Creating Value with Sustainable Decommissioning

CIRCULAR NORTH-EAST
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Investing in a Smart, Sustainable and Inclusive Future

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The Oil & Gas Technology Centre

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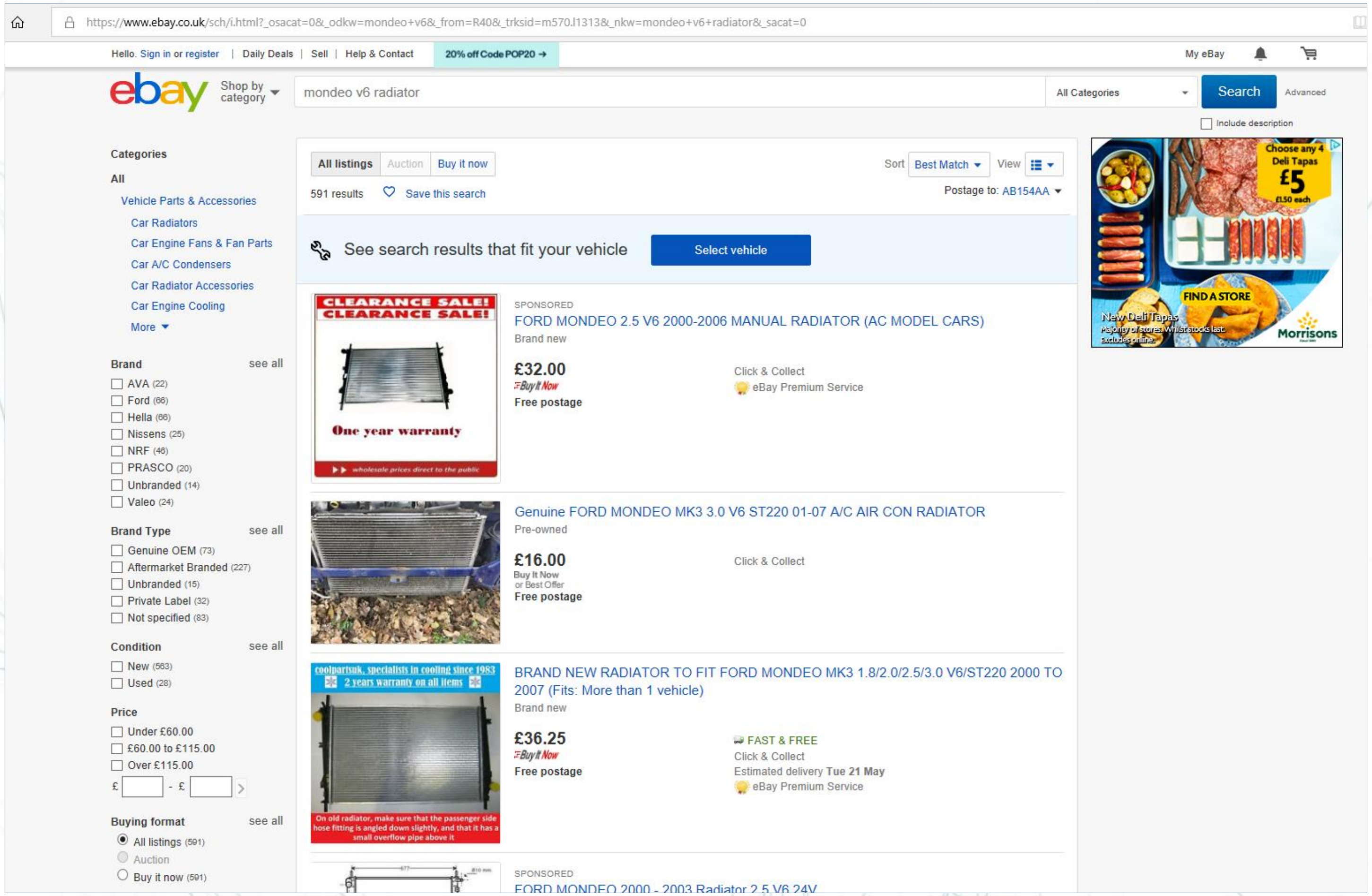
Benchmarking practices in Oil & Gas and sharing lessons learned

My Experience of Reuse



The beginning

Reuse Projects

Reduce, Recycle and Re-use

We live in a society that quite rightly encourages us all to progressively Reduce, Recycle and Re-Use. With regard to Reduce, the Scottish Environmental Protection Agency has recently announced a 36% reduction in landfill waste from businesses and households between 2005 and 2009. The Oil & Gas industry has also contributed to the Reduce concept with some innovative designs for lighter platform structures which have resulted in marginally smaller carbon footprints. When it comes to Recycling, early decommissioning projects in the North Sea have recorded an encouraging focus, with some impressive percentages being quoted. However, on the UK Continental Shelf, Re-Use has not yet featured strongly.

Decom North Sea believes this could be about to change. Earlier this year we were asked to chair a conference in Amsterdam entitled "Re-Use and Decommissioning". The conference attracted senior industry professionals from across Europe, with several of the speakers highlighting opportunities for re-use. These included :-

- Re-configuration for use with carbon capture and storage
- Conversion to gathering hubs or transformer stations for offshore wind farms and marine energy developments
- Conversion to booster stations for the planned North Sea Electricity Super Grid
- Modification of jackets for use on new developments with similar or different water depths
- Modification of topsides for use on new developments
- Toppling of jackets near to shore to assist the reduction of coastal erosion

(plus, of course the usual ideas for fishing, tourism and the like)! To date, re-use has primarily been recorded in the Gulf of Mexico plus some examples in the Dutch Continental Shelf, but there are signs that some operators are considering this option in other locations, such as West Africa, Southeast Asia and here in the UK and Norwegian Continental Shelves. Marathon has recently appointed a champion to actively research the possibilities for re-use throughout its own global operations and also the wider industry, and is keen to hear from the supply chain in this regard. In addition, at a Decom North Sea members' event in June, companies heard of Perenco's success in refurbishing the topsides of their Welland platform prior to re-deploying it on a new development in West Africa.

There would appear to be numerous possibilities to re-use all or part of redundant oil & gas production facilities if economic, environmental and social factors can be satisfactorily balanced.

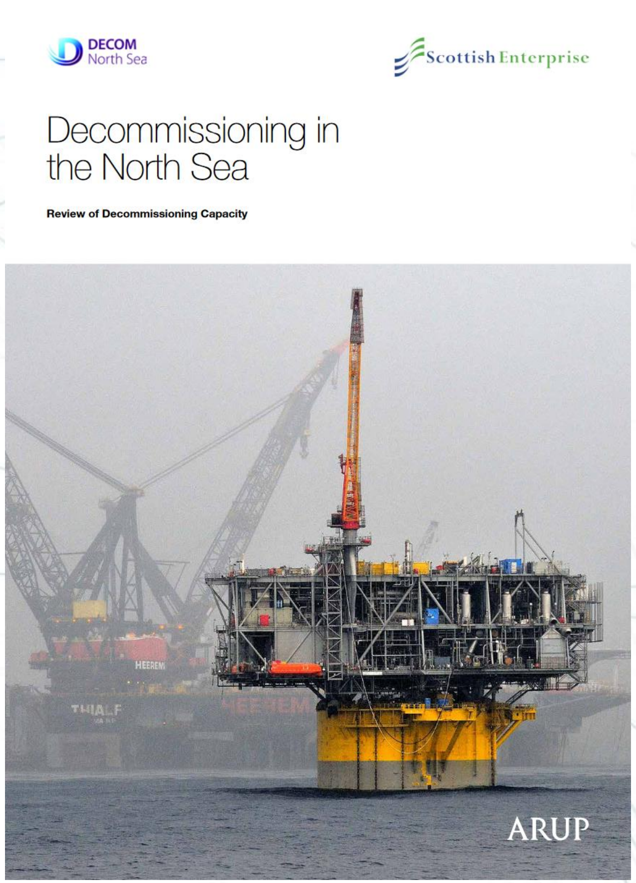
Topsides being lifted off the Welland platform prior to being refurbished and redeployed on a new development in West Africa.

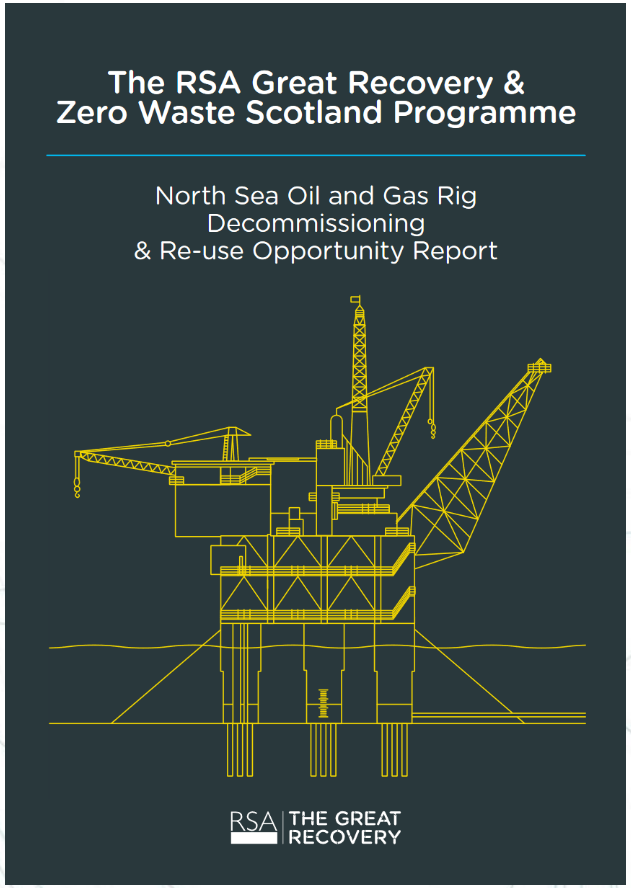
The accommodation modules from BP's North West Hutton platform were refurbished and redeployed as office accom-modation units at the onshore disposal yard. Clad vessels (perhaps designed for sour service) are likely to remain in good condition and be potentially suitable for re-use on new develop-ments. Drilling derricks could be upgraded and modernised. Gas turbines and power generation sets are capable of being overhauled and put back into service. And it is worth bearing in mind that many of today's new develop-ments will be designed for much shorter life-spans than those facilities being decommissioned.

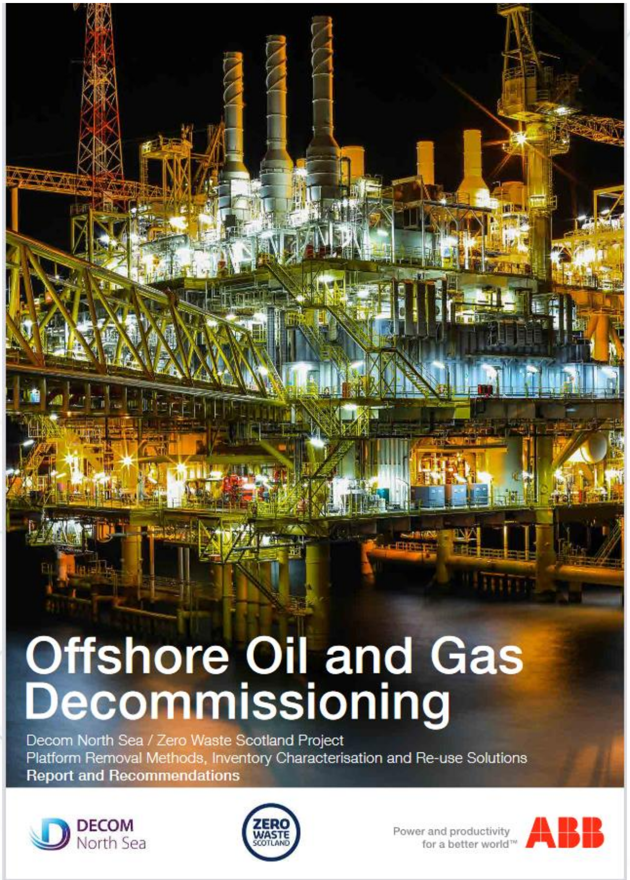
There would appear to be numerous possibilities to re-use all or part of redundant oil & gas production facilities

It is clear that the industry must move to reduce its energy footprint, improve its environmental performance and help to reduce the overall costs of the decommissioning programme over the next twenty to thirty years. Re-use must surely have a growing contribution to play in this ambition? ■

August 2011 Decom North Sea News | 5







Reuse & Remanufacture

- Entire installations
- Tubulars
- Valves
- Gas turbines
- Subsea equipment

PlatformBrokers.com

F3-FA Gas Production Platform main particulars

Introduction:

- Offered for sale: Gas production platform
- Normally manned operations, but designed for and can be remotely operated
- Specifically designed for re-location / re-use
- Facility is in excellent condition
- Planned to be removed mid-summer 2019
- Removal Contractor: Heerema Marine Contractors
- F3-FA platform can be delivered sea-fast on a seagoing transportation barge to ease transfer of ownership

Fabrication Yard Vlissingen

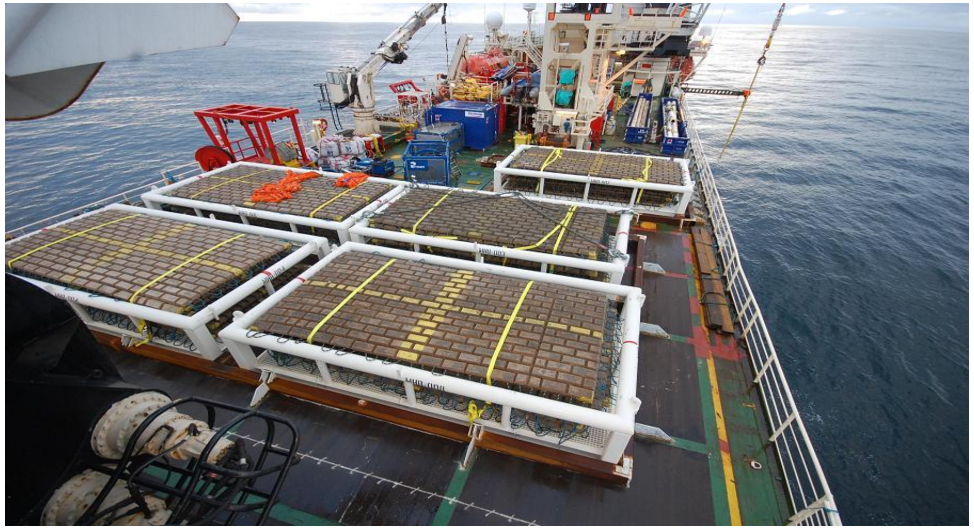
Offshore installation

General:

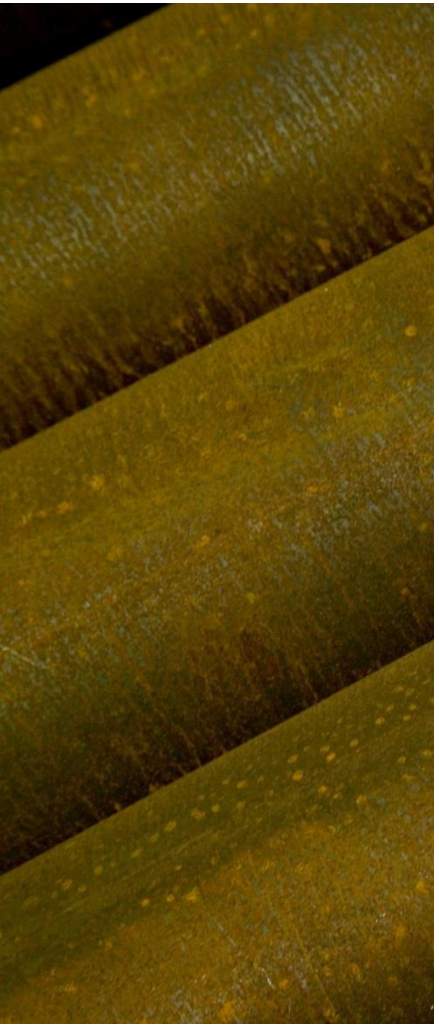
- Gas Production Platform. Excellent condition.
- 3 slots
- Location: Dutch sector North Sea, F Block
- Water Depth: 42m
- Installed: 2010
- Design Life: 20 years (TBC)
- Substructure: four-legged un-braced portal frame, supported by suction piles
- Topside weight: ± 4500 mT
- Substructure and Suction Piles Weight: ± 5,500 mT
- Topside dimensions: 30 x 50 x 30 (l x w x h)
- Engineering & Design: HFG (structural), IV Consult (process), SPT (suction piles & installation)
- Fabrication: Heerema Fabrication Group
- Installation: Suction Pile Technology
- Facility is specifically designed for re-location / re-use

Tech info F3-FA by: T.Sterker 14 May 2019

Reuse

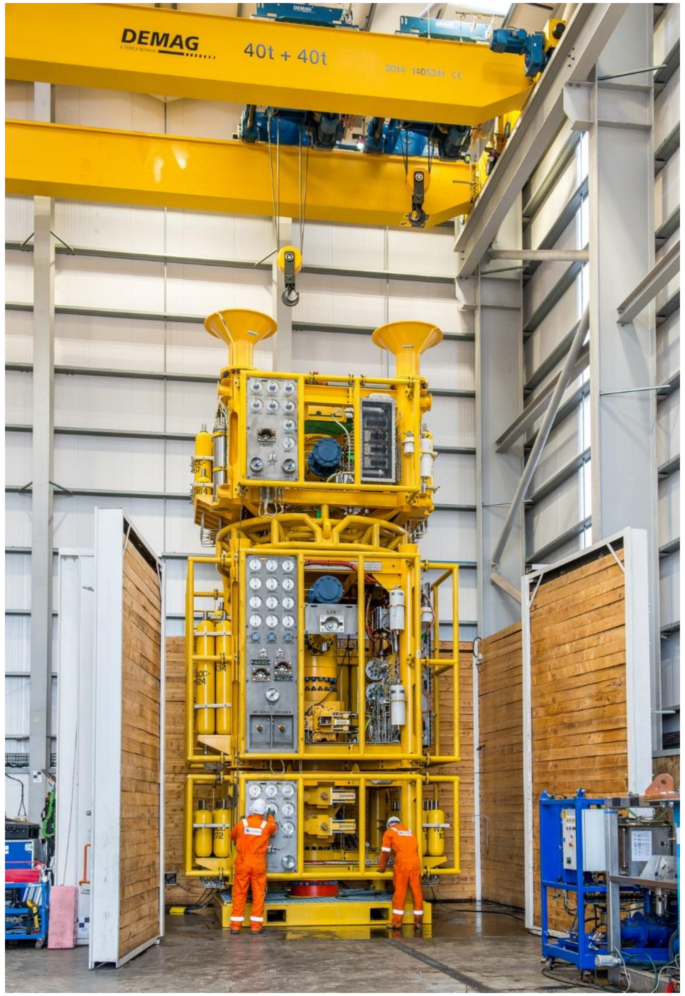


Reuse – Tubulars & Pipes



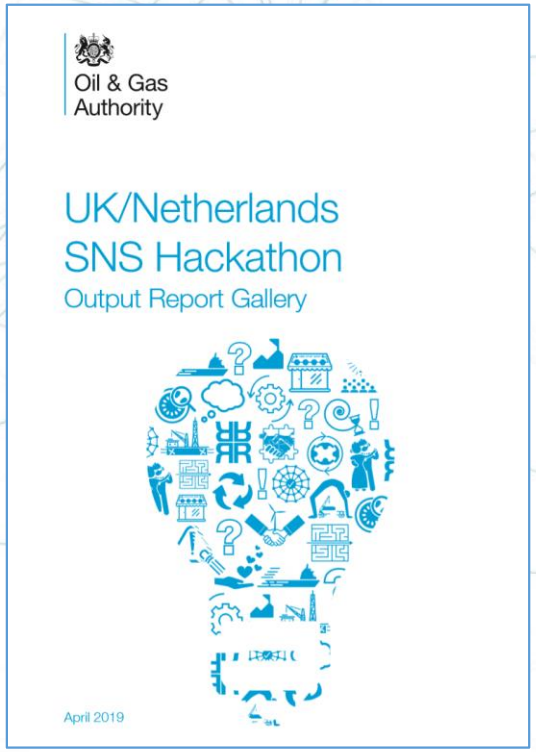

PSV
PMV
ABB
ABB Vetco Gray
ASV
AMV


PSV
PMV
ASV
AMV


DEMAG
40t + 40t


PARK
AB
PB
PP
TCL
PARK
AB

Reuse in the Netherlands


Oil & Gas Authority

UK/Netherlands SNS Hackathon

Output Report Gallery

April 2019

nexstep NATIONAL PLATFORM FOR RE-USE & DECOMMISSIONING

Re-use or adapt equipment and infrastructure in the same or a different location

Re-cycle equipment when removing infrastructure onshore and offshore

Re-purpose wells and reservoirs

SNS Hackathon Outputs

Create a market for reuse equipment–
e-bay model

Ethical versus cost – Could third world countries benefit

The legal requirement and cost of recertifications needs to be reduced to make this viable

Learn from the Netherlands reuse examples on regulatory drivers

Use old platforms onshore for training

Should regulator/government require reuse as part of decommissioning programme

Industrial Transition

A cleaner industry

Decarbonise operations

Net zero carbon basin

Integrated energy

Global net zero

Our contribution

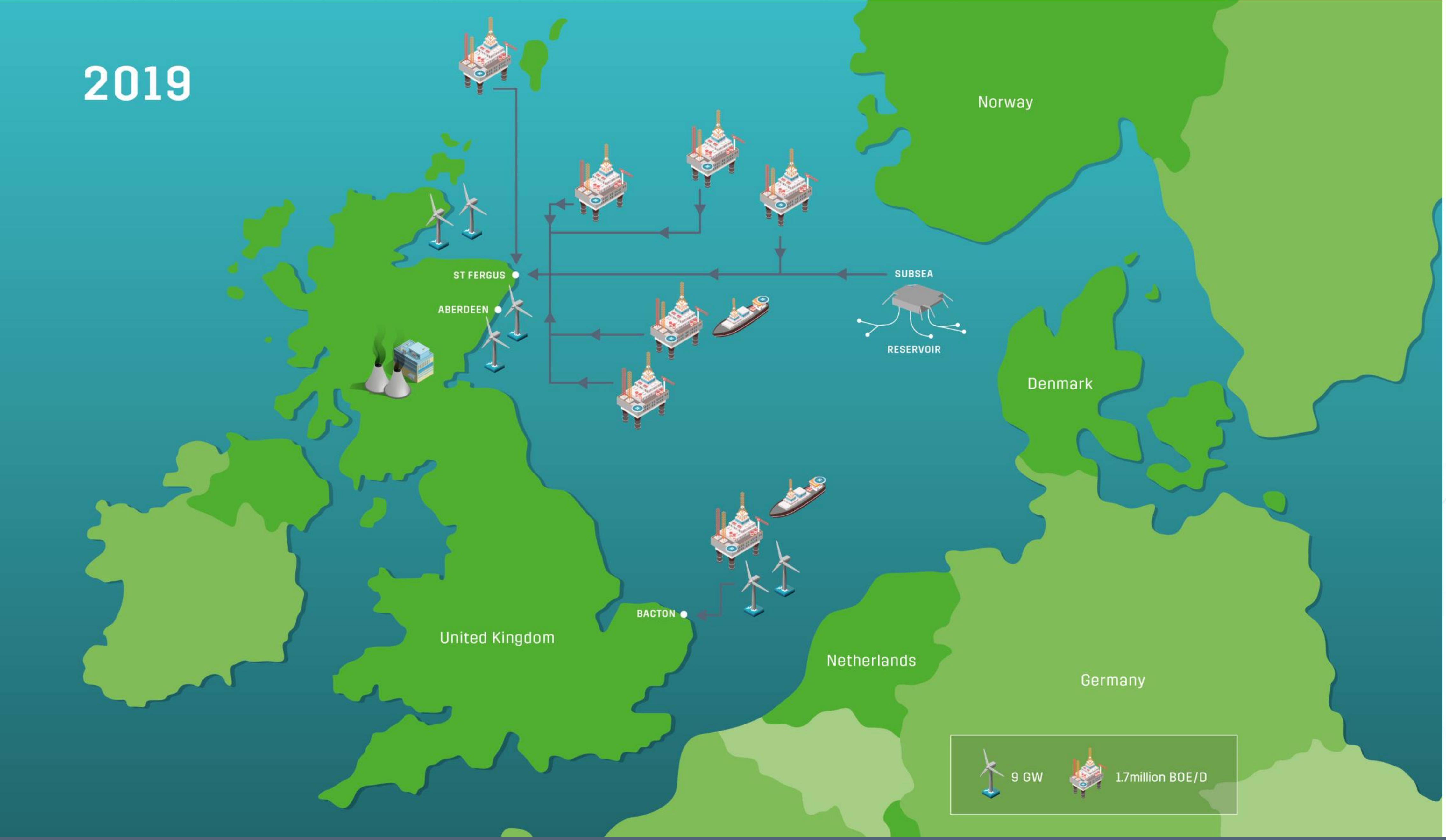
0%

Working across the energy sector to be part of the solution

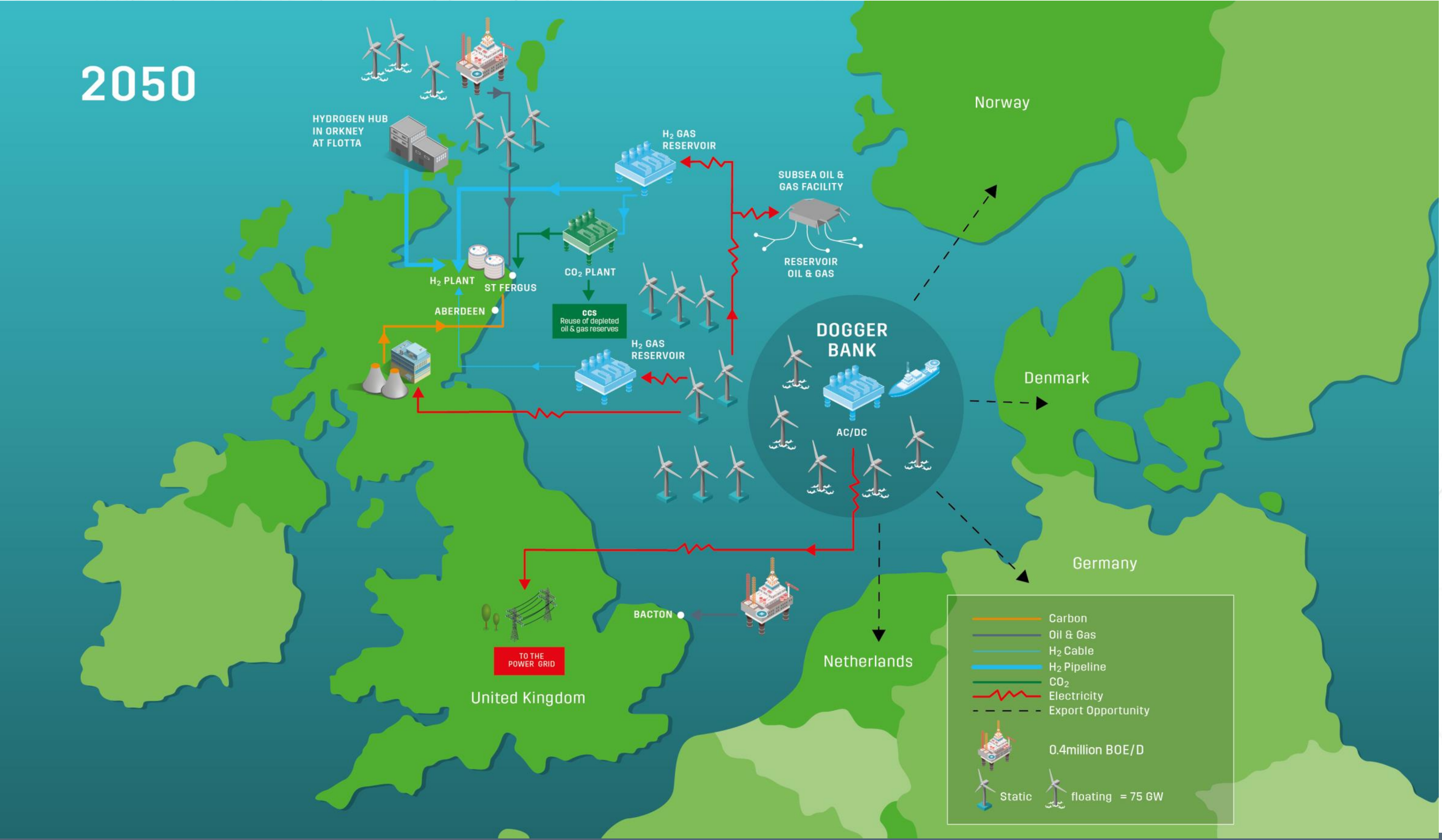
Future of the North Sea

	Vision 2035 production x today's oil & gas prices	CCC wind x £40/MWH	CCC H_2 x £2/kg	CCC CCS x £50/t	
2020	£24Bn	£2Bn			£26Bn
2030	£20Bn	£5Bn	£1Bn	£2Bn	£28Bn
2040	£16Bn	£11Bn	£5Bn	£4Bn	£36Bn
2050	£11Bn	£16Bn	£13Bn	£9Bn	£49Bn

