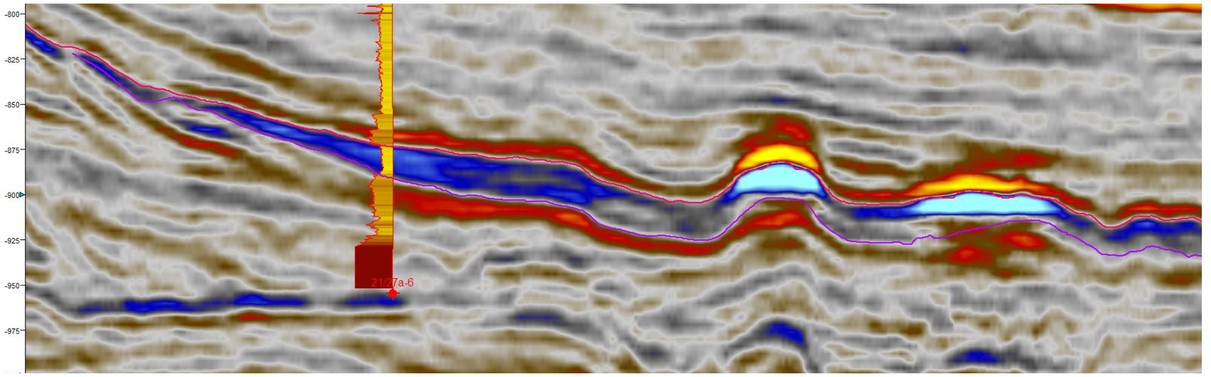
NET ZERO BASIN

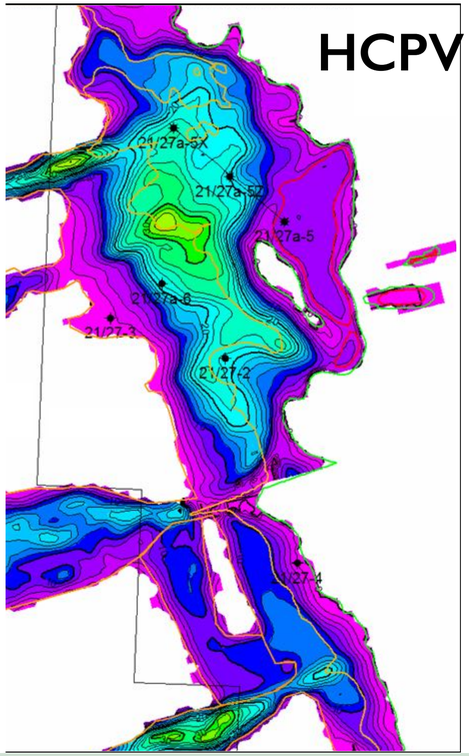
Pilot field development

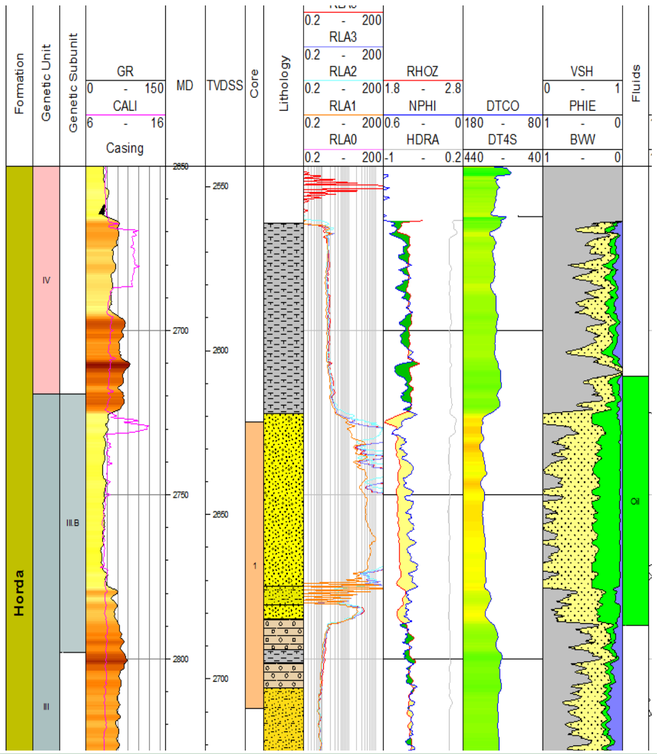
ORCADIAN ENERGY

Pilot field summary

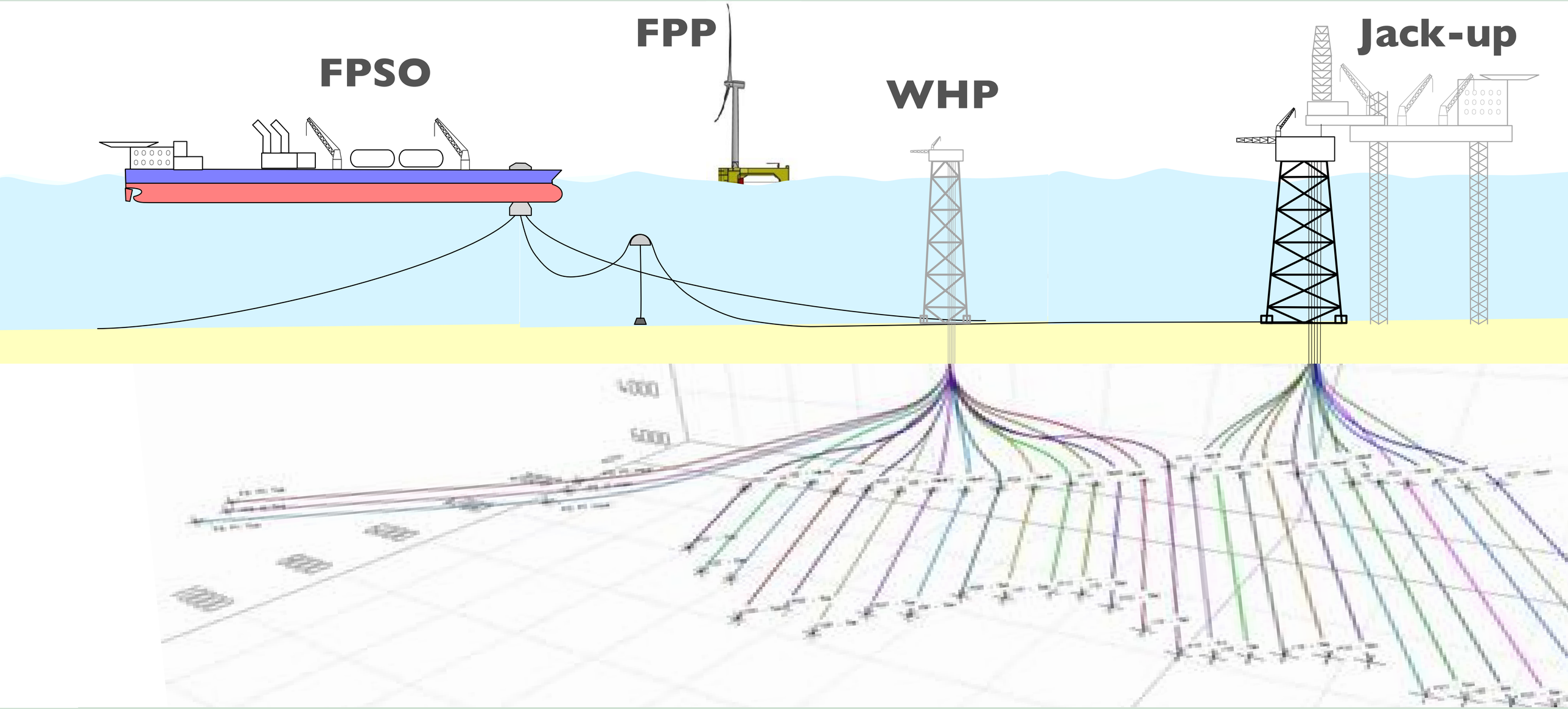
- Fully appraised, seven reservoir penetrations, three tested wells, core and fluid samples held by Orcadian, two high quality 3D seismic surveys
- Very high quality sandstone turbidite reservoir, 34% porosity, 2 to 10 darcies of permeability
- Significant oil in place: 263 MMbbls; audited 2P reserve of 79 MMbbls, based on a low salinity polymer flood of the reservoir
- Variable quality oil from 12° to 17° API, 160 cP to 1,200 cP
- Shallow water (c. 80m), 140 kms due East from Aberdeen, c. 40 kms from Gannet et al





