Project Development Assistance Delivery Report

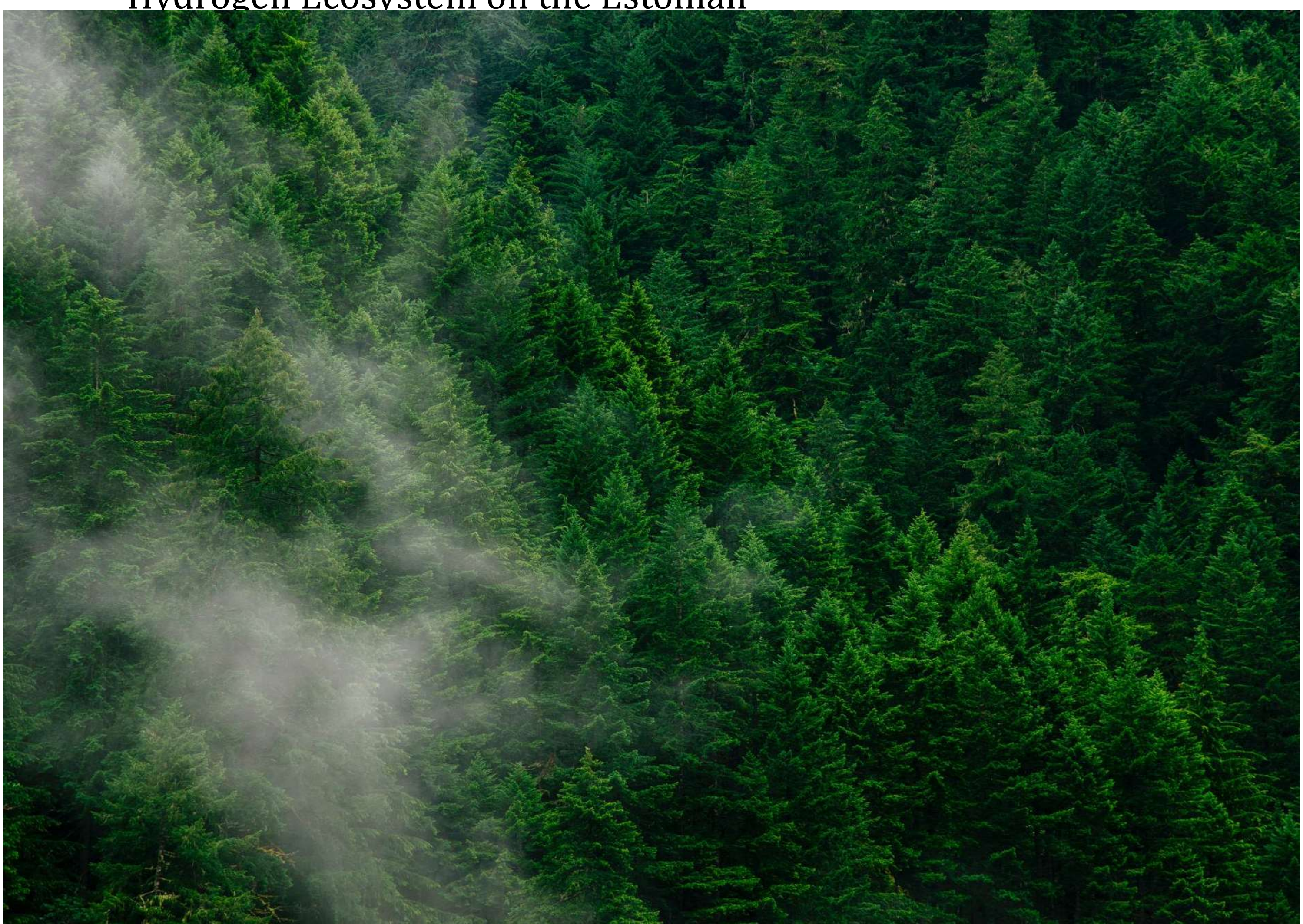
Hydrogen Ecosystem on the Estonian

PREPARED FOR

Clean Hydrogen Partnership

DATE
December 2023

REFERENCE
0654451



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1. INTRODUCTION

1.1 PROJECT CONTEXT

With announced plans to reach carbon neutrality by 2050, mainland Estonia and its islands will need to transition from their current energy system, which relies primarily on domestically produced oil shale[1], to one increasingly dependent on renewable energy sources. To this end, Estonia has witnessed recent consistent growth in its renewable energy capacity. Estonia's solar capacity has experienced another year of substantial growth (305 GWh in 2021 to 506 GWh in 2022[2]) and 50MW of additional solar PV farms are planned.

However, the investment in Estonia's renewable energy capacity is expected to outpace the grid's capacity to transmit the generated energy. To avoid energy curtailment, the project developers are exploring the use of renewable electricity to produce hydrogen. The produced hydrogen will primarily be used as fuel for multiple forms of mobility across five islands.

FIGURE 1: ESTONIAN ISLANDS INCLUDED WITHIN THIS PROJECT

1.2 LEARNINGS FROM OTHER DEPLOYMENTS

The project can learn from other hydrogen projects based on similarities in geographies of project locations, technologies deployed, or stakeholders involved.

[1] In 2018, 73% of total primary energy supplied to Estonia was generated using petroleum and gas derived from oil shale (Source: IEA)
[2] Link

Project	Description	Key learnings
Island deployments		
BIG HIT	To minimise energy curtailment, a green hydrogen ecosystem is being developed across the Orkney islands. The project had a budget of €13 million and deployed 1.5 MW electrolysers, hydrogen refuelling station and accompanying storage, compression, and tube trailer distribution system. The end uses for the project were 10 fuel cell-range extended vans, a fuel cell Combined Heat and Power plant and a fuel cell catalytic boiler.	• Contractual challenges: i.e. water and green electricity supply. Therefore, local authorities must be introduced to the project early and an environmental impact assessment should identify the project's impact on local resource supply. • Permitting can be a challenge in geographies new to the hydrogen economy. • Allowances for complex Project Management, Engineering & Integration (contingency) must be made. • Operational competence: local training & up-skilling is crucial to the project. • Continuous involvement of the local community is important to maintain social licence. • Deployment on islands led to logistical challenges due to the geographies and remoteness. This will need to be communicated early to suppliers.
Vehicle deployments		
HECTOR	These projects deployed hydrogen-fuelled refuse collection vehicles at seven sites across Scotland, the Netherlands, Germany, France, and Belgium. The vehicles trialled within these projects were manufactured by E-Trucks, FAUN (recently branded	• In engaging with suppliers, note the vehicle requirements for the highest demanding day. The requirements should also consider the impact of conditions such as distance to the refuelling station, traffic, etc.

Project	Description	Key learnings
	Enginius) and Holthausen, using chassis from DAF and Mercedes.	• The routes trialled should offer maximum opportunity for learning and emissions saving. • Pre-procurement engagement with suppliers will help in gathering information on the sector as it develops.
JIVE	The overall objectives of the JIVE and JIVE 2 projects are to: • Deploy nearly 300 buses & associated infrastructure. • Stimulate the market for FC buses in Europe by creating demand for hundreds of vehicles. • Lower the prices of fuel cell buses using joint procurement and economies of scale. • Demonstrate routes to achieve low-cost renewable hydrogen. Together with the associated MEHRLIN project (which is providing funding for the infrastructure in some of the sites), the JIVE projects will lead to the deployment and operation of around 300 buses in 18 sites across Europe.	• Scale is important as it reduces capital costs and H2 costs and allows more robust service and maintenance arrangements. • Maintenance arrangements need to be robust. Projects should aim to have their own mechanics trained quickly. Good spare parts inventory should be nearby, with diesel and FC components. Projects should also ensure robust contracts with OEMs with penalties for poor availability. • Procurement should be simple: Structure should mirror typical arrangements between OEM and bus operator (without transport authority being involved). Where possible, contract directly with OEM, not a system integrator. • Some depot modifications will be required: Sensors & vent pipes in buildings, check ATEX requirements. • Ensure the drivers are positive about the change: Give training to ensure understanding of the technology and its benefits.

