Your innovation partner

The Oil & Gas Technology Centre
Your Innovation Partner

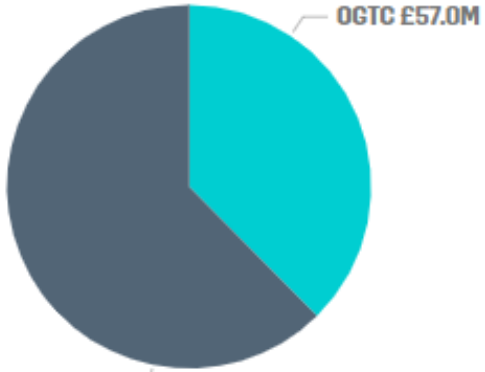
Reducing Operational Emissions Practical measures that can be deployed today, and new technologies that could be deployed tomorrow

Martyn Tulloch
Net Zero Solution Centre Manager

OGTC Track Record

£152M Invested

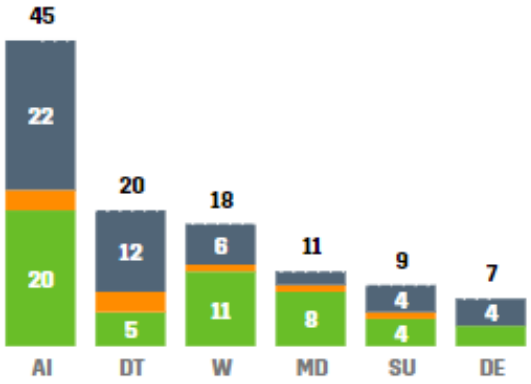
Co-investing in industry-led projects to develop and deploy new technologies.



1,160 + Technologies Screened

Harnessing the power of an ever-expanding range of transformational new technologies.

Field Trials



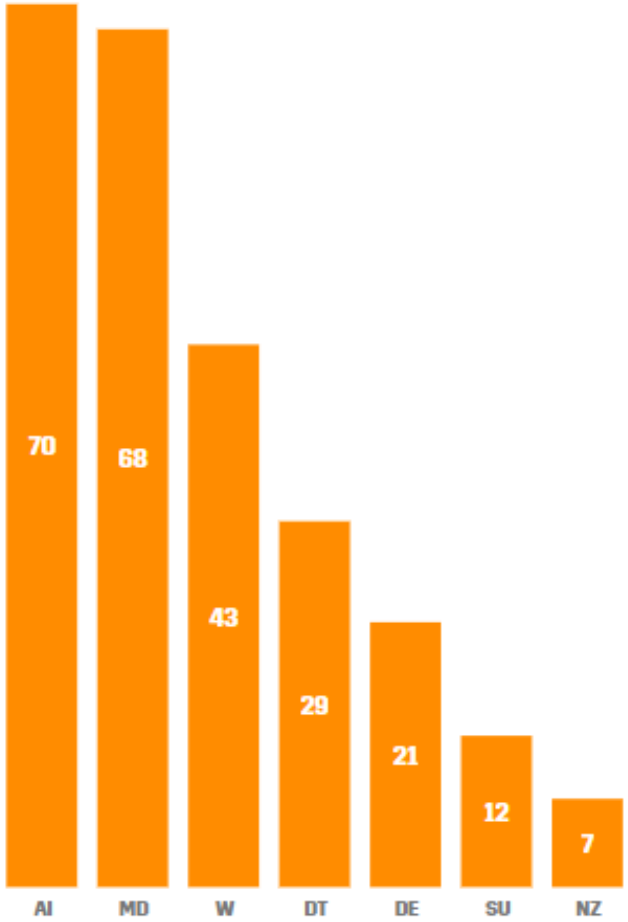
20+ TechX Startups

Accelerating innovation by helping a new generation of entrepreneurs take their technologies to market - faster.

307	applicants
2-3	ventures
46	countries
£1.2M	investment this year

250 Approved Projects

Delivering technology projects to fix today, maximise recovery and transform tomorrow.



Memberships

137 Bringing together Operating, Supply chain and technology companies to drive innovative new solutions.

71	Operating company
23	Service company
40	Technology developers
3	Business Advisors

Government Industry Schools Community

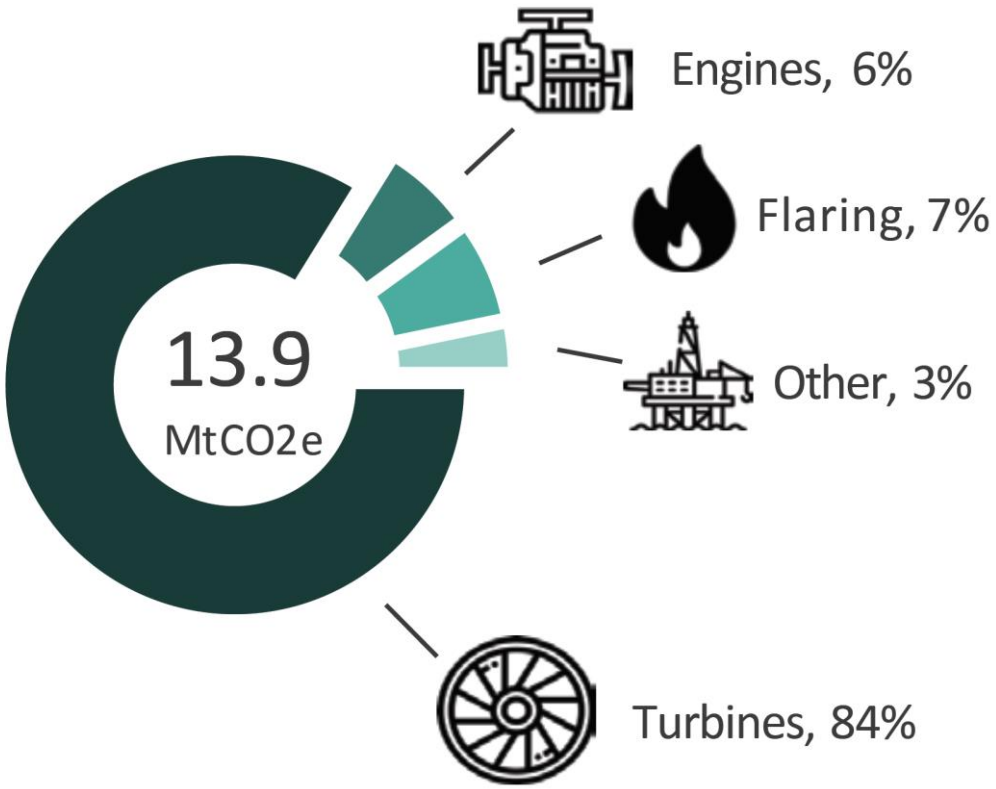
Visitors

23,500+

Creating a culture of innovation in the region through exciting events and workshops.