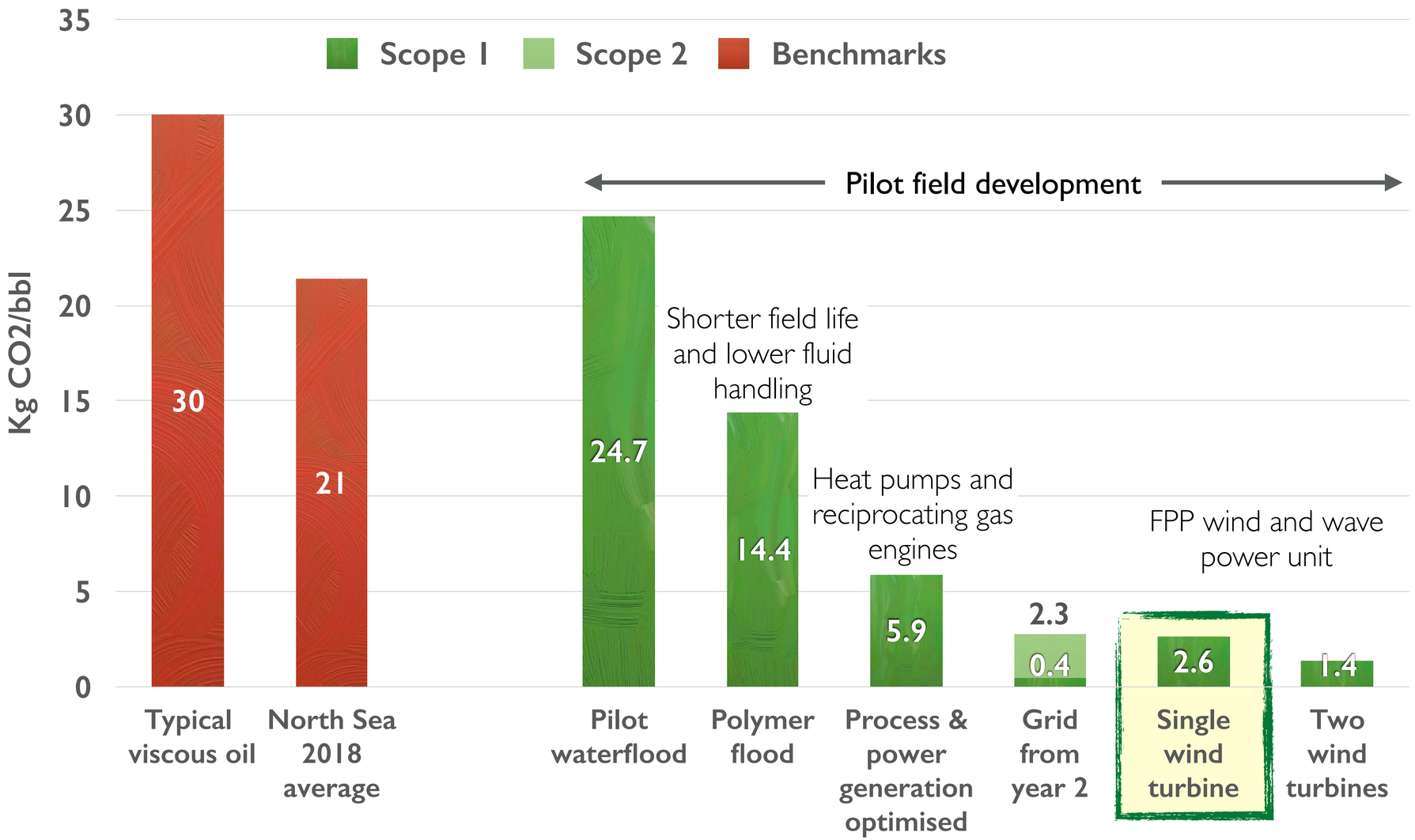


Pilot field development plan



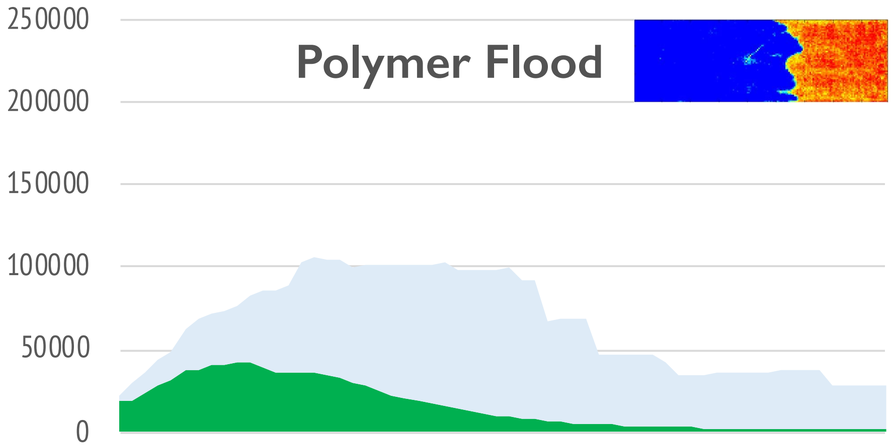
A project delivering on the Government's Net Zero agenda

