Socioeconomic Assessment

Solent Cluster - Local Industrial Decarbonisation Plan

PREPARED FOR
The Solent Cluster

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1. INTRODUCTION

Plans to decarbonise the industries in the Solent will not only lead to emissions reductions but will have a significant impact on the local economy through the displacement, safeguarding, and creation of new jobs, enhancing market dynamism, and leading to economic value for the region and numerous spillover effects. ERM have therefore been tasked by The Solent Cluster to quantify this perceived benefit and communicate this directly to the region to ensure that these opportunities are taken advantage of.

The objectives of this assessment are therefore to:

- Demonstrate the regional and national significance of The Solent Cluster.
- Analyse decarbonisation benefits and costs, including emissions, and economic, environmental, and social impacts, quantifying these where possible.

This report builds on ERM's previous work evaluating the economic opportunity from decarbonisation of the Fawley Refinery and other neighbouring projects in The Solent Cluster. . Accordingly, this study will focus on sites not covered in the original scope of work and develop additional case studies that further highlight local opportunities.

2. DECARBONISATION AMBITIONS IN THE SOLENT

With a population of over 1.3 million people and 50,000 businesses, the Solent region is a critical economic hub in the UK. The region is home to a wide range of industries, most notably maritime and associated sectors, and including health, education, retail and advanced manufacturing. Its proximity to major shipping routes and the region's natural harbours also make it well-suited for further growth of the maritime industry (the area's core sector) and its sustained relevance to the overall UK economy.

As the region emits roughly 5.3 million tonnes of CO_2 annually, the Solent's economic activities are currently coupled with its greenhouse gas emissions. To decouple the growth of industrial activities from carbon emissions, there is expected to be significant investment in decarbonisation technologies within the region, and this investment will in turn result in economic benefits for both the Solent region and the wider UK.

Within the region, there are potential key decarbonisation projects to reach the UK's 2050 Net Zero goal:

- To support the decarbonisation of the aviation industry, a potential Sustainable Aviation Fuel (SAF) plant could start operation in 2032 to produce 200,000 tonnes per year. If approved, this plant's production capacity will increase to 400,000 tonnes per year by 2035.
- Carbon capture facilities at Marchwood Energy from Waste (EfW) plant to reduce CO_2 emissions at the site.
- Offshore storage of CO_2 in saline aquifers in the English Channel

To support the development of carbon capture technologies in the region, CO_2 transport and storage infrastructure will also be required. There is also potential for the development of additional hydrogen and methanol production plants:

- Hydrogen could also be produced electrolytically using renewable electricity through two green hydrogen plants with a combined capacity of 400 MW.
- Methanol, which is expected to play a key role in decarbonising maritime transport, could be produced from a 70 kt/year synthesis plant.

To achieve the region’s net zero targets, industries in the region may consider decarbonisation levers other than carbon capture including switching fuels to low-carbon alternatives such as hydrogen, electrification of operations and improvements in efficiency. The adoption of each of the levers will depend on factors including the scale of operation and the type of industrial activity.

Several actors present in the Solent region have already adopted decarbonisation targets, including:

- The **University of Southampton** intends to achieve net zero emissions in Scope 1 (direct University-controlled emissions, mainly from on-site fuel use) and Scope 2 (emissions related to electricity purchase and use)[1]. This is in line with the recommendation from the Climate Commission for UK Higher and Further Education Students and Leaders. To achieve this, the university could improve the energy efficiency of its buildings, install on-site renewable energy or purchase grid electricity from renewable producers.
- The **National Health Service (NHS)** has committed to achieving net zero emissions for its direct emissions, referred to as the ‘NHS Carbon Footprint’, by 2040[2]. By 2045, the organisation aims to have reached net zero emissions for activities within its supply chains and travel, all encompassed within the wider ‘NHS Carbon Footprint Plus’ scope. Both social and technical interventions will be applied to reduce emissions. For instance, investment in building upgrades could account for roughly 20% of the reduction in emissions in the NHS’ primary and secondary care estates. Onsite electricity and heat generation is also a major lever as it could reduce emissions by a further 23%.
- The Solent is also home to the **ABP Southampton** and **Portsmouth International Ports**, both of which have committed to emissions reductions targets. ABP intends to reach net zero by 2040 by reducing emissions across its activities, from its vessel to port equipment operation. Two facilities to provide shore power to cruise ships have been installed at the port, where large arrays of solar arrays have also been installed[3]. The Portsmouth International Port also intend to be carbon net-neutral by 2030 and zero emissions by 2050[4]. This port is working through its decarbonisation through projects such as Sea Change, which is deploying a shore power system powered by renewable electricity, and the use of wind and solar power, as well as sea water for heating and cooling, in a terminal extension. These projects are not included in the Solent LIDP scope of assessment.