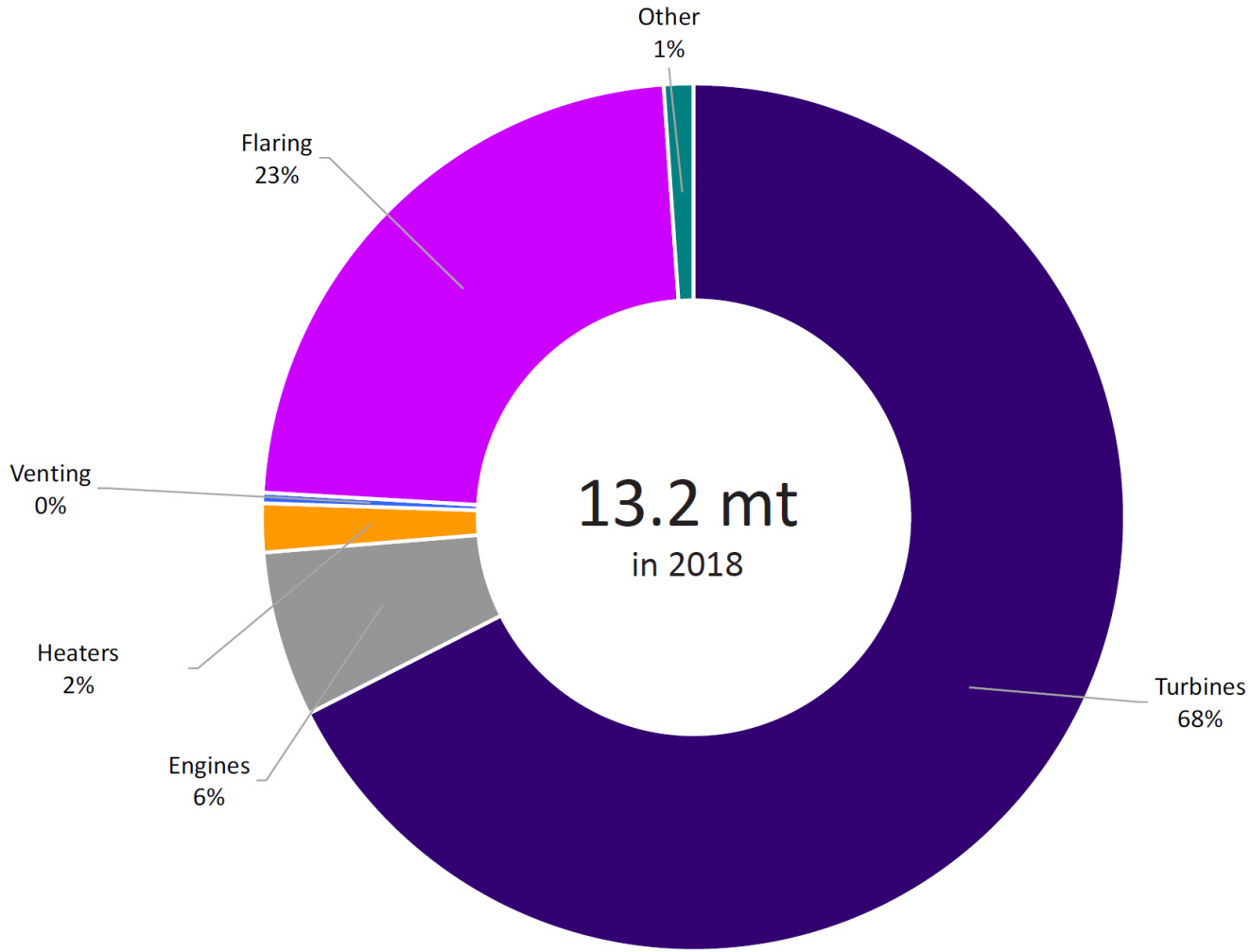
Offshore Operational Emissions

NCS CO_{2e}



Source: KonKraft (2020)/ Norwegian Environment Agency (2019)

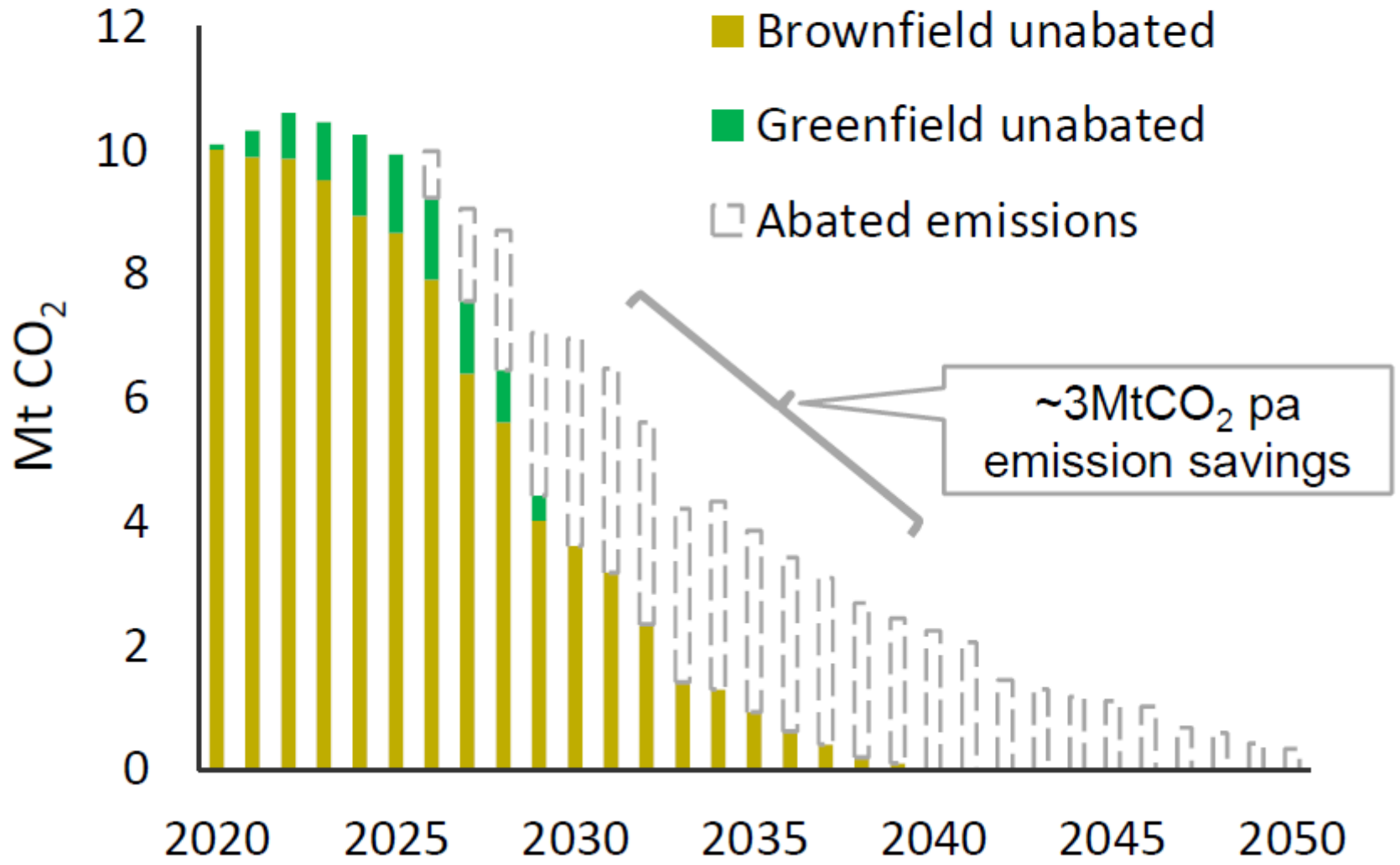
UKCS CO_2



Source: OGUK Environment Report (2019)

OGA - UKCS Energy Integration (August 2020)

Potential emission reductions from O&G power generation (EIP scenario)



Source: OGA Energy Integration Report (2020)

On the horizon

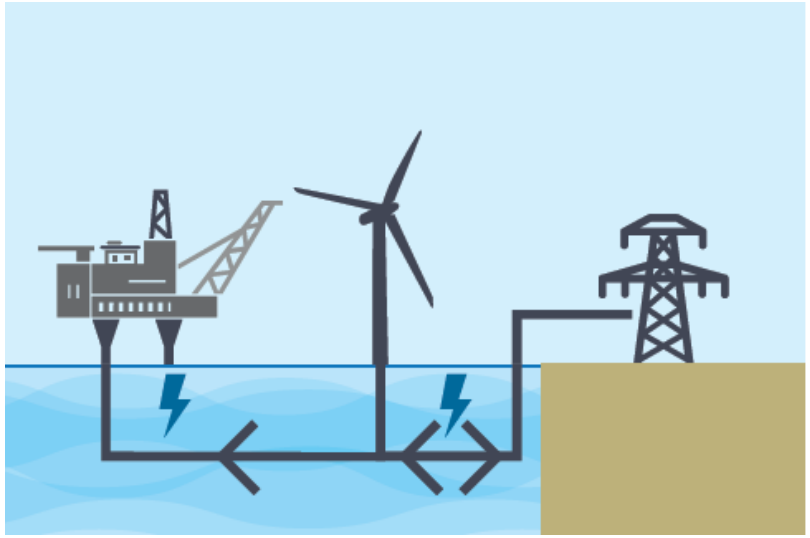
Electrification cost reduction

Waste heat recovery

Alternative Fuel Gas Turbines

Modular CCS

Power Hubs



PowerLink

Offshore Compact AC-DC Converter

- PowerLink is a 5x lower cost and 10x smaller footprint than conventional HVDC converter stations
- A key enabler in cost effective HVDC for offshore