A Period of Transition


2019
Norway
ST FERGUS
ABERDEEN
SUBSEA
RESERVOIR
Denmark
BACTON
United Kingdom
Netherlands
Germany
9 GW
1.7million BOE/D

Energy 2019



Energy 2050 – A reimagined North Sea

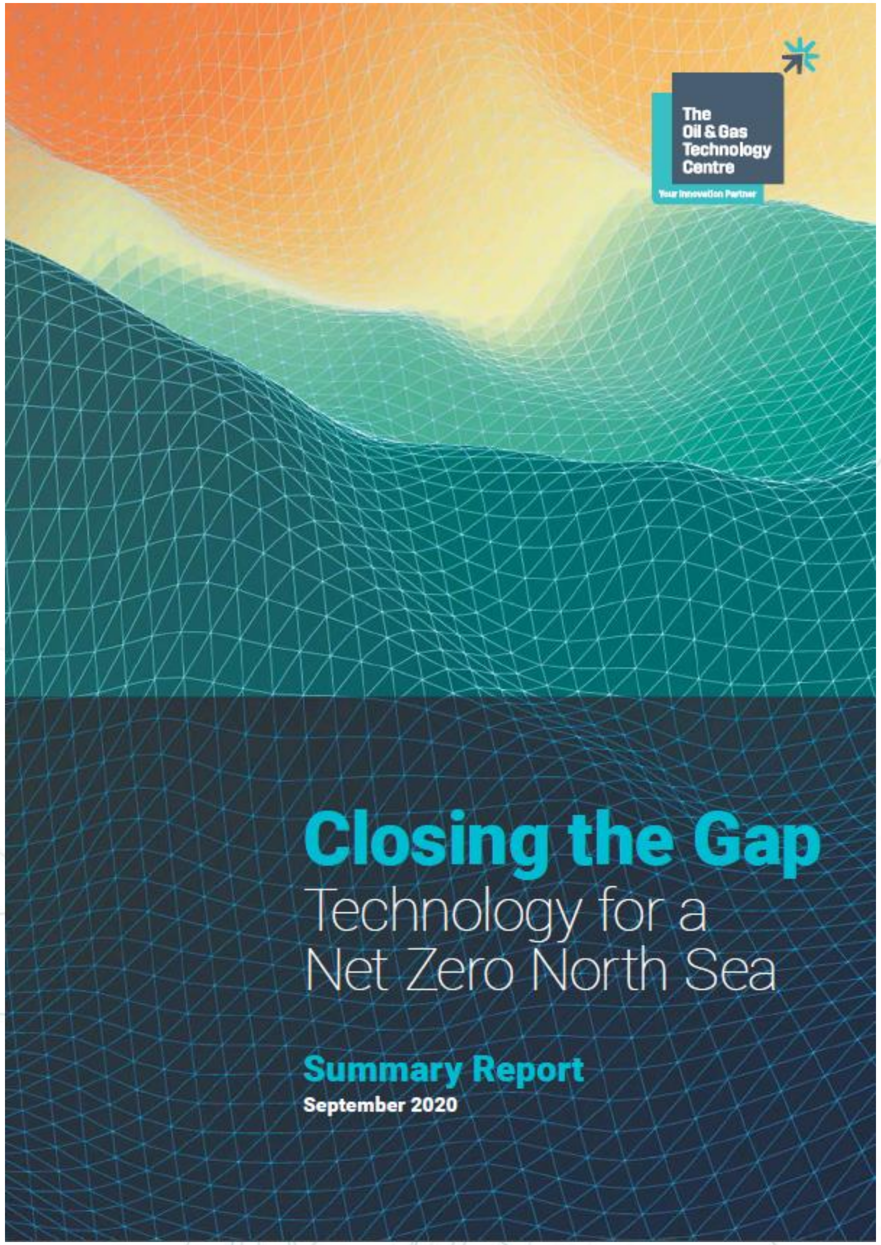
Closing the Gap

Hydrogen

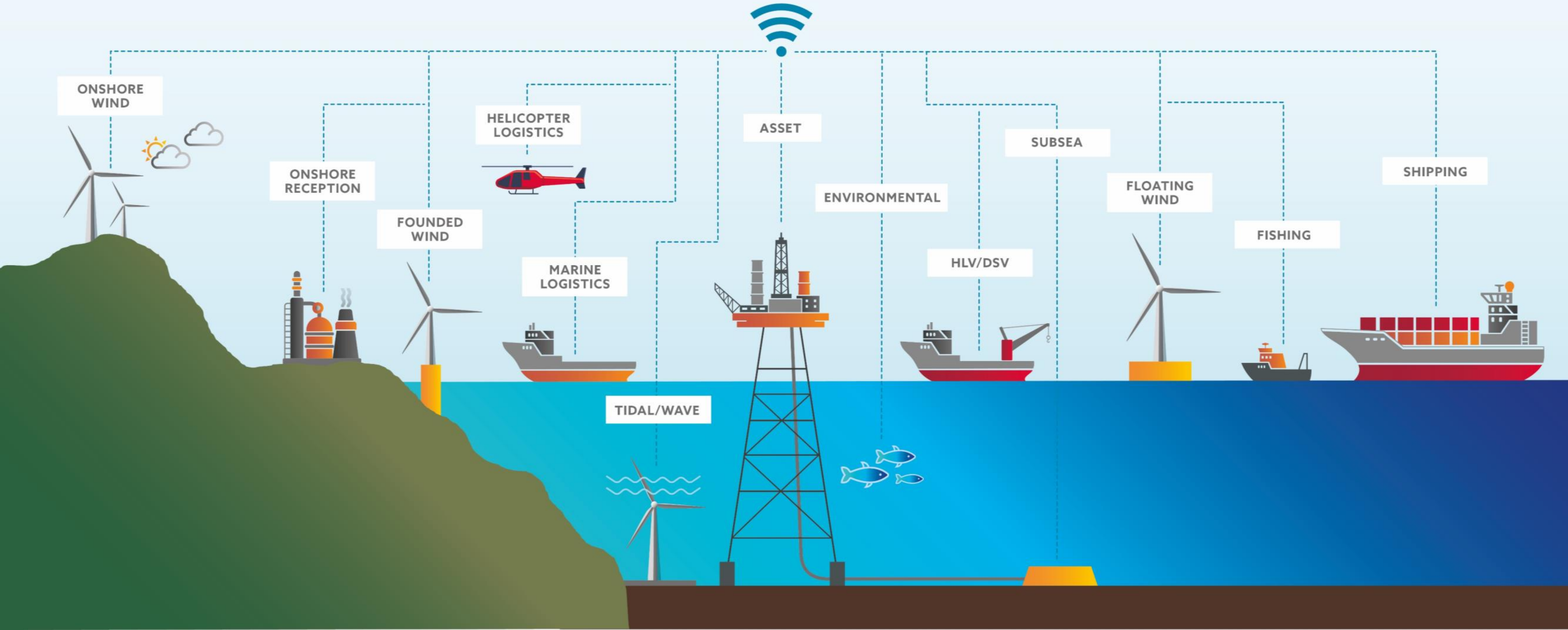
- Wide-scale adoption of hydrogen requires supply chains for large volumes. With no single clear winning technology, pilots using different options help identify economics and potential to repurpose existing UKCS assets.

CO2

- Achieving the CCC's Further Ambition scenario will require significant buildout of CO2 pipelines, or repurposing existing pipelines, to transport CO2 from source to storage sites.



Smart North Sea




Work with us
The Oil & Gas Technology Centre
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Together we can transform the future

Creating Value with Sustainable Decommissioning Webference
University of Leeds and the Aberdeen Grampian Chamber of Commerce
27 October, 2020

MACQUARIE University
SYDNEY · AUSTRALIA

International oil and gas decommissioning

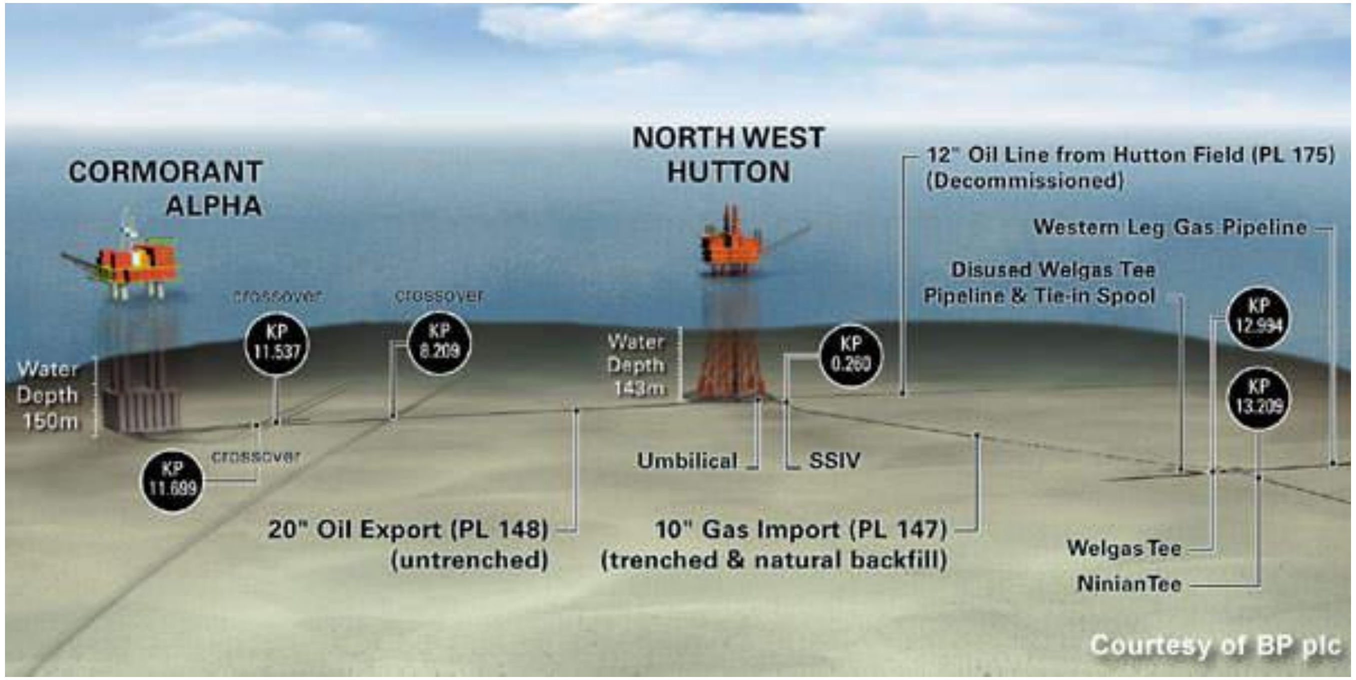
BEST PRACTICE FOR THE CIRCULAR ECONOMY

Professor Tina Soliman Hunter,
Professor of Energy and Resources Law, Macquarie University, Australia

Agenda for today

1. Consider
   1. reuse,
   2. repurpose,
   3. recycle
2. Examine practice in each
3. Discuss concept of best practice in each

REUSE:
Decommissioning and removal of NW Hutton



- Jacket commenced mfr 1981, installed 1983
- Reserved depleted by 2002
- Approval of Decom in 2006 – topside/jacket removed 2009
- Comprised wellhead modules, production modules, utility modules, drilling derrick and substructure, accommodation block and helideckRemoval and purchase by Sevmorneftegaz (Gazprom) and towed to Murmansk, where mated with hull, then transported to Severodvinsk for refurb/refit

REUSE:
Reincarnation as Prirazlomnaya

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CRITIQUE

- Field has 600m bbl oil
- First Russian offshore commercial development in the Arctic installed 2011, first oil 2013
- Part of the Geopolitical era – Race with Norway!
- Safety concerns raised due to ‘age’ of platform, but OSRP renewed in 2014

REPURPOSE/REMOVE

- Legal best practice articulated through **OPSAR 98/3?**
- Rigs to reef program –
    - ecologically valuable or ecologically destructive
    - Only the bottom structure
    - What about topside
- Repurpose ideas:
    - Flotel
        - Industry
        - Civilian
    - Wind farms
    - In the 60s, could have been a radio station!
- Are these options suitable or legally possible?
    - Climate
    - Location
    - Demand
    - Type – NCP-01
- Maintenance, safety threats, risk management?
    - Why decommissioned in the first place?

REMOVAL THE CHOICE OPTION?

Facilities must be removed in their entirety; only in extremely limited cases they can be abandoned on the field after ended use

Once removed what do we do with it?

Is this best practice?

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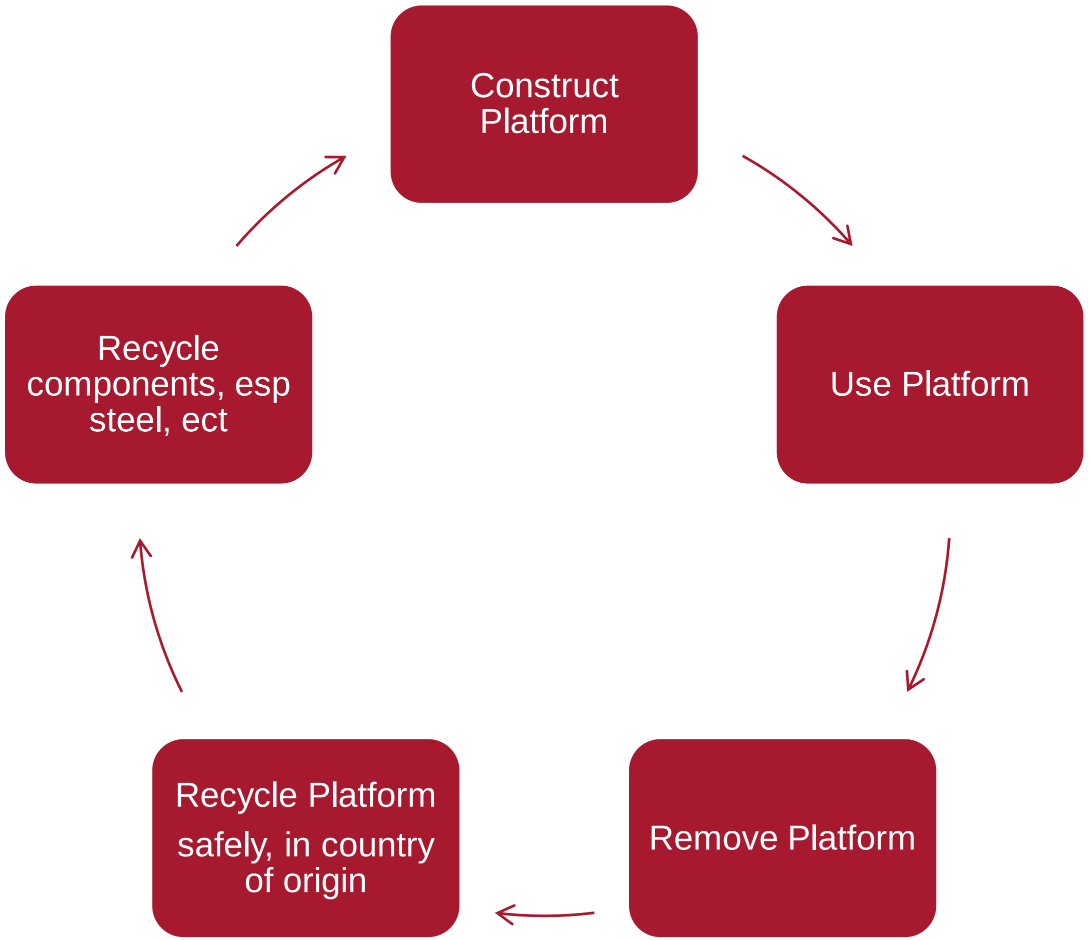
Workers tie a rope to a decommissioned rig at an Alang shipyard

The best practice solution #1

Best Practice Solution #2



The Australian recycling cycle???

