Growing Places Fund Business Case

1. Scheme Summary

Scheme Promoter: **Ryse Hydrogen Limited**

Project Name: **Green Hydrogen Generation Facility**

Federated Board:
Kent and Medway Economic Partnership

Lead County Council/Unitary Authority:
Kent County Council

Development Location:
Thanet Way, Herne Bay, Canterbury (*the land parcel west of Herne Bay Household Waste Recycling Centre, CT6 8DD)*

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Project Description:

In this project, new hydrogen production company Ryse Hydrogen Limited will install and operate the UK's largest zero carbon hydrogen production system in Kent. This will be powered by way of a direct connection to the on-land substation for the existing Vattenfall offshore wind farms - Kentish Flats and Kentish Flats Extension (in Herne Bay). In so doing, Ryse will demonstrate the economic and practical viability of generating hydrogen from wind energy to produce hydrogen on a bulk scale to be used in zero emission mobility solutions. In this way Ryse will become the first large scale producer of fully renewable and zero emission hydrogen fuel in the UK

Ryse will distribute the hydrogen produced in Herne Bay to fuel fleets of hydrogen buses in the South East (first contracts to supply Transport for London buses have been secured). In addition to these first customers for hydrogen buses, the hydrogen supply will eventually expand to serve fleets of trucks, taxis and trains.

Project Objectives:

1. Deploy a large-scale hydrogen production system in Kent, with a direct link to an offshore wind farm. The system will produce and store hydrogen before compressing the hydrogen for onwards distribution to customers for this transport fuel (using tube trailers).
2. Develop a first commercial renewable hydrogen production company for the UK. This will the largest water electrolyser in the UK and will be deployed at a scale where the company can operate profitably based on revenues from hydrogen sales. In this way, the project will act as a first real world proof of the viability of renewable hydrogen which is seen as an essential component of a zero carbon energy system. In this way, the project helps to meet the challenge of addressing the climate emergency.
3. Enable a real-world validation of the capital assumptions, operating strategies and market interaction of a wind hydrogen system in practice. This will provide the evidence required to demonstrate that future larger scale wind hydrogen systems are able to produce completely carbon free
4. Generate employment in hydrogen fuel cell electric value chain, consisting of various technical and management roles in design, installation, ownership and operations of new renewable energy sites (wind, solar, anaerobic digestion plants etc), hydrogen generation facility, distribution infrastructure, hydrogen refuelling stations and transport companies transitioning to zero emission technologies.
5. In alignment with SELEP Skills Strategy, the project will lead to sustained growth in high quality jobs and apprenticeships. The project will also lead to collaboration between industry and academia for research focused on hydrogen and fuel cell technology. The development will initiate opportunities with universities in the South East for PhD level studies and industrial placements throughout the project's operating life.
6. Create the evidence base for financiers and investors to back future larger scale wind hydrogen systems
7. Be the largest wind-electrolyser system in Europe and an important first step to the expansion of the supply of green hydrogen for emerging energy markets. Whilst the system is distinguished by its scale, wind-hydrogen technology has been previously tested in Germany, South Korea and Norway. The project will aim to capitalise on the key learnings from previous deployments (by including suppliers who have been involved in

these projects) and bring to Kent an integrated solution for the supply of a zero-emission fuel.

8. Demonstrate that coupling of hydrogen with wind developments can improve the economics of large-scale wind in the South East by providing a secure and flexible off-taker for wind developers. Our partnership with Vattenfall (the wind supplier) is based on understanding the wind-hydrogen opportunity with a view to developing larger scale systems for new wind farms.
9. The project will act as the starting point for further expansion of wind hydrogen deployment in Kent, with future projects already planned in the Kent region that will connect with other offshore wind sites such as the Thanet offshore wind farm. In this way the project will facilitate the development of the offshore energy industry for Kent. As some of the highest quality wind resource in the UK is concentrated around the South East coast, this project will maximise on the natural marine energy resources available and further entrench the region's competitiveness in offshore renewable energy and associated infrastructure.

Ryse requires this public support from the GPF loan in order to accelerate the pace of development. The company has been formed and is well capitalised to develop a first hydrogen production and dedicated hydrogen distribution system.

However, without external support:

a) The first system will be installed at a scale required to meet only the initial small customer demands for hydrogen. This leads to poor economics and a risk of a system stuck without capacity for expansion. With GPF support, a larger system can be installed which will enable a full demonstration of the renewable hydrogen principles on an economically viable basis and allow for expansion to satisfy demands from early large-scale markets for hydrogen in the UK. This will ensure the company is able to continue to expand renewable hydrogen production for the UK.

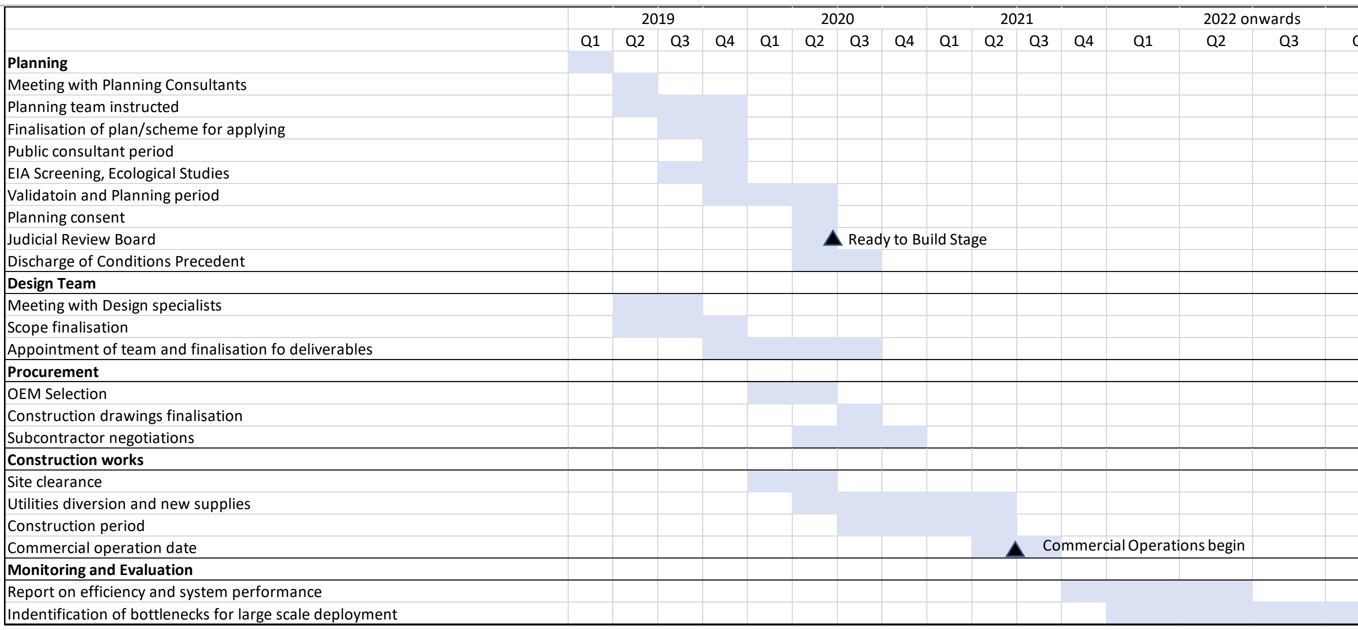
b) Without support the ability to support future projects at scale will be constrained. This will impact timescales for producing hydrogen at a cost which is competitive with conventional fossil based fuel or other "brown" methods for hydrogen generation, as well as the strategy for reaching these levels of production on an economic basis

c) The ability to access GPF support helps to underpin the decision to locate this first of a kind facility in Kent, thereby securing all of the regional economic opportunities which arise from being a first mover in a new technology deployment.

SOUTH EAST LOCAL ENTERPRISE PARTNERSHIP

Project Development Stages:

Project development stages			GPF funding required (yes or no)
Stage	Partners	Status	
Land development, energy studies and layout planning	Ryse Hydrogen, Nel Hydrogen (equipment supplier), Vattenfall UK (energy supplier), Zerum Consult (planning consultants),	Completed	No
Engineering drawings for production facility	Ryse Hydrogen, Nel Hydrogen	Completed	No
Pre-planning public consultation	Ryse Hydrogen, Newington Communication	Completed	No
Planning Application and Approval	Ryse Hydrogen, Zerum Consult	Ongoing (Planning application has been submitted in December 2019)	No
Construction Period	Ryse Hydrogen	Planned for June 2020 to May 2021	Yes
Operation Phase	Ryse Hydrogen, Nel Hydrogen, Vattenfall UK	Planned for June 2021 onwards	No



GPF Required: **£3,470,000**

2. Strategic Fit

Policy and Strategic Context:

Ryse's green hydrogen generation facility will be UK's first utility-scale green hydrogen plant with enough capacity to meet fuel demand from hundreds of fuel cell buses and cars daily. The entire production supply chain will operate from Kent throughout its design life of c. 50 years. As a result, the project will contribute greatly in fulfilling SELEP's strategic objectives, namely -

1) Priority One of SELEP's Industrial Strategy: Creating Ideas and Enterprise

Ryse's business model is well aligned with SELEP's goals for encouraging businesses with the capacity for innovation and high growth to scale up. The Energy South2East Action Plan provides a clear pathway for allocation of investment by private enterprises to help meet decarbonisation targets in the South East region. Specifically, the timelines and action plan laid out under Project Model 3 – Hydrogen Injection into the Natural Gas Grid and Project Model 4 – Offshore Wind Development are obvious enablers for scaling this business in Kent.

This project is at the cutting edge of the transport revolution. For decades, the UK has been reliant on nuclear and coal as the main source of power, and on the car as the dominant mode of transport. This project seeks to change the status quo, by linking renewable energy sources to 21st century public transport design. SELEP would be at the cusp of this energy revolution if GPF is granted. The Ryse investors are looking across the UK and globe to identify locations where they could cluster their hydrogen energy production facilities. Due to its natural assets and geography, the Kent coast line with its significant capacity for wind production, is one of the frontrunner locations. Were the SELEP GPF funding to be awarded, this would help decide where (geographically) the significant private sector equity is invested.

Ryse is also in discussions with the University of Kent for collaborations in developing new energy and materials in relation to Clean Growth and Future of Mobility Grand Challenges of the Industrial Strategy**.** This facility which is first of a kind for the UK will inevitably attract considerable academic interest and can be the basis for numerus research projects as Ryse seeks to improve and develop the process.

2) Priority Three of SELEP's Industrial Strategy: Accelerating infrastructure

The South East's transport infrastructure will benefit from deployment of green hydrogen production facilities which will be able to satisfy fuel demand from local fleets of zero emission fuel cell buses and cars expected to hit the roads from early 2020. It is now widely accepted by researchers and policy makers that hydrogen will play a crucial role in zero emission technologies for heavy duty transport.

Although the immediate contract to supply hydrogen fuel to green buses is with Transport for London, Ryse is at an advanced stage of discussion with several other bus operators, including operators located within the SELEP boundary. All Kent District Councils and Medway Council have declared either a climate emergency or have agreed that they will endeavour to reduce their carbon emissions to net zero by 2030. Kent County Council is seeking to reach zero emissions by 2050 across Kent. This project will therefore help the fourteen local authorities to achieve their strategic ambitions.

Fuel cell buses perform just as well as the incumbent diesel buses in terms of their availability, acceleration, gradeability, range and refuelling time. Hydrogen fuel cell buses powered with locally produced hydrogen from renewable energy will help the South East meet its zero emissions goals. In addition, each fuel cell bus powered by renewable energy will reduce CO2 by 122kg for every 100km of travel, in comparison to diesel buses. The benefits will increase exponentially as more and more fuel cell buses are deployed in the South East. The development will save

- **471,000 tons of carbon emissions over the period to 2035**
- **1,685 tons NOx, 21 tons of PM2.5, 414 tons of Hydrocarbons in the period to 2035**

Locally produced hydrogen provides fuel source security to the South East and the wider nation. It eliminates the need to import offshore oil and deal with the potential disasters associated with pipelines and seaborne oil spills.

At the same time, the South East's energy infrastructure will see renewed investor interest for its rich wind and solar resource that can be effectively routed towards the production of renewable fuels via direct coupling with electrolysers for hydrogen generation. Renewable energy developers will see many potential benefits such as:

- Improving the "capture price" for wind – by controlling the electrolyser in a smart way, it is possible to maximise the operation during periods when the electricity price is depressed (due to the correlation between wind output and electricity prices) – this means the wind operator can sell electricity to the electrolyser operator at an elevated price relative to the spot market, but at a lower price than the spot market which the electrolyser operator could access alone. In this way both parties' benefit.

- Participating in new markets – the electrolyser operation can be controlled to allow participation in frequency response, balancing, local DSO and TRIAD avoidance markets, further reducing the effective electricity cost.

- Constrained systems - Moving beyond the existing economic benefits to owners of wind farms, coupling with hydrogen will lead to better utilisation of installed capacity. A number of existing wind farms face considerable local grid constraints. They have been built despite these as the wind resource is particularly favourable. Adding an electrolyser to these systems can allow the constrained electricity to be consumed for hydrogen production at a very low cost. When coupled with the strategies above for the unconstrained output from the wind farm, the effective cost of the electricity input to the system is further reduced.