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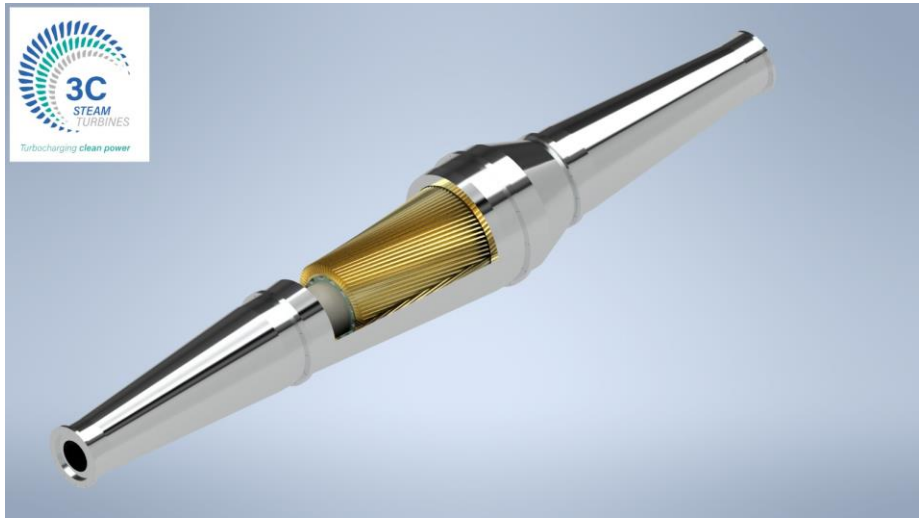

Utilise process and Geothermal heat – Waste heat and Geothermal even at low temperatures (70°C) can be harnessed by the 3C process.

On the horizon

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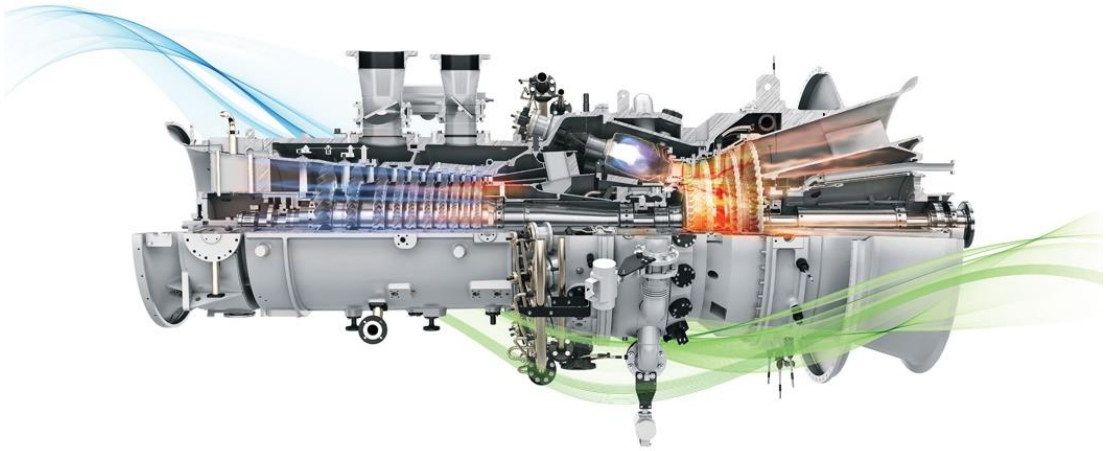
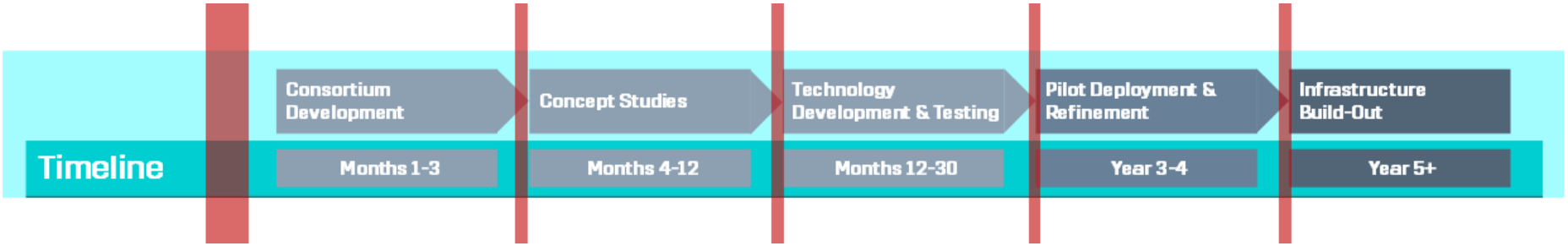
Project Objectives

- Provide a solution for decarbonisation of offshore operations without extensive modifications
- Can be adopted across a number of industries
- Provide UK manufacturing opportunity





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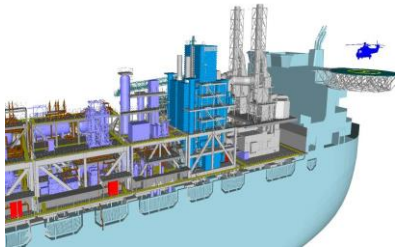

