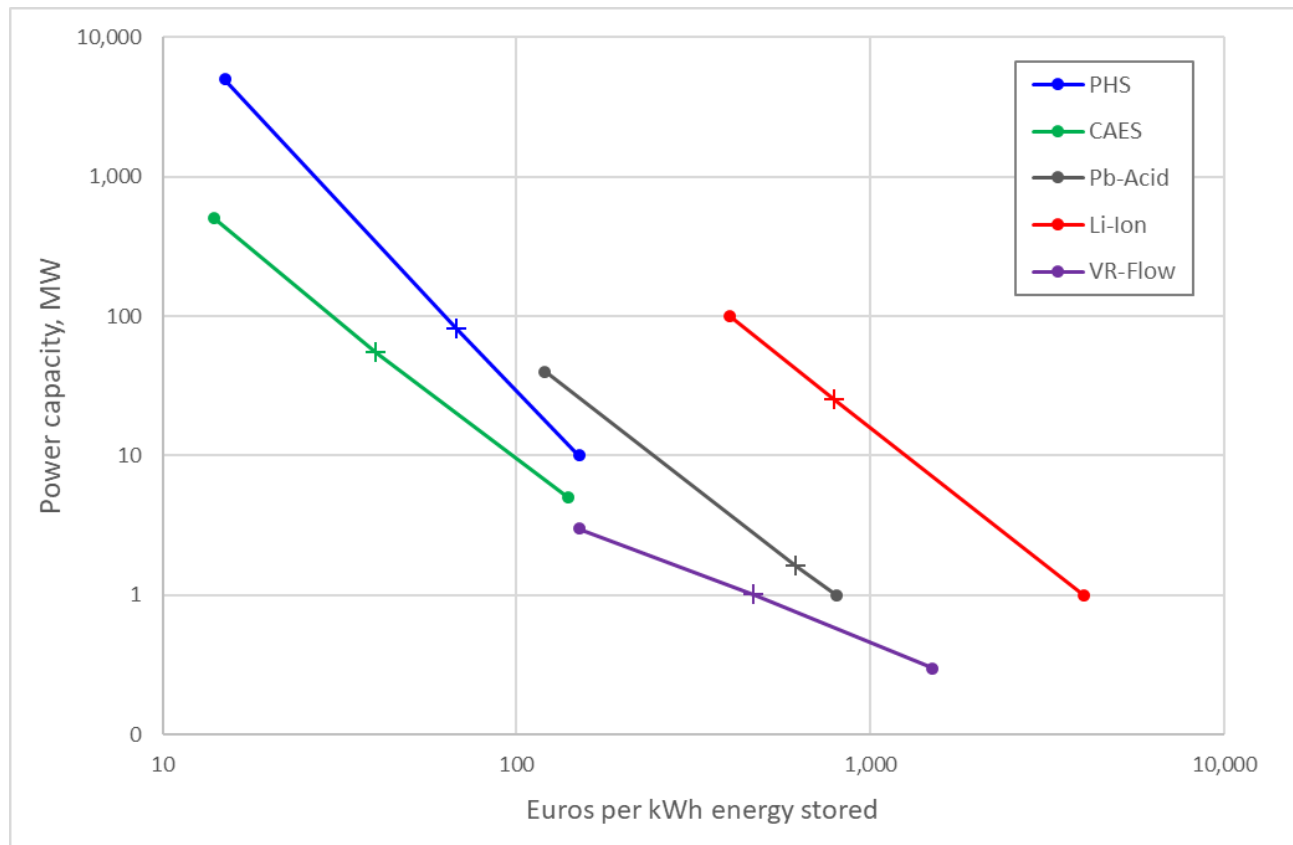
Turlough Hill – Ireland's main energy storage facility since 1974