- Overplanting – existing wind farms are often grid constrained and this prevents expansion. Adding a water electrolyser allows additional wind turbines to be deployed at a given site at very low cost. These additional turbines increase the total renewable energy output at the wind farm and allow the constrained operational mode described above.

- Grid Independence - Large scale offshore wind farms face enormous costs for connection to the electricity grid. Costs in excess of £1M/MW are common. Given that bulk hydrogen production facilities can be built for less than £0.5M/MW, there is potential to use the cost saving from avoided grid connection to pay for new electrolyser plant. This means that as and when large scale hydrogen markets exist, it will be possible to deploy very large GW scale offshore renewable schemes producing hydrogen as an alternative to electricity. Given the rate of cost reduction at offshore wind schemes, these schemes can be expected generate very low cost hydrogen (including all costs of hydrogen capital equipment) ready for bulk scale transport back to mainland markets.

This business case considers the erection of hydrogen fuel production facilities in Herne Bay. However, it is important to note that, were Herne Bay to work well, initial discussions are in progress about a second potential (larger) production facility, linked to Vattenfall's Thanet offshore wind farm.

Ryse draws encouragement from South2East Energy Strategy, which sets out how local energy generation to support heat, power and transport could be developed, making use of private sector investment, and supporting the 'decarbonisation' grand challenge and vision for the Future of Mobility set out in the Industrial Strategy.

3) Priority Two of SELEP Industrial Strategy: Developing tomorrow's workforce

The potential benefits of scaled deployment of renewable hydrogen production systems will lead to creation of many jobs across the supply chain. The development will lead to creation of

- **16 jobs at Herne Bay**
- **40 jobs at Phase 2 expansion at Thanet**
- **Other indirect benefits are not quantified, though there will be benefits across the region, including:**
  Facilitated renewable energy deployment (with associated jobs and carbon savings) by using hydrogen as a market for renewable energy
  Supply chain services to the facility – maintenance and support for specific aspects of the facility will be contracted to local firms
  Experience in construction of the facility – local contractors will be sued to build and assemble the facility. S this is a first of a kind deployment, they will gain unique skills which can then be applied to similar projects elsewhere in the UK
  Multiplier effects associated with the direct employment
- **6 PhD level research opportunities, 29 Industrial placements at the project reaches full capacity**
- Furthermore, it will give an impetus to ownership and operations of renewable energy farms, development of hydrogen production sites and downstream refuelling infrastructure, R&D for technology and performance improvements in fuel cell electric value chain, manufacturing of new energy vehicles and constituent parts.

Ryse is working with leading players in the hydrogen fuel cell value chain through its affiliation with H2Bus Consortium (https://www.h2bus.eu/). The consortium works closely on sharing technical know-how and human resources to help grow the hydrogen economy.
Ryse has access to skills from our partner companies Nel Hydrogen, the electrolyser manufacturers and Vattenfall, the energy suppliers to get the facility at Herne Bay, Kent up and running. These are available under sub-contract. However, in the near term Ryse aims to develop in-house capability for engineering and managerial functions. As such, Ryse intends to

recruit and train a local team, to take over responsibilities from external specialist contractors post construction.

Moreover, for future projects in the region Ryse is actively cultivating skills internally. For instance, members of the team worked closely with representatives of Transport for London (TfL) on the development and construction of its hydrogen refuelling station in Perivale, London. Ryse will continue to work on skills development of its current and future employees to emerge as a competent firm in the green hydrogen production sector.

A detailed list of prospective customers for zero emission mobility solutions that Ryse is in active discussions with in the South East and also in the rest of the country is included in Appendix H Ryse has also initiated discussions with the Industry Engagement Manager at Kent University for bringing the Industrial Strategy to the University of Kent through innovative collaborations. The discussions so far have been focused on potential tie-up to support the research, innovation and training activities for projects related to new energy and materials and especially, for studies related to production of green hydrogen with a focus on transport applications. Ryse Hydrogen recognises the importance of working closely with research institutes to unlock technological breakthroughs in new energy and hydrogen production. Conforming with the company ethos, Ryse Hydrogen has already committed support for research initiatives targeted towards hydrogen enables zero emission supply chains at Queens University in Belfast in 2020. Similarly, conversations with the Energy and Materials Innovation lead at University of Kent have been initiated for research on ‘Future of Mobility’ and ‘Clean Growth.’
In line with SELEP’s Skill Strategy for 2018-2023, Ryse Hydrogen will greatly contribute to an employer led partnership approach to a flourishing, inclusive economy

Need for Intervention:
[Please articulate the underlying issues driving the need for intervention, with reference to the specific market failure that the GPF will address. The request should consider whether the problem reflects a market failure or evidence that the market demand for the proposed project has weakened; ***maximum 0.5 pages]***

Ryse requires this public funding in order to accelerate the pace of development. The company has been formed and is well capitalised to develop a first hydrogen production and dedicated distribution system. However, without external support:

a) The first system will be installed at a scale required to meet only the initial small customer demands for hydrogen. This leads to poor economics and a risk of a system stuck without capacity for expansion. With GPF support, a larger system can be installed which will enable a full demonstration of the renewable hydrogen principles on an economically viable basis and b) allow for expansion to meet early large-scale markets for hydrogen in the UK. This will ensure the company is able to continue to expand renewable hydrogen production for the UK.

b) Without support the ability to support future projects at scale will be constrained. This will impact timescales for producing hydrogen at a cost which is competitive with conventional fossil-based fuel or other “brown” methods for hydrogen generation, as well as the strategy for reaching these levels of production on an economic basis

c) Ryse will need to consider alternative options for siting their new wind hydrogen system. Whilst Kent is attractive for the reasons described above, other regions across the UK (e.g. Humber) are also promoting their offshore wind sectors. The availability of the GPF is one of the factors which allows Ryse to see Kent as a favourable location.

Impact of Non-Intervention (Do nothing):

[Describe the expected outcome of non-intervention. Promoters should clearly articulate the impacts of not receiving GPF funding and how this is reflected against the SELEP objectives to support the creation of jobs, homes, skills and strategic connectivity, as well as the environment, economy and society, if applicable. This section should also highlight whether the project is expected to still go ahead without GPF and whether it is likely to have a reduced impact or a slower impact due to non-intervention; ***maximum 0.5 pages****]*

Ryse requires this public funding in order to accelerate the pace of technological development enabling production renewable fuel at prices that are comparable with conventional fossil-based alternatives.
With the help of GPF facility, Ryse will be able to broaden its customer base in the South East.
The table below summarises different scenarios and level of impact that the GPF facility will help create:

	Without GPF support	With GPF support	With GPF support including execution of development pipeline unlocked by GPF *
Total Production Capacity – kgs of H_2 per day	2000 kgs per day	4000 kgs per day	50,000 kgs per day
Maximum Design Load Factor (including redundancy for resilience) - %	50%	75%	75%
Number of fuel cell buses serviced daily	50 buses	220+ buses	3000+ buses
Marketable Price for green hydrogen	[redacted]	[redacted]	[redacted]
Direct Employment generated	5 jobs	16 – 25 jobs	350 – 400 jobs

- Note: The development pipeline consists of another green hydrogen production facility at Thanet, in Kent. This will connect with a 300 MW windfarm which will be owned and operated by our energy partners, Vattenfall UK. The windfarm at Thanet is expected to be commissioned by 2025 and has the potential to energise Europe's largest wind-hydrogen system, conditional up on the successful demonstration of a 4000 kgs/day system that Ryse will build at Herne Bay with the help of GPF.

As the total useful energy generated from 1 kg of hydrogen is broadly equivalent to that from 1 gallon of diesel, the cost of green hydrogen at £5-6/kg allows end users to reach cost parity with diesel. The availability of an affordable and fully renewable transport fuel will help accelerate the uptake of zero emission transport solutions in a big way.

Funding Options:

Ryse Hydrogen Limited is founded by Jo Bamford, an energy entrepreneur passionate about driving the transition to zero carbon economy, to target the emerging hydrogen sector, recognising the requirement to eliminate diesel and other hydrocarbons. Ryse's initial target market is the hydrogen Transport sector in the UK and the company is developing plans to serve early customers in the bus and other heavy-duty vehicle segments in the early 2020s.
The capital contribution by way of sponsor equity will be committed by the owners of Ryse.

Other grant schemes from Department for Business, Energy and Industrial Strategy (BEIS) and European Union backed organisations have been explored in the past. Some of these schemes were affected by uncertainty related to UK's departure from the European common market i.e. Brexit and are therefore not available in the timescales associated with this project.

Asset Financiers that have shown interest in debt financing the electrolyser system include [redacted]. However, each of the 3 lenders have indicated their preference to be involved post commissioning and stabilisation of operating performance at the site to mitigate construction and technology deployment risks in an emerging sector.

Separately, Ryse is in conversations with export credit agencies (e.g. Export Credit Norway (ECN)) for debt financing of exports, i.e. alkaline electrolysers, compressors etc. These exports will be backed by credit guarantees from the buyer's local banks and other guarantee institutes. Stringent credit criteria from such development finance institutes implied narrow funding limits for a relatively new company in Ryse Hydrogen. This would significantly limit Ryse Hydrogen's ability to achieve sufficient production volume needed to unlock the project's societal, economical and environmental benefits.

Funding for this project as an extension of Vattenfall's existing utility business operations was also discussed with Vattenfall UK, our energy partners. A successful demonstration of a 4000 kgs/day system will get the investment board sufficiently confident for a larger scale deployment at Thanet, in partnership with Ryse Hydrogen, a dedicated hydrogen focused business with developmental and execution capabilities in the UK.

Interest from other co-investors has been strong yet conditional up on successful operation of the first production facility at Kent. Therefore, Ryse Hydrogen decided to apply for GPF support recognising the vast untapped potential of South East's rich wind resource in bringing inclusive growth for the region.

3. Infrastructure requirements

Infrastructure Requirements:

Value Chain :

Wind Farm at Kentish Flats – Operational since 2005

Hydrogen Production facility – Electrolysers, compressors and supporting infrastructure

Specialised tube trailer for storage and distribution

Hydrogen Refuelling System

The description of our development as per the Planning Statement submitted to Canterbury County Council in December 2019 is as follows:
"Erection of electrolysis hydrogen production facility with associated storage, parking, landscaping, security fencing, fuelling, access, ancillary maintenance and linking power cable.

The use of proceeds from GPF will be for purchasing equipment for hydrogen production facility namely electrolysers and compressors, specialised tube trailers for storage and distribution of hydrogen and hydrogen refuelling systems which are installed within the SELEP region.

Site Location:
The site is located to the south west of Herne Bay centre along old Thanet Way and is situated between old Thanet Way and the South Eastern railway. Currently, the site principally comprises a cleared brownfield site which has become overgrown with self-seeded low-rise vegetation and the remaining roller-rink and associated surface car park

The site is bound to the east by the Herne Bay Household Waste Recycling Centre with access taken from Westbrook Lane for the recycling centre. To the west of the site is a small brook 'West Brook' an Environment Agency (EA) main river and beyond this an agricultural field. To the south of the site is old Thanet Way 'A2990' and agricultural fields, with residential

accommodation to the south east. To the north of the site is the railway and then residential accommodation associated with the suburbs of Herne Bay.
The proposal presents the erection of a hydrogen production facility of which 1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space. The production will use electrolysis to generate the hydrogen. The power supply for the hydrogen facility will be taken from the existing sub-station located to the south of the proposed development site. The sub-station is specifically selected as it is powered by an offshore wind farm 'Kentish Flats' that generates renewable energy which will be used to power the hydrogen production.

Accessibility:
The principle site accessibility requirement for this proposal was ensuring that the site was within a short distance from the Kentish Flats offshore windfarm fed sub-station. The sub-station is located to the south of the proposed site immediately adjacent the new Thanet Way 'A299' with the cable route running alongside the extant Thornden Wood Road and Thornden Close up to and across the old Thanet Way 'A2990' which borders the proposed hydrogen site
The proposed site layout plan shows the physical extent of the proposed development in relation to the nearest roads, surrounding land uses and wider area. Careful thought has been given to ensure that the proposed scheme conforms to the surrounding land uses and respects both wider views of the development and its more immediate surroundings.
The indicative cable route layout is presented **in Appendix I**

Equipment: A detailed description of the components used and physical infrastructure in the production and distribution of hydrogen is included in **Appendix J**

Safety:
Ryse will comply with all safety codes and standards in the design, build and operation of the facility. Hydrogen is widely used as an industrial gas and there is extensive industrial experience as well as safety standardisation for the safe generation, storage and distribution of hydrogen (for example, internationally recognised safety distances from key hazards) to ensure the production and use of hydrogen is safe.
The electrolysis process has multiple feedback features on each stage of the production process which are all focused on ensuring that the safety on the production of hydrogen is built-in as a critical element on the development. NEL who produces the equipment have a very strong safety record across the multiple sites around the globe and adhere to the most stringent international standards notably ISO 22734-1:2008 – Hydrogen generators using water electrolysis process, defining the construction, safety and performance requirements of packaged or factory matched hydrogen gas generation appliances**.**
The tube trailers are designed with highest safety standards and are equipped with valve systems to allow for rapid evacuation of fuel in the event of emergency. These standardized products are tested and certified at-factory before being dispatched for commercial use.
At the refuelling site, the Station module includes sophisticated control systems and safety components that ensure safe operations and allows for remote monitoring and control and collection of operational data.

Layout:
The overall aim of the design has been to create a building which ties into the wider agricultural nature of the surrounding area whilst also minimising the visual impact upon nearby receptors.