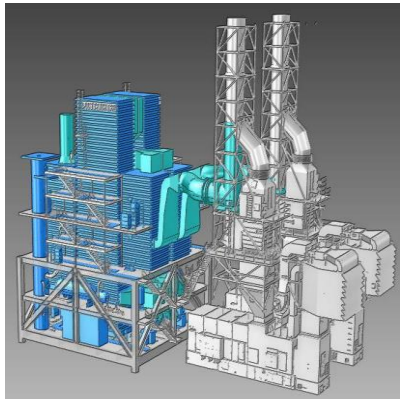

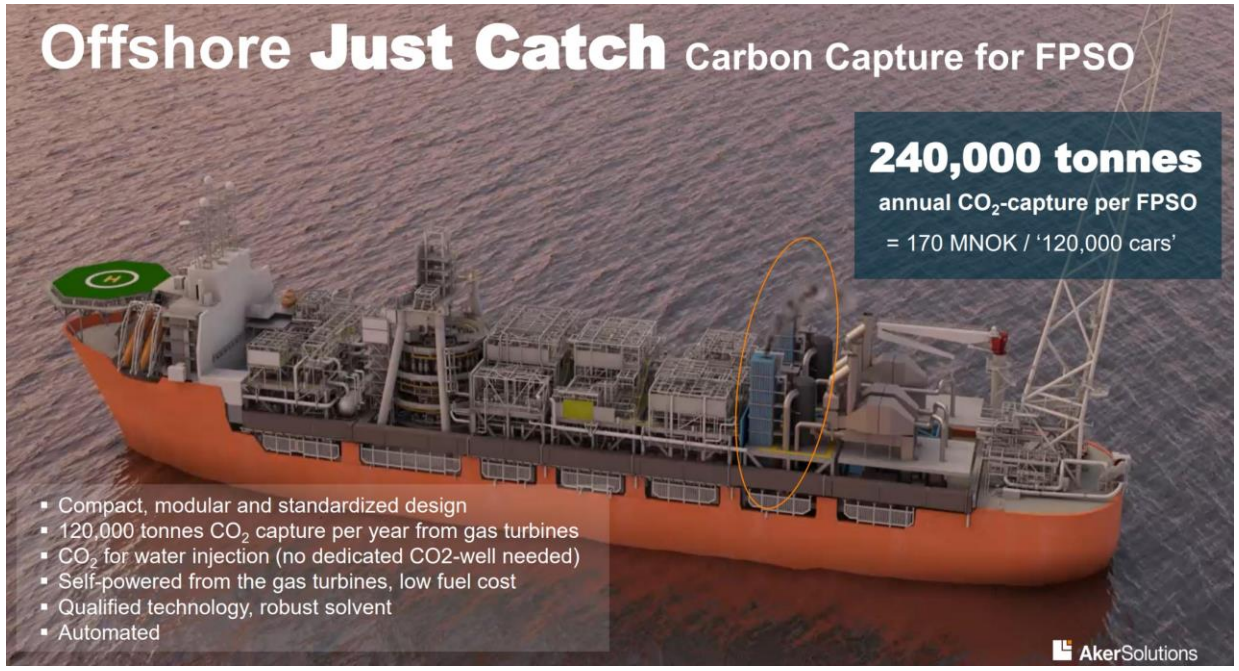

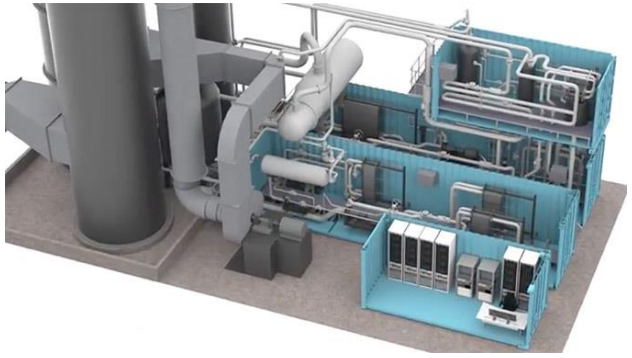

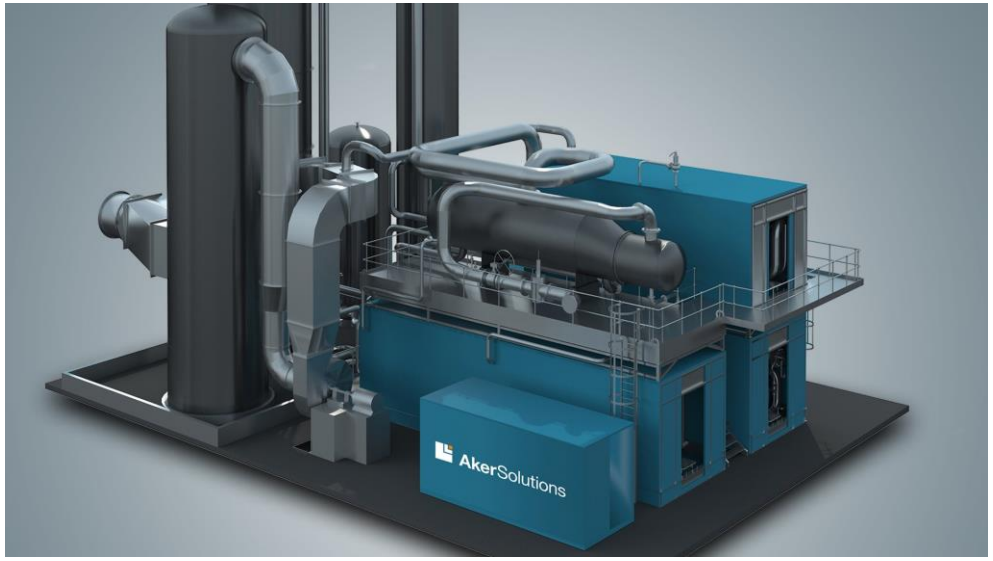

On the horizon

Electrification cost reduction

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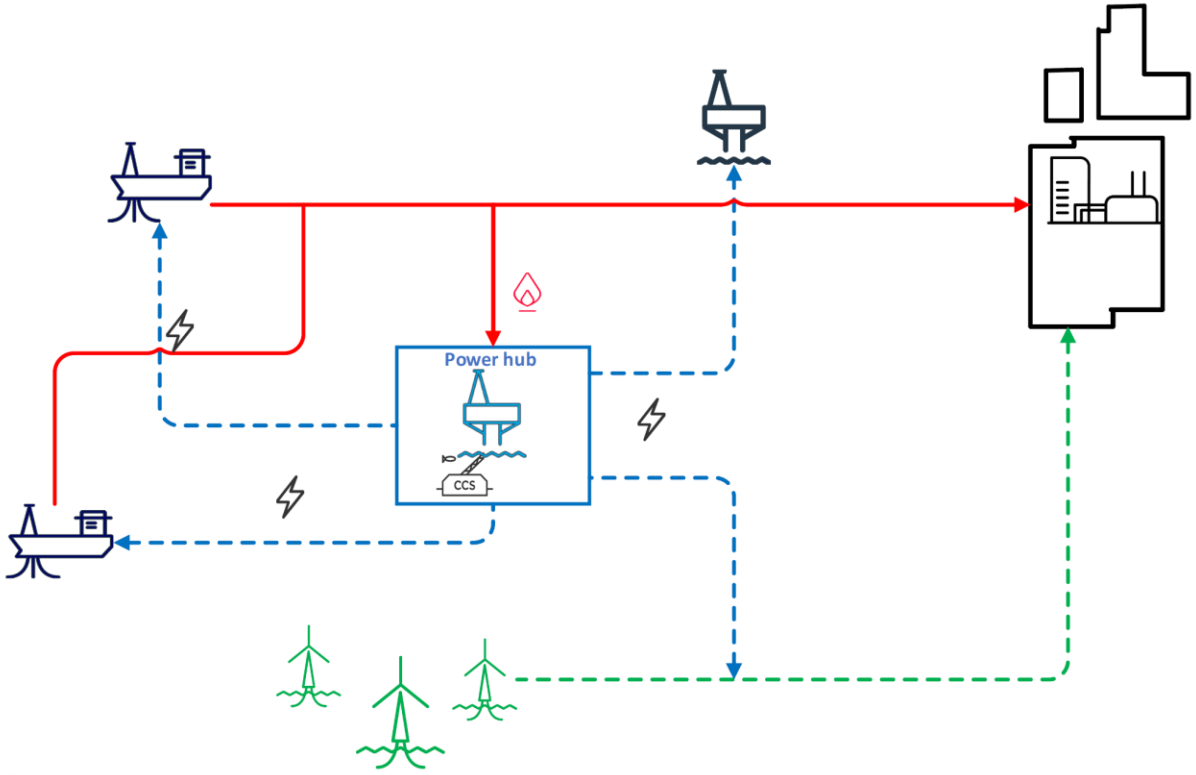
Power Hubs

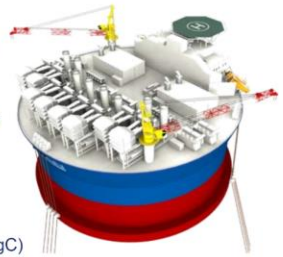
An offshore gas-fired power plant hub with CO_2 capture

- Optimally located amongst O&G platforms
- Local gas supply & CO_2 storage
- Avoids cables to shore and long pipelines
- Dispatchable complement to wind power



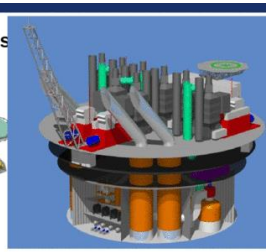
Sevan 650 540MW Powerplant – Main Characteristics

- Power production from locally produced gas
- Transmission lines to platform cluster and/or shore
- Combined cycle (gas/ steam turbines)
- The Sevan 650 GTW consists of
  - 8 Siemens SGT800 Gas Turbine generator sets
  - Heat Recovery Steam Generators (HRSG)
    4 Steam Turbine generator sets
- Plant power capacity is 540 MWe net
- At full utilization this represents 4,73 TWh/year
- Plant efficiency is 54% (Air/ Seawater temp 15/7 degC)
- Estimated gas consumption is 2 MM SM^3/day
- CO2 handling feasible (ref study with SINTEF)
- Net power capacity after CO2 removal is 450MW
- Net efficiency after CO2 removal is 45%
- CO2 injection into subsea reservior (facilitates IOR initiatives)