Project	Description	Key learnings
		• Knowledge sharing approach – the recently conducted roadshows during which the fuel cell buses were exhibited across multiple geographies, drummed up significant stakeholder buy-in.

1.3TECHNOLOGY DOWN-SELECTION FRAMEWORK

Within this project, multiple end-uses of hydrogen were considered, as outlined in Figure 2.

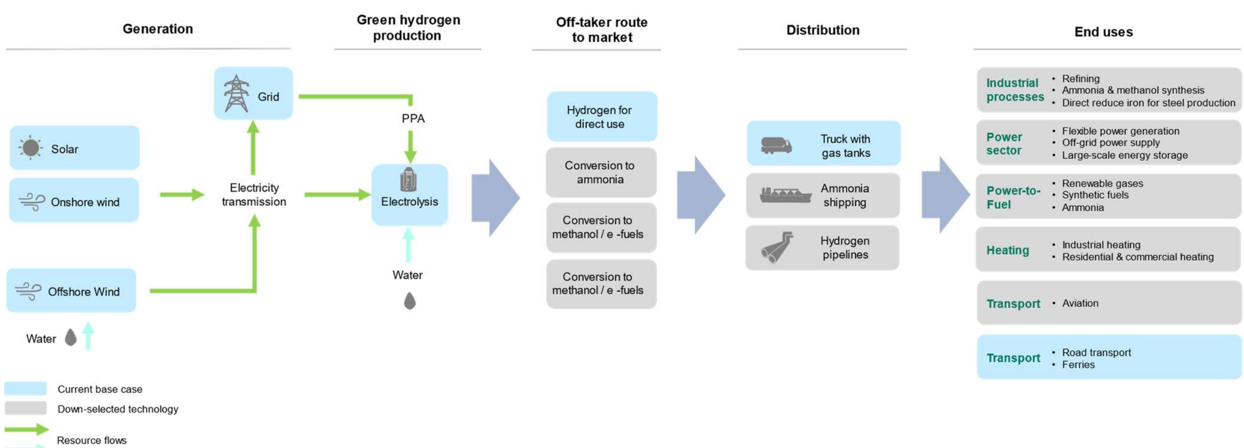
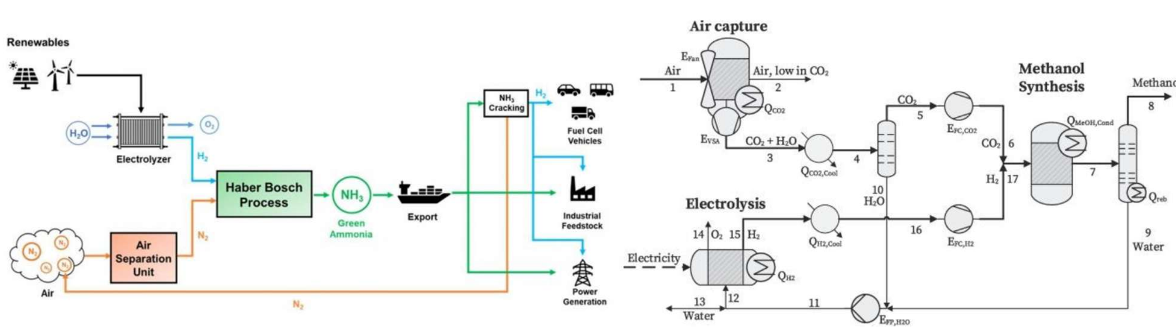


FIGURE 2: HYDROGEN VALUE CHAIN CONSIDERED WITHIN THIS PROJECT

1.3.1 PRODUCTION OF E-FUELS

Overview

Hydrogen can be further processed to produce low carbon products such as ammonia and e-methanol.



Challenges

- **Scale**

Compared to mobility projects, which can be deployed at relatively low scale, ammonia and e methanol plants need to be developed at large scale to be economically viable. As an example, the Hynovi project in France which aims to develop e-methanol targets an electrolytic capacity of around 200-330MW. Furthermore, Hy2gen's green ammonia plant in Finland has an announced electrolytic capacity of 800MW.

- **Intermittency in renewable energy supply**

Variations in renewable energy generation occur on both an hourly and seasonal level. Adding a PV plant equal in size to the ammonia base load power demand results in a greatly reduced energy gap during the summer months. This lowers the need for energy storage to bridge time windows with less available wind energy. The energy gap (energy required which cannot be supplied by intermittent renewables) increases with increasing ammonia production scale, as energy base load demand increases while wind electricity production remains constant.

Either a battery system or hydrogen could be used to bridge times of low renewable energy availability. An oversized electrolyser could be used to produce excess hydrogen during times of high renewable electricity, which could also be converted back to electricity using a fuel cell to power the air separation unit and Haber Bosch process unit. This is likely cheaper compared to battery system.

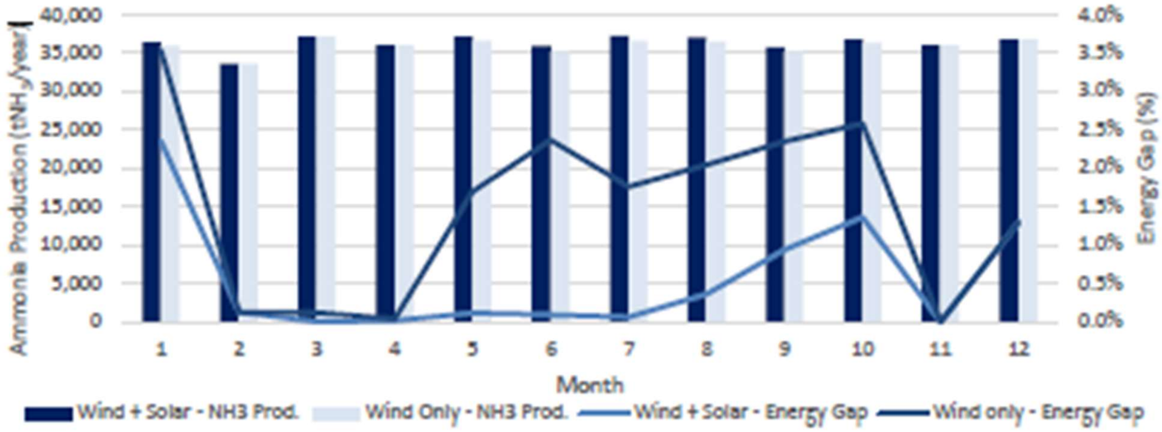


FIGURE 3: EXAMPLE AMMONIA PRODUCTION PROFILE BASED ON RENEWABLE ENERGY CAPACITY

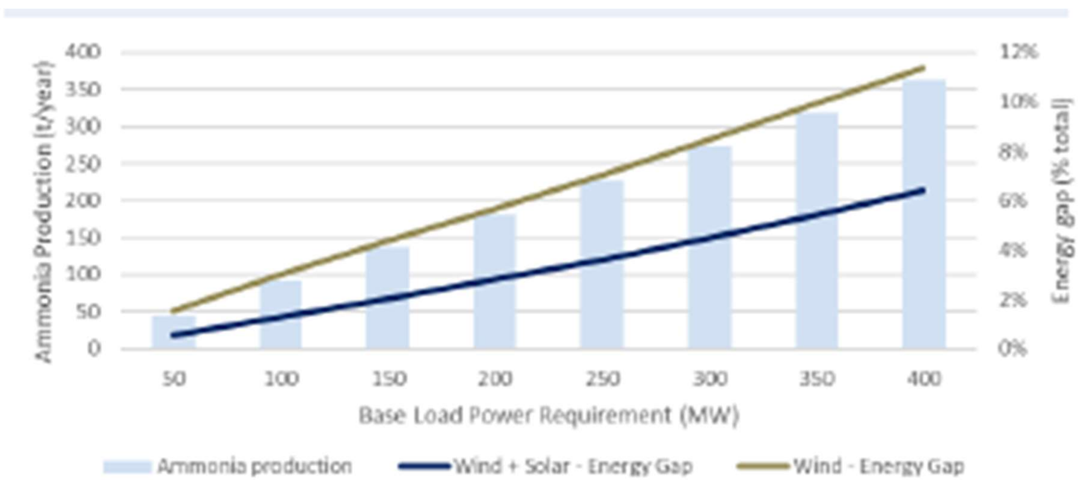


FIGURE 4: EXAMPLE AMMONIA BASE LOAD POWER REQUIREMENTS AND RESULTING RENEWABLE ENERGY GAP

1.3.2 HYDROGEN FOR POWER PRODUCTION

Overview

Hydrogen can be used to power vacation homes, but economic viability strongly depends on the hydrogen logistics and the utilisation factor of the generating equipment.