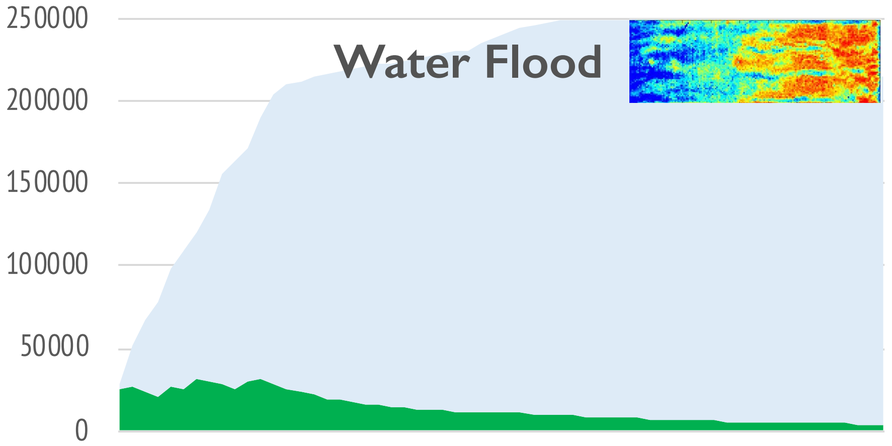
- Many opportunities to reduce emissions identified
- Integration of aggressive process heat management with high efficiency back-up power generation and electrification has the potential to drive emissions down by over 80%
- Local wind farm power, with highly efficient back-up gas engines, reduces emissions as low as connection to a future grid with half of today's CO_2 intensity

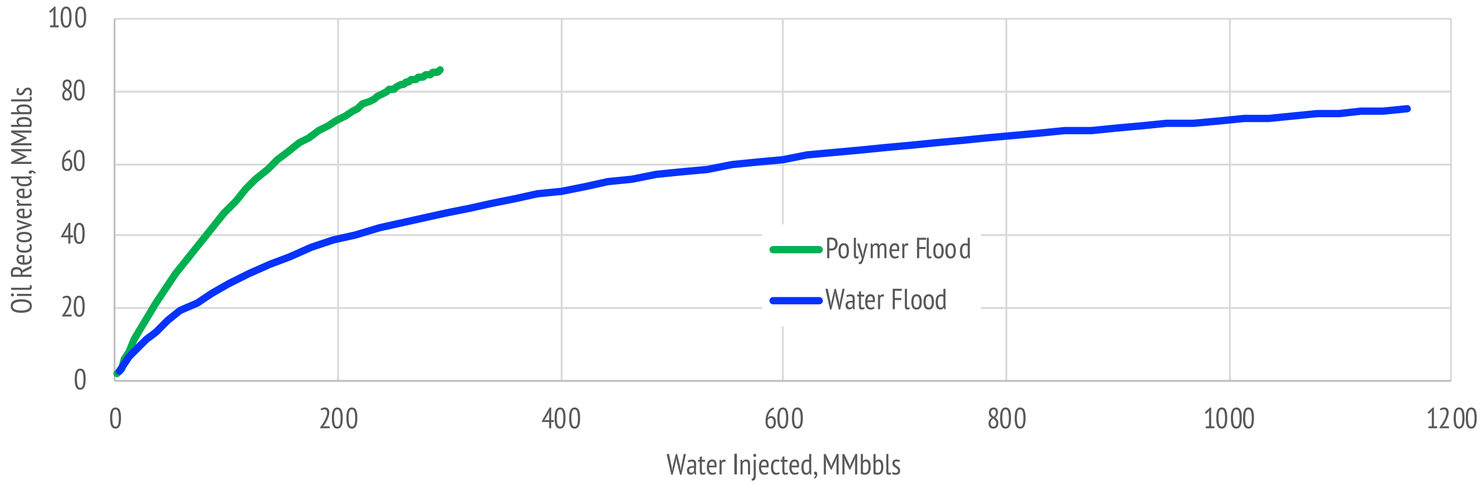


Estimates from recently submitted CSR Addendum prepared with Crondall Energy. These numbers are CO_2e