The design has sought to include an a-symmetric pitched roof to elongate views from residents within Hampton Close and enable the landscaping to better screen the building.
The layout has been informed by the process itself and the associated feedback loops between the various elements of the operation as outlined above. As a result, there has been an iterative process on the design to ensure that the various aspects are all accommodated in an appropriate manner.

1. Cost and funding

Funding breakdown:

Funding Source	Funding security	Funding profile						
		20/21 £000	21/22 £000	22/23 £000	23/24 £000	24/25 £000	25/26 £000	Total
Capital Funding sources								
SELEP – GPF	For decision on the 17th of April	3,470						3,470
Sponsor Equity and other investment partners	Committed[1]	[redacted]		[redacted]	[redacted]			[redacted]
Asset Finance	Indicative term sheets in place, disbursement subject to further due-diligence				1,000	1,258	943	5,701
Total capital funding requirement		[redacted]		[redacted]	[redacted]	1,258	943	[redacted]
Revenue Funding sources								
Project revenue	Committed[2]		2,360	3,506	4,170	3,996	5,151	19,183
Shareholder loans and other support	Committed[3]	1,150						1,150
Total revenue funding requirement		1,150	2,360	3,506	4,170	3,996	5,151	20,333

- [1] Written commitment from the founder of Ryse Hydrogen Limited. Other co-investors have shown interest in participating after initial development and production milestones successfully accomplished by Ryse in the initial years of the project
- [2] Contracted revenue from hydrogen supply contracts with existing and future customers. These contracts are typically for a 10 to 15 year period. For instance, hydrogen supply contract with

Transport for London executed in May 2019 is for a period of 10 years. Other ongoing negotiations with prospective customers in Kent region are for hydrogen supply contracts lasting 10 to 15 years.

- [3] In the initial year, Ryse Hydrogen will cover any shortfall in operating cashflow that is not met by revenue from hydrogen sales. As the project matures, it is expected that the project will be self-funding as a result of economies of scale being realised. It is therefore very crucial to have external support in the initial period.
- [4] Investment from coinvestors will become available, subject to successful delivery of the first site using GPF support

GPF flexibility

Ryse requires this public funding in order to accelerate the pace of development and thereby produce renewable fuel at rates that are comparable with conventional fossil-based alternatives. Ryse has been formed with the goal to decarbonise the transport sector in the UK. To meet this ambitious target, the promoters of Ryse have taken a long-term view of the market in deciding to invest in building necessary infrastructure for generating green hydrogen.

Amending the spend profile will have a direct impact on the company's ability to service future demand from zero emissions vehicles. However, if the growth demand is slower than anticipated from market research, Ryse will be able to reconfigure the drawdown schedule for funds from GPF to fulfil only the available demand. Therefore, an understanding of the liquidity made available to Ryse will be key to determining a flexible expenditure schedule.

Cost breakdown:

£'000s	Expenditure profile						
Cost type	20/21 £000	21/22 £000	22/23 £000	23/24 £000	24/25 £000	25/26 £000	Total
Hydrogen Generation Plant							
Electrolyser Stacks	[redacted]			[redacted]			[redacted]
Compressors	[redacted]			[redacted]			[redacted]
Balance of System – EPC works, grid connection, piping and cabling	1,775						1,775
Project Management & EPC	827			130			957
Hydrogen Tube Trailers	1,886		1,258		1,258	943	5,345
Hydrogen Refuelling Stations[1]							
Contingency	**440**						
TOTAL CAPEX	**9,249**		**1,258**	**4,252**	**1,258**	**943**	**16,520**
Quantified Risk Assessment (QRA)							
Monitoring and Evaluation*	5	5	5	5	5	5	30
Electricity costs		672	1,385	1,854	1,910	2,723	8,544
Water costs		15	31	41	42	59	**188**
Transport costs		230	470	623	636	898	**2,857**
Operations and Maintenance (O&M) of production facility		204	312	318	325	331	1,490
Operations and Maintenance (O&M) of tube trailers		67	114	117	167	207	672
Salaries, admin costs & start up costs	600	612	624	743	758	773	4,110
Market development and consultancy fees	400	408	416	424	108	110	1,856
TOTAL OPEX	**1,105**	**2,315**	**3,461**	**4,125**	**3,951**	**5,106**	**20,288**

* *Costs associated with monitoring and evaluation represent revenue spend and must therefore be funded locally.*

[1]Ryse intends to fund, own and operate 2 Hydrogen Refuelling Systems(HRSs) in the SELEP region. The equipment costs per system is £1,886,000 based on quotes from suppliers. Therefore, the cost for delivering a turnkey solution (including the civils, planning etc) will be c. £2 Mn per system. The location of these HRSs is currently under review, and therefore the exact costs are yet to be determined.

SOUTH EAST
LOCAL ENTERPRISE
PARTNERSHIP

2. Deliverability

Planning, Approvals and Specialist Studies:

A planning statement seeking full planning consent for the erection of electrolysis hydrogen production facility with associated storage, parking, landscaping, security fencing, fueling, access, ancillary maintenance and linking power cable was submitted to Canterbury County Council on 18th December 2019.

This planning submission included supporting documents which demonstrate how the scheme responds appropriately to best practice in design and sustainability, as well as planning policy objectives. The documents submitted as part of the planning application are:

1) Planning Statement, prepared by Zerum;
2) Design and Access Statement, prepared by Fletcher Rae;
3) Landscape and Visual Impact Assessment, prepared by DEP Landscape Architecture;
4) Transport Statement, prepared by Mosodi;
5) Preliminary Ecological Appraisal, prepared by Wardell Armstrong; Habitats Regulations Screening Assessment, prepared by Wardell Armstrong;
6) Archaeological Assessment, prepared by Wardell Armstrong;
7) Noise Impact Assessment, prepared by Hann Tucker Associates;
8) Drainage Strategy, prepared by Hydrock;
9) Flood Risk Assessment, prepared by Hydrock;
10) Arboriculture Impact Assessment, prepared by DEP Landscape Architecture;
11) Arboriculture Survey, prepared by DEP Landscape Architecture;
12) Utilities Statement, prepared by Hydrock;
13) Phase 1 Ground Conditions Assessment, prepared by Hydrock;
14) Air Quality Assessment, prepared by Hydrock; and
15) Statement of Community Involvement prepared by Newington Communications

There were early pre-application discussions with officers of Canterbury City Council to discuss the proposals and the nature of the operation. During the preapplication process an Environmental Impact Assessment Screening Request was submitted and a Screening Opinion provided confirming that the proposals were not considered to be an EIA development.

Following the pre-application discussions with the Council there has been on-going dialogue informing the design and content of the application. There has also been a comprehensive public consultation where 5,000 leaflets were circulated to nearby residents and businesses. Following these two public consultation events were held on Friday 8th November and Saturday 9th November 2019. The details of these events and the feedback will be included within the Statement of Community Involvement submitted as part of this application and prepared by Newington Communications.

The proposed development has been designed following detailed consideration of the site and its location in relation to residential amenity for those residents north of the railway line and south of the old Thanet Way. The approach taken was also further informed by the responses received at the two public consultation events held on 8th and 9th November 2019. The design sought to position the building within the centre of the site as far as possible to increase the separation distance from the residents north of the railway line along Hampton Close. Various options were also considered during the design evolution with alternative massing to envelope the building assessed. The preferred option arrived at was for a portal frame which would keep the building height to a minimum and introducing an asymmetric ridge to both assist in emphasising the farmstead vernacular but also position the roof pitch off centre to improve view aspect for properties north of the railway line. An overwhelming majority of respondents from the public consultation agreed with the design and materials of the facility and welcomed the extensive landscaping and biodiversity Ryse will add to the site

Procurement:

This project will catalyse investment into emerging energy production process presenting opportunities for local markets to feed into supply chain and entrench the use of clean energy and fuel for local operations. The production equipment will be provided by NEL Hydrogen, a Norwegian based company, who have been producing hydrogen production equipment since the 1920's and now have more than 3,500 hydrogen solutions delivered in 80 countries around the world. The NEL production equipment is able to utilise the provision of power from renewable sources assisting in achieving the clean generation of hydrogen. The process being applied is known as electrolysis and is the cleanest method of hydrogen production compared to others which create hydrogen either through burning fossil fuels or as a by-product from chemical processes

By procuring energy from windfarm at Kentish Flats, the project capitalises on this abundant natural resource available in Kent and sets the platform for future integrated wind-hydrogen developments in Kent. This will support Canterbury's position as a major contributor to the renewable energy market.

The focus on siting the development on a brownfield site as opposed to greenfield is supported within the National Planning and Policy Framework by making as much use as possible of previously developed land, with decisions reflecting the changing needs in the demand for land. Ryse Hydrogen will engage the services of a local contractor to build this state-of-the-art hydrogen production facility that will help meet Canterbury City Councils commitment to become carbon neutral producing a clean energy of the future. Extensive landscaping and ecological proposals will provide a positive enhancement to the local biodiversity while help to screen the facility from both close and distant visual receptors.

Please refer to appendix K for general principles adopted by Ryse Hydrogen Limited in implementing the project successfully, such that it leads to inclusive growth

Property Ownership and Legal Requirements:

A lease option agreement has been signed between Ryse Hydrogen Limited, the sponsors, and Canterbury City Council for the 11-acre site identified for setting up with the production facility. As per the terms of the agreement, Ryse will have access to the site for a period of 25 years.

A copy of the lease option agreement can be shared upon request.

The site is located within the Green Gap between Whitstable and Herne Bay as allocated under Local Plan policy OS7. The proposed development would be for a minimum time period of 25 years after which we would reassess the possibilities of extending.

Equality:

Ryse Hydrogen Limited is committed to protecting and promoting equality. Ryse recognises protected characteristics, namely - age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; gender; and sexual orientation, and that its policies and decisions will not be discriminatory in that regard.

Ryse will ensures that employment policies will ensure that all groups are treated equally both at the recruitment stage and in our work place practices.

A full EQIA (Equality Impact Assessment) will be provided as part of the finalisation of the financial close for this GPF application. At this stage we do not expect any negative impacts on equality associated with this application..

Project milestones:

[Please complete the table below to show the key project milestones. This should include the expected project completion date]

Project milestone	Description	Indicative date
Planning Consent for land identified	The land parcel identified is ideally located for direct power connection with wind turbines off the Thanet coast. Planning permission including hazardous substances consent will be approved via a planning certificate. Tasks: Meeting with Planning Consultants Planning team instructed Finalisation of plan/scheme for applying Public consultant period EIA Screening Validation and Planning period Planning consent Judicial Review Board Discharge of Conditions Precedent	July 2019 – April 2020
Design Finalisation	CAD drawing and package of information ready to build Tasks: Meeting with Design specialists Scope finalisation Appointment of team and finalisation of deliverables	September 2019 – May 2020
Selection of Contractors and Procurement	Contractors for civils works approved. Local EPC contractor approved by Nel the main equipment supplier Tasks Contractor Selection Construction drawings finalisation Subcontractor negotiations	January 2020 – July 2020
Construction Works	Civil works (building + hardstanding) complete (completion certificate) Tasks: Site clearance Utilities diversion and new supplies Construction period	March 2020 – May 2021
Electrical Connection completion	Site electrical works completed (completion certificate)	January 2021
Commercial Operations date	Start of operation – first delivery of Ryse produced hydrogen to customers	May 2021

Impact Assessment	Impact on grid Report on efficiency and system performance Identification of bottlenecks for large scale deployment	June 2021 – December 2021

3. Expected Benefits

Overall Project Impacts:

This project will demonstrate a valid pathway to 100% renewable hydrogen at an affordable price. Furthermore, it will illustrate how hydrogen can offer a secure market for the output from a wind farm, which in turn can be used to help to stimulate renewable energy deployment and in so doing help the UK and the SELEP region meet its renewable energy and carbon reduction commitments. Specific carbon savings estimates are tabulated below and valued as benefits of the project using Green Book guidelines.

In addition, the project will lead to zero local pollutant emissions from the buses powered by the hydrogen fuel These ca be quantified using Green Book (DEFRA) guidelines.

In the process, the project will originate multiple jobs – both directly and indirectly. Once the hydrogen generation plant is operational, it is expected that two (2) managerial positions and two (2) admin staff positions will be created for the daily upkeep and operations of onsite activities. Furthermore, as the demand for hydrogen scales, the company will directly employ one (1) transport manager and up to eight (8) truck drivers (including backup support). To attend to customer inquiries and for maintenance of stakeholder relationships in the region, an additional three (3) sales personnel will be appointed on a full time basis. Thus a total of sixteen (16) direct jobs will be created in the short term, following the commissioning of the facility and the scale up to full capacity (expected in Q2 2021).

Additionally, demand growth for hydrogen fuel and zero emission transport modes will provide a huge impetus to businesses involved in the supply chain. Considering the hydrogen fuel cell electric value chain alone, a large number of jobs will be added in deployment and support of wind turbines, solar panels, electrolysers, hydrogen refuelling systems, hydrogen fuel cell buses, fuel cell stacks, hydrogen storage tanks and hydrogen trailers. Similarly, engineering, research and business oriented roles will emerge to support innovation in what is anticipated to be a crucial technology for displacing fossil fuels in transport, heat and power generation and wider industrial applications.