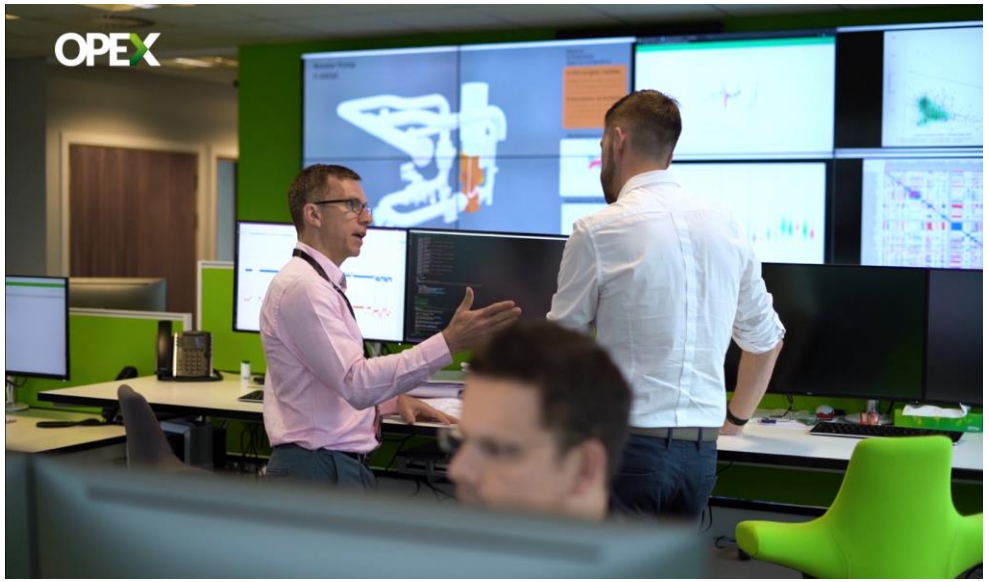
SEVAN marine

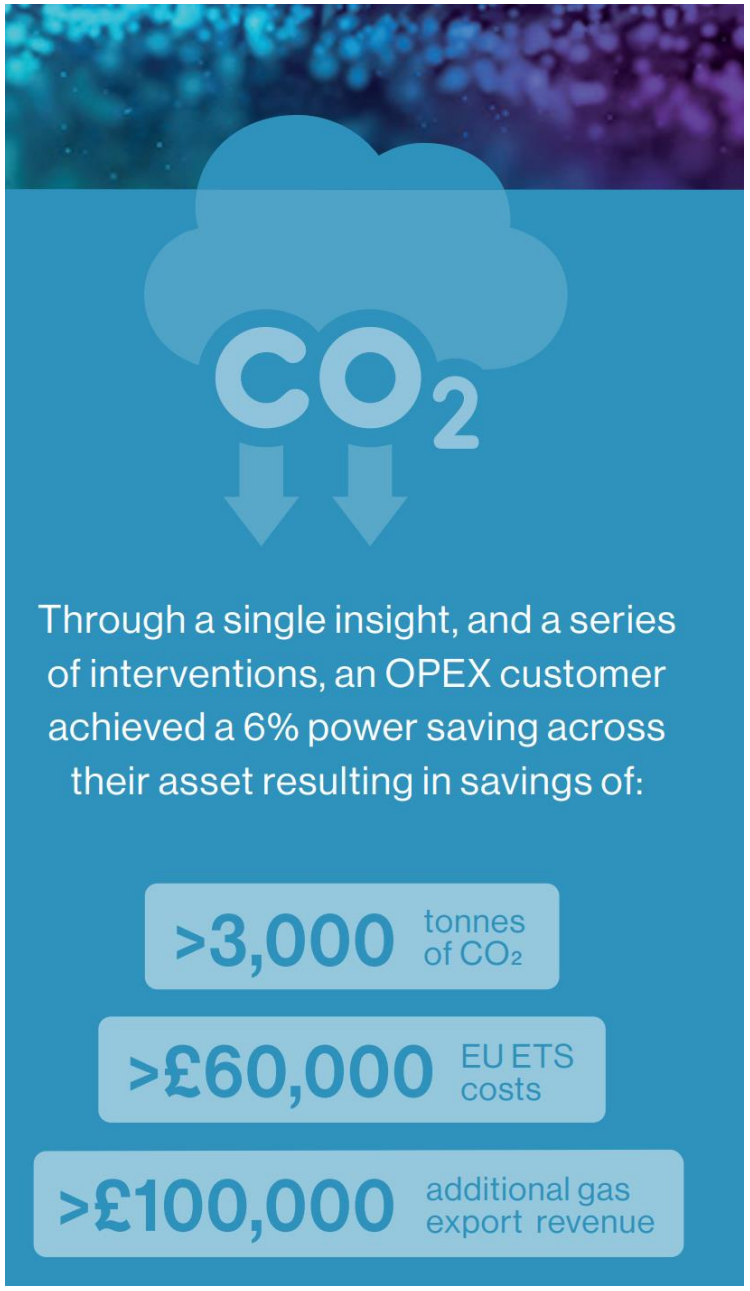
Floating powerplant applications
Onboard Co2 capture and compression plant feasible



SEVAN marine

Ready now – Data Analysis & Digitalisation





An emissions reduction solution that delivers immediate impact

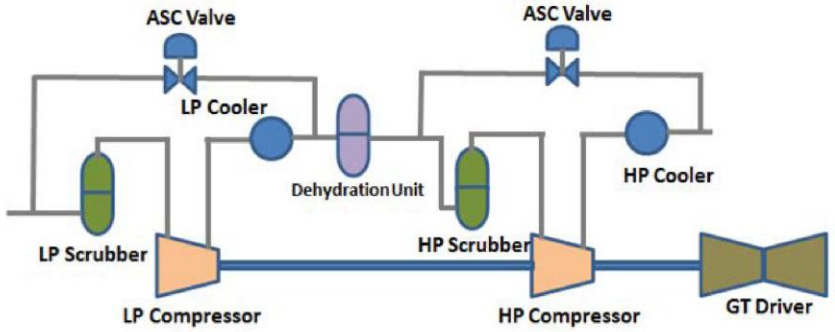
The new X-PAS™ Emissions service is targeting a 10-15% reduction in annual CO_2 tonnage

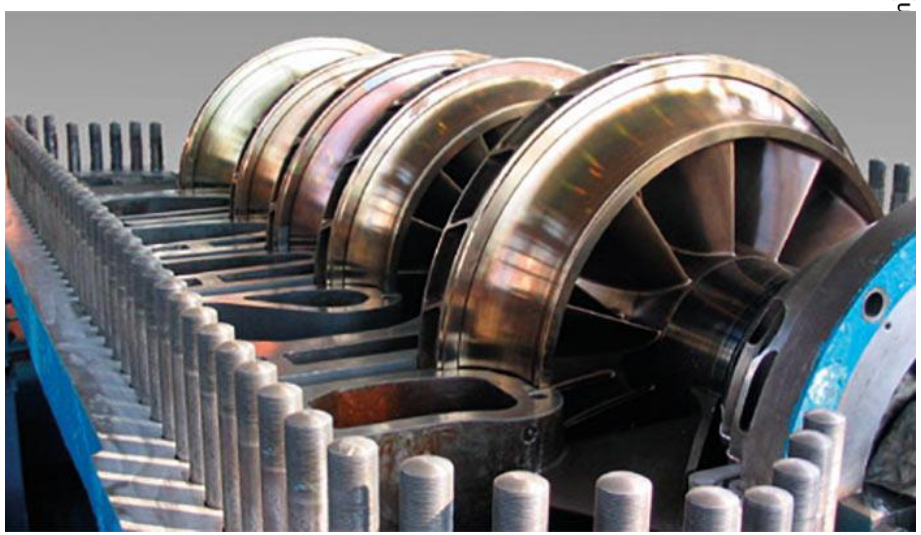
A **10%** saving across the UKCS would equate to **1,460,000t/yr** which is the equivalent of

