Faroe Islands

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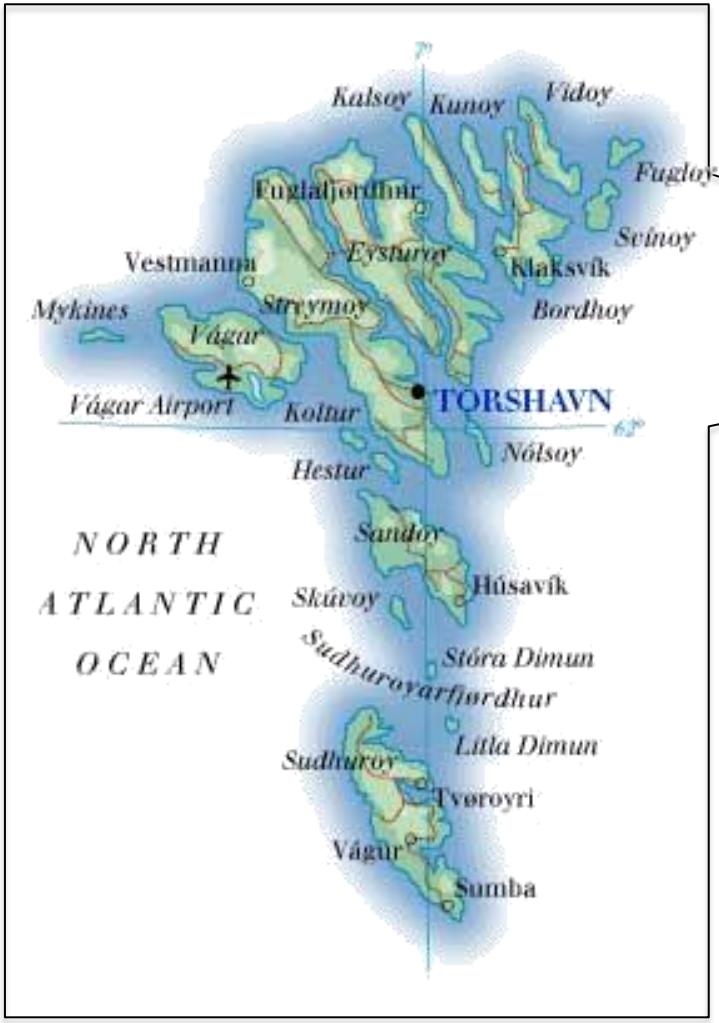
Large share of wind power
Challenges and innovative solutions

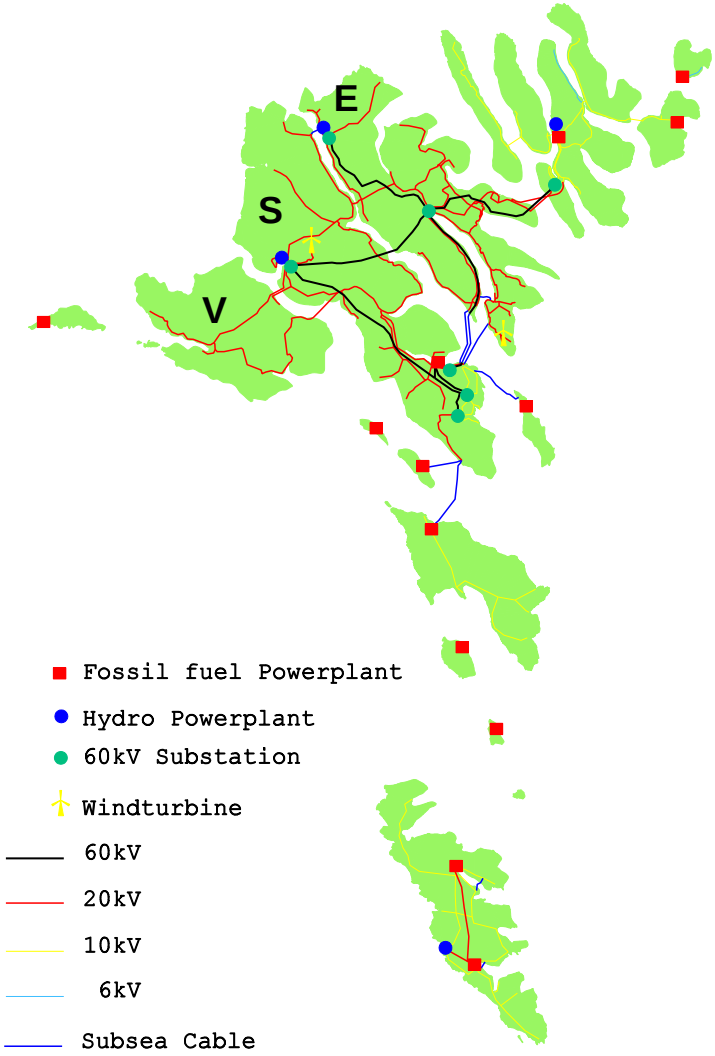
Twenties Demo 2 Lead Anders Birke, DONG Energy