Why polymer reduces CO_2



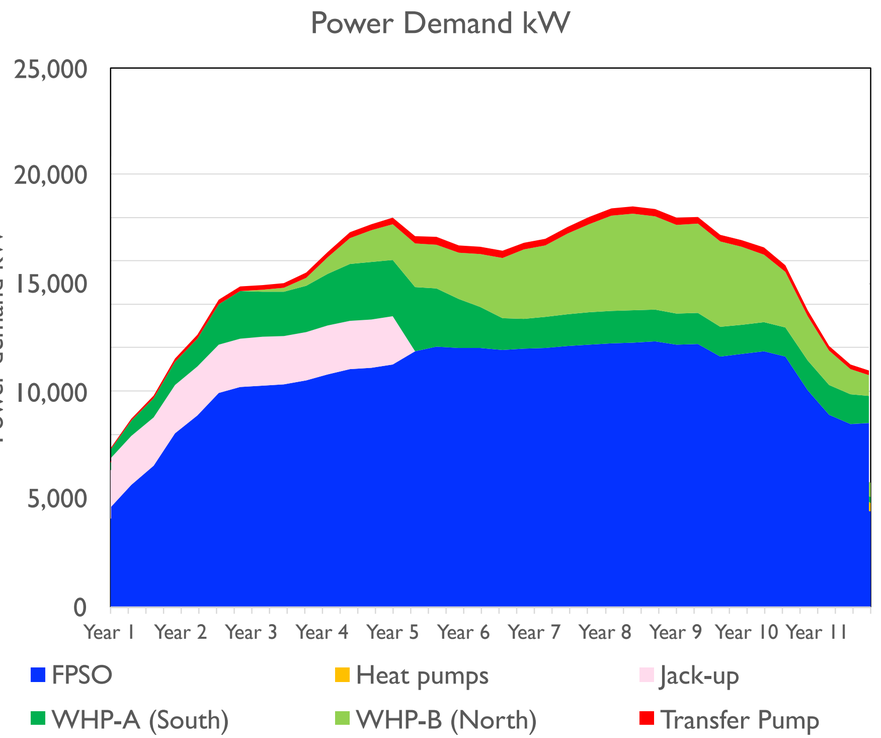


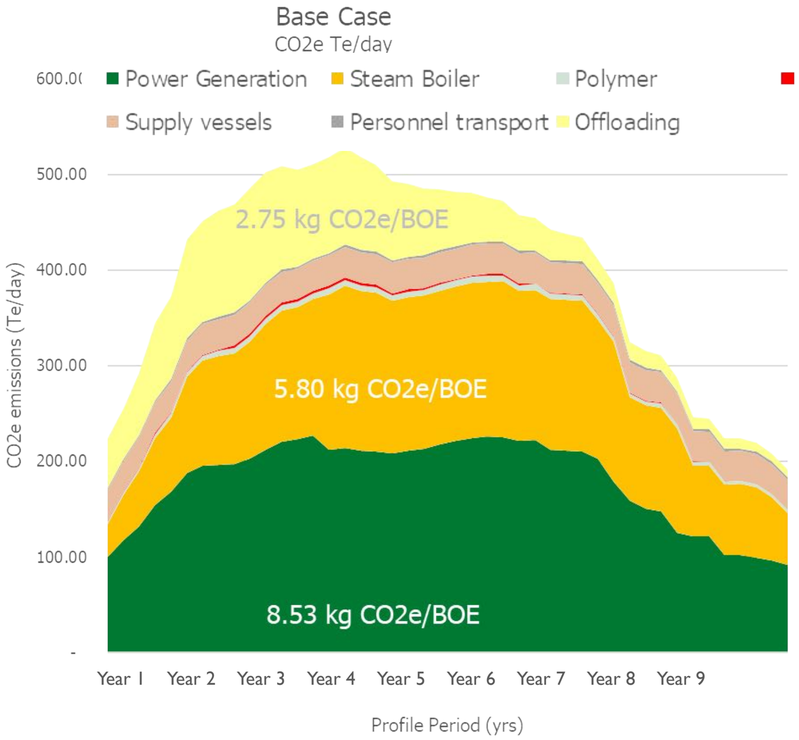


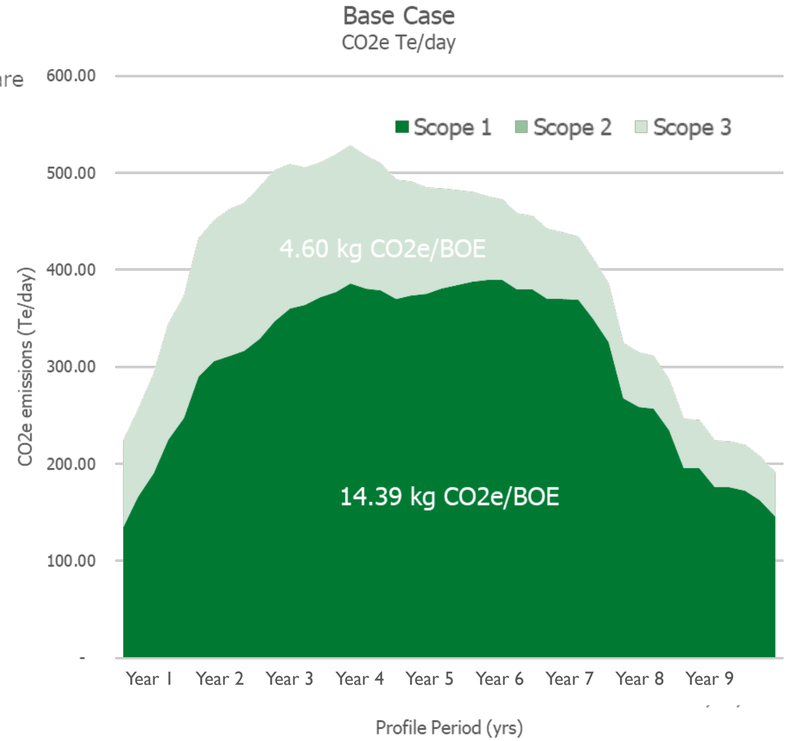
- Fluid handling requirements massively reduced by using polymer
- Field life significantly shortened with polymer
- Pumping wells and injecting fluid are the key drivers of CO_2 emissions
- Polymer boosts recovery so there are more barrels produced in less time and for much less energy
- Polymer use significantly enhances project economics while minimising environmental impacts

Production profiles for polymer flood and water flood from Orcadian Energy reservoir simulations; plot of recoverable oil vs. water injected based upon the same simulations.