The 'GUPTA PROCESS'

Thank You

PROFESSOR TINA SOLIMAN HUNTER
MACQUARIE UNIVERSITY

tina.solimanhunter@mq.edu.au

www.mq.edu.au

Aberdeen & Grampian Chamber of Commerce Webinar

27 October 2020

DECOMMISSIONING SECURITY FOR UK OFFSHORE ENERGY INSTALLATIONS

Dr Colin Mackie

Associate Professor in Business Law, School of Law, University of Leeds

- **Introduction**

- Operators, owners and developers of offshore energy projects normally required to decommission the infrastructure at the end of its functional life.

- Where the responsible person does not fulfil their end-of-life obligations, the **burden falls on other stakeholders** in the project (e.g. taxpayers and the environment).

- Financial security requirements, when implemented within a framework, necessitate that the responsible person (or a company affiliated with them e.g. parent company) evidences **ability to pay** for the future works.

- **Offshore Oil & Gas Installations and Pipelines (1)**

- No requirement under the Petroleum Act 1998 for all responsible persons to provide decommissioning security as a matter of course.

- Regulatory scheme based on regular assessment of **financial capability** to meet decommissioning liabilities.

- Under Act, SoS “may” require security where responsible person is deemed **incapable** of carrying out their obligations: s 38(4)-(4A).

Offshore Oil & Gas Installations and Pipelines (2)

- At as January 2019, against estimated future decommissioning costs to operators of between £45 billion and £77 billion, BEIS had only required operators to set aside £844 million in security.

- **Security held by BEIS only covers between 1.88% and 1.1% of the sector's total estimated liabilities.**

- The crucial context is that the U.K. government bears ultimate responsibility for decommissioning these installations and pipelines under international convention.

- **Offshore Renewable Energy Installations (OREIs)**

- The decommissioning scheme for wind farms, wave and tidal energy devices contained in the **Energy Act 2004** (ss 105-114).

- Applicable to territorial waters in or adjacent to England, Scotland and Wales and to waters in a Renewable Energy Zone.

- Legislative framework substantively the same for Scotland and England and Wales but some differences in the guidance provided for industry in each legal jurisdiction.

- **Energy Act 2004: a discretionary framework**

- Under s 105(2), a person who is responsible for the installation "may" be required to submit a decommissioning programme.

- Decommissioning programme may be approved **subject to conditions**, including that the person who submitted the programme provides such security "*as may be specified*": s106(4).

- **The purpose of providing security is to enable BEIS/Scottish Ministers to decommission the installation *if required*.**

- **The Scale of Decommissioning Costs**

- U.K. government "decommissioner of last resort" and so bears ultimate responsibility for the associated costs.

- The costs may be significant.

- **Total cost of decommissioning offshore wind farms in the U.K. until 2045 has been estimated at £1.28 billion - £3.64 billion.**

- BEIS' liability estimated at approx £1.03 billion - £2.94 billion.

- **Acceptable Means of Evidencing Security**

- Upfront cash, cash reserving, letters of credit, bank guarantees & performance bonds.

- Reserving cash in own accounts is not acceptable to BEIS; draft Scottish Guidance does not explicitly exclude it.

- Parent company guarantees only accepted by BEIS in "exceptional" circumstances; not acceptable in Scotland.

- **While a secure, segregated fund that accrues early in, or during the middle of (years 10-20), installation's life likely to be acceptable, one that accrues late into the operating life will not.**

- **Risks Associated with Security Provision for OREIs**

1. Confers significant discretion upon BEIS/Scottish Ministers regarding *type* and *timing* of security; **lack of transparency**.

2. Serious concerns as to ability of owners/developers to estimate their own decommissioning costs reliably; **security shortfall**.

3. The "financial strength" of responsible person still a relevant consideration; **financial deterioration**.

- **Security for OREIs: some recommendations**

- Set out security requirements in legislation, supported by industry guidance & publish data on estimated costs and security provided - **transparency**.

- Security provision should occur **earlier** in an installation’s life.

The “financial strength” of the owner/developer should **not** feed into decisions around type and timing of security provision.

- Consciousness that variations, even subtle ones, in security requirements can create **competitive advantages** for a jurisdiction.

Circular Economy in North Sea oil & gas and offshore wind end-of-use management

Dr Anne P.M. Velenturf
Research Impact Fellow in Circular Economy and Offshore Wind
University of Leeds
M: A.Velenturf@leeds.ac.uk T: @RRfW6

Resource Recovery from Waste

Natural Environment Research Council

Department for Environment Food & Rural Affairs

Economic and Social Research Council

Engineering and Physical Sciences Research Council

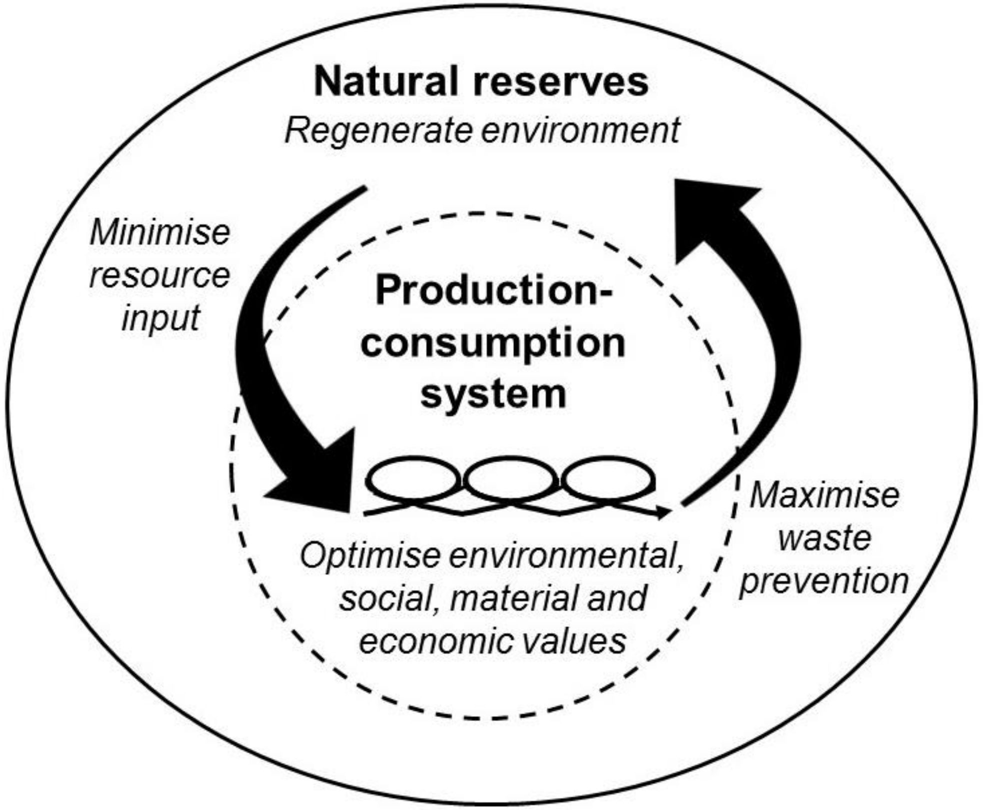
Zero Waste Scotland

Catapult Offshore Renewable Energy

Department for International Trade

University of Leeds

Circular Economy



- Opposite of the linear take-make-use-dispose economy
- Make better use of materials, components and products
- Optimise economic, technical, social and environmental values of materials and products
- Whole lifecycle approach

Velenturf, A.P.M., Archer, S.A., Gomes, H., Christgen, B., Lag-Brotons, A.J., Purnell, P. (2019) *Circular Economy and the Matter of Integrated Resources.* Science of The Total Environment, Vol. 689: 963-969.

Values of a Sustainable Circular Economy

Fair access to resources

Environmental quality

Economic prosperity

Velenturf and Purnell (Under review) Principles for a Sustainable Circular Economy.

Images from Pixabay. Free for commercial use. No attribution required.

+$25 trillion
globally
by 2050

-63% CO_2
globally
by 2050

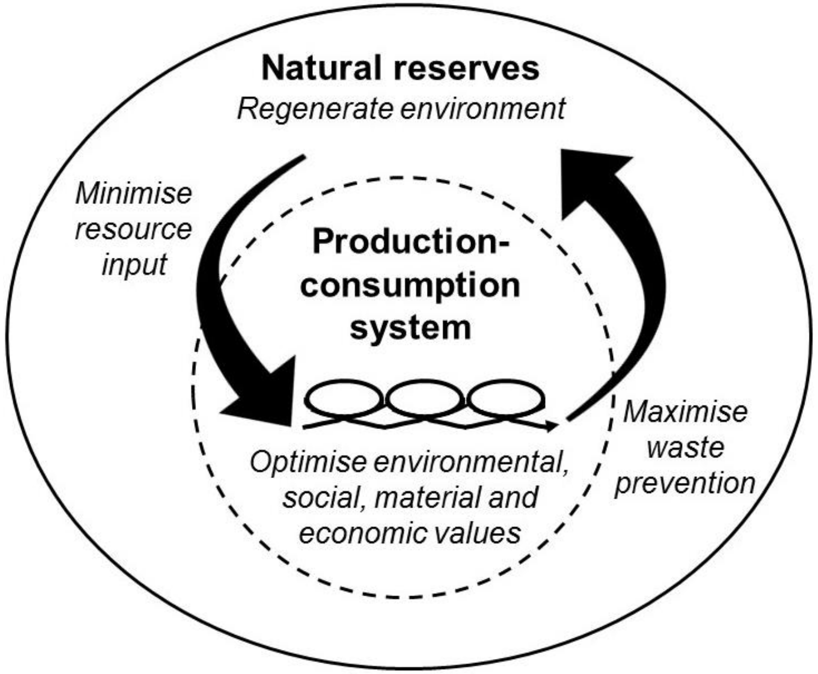
Benefits of a Circular Economy

Summarised in: Velenturf, A.P.M., Jensen, P.D., Purnell, P., Jopson, S.J., Ebner, N. (2019) *A Call to Integrate Economic, Social and Environmental Motives into Guidance for Business Support for the Transition to a Circular Economy*. Administrative Sciences, special issue on Industrial Ecology and Innovation, Vol. 9(4): 92.

Circular economy strategies: the R-ladders

Narrowing
- Reduce
- Refuse

Slowing
- Repair
- Redesign
- Reuse
- Repurpose
- Remanufacture
- And more!



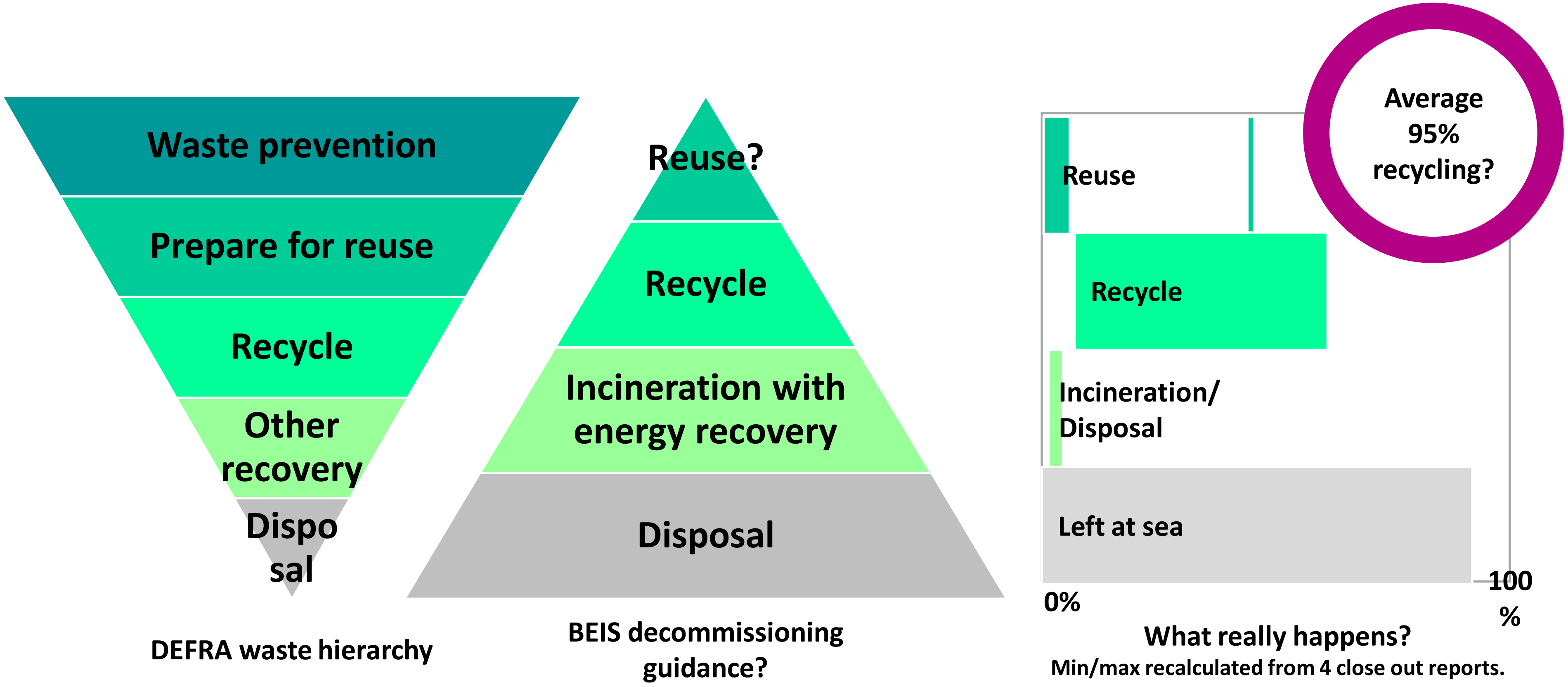
Integrating
- Recover
- Return
- Re-mine
- Renew

Closing
- Recycle

Bocken, N.M.P., de Pauw, I., Bakker, C., van der Grinten, B., 2016. Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering 33, 308-320.