The Faroe Islands are remotely located



- 18 islands
- 49.000 inhabitants
- Main export: Fish and fish products

Power system stability was further challenged when the Faroe Islands went from 5% to 25% wind power in 2 years (2012-2014)



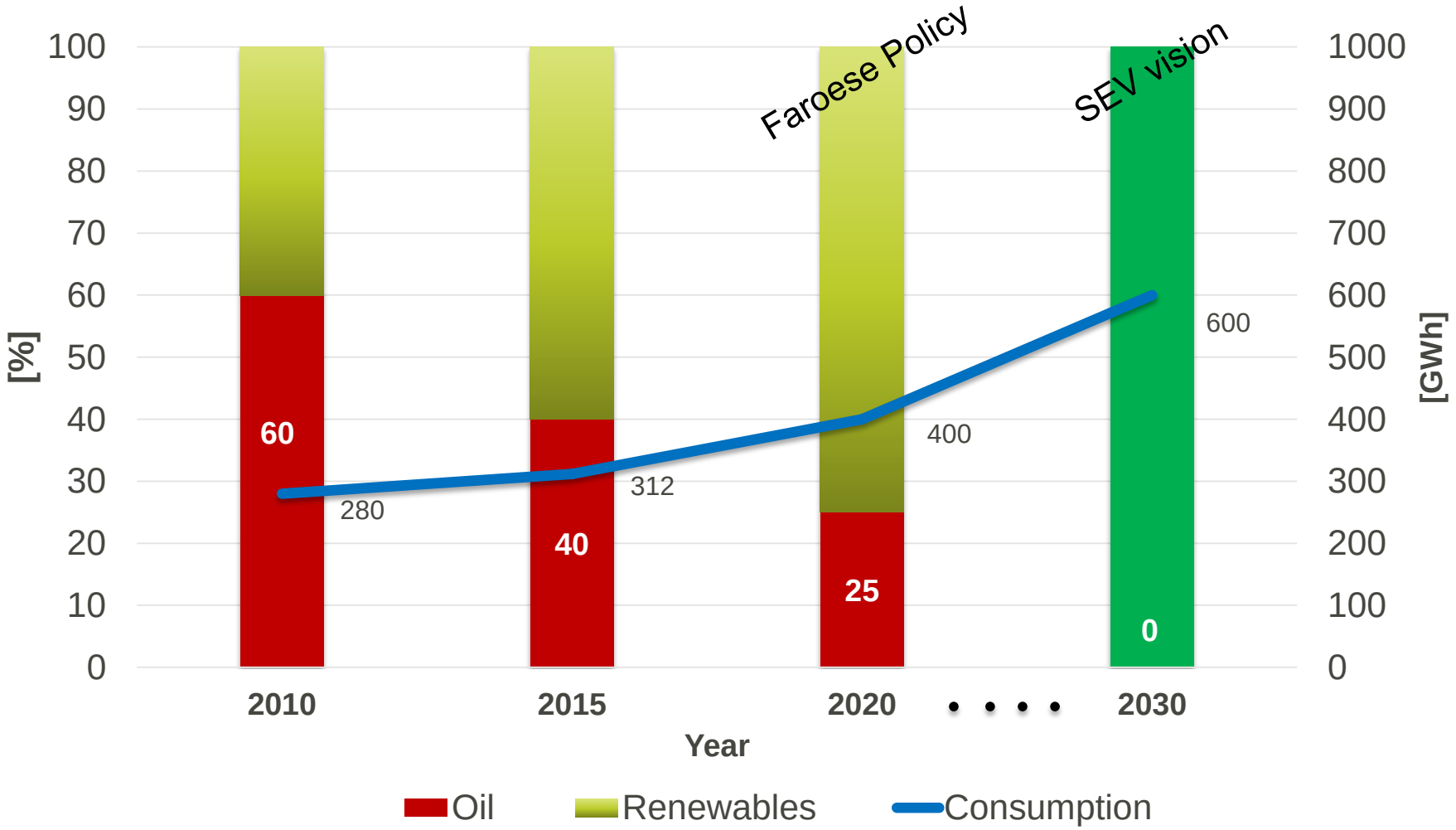
Power system basics:

- Isolated power system
- Peak production 45 MW
- Annual electrical production 305 GWh
- A non subsidized island power system

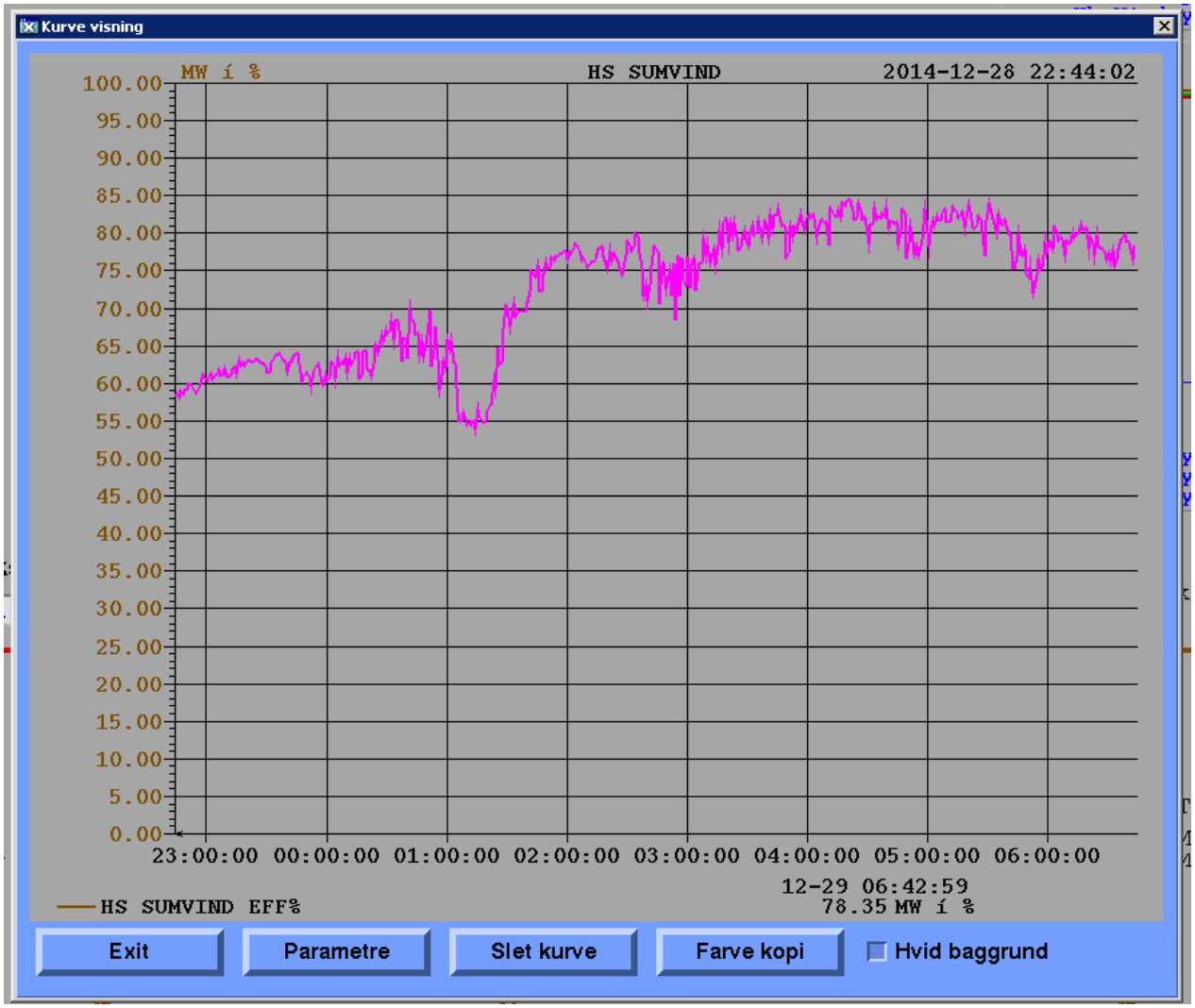
Operational challenges:

- Few power plants
- Extreme weather conditions
- Unpredictable weather (“The land of maybe”)
- High share of wind power

Green leadership from SEV and Faroese government



>80% wind penetration for hours

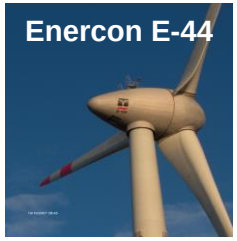


Innovative solutions to cope with the challenges (now)

Operational solutions

Highly advanced but small wind turbines

- Operate at higher wind speeds
- Ramps down slowly in case of a storm
- Can be set to a fixed output
- Can deliver frequency support



Sub second demand response

- The VPP Power Hub can shed loads from 3 industries (½-1 sec.) (4MW)

Emergency gensets supplying the grid

- The VPP controls gensets in 2 industries that are connected to the grid (20 sec.) (2MW)

Improved wind and hydro forecasts

New operational practices

Innovative solutions to cope with the challenges (the future)

Solutions under development

Battery at wind park

- To cope with the intra hour small variations in wind production (2MW)

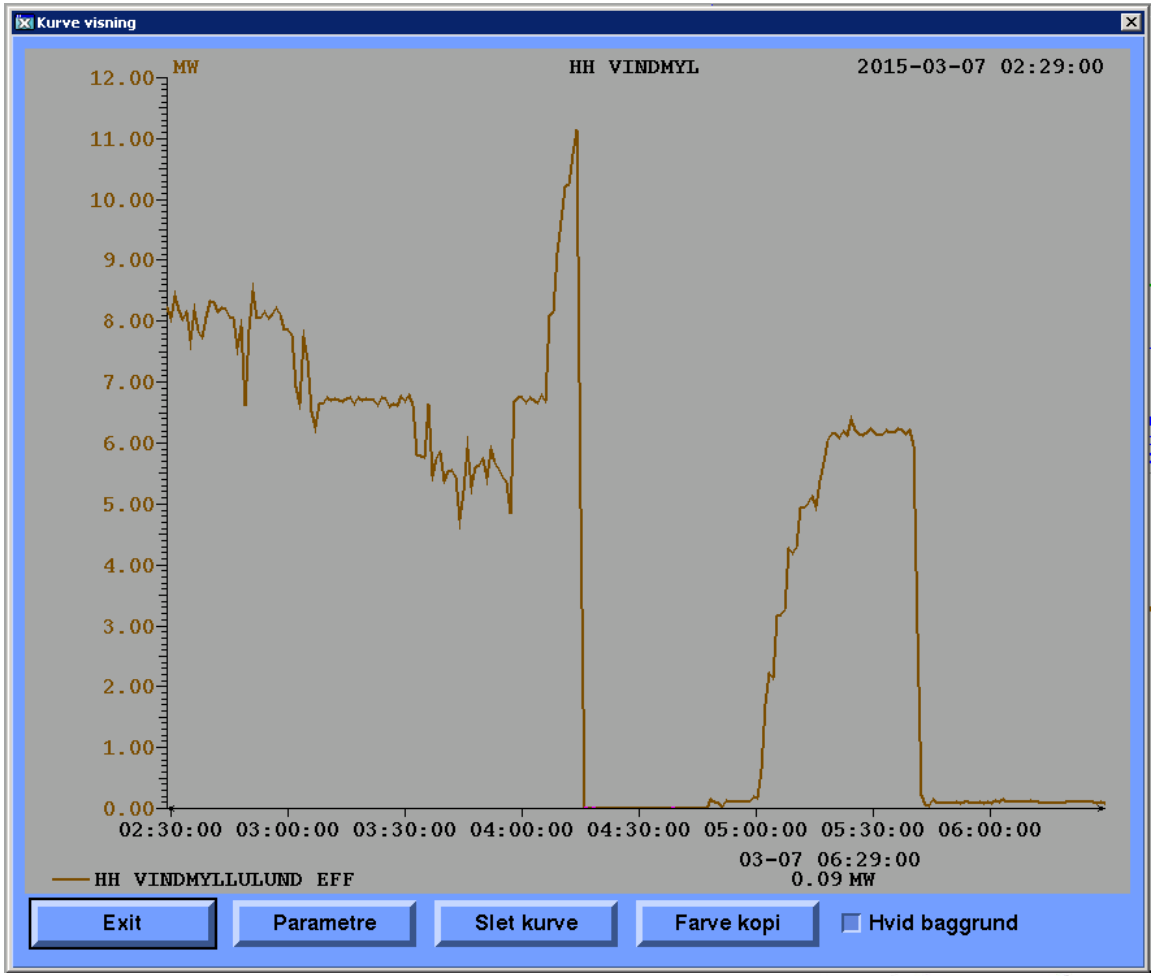
New Advanced DMS – Intelligent dispatch and control