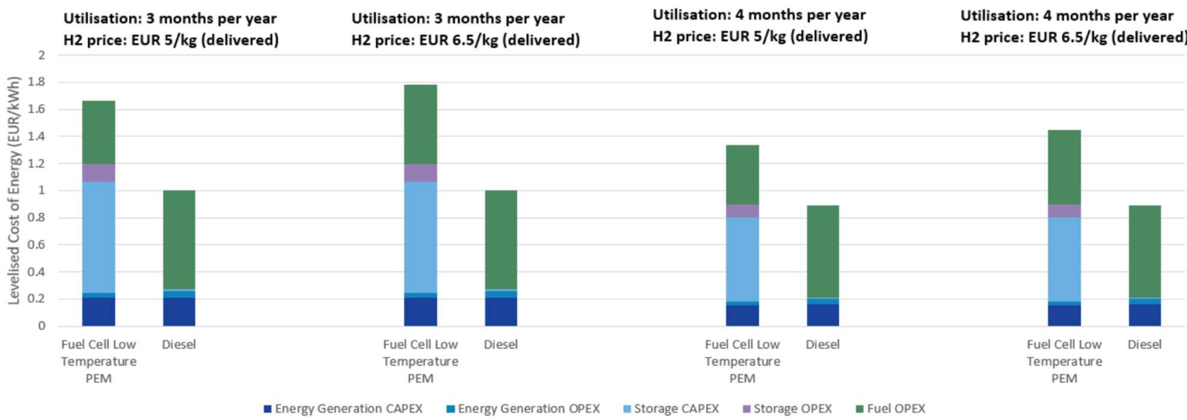
Challenges

In general, for remote homes the competitiveness of fuel cells compared to incumbent technologies depends on:

- On-site storage volume: storing hydrogen is significantly more expensive than diesel.
- Utilisation factor: as storage is a significant portion of the CAPEX, a lower utilisation factor will have a disproportionate effect on the fuel cell's competitiveness.

If on-site storage is reduced, this would likely drive up the hydrogen delivery costs, as the number of deliveries would increase while the volume transported would decrease. Heat integration is often considered to improve the competitiveness of fuel cells; however, this mainly applies to homes that are used continuously rather than vacation homes.

Since vacation homes have with low utilisation factors, the additional CAPEX required would further increase generation costs. As vacation homes are mainly used in summer, the extent to which heat integration is required is not certain.



1.3.3 HYDROGEN FOR MOBILITY

The high energy density and transportability of hydrogen also make it a candidate to displace fossil-fuel based fuels used in transport. Globally, multiple projects are demonstrating the technical, economic, and operational viability of multiple hydrogen mobility modes (as outlined in section 1.2).

Transport was selected as the base case for the following reasons:

- **Alignment with ongoing initiatives** – The Estonian government is currently developing a project to trial a zero-emission ferry to operate between the ports of Kuivastu and Virstu. The conversion of more public transport modes would provide sufficient demand to necessitate the local production of hydrogen.
- **Utilisation patterns –** public transportation modes have a generally higher utilisation rate than private vehicles. Their higher mileage and need for minimal vehicle unavailability make them well suited for the energy density and fast refuelling times (typically <15 minute) associated with hydrogen vehicles.
- **Technology readiness** – thanks in large part to demonstration projects such as those in section 1.2, the landscape of equipment suppliers providing hydrogen mobility solutions is expanding.

2. PROJECT SCOPE

2.1 OVERVIEW

Within this project, the renewable energy deployments across the islands of Saaremaa, Hiiumaa and Ruhnu will be used to produce hydrogen for use as fuel for the public transport system across the islands of Saaremaa, Hiiumaa, Ruhnu and Muhu.

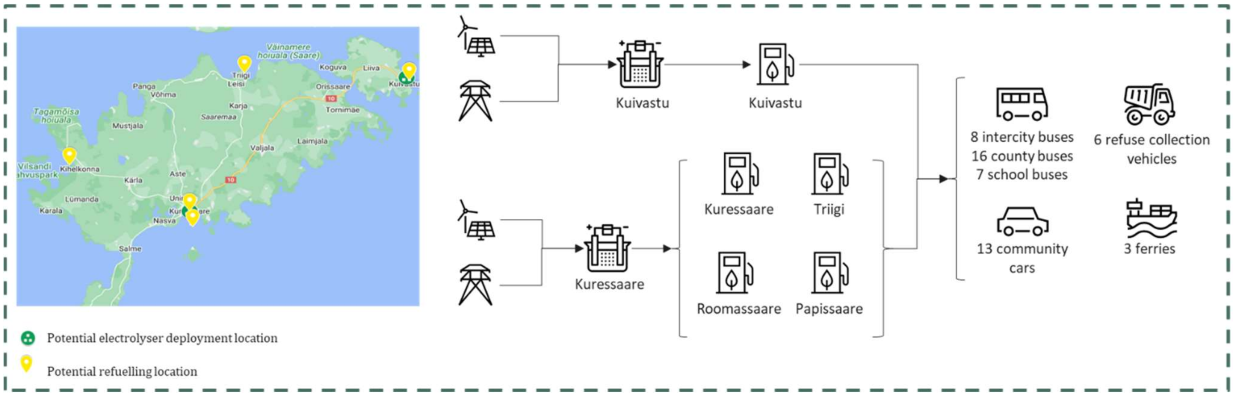


FIGURE 5: DEPLOYMENTS ON SAARE COUNTY

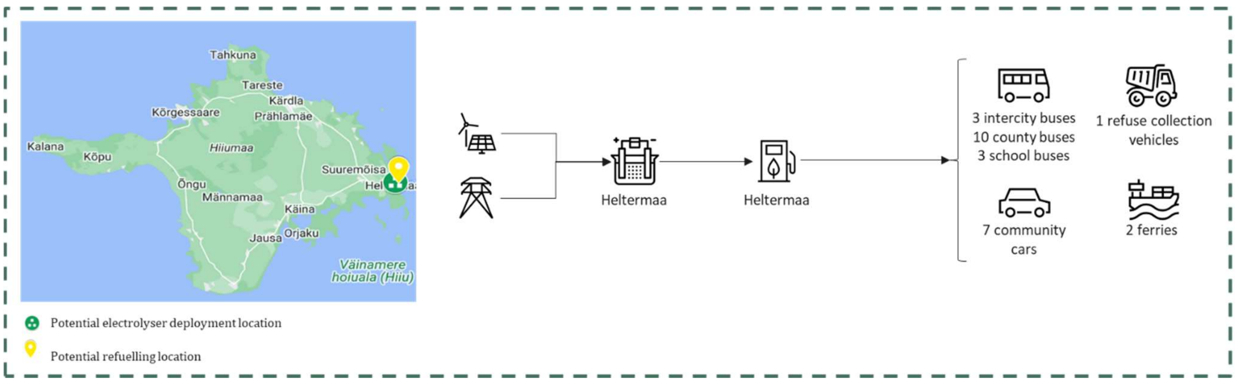
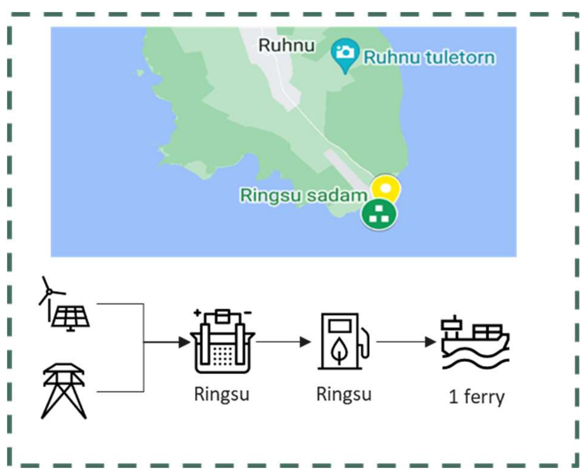