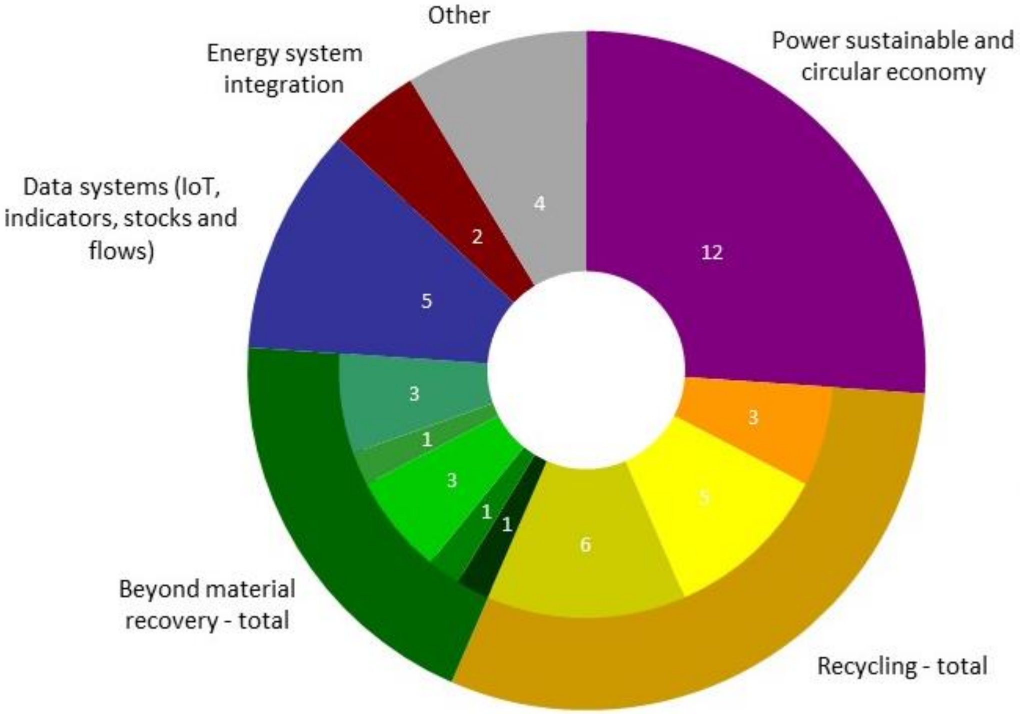
Velenturf, A.P.M., Archer, S.A., Gomes, H., Christgen, B., Lag-Brotons, A.J., Purnell, P. (2019) *Circular Economy and the Matter of Integrated Resources.* Science of The Total Environment, Vol. 689: 963-969.

Circular economy practices in UK North Sea oil & gas



Marques et al (2020) Reusing materials decommissioned from the North Sea: A systems perspective

Circular economy in offshore wind in the UK



Ca 40 articles on circular economy and wind

Based on academic literature in Scopus, August 2020

"Wind power is following the path of sustainable development and circular economy" (Liu et al 2010)

But did it?

Review of decommissioning programmes for UK offshore wind farms:

- No mention of circular economy
- Focus on lower parts of waste hierarchy: recycling, energy from waste and landfill

Jensen, P.D., Purnell, P., **Velenturf, A.P.M.** (2020) *Highlighting the Need to Embed Circular Economy in Low Carbon Infrastructure Decommissioning: The Case of Offshore Wind.* Sustainable Production and Consumption, Vol. 24: 266-280.

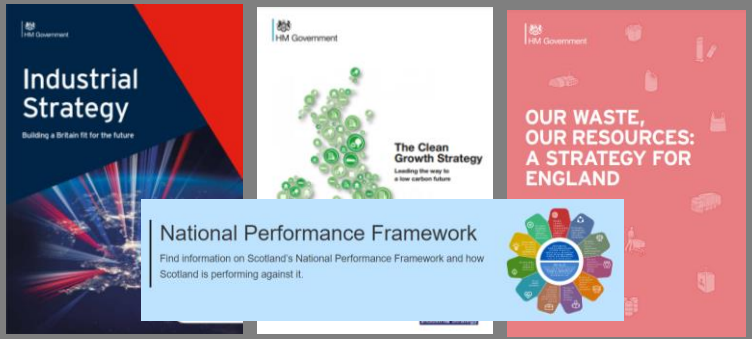
Current norm = No design to enable sustainable decommissioning and circular economy

High costs and risks

Oil & gas £45-£77bn.

In offshore wind 4-10 times higher costs than budgeted.

Contradicts UK Government strategy

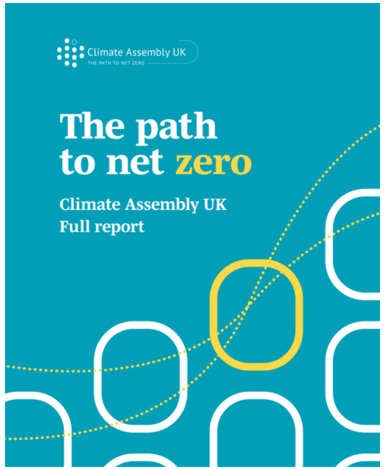


Negative impact on public opinion and social licence to operate

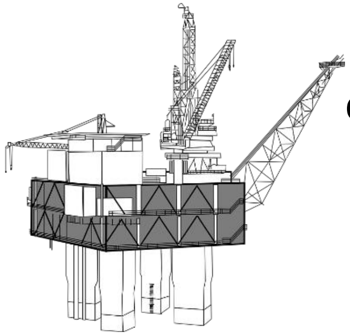
Velenturf, A.P.M. (2020) Circular Oil & Gas Decommissioning.

Benefits and drivers for integrating circular economy

1. Reduce decommissioning costs and increase whole lifecycle values of offshore energy infrastructure
2. New decommissioning industry: Regional economic development and jobs
3. Contribute to lower carbon economy and energy transition
4. Contribute to environmental restoration
5. Investment, increasingly demanding oil & gas to become "energy companies" => design for energy transition
6. Public opinion: broad support for low carbon materials and energy & offshore wind, onshore wind and solar power



Design infrastructure for the energy transition



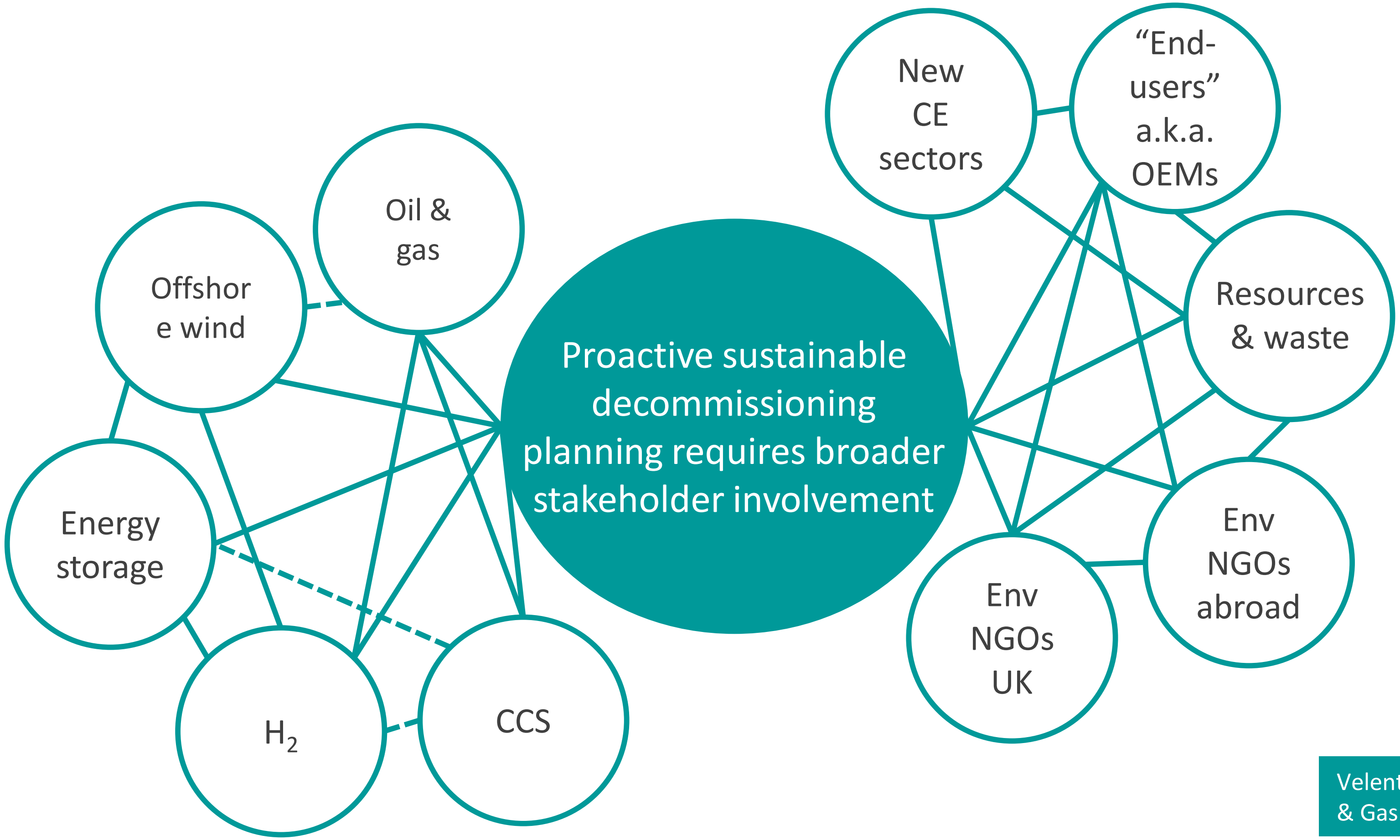
North Sea oil & gas
Design for repurposing for hydrogen, carbon capture and storage and integration with renewables.

Offshore wind
Design sites for longevity i.e. with lifetime extension and repowering in mind.
Design components for durability, disassembly, repair, reuse, remanufacturing and – eventually – recycling.

- Adapt decommissioning programme guidance and OGA strategy accordingly.
- Build into permitting process, with proposed "decommissioning" programmes submitted earlier to enable revisions in the design of oil & gas and offshore wind infrastructure.

Also see Velenturf et al (2020) consultation responses to Marine Scotland and Environmental Audit Committee on offshore wind and to the Oil & Gas Authority on North Sea oil & gas.

Collaboration for proactive “decommissioning” planning



Plus relational approach to enable change:

- Coach for compliance
- Share good examples of new business practices

Velenturf, A.P.M. (2020) Circular Oil & Gas Decommissioning.

Resources and waste management

Collaborate with broader "circular economy" stakeholders to:

- Investigate potential for reuse, repurposing and remanufacturing well before end of service life / cease of production – prevent components from being classed a "waste"
- Prepare offshore wind "waste management" plans and costings
- Gap analysis of missing end of use solutions

1. Set higher ambitions for managing wastes from offshore energy infrastructure in the UK
2. Make export more expensive/ difficult via permitting procedures

Velenturf, A.P.M. (2020) Circular Oil & Gas Decommissioning.

Thank you!

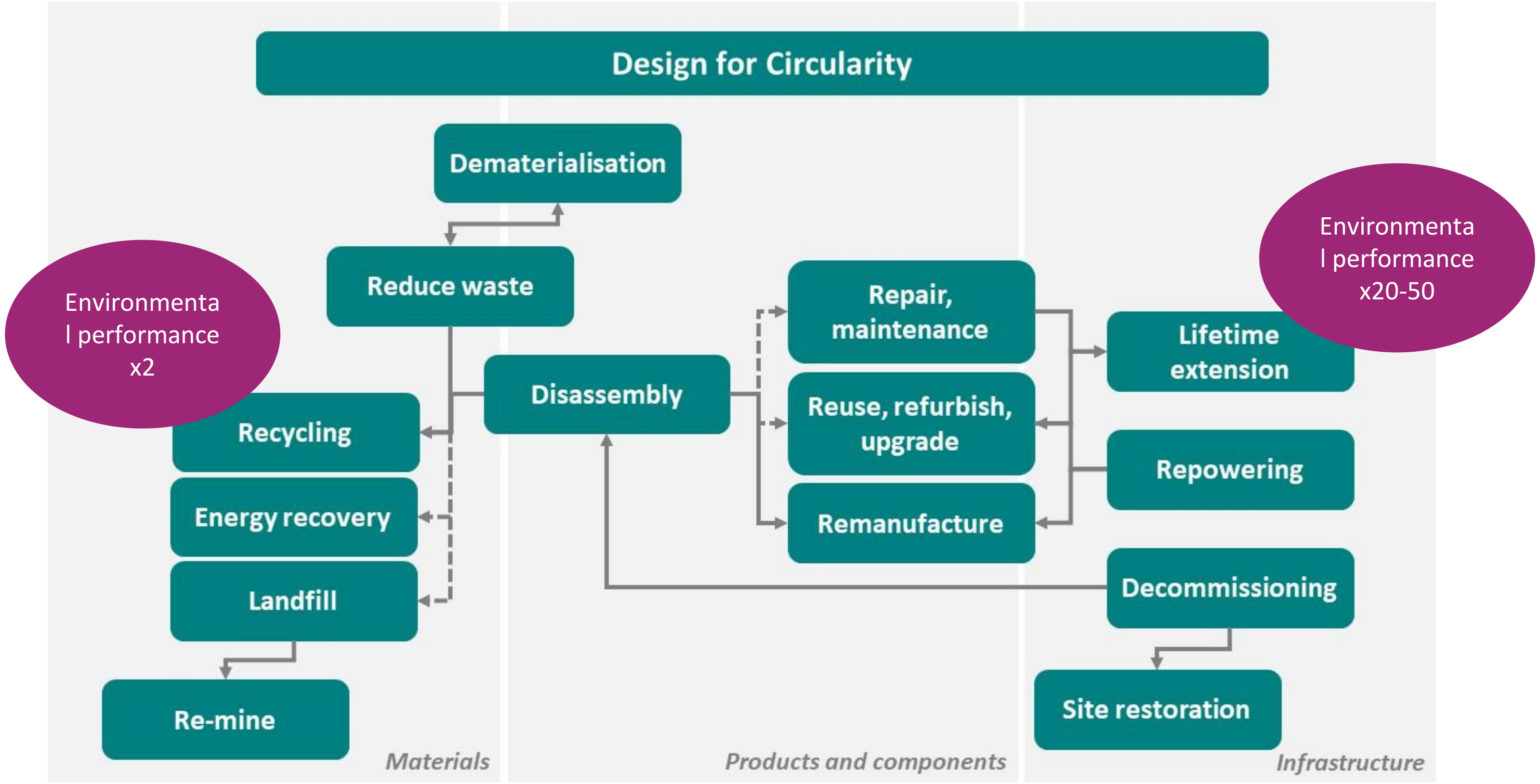
To Profs Naomi Brookes and Phil Purnell who helped to secure the various projects on circular economy and energy infrastructure.

To everyone who patiently contributed to the numerous engagement events and meetings.

To the Aberdeen & Grampian Chamber of Commerce, Zero Waste Scotland and all speakers for organising and supporting this event.

And to you for listening!