- Better control/visibility of all units
- From manual to more automatic control
- Planning for total optimization (consumption, wind/hydro/oil generation, reserves, the grid, …)

Likely future solutions

Large scale battery storage, Synchronous condenser , Electric boiler in the district heation system, Heat pumps in households, EV´s, More wind power and maybe tidal and solar power

Black outs do still happen
Example: Unexpected wind speed change
from 15m/s to 32m/s in 90 sec.



Questions

Anders Birke, Twenties Demo 2 Lead

Neshagi Wind farm

Project specification:

- *3 pcs ENERCON E44/900kW (2,7MW)*
    - *Capacity factor: 45%*
- *Annual production: 10,6 GWh*
- *Building phase: 2012*

Economical figures:

- *Total cost: 3.5 M€*
- *Oil savings: 2.300 ton/year*
    - *more than 1,4 M€/year*

Carbon footprint:

- *Annual CO_2 reduction: 7.000 ton*

Húsahagi Wind farm

Project specification:

- *13 pcs ENERCON E44/900kW*
- *Capacity factor: 42%*
- *Annual production: 41 GWh*
- *Building phase: 2013-2014*

Economical figures:

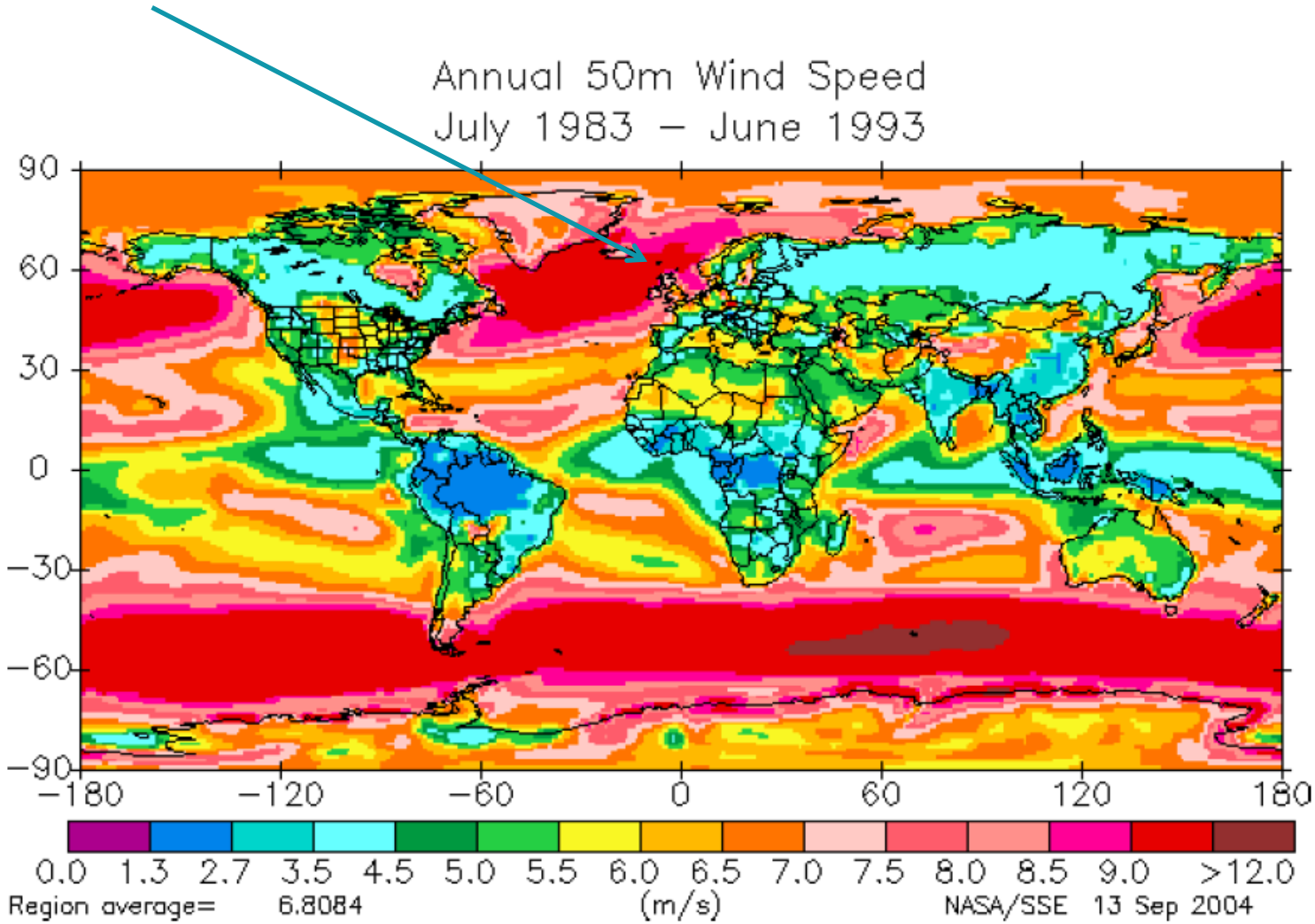
- *Total cost: 13.6 M€*
- *Oil savings: 8.000 ton/year*
    - *approximately 4 M€/year*