Cross-section view of cavern

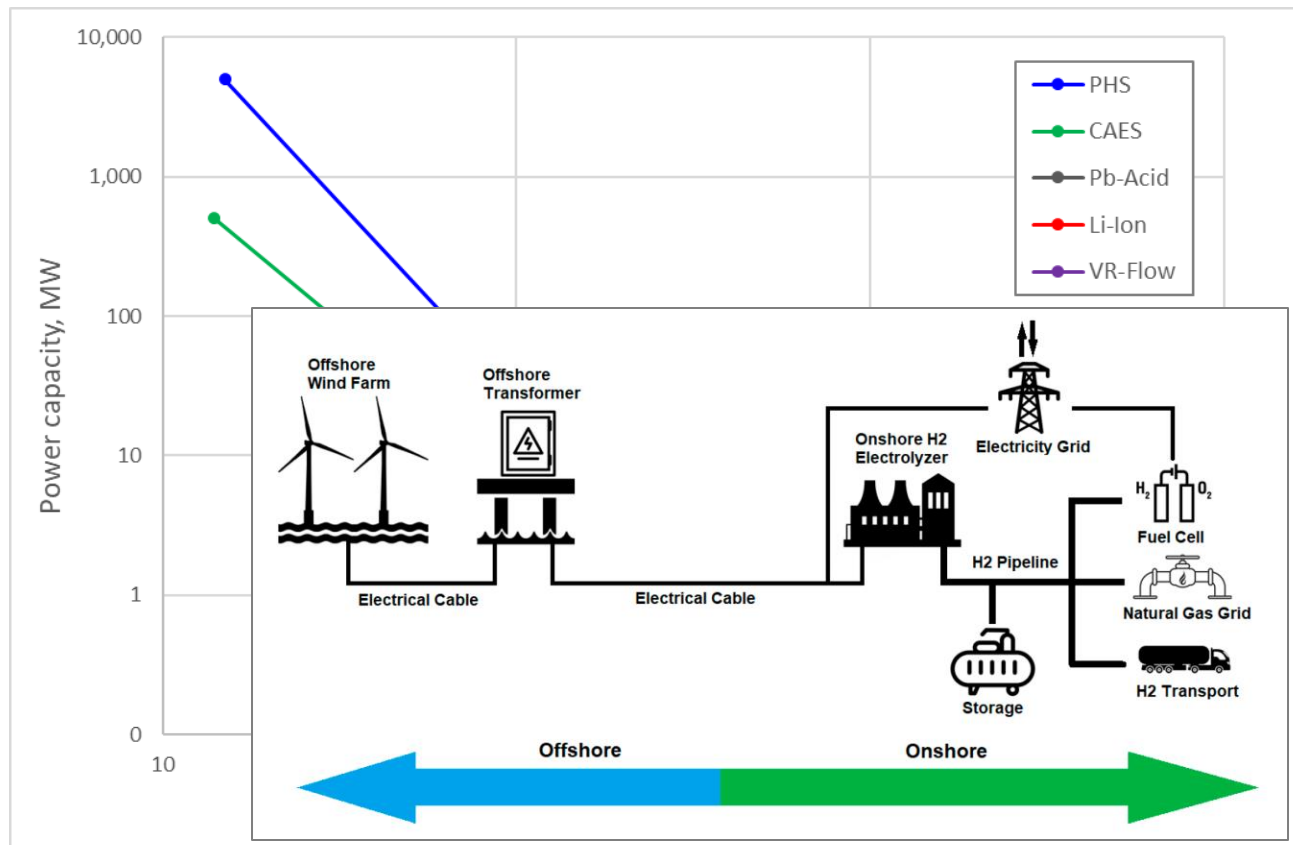
1. Pump Turbine
2. Motor/Generator
3. Main Unit Transformer
4. Flap Gate
5. Turbine Inlet Valve
6. Pony Motor/Generator
7. 10 kV Switchgear, Control Panels and Relays
8. 2 x 70 ton Bridge Cranes
9. False Roof with Soundproofing
10. Haunch Beams
11. 50 ton Bridge Crane
12. Cable Gallery for 220 kV Cables

Energy storage options – power versus cost per kWh



Pumped Hydro Storage
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Energy storage options – power versus cost per kWh