It is not easy to quantify this benefit for the SELEP region, but by way of illustration, the next project which is in planning for the Thanet wind farm in 2023 will be approximately 5 times the size of the Herne Bay deployment and will create ~40 further direct jobs, expected in maintenance of hydrogen refuelling stations and with our sub-contractors – Suttons who will support in the logistics of hydrogen movement. Sutton have a base in Purfleet which will be the centre of their operations to support Ryse Estimated employment growth is provided in the table below. Further jobs are e

In addition to the direct jobs, Ryse will also stimulate new opportunities for learning This will includes relations with local universities (notably the Universities of Kent and Sussex) to study and look to optimise the wind hydrogen production process. There are considerable academic opportunities in improving wind hydrogen system controls, electrolyser process optimisation, new components in the wind hydrogen system and overall system management These relationships will mirror relationships which Ryse's sister company (Wrightbus) has developed with Queen's University in Belfast, where a specialist team of PhD students is charged with optimising bus drivetrains and chassis design and where Industrial placements are used to help ensure a pathway for bright graduates into the firm. Ryse will establish a similar local academic collaboration once the facility is up and running.

Finally, the project will create new commercial space. The project leads to the creation of a new and attractive commercial premises built on disused land. A similar quantity of floorspace will be created with expansion at Thanet.

	Outcomes	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27 onwards	Total

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Direct outcomes (gross terms)	Ryse Jobs created @ Herne Bay	16 (during construction) 8 new permanent staff	4 new permanent staff	4 new permanent staff				**16 permanent**
	Carbon Savings / tons per annum	3,172 tons (40 FC buses eq.[1])	4758 tons (60 FC buses eq.)	9,516 tons (120 FC buses eq.)	17,466 tons (220 FC buses eq.)	39,650 tons (500 FC buses eq.)	39,650 tons (500 FC buses eq.)	**471,000** tons over the period to 2035
	Air Pollution emission savings vs Euro VI bus emission standards	11 tons NOx, 0.14 tons of PM2.5, 2.8 tons of Hydrocarbons	17 tons NOx, 0.21 tons of PM2.5, 4.2 tons of Hydrocarbons	34 tons NOx, 0.43 tons of PM2.5, 8.4 tons of Hydrocarbons	62 tons NOx, 0.78tons of PM2.5, 15.3 tons of Hydrocarbons	141 tons NOx, 1.7tons of PM2.5, 34.9 tons of Hydrocarbons	141 tons NOx, 1.7tons of PM2.5, 34.9 tons of Hydrocarbons	**1,685 tons NOx, 21 tons of PM2.5, 414 tons of Hydrocarbons in the period to 2035**
	Cumulative commercial floorspace delivered (includes Thanet)	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space	1,610 m^2 is fully enclosed and a further 520 m^2 of screened external plant space
	Additional learners	1 PhD level studies, 3 Industrial placements	2 PhD level studies, 3 Industrial placement	2 PhD level studies, 4 Industrial placements	2 PhD level studies, 4 Industrial placements	3 PhD level studies,5 Industrial placements	3 PhD level studies, 10 Industrial placements	6 PhD level students, 29 Industrial placements
Direct outcomes (net terms, after considering additionality)	These numbers are as above as there is no displacement effect							
Indirect outcomes (gross terms)	Ryse jobs created in SELEP region @ planned Thane wind hydrogen site			16 (construction) 15 permanent	8 new permanent staff	8 new permanent staff	9 new permanent staff	**40 permanent**

[1] Carbon Savings assume 122 kgs of CO2 saved per 100 km, each bus travels 65,000 kms per annum,

	Commercial floor space created at Thanet				3,390 m^2 is fully enclosed and a further 1,500 m^2 of screened external plant space	3,390 m^2 is fully enclosed and a further 1,500 m^2 of screened external plant space	3,390 m^2 is fully enclosed and a further 1,500 m^2 of screened external plant space	3,390 m^2 is fully enclosed and a further 1,500 m^2 of screened external plant space
	Other indirect benefits are not quantified, though there will be benefits across the region, including: • Facilitated renewable energy deployment (with associated jobs and carbon savings) by using hydrogen as a market for renewable energy • Supply chain services to the facility – maintenance and support for specific aspects of the facility will be contracted to local firms • Experience in construction of the facility – local contractors will be sued to build and assemble the facility. S this is a first of a kind deployment, they will gain unique skills which can then be applied to similar projects elsewhere in the UK • Multiplier effects associated with the direct employment							
Indirect outcomes (net terms, after considering additionality)	**As above**							

Calculation of Project Impacts:

Assumption in the table above:

Jobs - two (2) managerial positions and two (2) admin staff positions will be created for the daily upkeep and operations of onsite activities. Furthermore, as the demand for hydrogen scales, the company will directly employ one (1) transport manager and up to eight (8) truck drivers (including backup support). To attend to customer inquiries and for maintenance of stakeholder relationships in the region, an additional three (3) sales personnel will be appointed on a full time basis. Thus a total of sixteen (16) direct jobs will be created in the short term, following the commissioning of the facility and the scale up to full capacity (expected in Q2 2021).

CO_2 emissions avoided – based on 1:1 replacement of diesel buses (double deck), with a fuel consumption of 40l/100km and a CO_2 content of diesel of 3 kgCO_2/litre. Umber of buses fuelled based on 15kg/day per hydrogen bus. CO_2 traded values (for cost benefit calc below are based on Green Book assumptions – central case. Buses assumed to travel 65,000km/year

Air Quality savings – based on standard Euro VI emission per kWh of fuel and the same fuel consumption as above. We assume50% of these savings will occur in th SELEP region based on customers in Brighton and Kent.

Commercial space is as per planning application. The current site is a disused waste site with no road access. This project will ensure road access, service and new commercial space.

The Role of GPF in Benefit Realisation:

Ryse Hydrogen Limited has been incorporated exclusively for the purpose of manufacturing and supplying high purity (99.999%) hydrogen across UK to displace various uses of natural gas and other fossil fuels.

The proceeds from GPF are expected to fund the installation of a hydrogen generation facility at Herne Bay, Kent along with the associated hydrogen compression and distribution infrastructure.

Ryse has chosen Nel Hydrogen Limited as their partner for equipment supply and have an exclusive relationship with Nel for the UK market, Nel are chosen for their highly efficient alkaline electrolysers as well as Nel's capabilities in downstream logistics (hydrogen compression, tube trailers and fuelling stations) which help unlock cost synergies by opening access to a well-developed hydrogen supply chain crucial for catalysing early adoption. Nel also bring operational and maintenance experience on keeping the electrolyser and associated balance of plant running.

The near-term ambition of the partnership involves the deployment of a small (4.4MW) electrolyser connected the Kentish Flats offshore wind farm, to serve the demands of a fleet of 40 buses which will be deployed under the JIVE project. GPF support allows Ryse to plan the expansion from this first deployment towards larger scale bulk hydrogen production using renewable energy.

By connecting the electrolyser directly to the output of the wind farm, a number of benefits accrue to both - the electrolyser owner and to the wind developer:

- To the electrolyser operator - the cost of electricity input is reduced dramatically by direct coupling of the production site to a wind farm that avoids steep network charges. Depending on electricity market conditions and the nature of the grid connection, it also means the cost for electricity is ultimately set by the levelized cost of electricity from the wind farm. As the capital costs for such wind farms fall, the resultant renewable hydrogen cost can fall in concert. At a bulk scale - implying GW scale wind farms and over 50MW scale electrolysers - this can lead to very low costs of 100% sustainable hydrogen.

- To the wind developer – the challenge of subsidy free wind development is the main topic for today's onshore and offshore wind farms. The availability of a flexible source of demand (an electrolyser) as part of a new wind development means:

    - The ability to fix a long term secured power purchase price for the development o Intermittent generation does not always correlate with demand profiles, creating downwards pressure on wholesale prices. By creating flexible demand, we can ensure the “captured price” for the wind farm remains stable by modulating electrolyser demand (at a fixed electricity price) with wind output. This also has the benefit for other generators on the electrical grid of mitigating the effect of excess wind on the prices which are achieved.

o A number of planned wind installations are unable to obtain sufficient grid capacity to proceed. Hydrogen offers another option to avoid the need for expensive grid reinforcement or accepting the curtailment of the wind turbine. This in turn allows the UK’s renewable resource to be optimised with turbines sited in high resource regions rather than in locations where grid connections are available.

o Many wind farms are subject to network constraints, which means they are constrained off at times of network stress. The availability of an electrolyser helps avoid these issues (by allowing electricity to be diverted to the electrolyser at times of network constraint) and ensure the maximum amount of renewable electricity is brought into the UK’s energy system

o The availability of a flexible load at the wind site will allow more flexibility in dispatch into the wholesale electricity and ancillary services markets, increasing the overall revenues available at the site.

o Longer term, electrolysers also offer the potential for optimising grid connection costs (by using the electrolyser as an alternative route for the power generated), which, in turn, dramatically reduces the cost of energy production.

When an electrolyser is installed at the site of a large wind turbine (we envisage the ratio of peak wind output to electrolyser output could be 3-5:1), the above advantages combine to enable low cost electricity supply to the electrolyser with a good load factor. This then becomes a very promising option to a) secure fully sustainable green hydrogen for the UK and b) enable faster and more resource efficient wind development. To develop these options requires new understanding of the control systems and market interactions for these wind hydrogen systems and this is the subject of this study.

The all-in price for electrolytic hydrogen (ex-works) can be significantly improved considering that electricity consumption at current tariffs accounts for a major component of current hydrogen costs [redacted]. By off-taking renewable power at a fixed tariff locked for long periods, the production economics as per initial analysis result in a hydrogen production cost of [redacted] using today’s known economics and at MW scale (and it is on this basis that Ryse is planning Phase 2). The feasibility analysis will be carried out for progressively larger systems up to 100MW+ integrated systems with the target to further improve on this number so that high purity green hydrogen at < £2/kg will be able to compete with chemically synthesized brown hydrogen from carbon intensive steam methane reforming (SMR) process.

A major advantage of this project is that Ryse is already developing a wind hydrogen site and associated end users. This is being developed at a smaller scale, but GPF funding will allow resources to expand the electrolyser to 8.8MW and ensure additional customers. The size of this system will allow Ryse to supply green hydrogen for a fleet of hundreds of fuel cell buses and cars in the South East.

The table below summarises different scenarios and level of impact that the GPF facility will help create

	Without GPF support	With GPF support	With GPF support including execution of development pipeline unlocked by GPF *
Total Production Capacity – kgs of H2 per day	2000 kgs per day	4000 kgs per day	50,000 kgs per day
Maximum Design Load Factor (including redundancy for resilience) - %	50%	75%	75%
Number of fuel cell buses serviced daily	50 buses	220+ buses	3000+ buses
Marketable Price for green hydrogen	[redacted]	[redacted]	[redacted]
Direct Employment generated	5 jobs	16 – 25 jobs	350 – 400 jobs

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Value for Money (VfM) assessment:

Here, we calculate a cost benefit ratio for the project.

Cost Calculations:

In the case of GPF loan funding, the cost to the public sector is the value of interest forgone, assuming full and timely repayment. Interest on GPF loans is charged at 2% below Public Works Loan Board (PWLB) in accordance with SELEP Strategic Board decision. Under current market conditions, this means that the interest rate will be 0.42% - although this could change by the time a legal agreement for funding is executed between Kent County Council and SELEP.

The total cost to SELEP is £1,024,000

£'000s	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
Capital drawn down	3,470					
Capital held	**3,470**	**3,470**	**3,470**	**3,470**	**3,470**	**3,120**
Interest	-	15	15	15	15	13
Capital plus interest	3,470	3,485	3,485	3,485	3,135	13
Repayment					**350**	**3,120**
Cost of capital	174	174	174	174	174	156
Interest due***	72					
Cost of capital (SELEP)	**1,024**					

Benefits Calculations

The table below calculates the three main quantifiable benefits (note we do not lace a financial value on the employment created and other less easily quantified numbers, these would be additive to the numbers below. The quantified benefits derive from:

- Carbon dioxide savings triggered by the development, which arise from substituting diesel consumption in buses
- Air Pollutant savings which arise from removing Euro VI (newest) diesel buses from the road
- Increase in land value associated with the investment in the site

CO2 saving (based on Green Book values (central case) for CO2 emissions). NPV from 2021 to 2035 @3.5% discount rate)	Expansion to full 500 capacity at Herne Bay	£11,292,424.47
	60% Of which directly enabled by GPF investments	**£6,775,454.68**
Air Quality benefits - using Green Book and DEFRA guidleines for harm of different pollutants. NPV from 2021 to 2035 @3.5% discount rate	Expansion to full 500 capacity at Herne Bay	£9,243,420.92
	60% Of which directly enabled by GPF investments	£5,546,052.55
	50% of which expected in SELEP region (Kent and Brighton)	**£2,773,026.28**
Land value before GPF funded investment	11 acre site, no road access land value £7,500-£10,000 per acrse	£100,000
Land value after GPF funded investment	Includes new commercial building with retail rental value giving a commercial NPV of £2.5m (based on £7.50/sq.ft p.a) and 25,000sq.ft of new commercial space.	£2,500,000
	Net Benefit from GPF	**£2,400,000**
TOTAL BENEFIT FROM GPF		**£11,948,480.96**

Benefit Cost Ratio

The calculations above lead to a Benefit:Cost ratio of 11.7

4.Contribution to the Establishment of a Revolving Fund

GPF Repayment Mechanism:

It is expected that the borrowing entity (Ryse Hydrogen and/or associates) will repay debt raised from GPF by following a linearly amortising repayment schedule and from the project cashflows generated from sale of hydrogen for zero emission transport applications.
As with most infrastructure projects, the initial demand will be subdued and necessary impact revenue realisation. However, demand maturation will lead to optimum capacity utilisation of the project. It is therefore critical for Ryse Hydrogen to have the initial support in the form of GPF, so as to be able to deliver a scaled development that compresses the path to financial viability.

