



CASE STUDY

ARGYLL HYDROGEN HUB MULTIDISCIPLINARY TECHNICAL SERVICES

**CLIENT: GREENPOWER
HYDROGEN LTD**

LOCATION: SCOTLAND

Highlights:

- Masterplanning
- Occupied Building Design
- Blast Rated Building Design
- Civil Infrastructure



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CONTEXT

On behalf of our client, GreenPower Hydrogen Ltd, Arthian formed a multi-disciplinary design team and demonstrated the feasibility of a green hydrogen production, storage and dispensing facility on the west coast of Scotland.

Arthian was appointed by GreenPower Hydrogen Ltd to deliver a green hydrogen production, storage and dispensing facility on two serviced plots totalling 0.86ha at Glenshellach Industrial Estate, Oban. To deliver our client's requirements, we compiled and managed an experienced, integrated, multi-disciplinary team comprising engineers, architects and other specialists.

At the time of writing, the scheme is submitted to the local authority (Argyll & Bute Council) and their statutory consultees for detailed planning approval and Hazardous Substances Consent.



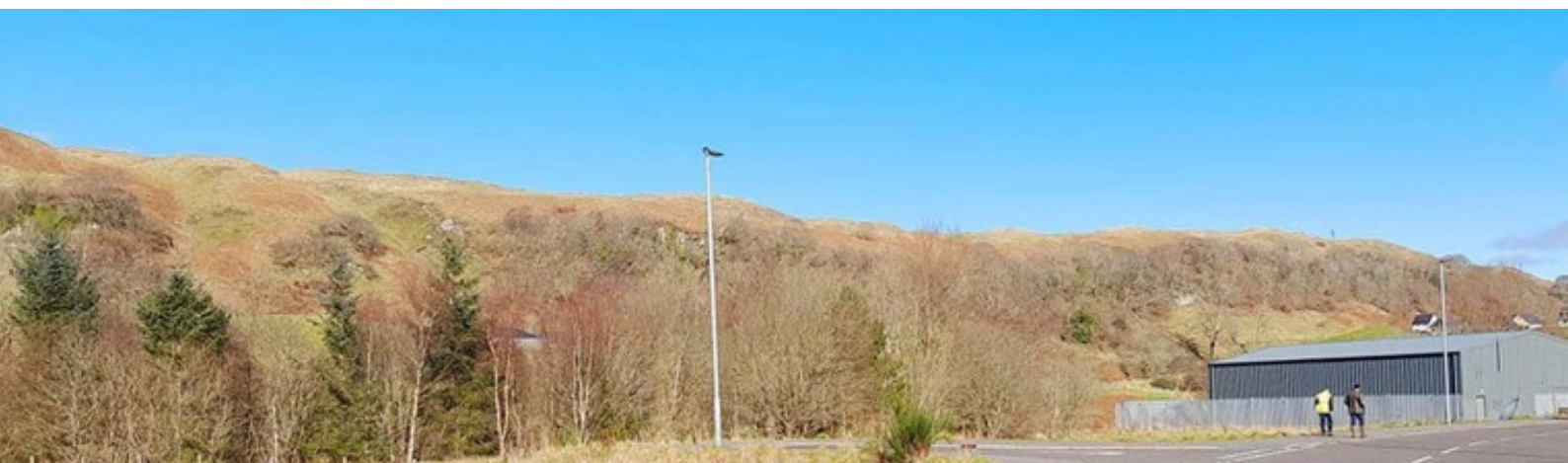
THE CHALLENGE

GreenPower Hydrogen aspires to augment their existing sustainable energy (wind) portfolio with a green hydrogen production, storage and dispensing facility. GreenPower Hydrogen identified the site at Plot 3 & 4, Glengallan Road, Glenshellach Industrial Estate, Oban and entered into missives with Highland and Islands Enterprise.

The opportunities for wholesale supply of green hydrogen to the immediate area includes commercial road users such as hauliers and public service vehicle operators and energy infusion to the local independent gas network. Longer term opportunities include supplying alternative transport means and delivery to large-scale users by pipeline (with bunkering within customer's premises) as opposed to by road-going container. Road users will have hydrogen fuel dispensed into fuel cells in an arrangement like a traditional filling station.

GreenPower Hydrogen appointed Arthian because of their more than 25 years' experience delivering complex engineering solutions within high- hazard, COMAH and DSEAR environments to deliver the project scope as below.

- Development of a site layout, considering storage volumes, production rates and processes, existing site constraints and internal configuration;
- Utilising the agreed layout to identify the technical deliverables required for a valid planning application and production of the same; and
- Submission of an application for detailed planning permission to Argyll & Bute Council and an application for Hazardous Substances Consent to the Health and Safety Executive via Argyll & Bute Council.