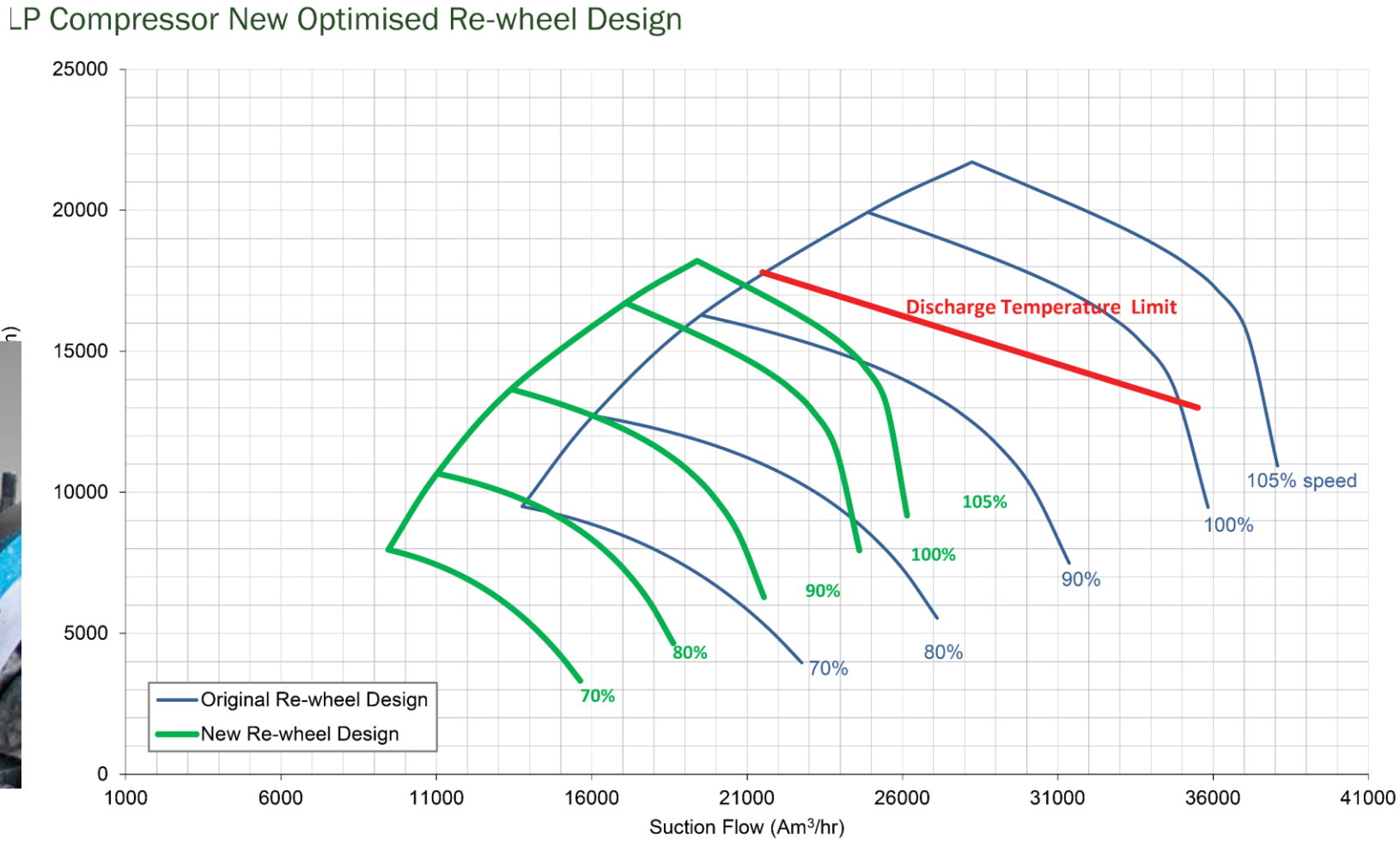
taking **280,000** cars off the road

or planting **24 million** trees

Ready now – Compressor Re-wheel







Ready now – Halo Seals

Hydrostatic Advanced Low Leakage Seal

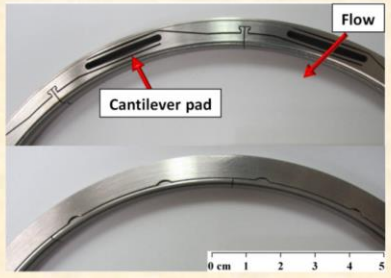
HALO™ seal

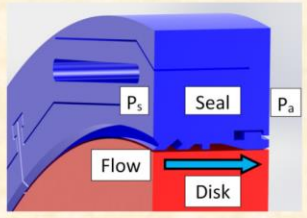
Advantages

- Low leakage.
- Radial compliance and stiff in axial direction.
- Pads generate hydrodynamic wedge separating seal from rotor (non-contacting).

Disadvantages

- Difficult to manufacture (EDM).
- Not many commercial applications.
- Expensive.





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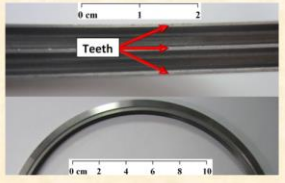
Labyrinth Seal

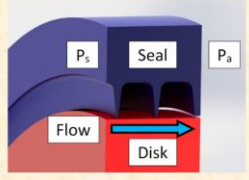
Advantages

- Non-contacting.
- Wide range of pressures, temperatures, and shaft speeds
- Inexpensive.

Disadvantages

- Leakage depends on clearance
- Inevitable wear (enlarges clearances) and worsens leakage.
- Long seals lead to instability i.e. large cross-coupled stiffness.





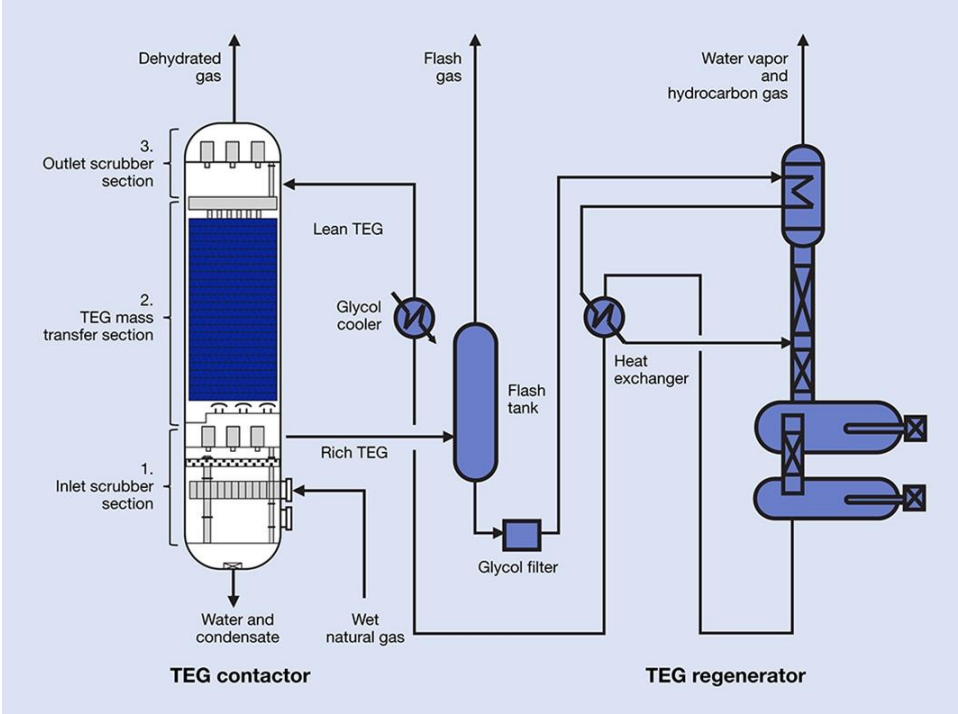
Hydrogen Compressor Seal Case Study, Justak, J., (2013)

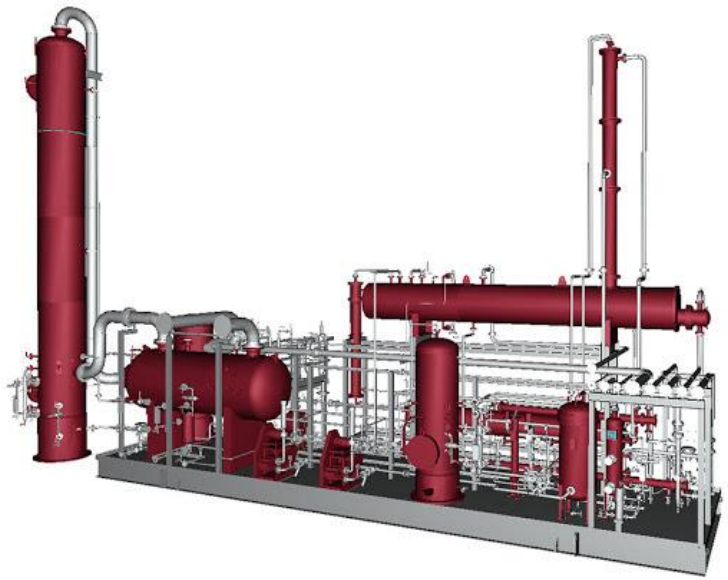
"HALO seals replaced 4 interstage, 5 impeller eye, and buffer gas seals for a hydrogen compressor."