It may be possible that revenue generation in the early years may be lower than the expected repayment amount. However, over the term of the loan (5-year period) cashflow available for debt service (CFADS) from project operations will be sufficiently higher than the outstanding debt amount.

As explained 'Need for Intervention' section, support from GPF will enable greater volume of annual hydrogen production and unlock operating cost efficiencies. This will ultimately catalyse the investment decision making on developing Europe's largest green hydrogen production facility in Kent.

GPF Repayment Schedule:

	2020/21 £	**2021/22 £**	**2022/23 £**	**2023/24 £**	**2024/25 £**	**2025/26 £**	**Total £**
GPF Repayment (Capital) (£'000s)	-	-			350	3,120	£3,470

GPF Repayment Risk:

Clearly the Ryse business model is dependent on the development of demand for hydrogen. If the demand from the transport sector does not materialise, then there is a risk to the development of this wind-hydrogen model. Also, the role of hydrogen in decarbonising heavy duty transport sector has been recognised in various academic and policy reports including the one by Committee on Climate Change published in May 2019, and describing the roadmap to Net Zero carbon in the UK.

Long term (between 10 and 15 years) fuel supply contracts with public transport authorities such as Transport for London and other prospective customers will ensure visibility of cashflows through the loan period. Cashflows are expected to be linked to inflation, have low demand elasticity and have low correlation with other asset classes. This combined with the high barriers to entry of Ryse's business model will protect the underlying financial viability of the project.

Recognising the long operational life of the project and the high sensitivity of GPF to delay in repayment, **Ryse Hydrogen have proposed a repayment profile that is suitably and substantially stress tested for various operating scenarios**. Ryse commit to following precedent setting ongoing management to deliver services for the community and value for GPF money

To mitigate the impact of any external factors on Ryse's ability to repay the GPF facility,
1) Ryse will pivot its business model to sell hydrogen to other existing applications for hydrogen – namely: fertilizer plants, glass manufacturing factories, ammonia production sites, etc.
1) Ryse will negotiate a buy-back guarantee from component suppliers.
2) Ryse will be open to discussing recourse options for outstanding debt amount to be repaid over an agreed period.

Financial Viability:

The hydrogen generation facility is expected to reach commercial operations by May 2021. Ryse Hydrogen has long term hydrogen supply contracts with bus fleet operators in the South East. For instance, Ryse Hydrogen signed a 10-year supply contract with Transport for London (TfL) for supplying hydrogen to its fleets of 20 hydrogen fuel cell buses starting Spring 2020. Long term hydrogen supply contracts are also being negotiated with other transport operators in the South East. Revenue generated from sale of hydrogen will be used for debt service of GPF loan.

A comprehensive business plan, with underlying operating assumptions and cashflow projections, can be shared in an excel format upon request.

Cash flow:

	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27 onwards
Incoming							
Growing Places Fund drawdown	3,470						
Revenue from Hydrogen sales + Revenue from Renewable Transport Fuel Certificates (RTFCs)		2,929	5,912	7,757	7,830	10,944	10,918
TOTAL Incoming	**3,470**	**2,929**	**5,912**	**7,757**	**7,830**	**10,944**	**10,918**
Outgoing							
Capital Expenditure (For breakdown please refer to section 'Cost Breakdown' on Pg 28)[1]		8,809		1,258	4,252	1,258	943
Growing Places Fund repayment					350	3,120	
Monitoring and Evaluation – GPF		5	5	5	5	5	5
Electricity costs		672	1,385	1,854	1,910	2,723	3,428
Water costs		15	31	41	42	59	74
Transport costs		230	470	623	636	898	1,119
Operations and Maintenance		204	312	318	325	331	338

(O&M) of production facility							
Operations and Maintenance (O&M) of tube trailers		67	114	117	167	207	211
Salaries, admin costs & miscellaneous expenses		600	612	624	743	758	773
Market development and consultancy fees		400	408	416	424	108	110
TOTAL Outgoing		**11,002**	**3,337**	**5,256**	**8,854**	**9,467**	**7,001**
Net income*	**3,470**	**-8,073**	**2,575**	**2,501**	**-1,024**	**1,477**	**3,917**
Cumulative total	**3,470**	**-4,603**	**-2,028**	**473**	**-551**	**926**	**4,843**

[1]Please note that the Capital Expenditure does not include the cost of Hydrogen Refuelling Systems the section “Cost Breakdown”

***** Note the GPF proceeds will be used for buying equipment used in the hydrogen generation facility and downstream infrastructure. The cumulative total of the Net Income depicts the financial position of the sponsor, Ryse Hydrogen Limited, through the course of the loan period. Post stabilisation of operations of the new production facility and the accompanying infrastructure, expected from the year 2025 onwards, positive cashflows will be expected through the design life of the project. As is typical for infrastructure projects of this nature, the project sponsor will be able to recuperate its capital by successfully operating and maintaining the plant over the long run.

4. Risks

Risk Register:
[Please complete a Risk Register, identifying overall and GPF related project risks, likelihood, impacts and mitigations as per the table in Appendix D. This should include a description of any scheme dependencies, risks and delivery constraints which may impact on the delivery of the project or the benefits achieved through GPF investment in the project. The Risk Register should detail all identified project risks.

For the most significant project risks provide supporting commentary which considers the implementation risks associated with not securing GPF funding and risks to the repayment of the GPF; ***maximum 0.5 pages****]*

Please refer to Appendix D

5. State aid

State Aid:*]*

The aid component is not the loan itself (which must be repaid) but the advantage conferred on the borrower through not having to pay interest or having a preferential rate of interest on the loan. As shown above, this is valued at £1m over a 5 year period. IN this period Ryse will expend over £20m (in capital and operating costs at Herne Bay). Currently, Ryse is not a beneficiary of any UK government backed scheme that may result in distorting market balance in favour of Ryse or against any competitors of Ryse. Ryse supports the creation of an open and competitive market in the field of hydrogen production.

As a result, the size of the intervention is below 5%.

This level falls below various block exemptions which are relevant to this scheme:

- Aid for the early adaption to future environmental standards for SMEs
- Aid for investment into energy saving measures
- Aid for investment in the promotion of energy from renewable energy
- Risk capital aid

As a result, we don’t believe the project causes and contravention of State Aid regulations.

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6. Monitoring and evaluation

Monitoring and Evaluation:

Please refer to Appendix E

7. Declaration (To be completed by applicant)

Has any director/partner ever been disqualified from being a company director under the Company Directors Disqualification Act (1986) or ever been the proprietor, partner or director of a business that has been subject to an investigation (completed, current or pending) undertaken under the Companies, Financial Services or Banking Acts?	No
Has any director/partner ever been bankrupt or subject to an arrangement with creditors or ever been the proprietor, partner or director of a business subject to any formal insolvency procedure such as receivership, liquidation, or administration, or subject to an arrangement with its creditors?	No
Has any director/partner ever been the proprietor, partner or director of a business that has been requested to repay a grant under any government scheme?	No

If the answer is “yes” to any of these questions, please give details on a separate sheet of paper of the person(s) and business(es) and details of the circumstances. This does not necessarily affect your chances of being awarded SELEP funding.

I am content for information supplied here to be stored electronically, shared with the South East Local Enterprise Partnerships Independent Technical Evaluator, Steer, and other public sector bodies who may be involved in considering the Business Case.

I understand that a copy of the main Business Case document will be made available on the South East Local Enterprise Partnership website one month in advance of the funding decision by SELEP Accountability Board. The supporting appendices to the Business Case will not be uploaded onto the website. Redactions to the main Business Case document will only be acceptable where they fall within a category for exemption, as stated in Appendix G.

Where scheme promoters consider information to fall within the categories for exemption (stated in Appendix G) they should provide a separate version of the main Business Case document to SELEP 6 weeks in advance of the SELEP Accountability Board meeting at which the funding decision is being taken, which highlights the proposed Business Case redactions.

I understand that if I give information that is incorrect or incomplete, funding may be withheld or reclaimed and action taken against me. I declare that the information I have given on this form is correct and complete.

I confirm that the risk analysis included in this Business Case identifies all known project risks and I agree to follow public procurement regulations to the extent applicable during the delivery of the project. I declare that the GPF investment does not contravene State Aid regulations.

All spend of Growing Places Fund funding will be compliant with the Loan Agreement.

I understand that any offer may be publicised by means of a press release giving brief details of the project and the loan amount.

Signature of applicant	
Print full name	*Jo Bamford*
Designation	*Executive Chairman – Ryse Hydrogen Limited*

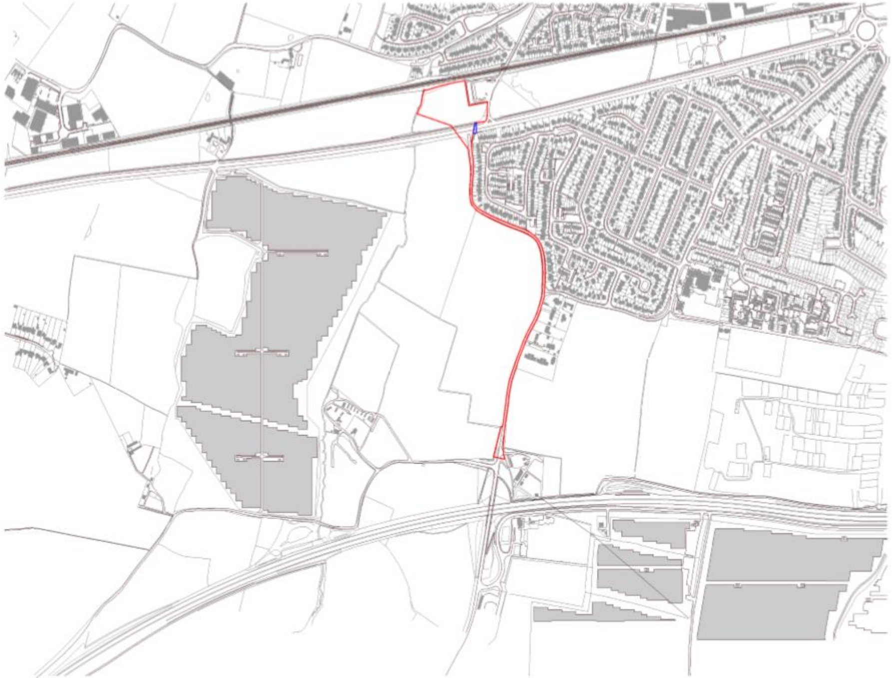
The lead County Council/Unitary Authority should also provide a signed S151 Officer Letter to support the submission – see example letter in Appendix F

Appendices

Appendix A	Location, layout and site plans
Appendix B	Equality Impact Assessment
Appendix C	GPF repayment mechanism – supporting documentation
Appendix D	Risk register
Appendix E	Monitoring and Evaluation Plan
Appendix F	Example letter of support from S151 officer of relevant Upper Tier Authority
Appendix G	Categories for Exemption – redactions to main Business Case
Appendix H	List of prospective customers
Appendix I	Indicative cable route layout
Appendix J	Description of physical infrastructure for production and distribution of hydrogen
Appendix K	Procurement Strategy – main principles
Appendix L	Impact of COVID 19

Appendix A – Location, Layout and Site Plans

1) Site Location: Thanet Way, Herne Bay, Canterbury (the land parcel west of Herne Bay Household Waste Recycling Centre, CT6 8DD)



Wider Location Plan

General Notes

Do not scale from this drawing. Only work to written dimensions.

All site dimensions shall be verified by the Contractor on site prior to commencing any works.

