Blick über den Tellerrand - Die Färöer Inseln

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Dipl.Ing. E.E. (Hons)

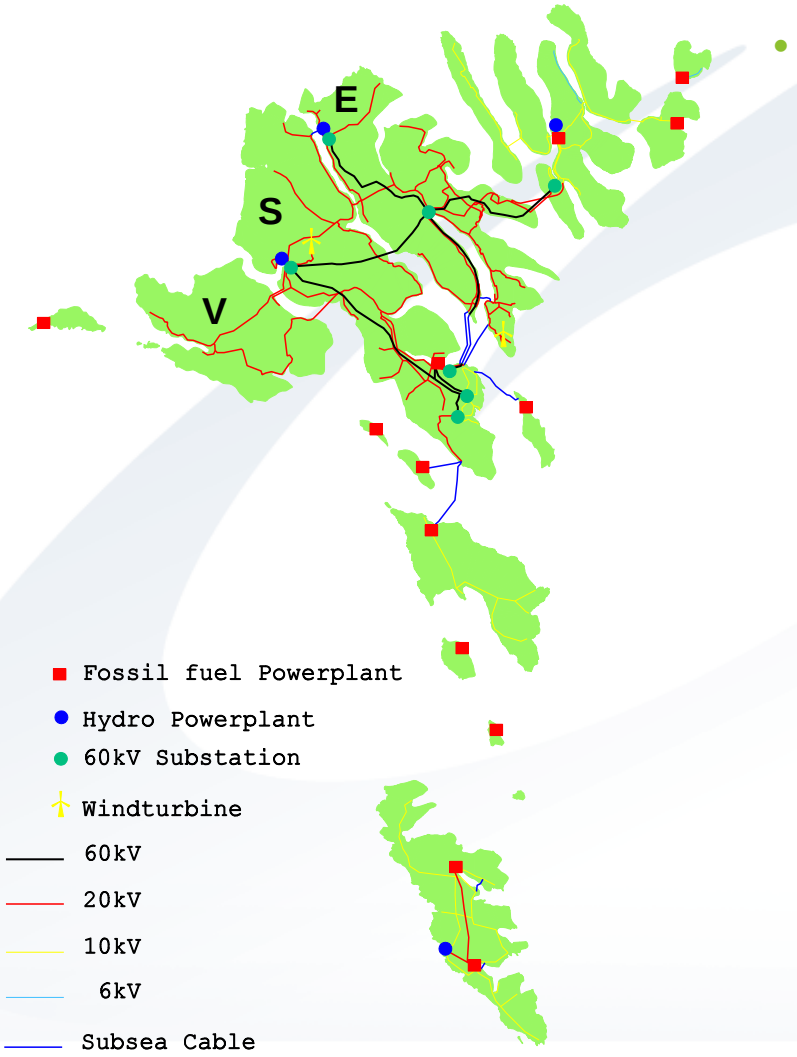
MBA Renewables

Faroe Islands

Faroe Islands

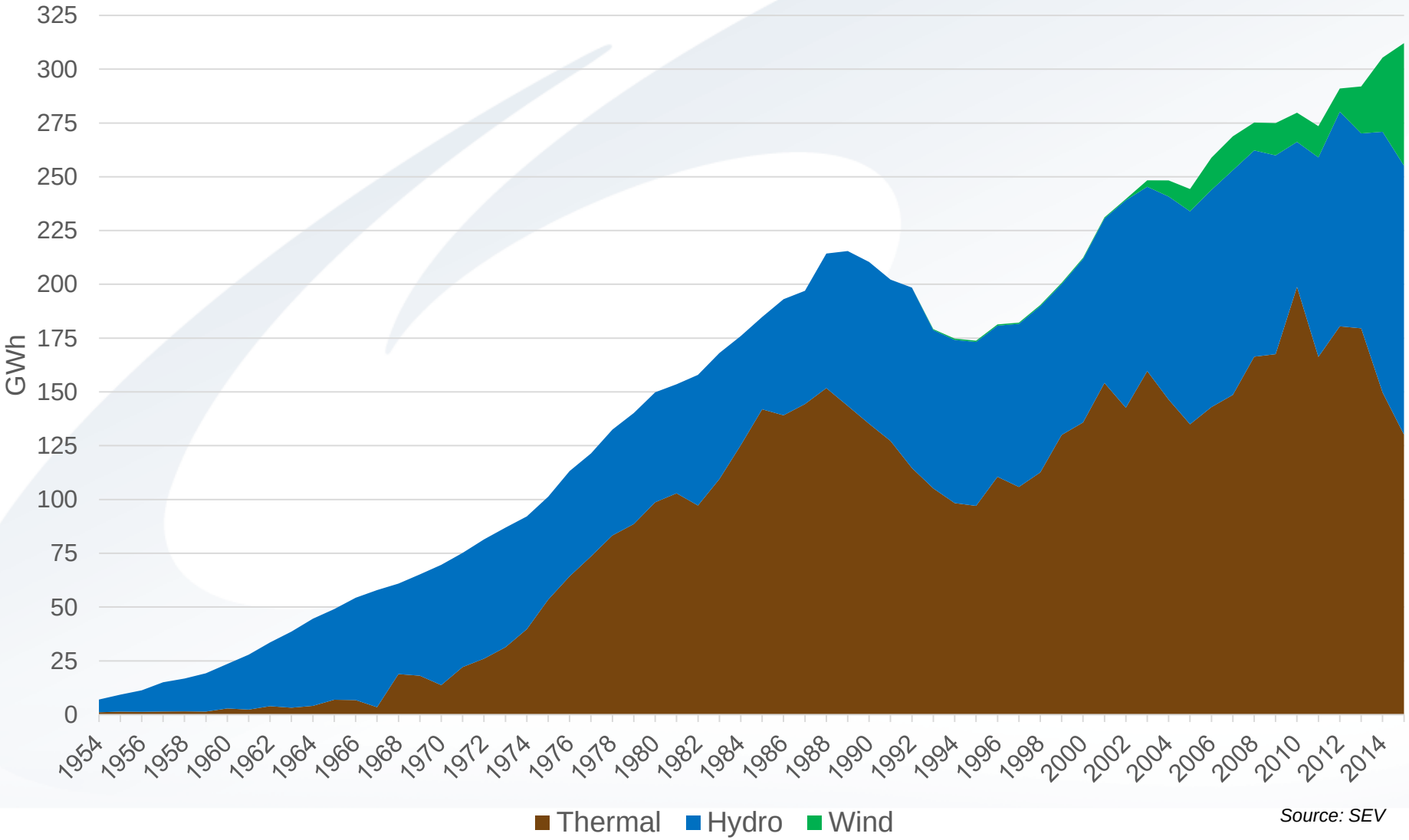
- **General data:**
  - 18 islands (17 are populated)
  - 49.000 inhabitants
  - Area of 1.399 km^2
  - Main export: Fish and fish products

