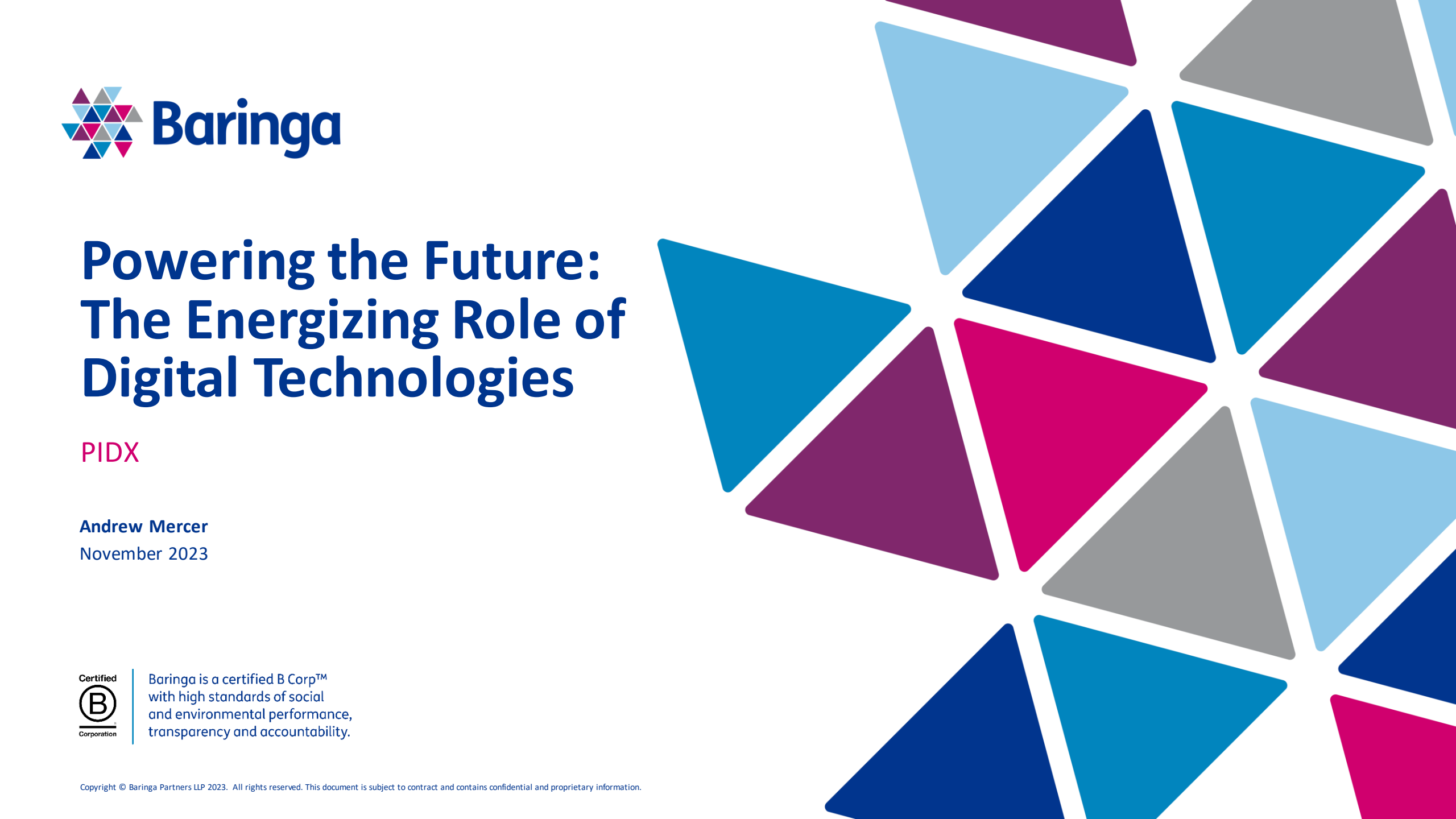

Powering the Future: The Energizing Role of Digital Technologies

PIDX

Andrew Mercer

November 2023

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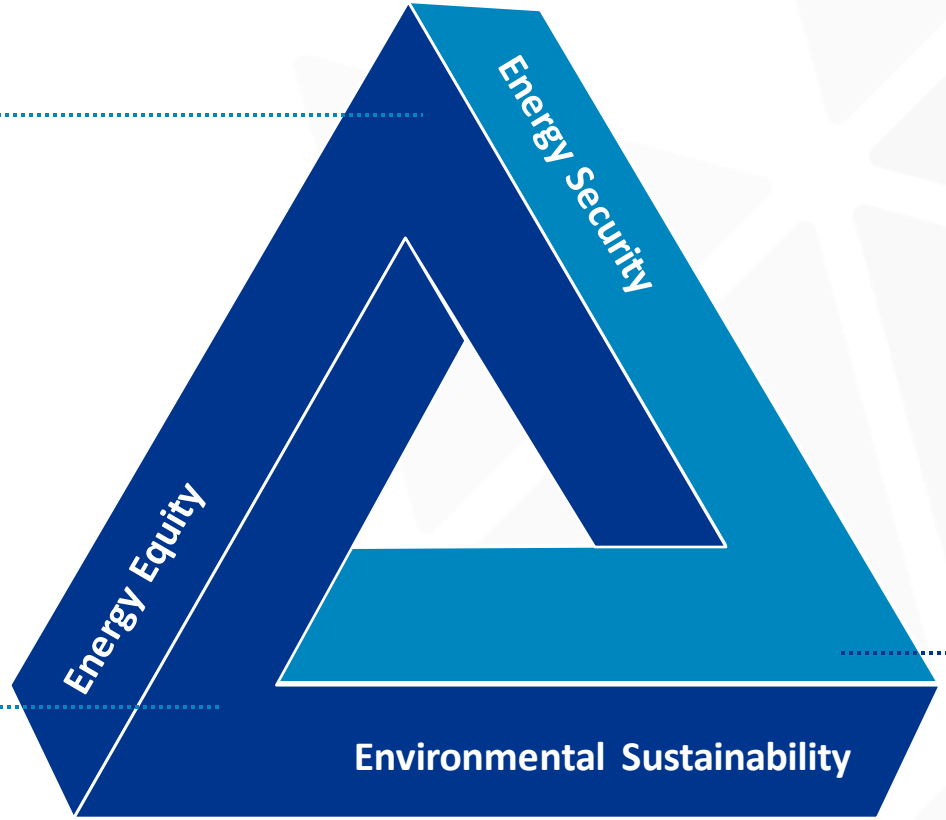
Balancing the ‘Energy Trilemma’

Rooted in Baringa’s values as a B Corp is helping clients solve for the Energy Trilemma

Energy security
The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy to meet current and future demand.



Environmental sustainability
Meeting of resources and services needs of the current and future generations without compromising the health of our ecosystems.

Energy equity
Accessibility and affordability of energy supply across the population.