Visualization

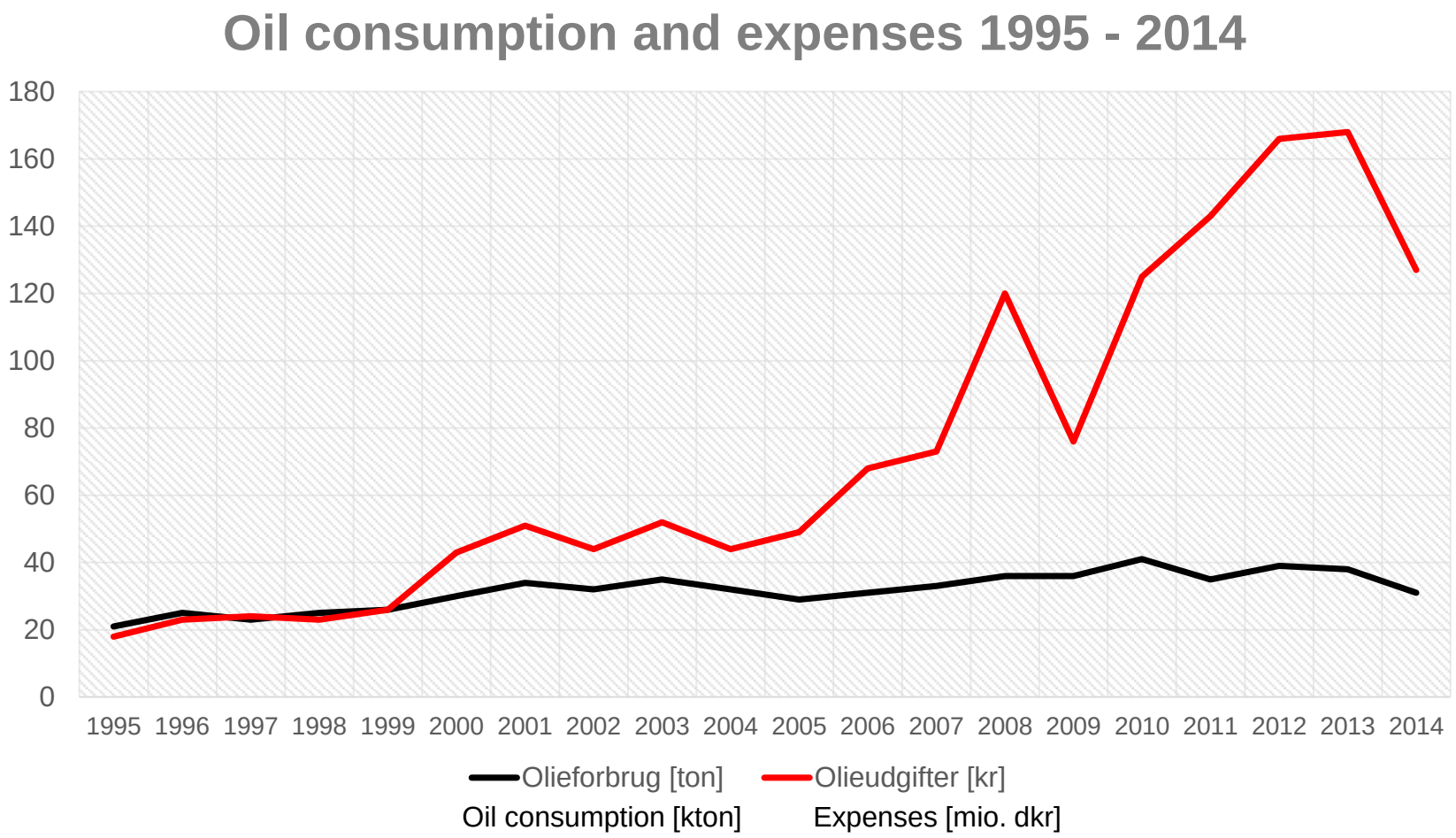
Carbon footprint:

- *Annual CO_2 reduction: 33.000 ton*

The Faroe Islands has some of the worlds best wind resources



SEV is challenged by the cost of the oil based power production



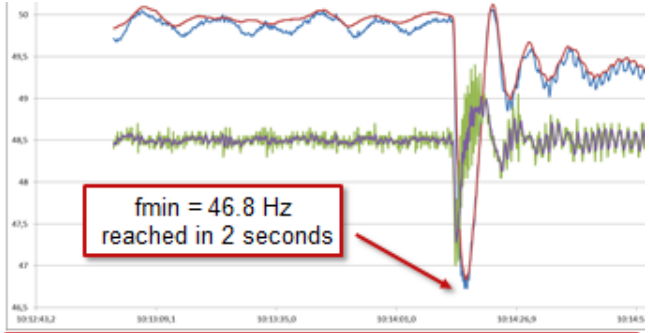
The Faroe Islands has a high number of blackouts compared to continental Europe

The Faroe Islands power system is small and vulnerable

The islands has a small and vulnerable power system with a high number of blackouts compared to continental Europe (1-3 total blackouts yearly). They only have a few power plants, no interconnectors to other countries and harsh weather conditions with frequent storms.

The Faroe Island power system can collapse in a few seconds

In case of failure at a power plant or a sudden drop in the wind power generation the frequency can drop many times faster than in Europe. Loosing only one generator is the same as loosing a large percentage of the production. SEV has to keep a large spinning reserve and many power plants running at low capacity to keep the security of supply, but this comes at the cost of an extra high fuel consumption.



Response times (for comparison)	50 %	100%
West Denmark:	15 s	30 s
East Denmark:	5 s	30 s