Electrical Company SEV



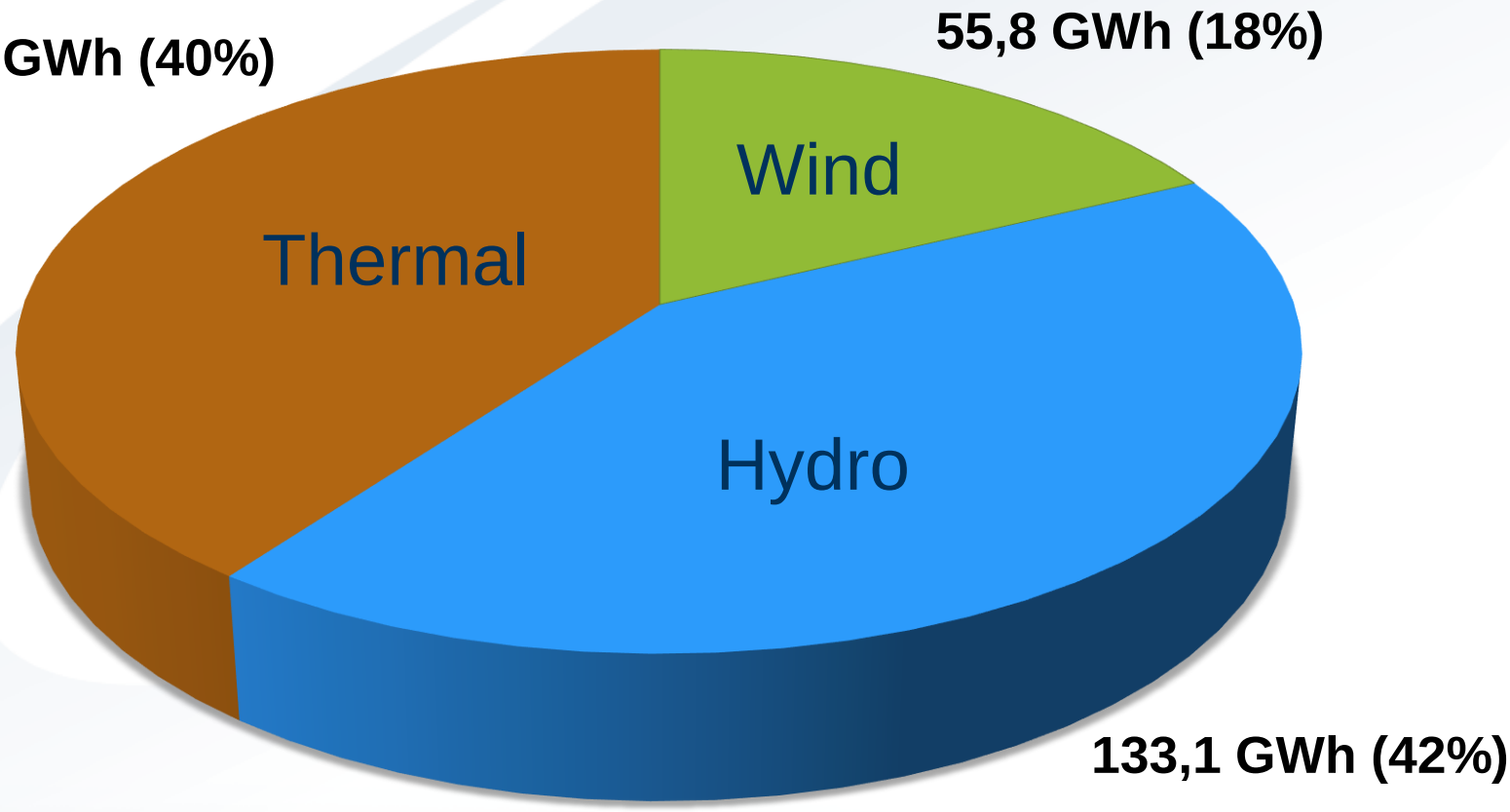
- **General company facts:**
  - Non-profit, founded 1st October 1946
  - 100 % owned by all Faroese municipalities
  - Vertically Integrated Company
  - Joint and several price structure
  - Monopoly on grid operation *(transmission & distribution)*
  - "*De facto*" monopoly on production (98%)
  - *"Micro isolated system" in EU terms (< 500 GWh)*
    - *Directive 2009/72*
      - *Derogation from relevant provisions in different chapters about unbundling, third party access etc.*