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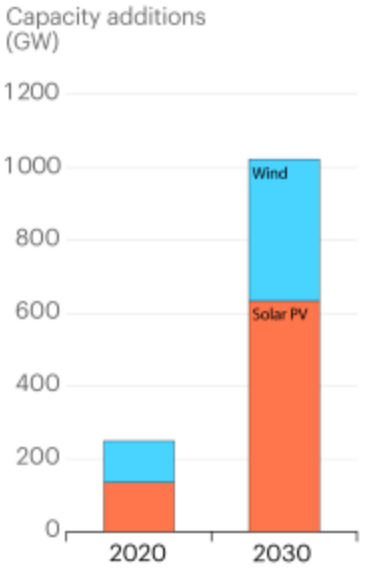
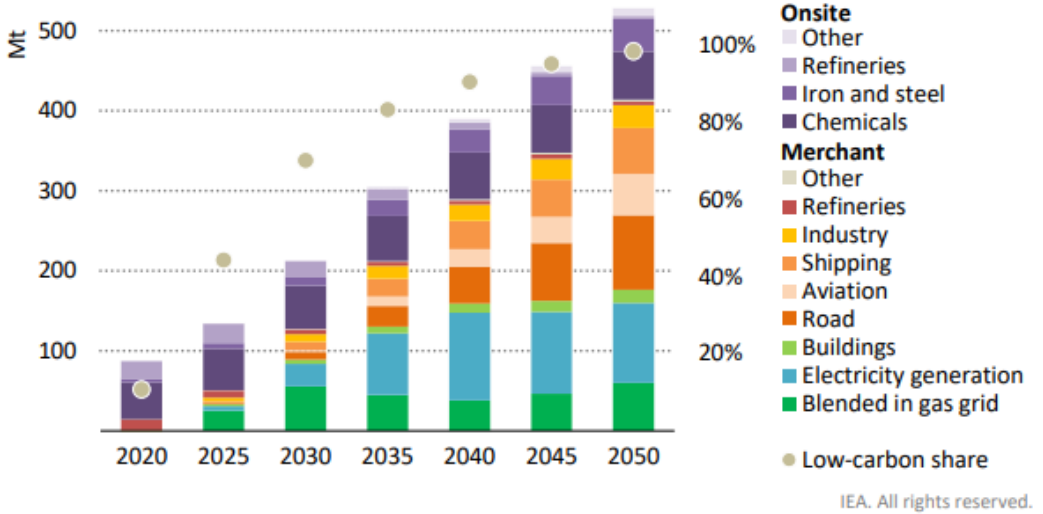
While electrification is key in the transition to net zero, abated fossil fuels will remain a part of the energy mix in the medium term.

Renewables



Hydrogen



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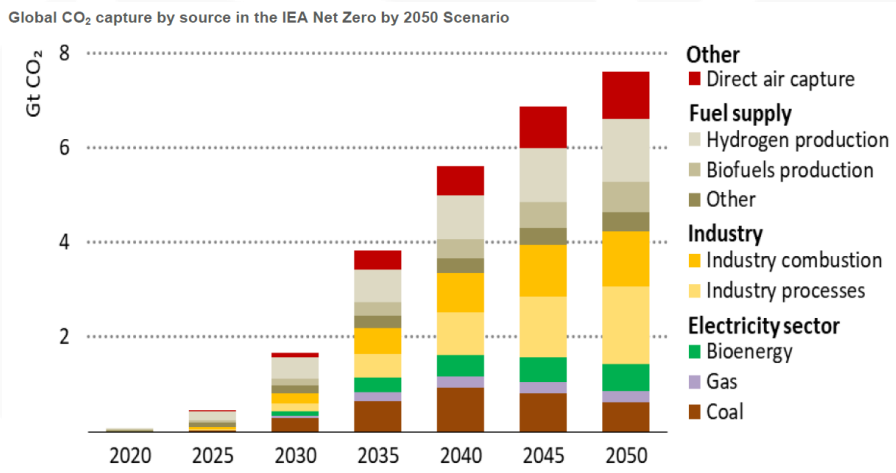

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Two-thirds of total energy supply in 2050 is from wind, solar, bioenergy, geothermal and hydro energy

Global hydrogen use expands from less than 90 Mt in 2020 to more than 500 Mt in 2050. *Blue and green hydrogen both play a key role to decarbonise hydrogen rising from 10% to 90% share*

Almost 8 billion tonnes (Gt) of CO_2 are captured across the global energy system in 2050 – almost a 200-fold increase from today.

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Extraction and processing of oil & gas is responsible for a significant proportion of global emissions, so decarbonisation can make a big impact.