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Electrolysis → Hydrogen

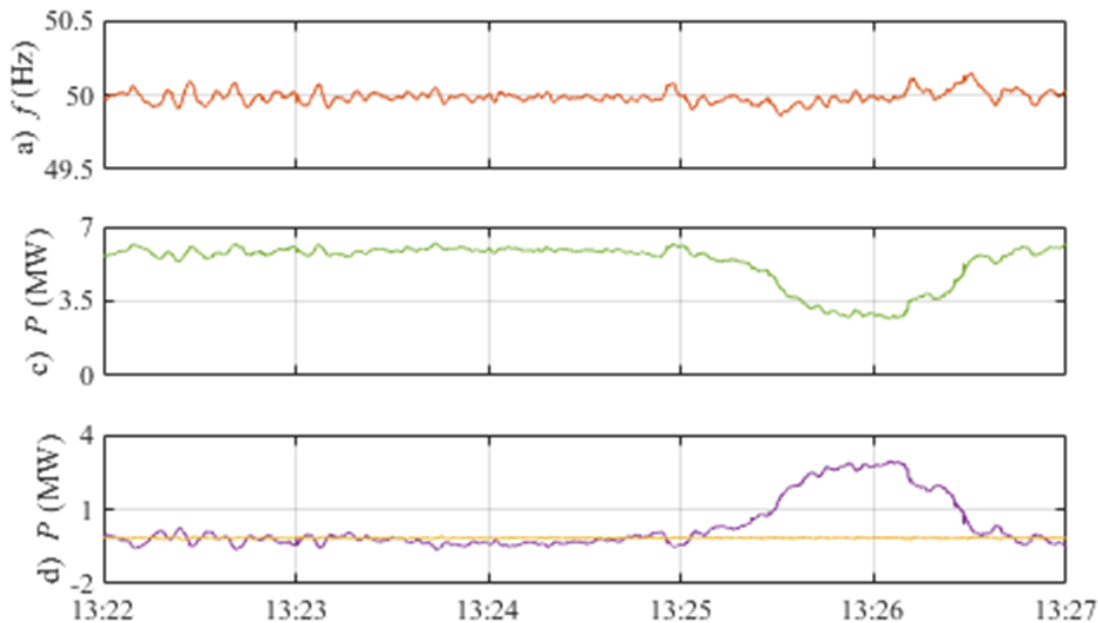
Variations in power can destabilise frequency & voltage



Stabilised with batteries + electronics (+/- synchronous machine)



Stabilised with batteries + electronics (+/- synchronous machine)