Energy mix 1954 - 2015



Source: SEV

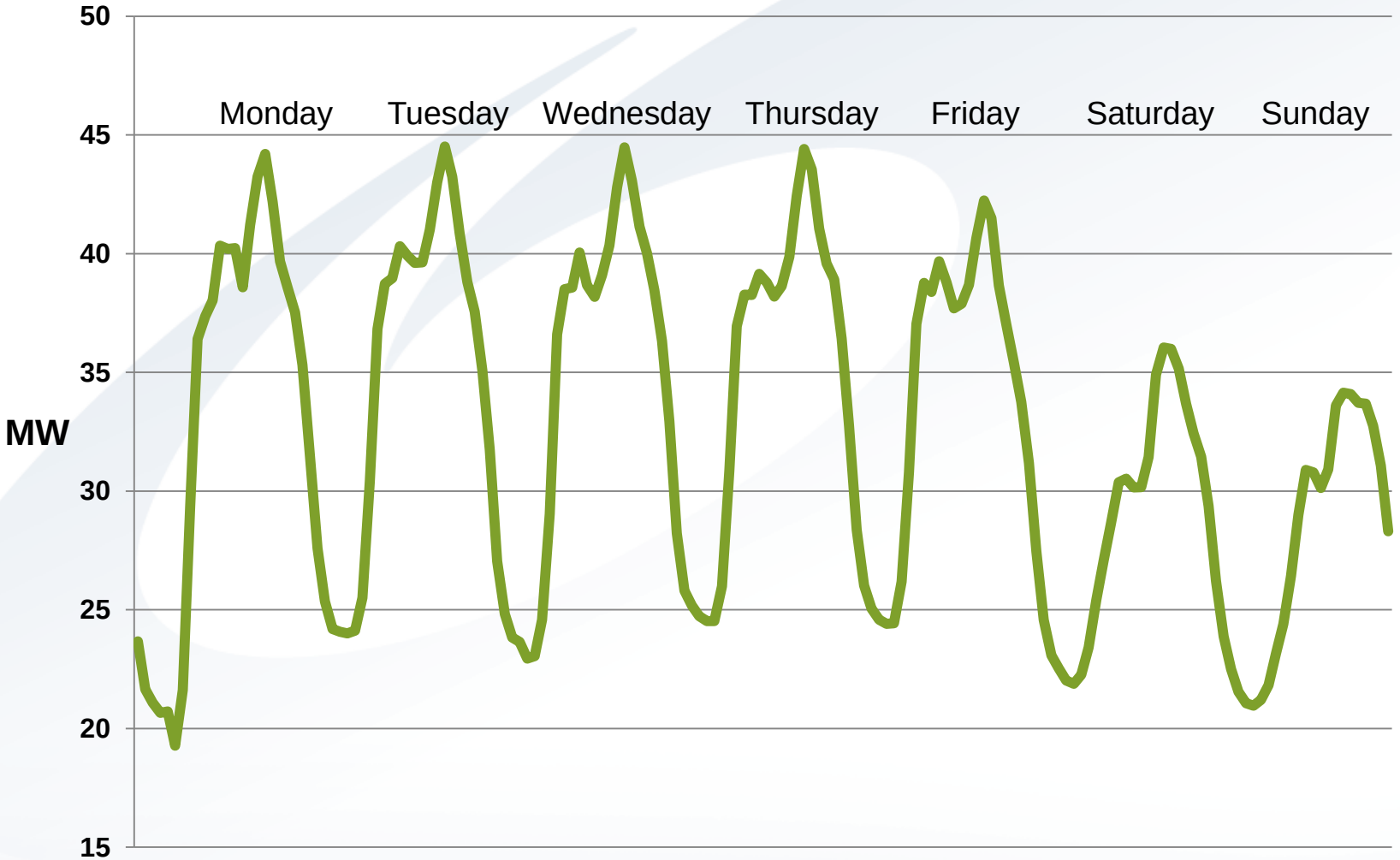
Energy mix 2015



Total electricity production: 314.4 GWh

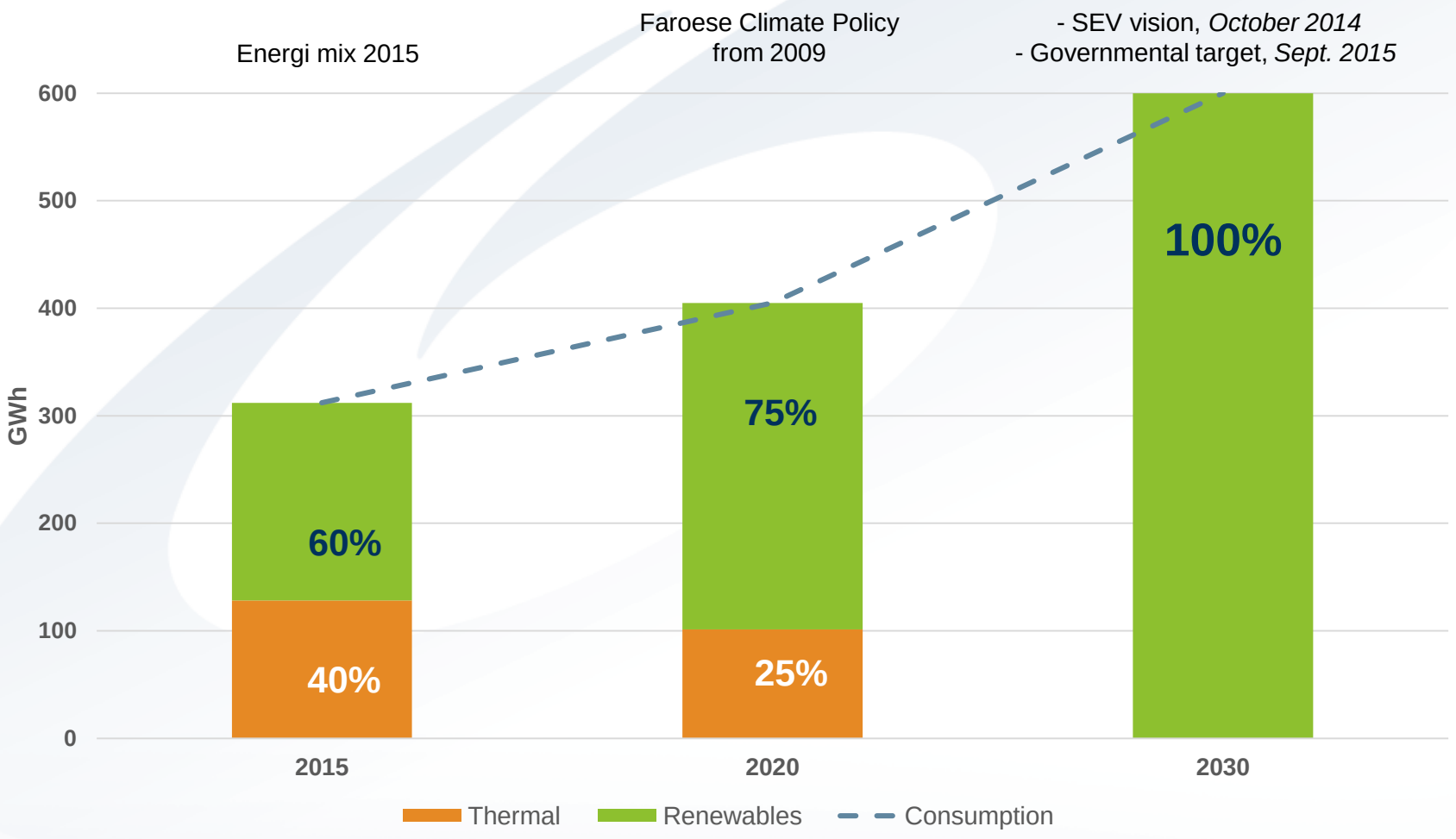
Source: SEV

Weekly demand pattern



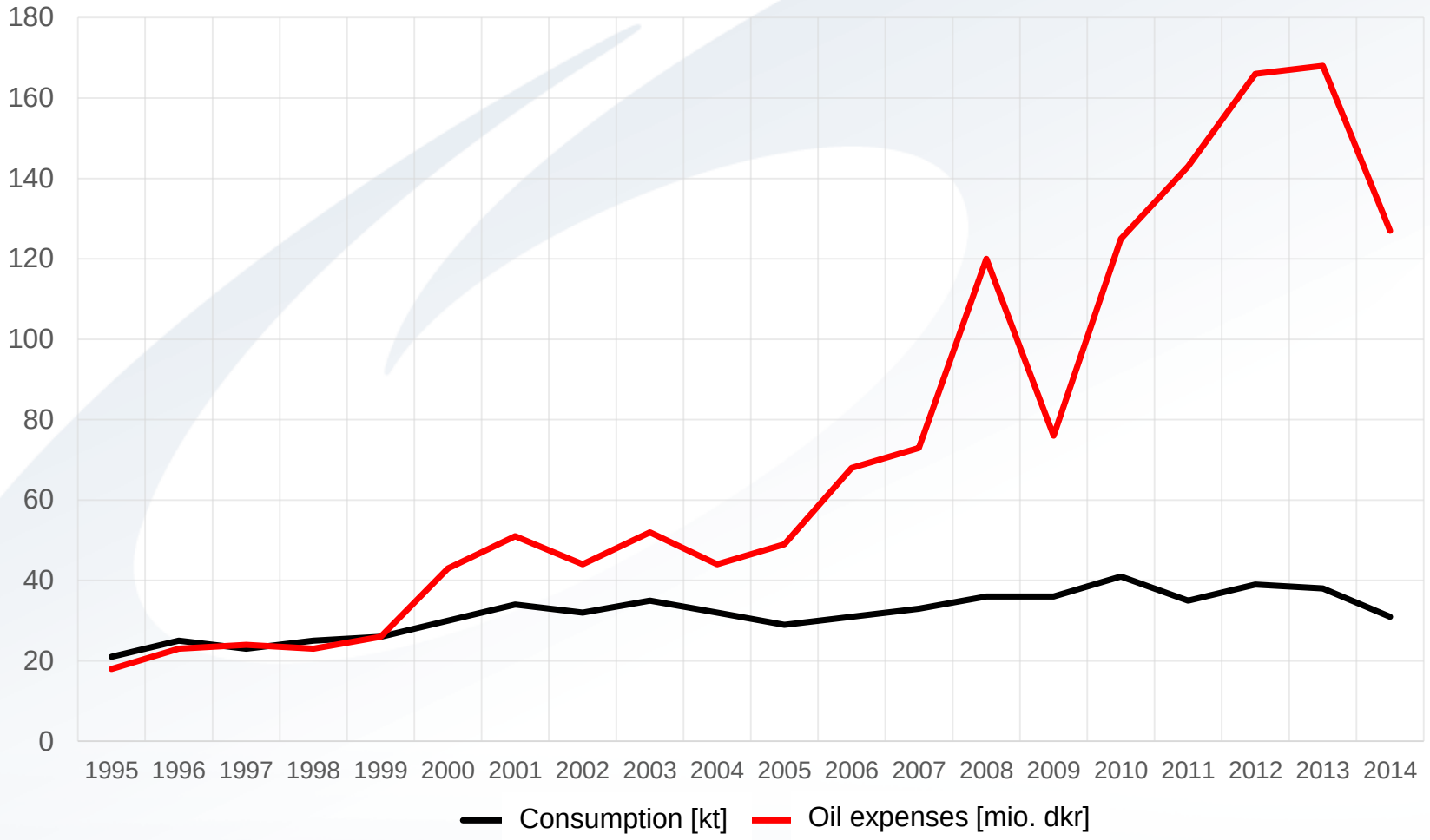
Main drivers for renewable energy in the Faroe Islands