- Minimising methane leaks and venting
- Eliminating all non-emergency flaring
- Electrification of production facilities
- Equipping facilities with carbon capture utilisation and storage (CCUS)
- Expanding the use of green hydrogen in refineries

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According to the WEF, digital solutions can reduce global emissions by up to 20%.

Digital technologies play a significant role in decarbonisation over differing planning horizons.

Near-term

Moving from estimates to actual data

- Actionable insights from real-time emissions measurements

Meet stakeholder reporting expectations

- Emissions accounting methodology, data and technology foundations

Methane sensing and data collection

- Satellite, drone and fixed methane sensing, comms and data collection

Medium-term

Lower emissions without lower production

- Digital twins to optimise efficiency and effectiveness of asset operations

Asset modification insight

- Data-driven marginal cost emission abatement curves

Cross-company insight & collaboration

- Information sharing up and down the supply chain

Long-term

Portfolio decision making

- Data-driven scenario planning to optimise shareholder value

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The ESG Regulatory Landscape is Consolidating

Demand for investor grade sustainability reporting has been rising up the international agenda throughout 2022, as International bodies and governments look to finance the energy transition and achieve climate targets. The forecast cost of adapting to climate impacts is expected to grow to $300bn per year by 2030 and $500bn by 2050*

In 2022, ESG sustainability disclosures have come to the forefront through Corporate Sustainability Reporting Directive (CSRD) and specifically ESRS in the European Union, the SEC in the US and through ISSB on the international level. All require expansive sustainability disclosures, and the details vary over each

Understanding the similarities between disclosure standards means that disclosure under one reporting framework can often satisfy the requirements of another. Understanding these prerequisites is key to developing a robust reporting strategy, a methodical data gathering process and related controls for a streamlined and effective deployment of resources

* Source: UN Environment Programme

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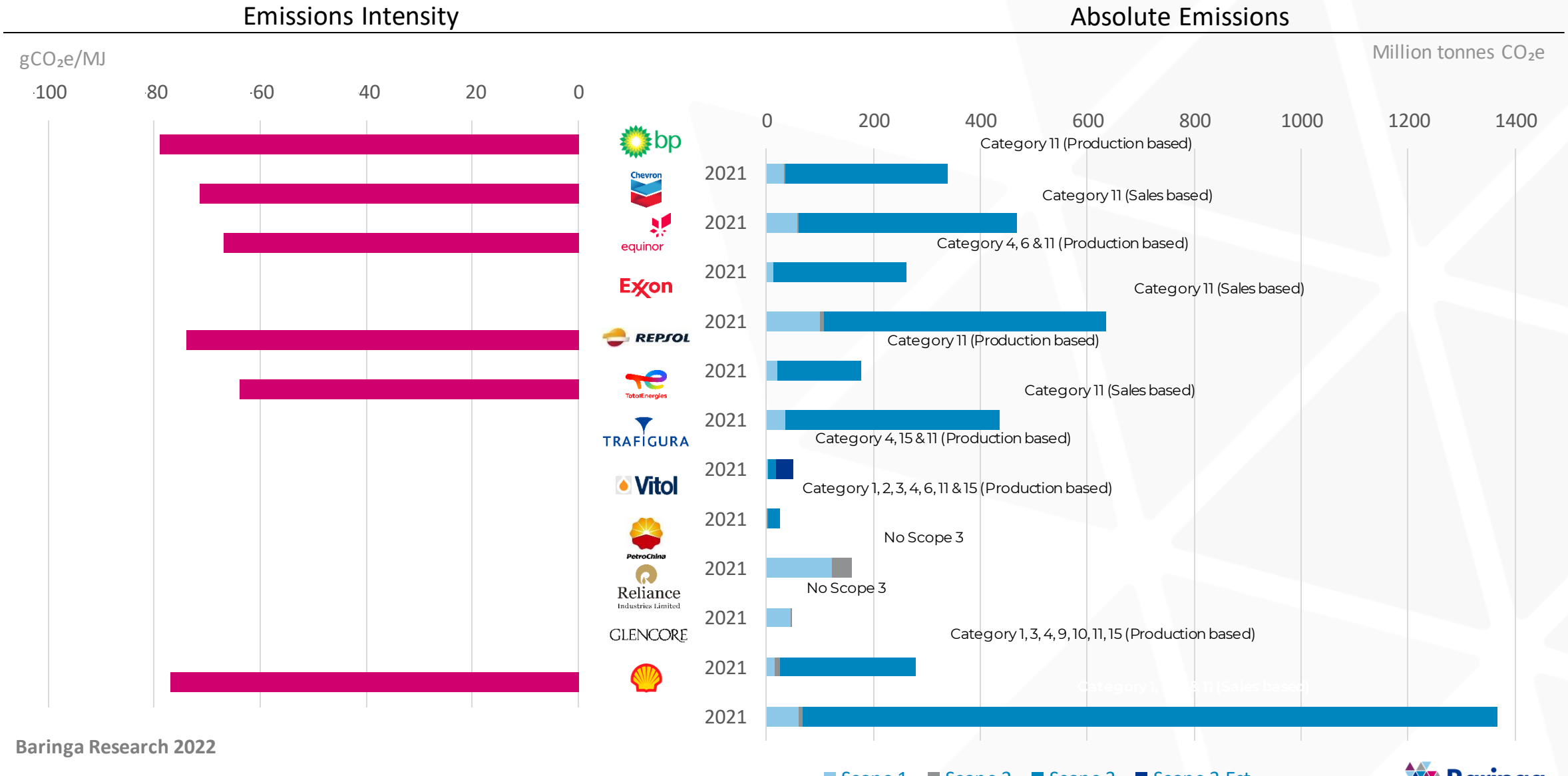
Leading to greater standardisation in emissions reporting