Circular economy framework for offshore wind*



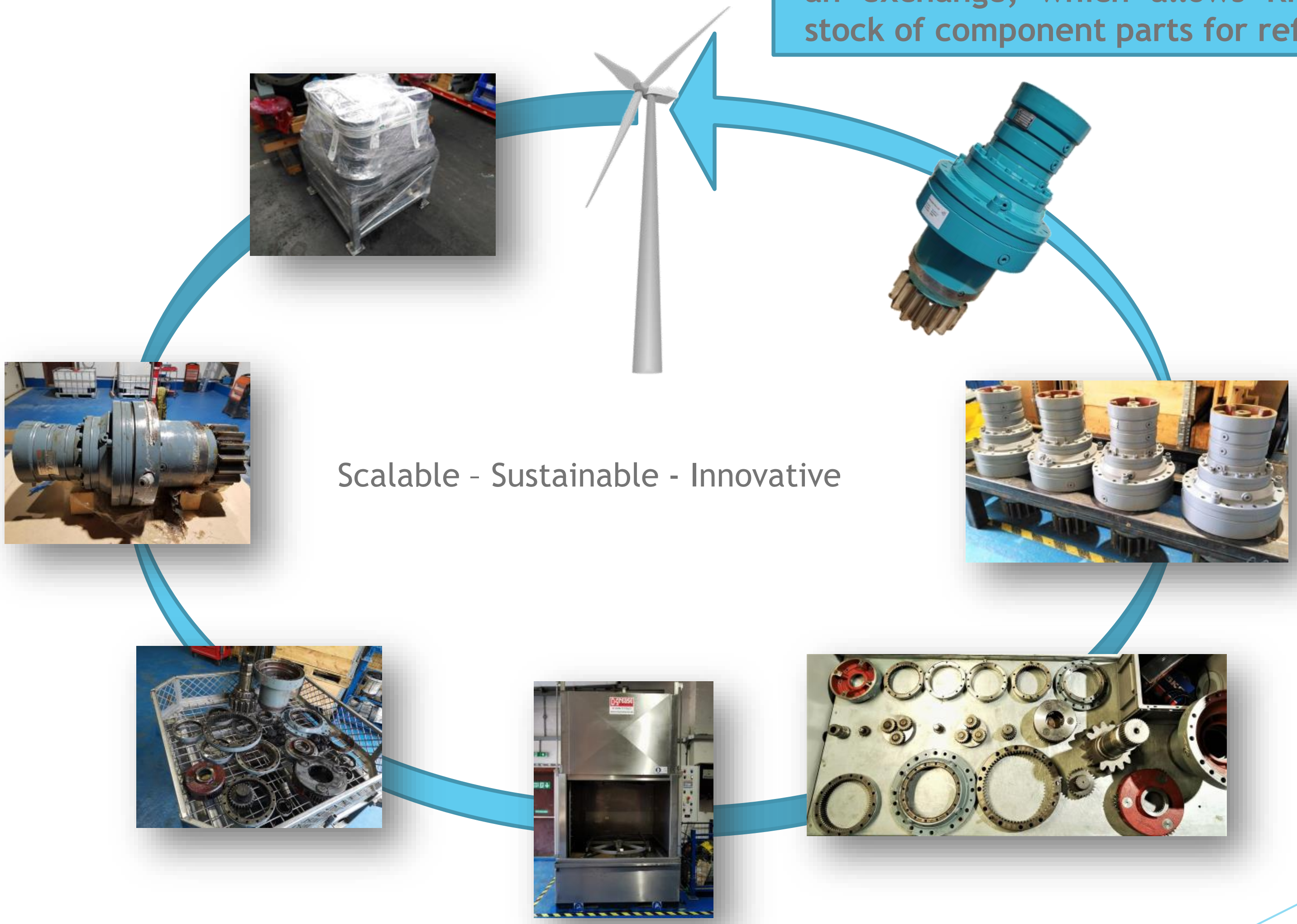
*Currently circulating for feedback.

Velenturf, A.P.M. and others (In preparation) *A Framework for a Sustainable Circular Economy in Offshore Wind.*

Creating a Circular Economy in the Wind Industry

How does it work

Our refurbished parts can be ordered as an alternative to new, in most cases with a like-for-like warranty. When you buy a refurbished part from RPL it is on the condition that a used part is returned as an exchange, which allows RPL to maintain feed stock of component parts for refurbishment.

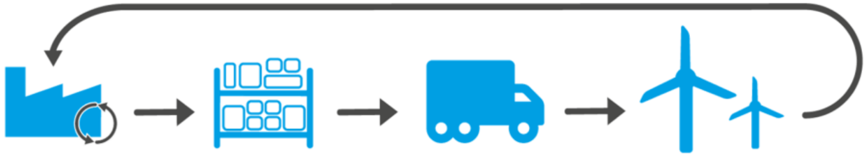


Cutting waste, reducing lead times, saving money

Reverse Logistics

Reverse logistics is a key enabler for the circular economy and to that end we have made the returns process as easy as possible with custom frames and packaging for many of our refurbished components.

Ease of returning used products is critical in creating a circular economy, and the process requires close engagement with customers. If the customer is engaged and in a position to nominate someone to oversee refurbished goods in and unserviceable goods out, this removes a huge barrier.



Cutting waste, reducing lead times, saving money

LEGASEA

Recover Refurbish Recertify Reuse

Standard Subsea Lifecycle

Design & Manufacture → Installation → Oil & Gas Production → Decommissioning → Disposal

Legasea Lifecycle

SME news SCOTTISH ENTERPRISE AWARDS 2020 Winner Environmental Services Company of Year

We are a Living Wage Employer

Aberdeen & Grampian Chamber of Commerce Member

Achilles FPAL MEMBER

ISO 9001

ISO 14001

ISO 45001

GREAT BRITISH ENTREPRENEUR AWARDS 2020 FINALISTS

WE'RE A SOCIAL ENTERPRISE SUPPORTER

CIRCULAR NORTH EAST

SME news UK ENTERPRISE AWARDS 2020 Winner Subsea Company of the Year

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Recover Refurbish Recertify Reuse

ANGUS 3D SOLUTIONS

ANGUS MACHINING SOLUTIONS

A Leading 3D Scanning, 3D Printing & Manufacturing Services Company

andy@angus3dsolutions.co.uk

Presented By Andy Simpson

ANGUS 3D SOLUTIONS

ANGUS MACHINING SOLUTIONS

For aging assets, replacement components may be difficult to source, require a long lead time to manufacture, and incur significant expense to produce, so the asset is then scrapped.

3D printing (Additive Manufacturing) could be the answer to remanufacture difficult components.

By utilising additive manufacturing you can extend the life of a component / asset and can increase its functional performance.

This could play a key role in enabling companies to reinstate their existing old equipment, allows to extend maintenance schedule cycles, and increase functional performance.

andy@angus3dsolutions.co.uk

Re Use and Re Certification of Flexible Pipe

Engineering, fatigue life and material assessments

Pigging and flushing to remove hydrocarbon in a closed system.

Skin repair, plastic welding.

Annulus Testing

Hydrostatic testing

Collaboration & Innovation in the Dutch Decommissioning Challenge

Jacqueline Vaessen
General Manager Nexstep

“Road to 30 %” program

- Road to joint execution
- Road to rigless abandonment
- Road to heavy lift standard
- Road to value protection pipelines

MLS Joint Campaigns - Background

Recognition that the sector must start to prepare itself now in order to be well-equipped for the increasing workload in the upcoming years.

MLS wells provide a good starting point for collaborative working, knowledge sharing, standardization and use of new technology.

Inventory of approximately 100 wells from a representative cross section of Operators provides a meaningful and impactful scope.

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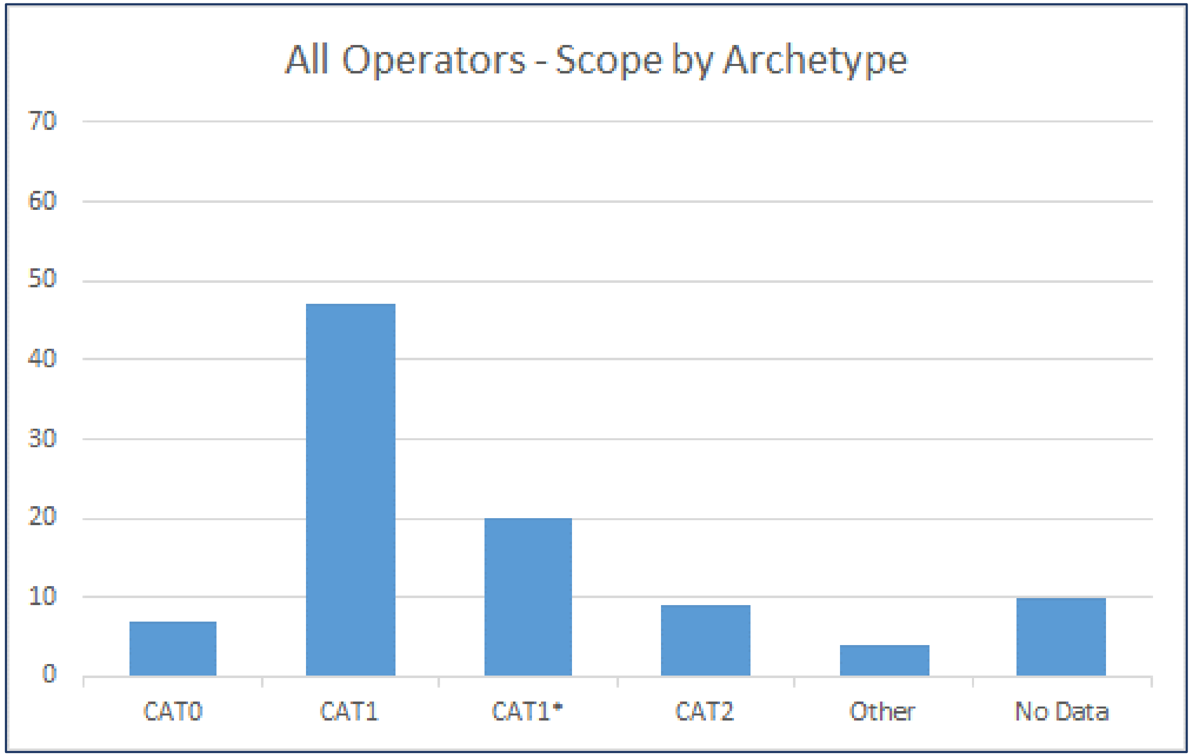
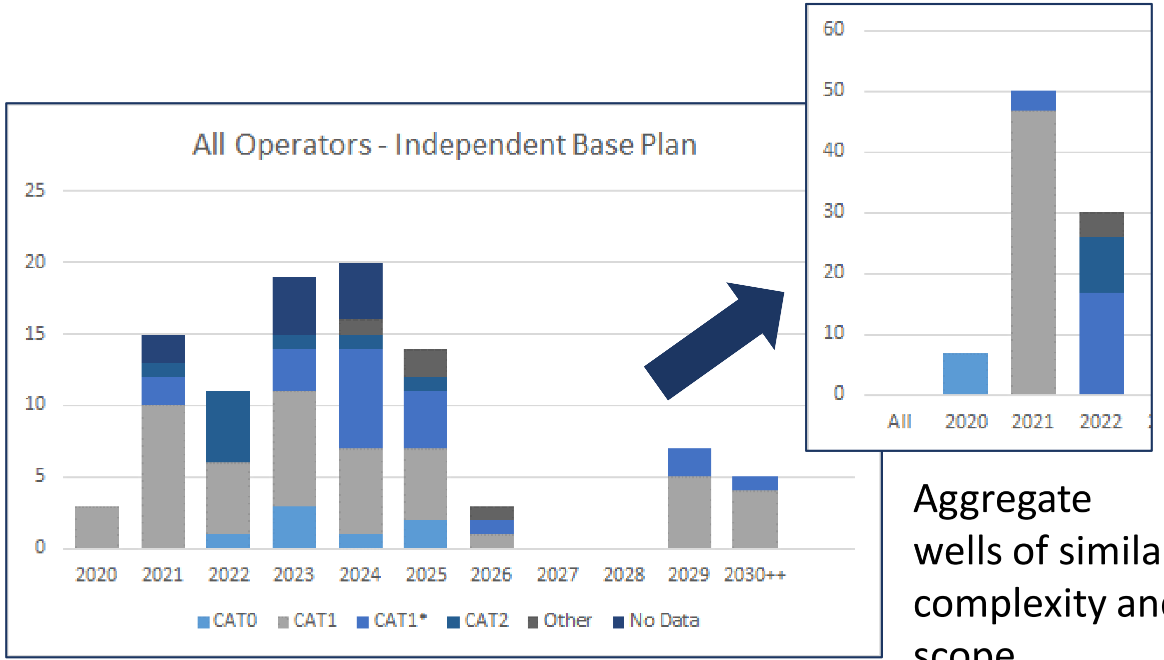
Insights from Phase-1 - Opportunity



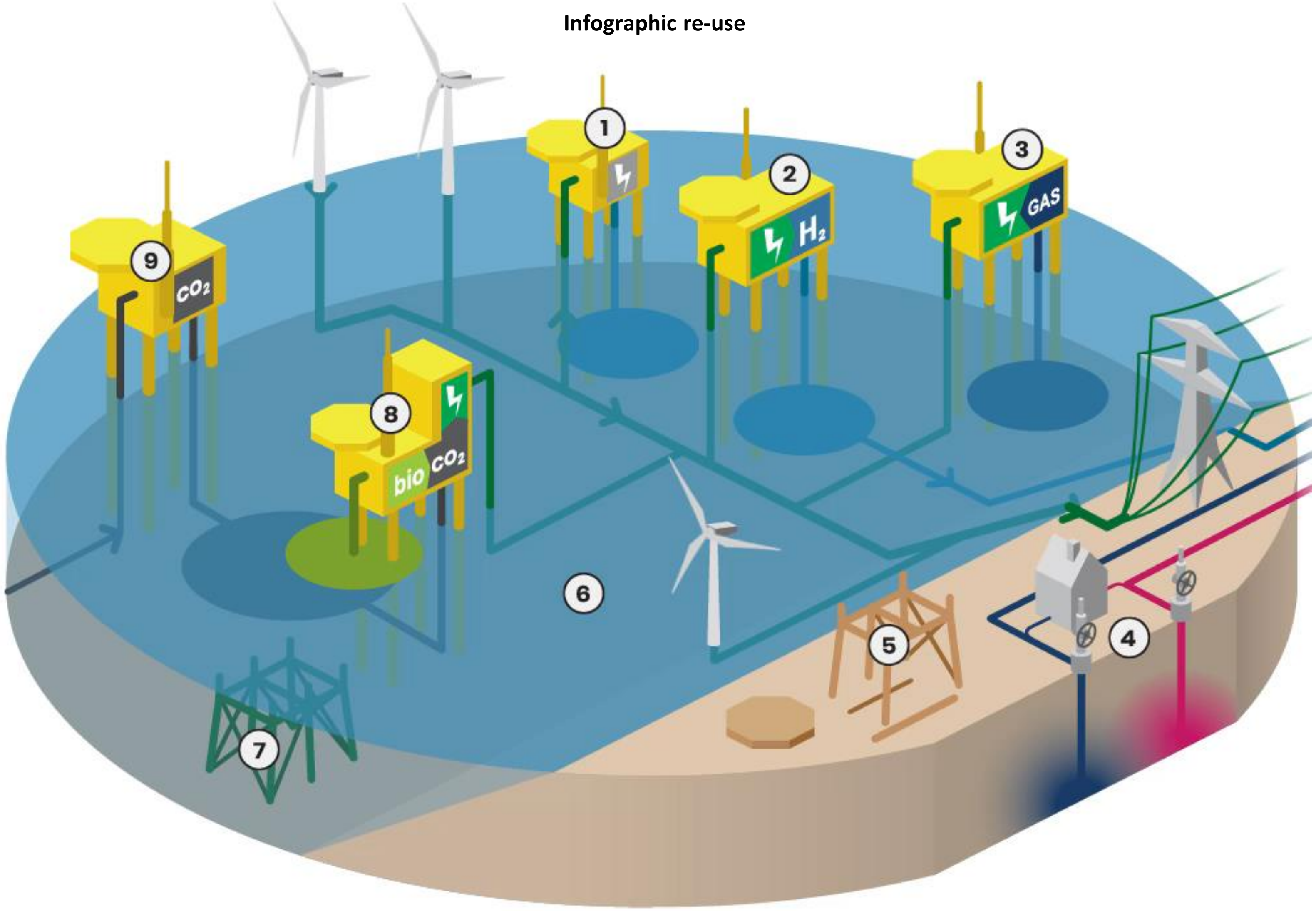
Increasing level of complexity

Opportunity to align multiple Operators to permanently abandon many relatively simple and low-risk MLS wells in 2021/2022 using rigless abandonment technology.