Target settings for sustainability



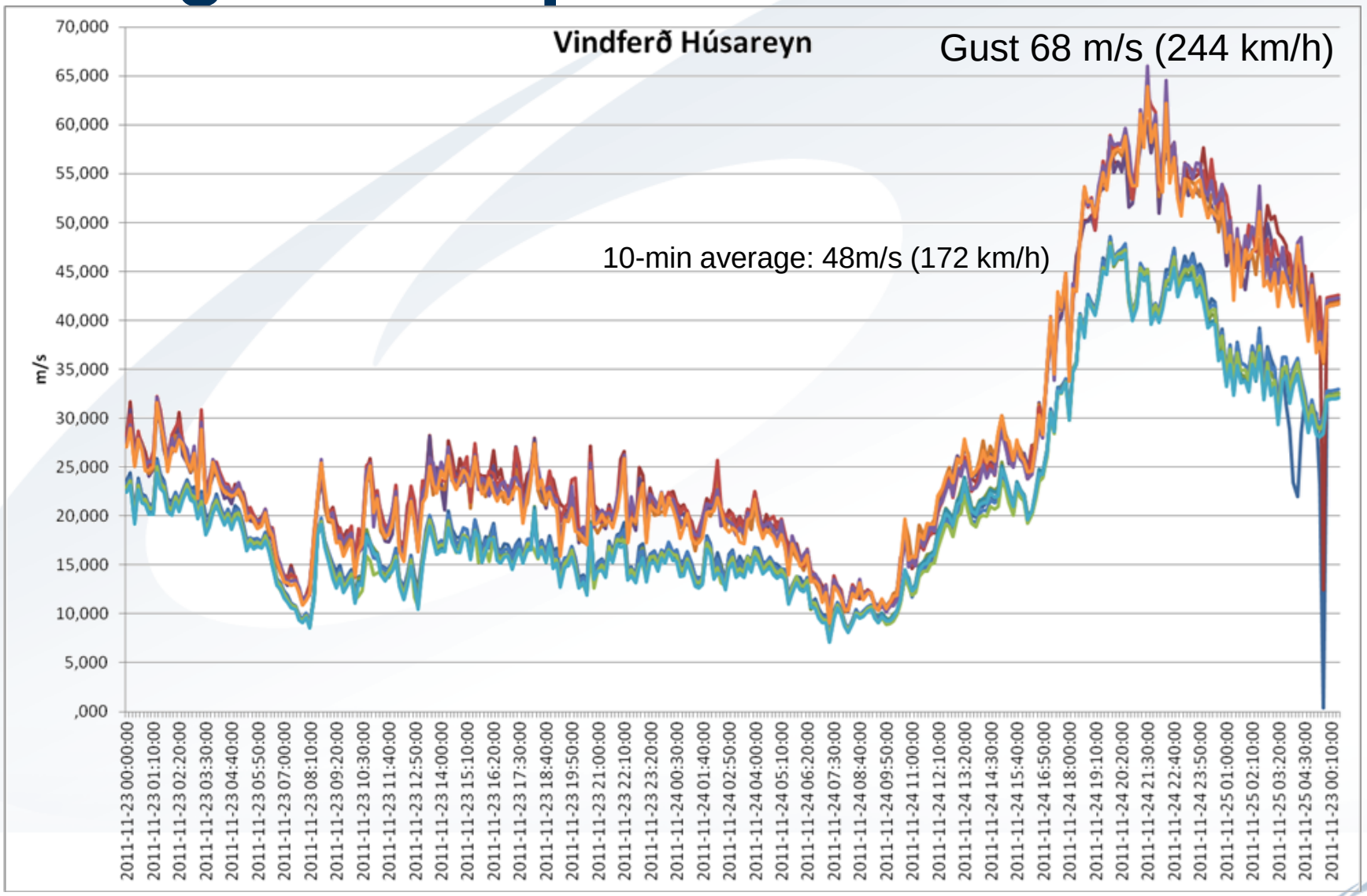
Assumptions:
- *2% increase in consumption*
- *Linear electrification of Heating 2016 – 2035*
- *Linear electrification of transport on land from 2019*

Oil consumption and expenses



Wind energy in the Faroe Islands

High windspeeds



Wind turbine requirements

- Storm Control ("GridCode requirement")
- Farm Control (GridCode requirement)
- Advanced Grid Code Requirements
  - Power/Frequency control
  - Setpoint for Active/Reactive power
  - Setpoint for Ramp rate gradients
  - Reactive power capabilities (even at no P production)
  - FACTS and Riding Through capabilities (UVRT/OVRT)
- STATCOM
- De-Icing

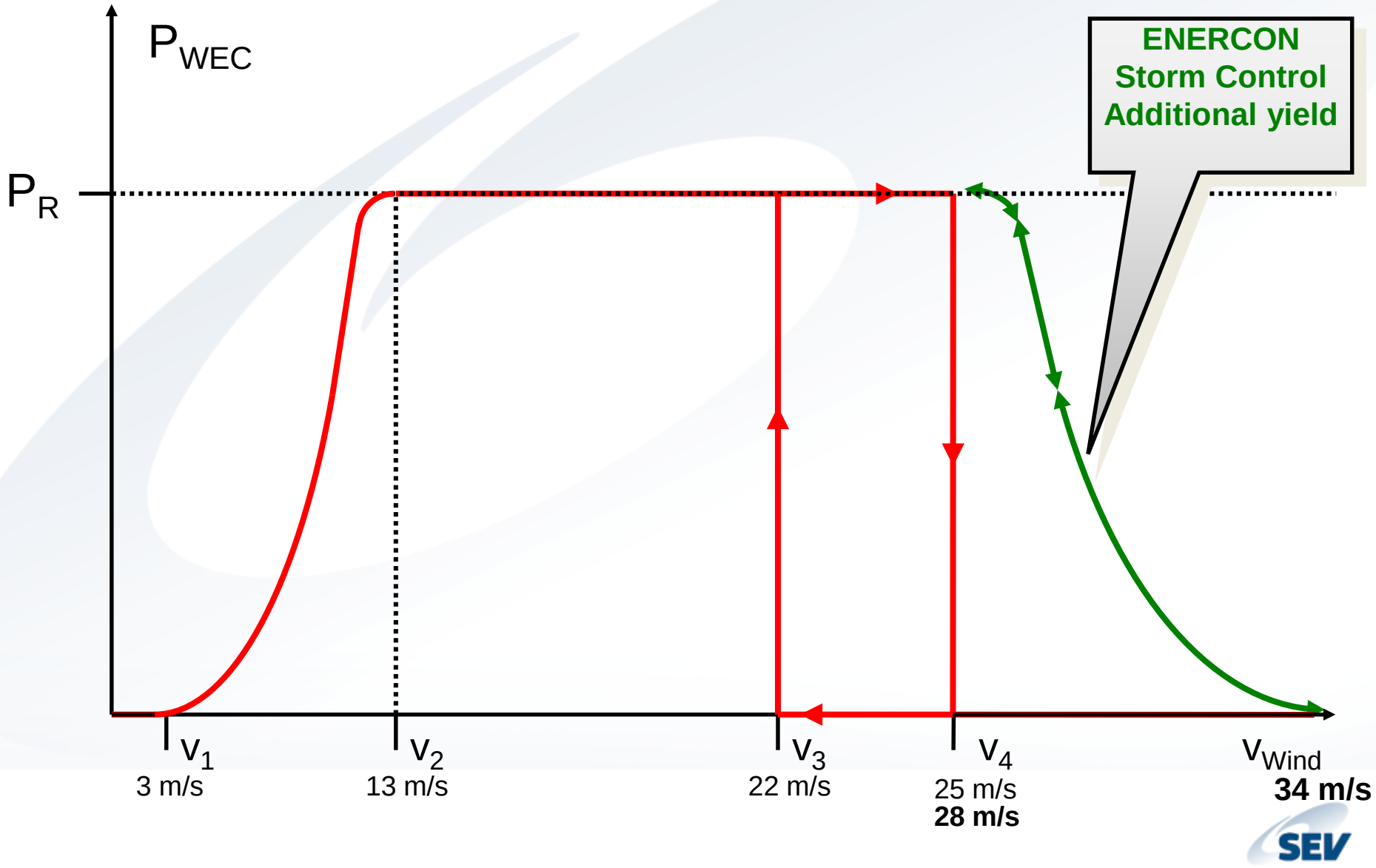
Suitable wind turbine

Norconsult

DONG energy

- ENERCON E-44/900kW
  - *Gearless design*
  - *Variable Speed: 18 – 34 rpm. Active pitch regulated.*
  - *Class: IEC 1a (70 m/s)*
  - *Hub Height: 45m*
  - *Full Scale Power Converter*
  - *Built for high wind speeds (Storm Control)*

Enercon Storm Control



The Neshagi Wind farm

Project specification:

- *3 pcs ENERCON E44/900kW (2,7MW)*
- *Capacity factor: 45%*
- *Annual production: 10,6 GWh*
- *Building phase: 2011-2012*

Economical figures:

- *Total cost: 3.5 M€*
- *Oil savings: 2.300 ton/year*
    - *more than 0.8 M€/year*