"At full speed the compressor was 20% more efficient than with the labyrinth seals."

Ready now – optimising glycol regen.

	Performance Summary
	CO_2 Equivalent (Tonnes/year based on 85% availability)
Vent to Atmosphere	16,275
Stripping Gas to LP Flare	1,811
CO_2 Abatement	14,464





Ready now – engage teams – Challenge, Check Change

Brownfield Exchange (BEX)
Replacement of existing gas turbines

SIEMENS energy

"Plug and Play" concept for replacement of old and less efficient gas turbines with state-of-the-art turbines

- Exhaust condition kept in the proven range to minimize modifications to the balance of plant
- Scope is customized in each unique opportunity
- Customized Operation & Maintenance program

Sustainability impact

Example: replacement of a Fr6B.03 with SGT-800:

- Increased efficiency of 9% in simple cycle and 10% in 1+1 CCPP
- Reduction of CO_2 foot print from 632 kg/MWh to 491 kg/MWh
- Capability to operate on up to 50 % hydrogen today and up to 100 %

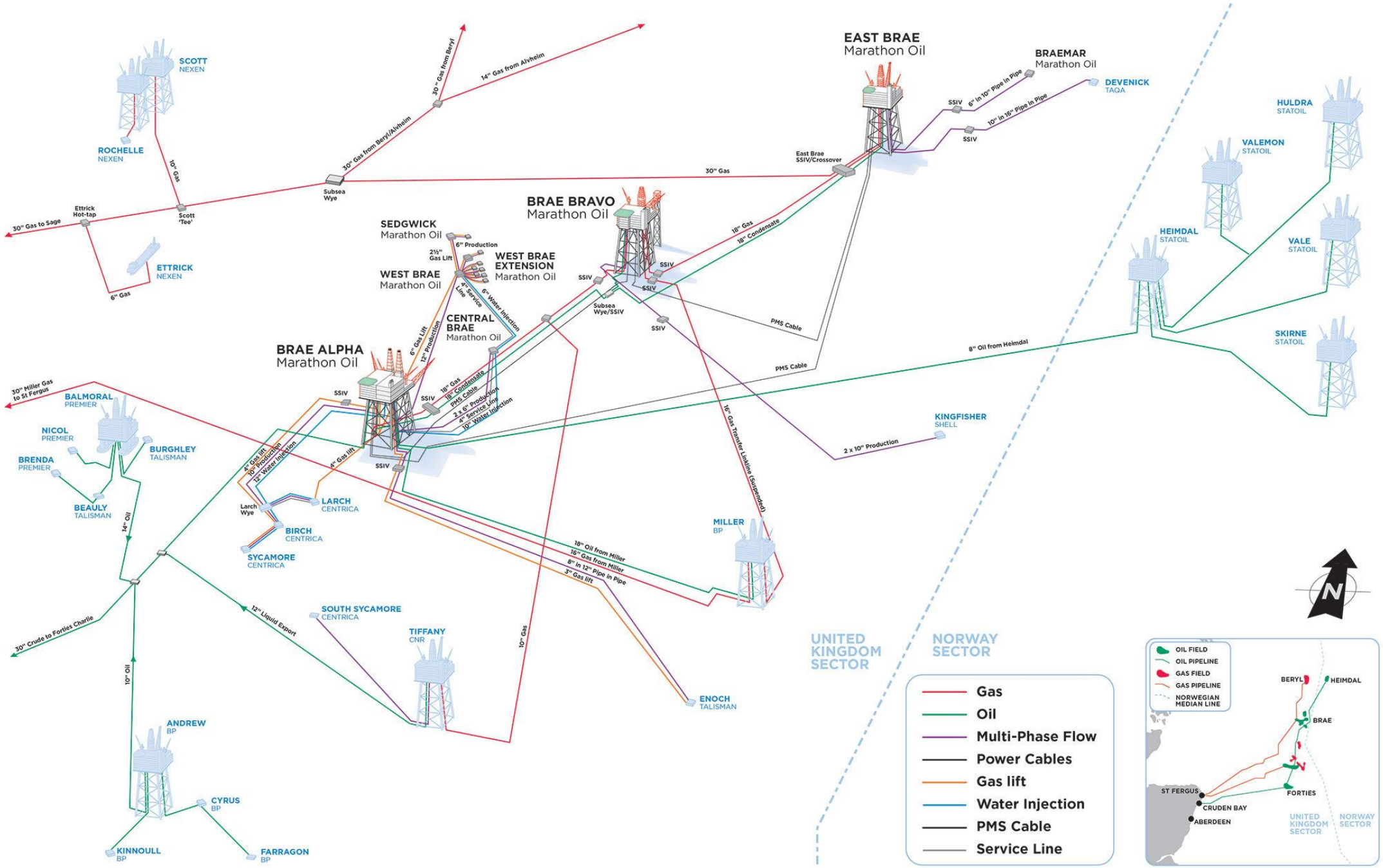
Further benefits

- High modernization effect with low CAPEX (compared to building a new power plant)
- Significant OPEX reduction (fuel cost savings)
- Increased revenues due to higher availability
- Siemens Energy SGT-800 best-in-class reliability of 99.8 %
- Great possibility to optimize and prolong plant lifecycle by implementing Flex LTP and dynamic lifting