[1] University of Southampton, Sustainability Strategy 2020-2025
[2] NHS England, 2022, Delivering a ‘Net Zero’ National Health Service
[3] ABP, ‘Ready for Tomorrow’
[4] Portsmouth Port, Sustainability and innovation

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Relation of Solent Outputs to UK Targets

400 MW of green hydrogen production in the Solent could position the region as a strategic hydrogen supplier, both due to the amount of hydrogen produced and its proximity to industries for offtake and ports for potential export. This electrolytic capacity would contribute **4%** of the UK Government's 2030 target of up to 10 GW of low-carbon hydrogen production.

The UK SAF mandate, published in April 2024, requires Sustainable Aviation Fuel constitute 10% of the total jet fuel supply by 2030, resulting in 1.2 million tonnes SAF demand. The SAF plant in the Solent could contribute 16% of the required supply once it begins full operation.

3. METHODOLOGY OF ASSESSMENT

The following steps were taken to estimate the macroeconomic impact of the decarbonisation investments in the Solent region:

i. **The investment profile** was developed based on public data sources and provisional capital and operational spending indicated by Solent LIDP partners. The profile focused on the estimated costs of these installations, and the realisation of the estimated benefits would depend on the final technology choices by the investing organisations. As the macroeconomic impact estimate focused on the economic benefits to the UK, the cost items expected to be purchased or contracted from outside the UK were not considered in the estimate.

ii. **Each cost item was assigned a Standard Industrial Classification (SIC) code,** which was linked to UK input-output tables and business surveys produced by the Office of National Statistics (ONS). Each cost item was classified within the relevant five- and two-digit Standard Industry Classification system, as defined by the ONS. There is a wide range of SIC codes that classify economic activities across industries[5].

iii. **The GVA and job creation estimates** were calculated from the investment profile based on UK input-output tables and the Annual Business Survey produced by the ONS. For each SIC code, the number of direct jobs estimated was calculated as a product of the UK domestic output and the adjusted labour intensity.

The indirect job generation was also calculated as:

Indirect jobs = Direct job creation × (Employment cost multiplier – 1)

The employment cost multipliers are sourced according to the corresponding SIC codes from the Input-Output Analytical Tables.

[5] A full list of current UK standard industry classification can be found here.

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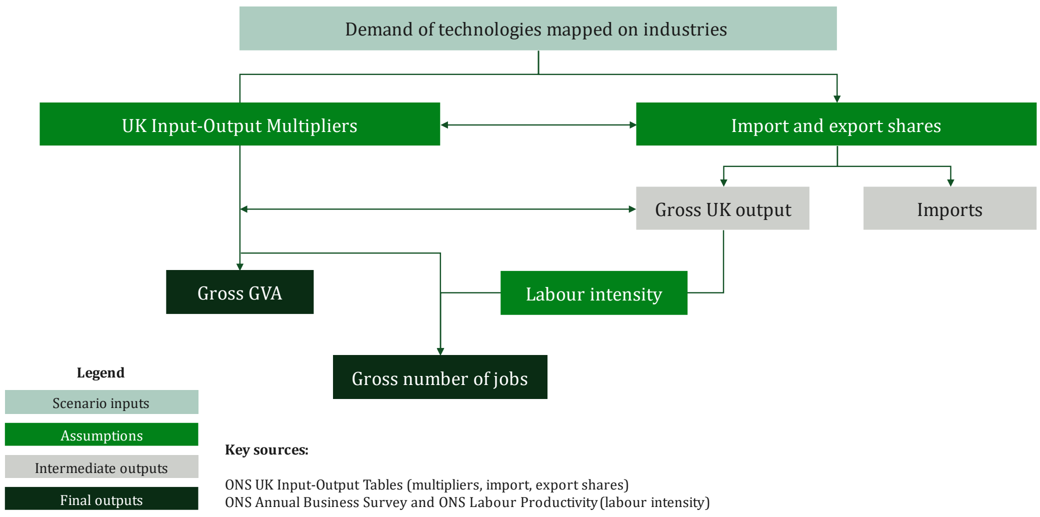

FIGURE 1: ERM MACRO-ECONOMIC IMPACT ASSESSMENT ANALYSIS

4. ECONOMIC IMPACT

4.1 NATIONAL IMPACTS

The adoption of decarbonisation levers by actors in the Solent industrial cluster can also result in an additional c. £40 million investment in the UK. This could in turn result in £31 million Gross Value Added (GVA) to the UK economy, 51% of which arises directly from the projects' materials and services across supply chains. To enable these decarbonisation projects to be online in the early 2030s, the required capital expenditure could sustain roughly 140 FTE/year during the peak construction period. As construction is completed, additional permanent operational and maintenance jobs become required.