Carbon footprint:

- *Annual CO_2 reduction: 7.000 ton/year*

The Húsahagi Wind farm

Project specification:

- *13 pcs ENERCON E44/900kW (11.7MW)*
- *Capacity factor: 42%*
- *Annual production: 41 GWh*
- *Building phase: 2013-2014*

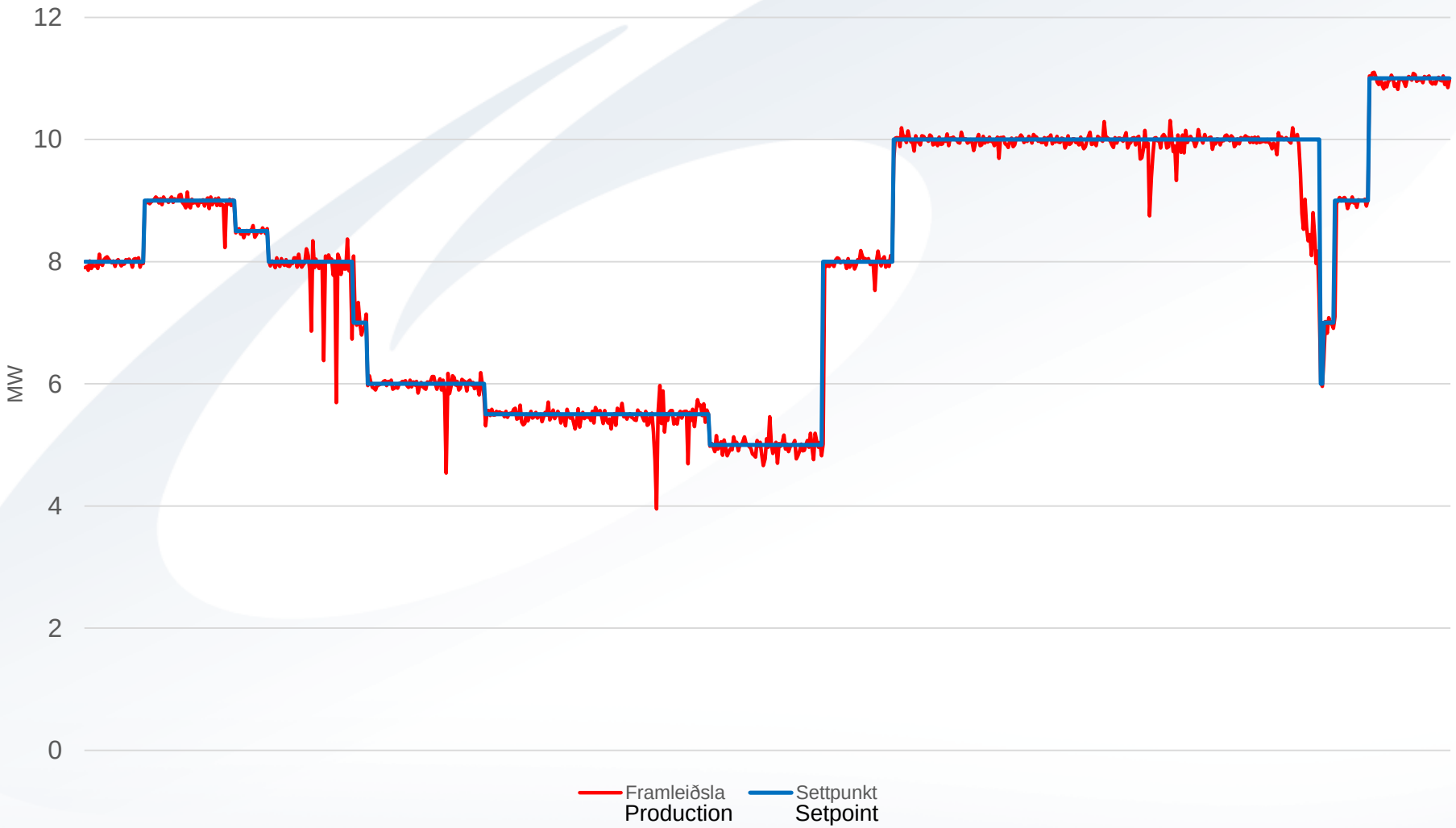
Economical figures:

- *Total cost: 13 M€*
- *Oil savings: 8.000 ton/year*
    - *approximately 3 M€/year*

Carbon footprint:

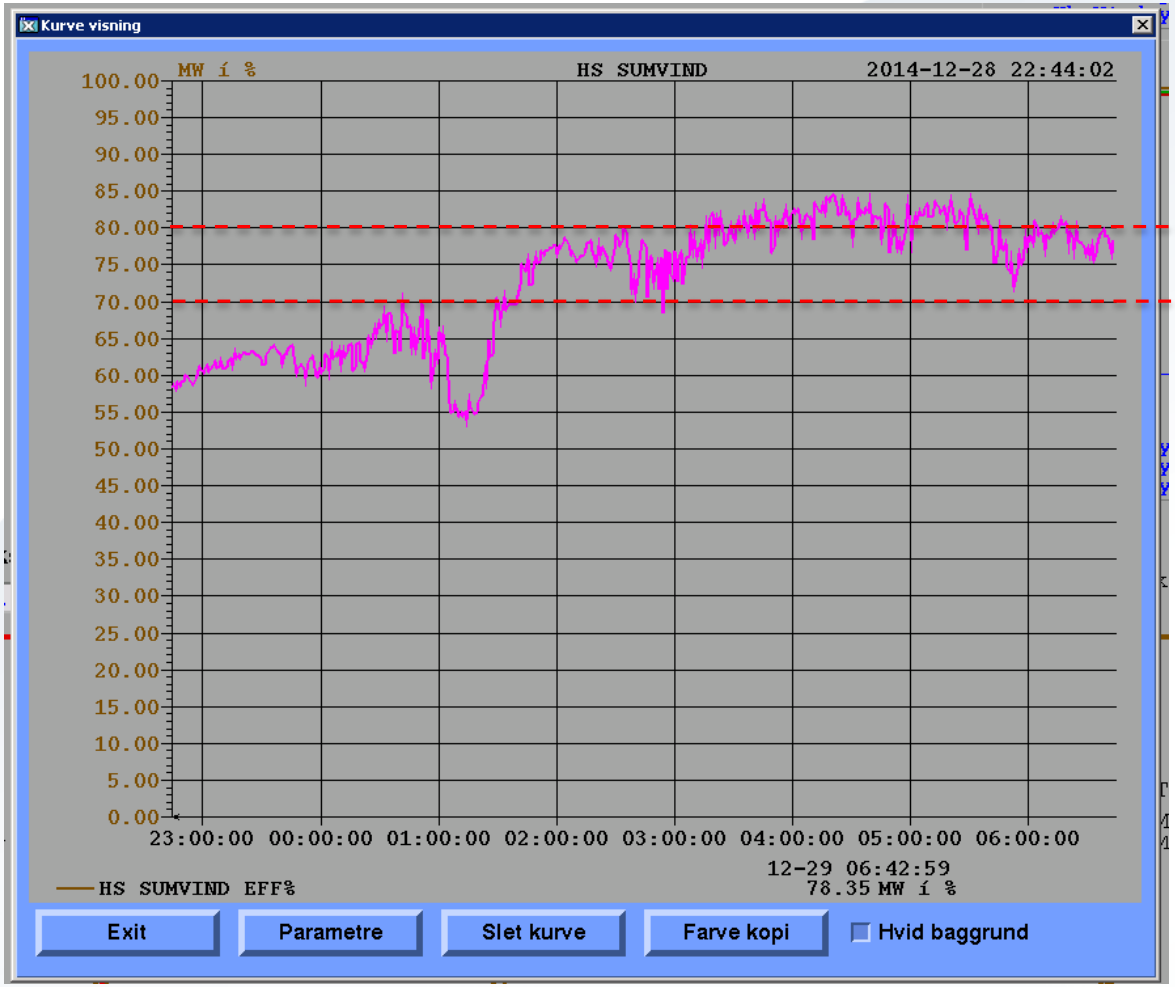
- *Annual CO_2 reduction: 28.000 ton/year*