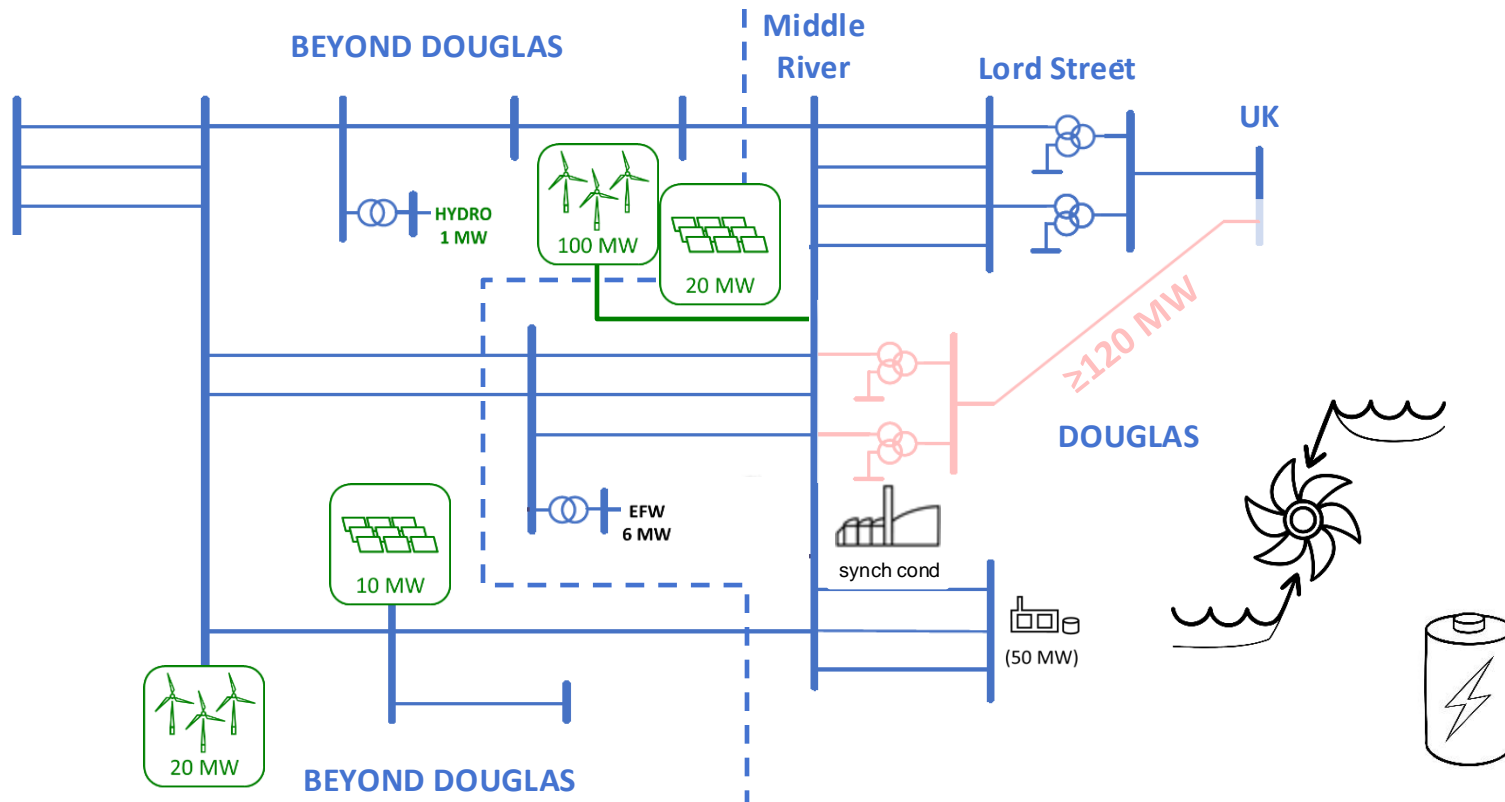
grid frequency

wind power

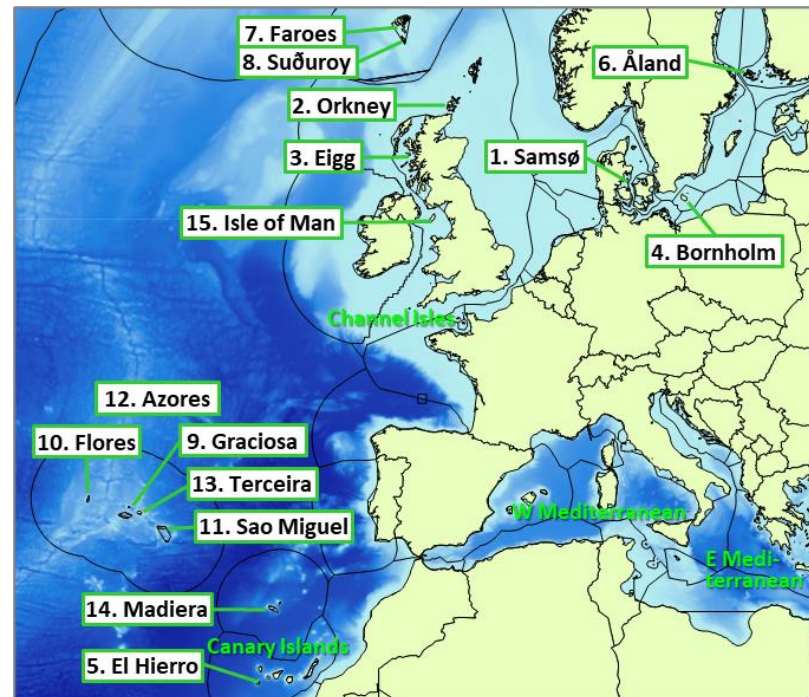