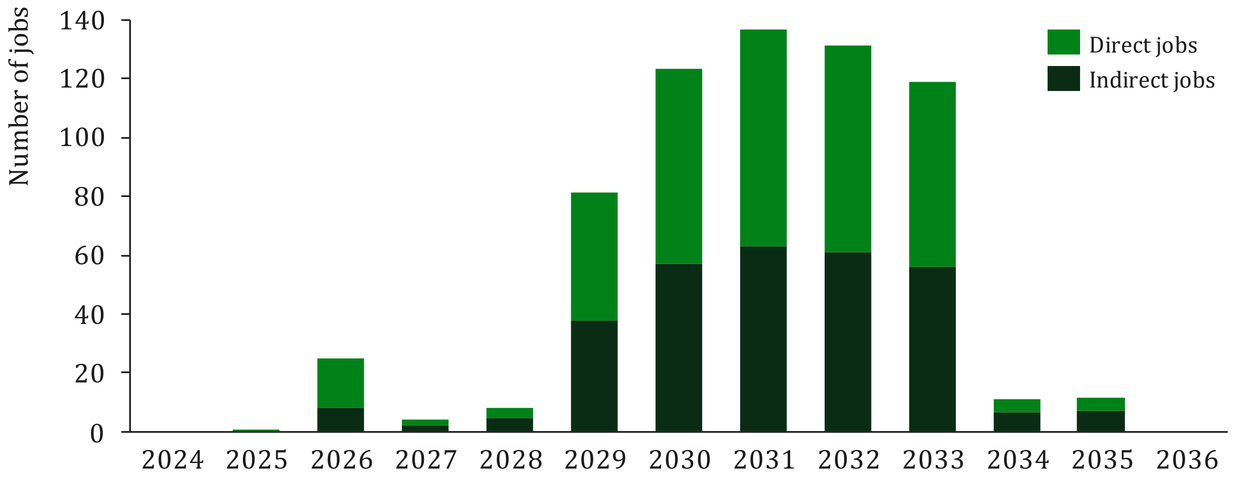

FIGURE 2: GROSS ANNUAL JOBS GENERATED IN THE UK THROUGH THE ADOPTION OF DECARBONISATION LEVERS

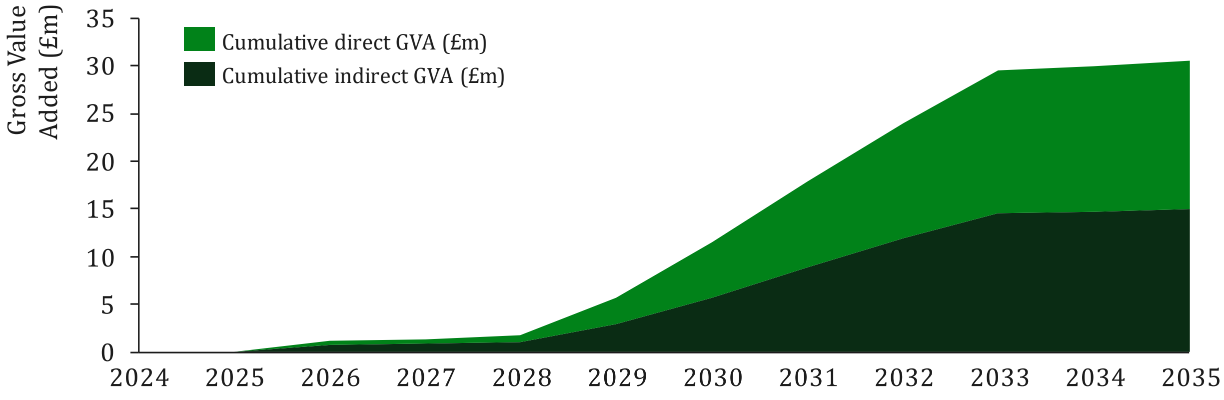

FIGURE 3: CUMULATIVE GROSS VALUE ADDED IN THE UK BY THE ADOPTION OF DECARBONISATION LEVERS

4.2 REGIONAL IMPACTS

At the peak of construction, the adoption of these decarbonisation levers could support an additional 100 jobs, 53% of which would be direct and 47% of which would arise indirectly across the project supply chain. By 2035, these projects would also contribute £26 million in Gross Value Added (GVA) to the Solent.

The level of value retained in the Solent region will depend on the availability of local suppliers for key materials for decarbonisation projects, including equipment such as compressors and batteries.