Regulating capabilities



100% RE generation

>80% wind penetration for hours

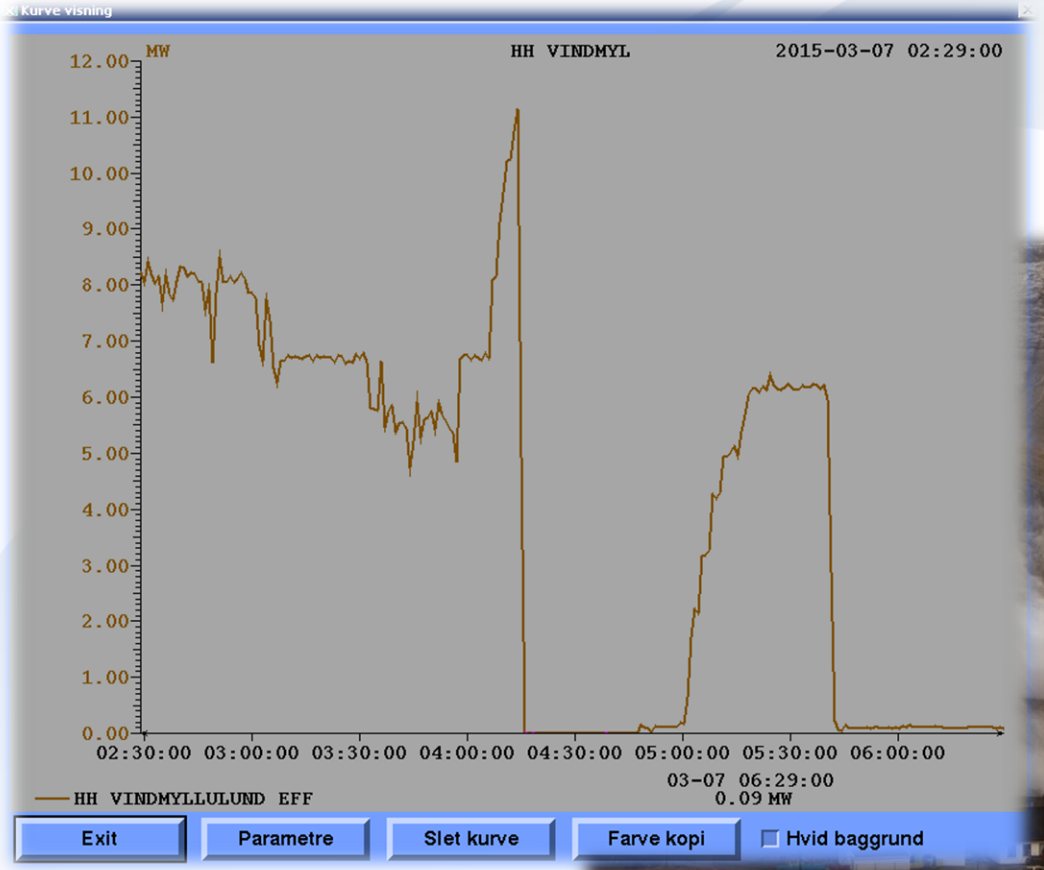


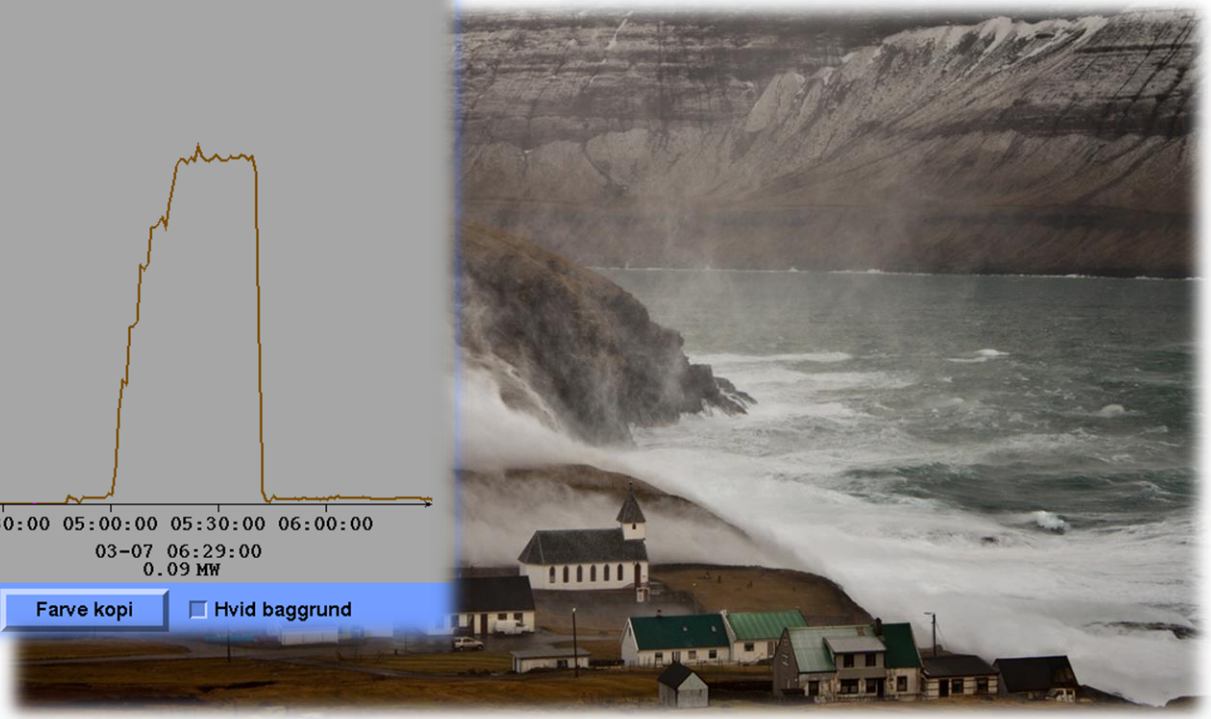
80% Wind penetration

70% Wind penetration

From SEVs SCADA system (BECOS32)