FIGURE 6: DEPLOYMENTS ON HIIUMAA



Potential electrolyser deployment location

Potential refuelling location

FIGURE 7: DEPLOYMENTS ON MUNALAID

FIGURE 8: DEPLOYMENTS ON RUHNU

The project will be deployed over two phases between 2027 and 2033. This phased approach will enable the aggregation of hydrogen demand which will in turn reduce the cost of hydrogen production:

- **Phase 1 (2027-2030):** The project team has already commenced tendering for a ferry. This phase will enable the deployment of this vehicle as well as further mobility modes and the hydrogen required to supply their operation. This deployment will focus on deployments on the islands of Saaremaa and Muhu.
- **Phase 2 (2031-2033):** This phase includes the expansion of hydrogen deployments that require refuelling on other islands.

2.2HYDROGEN PRODUCTION

Electrolysers ranging from 1 to 14.5 MW will be deployed across four ports across multiple islands as noted in Figures 5 to 8.

Port	Electrolyser capacity (MW)	
	Phase 1	Phase 2
Roomassaare	2.5	3.0
Kuivastu	5.0	14.5
Heltermaa	-	4.0
Ringsu	-	1.0

The electricity for the hydrogen production will be sourced from direct connections to renewable energy sources and grid-sourced electricity. The table below summarises the planned RES deployments across the Estonian islands.

Island	Solar PV (MW)	Wind (MW)	Start of operation
Hiiumaa	2	7	2030
Muhu	10	7	2027
Ruhnu	0.45	0.55	2029

3. RISK REGISTER

The below risk register is a starting point, to be continuously updated and monitored throughout the project implementation. Risks that either are likely to occur or have occurred will be raised to the steering committee.

3.1 TECHNICAL RISKS

TABLE 1: TECHNICAL RISKS

#	Risk	Description	Impact	Mitigation
R1.1	Unexpected electrolyser downtime	The unavailability of any electrolyser can result in a disrupted hydrogen supply for vehicles. This can in turn result in interrupted public transport availability for residents.	Medium	Hydrogen storage has been planned at each refuelling location to provide a buffer supply at periods of lower productivity. In cases of short-term electrolyser downtime, some vehicles, ferries especially, could be rerouted to refuel at different locations in. Additionally, the project can explore an emergency hydrogen supply contract with hydrogen producers on the Estonian mainland.
R1.2	Insufficient grid connection capacity	Connection to the grid will be required to maintain a minimum load factor for the electrolysers and at the expected refuelling stations. If the grid connection at each site is insufficient or there are delays to permitting and planning of an upgraded grid connection, there could be a significant increase in the investment costs and hence cost of hydrogen dispensed at the refuelling station.	Low	The project should initiate early engagement with the TSO (Transmission System Operator) to reserve project capacity at each required location. This validation of grid capacity is planned for work package 3.
R1.3	Disruption in the electricity supply to the electrolyser	The intermittency of the renewable electricity supply has been accounted for in the estimation of the electrolyser load factor. However, upstream disruptions in electricity supply can result in the electrolyser	Medium	Initial supplier engagement has demonstrated the ability of electrolysers to operate at considerable flexibility (in one case, 40% load factor per stack). Therefore, the electrolyser system can be flexibly operated if needed. Additionally, the electrolysers at each site aim to diversify

#	Risk	Description	Impact	Mitigation
		operating at a lower load factor and reduce the available hydrogen for use.		their power sourcing and include grid connections to ensure a robust supply of electricity.
R1.4	Unavailability of necessary electrolyser size to suit project capacity	As this project aims to deploy electrolysers across multiple islands, the unavailability of electrolyser capacity can delay the project schedule and hinder the deployment of the associated transport modes.	Medium	During the feasibility study phase, the project should assess multiple electrolyser types from a wide range of suppliers. The procurement framework should prioritise supplier delivery time, maturity of technology, and manufacturing capacity. Additionally, the use of one electrolyser manufacturer could allow for economies of scale (cost, time or administrative savings) to be accrued to the project. Furthermore, the impact of a severe delay in electrolyser availability can be mitigated by decommissioning the diesel-fuelled transport modes in phases and after the hydrogen-fuelled alternatives are in operation.
R1.5	Hydrogen mobility mode supply delay	Delays in the availability of the hydrogen-fuelled vehicles can lead to a postponed operational date.	Low	Hydrogen fuel cell buses, cars, refuse collection vehicles and ferries have been demonstrated in projects, with some mobility types already available on a commercial scale. The project team is engaging with suppliers that have demonstrated technology in other projects. The procurement framework should also assess suppliers based on their delivery timeline, manufacturing capacity and ability to supply to remote island locations.

3.2 COMMERCIAL RISKS

TABLE 2: COMMERCIAL RISKS

#	Risk	Description	Impact	Mitigation
R.2.1	Increased project costs	There are outstanding uncertainties around project costs. Whilst the costs and budgets used here and to justify the overall financial case represent best available data, there are still risks that the project economics could deteriorate due to a rise in project costs or a sharp change in exchange rates over which the partners would have no control.	High	Conservative assumptions have been made in the financial analysis, demonstrating the upper bound of project cost. Nonetheless, continuous revisions of the budget will be conducted prior to final investment decision. If necessary, project partners will meet to adjust the project scope by reducing certain vehicle deployments or delaying timelines.
R.2.2	RFNBO (Renewable Fuels of Non-Biological Origin) Compliance	Although there is currently no framework in Estonia where RFNBO fuel off-takers can benefit from financial incentives like in other countries through RED III credits (HBE – Netherlands, THG – Germany), these might develop in the future. To ensure the vehicle operators can benefit from such schemes, the hydrogen procured should be RFNBO eligible.	Medium	The electrolyser power sourcing strategy has been developed to maximise the usage of renewable energy across the islands. The Power Purchase Agreements with the energy suppliers should be negotiated to ensure sufficient volumes of power are available for the produced hydrogen aligned with RED III requirements.
R.2.3	Increases in costs of electricity	The cost of electricity greatly influences the cost of producing hydrogen. The project will therefore need to mitigate the risks of variable energy prices while minimising the effect on the customers.	Medium	The project will develop a pricing structure for the produced hydrogen that accounts for the expected variability in renewable energy prices. Long-term PPAs can also be sourced to minimise the project's exposure to price variability.

#	Risk	Description	Impact	Mitigation
R.2.4	High hydrogen prices affect project competitiveness	This can delay the securing of hydrogen offtake and adoption of hydrogen-fuelled vehicles.	Medium	Since multiple hydrogen production points are being developed within this project, different levelized costs of hydrogen are expected at each location (see section XXX). Engagement with public funding opportunities should be undertaken throughout further project development activities to improve commercial viability of the project.
R.2.5	Future hydrogen demand does not materialise	This could be due to equipment availability (R1.5) or low offtake buy-in. This could result in either a delay to FID (if known prior) or a delay to commercial operations date, or impact on hydrogen production rates.	Medium	The project has already begun engagement with potential operators. As the policy environment and local buy-in can help mitigate this risk, the project will share the project benefits to the island economies with the local transportation agency to ensure that future public transport tendering rounds have requirements relating to the emissions reduction targets for the vehicles.