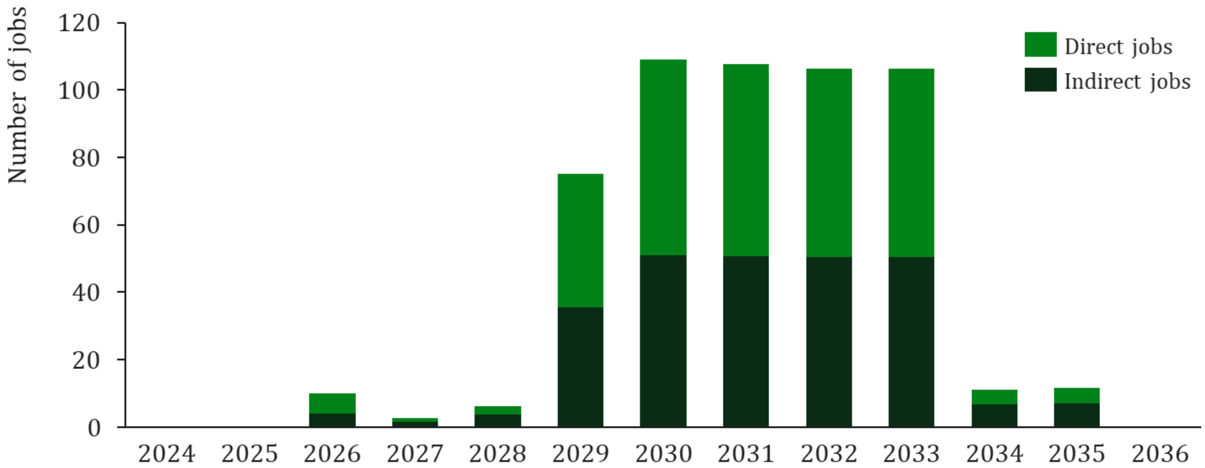

FIGURE 4: GROSS ANNUAL JOBS GENERATED IN THE SOLENT REGION THROUGH THE ADOPTION OF DECARBONISATION LEVERS

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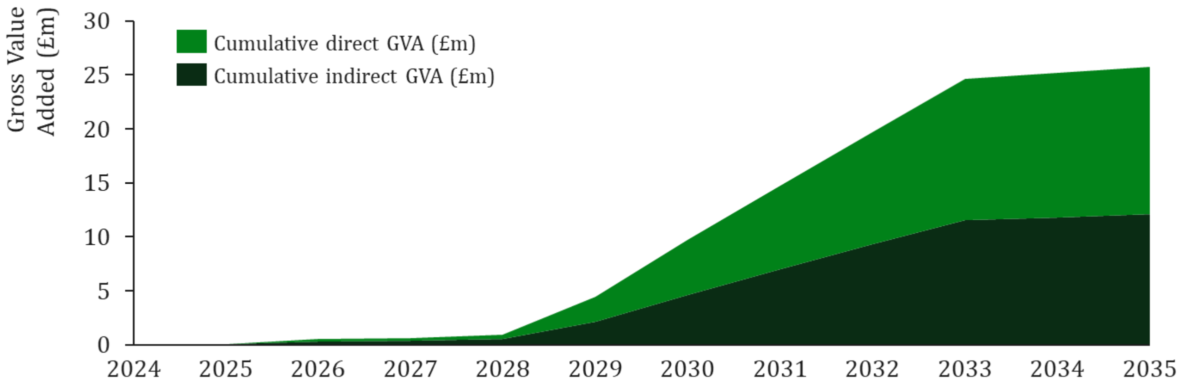

FIGURE 5: CUMULATIVE GROSS VALUE ADDED IN THE SOLENT REGION BY THE ADOPTION OF DECARBONISATION LEVERS

5. SKILLS AVAILABILITY

Roughly 40% of the Solent's population was qualified to NVQ Level 4 qualifications[6] and above this in 2020 (slightly lower than the UK average of 43%)[7]. Based on the conducted analysis, over 60% of the architecture, engineering and head office direct roles require at least Level 4 qualifications. To ensure that the gap does not result in value loss from the Solent region, there should be a focus on the retention of graduates from the higher education institutions in the area.

Nonetheless, opportunities are also likely to exist for apprenticeships, Level 1 qualifications and below, as these categories account for over 30% of the job opportunities generated by the considered projects within sectors such as iron and steel, construction and electrical equipment. This also provides opportunities for upskilling through involvement in these projects.

The construction sector is already a significant GVA contributor in the Solent region, contributing to 6% of the region's employment in 2020. Due to the low carbon transition, there will also be an increase in demand for the construction and development of new infrastructure, and installation of electrical and HVAC (Heating, Ventilation and Air Conditioning). As many decarbonisation projects may require similar skill sets and occur along similar timescales, there may likely be increased pressure on the construction sector. If left unaddressed, a shortage of workers in this sector with the required skillset can lead to project delays or higher employment costs.

[6] NVQ Level equivalent may vary according to industries, and the descriptions of qualifications within each level are outlined here
[7] Solent LEP Local Skills Report ANNEX 2022

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To minimise the risk of a mismatch between the needed skills and available workforce, there needs to be a concerted effort to ensure that the Solent understands the requirements of the low-carbon transition. This is already underway through initiatives such as the Solent Local Skills Improvement Plan (LSIP)[8]. By leveraging partnerships with the three world-class universities in the region, the Solent region can also ensure that apprenticeships and upskilling opportunities include skills reflective of the growing industry experience in decarbonisation.

Low carbon and green skills needed in the Solent

A report by Germserv highlighted that investment in the following skills are needed to support the low carbon transition in the Solent:

- Retrofitting and low carbon heat installation, including heat pump engineers and solid wall insulation.
- Electrical skills needed for low emission transport, including electrical vehicle (EV) charge point installers and maintenance personnel.
- Specialist engineering skills in hydrogen production and storage, and CO_2 capture, transport and storage.
- Alternative, low carbon fuels handling for maritime workforce.