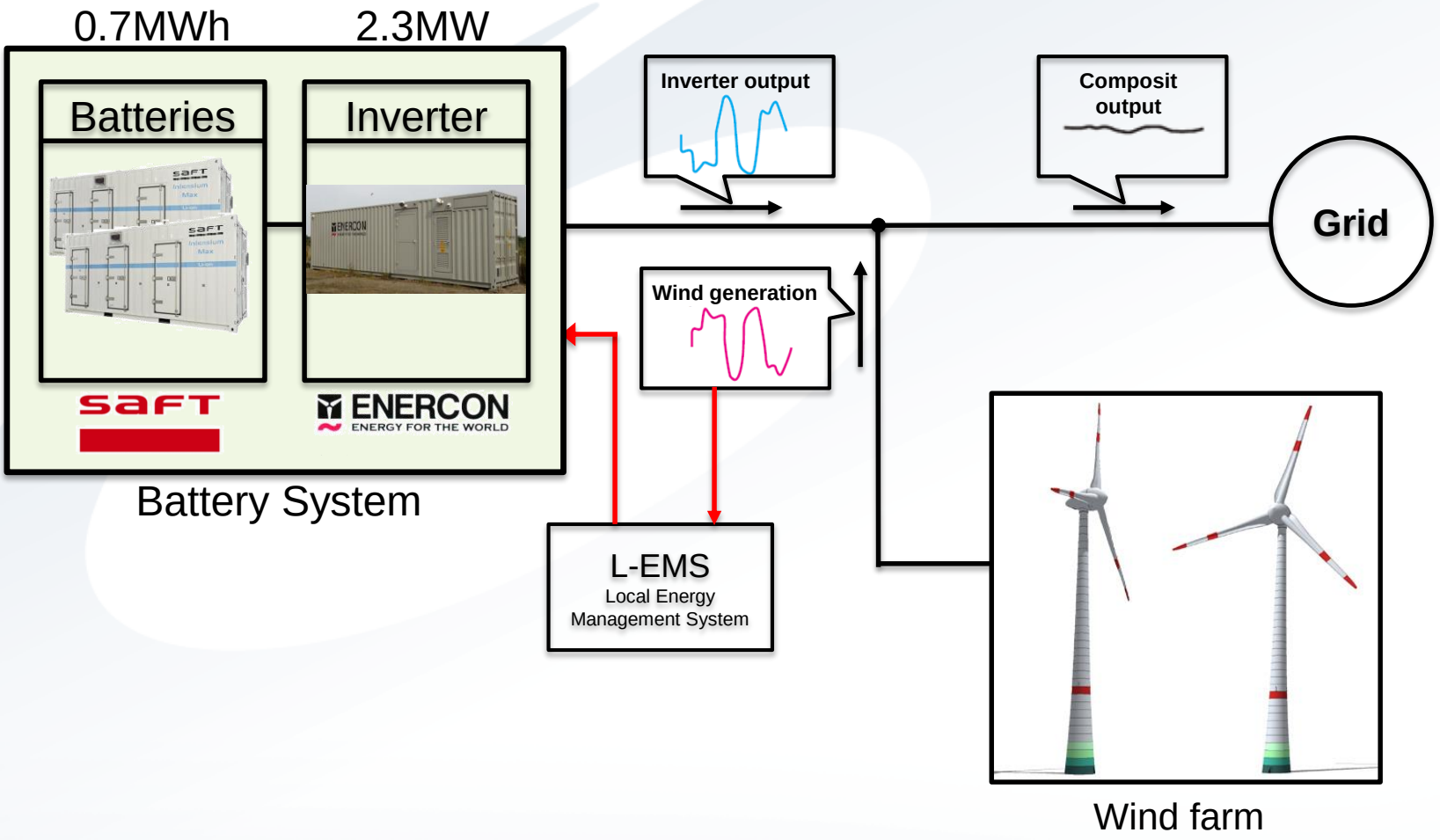
Challenging weather conditions



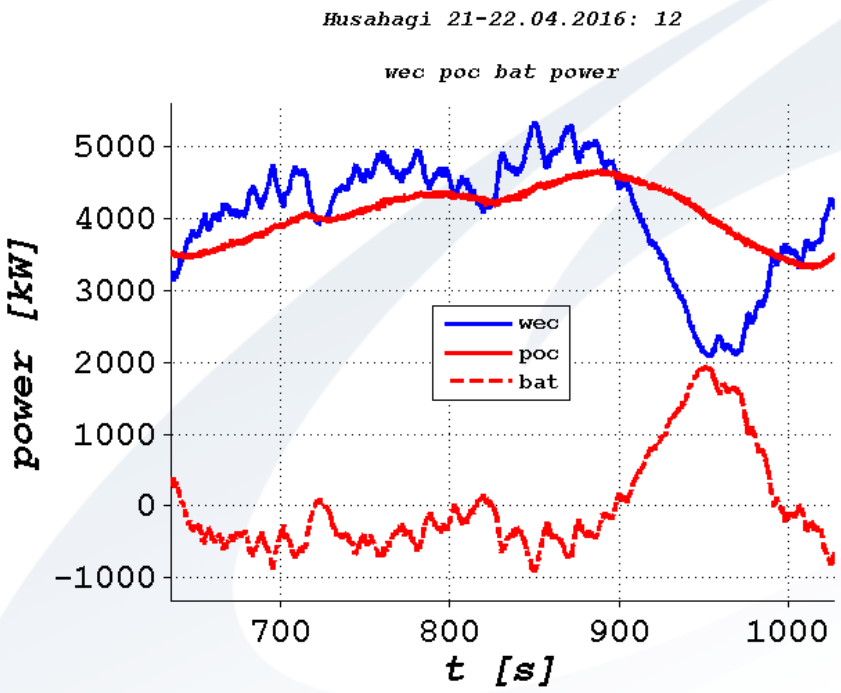


Batteries for Ramp Rate Control of fluctuating wind power

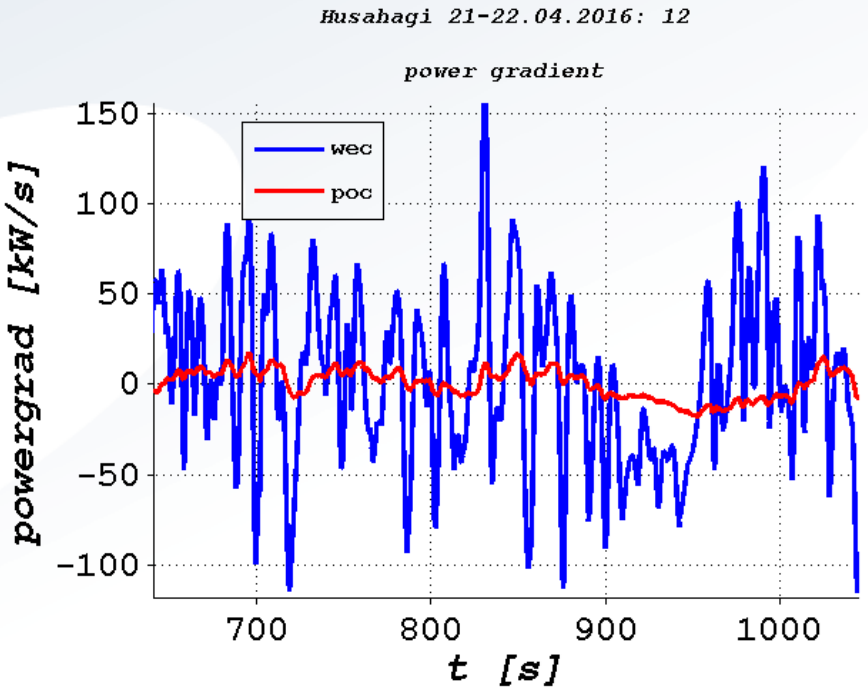
Schematic Overview BES



SEV Battery system in Húsahagi



WEC/PoC power



WEC/ PoC

power-gradients

SEV Battery system in Húsahagi

Other renewable sources

Hydro and tidal energy

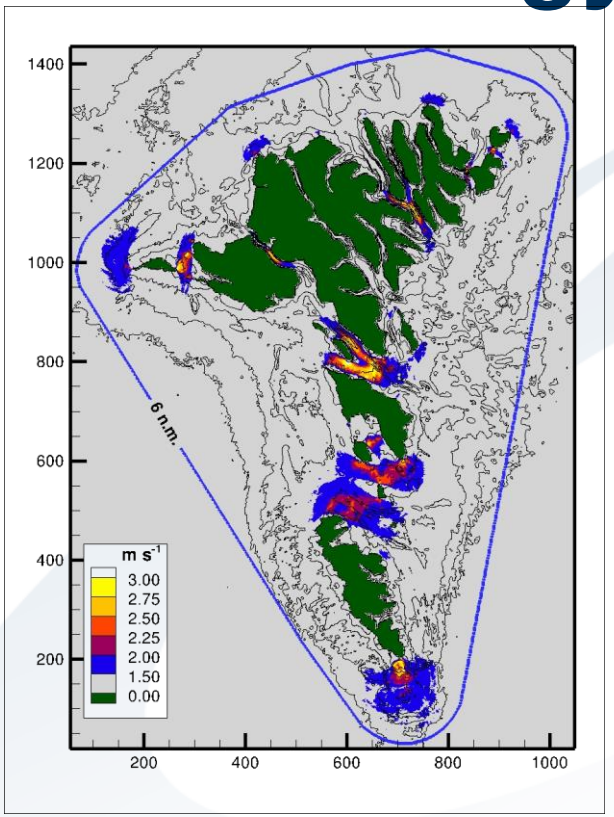
Hydropower

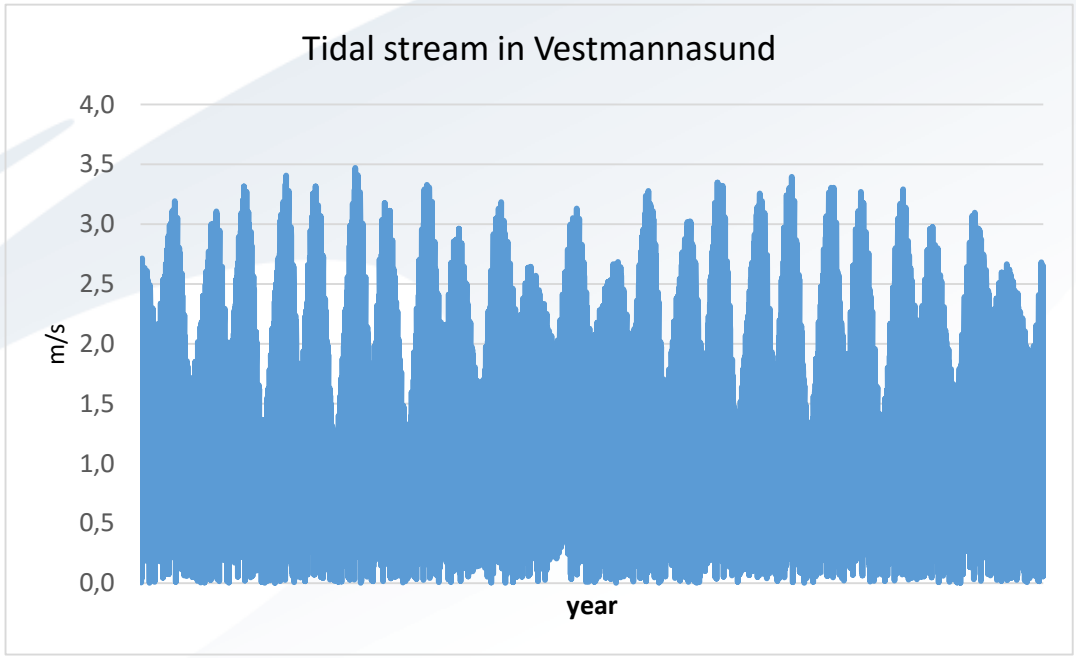
6 Hydropower plants

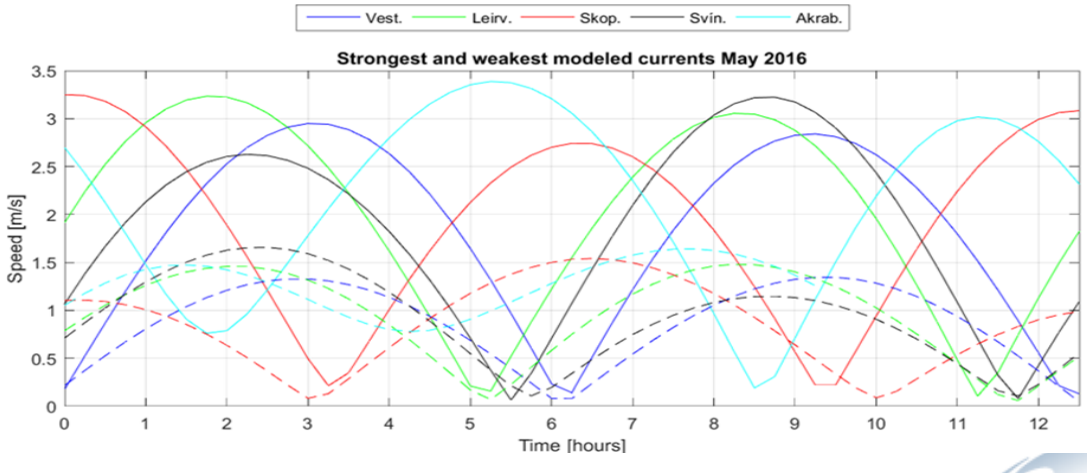
Total installed capacity: 37MW

First installation in 1921