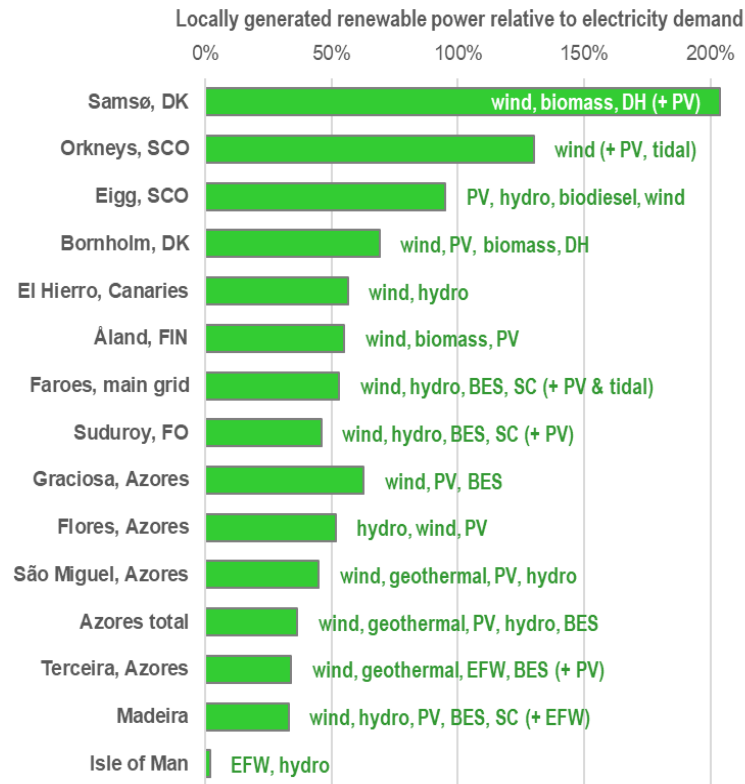
20-120 MWh for IoM
battery power