Overall, the availability of colleges and universities in the region will satisfy much of the growing skills demand, and these institutions can support the need for upskilling for nascent markets such as hydrogen and carbon capture. Additionally, although the needed skills for electrical installations are well-established, **the rapid scale-up in decarbonization technology adoption needed also necessitates a rapid scale-up in professionals to support installations.**

6. CASE STUDIES

6.1 E-METHANOL PRODUCTION IN THE SOLENT

Methanol is currently primarily produced from natural gas (65%) and coal (35%), while bio-based and renewables currently account for less than 1% of current methanol production. However, this distribution is likely to change as technologies required for low carbon and renewable methanol production, including carbon capture technologies and electrolysis, mature and become commercially competitive.

Low carbon methanol is produced where one or multiple steps in the methanol production process, such as the production of syngas, has been decarbonised. The use of biomass in the production yields bio-methanol, while the use of carbon dioxide and hydrogen produced using renewable electricity produces e-methanol, as shown in Figure 6 below.

[8] Hampshire Chamber of Commerce, 2023, Solent Local Skills Improvement Plan (LSIP)

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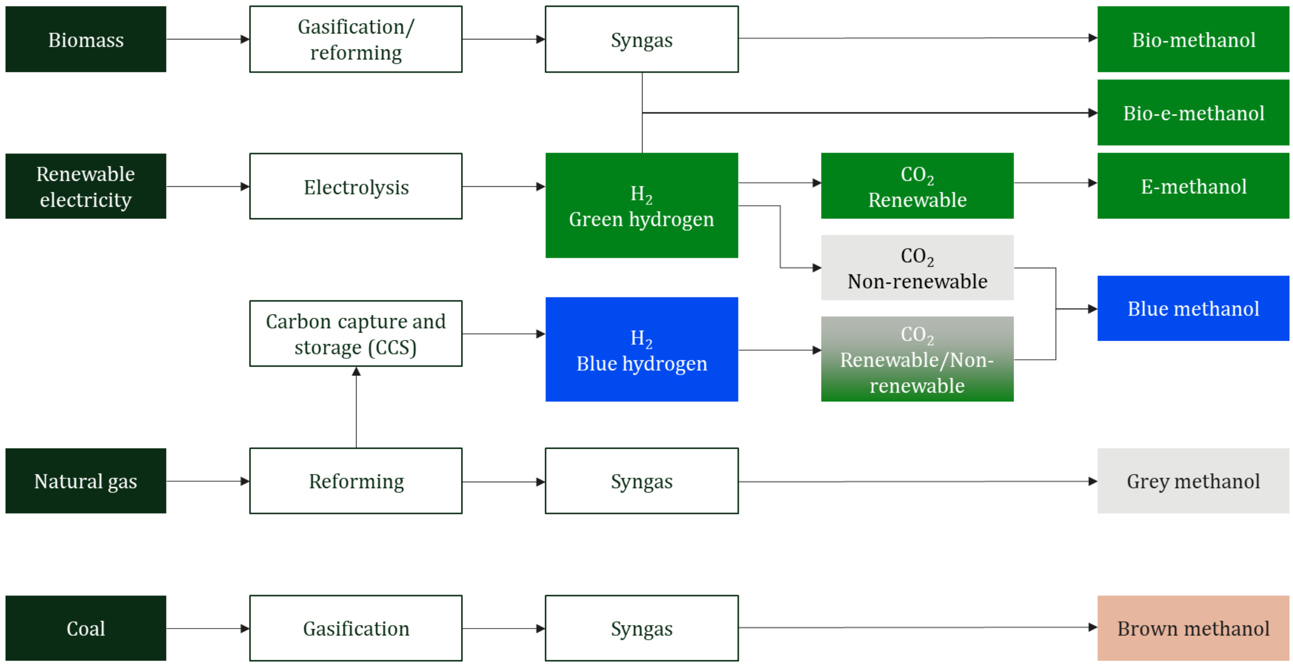

FIGURE 6: ROUTES FOR THE PRODUCTION OF METHANOL[9]

Methanol is used in a wide range of applications as a raw material and a fuel. While some of these applications are established technologies, there are emerging uses that will also contribute to the market. For example, the use of methanol in aviation (through conversion to jet fuel) and maritime transport are expected to significantly contribute to the growth in the fuel's markets.

Maritime decarbonisation in the Solent

There is a growing commitment from maritime operators to decarbonise, and an e-methanol project would decarbonise local maritime transport and attract large methanol-ready vessels to the bunker. The Solent is well-positioned to be a strategic source of e-methanol production and distribution as it is home to several ports, including the major commercial ports of Southampton and Portsmouth. Southampton, for instance, is also a critical intermediary on the world's busiest trade route from Shanghai to Rotterdam.

However, the adoption of e-methanol as a maritime fuel depends on its cost competitiveness compared to fossil fuel alternatives. E-methanol can be up to seven times more expensive than grey methanol (£640-1,260/tonne for e-methanol compared to £80-200/tonne for grey methanol[10]). This cost disparity is primarily driven by the cost of the hydrogen used as feedstock to the process.

If biogenic carbon dioxide from the Marchwood Energy from Waste facility is combined with green hydrogen to produce methanol, the production of the fuel results in a 93% GHG emission reduction compared to heavy fuel typically used in maritime transport.