Emissions, by cause and scope
CSR initial polymer scenario

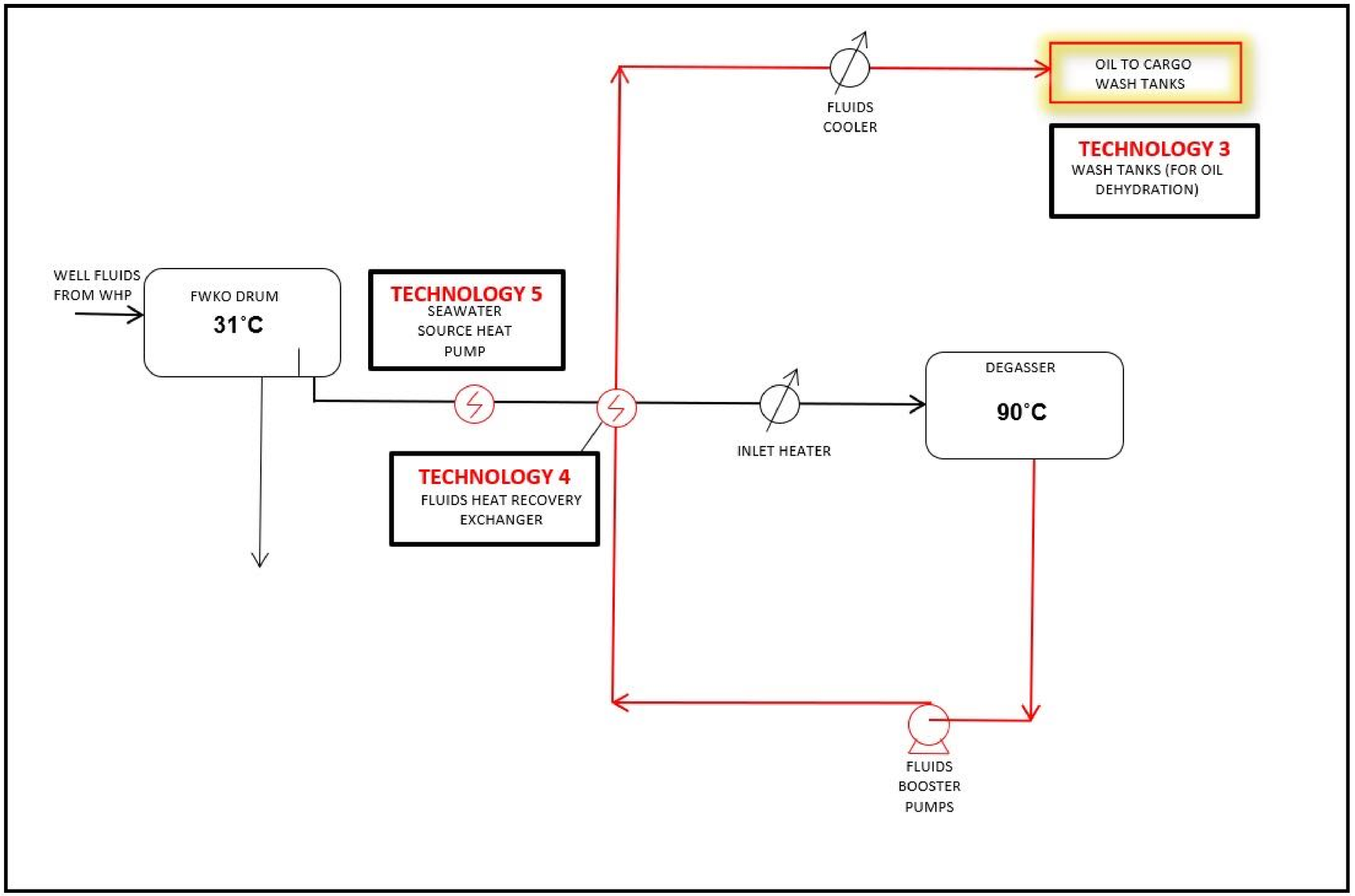






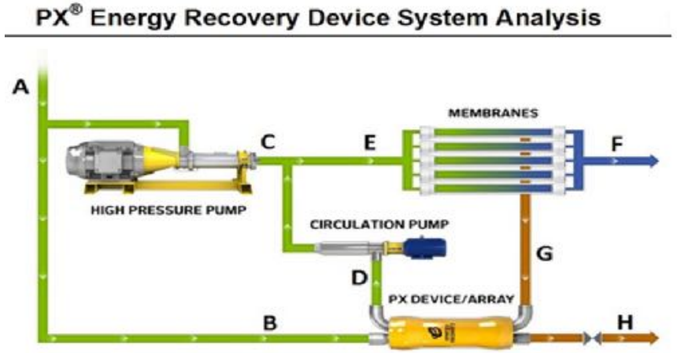
- Base case from September 2020 CSR submission, focus had been on quantifying rather than driving down emissions (included some worst case assumptions e.g. downhole pump power demands)
- Adoption of polymer flood had reduced both fluid handling and field life