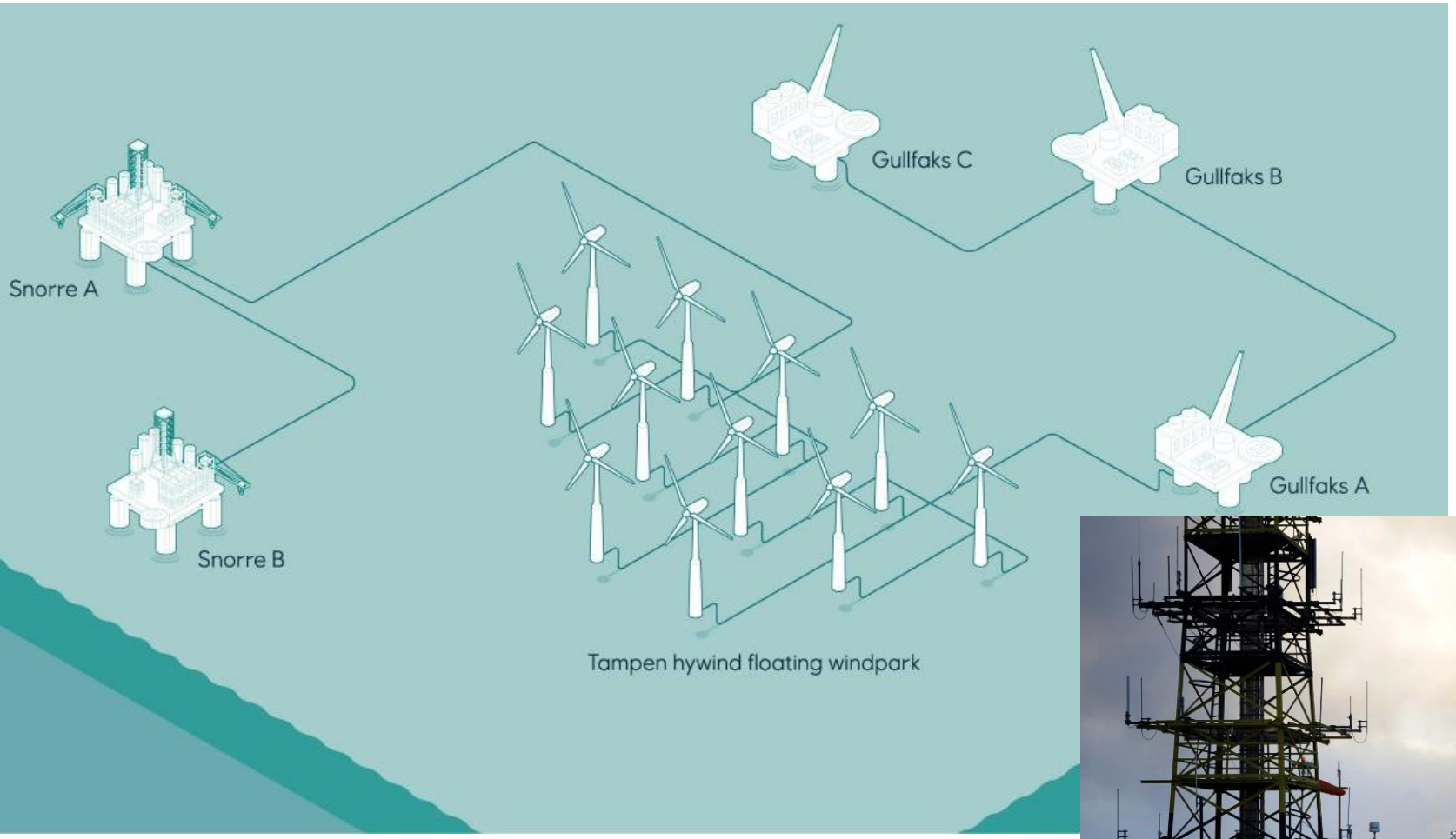
Reference

- BASF Schwarzheide, Germany – Fr.6B exchanged by SGT-800 (57MW)

Ready now – Platform Interconnection – Turbine Efficiency Optimisation



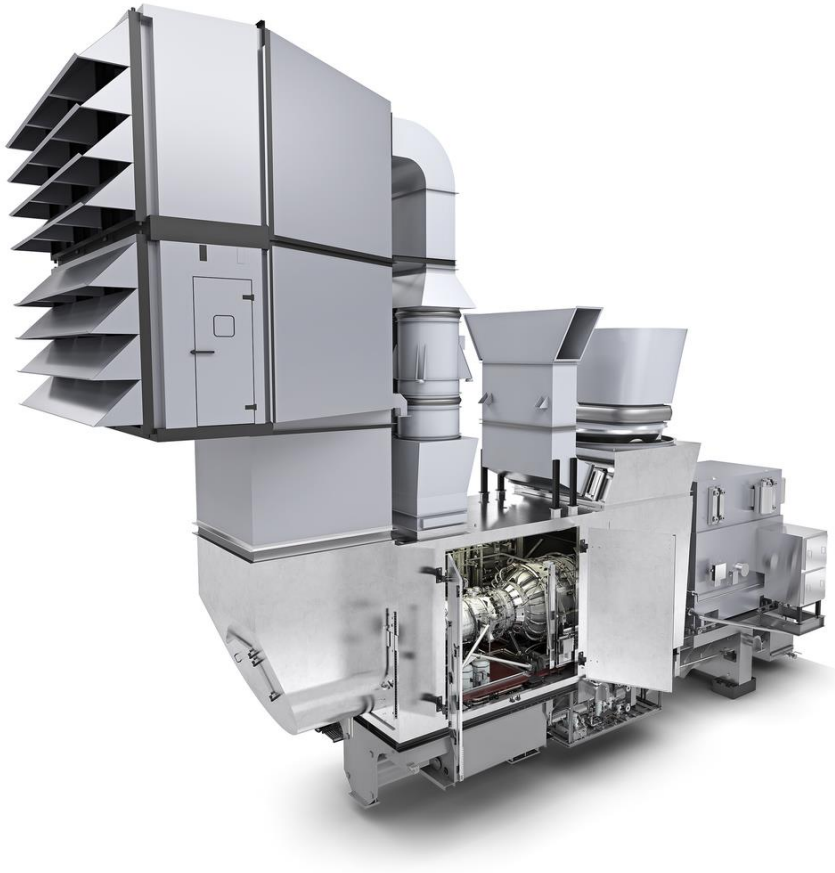
Ready now – Offshore Wind

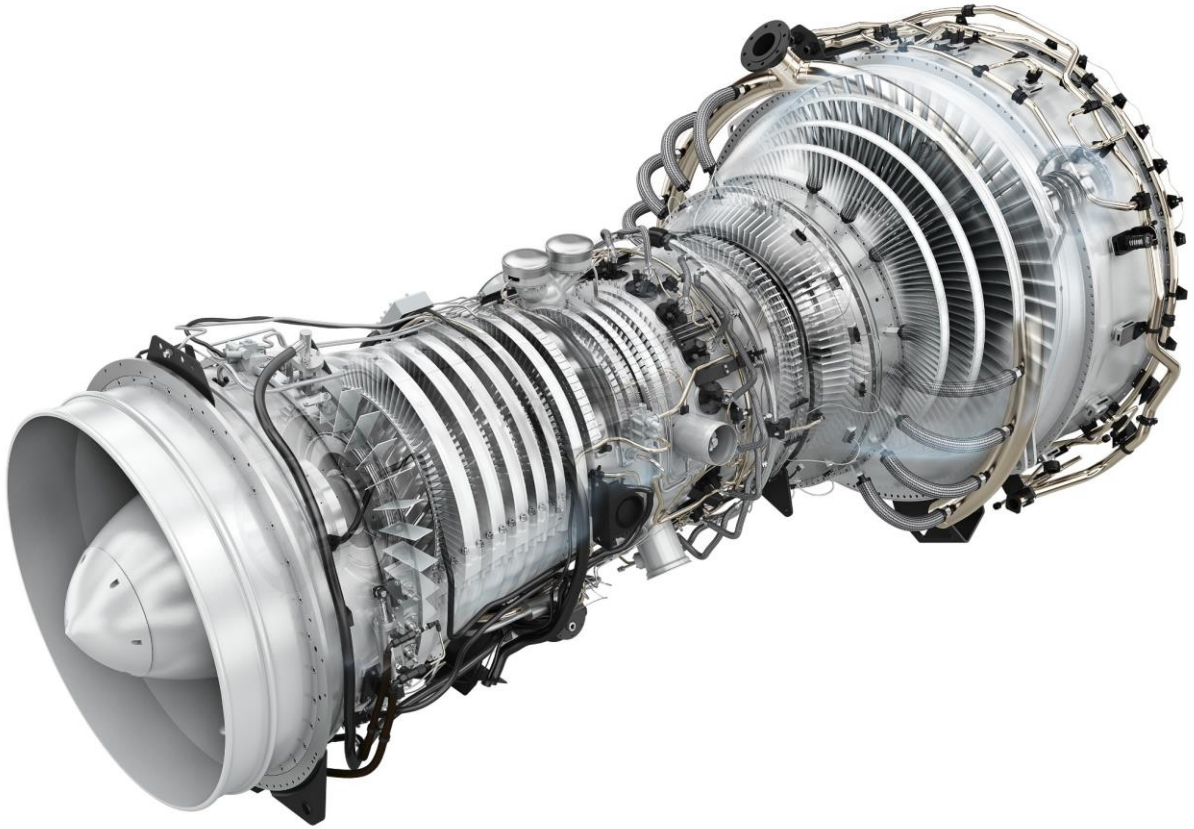


Ready now – Highest-efficiency (H)EPA filter

Up to 90 % of power output decline of gas turbines is attributable to inadequate filtration of inlet air.

HEPA filters maintain power capacity and efficiency of the gas turbine (estimated average 2% reduction in fuel consumption and CO_2 emissions). Vastly reduces the need to perform compressor wash.





Thank You

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