Baringa Research 2022

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Putting data to work to reduce emissions

Emissions management framework in a oil & gas operational planning cycle

Over a 3-month pilot period, this resulted in a **20% emissions reduction** and increase in gas throughput due to lower flaring and combustion.

This was delivered with **zero CAPEX**. ETS cost reduction and increased sales gas volumes amounted to **£20mm annual bottom-line increase**.

Re-framed the value proposition of decarbonisation, engaging staff and shifting behaviours to align performance with client's **net zero commitment**.

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Low carbon hubs will be critical for the decarbonisation of industry

Digital technologies will be key across the complex Power, CCUS and H2 value chain

Complex integrated value chain, multiple 3rd parties

Different asset classes/crosses internal boundaries

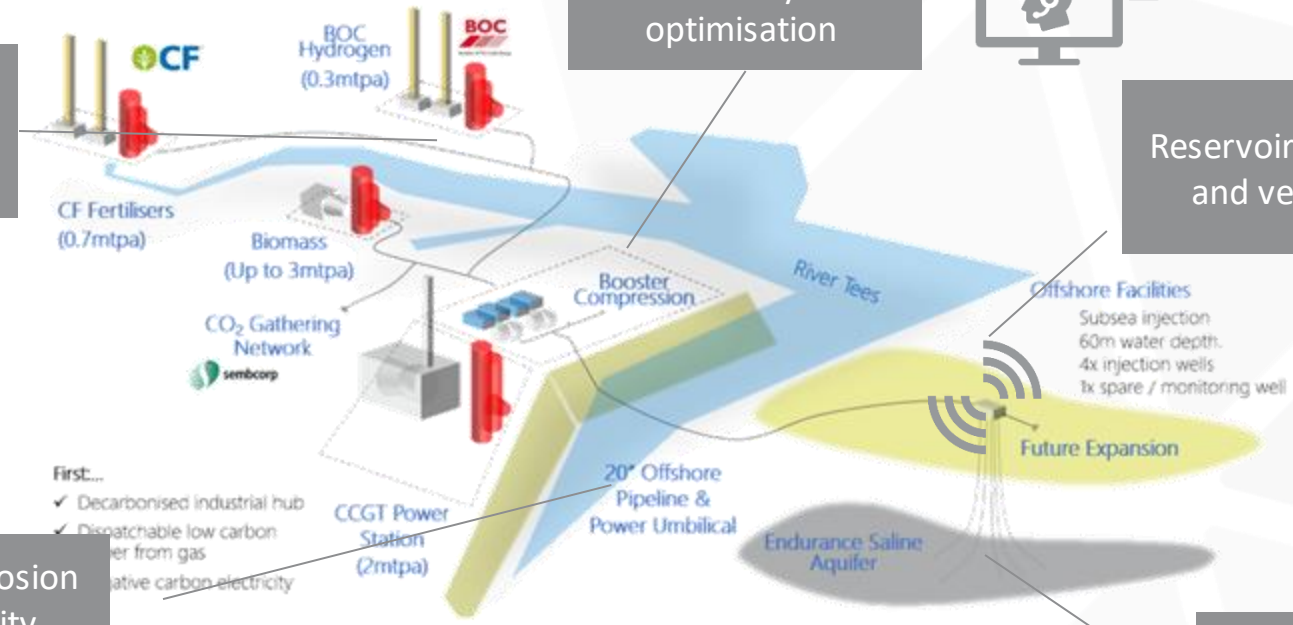
Re-use of existing pre-digital infrastructure