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Key

Planning Application Boundary

Ownership Boundary

Rev.	Description	Date	ISS	APP
P4	Red line planning boundary adjusted to reflect client comment	18.12.19	CF	RT
P3	Issued for submission	06.12.19	RT	RT
P2	Planning boundary adjusted to included scope for incoming cable services	21.11.19	RT	RT
P1	Planning boundary adjusted to include cable route to substation and highways from Thanet Way	23.10.19	RT	RT

Scale: **1 : 5000 @ A1**
Status: **S1 - Co-ordination**
Drawn By: **RT**
Checked By: **Checker**
Date

Client:
Ryse Hydrogen Ltd

Project:
Proposed Hydrogen Production Facility Herne Bay

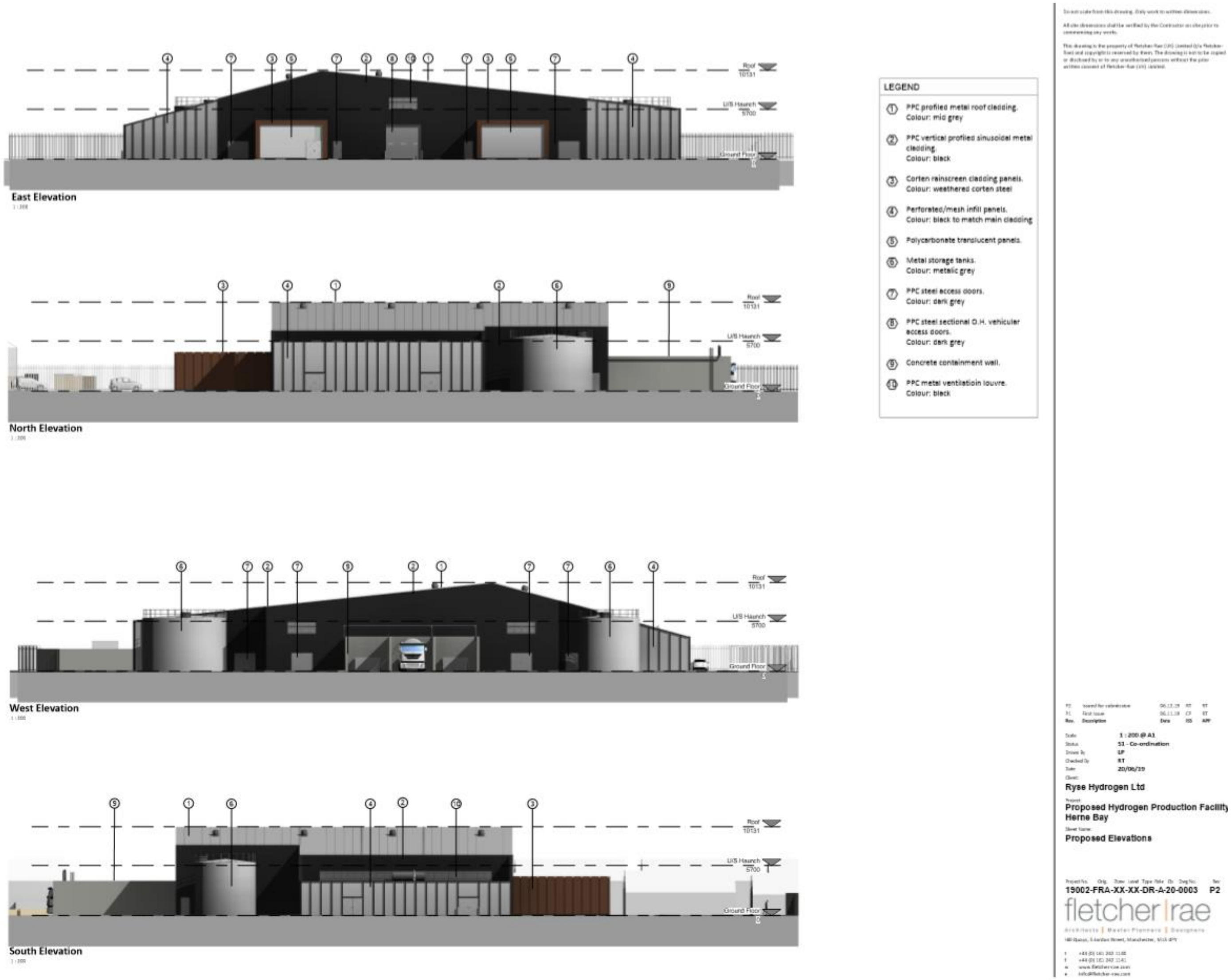
Sheet Name:
Wider Location Plan

Project No. Orig. Zone Level Type Role Cls. Dwg No. Rev
19002-FRA-XX-00-DR-A-90-0004 P4

fletcher|rae
Architects | Master Planners | Designers
Hill Quays, 5 Jordan Street, Manchester, M15 4PY

2) Layout Plan

3) Site Elevation


East Elevation
North Elevation
West Elevation
South Elevation
Roof
10131
U/S Haunch
5700
Ground Floor
LEGEND
① PPC profiled metal roof cladding.
Colour: mid grey
② PPC vertical profiled sinusoidal metal cladding.
Colour: black
③ Corten rainscreen cladding panels.
Colour: weathered corten steel
④ Perforated/mesh infill panels.
Colour: black to match main cladding
⑤ Polycarbonate translucent panels.
⑥ Metal storage tanks.
Colour: metalic grey
⑦ PPC steel access doors.
Colour: dark grey
⑧ PPC steel sectional O.H. vehicular access doors.
Colour: dark grey
⑨ Concrete containment wall.
⑩ PPC metal ventilatioin louvre.
Colour: black
Rev. Description Date BS APP
Scale 1 : 200 @ A1
Status S1 - Co-ordination
Drawn By LP
Checked By RT
Date 20/06/19
Client:
Ryse Hydrogen Ltd
Project:
Proposed Hydrogen Production Facility
Herne Bay
Sheet Name:
Proposed Elevations
19002-FRA-XX-XX-DR-A-20-0003 P2
fletcher|rae
Architects | Master Planners | Designers

Appendix B – Equality Impact Assessment

Formal EIA assessment is underway. Appendix K illustrates the general principles adopted by Ryse Hydrogen Limited for successfully delivering the project

Appendix C – GPF Repayment Mechanism: Supporting Documentation

Supporting evidence for revenue and cost assumptions – such as contracted demand, suppliers' quotes, company records etc - can be made available upon request.

Furthermore, a formal commitment letter from project sponsors, Ryse Hydrogen Limited, stating our intent to construct, own and operate the project in adherence with highest ethical standards to realise inclusive growth in the South East can be made available.

Appendix D – Risk register

Description of Risk	Impact of risk	Risk Owner	Risk Manager	Likelihood*	Impact **	Risk Rating ***	Risk Mitigation	Residual Risk Rating
Planning problems cause delays - Failure to secure planning permission (or news that there will be a problem with the planning consents) is a significant risk which could hold up or require a rethinking of the Phase 2 siting strategy	4- High			2- Low			The site at the Herne Bay substation has been selected to minimise the risk of a planning permission rejection. The site is next to a main road and on land zoned for this type of industrial use. If we discover that the site cannot be made workable. Then the mitigation is to a) explore other sites around the Herne Bay sub-station and b) consider other locations in the UK where this wind-hydrogen scheme could be implemented. Planning application will be made by end of 2019 and therefore fund disbursement will not be expected before receiving planning approval	

Delays in carrying out work – there is a risk of delays from one supplier cascade to delay the overall project	4- High			3- Medium			Where delays are identified the affected partner/sub-contractor will be required to develop mitigations and resolve the issue rapidly. Continued failure to deliver will lead to an increased use of the escalation procedures agreed by the partners as part of the process with the ultimate mitigation being a change of partner. There is some give in the time planning to allow for delays. Where delays become more significant, we will look to rework the time planning in discussion with GPF.	
Loss of personnel – losing key personnel from the partners or sub-contractors could challenge the tight timescales of this project	4- High			2- Low			Ryse has developed good relationships with expert consultancies such as Ernst and Young, Element Energy, Arcola and Grid Connection Consulting who can provide personnel who can be brought in to fill in as required on a secondment basis.	

Pace of demand development – clearly the Ryse business model is very dependent on the development of demand. If the demand does not materialise, then there is a risk to the development of this wind-hydrogen model	4- High			2- Low			The Ryse business model relies on profitably supplying the early markets in the transport segment. If demand does not materialise as fast as anticipated, the strategy will be to serve the existing markets (on a profitable basis) and build out slower than expected	
Threat of litigation from customers	3- Medium			2- Low			Ryse will have stringent supply contracts and carry product liability. In the case where a supply contract has been breached, or product liability occurred, Ryse may face litigation from a customer. Ryse will maintain insurance against all such liabilities	
Industrial Accident	4- High			2- Low			Hydrogen is a hazardous substance and carries the risk of industrial accidents. If Ryse were to suffer a catastrophic industrial accident affecting its ability to supply hydrogen, or	

							creating the possibility of litigation, and such an accident were to be proven to have occurred as a result of negligence by the company, this could result in insolvency. Industrial All Risk insurance policy will cover against fire, explosions, natural calamities, machinery breakdown. Additionally, business interruption insurance will protect against a long term break in business activity and the consequential financial losses. Ryse's risk reduction and mitigation policies and strategies will be propagated and implemented by Nel. Ryse will recruit senior engineering personnel charged with maintaining and building upon those policies, and all additional and further policies and compliance	

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							procedures required in the UK.	

** Likelihood of occurrence scale: Very Low (1) more than 1 chance in 1000; Low (2) more than 1 chance in 100; Medium (3) more than 1 chance in 50; High (4) more than 1 chance in 25; Very High (5) more than 1 chance in 10.*

*** Impact scale: Very Low (1) likely that impact could be resolved within 2 days; Low (2) potential for a few days' delay; Medium (3) potential for significant delay; High (4) potential for many weeks' delay; Very High (5) potential for many months' delay.*

**** Risk rating = Likelihood x Impact*

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Appendix E – Monitoring and Evaluation Plan

Outcome/benefit to be measured	Expected outcome	Monitoring approach	Benefit realisation timetable
Delivery of hydrogen production facility	Enclosed facility with 2 tons per day hydrogen production capacity up on commissioning	Delivery of construction to be monitored against agreed construction schedule agreed with the selected contractor	Production facility to be delivered by Q2-Q3 2021
Creation of direct jobs	16 direct jobs in Year 1 – including 2 managerial positions, 2 onsite admin staff, 3 stakeholder relationship professionals, 1 transport manager and up to 8 drivers	A project leader will be accountable for managing the recruitment process. This individual will be responsible for ensuring that interviews are conducted, and the record of each job opening is maintained	Recruitment process to begin just before commissioning of the project in Q2 2021. The jobs cycle – from initiation and interviewing to onboarding and training – will take place over a period of 3 months leading up to Q3 2021
Creation of indirect jobs		Critical data of the supply chain will be recorded. They must be retained in a form that ensures their integrity and security, and prevents unauthorised modification, for a period to be agreed by the SELEP	From start of construction in Q2 2020 through the entire design life of the project – expected 30 years
Research roles at local universities and increased collaboration for future research		A record will be maintained of every industry – academia collaboration and this will be shared with SELEP on an annual basis, throughout the loan period i.e. 5 years	From start of commercial operations in Q2 2021 through the entire design life of the project – expected 30 years
Growth in zero emission public transport fleets that run on green hydrogen produced at the facility	Up to 220 hydrogen fuel cell buses being supplied hydrogen fuel on a regular basis by 2024	Database of existing and future customer base for hydrogen fuel produced at the facility will be maintained and shared with SELEP on an annual basis, throughout the loan period i.e. 5 years	From start of commercial operations in Q2 2021 through the entire design life of the project – expected 30 years

	With successful deployment of the first tranche of bus fleets, expansion of production facility to meet hydrogen demand from c. 1000 buses by 2030		
Improvement in air quality			From start of commercial operations in Q3 2021 through the entire design life of the project – expected 30 years

.

Appendix F – Example S151 Officer Letter to support Business Case submission – Growing Places Fund

Dear Colleague,

In submitting this project Business Case, I confirm on behalf of *[Insert name of County or Unitary Authority]* that:

- The information presented in this Business Case is accurate and complete.
- The funding has been identified to deliver the project and project benefits, as specified within the Business Case. Where insufficient funding has been identified to deliver the project, this risk has been identified within the Business Case.
- The identified project expenditure represents capital spend. GPF cannot be used to cover revenue costs.
- The risk assessment included in the project Business Case identifies all substantial project risks known at the time of Business Case submission.
- The delivery body has considered the public sector equality duty and has had regard to the requirements under s.149 of the Equality Act 2010 throughout their decision-making process. This should include the development of an Equality Impact Assessment which will remain as a live document through the project's development and delivery stages.
- The delivery body has access to the skills, expertise and resource to support the delivery of the project.
- Adequate revenue budget has been or will be allocated to support the post scheme completion monitoring and benefit realisation reporting.
- The project will be delivered under the conditions of the Loan Agreement which will be agreed with the SELEP Accountable Body, including the repayment of the Growing Places Fund loan in accordance with an approved repayment schedule.
- The requested GPF investment does not contravene State Aid regulations.
- The appropriate checks have been undertaken and it has been confirmed that this funding application is from a creditable source which has the means to repay the loan.

I note that the Business Case will be made available on the SELEP website one month in advance of the funding decision being taken, subject to the removal of those parts of the Business Case which are commercially sensitive and confidential as agreed with the SELEP Accountable Body.

Yours Sincerely,

SRO (Director Level) ……………………………………………

S151 Officer …………………………………………………………

Appendix G – Categories of exempt information

There is a clear public interest in publishing information and being open and transparent. But sometimes there is information which we can't publish because it would cause significant harm to the scheme promoter - for example by damaging a commercial deal or harming their position in a court case. Equally sometimes publishing information can harm someone who receives a service from the scheme promoter or one of their partners.

The law recognises this and allows for information to be placed in a confidential appendix if:

a) it falls within any of paragraphs 1 to 7 below; and

b) in all the circumstances of the case, the public interest in maintaining the exemption outweighs the public interest in disclosing the information.

1. Information relating to any individual;
2. Information which is likely to reveal the identity of an individual;
3. Information relating to the financial or business affairs of any particular person (including the authority holding that information);
4. Information relating to any consultations or negotiations, or contemplated consultations or negotiations, in connection with any labour relations matter arising between the authority or a Minister of the Crown and employees of, or office holders under, the authority;
5. Information in respect of which a claim to legal professional privilege could be maintained in legal proceedings;
6. Information which reveals that the authority proposes – (a) to give under any enactment a notice under or by virtue of which requirements are imposed on a person; or (b) to make an order of direction under any enactment;
7. Information relating to any action taken or to be taken in connection with the prevention, investigation or prosecution of crime.