3.3 OPERATIONAL RISKS

TABLE 3: OPERATIONAL RISKS

#	Risk	Description	Rating	Mitigation
R.3.1	Low availability of skilled workers	Increases project costs by using international (e.g., European) staff and could cause delays delivery	Medium	Taltech and University of Tartu have introductory hydrogen courses that can be extended to the public. To mitigate this risk in the future, the knowledge sharing strategy should share the project learnings with technical colleges.

#	Risk	Description	Rating	Mitigation
R.3.2	Low availability of maintenance personnel and equipment	This can affect the availability of the deployed vehicles and increase the costs of operation	Medium	The supplier requirements should include a maintenance training package where local technicians and workshops are trained on how to operate and maintain the vehicles.
R.3.3	Poor communication among partners	This can lead to delays in project delivery	Low	The project coordinator will set up regular bilateral calls with work packages leaders to supplement the regular project communication strategy. This approach will allow any issues to identified early thereby minimising their impact on the overall project.

3.4 REGULATORY RISKS

TABLE 4: REGULATORY RISKS

#	Risk	Description	Rating	Mitigation
R.4.1	Delays in permitting due to novelty of the project	This may arise due to insufficient knowledge of the hydrogen value chain. This can result in delays to the project timeline.	Medium	The project team should identify and engage with relevant permitting bodies across islands to agree on permitting process. A scoping exercise can be conducted with the permitting body and a permitting specialist to assess the required permits during the project feasibility phase.

#	Risk	Description	Rating	Mitigation
R.4.2	Insufficient acquisition of public subsidies	As noted in section XXX, although a budget has been earmarked for the development of the zero-carbon economy across the islands, the availability of the funding mechanism through which the funding will be distributed in unclear.	High	The project feasibility phase should aim to improve the project maturity to enable applications for European funding programmes, for both capital funding (e.g., Innovation Fund small-scale projects) and operational funding (e.g., the EU Hydrogen Bank Innovation Fund Auction). Additionally, the project knowledge sharing plan should include targeted advocacy with key national and local policymakers, to further develop the existing Estonian Hydrogen Policy funding grant execution. Where necessary, the project can also utilise mitigation actions for risk R.2.1.

4. WORK STRUCTURE

4.1 WORK PLAN

4.1.1 OVERVIEW

TABLE 5: WORK PLAN OVERVIEW

#	Work package (WP)	Task breakdown	Suggested deliverables
1	Project Management	T1.1 Detailed project management plan T1.2 Detailed project budget and business plan T1.3 Project coordination T1.4 Financial administration T1.5 Project reporting	D1.1 Detailed project management plan D1.2 Detailed project budget D1.3 Annual project progress reports D1.4 Final project report
2	Feasibility study	T2.1 Feasibility study for hydrogen supply and distribution T2.2 Feasibility study for ferry deployments T2.3 Feasibility study for road vehicle deployment	D2.1 Feasibility report – hydrogen supply and distribution D2.2 Feasibility report – ferry deployments D2.3 Feasibility report – road vehicle deployment D2.4 Compiled feasibility report
3	Engineering studies	T3.1 Project permitting T3.2 Pre-FEED T3.3 FEED and detailed engineering	D3.1 Environmental Impact Assessment D3.2 Environmental and building permits D3.3 Grid connection permits D3.4 Pre-FEED report D3.5 Basic Design and Engineering Packages
4	Commercial preparation for Phase 1 deployment	T4.1 Tendering for electrolysers T4.2 Tendering for hydrogen refuelling infrastructure T4.3 Tendering for ferries T4.4 Tendering for buses T4.5 Tendering for cars T4.6 Tendering for refuse collection vehicles (RCVs)	D4.1 Purchase orders for electrolysers D4.2 Purchase orders for ferries D4.3 Purchase orders for buses D4.4 Purchase orders for cars D4.5 Purchase orders for RCVs
5	Technical preparation for	T5.1 Development of maintenance package	D5.1 Maintenance and operational procedures for fuel cell vehicles

#	Work package (WP)	Task breakdown	Suggested deliverables
	Phase 1 deployment	T5.2 Development of operational procedures T5.3 Development of operational plan T5.4 Training of vehicle operators and maintenance personnel	D5.2 Maintenance and operational procedures for electrolysers D5.3 Maintenance and operational procedures for hydrogen refuelling infrastructure
6	Finalisation of commercial structuring	T6.1 Power sourcing agreements T6.2 Site contracts	D6.1 Cover pages of signed agreements
7	Phase 1 deployment	T7.1 Electrolyser deployment T7.2 HRS deployment T7.3 Vehicle deployment	D7.1 Input into annual progress reports
8	Communication and knowledge sharing	T8.1 Finalisation of project knowledge sharing plan T8.2 Creation of dissemination materials T8.3 Targeted dissemination tasks aiming at key groups T8.4 Collaboration with educational institutions	D8.1 Knowledge sharing plan D8.2 Project website D8.3 Press releases D8.4 Conference presentation materials

4.1.2 DETAILED DESCRIPTIONS

WP1: Project Management

This work package concerns the overall coordination of the project and day-to-day project management activities to ensure work progresses to programme, milestones are met, and deliverables are completed.

Task 1.1: Detailed project management plan – a plan further detailing how the project will be managed will be developed. This will include a final project governance structure, building on the proposal in section 4.3, a work plan with assigned task leaders and a regular cadence for project team update meetings.

Task 1.2: Detailed project budget and business plan – This task involves the further refinement of the project's existing budget, to assess the overall viability of the project ahead of the Final Investment Decision.

Task 1.3: Project coordination – the overall coordination covers the range of tasks required to monitor progress, ensure that the project is adhering to its deliverables and timeline, monitor risks and implement mitigation strategies where issues arise. The project coordinator will maintain a live project plan, with a description of all the tasks and objectives, updated over time, and an active risk register, to be updated regularly after each project management-related meeting. The project coordinator will act as the main go-to to resolve any issues that may arise throughout the project.

Task 1.4: Financial administration – the project coordinator will coordinate all financial aspects of the project, ensuring that all work packages are performing to budget and are not over-running on cost. Any risks associated with project costs will be noted in the project risk register, with appropriate corrective actions identified. The project coordinator will raise any issues that exceed agreed project tolerances to the steering committee.

Task 1.5: Project reporting – at the end of the feasibility phase, a feasibility report will be produced as an output of WP2. Additionally, once into operation, the project will generate annual progress reports, detailing the status of the project against key timelines and a summary of the financial expenditure on the project to-date. A final project report will be produced at the end of this project summarising the overall project achievements against its objectives, the performance of each of the work packages and the partners involved in them and the main findings of the project. A public summary of this reports will also be made available at the close of the project.

WP2: Feasibility study

This work package involves all the activities required to assess the technical, commercial, and operational feasibility of the project.

Task 2.1: Feasibility study for hydrogen supply and distribution – this task will involve:

- Developing scheme designs for the hydrogen production plants
- Selecting electrolyser technology
- Finalising hydrogen distribution strategy
- Sizing the key equipment across the value chain, including hydrogen storage, and any required pipelines
- Articulating cost, labour, and time requirements associated with constructing and operating the facility
- Identifying suitable sites for electrolyser installation and ranking them based on different parameters with the aim to ultimately select the most suitable option

Task 2.2: Feasibility study for ferry deployments – this task will involve:

- Initiating supplier engagement with vehicle OEMs
- Initiating supplier engagement with bunkering infrastructure providers
- Finalising the routing and refuelling requirements at each location

Task 2.3: Feasibility study for road vehicle deployment – this task will involve:

- Initiating supplier engagement with vehicle OEMs
- Sizing hydrogen refuelling station requirements across islands
- Initiating supplier engagement with hydrogen refuelling station providers
- Articulating cost, labour, and time requirements associated with constructing and operating the hydrogen refuelling stations
- Identifying suitable sites for HRS installation and ranking them based on different parameters with the aim to ultimately select the most suitable option

WP3: Engineering studies

Task 3.1: Project permitting – the task leader will work with the Estonian permitting authorities to identify the required permits for the project's development, construction and operation. This tank will also involve the:

- Preparation of any associated studies such as Environmental Impact Assessments that will feed into the permitting process.
- Continuous engagement with the Estonian permitting authorities to respond to questions and share information on the project.
- Application for the relevant permits
- Engagement with emergency services in the region, e.g. fire services, to introduce the project and highlight any required services.