To produce a low-emission e-methanol product with competitive pricing, the green hydrogen price needs to be reduced to around £3000/tonne. Achieving this price requires a combination

[9] IRENA, Methanol Institute (2021) Innovation Outlook: Renewable Methanol
[10] An exchange rate of 0.78 GBP/USD was applied; Source: IRENA, Methanol Institute (2021) Innovation Outlook: Renewable Methanol

of scale up of green hydrogen production and reduced electricity costs. However, in the near term, policy support will be required to bridge this gap.

According to IRENA, incentives for renewable fuels, carbon taxes and government mandates for fuel blending quotas can increase the market's willingness to pay for a green premium on methanol. The costs of green hydrogen production can also be subsidised through funding mechanisms such as the Hydrogen Allocation Rounds. Providing revenue support for hydrogen produced in the Solent will also drive the development of an e-fuels market in the Solent region.

Economic benefits of methanol production

The realisation of the key decarbonisation projects would result in a reliable supply of hydrogen and carbon dioxide, which are essential feedstock for producing methanol. Methanol, which can be produced from hydrogen and carbon dioxide, is crucial to the decarbonisation of the chemicals and maritime industry. A plant producing 70 tonnes/day of methanol will result in an additional approximate £40 million investment in the UK. This investment will in turn lead to roughly 60 direct and indirect jobs and a cumulative GVA of £13 million to the UK by 2035.

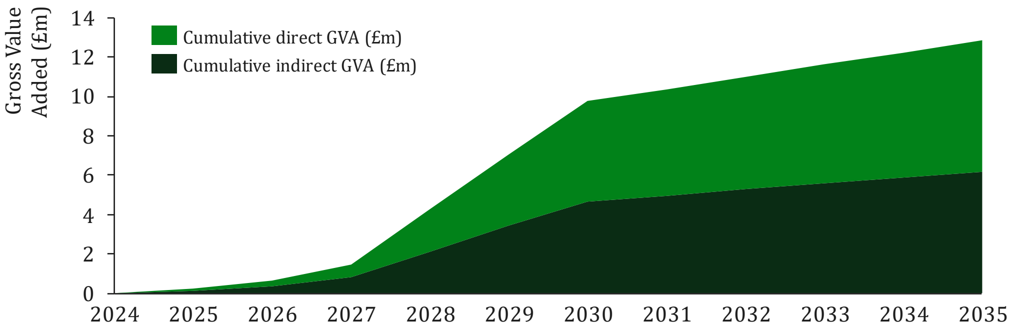

FIGURE 7: CUMULATIVE GROSS VALUE ADDED IN THE UK THROUGH A POTENTIAL METHANOL SYNTHESIS PLANT

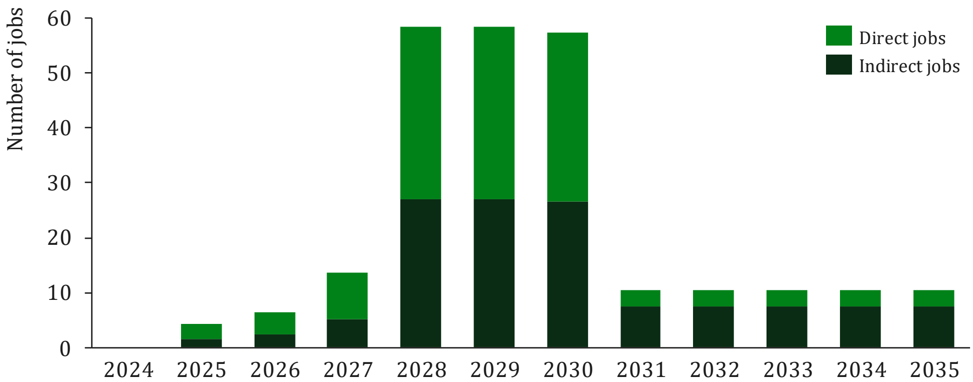

FIGURE 8: GROSS JOBS GENERATED IN THE UK THROUGH A POTENTIAL METHANOL SYNTHESIS PLANT

6.2 AVAILABILITY OF HYDROGEN IN THE SOLENT

In the Solent region, two green hydrogen production plants are planned with a combined capacity of 400 MW. These plants are in early stages of development, and their construction and operation could result in:

- Investment of over £360 million in the UK

- Gross generation of over 600 direct and indirect roles
- Cumulative direct and indirect GVA of over £130 million by 2035
- 35 full-time roles and 40 indirect jobs

The figure below represent the potential gross employment generated by a project in operation by 2030.