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Appendix H – List of Prospective Customers

Name of Company	Location	Indicative number of buses suitable for conversion to zero emission hydrogen fuel cell electric driveline
Go Ahead Group – Brighton & Hove	Crawley	148
Go Ahead Group – Brighton & Hove	Brighton	200
Kent County Council	Kent	200
Transport for London		
- Short term sales	Perivale	150
	Lea Interchange	250
	South Hall	175
	Hayes	100
- Longer term opportunities	across London depots	1,200
Total		2,423

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Appendix I – Indicative Cable Route Layout

Appendix J – Description of physical infrastructure for the production and distribution of hydrogen

Hydrogen Generation Facility:

The production equipment is being provided by NEL Hydrogen, a Norwegian based company who have been manufacturing the hydrogen production equipment since the 1920's and now have more than 3,500 hydrogen solutions delivered in 80 countries around the world. The process being applied is known as electrolysis and is the cleanest method of hydrogen production compared to others which create hydrogen either through burning fossil fuels or as a by-product from chemical processes.

The below goes through each step of the production process in turn:

1. Transformer

The power system consists of a transformer, which steps down the high voltage AC (Alternating Current) provided from the sub-station which is in-turn fed by the Kentish Flats offshore wind farm. The transformer then ensures that the AC voltage is stepped down so it can be converted by the rectifier.

2. Rectifier

The rectifier converts the stepped-down AC voltage from the transformer to a DC (direct current) voltage to supply the electrolyser.

3. Electrolyser

The DC voltage is applied between the first and last electrodes, this causes the hydrogen and oxygen to be produced as current flows through the electrolyser cells. The hydrogen and oxygen rise in the cells, separated by a woven diaphragm, and enter the respective gas channels which run along the top of the cell stack. The gases flow, with lye, to the hydrogen/lye and oxygen/lye separator tanks.

The hydrogen and oxygen mixed with electrolyte enter the bottom of their respective gas/lye separator tanks through a diffusor. The hydrogen and oxygen gases each passthrough demisters at the top of their separator tanks and flows downstream to the gas scrubber and gas holder. The oxygen is vented through a water seal back to the atmosphere at a safe location. The water seal provides the necessary backpressure to ensure that the pressures on the hydrogen and oxygen sides in the electrolyser are balanced.

The two separator tanks are connected by a pipe to allow the liquid levels in the tanks to balance. Lye leaves the separator tanks and is recirculated, via the lye cooler to the lye distribution channels running along the bottom of the cell stack. Excess heat from the electrolysis process is removed by the lye cooler, which is a water-cooled, plate heat exchanger.

4. Gas Scrubber

The gas scrubber has three main functions, removal of residual droplets from the hydrogen gas, in addition the scrubber acts as a gas cooler, a heat exchanger is integrated in the circulation loop to cool the gas. The basin also acts as the feed water reservoir for the electrolyser and since the electrolyser is topped up with feed water from the scrubber basin recovery from the gas is ensured.

5. Gas Holder

The Gas Holder is to maintain a positive pressure within the system and also acts as a buffer between the electrolyser and the compressor.

6. Compressor

The compressor is used to compress the hydrogen gas from the gas holder up to the pressure required by the end-user. The compressors have fixed capacity, so any reduction in demand by the customer has to be accommodated by increasing the proportion of recirculated gas.

7. Deoxidizer

The compressed hydrogen first passes through the deoxidizer pre-heater. This heats the gas slightly, to ensure that it is free from condensation, as this would inhibit the action of the deoxidation catalyst. The pre-heated hydrogen then enters the catalytic deoxidiser column which promotes the reaction of hydrogen with residual oxygen in the gas stream.

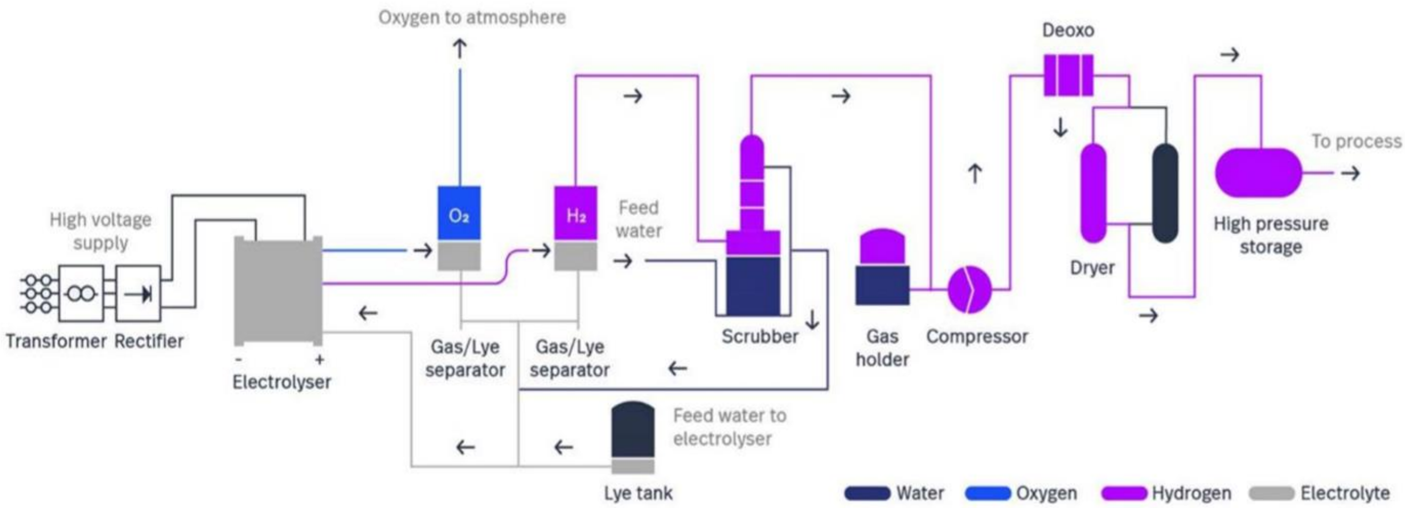
8. Dryer

Once the hydrogen has been through the deoxidiser it flows to the dryer. The gas is dried by passing it through one of two twin-tower gas dryers where it passes through a bed of ceramic (silica) desiccant. The desiccant has a limited water adsorption capacity and consequently a twin-tower design is used. Whilst one tower is drying the gas, the other tower is regenerated. Drying the adsorbent is carried out by a small flow of dried gas which is heated by a regeneration heater. On completion of the regeneration period, the adsorbent is allowed to cool before the regenerated tower is switched back to gas drying mode. There is no loss of product gas during the regeneration cycle as the gas used for regeneration is circulated internally in the dryer.

9. Storage

The nature of the process is to provide a consistent supply of hydrogen to end user customers. As a result, it is not the intention for the facility to have large volumes of stored hydrogen on site. There will be an element of stored hydrogen whilst the arrival of the HGVs is awaited, however the process increases the frequency of the HGV vehicle trips to respond to demand accordingly. As a result, there will only be a requirement for less than 2 tonnes of stored hydrogen on-site at any given time.

Schematic diagram of the hydrogen production facility:

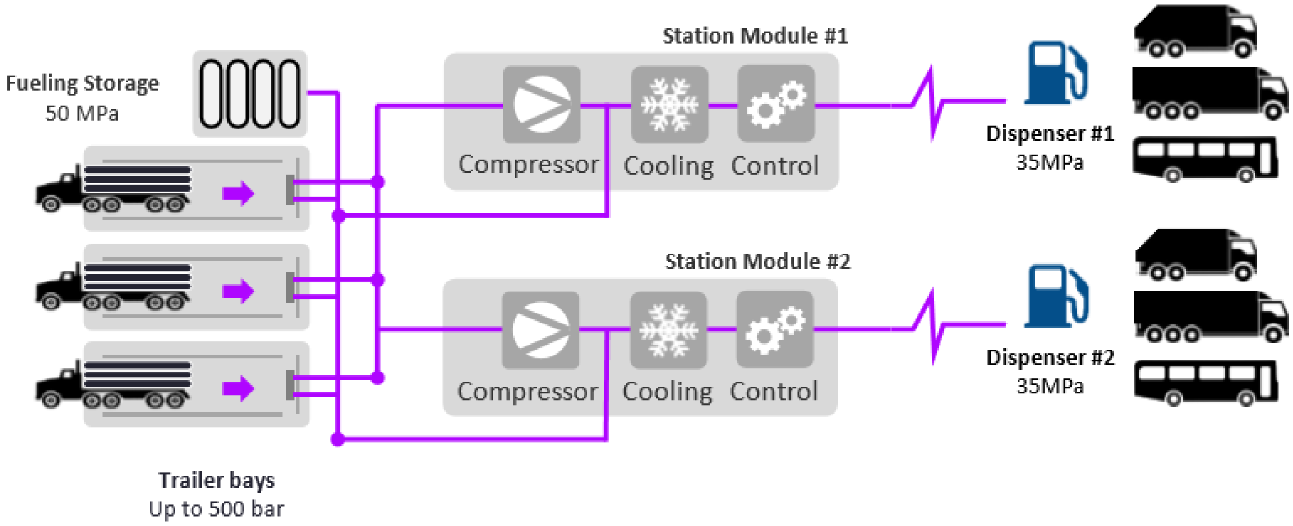


Tube Trailers

Hydrogen is transported in specialised tube trailers engineered to store pressurised gases over long distances. Below are the technical specifications for trailers:

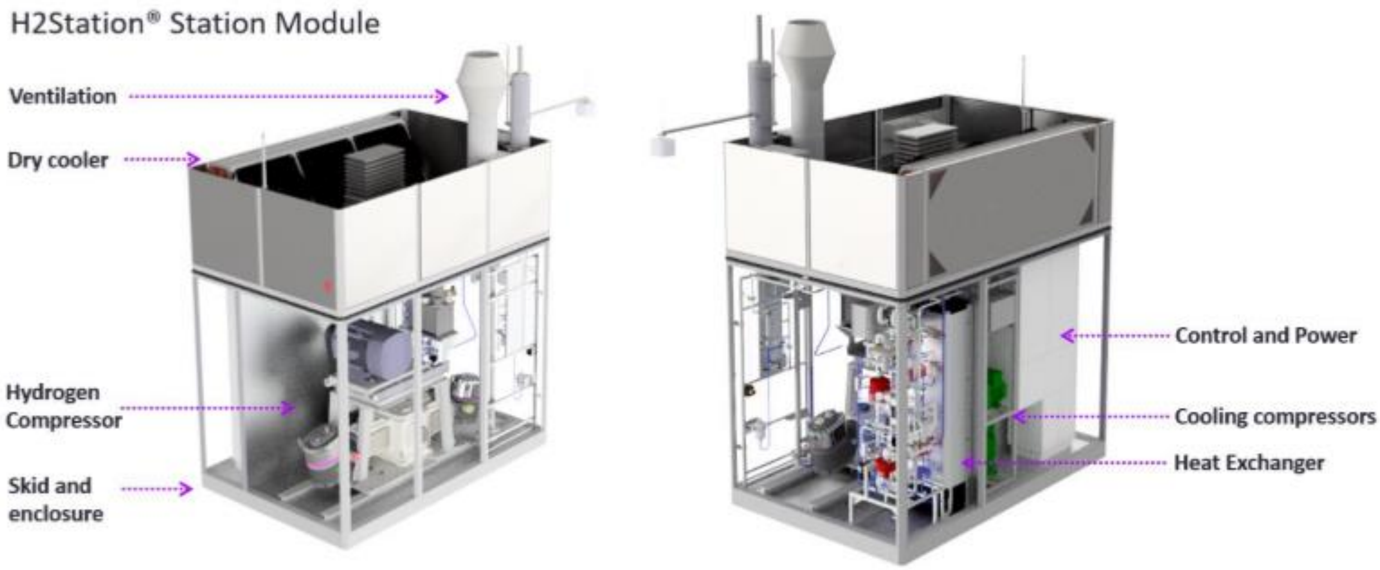
Designation	Umoe (Supplier 1)	Hexagon (Supplier 2)
Cylinder type	Type 4	Type 4
Material	Glass Fibre	Carbon Fibre
Volume	30,600 litres	45,150 litres
Number of Sections	2	2
Capacity	734 kgs	955 kgs
Full pressure	350 bar	350 bar
Targeted Empty pressure	15 bar	15 bar
Usable Capacity	700 kg	900 kgs

Hydrogen Refuelling System:



The fueling solution consists of the following standard equipment modules:

- Trailer connection panel
- Station module
- Fueling storage module
- Dispenser



The Station Module takes hydrogen from the trailers and compresses this into the Fuelling Storage at pressure up to 45MPa. The Fuelling Storage is dimensioned to achieve the specified fuelling capacity, provided that sufficient hydrogen is supplied. During non-refuelling time the compressor conducts pressure consolidation of the tube trailers to optimize capacity.

Fuelling is conducted from the trailers and the fuelling storage via a pipeline to the stand-alone Dispensers. Hydrogen is cooled down to -40°C inside the Station Module, before being transferred to the Dispenser, which can be located up to fifty (50m) away. The Control system inside the Station Module ensures a fast and complete fuelling in compliance with SAE-J2601-2.

Appendix K – Procurement Strategy: Main Principles

Procurement Strategy

The purpose of this strategy is to set out the guidelines for all parties that are to be engaged in Procurement Activity in relation to the construction works in order to ensure compliance with varying statutory requirements whilst allowing Ryse Hydrogen Limited to fulfil its full objectives.