Tidal energy

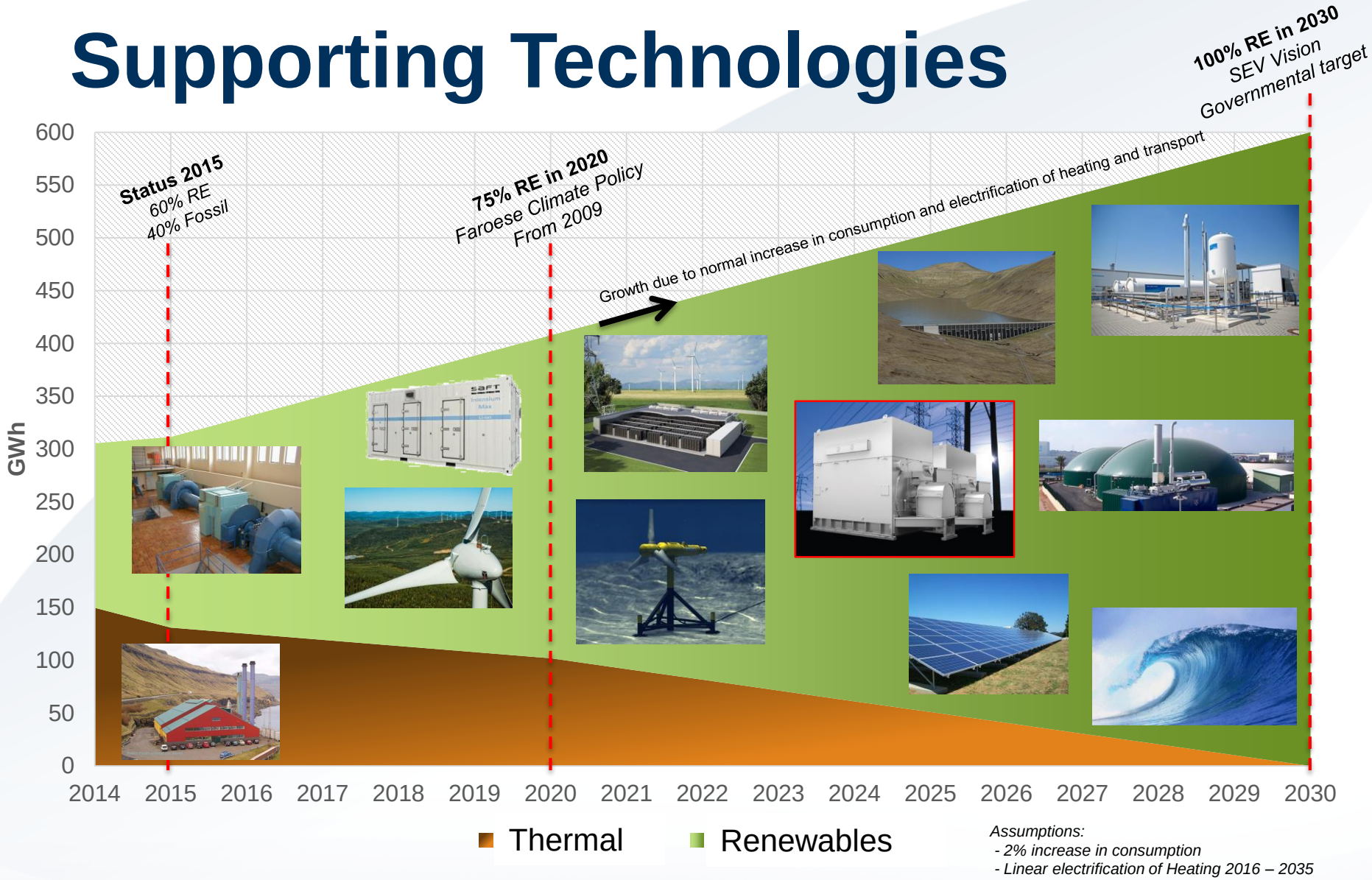






Technologies supporting the 100% RE Vision

Supporting Technologies



Assumptions:
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- *Linear electrification of Heating 2016 – 2035*
- *Linear electrification of transport on land from 2019*

” We simply must balance our demand for energy with our rapidly shrinking resources.
By acting now we can control our future instead of letting the future control us”

Jimmy Carter 1977

Thank you!

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PowerHub

IT system

A box at 3 Industries