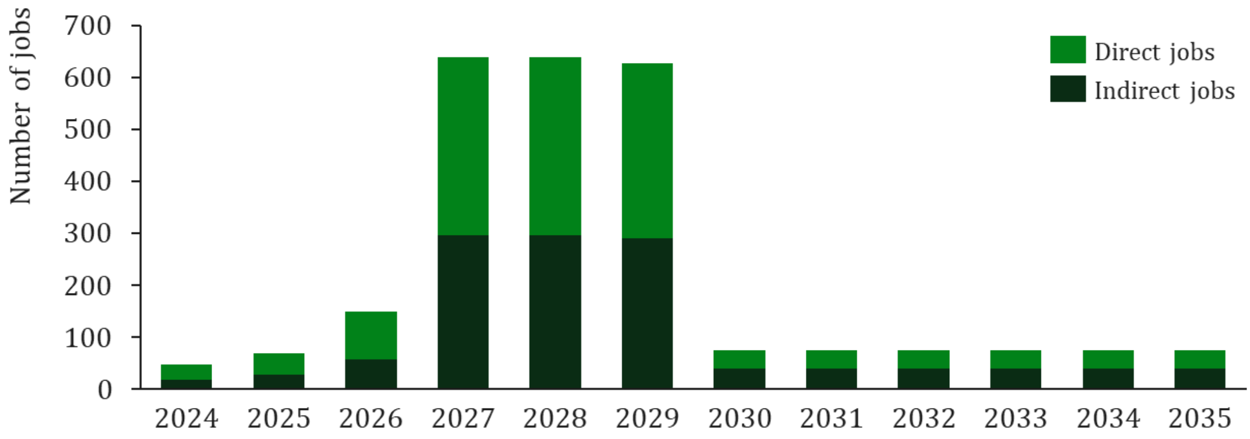

FIGURE 9: TOTAL JOBS GENERATED BY GREEN HYDROGEN PRODUCTION IN THE UK

In addition to local hydrogen production, hydrogen can also be supplied to the Solent. This could be done through eventual import through the ports, tube trailer transport within the United Kingdom or pipeline transport through an established network.

The National Gas Transmission's Project Union could further connect the Solent region to other hydrogen production and storage sites across the UK as well as wider European networks. The project will convert existing natural gas pipelines and construct new pipelines where needed to transport 100% hydrogen.

6.3 DECARBONISATION BY SMALL-SCALE INDUSTRIAL PLAYERS

Although the key decarbonisation projects could deliver a sizeable proportion of the carbon dioxide emissions reductions in the Solent region, investments by smaller-scale industrial actors to reduce their emissions are also a key element of the puzzle. These investments could cover several aspects of the company's operation, such as building energy usage, energy sourcing and equipment utilised for industrial processes.

The emissions associated with buildings can be reduced through low-carbon heat installations such as heat pumps, insulation, and the adoption of low-carbon fuel boilers. The industrial players within the Solent LIDP are evaluating multiple decarbonisation levers, and section 4 captures the potential economic benefits of these projects. The table below groups a selection of the potential investments according to the decarbonisation levers they represent.

Decarbonization lever	**Potential investments**	**Description**
Fuel switching	Steam production using geothermal heat	• Gas-powered steam generators with a geothermal system can be used to lower the emissions associated with steam production.

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Decarbonization lever	**Potential investments**	**Description**
	On-site renewables installation	• In reducing the emissions associated with electricity use, renewable electricity could be purchased from the grid. It can also be generated at the point of use through on-site installation of technologies such as roof-top solar photovoltaics.
Efficiency improvements	Digital twin of facility	• An AI-powered digital twin tool can explore on-site activities that drive energy demand and anticipate future demand. • Potential operational measures to improve efficiency could be identified, including scheduling of annual production and prioritisation of process improvements or plant modifications.

	Installation of high efficiency and hydrogen-ready boilers	• Natural gas-fired boilers can also be replaced with alternatives capable of operating with low-carbon fuels such as hydrogen. Specifically, new boilers could provide two key benefits:
		  ○ **Efficiency:** the boilers are significantly more efficient, reducing emissions and costs from natural gas usage.
		  ○ **Hydrogen-ready:** new boilers can accept hydrogen fuel (or blends of hydrogen with natural gas) to achieve further emissions reduction when this fuel becomes available.

	Lagging and the upgrading of equipment	• Existing equipment can be retrofitted to reduce energy consumption.
	Lighting	• Lighting can account for up to 20% of total energy consumption in commercial buildings[11], Replacing existing fluorescent bulbs with LED lights can deliver efficiency improvements.
Electrification	Electrification of processes	• Where possible, the electrification of processes that have previously run on natural gas can reduce the emissions association with operations. For instance, in some processes, natural gas-fired process jets are employed for steam production and vacuum generation. By adopting electric vacuum pump systems when combined with a low-carbon electricity supply, this results in reduced process emissions.

[11] National Renewable Energy Laboratory, DOE, 2022 - Link

Realizing the full potential of these efforts does however require a reliable supply of low-carbon fuels such as hydrogen, as well as continued reductions in the costs of technologies such as hydrogen-ready boilers and solar photovoltaics.

6.4 COLLABORATIONS TO SUPPORT SKILLS DEVELOPMENT

Collaboration across multiple stakeholders, including education institutions, local councils, and industries, is necessary to ensure that the region's workforce has the current and future skills required to realise the ambitions for net zero emissions. The following initiatives have been organised in the region:

- The Local Skills Improvement Plan, prepared by the Hampshire Chamber of Commerce, was published in 2023. The document builds on the skills assessments conducted by the Solent SAP. In addition to highlighting employer priorities, the document outlines priorities for skills development in the region and recommendations for realising them.
- The Solent Skills Advisory Panel (SAP), in operation from 2019 to 2024, was an example of this partnership as it brought together skills providers and employers to understand any mismatches in demand for skills.
- Multi-stakeholder groups within the region such as The Solent Cluster are crucial to achieving the priorities of the LSIP. Such groups can catalyse their membership, which include education institutions, councils and various industrial players, and reduce the time lag between identifying and addressing gaps in skills availability.