Main Principles

Definition of Procurement

The term procurement refers to the process by which goods are, services and works are acquired from third parties. This is a lifecycle process that covers from the initial purchase concept through to the end of the life for the purchased asset or service.

The key factors are:

1. Commitment to Competition
2. Value for Money
3. Fairness
4. Honesty and Openness
5. Efficiency and Effectiveness
6. Professionalism

Commitment to Competition

Value for Money is best achieved by competition. Competition promotes economy, efficiency and effectiveness in expenditure and contributes to the competitiveness of suppliers

Value for Money

In procuring goods, services or works all teams/departments are responsible and accountable for achieving value for money. In addition, all company staff/consultants are urged to seek continuous improvements in value for money.

The means prioritising the following:

- Value for Money should always be assessed over the whole life of the contract. This should include disposal and take into account all costs and benefits to society as a whole including the environmental and social benefits and costs.
- Assessment of tenders/quotations should only be conducted in relation to a published set of evaluation criteria/documents, which must be relevant to the subject of the contract.
- Affordability should always be considered.
- Value for Money should normally be considered through the competitive process. A strong competition from a vibrant market will generally achieve a Value for Money outcome.

Fairness

Ryse Hydrogen Limited has a commitment to act fairly throughout the procurement process. This will be achieved by:

- Managing and participating in the procurement process fairly
- Providing accurate and timely information and in appropriate detail
- Respecting the confidentiality of third parties and members of the supply chain, particularly where some information may be covered by the provisions of IPR
- Being objective, even handed and transparent when making decisions and ensuring that all competition is judged evenly

Honesty & Openness

Ryse Hydrogen Limited will be honest and open when conducting procurement and shall achieve this by:

- Working collectively to manage expectations
- Sharing views of risks and contingency plans for the procurement and contract performance
- Raising any issues of concern at an early stage to enable constructive joint resolution
- Indicating how tenders/quotations will be evaluated by stating the evaluation criteria
- Providing successful and unsuccessful candidates and tenderers with feedback that is as helpful as possible and intended to promote future improvement and involvement

Efficiency & Effectiveness

All parties shall seek to improve the efficiency and effectiveness of the procurement process by:

- Striving for the highest standards of performance and best practice
- Seeking to mitigate disruption, delays and additional costs

- Minimise post-contract changes but if required, changes shall be instructed with the full consultation of all parties whilst seeking to maintain value for money and competitiveness
- Ensuring that the best timescales are wholly met but are realistic
- Where appropriate, utilising eProcurement

Professionalism

Ryse Hydrogen Limited and its employed consultants, shall work to a high standard of professionalism by:

- Acting with courtesy, consideration and integrity during the project, including before and after the procurement phase
- Actively respecting people
- Adequately resourcing the planning, preparation and delivery stages of all projects
- Making sure that roles and responsibilities and clearly understood
- Ensuring adequate management and supervision throughout
- Responding promptly and courteously to communications
- Behaving ethically in all business interactions

Contractor Selection

The contractors would be selected based on previous experience with the design team, track record, financial stability and suitability to this particular scheme.

Particular emphasis and promotion shall be given to Contractors local to the regional area.

This would be an open and transparent process.

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Appendix L – Impact of COVID 19

Role of project in supporting local economic recovery

The disruption caused by COVID 19 has resulted in dramatic drops in air pollution levels across the nation and the importance of preparing for another impending crisis related to climate change has never been starker. Governments worldwide have stressed the need for a recovery roadmap linked to a green recovery. This is an opportunity for the South East to emerge as a pioneer in green hydrogen production, which will help decarbonise transport in the immediate term, and progressively replace fossil fuels as industrial feedstocks and in heating.

1) Renewable Energy Generation: Our project is designed to connect directly with offshore wind farms in Kent, owned and operated by Vattenfall UK. As explained in the business plan, any delay with respect to successful commencement of operations at this project will lead to further delay in planned investments for a second large scale green hydrogen production plant that will connect with the Thanet wind farm, also owned and operated by Vattenfall UK in the South East region. Currently, the South East has a competitive advantage for growth of such infrastructure projects and delays could cause corporations to look for alternative locations with similar incentives.

2) Transport: Hydrogen fuel cell buses powered with locally produced hydrogen from renewable energy will help the South East meet its zero emissions goals. In addition, each fuel cell bus powered by renewable energy will reduce CO2 by 122kg for every 100km of travel, in comparison to diesel buses. The benefits will increase exponentially as more and more fuel cell buses are deployed in the South East.

3) Fuel Security: Locally produced hydrogen provides fuel source security to the South East and the wider nation. It eliminates the need to import offshore oil and deal with the potential disasters associated with pipelines and seaborne oil spills. This is particularly important in light of geopolitical uncertainties that have been exacerbated due to the COVID-19 crisis

New risks emerged as a result of the COVID 19 pandemic and the impact that these risks will have on the ability to deliver the project

Description of Risk	Impact of risk	Risk Owner	Risk Manager	Likelihood*	Impact **	Risk Rating ***	Risk Mitigation	Residual Risk Rating
Deterioration of financial health of suppliers and customers	4- High			3- Medium			Offering the customers, a bus-as-a-service proposition to reduce upfront capital expenditure on zero emission fleets Working with suppliers with strong balance sheets and deep sectorial knowledge. Awareness drives to stress the need for governmental intervention to support transport companies that have been adversely affected by the sudden drop in passenger journeys.	
Protracted construction schedule due to social distancing norms	2-Low			4-High			Budget extra time for civil works Plan the construction schedule closely with delivery partners.	

Impact on project outcomes and benefits in light of the changing economic and working context

The project will deliver benefits for several years, as explained in the business case.

The benefits will increase exponentially as more and more fuel cell buses are deployed in the South East. The development will save:

- 471,000 tons of carbon emissions over the period to 2035 - 1,685 tons NOx, 21 tons of PM2.5, 414 tons of Hydrocarbons in the period to 2035

The development will lead to creation of
- At least 16 jobs at Herne Bay
- At least 40 jobs in the Phase 2 expansion at Thanet
- Other indirect benefits are not quantified, though there will be benefits across the region, including:
a) Facilitated renewable energy deployment (with associated jobs and carbon savings) by using hydrogen as a market for renewable energy
b) Supply chain services to the facility maintenance and support for specific aspects of the facility will be contracted to local firms
c) Experience in construction of the facility – local contractors will be used to build and assemble the facility. This is a first of a kind deployment, they will gain unique skills which can then be applied to similar projects elsewhere in the UK Multiplier effects associated with the direct employment

6 PhD level research opportunities, c.30 Industrial placements as the project reaches full capacity. Furthermore, it will give an impetus to ownership and operations of renewable energy farms, development of hydrogen production sites and downstream refuelling infrastructure, R&D for technology and performance improvements in fuel cell electric value chain, manufacturing of new energy vehicles and constituent parts.

With the potential for changes in climate policies in response to the COVID crisis, benefit realisation may be materially accelerated and future pipeline projects, including a second green hydrogen generation facility connecting with Thanet wind farm, could be deployed earlier than expected. The Committee for Climate Change (CCC), government's advisers on climate policy, stressed the importance of actions needed to tackle climate change as "central to rebuilding our economy", in a letter to the Prime Minister of the UK in May 2020. Ryse Hydrogen fully agrees with and supports this point of view and have spoken directly with the CCC to share our business plan and vision for how hydrogen can form a central part to this rebuilding of the economy.

Other nations, such as Germany, Portugal, Australia, Japan, South Korea, Canada, China and the EU have already set ambitious, multi-billion-pound strategies for growing their hydrogen economies. The Prime Minister's commitment to "invest massively in hydrogen" is essential now if the UK is to succeed in a global hydrogen economy that is estimated to be worth $2.5 trillion by 2050, supporting 30 million jobs. We will work with the Government to ensure the UK is a clear world-leader in hydrogen by the time of COP26, so that we can inspire the world to follow in our footsteps and buy our skills and technology to do so. UK designed and produced hydrogen technology exists and is ready to be scaled up today (covering transport, production, power and heat)

Impact on milestones, spend profiles and repayment schedules

The project received planning permissions from Canterbury County Council in June 2020, providing a necessary impetus to the development plans. With the accomplishment of this important milestone, Ryse Hydrogen is preparing to pursue the construction of a renewable hydrogen production facility with a 4 ton /day capacity with the help of SELEP support.

With increased regulatory measures for transport operators to transition their fleet of buses to zero emission options, customer enquiries for fuel cell grade hydrogen, as will be produced at the site in Herne Bay, has surged considerably from bus and rail industry operators. It is important to highlight that Department for Transport's report on “Decarbonising Transport” released on 4th March 2020, clearly lays out the importance of supporting the industry in “developing hydrogen solutions for use in rail that will play an important role in future decarbonisation.”

Ryse Hydrogen have consistently pursued its development activities, whilst adhering to government guidelines since the announcement of lockdown in March 2020, to mitigate any risks that may lead to delay in start of construction, expected for Q3 2020 (as mentioned in the business case). For instance, Nel Hydrogen Limited, supplier of electrolysers for the project, entered into a framework agreement with Ryse Hydrogen in April 2020, to ensure timely delivery of equipment during the construction phase at pre-agreed prices. These prices have been reflected in the business case presented to SELEP.

The repayment schedule remains unchanged. As with most infrastructure projects, demand maturation will lead to optimum capacity utilisation of the project. It is therefore critical for Ryse Hydrogen to have the initial support in the form of GPF, so as to be able to deliver a scaled development that compresses the path to financial viability.

It may be possible that revenue generation in the early years may be lower than the expected repayment amount. However, over the term of the loan (5-year period) cashflow available for debt service (CFADS) from project operations remains forecast to be sufficiently higher than the outstanding debt amount.

Sensitivity Analysis of Project Benefits

1) Scenario 1 – 30% reduction in expected demand for hydrogen fuel

Over the short term, social distancing norms and health concerns will result in fewer commuters and decreased transportation needs, especially at peak times that have traditionally seen the most work travel. However, in the longer-term customer preferences and environmental concerns will create different mobility mixes for urban and rural transport.

Assuming a 30% reduction in demand for buses and reflecting this reduction in total hydrogen fuel demand from 220 buses (initial conservative projection) to 154 buses through 2035 will lead to the following benefit realisation from the project.

CO2 saving (based on Green Book values (central case) for CO2 emissions). NPV from 2021 to 2035 @3.5% discount rate)	Expansion to 154 buses at Herne Bay (assuming a 30% reduction from initial projected demand from 220 buses)	**£3,745,452.68**
Air Quality benefits - using Green Book and DEFRA guideleines for harm of different pollutants. NPV from 2021 to 2035 @3.5% discount rate	Expansion to 154 buses at Herne Bay (assuming a 30% reduction from initial projected demand from 220 buses)	**£3,308,534.67**
Land value before GPF funded investment	11 acre site, no road access land value £7,500-£10,000 per acre	£100,000
Land value after GPF funded investment	Includes new commercial building with retail rental value giving a commercial NPV of £2.5m (based on £7.50/sq.ft p.a) and 25,000sq.ft of new commercial space.	£2,500,000
	Net Benefit from GPF	**£2,400,000**
TOTAL BENEFIT FROM GPF		**£9,453,987.34**

The total cost to SELEP is £1,024,000, as seen under 'Section 3 – Expected Benefits: Value for Money Assessment' previously.

Thus, the **Benefit Cost Ratio in this scenario is 9.23**

2) Scenario 2 – minimum demand required to surpass threshold Benefit Cost Ratio of 2:1

As per Eligibility Criteria for GPF Investment, for any project to be approved by the Accountability Board for GPF support, it is required to demonstrate high value for money with a Benefit Cost Ratio of over 2:1.This threshold of 2:1 Benefit Cost Ratio is surpassed from the uplift in land value alone, resulting in net benefit from GPF of £2,400,000 as against total cost to SELEP of £1,024,000.

However, it can be seen in the following table that the environmental benefits as a result of carbon savings and air quality improvements (based on Green Book & DEFRA guidelines) from deployment of 47 buses in the SELEP region offers a Benefit Cost Ratio great than 2:1. Ryse Hydrogen Limited is already in advanced discussions with bus transport operators for deployment of 52 hydrogen buses in the SELEP region starting as early as 2021.

CO2 saving (based on Green Book values (central case) for CO2 emissions). NPV from 2021 to 2035 @3.5% discount rate)	Based on deployment of 47 hydrogen fuel cell buses in SELEP region	**£1,225,632.39**
Air Quality benefits - using Green Book and DEFRA guidleines for harm of different pollutants. NPV from 2021 to 2035 @3.5% discount rate	Based on deployment of 47 hydrogen fuel cell buses in SELEP region	**£1,159,113.90**
Land value before GPF funded investment	11 acre site, no road access land value £7,500-£10,000 per acrse	excluded for scenario analysis
Land value after GPF funded investment	Includes new commercial building with retail rental value giving a commercial NPV of £2.5m (based on £7.50/sq.ft p.a) and 25,000sq.ft of new commercial space.	excluded for scenario analysis
	Net Benefit from GPF	
TOTAL BENEFIT FROM GPF		**£2,384,746.29**

The total cost to SELEP is £1,024,000, as seen under ‘Section 3 – Expected Benefits: Value for Money Assessment’ previously.

Thus, the **Benefit Cost Ratio in this scenario is 2.32**