Process optimisation

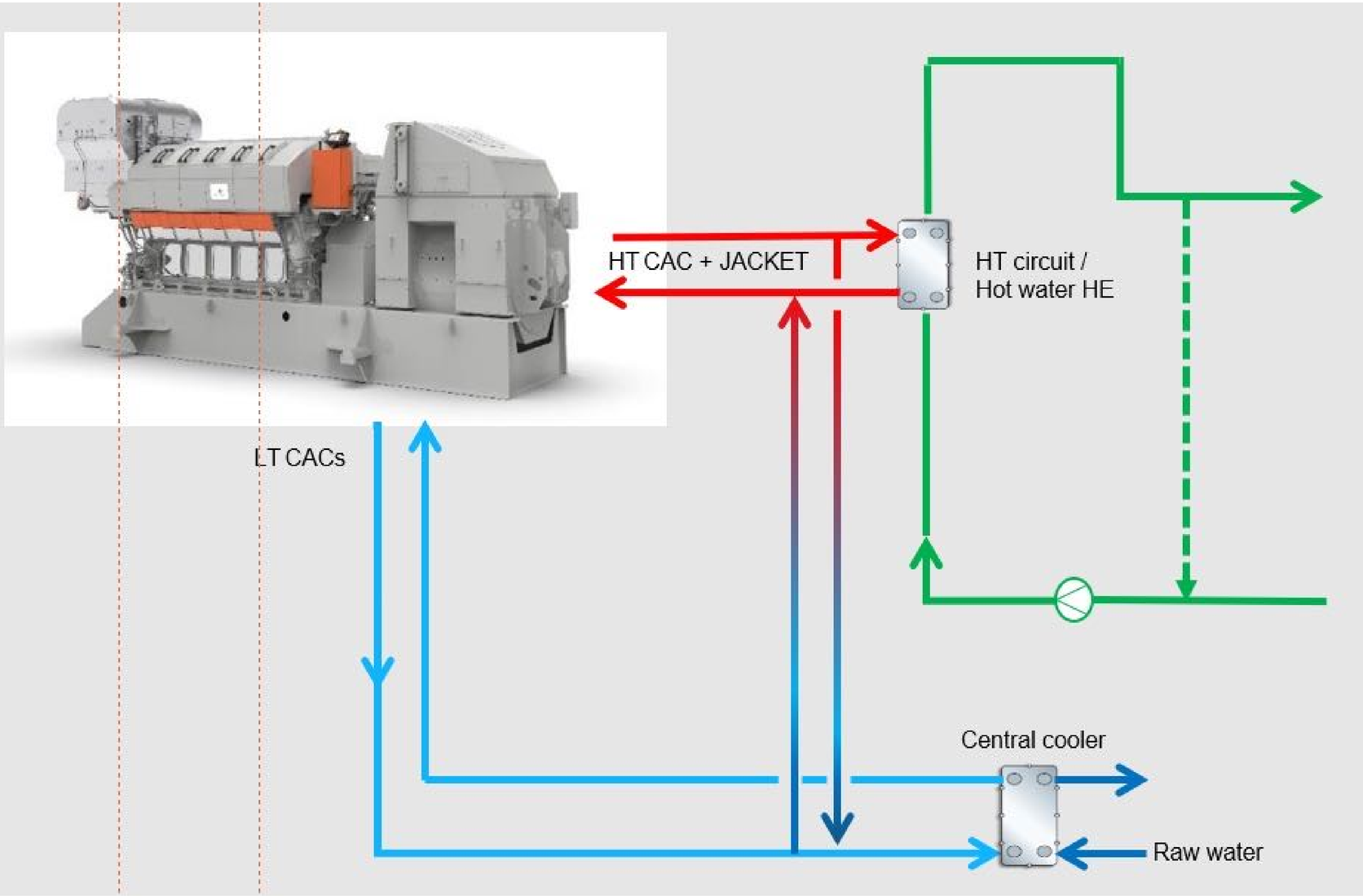


- Industrial heat pumps

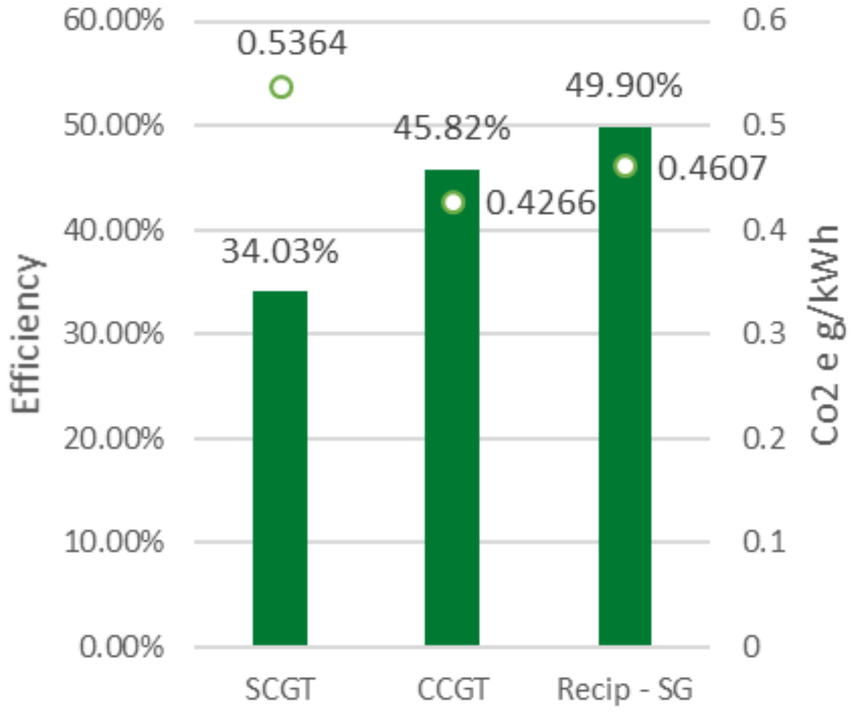
- Energy recovery systems



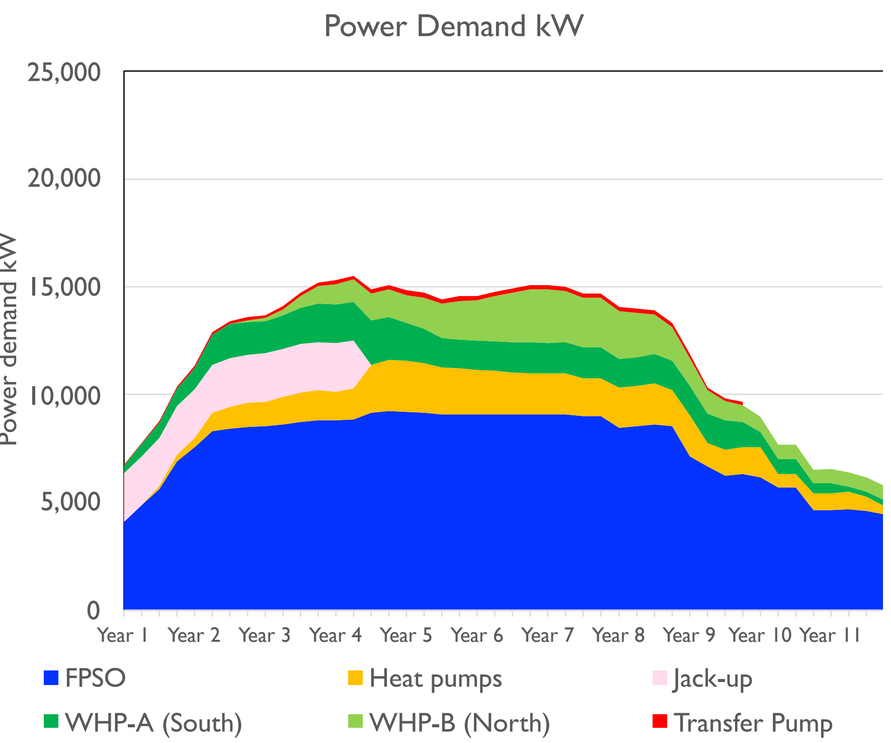
Power Generation

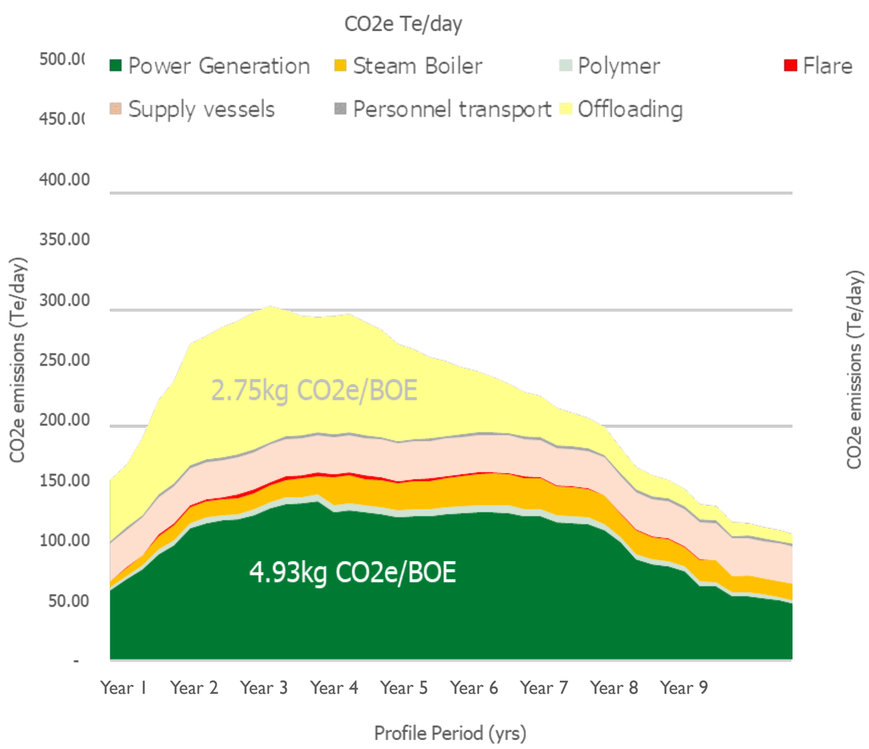


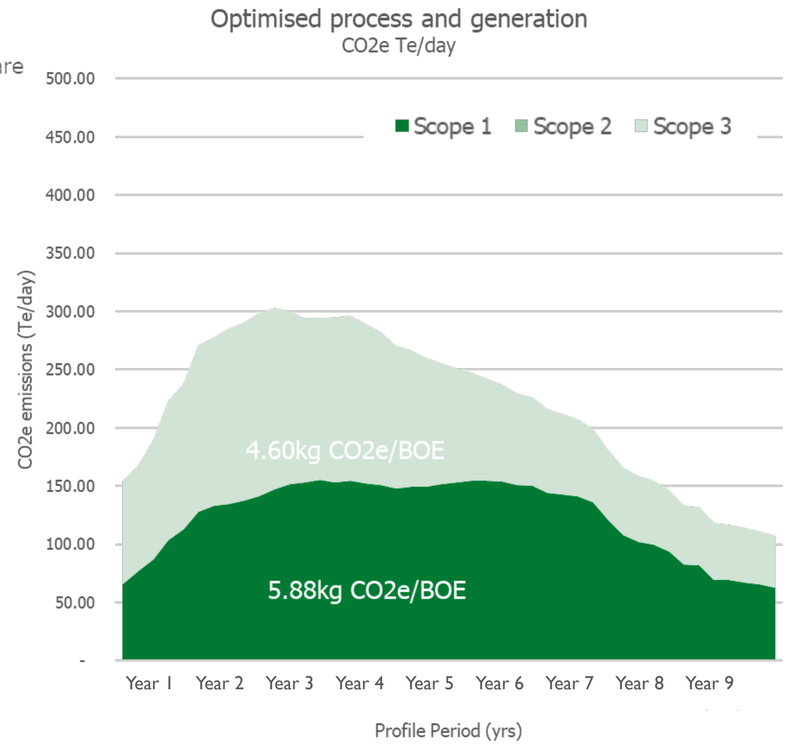
- Wartsila, dual fuel gas reciprocating engines
- “Smart heat recovery” system