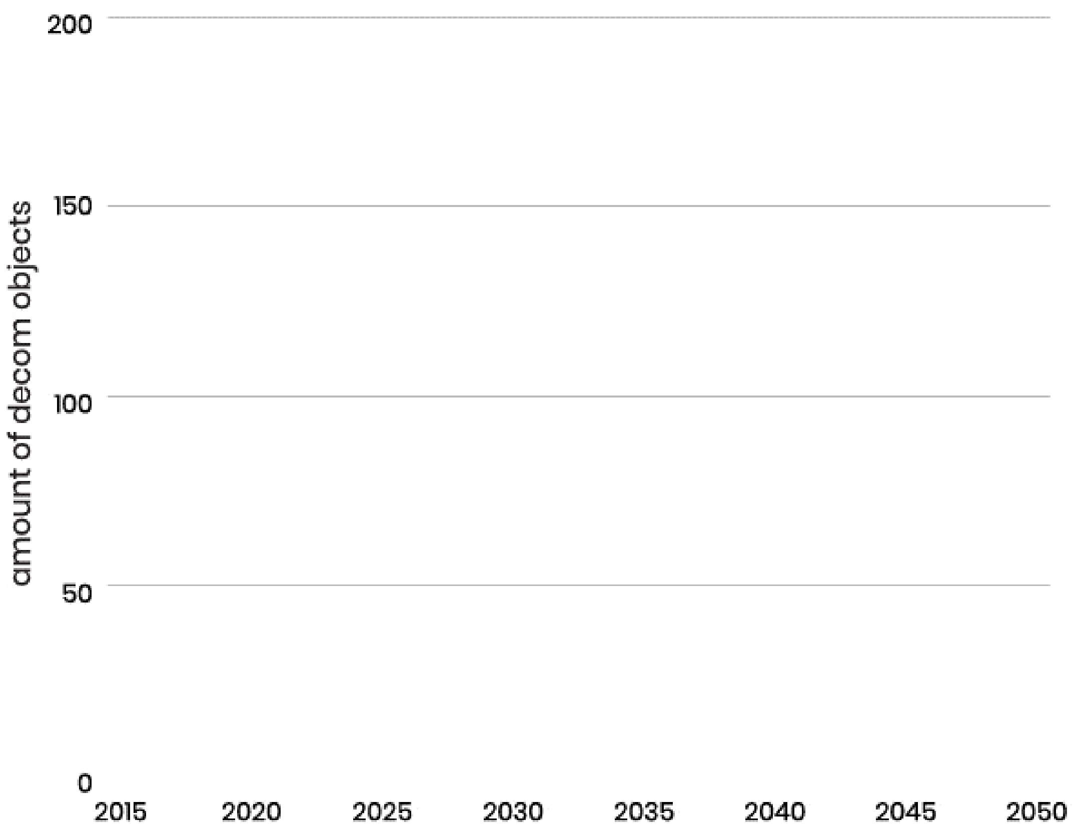
Aggregate wells of similar complexity and scope

Infographic re-use

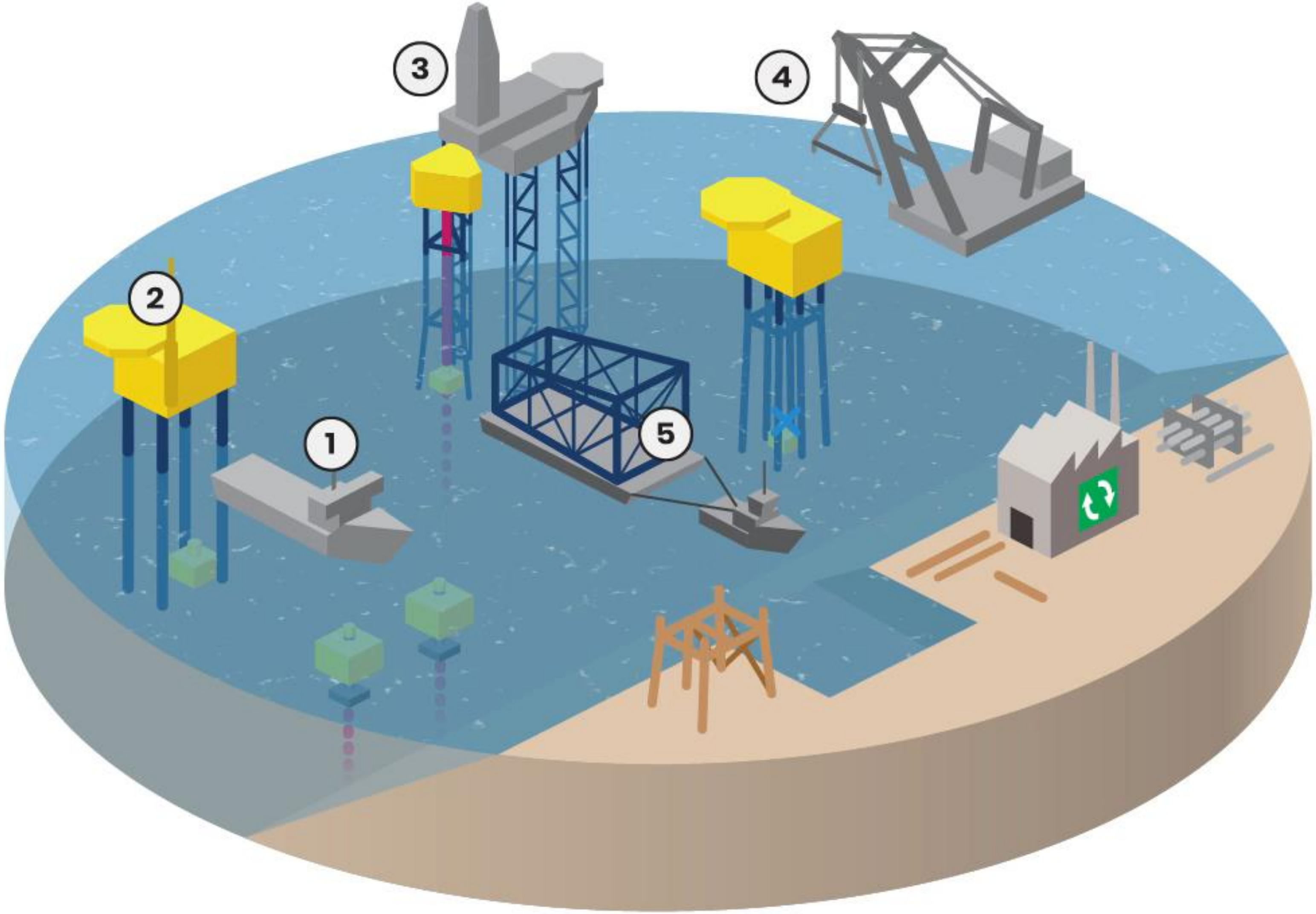


1. offshore electrification
2. hydrogen production and storage
3. gas to wire
4. geothermal energy
5. recycling
6. relocation
7. rigs to reef
8. biomass production
9. carbon capture and storage

Figure 7.4.1a
Available offshore installations for re-use (platforms + subsea installations)



Infographic decom



1. ship
2. rigless
3. jack-up rig
4. heavy lift vessel
5. transport barge

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The decommissioning market

Professor Giorgio Locatelli PhD CEng FHEA

School of Civil Engineering - University of Leeds

Senior Editor - Project Management Journal (PMI)

g.locatelli@leeds.ac.uk

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ELSEVIER

Developing policies for the end-of-life of energy infrastructure: Coming to terms with the challenges of decommissioning

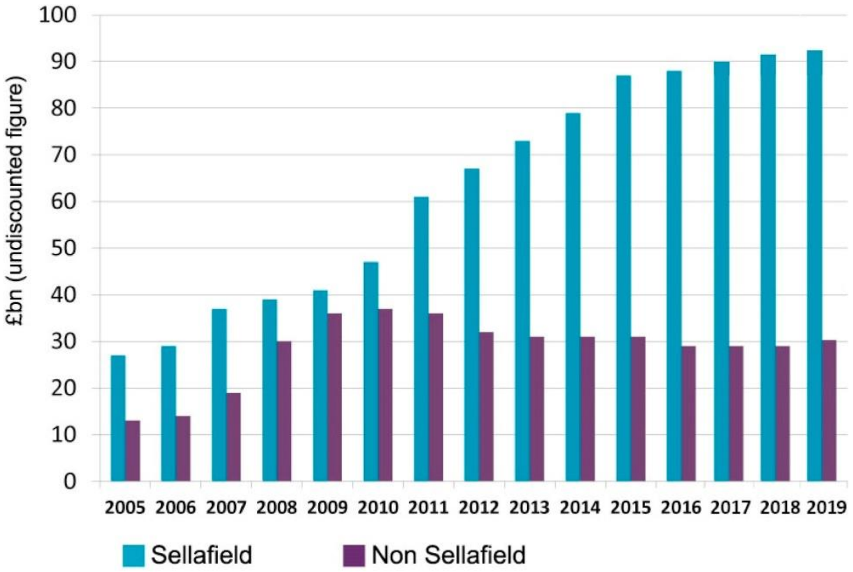
Diletta Colette Invernizzi[a], Giorgio Locatelli[a,*], Anne Velenturf[a], Peter ED. Love[b], Phil Purnell[a], Naomi J. Brookes[c]

[a] University of Leeds, School of Civil Engineering, UK
[b] Curtin University, School of Civil and Mechanical Engineering, Australia
[c] University of Warwick, Warwick Manufacturing Group, UK

The elephant in the room: nuclear decommissioning

The 2019 forecast is that future clean-up across the UK will cost around £124 billion spread across the next 120 years or so

6 sq. kilometres
1,000 buildings
10,000 employees

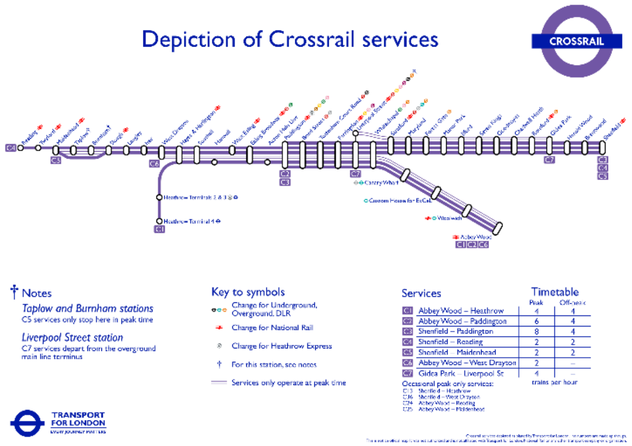


https://www.gov.uk/government/publications/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy/nuclear-provision-explaining-the-cost-of-cleaning-up-britains-nuclear-legacy

Making sense of the value

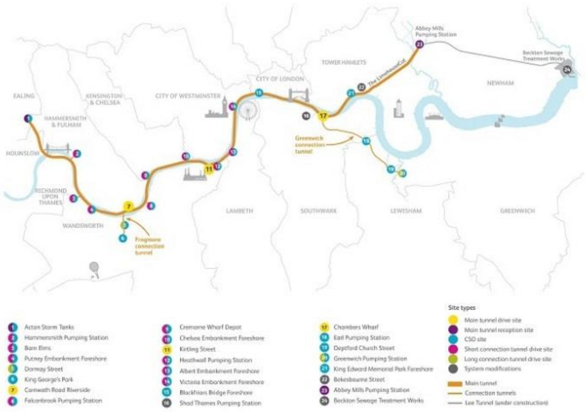
High Speed 2 (£56b)

Crossrail (£16b)



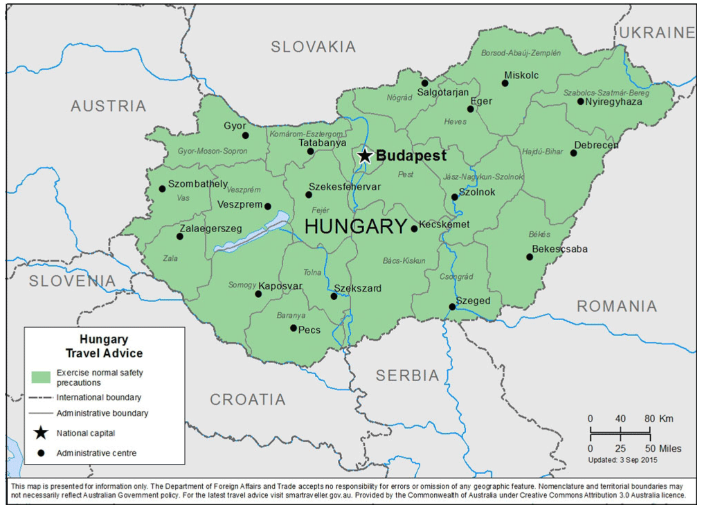
Hinckley Point C (£20b)

Thames Tideway Scheme (£5b)



Making sense of the uncertainty

NDA publishes a range of estimates […] somewhere between £99 billion and £232 billion



UK Oil & Gas Decommissioning

- 320 fixed installations – e.g. oil platforms – in the UK, primarily in the North Sea.
- Recovered more than 44 billion barrels of oil and gas, but reserves are running out and tax revenues from production have declined significantly over the past decade
- £45bn-£77bn The Oil & Gas Authority's estimate of future decommissioning costs to operators → £1 per barrel. (The price is around 40)
- £24bn HM Revenue & Custom's estimate of the total cost to government of decommissioning due to tax reliefs → TAXPAYER MONEY
- £334 billion Net tax revenues for the government from the oil and gas sector since 1970-71

https://www.nao.org.uk/press-release/oil-and-gas-in-the-uk-offshore-decommissioning/

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Let's look outside the UK Nuclear (IAEA-PRIS data)

Category	Number of units	GWe
Operating	442	391,685
Under Construction	54	57,336
Permanent Shutdown Reactors	189	84,841
TOTAL	**685**	533,862

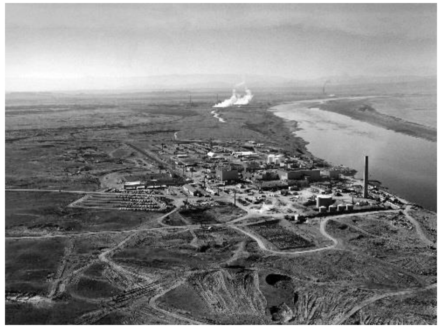
Only 17 have been taken to fully "greenfield status"

But nuclear reactors are "easy"…

More than reactors…
(beside Chernobyl and Fukushima)

The Hanford Site, Washington, USA

During the Cold War it as the United States' main Plutonium production facility for their nuclear weapon arsenal.