Task 3.2: Pre-FEED – within this task, the task leader will work to down-select the technologies identified in the feasibility phase.

Task 3.3: FEED and detailed engineering – this task will involve the preparation of the necessary engineering documents, such as the Basic Engineering and Design Package and the Basis for Design. The work package lead can identify the need to source a contractor to support this task during the feasibility phase.

WP4: Commercial preparation for Phase 1 deployment

The equipment to be utilised in the project will be procured through a competitive tender process, covering the hydrogen production, distribution and the end uses (ferries, buses, RCVs and cars). The selection criteria for the tendering process will be determined as part of the feasibility study phase.

Task 4.1: Tendering for electrolysers – the task leader will lead the preparation of procurement documentation for 3 MW stacks (requirement for the first phase of deployment from electrolyser suppliers, according to the project distribution (see section XXX). The document will be checked by the project manager who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the electrolyser supplier, the task leader will lead the preparation of documents for contract signature with the selected supplier, and coordinate with the supplier on all activities required to ensure the timely delivery of equipment to the selected locations.

Task 4.2: Tendering for hydrogen refuelling infrastructure – fixed hydrogen refuelling stations with capacity of XXX kg/day will be required in Kuivastu, Kuressaare and Heltermaa. Bunkering facilities will be required at the ports of Roomassaare, Ringsu and Munalaid. Within this task, the task leader will prepare the procurement documents for the required refuelling capacity in the first phase. The document will be checked by the task leader who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the refuelling equipment supplier(s), the task leader will lead the preparation of documents for contract signature with the selected supplier(s), and coordinate with the supplier(s) on all activities required to ensure the timely delivery of equipment and construction of the refuelling infrastructure.

Task 4.3: Tendering for ferries – the task leader will lead the preparation of procurement documentation for the three ferries deployed in the first phase from ferry OEMs, according to the vehicle specifications previously. The document will be checked by the task leader who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the ferry supplier, the task leader will lead the preparation of documents for contract signature with the selected supplier, and coordinate with the supplier on all activities required to ensure the timely delivery of equipment to the State Fleet authority.

Task 4.4: Tendering for buses – Energy Agency will lead the preparation of procurement documentation for the sixteen county buses, seven school buses and eight intercity buses to be deployed in the first phase from bus OEMs, according to the vehicle specifications outlined in section XXX. The document will be checked by the project manager who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the bus supplier(s), agency will lead the preparation of documents for contract signature with the selected supplier, and coordinate with the supplier on all activities required to ensure the timely delivery of equipment to the municipalities.

Task 4.5: Tendering for cars – Energy agency will lead the preparation of procurement documentation for the thirteen cars to be deployed in the first phase from bus OEMs, according to the vehicle specifications outlined in section XXX. The document will be checked by the project manager who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the car supplier(s), agency will lead the preparation of documents for contract signature with the selected supplier, and coordinate with the supplier on all activities required to ensure the timely delivery of equipment to the municipalities/contractor.

Task 4.6: Tendering for refuse collection vehicles (RCVs) – operating contractor will lead the preparation of procurement documentation for the four refuse collection vehicles to be deployed in the first phase from bus OEMs, according to the vehicle specifications outlined in section XXX. The document will be checked by the energy agency who will release the tender, evaluate submissions, and select the equipment supplier. Following the selection of the RCV supplier(s), operator will lead the preparation of documents for contract signature with the selected supplier, and coordinate with the supplier on all activities required to ensure the timely delivery of equipment to the operating contractor.

WP5: Technical preparation for Phase 1 deployment

Before the first phase of deployments, the supporting system for the hydrogen vehicles needs to be established. This work package aims to prepare the maintenance providers and vehicle operators for the operation of hydrogen vehicles.

Task 5.1: Development of maintenance package – the task leader will work with the selected vehicle suppliers to develop a plan for how regular bus maintenance and breakdown repair will be performed. This task will be sub-divided according to each mobility mode deployed. It is expected that the vehicle operators will take on all regular maintenance and minor repair work, but the vehicle suppliers will provide support for any major repair work as part of the tender. Plans will be developed for the transport operators to hold spare parts locally, to minimise downtime in the event of a breakdown. A training strategy will be developed to set out the level of training required for various technicians (and how many technicians at each level of expertise will be required), and how this training will be delivered, including trainers, timelines, equipment needed, and certification for technicians who have completed training.

Task 5.2: Development of operational procedures – here, the task leader will work with the transport agency to develop the instructions for the drivers operating the vehicles. These procedures will be used in training the vehicle operators in Task 5.4.

Task 5.3: Development of operational plan – although operational routes have been identified within this work, the operational plans for each mobility modes (including routes, refuelling frequency, mitigation options in case of vehicle unavailability etc) will need to be developed.

Task 5.4: Training of vehicle operators and maintenance personnel – training for the vehicle operators will be provided as part of the package from OEM suppliers. In this task, the training strategy developed in Task 5.1 will be executed and overseen by the task leader.

WP6: Finalisation of commercial structuring

Within this work package, the task leads will finalise the contracting required for phase 1 deployments.

Task 6.1: Power sourcing agreements – this task involves the finalisation and signature of the power sourcing agreements, especially for supply to the multiple electrolyser sites.

Task 6.2: Site contracts – this task involves the final negotiation on the locations across which the project equipment will be sited before parties reach the definite agreement on terms discussed and sign the contracts.

WP7: Phase 1 deployment

Task 7.1: Electrolyser deployment – this task includes the construction, commissioning and operation of the multiple electrolyser deployments.

Task 7.2: HRS deployment – this task includes the construction, commissioning and the day-to-day operation of the multiple hydrogen refuelling stations.

Task 7.3: Vehicle deployment – this task involves the delivery of the vehicles to the operators and their operation. The vehicle operators will be responsible for the day-to-day operation and maintenance of the vehicles.

WP8: Communication and knowledge sharing

Task 8.1: Finalisation of project knowledge sharing plan – within this task, the task leader will further develop the final communication strategy and knowledge sharing plan for the project.

Task 8.2: Creation of dissemination materials – the project will work to increase public acceptance and support for the production and use of low-carbon hydrogen in public transport by creating a project brand and regularly publishing public materials on project progress and results. This will include press releases at key points in the project, and regular reports on the learnings from the project.

Task 8.3: Targeted dissemination tasks aiming at key groups – this task will involve the execution of the targeted dissemination activities outlined in the knowledge sharing plan (a draft of which is in section 5).

Task 8.4: Collaboration with educational institutions – educational institutions such as the University of Tartu and TalTech are expected to play key roles in ensuring local buy-in for a hydrogen ecosystem and developing a local pool of hydrogen literate technicians.

4.2 PROJECT SCHEDULE

The following schedule has been proposed for the implementation of the project's work plan.