Emissions, by cause and scope
Process optimisations and recips







- Crondall reshaped process and power generation with the intention of driving down emissions
- The combination of heat pumps and high efficiency generation is the key to reducing emissions

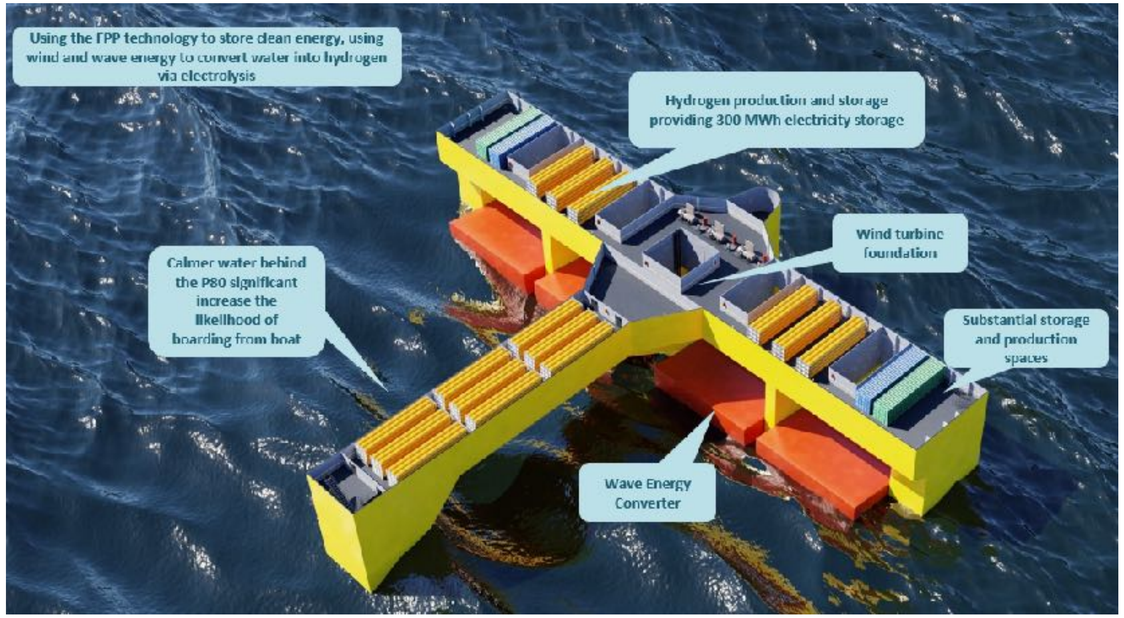
SYSTEM OVERVIEW

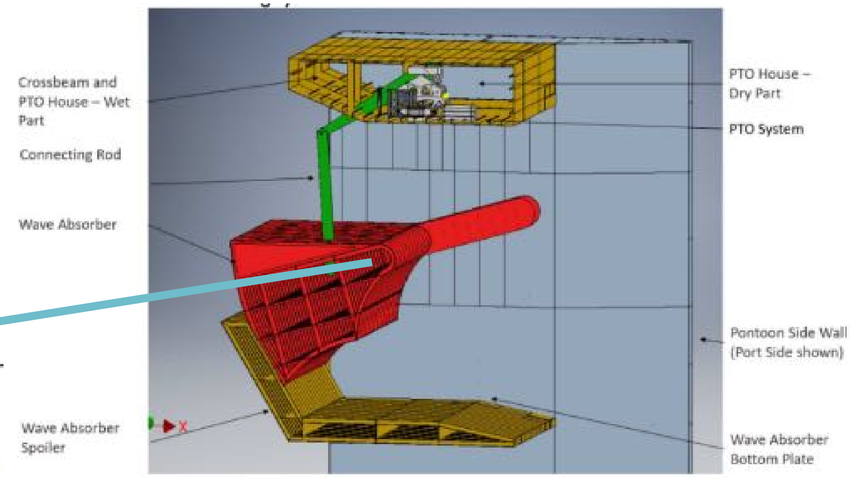
- **Platform**
  - North Sea design for 15m Hs sites
  - Panel based semi submersible
  - Makes use of harbour effect for transfer
  - Hydrogen energy storage can be accommodated

- **Turret Mooring System**
  - Vanes into wave direction
    - WTG yaws independently
  - Multi point catenary mooring system
  - Disconnectable if required

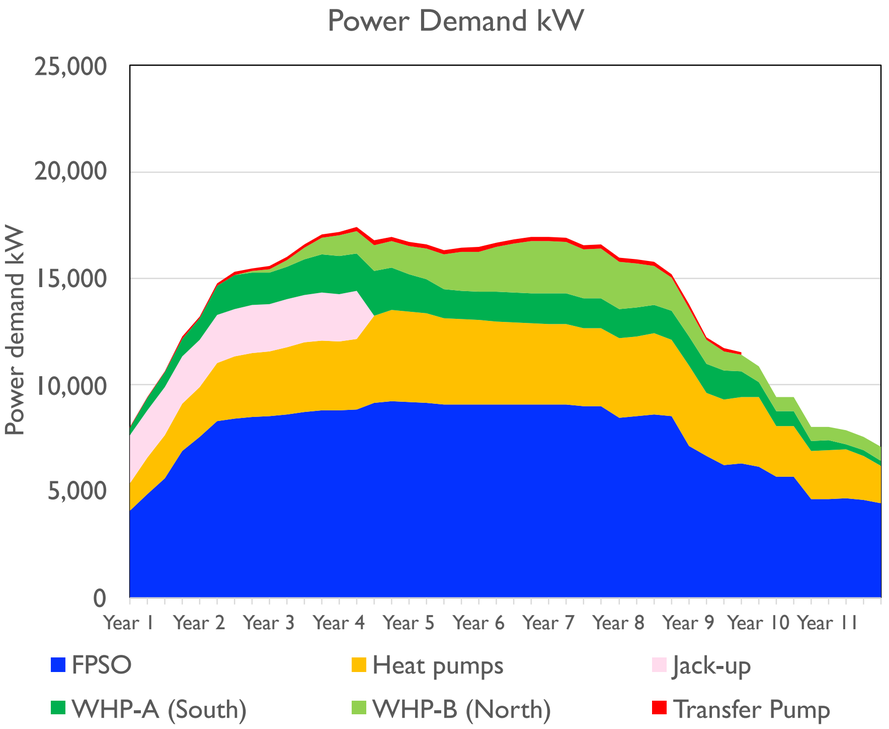
- **Wind Turbine Generator (WTG)**
  - Turbine agnostic
  - 12 to 15MW (to be assessed)