synchronous cond

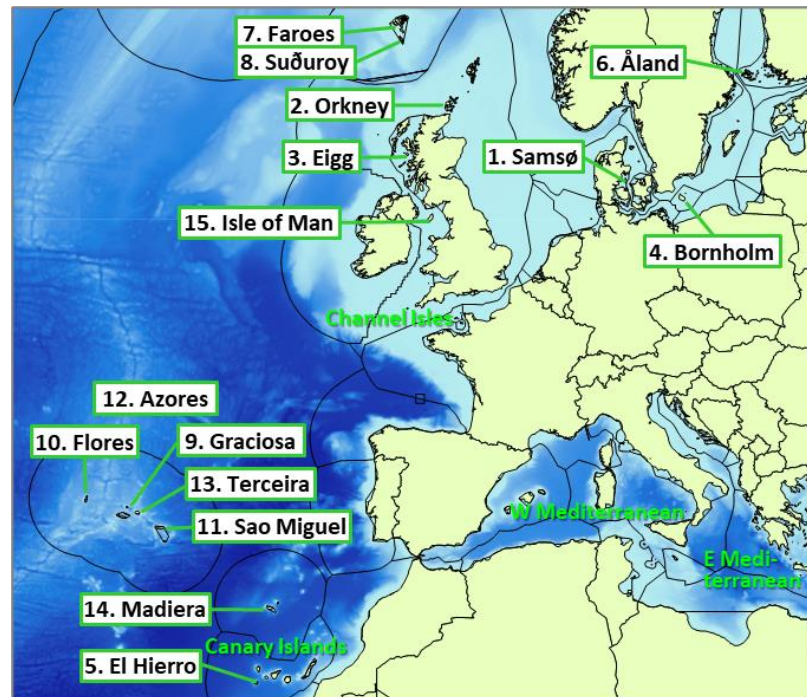
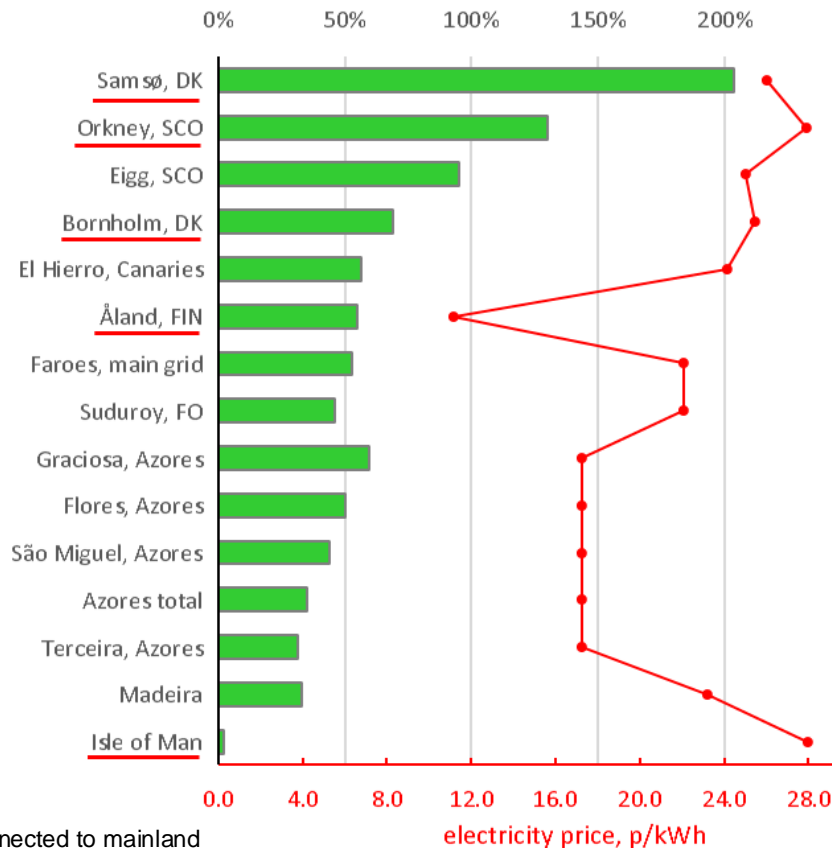
IOM grid needs upgrading for wind & solar



How do investments in renewables affect electricity prices?



Locally generated power + price



Isle of Man EnergyPLAN model – 100 MW wind + 40 MW PV + BES



25%-40% cheaper, 155,000 tonnes CO₂ saving


Conclusions – the Island will thrive with renewable energy

- Action needed for **independent, sustainable energy** – choose clever, limit imports
- Developing wind & solar is straightforward – especially for **private sector**
- The lights won't go out with renewable energies... with grid-scale **energy storage**
- Public engagement is crucial – **include the community** in decisions & benefits

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- The lights won't go out with renewable energies... with grid-scale **energy storage**
- Public engagement is crucial – **include the community** in decisions & benefits
- Issues:
 - Skills gap
 - Habits (heat)
 - Reluctance to change (e.g. car)
 - Vested interests (fossil fuels)
 - Engage farmers (& check landuse emissions)

Conclusions – the Island will thrive with renewable energy

- Action needed for **independent, sustainable energy** – choose clever, limit imports
- Developing wind & solar is straightforward – especially for **private sector**
- The lights won't go out with renewable energies... with grid-scale **energy storage**
- Public engagement is crucial – **include the community** in decisions & benefits
- Develop the model, decide the rules, **build the infrastructure** & welcome investors
- Don't forget **heating & transport** (75% of power) – need joined-up strategy
- Done right, all will benefit & the **economy will flourish**... without 100,000 residents
- IoM efforts are important – lead by example, feel proud, save money, **feel secure**
- Release of **Island Power App**  with Imogen Bhogal at Gaiety Theatre on 7 Nov