The Polygon, Semiplataninsk, Kazakhstan

Used by the Soviet Union as one of their main nuclear weapon testing sites during the Cold War- 450 nuclear tests - 1949 and 1989

The Siberian Chemical Combine, Seversk, Russia

Nuclear production facility in Seversk, Russia. It was one of the production facility for fissile weapon-grade nuclear products fo the Soviet Nuclear weapon program.

More than reactors…
(beside Chernobyl and Fukushima)

Zapadnyi Mining and Chemical Combine, Mailuu-Suu, Kyrgyzstan

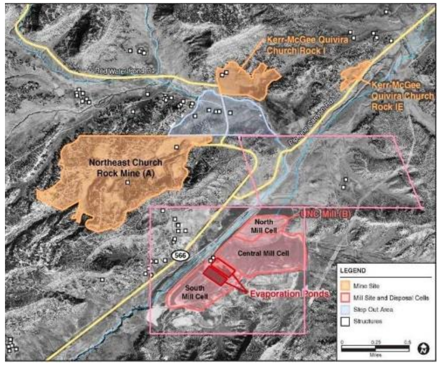
Mining operation was set up by URSS and large amounts of Uranium ore was excavated from the area. Heavily contaminated waste mining products were buried around the excavated areas, but significant amounts were left above ground.

Mayak, Russia

One of their main nuclear plants for plutonium production. Also the site of the third worst nuclear accident ever. 100 tons plus of radioactive waste were released by an explosion releasing large amounts of nuclear material over a large area. The accident occurred in 1975 and was kept a secret well into the 1980's.

Church Rock Uranium Mill, Church Rock, New Mexico

In 1979 a large spill sent thousands of tons of solid radioactive mill waste and millions of gallons of acidic radioactive tailings solutions into the Puerco River. The contamination spread over some 130 km downstream

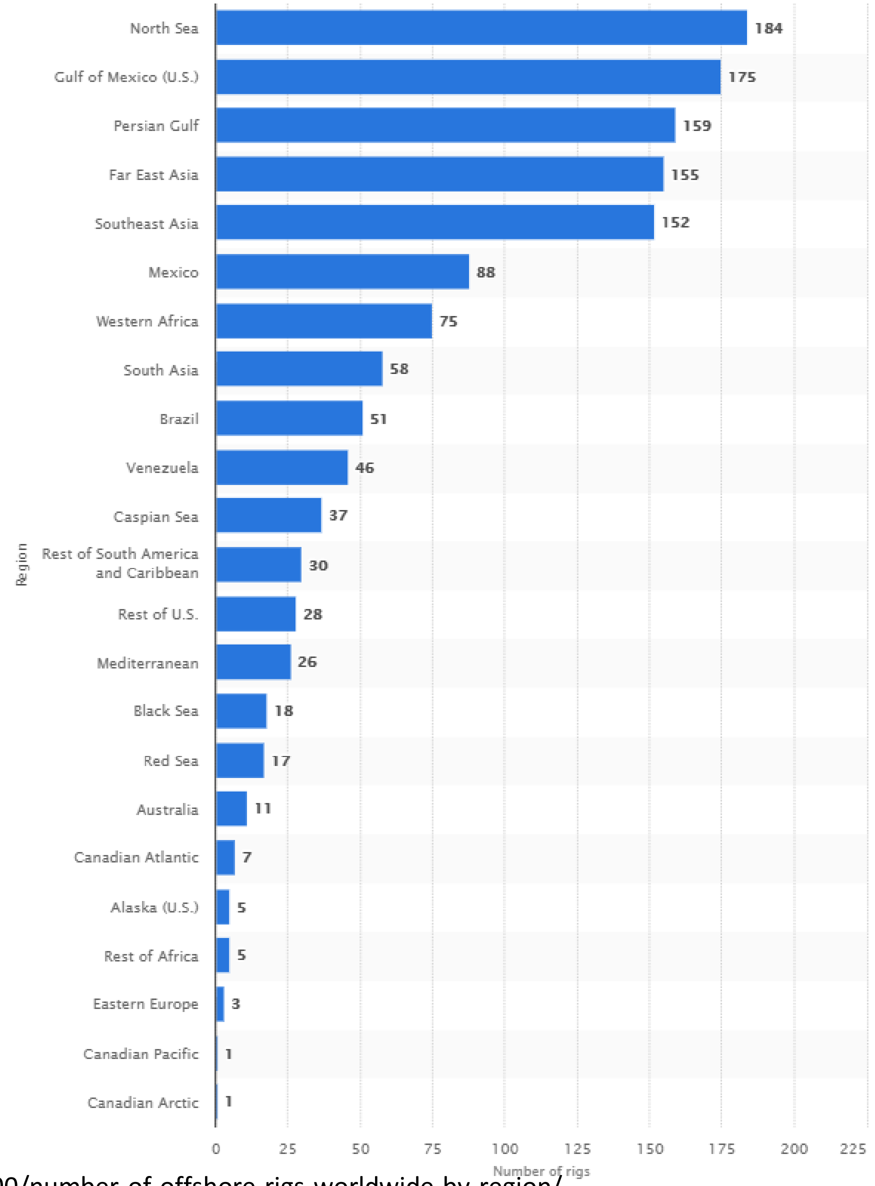


“Radioactive decommissioning” is also… hospitals! (The Goiânia accident)

- A radioactive contamination accident that occurred on September 13, 1987, at Goiânia, in the Brazilian state of Goiás,
- A forgotten radiotherapy source was taken from an abandoned hospital site in the city. It was subsequently handled by many people, **resulting in four deaths.**
- About 112,000 people were examined for radioactive contamination and 249 were found to have significant levels of radioactive material in or on their bodies.

13. Contaminated rubble from the demolition of R.A.'s house on 57th Street.

Number of offshore rigs worldwide - 2018



https://www.statista.com/statistics/279100/number-of-offshore-rigs-worldwide-by-region/

Dams

- USA
  - 74,000 dams existing
  - 1565 Decomissionioned (https://www.americanrivers.org/threats-solutions/restoring-damaged-rivers/dam-removal-map/)
  - Largest projects: $350M removal of two Olympic Peninsula dams as part of the Elwha Ecosystem Restoration, have been driven by restoration of river habitat and fish passages.
- Globally some 5,000 large dams are now more than 50 years old

Dam/incident	Date	Location	Fatalities	Details
Brumadinho dam disaster	2019-01-25	Brumadinho, Minas Gerais, Brazil	142	Tailings dam suffered a catastrophic failure releasing 12 million cubic meters of tailings slurry. 248 people missing.
Swar Chaung Dam	2018-08-19	Yedashe, Myanmar	4	Breach in the dam's spillway. 63,000 evacuated, 3 missing. 85 villages affected.
Xe-Pian Xe-Namnoy Dam	2018-07-23	Attapeu Province, Laos	36	Saddle dam under construction collapsed during rainstorms. 6600 people homeless, 98 missing.
Panjshir Valley dam	2018-07-11	Panjshir Valley, Afghanistan	10	Dilapidated dam crumbled under heavy summer rains, 13 missing, 300 houses destroyed.
Patel Dam	2018-05-10	Solai, Kenya	47	Failed after several days of heavy rain.

https://www.internationalrivers.org/dam-decommissioning

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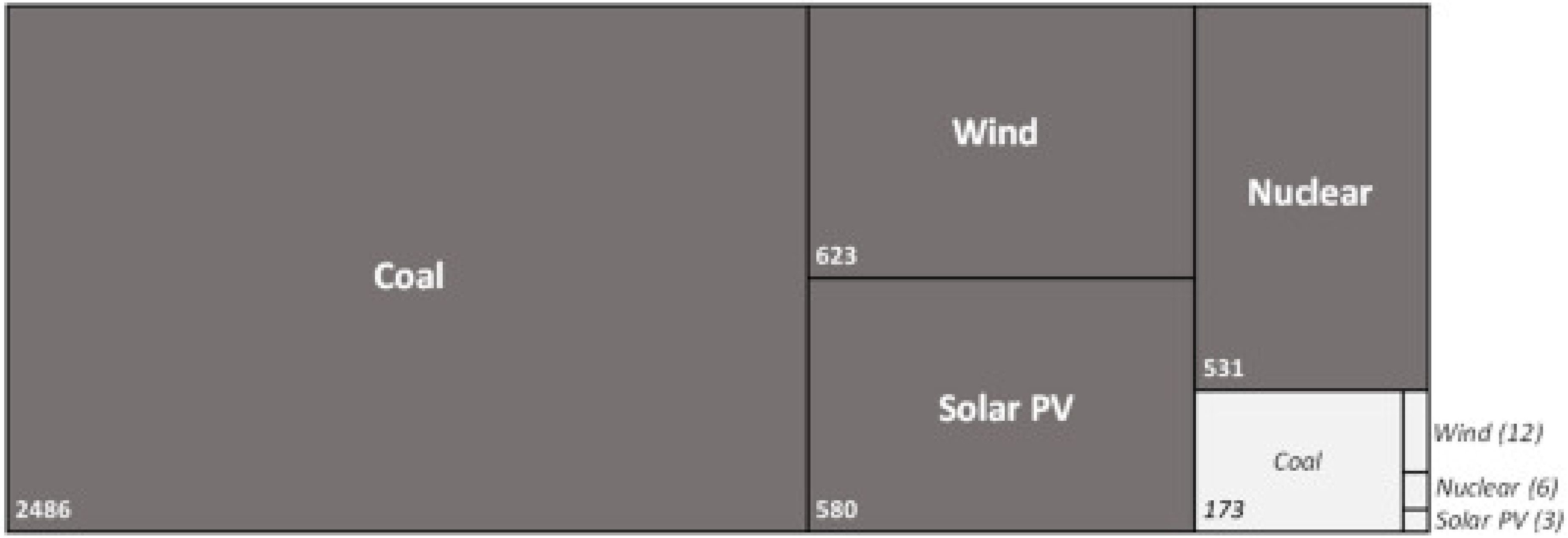
More than words…



Final message

2560 - 2540 BC

220 – 206 BC

70 - 80 AD

1950 – 1960 AD

What do all these projects have in common?

- Huge Budget
- Long-time of planning/construction
- Great technical, economic and social challenges
- Poor project performance (are we sure?)
- …

Little or no considerations regarding the end of their lifecycle:

- Decommissioning
- Dismantling
- Eventual Decontamination
- …

Final message
Decommissioning projects

- Small projects to major national multibillion projects
- At least partially commissioned by governments
- Usually involve large numbers of stakeholders (morally troublesome also from an intergenerational perspective)
- No or little cash in-flow at the end
- No revenue-generating-assets are created
- No “landmark outputs”
- Job positions often “lost”

CONSTRUCTION MANAGEMENT AND ECONOMICS
2020, VOL. 38, NO. 10, 947–963
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Routledge Taylor & Francis Group
Check for updates

Characterising nuclear decommissioning projects: an investigation of the project characteristics that affect the pr

Diletta Colette Invernizzi[a], Giorgio Locatelli[a] and Nao
[a]School of Civil Engineering, University of Leeds, Leeds, UK; [b]Warwick

ABSTRACT
Historically, project management research on infrastructure h
design and construction. However, globally, more and mo
power plants, bridges, dams or oil rigs, are reaching their en
decommissioned. Decommissioning projects are long, comple
multi-billion megaprojects. Their costs keep increasing, while t
why this happens. Nuclear Decommissioning Projects and Pr
analysis of this article, due to the relevance of this sector and
available. The aim is to identify the NDP characteristics that n
in terms of cost and time. Findings from the application of c
collected through 35 interviews with senior practitioners hi
NDP characteristics, including the need to have detailed kn
good relationship with the regulatory authorities, the availa
ble funding.

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Applying value management when it seems that there to be managed: the case of nuclear decommissi

Diletta Colette Invernizzi *, Giorgio Locatelli, Marcus Grönqv
School of Civil Engineering, University of Leeds, Woodhouse Lane, Leeds L

Received 20 April 2018; received in revised form 7 January 2019; accepted 7
Available online 28 January 2019

Abstract
The vast majority of project management literature relating to infrastructure focuses on the project l
Conversely, little attention has been paid to the end-of-life of infrastructure, i.e. when decommission
projects are long and complex projects, involving an extensive network of stakeholders. Moreover, the
Euros and, for many of these projects, keep increasing. Since decommissioning projects do not genera
an expensive nuisance with limited value linked to their delivery. This paper explores the use of
constraints of decommissioning projects and the requirements for successful implementation of VM,
techno-socio-economic relevance. Findings derived from the application of content analysis on se
decommissioning practitioners include suggestions on how to implement VM, ultimately contributing
decommissioning projects with better performance.

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Project

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How benchmarking can support the selection, planning and delivery of nuclear decommissioning projects

Diletta Colette Invernizzi*, Giorgio Locatelli, Naomi J. Brookes
School of Civil Engineering, University of Leeds, Woodhouse Lane, Leeds LS2 9JT, UK

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Statistical analysis

ABSTRACT
Nuclear Decommissioning Projects and Programmes (NDPs) are jeopardized by several risks, long schedule and cost estimates that lay in the range of hundreds of billions of pounds. Moreover, in some countries, these estimates keep increasing and key stakeholders have a limited understanding of the determinants that engender this phenomena. Benchmarking refers to the process of comparing projects in order to identify best practices and generate ideas for improvement. However, even if it is the envisaged approach to tackle the decommissioning challenges (and due to the NDPs' uniqueness), until now, benchmarking has been only partially used. This paper proposes an innovative methodology to benchmark decommissioning projects, both from the nuclear and non-nuclear industry, within the UK and worldwide. From this cross-sectorial and cross-country analysis, it is possible to gather a list of key NDPs' characteristic and statistically test their correlation with the project performance. The ultimate aim of the research underpinning this paper is to investigate the possible causation between the NDPs' characteristics and the NDPs' performance and to develop guidelines to improve the selection, planning and delivery of future NDPs.

Creating Value with Sustainable Decommissioning

Q&A

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