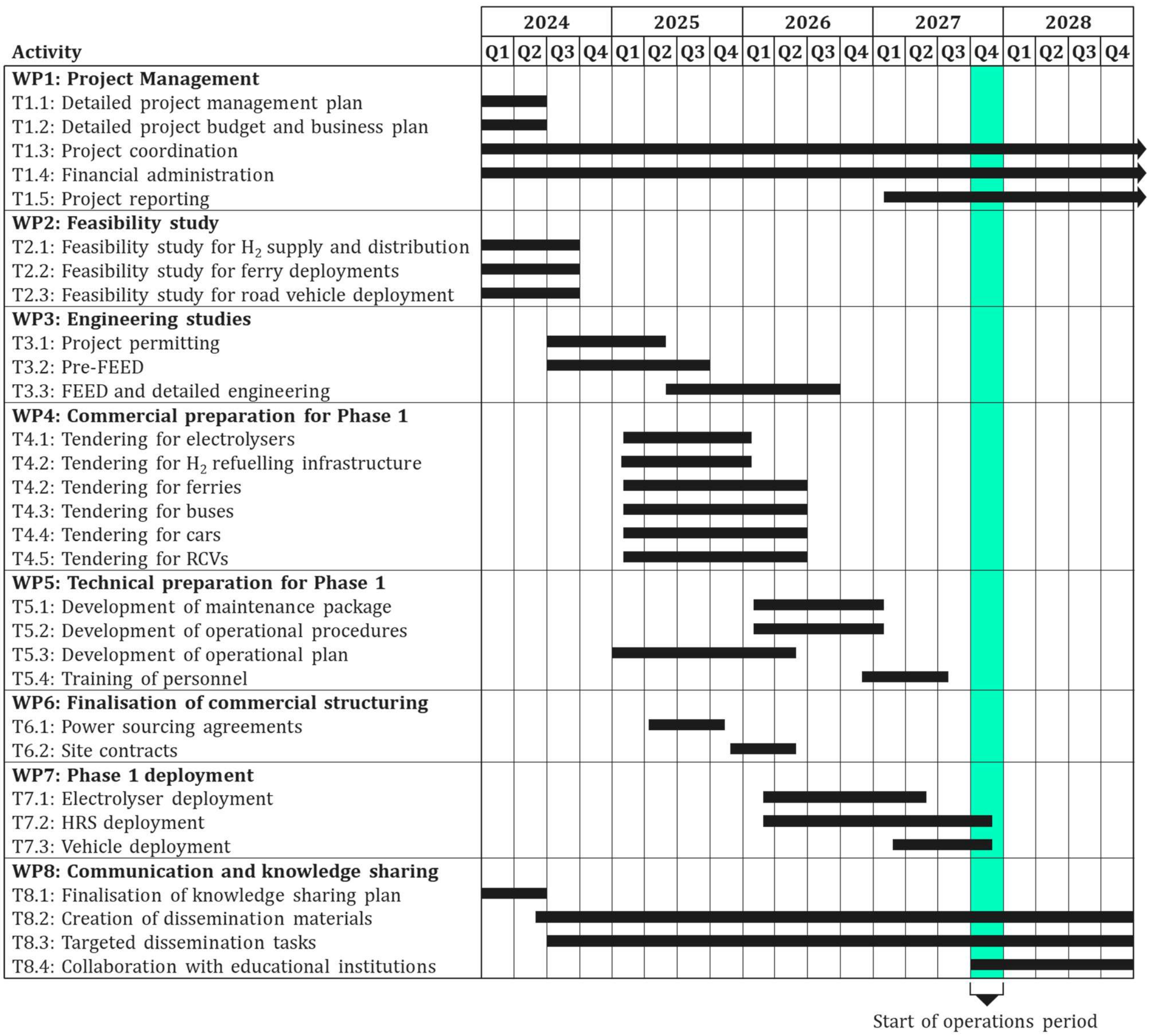


FIGURE 9: PROPOSED GANTT FOR THE PROJECT PHASE 1 DEPLOYMENT

4.3 PROJECT GOVERNANCE

The below graphic shows the project governance structure, individuals involved, and their management responsibilities.

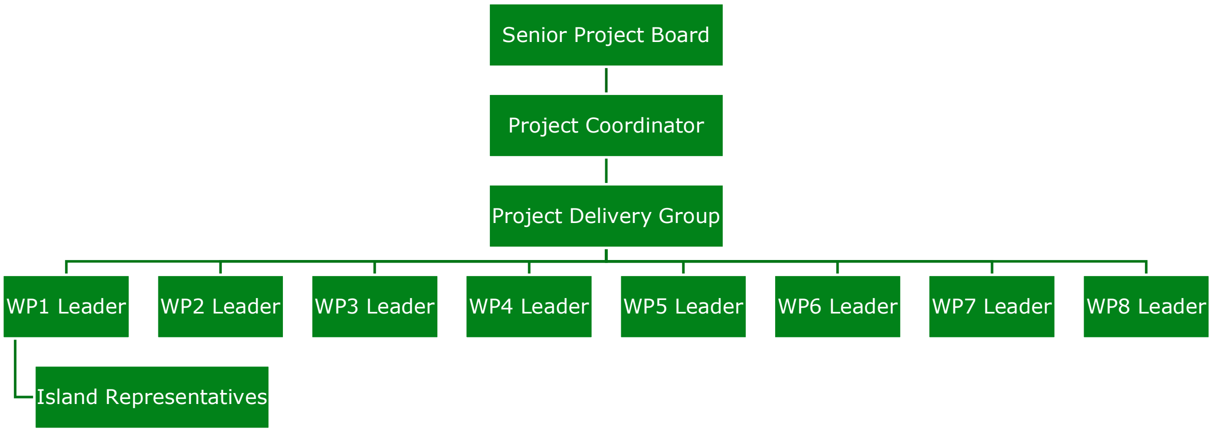


FIGURE 10: PROPOSED PROJECT GOVERNANCE STRUCTURE

The Project Coordinator will be responsible for:

- Preparing and maintaining the project plan and risk register.
- Ensuring planned milestones are reached in line with the project plan.
- Ensuring that reports are published in line with the project plan.
- Communicating regularly with consortium members bilaterally to monitor progress.
- Organising regular Project Delivery Group meetings with work package leaders to monitor progress.
- Organising and chairing Senior Project Board meetings.
- Ensure effective communication with all of the local stakeholders in the demonstration project (local residents, the planning department, first responders, hydrogen end-users etc.).
- Mediate in any issues that may arise either between project partners, or between project partners and external stakeholders.

The day-to-day management of the project will be undertaken by a Project Delivery Group comprised of the leaders of each of the work packages and the Project Coordinator. This group will meet at least every two weeks to review progress across each of the work packages and ensure that the project is delivering against the agreed timescales and action plan. This meeting will allow work package leaders to align and coordinate on work being undertaken across the boundaries of work packages.

The project implementation plan has been broken down into work packages, each with a work package leader. The work package leader and leaders for each task will be assigned by the project coordinator before the project begins. The work package leader will be responsible for delivery of tasks contained within that work package and reporting the progress of the work package against the agreed timescales and action plan to the Project Delivery Group. Work package leaders will convene meetings with those involved in the delivery of the work package as required to ensure progress.

4.4 DECISION-MAKING PROCESS

The decision-making process for this project is linked to the project governance structure described above:

1. Work package leaders will have the authority to make decisions affecting the work package for which they are responsible and related deliverables, subject to confirmation with the project coordinator. The coordinator must ensure that major decisions at the work package level are in-keeping with the overall objectives and progress of the project, and this should include communicating with the Senior Project Board when appropriate (see point 3). The coordinator must also ensure that the impacts of decisions at the work package level are communicated to other relevant work package leaders.
2. The Project Coordinator will have the authority to make day-to-day decisions affecting the project as a whole and is responsible for raising major decisions to the Senior Project Board. The Project Coordinator must communicate key outcomes of these decisions to the relevant work package leaders.
3. Major decisions affecting the project (changes to project scope, consortium formation, or budget) will be put to a majority vote at the Senior Project Board meetings.

5. KNOWLEDGE SHARING STRATEGY

5.1 OBJECTIVES

This project is innovative in its demonstration of a multimodal hydrogen mobility ecosystem across multiple island economies. The knowledge sharing strategy has been formulated to maximise its impact on future hydrogen projects and facilitate the necessary socio-political conditions for its operation. The objectives of the strategy are as follows:

- Record and share lessons learnt from the planning, execution and operational phases of the project with other industry stakeholders to inform the approach taken in subsequent initiatives. This will include technical learnings from supplier-provided maintenance training packages.
- Ensure buy-in for the use of hydrogen from the residents across islands and local public transport operators, refuse collection companies and the supporting value chain (i.e. technicians, vehicle workshops etc.)
- Develop relevant skills and hydrogen literacy in the regions of work by upskilling workers during the design, construction and operational phases of the project.
- Capitalise on regional hydrogen development (e.g. across Estonia, central and eastern Europe) by establishing connections and sharing lessons learnt with other project developers.