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FIGURE 10: THE SOLENT CLUSTER NETWORKING MEETING ON SKILLS[12]

In addition to early identification of needs, these skill gaps could be addressed by[13]:

- Supporting local retention of talent through consistent engagement between industry and universities and colleges through career fairs, talks and other forms of partnerships, as well as competitive benefits.
- Coordinating partnerships between skills providers and industry to develop strategies to address projected skills demands. These partnerships could lead to industry-informed education programmes, education institution-led retraining programmes, and apprenticeships and Skills Bootcamps[14].
- Upskilling employees through ‘on the job’ training opportunities through internal courses or supervised task completion to facilitate learning.
- Funding the subsidization of reskilling and upskilling for the required roles in the low carbon economy.
- Sharing knowledge from demonstration projects through reports and public sessions, such as presentation and conferences, to increase awareness of emerging technologies as well as key challenges faced.
- Communication programmes through industry conferences, networks and public-facing networks highlighting topics such as job openings, available trainings and scholarship support.

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[12] The Solent Cluster, 2024, June Network meeting - Focus on Skills
[13] Germserv, 2023, Solent Local Enterprise Partnership Low Carbon Skills Report
[14] Solent Partners – Skills Bootcamps

Overall, it is important that these programmes explore both established networks and conduct outreach to ensure that there is widespread access to these opportunities presented by the green transition in the Solent.

6.5 RESEARCH TO POSITION THE SOLENT CLUSTER AS A LEADER IN THE CARBON VALUE CHAIN

The availability of established ports in the region, combined with its proximity to saline aquifers for CO_2 storage, make the Solent a likely key player in CO_2 shipping and storage. To support the realisation of this potential, the National Industrial Decarbonisation Research and Innovation Centre (IDRIC) is supporting a range of projects on the topic, including CO_2 Ports to Pipeline, led by the University of Southampton, and the identification of optimal sites for Bioenergy with carbon capture and storage (BECCS), led by the University of Southampton, the University of Exeter and the University of California.

Bioenergy with Carbon Capture and Storage technology is crucial to the decarbonisation of electricity. However, its environmental and social impacts on the host region, such as the implications of potential changes in land use, are not well-understood. The project to identify new locations for BECCS infrastructure aims to ensure that the selected regions for the technology's deployment also offer wider environmental benefits in addition to enabling energy decarbonisation. The research will:

- Create a national-scale cost minimization model to investigate the spatial impacts of BECCS (Bioenergy with Carbon Capture and Storage).
- Integrate environmental effects from land-use changes into the spatial optimization model.
- Deepen our understanding of the trade-offs between energy, agriculture, and the environment as the UK moves toward a low-carbon energy future.

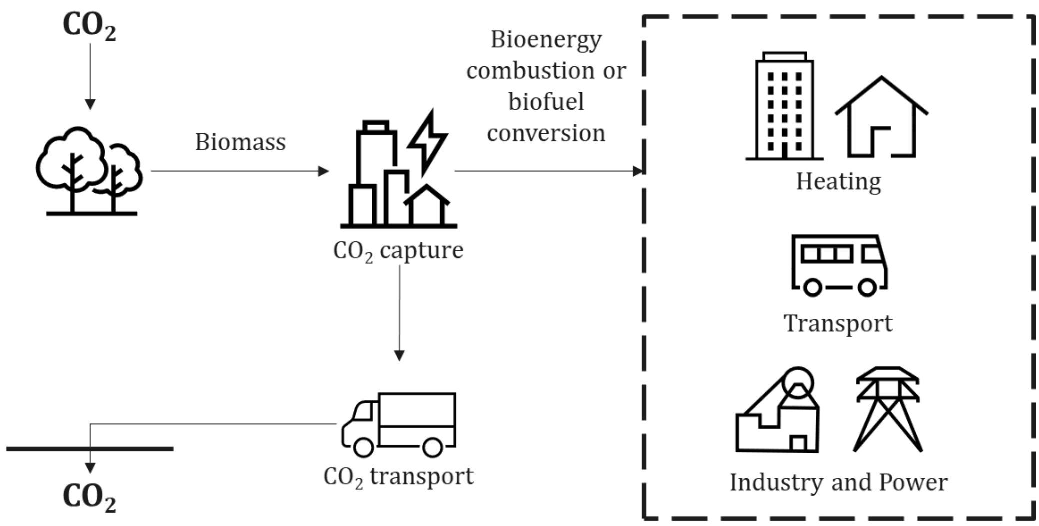

FIGURE 11: BIOENERGY WITH CARBON CAPTURE AND STORAGE CONCEPT OVERVIEW

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
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