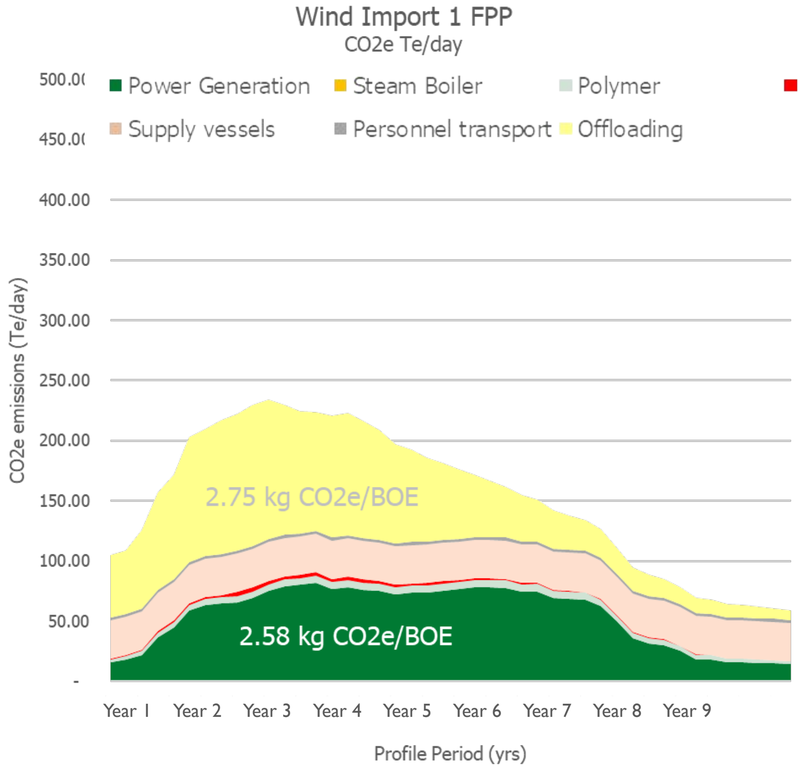
- **Wave Energy Convertor**
  - 4 off, from 500kW to 1MW each (to suit site)
  - Wave energy converted to motion by absorber
  - Mechanical motion converted to electricity via oil hydraulic Power Take Off (PTO) system

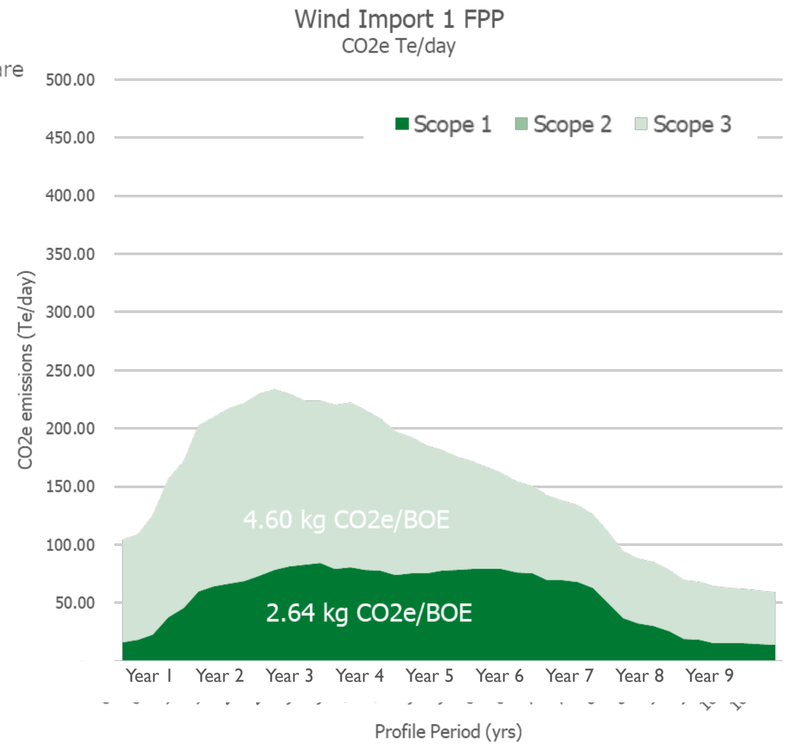




Emissions, by cause and scope
Local wind and wave power

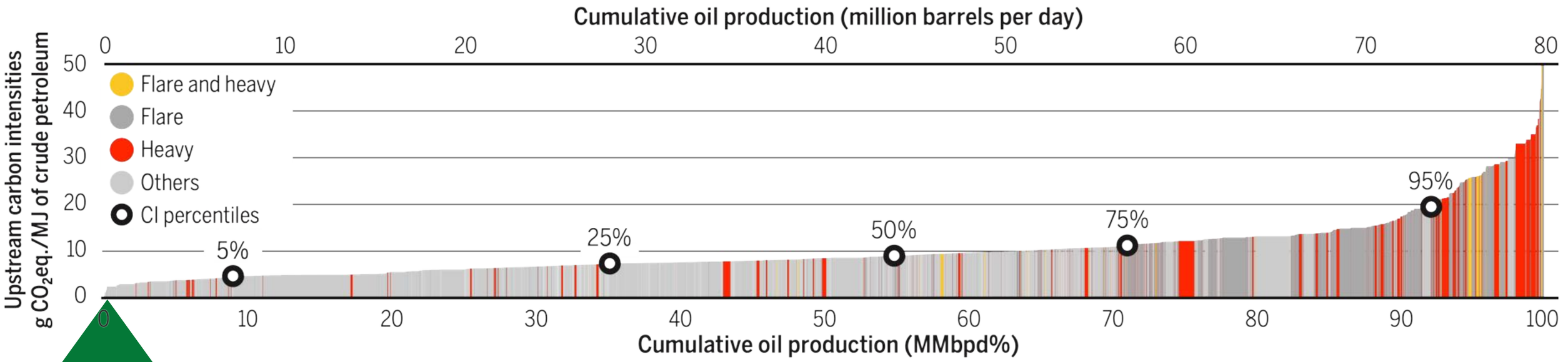






- Local renewable power eliminates the need for a gas import pipeline and halves emissions again
- Unit will be a 12MW wind turbine with a 2MW wave power generator from FPP

Comparison with global oil production emissions
Viscous oil doesn't have to mean high emissions



Pilot emissions will lie in the lowest 5% of global oil production

- To be comparable with this Stanford University dataset, to our Scope 1 & 2 emissions we have added:
  - Scope 3 emissions from offshore logistics, oil transportation to the refinery, and polymer production
  - Estimates of emissions during the exploration and development phases (done using the Stanford tool)
- Pilot field comparable emissions are 1.4 gCO_2eq/MJ with a single wind turbine

Masnadi et al (2018). Global carbon intensity of crude oil production. Science. 361. 851-853. 10.1126/science.aar6859.

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