5.2 KEY MESSAGES

The knowledge dissemination will focus on the following points (which will be revised and updated as the project progresses):

- **The relevance of hydrogen to Estonian island economies.** The availability of renewable energy developments is a key driver for this project. The simultaneous roll-out of the hydrogen economy with the scale up of the renewable energy production will position the Estonian islands as a hydrogen hub leading the deployments of multiple modes of hydrogen mobility. In addition to decarbonising its public transport system, this project will enable the Estonian islands to participate in the growing hydrogen initiatives across Europe, including the BalticSeaH2.
- **Project objectives and key timelines.** This project requires collaboration across a wide range of stakeholders, from the operators to the local island leadership. As such, the role of each project partner, the project objectives and timelines for deployment across each island will need to be communicated through bilateral engagements and publicly through media, e.g. press releases.
- **Business for the operation of hydrogen mobility.** This project will demonstrate the economic viability of a hydrogen-fuelled public transportation system across Estonian islands. The results of this demonstration and the assumptions behind the project business case, such as the cost of the hydrogen fuel, costs of the vehicles, etc., will be communicated to the relevant stakeholders.
- **Enablers of the hydrogen economy on Estonian Islands.** As previously identified in section 3, there are several factors that will form the foundation of a strong hydrogen economy on the Estonian islands. The policy environment, availability of skilled workers and stakeholder buy-in are among some of the key enablers that should be communicated within the knowledge sharing plan.
- **The collaboration across islands to develop and operate the project.** This project can see collaboration across multiple industry players, including end users, project developers and equipment suppliers. It will also involve collaboration and consistent engagement across stakeholders on multiple islands.

5.3 DISSEMINATION MATERIALS/ACTIVITIES

The project consortium will lead a campaign to disseminate its learnings to a targeted list of audiences. This will be facilitated by a communications group that could be led by the islands energy agency and its membership can be comprised of specialists provided by project consortium members. This group will maintain direct communication with workstream leads through periodic meetings to collect information on dissemination and by communicating with workstream leads on the production of outputs, such as the project learning reports. The communication group will also be represented at the monthly steering committee meetings.

The project communication group can utilise the following means for knowledge sharing:

- A website and social media presence (e.g. X – formerly Twitter, LinkedIn)
- Regular press releases noting significant project milestones and ensuring that the project is highly visible to industry participants. Project-organised events such as workshops, open days should also be publicised.
- Guest lectures at institutes such as the University of Tartu, TalTech, Kuressaare Vocational Institute.

- Presentations on project learnings at conferences such as the Clean Energy for EU Islands forum.
- Onsite workshops or site visits, where visitors can observe from a safe distance the project operation and discuss with technical leads the project's key objectives.
- Vehicle demonstrations, where the first hydrogen vehicles purchased can be made available at a site for interested operators to observe and question a technical lead on its operation.
- Project progress summaries outlining the project's achievements at milestones, such as start of operations or after the first year of operations. As the project develops and aims to apply for public funding, this deliverable can be aligned to the funding requirements.
- Project learnings on themes, such as technical learnings on vehicle operation, policy requirements for further deployments and operational learnings developed with vehicle operators on driver's experiences with the vehicles.
- Roundtable discussions with island and national policymakers presenting project learnings or any of the project deliverables.

The Estonian islands are also site to ongoing hydrogen engagement. The project can utilise the following opportunities for collaboration, as described in Table 6.

TABLE 6: OPPORTUNITIES FOR COLLABORATION FOR KNOWLEDGE SHARING

Activity	**Description**	**Owning body**	**Potential collaboration**
Online hydrogen course	Course planned to commence from 2024	University of Tartu	• Provision of case studies based on project operation. • Collaboration with island development authority to maximise reach of course
Mobile workshops	An application has been made for a truck to be purchased for use as a mobile classroom, providing workshops on specific energy-related topics.	Taltech Kuressaare	• If the purchased truck is hydrogen-fuelled, the project can provide fuel for its operation. • The project can develop a workshop for the truck. This workshop can be advertised to stakeholders across the value chain. • Project representatives can also collaborate with other hydrogen deployments in

Activity	Description	Owning body	Potential collaboration
			neighbouring regions to deliver the project workshop.
Hydrogen hub in the Centre for Technology	There is a planned higher education course focusing on hydrogen. This course is to be delivered at Taltech, University of Tartu and EA.	Taltech, University of Tartu and energy agency	• Provision of guest lectures • Organisation of on-site workshops
Hydrogen working group	There could be collaboration among island energy stakeholders to form a hydrogen working group to address relevant value chain concerns, such as availability of skilled personnel.	Potentially Taltech, Island Development Authority, University of Tartu, Estonian Hydrogen Association	• Collaboration within working group for funding from e.g. interreg sources to send local technicians to learn from international hydrogen operations, e.g. other island deployments.

5.4 DISSEMINATION STRATEGY

Table 7 outlines a proposed strategy that can be used to maximise the impact of the project learnings.

TABLE 7: PROPOSED DISSEMINATION STRATEGY

Target Audience	Reason for Engagement	Key messages	Activities
Transport sector operators	To generate interest in the use of hydrogen and communicate the business for the operation of hydrogen-fuelled vehicles.	• Technical descriptions of hydrogen technologies • Overall business case for each hydrogen-fuelled transport mode • Project objectives and timelines	• Vehicle demonstrations • Conference presentations • Bilateral presentations on project learnings and summaries • Collaboration with universities to expand transport operators' involvement in hydrogen courses and

Target Audience	Reason for Engagement	Key messages	Activities
			attendance at mobile workshop
Local and national policymakers	To provide information on the value of hydrogen technology in supporting the transition of the mobility sector to low carbon fuels.	• Relevance of hydrogen to Estonian island economies • Required collaboration across islands • Policy enablers for the hydrogen economy • Project objectives	• Site visits • Roundtable/bilateral discussions • Collaboration with Taltech to invite policymakers to mobile workshops
Technicians and maintenance providers	To introduce the required skills for working with hydrogen technologies.	• Technical descriptions of hydrogen technologies • Business case for the operation of hydrogen mobility	• Collation of technical lessons learned to inform a workshop. • Collaboration with hydrogen working group to facilitate training programmes for interested technicians. • On-site workshops/visits • Collaboration with Taltech and University of Tartu to advertise hydrogen courses to interested technicians
Universities and educational institutions	To support development of hydrogen expertise and high-level research and innovation activities to meet existing needs in the green hydrogen field.	• Enablers of hydrogen economy • Relevance of hydrogen to local economies • Technical description of hydrogen technologies	• Guest lectures and provision of case studies • Collaboration with Taltech, University of Tartu and SEA within the Hydrogen hub in the Centre for technology in Estonia

Target Audience	Reason for Engagement	Key messages	Activities
Local authorities/permitting agencies	To discuss and resolve issues surrounding planning and permitting for the project.	• Project objectives and timelines • Technical descriptions of hydrogen technologies	• Regular communications and meetings between project team and authorities
Hydrogen value chain developers	To stimulate investment across hydrogen value chain and de-risk the future deployment and operation of hydrogen projects.	• Project objectives and key timelines • Enablers of hydrogen economy across Estonian islands • Required collaboration to deliver hydrogen economy	• Conference presentations • Press releases • Vehicle demonstrations • Project progress summaries • Project learning dissemination
Influential organisations in hydrogen development, e.g. Hydrogen Europe, trade bodies	To build credibility of hydrogen ecosystem deployments on islands.	• Project objectives and key timelines • Enablers of hydrogen economy across Estonian islands	• Press releases • Conference presentations
General public	To generate support for the development of hydrogen projects across islands.	• Project objectives and key timelines • Relevance of hydrogen to local economy • Enablers of hydrogen economy across Estonian islands • Required collaboration to deliver hydrogen economy	• Press releases • Social media presence • Vehicle demonstrations • Conference presentations • Collaboration with Taltech and University of Tartu to advertise hydrogen courses and hydrogen hub