Low cost, efficient operations

Platforms for 3rd party collaboration

Digital twin Co2 Facility optimisation

Reservoir monitoring and verification



Pipeline corrosion and integrity management

Subsurface digital twin

Digitisation of historical data

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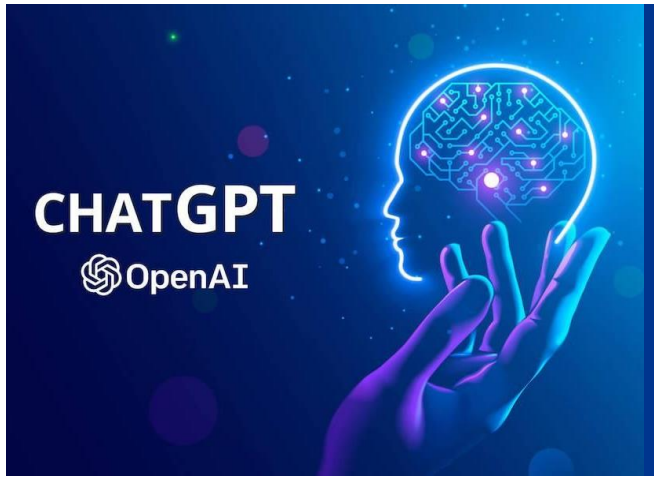
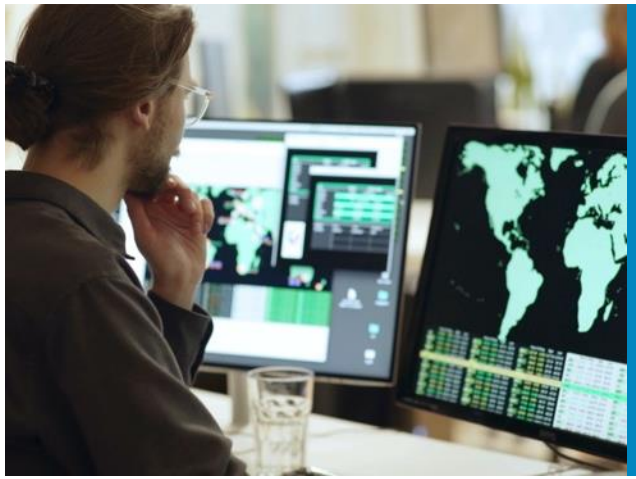
Harnessing the power of data across the supply chain is key to success



Generative AI / LLM

Industrial Internet of Things



Integrated (emissions) digital twins

Open data and collaboration

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