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THE SOLUTION

Arthian formed a team with expertise in industrial site masterplanning and in green hydrogen production. Their team was managed internally. Its initial objectives included:

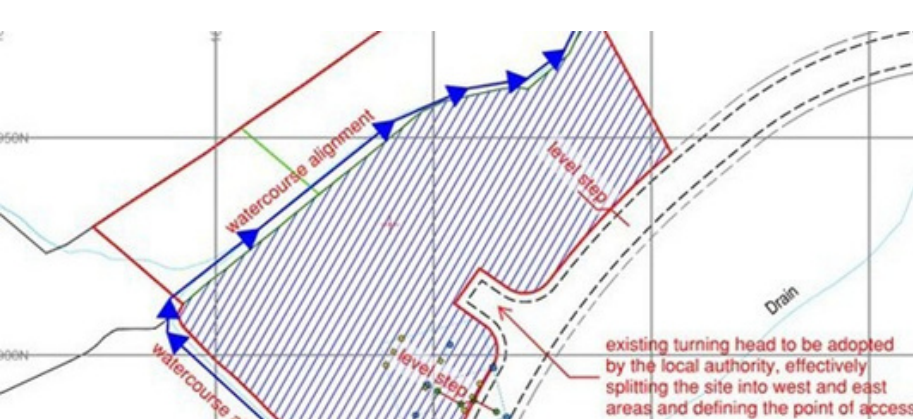
- To thoroughly understand their client's aspirations,
- To formalise a project team structure to ensure effective communication between all members, and
- To refamiliarise themselves with the latest guidance and the regulatory framework for green hydrogen assets.

Additionally, Arthian's design team considered the strengths and weaknesses (relative to the project) of currently available electrolyser types and made recommendations to their client regarding the number of electrolysers, ancillary plant, and their spatial distribution across the site.

A principal challenge in delivering the scheme was the size, shape and existing features surrounding the site. As illustrated in the graphic below, these included the existing turning head, existing watercourses and the site levels relative to the public road.

Considering the capital cost of delivering the scheme, Arthian satisfied themselves that an efficient and effective site layout was possible without major disruption to the site's existing features. The site layout is illustrated in the supporting imagery.

The team was also challenged to predict the demand for green hydrogen with enough accuracy to (1) avoid proposing a scheme whose capacity would quickly be exceeded by demand, and (2) to ensure proper positioning within the tiers specified in the COMAH guidelines.



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THE SOLUTION

Arthian evaluated the demand for gas in the local network using data supplied by the network operator. This included a review of annual, monthly and daily demands and peaks, and seasonal and daily fluctuations. Arthian also considered:

- The effects of a volume-equivalent or energy-equivalent percentage infusion into the gas network,
- Appropriate volumes to be stored for an unplanned 5-day or 7-day production shutdown, and
- The impact of varying numbers of green hydrogen fuelled HGV's and PSV's on production rates and buffer volumes and pressures.

Our assessment allowed the number of electrolyzers, the number and capacity of vessels and containers, and their varying pressures to be determined. It also allowed the duty/standby operational hours for each electrolyser to be quantified. In turn, this allowed GreenPower Hydrogen to include these factors in their operational cost modelling.

Green hydrogen is generally defined as 'hydrogen, the production of which is powered solely by renewable energy'. GreenPower Hydrogen's Argyll Hydrogen Hub is meeting this criterion using power from wind farm assets in the area.

Arthian has, however, investigated if greater efficiency and sustainability can be embedded into the production process, and two areas were identified:

- **Water:** As opposed to depleting already stretched water company resources and risking a detrimental effect on levels of service to existing water company customers, the scheme is testing whether water may be drawn from a watercourse, appropriately treated and used from green hydrogen production. Similarly, as the detailed design progresses, consideration will be given to re-use of water that is ejected from the production process. Early indications suggest this may be used without negative effects for non-potable water purposes within the site and management building.
- **Oxygen:** Oxygen is a principal by-product of green hydrogen production. Within the Oban area, Oxygen is in high demand for use in fish- and shellfish-farming. Our scheme includes proposals to capture the oxygen by-product and make it available in cryogenic form to users using road-going containers.



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THE SOLUTION

Arthian's multi-disciplinary team delivered the following services:

- Design team management/ Project coordination
- Principal Designer
- Civil and Structural Engineering
- Architectural Masterplanning
- Process and Mechanical, Electrical, Control and Instrumentation Design
- Environmental and Ecological Appraisal

Our deliverables supported an application for planning permission and for Hazardous Substances Consent.

Additionally, our deliverables at stages throughout the design phase and our final deliverables supported GreenPower Hydrogen in formulating their operational approach to Argyll Hydrogen Hub.

Our solution delivers the familiarity of an everyday filling station with the enhanced safety and security of a segregated green hydrogen production plant. It is inherently flexible to accommodate advances in technology throughout the design phase and can accommodate spatial changes as safety is reviewed at each project milestone.

Our safety systems for the development are intrinsic, passive and active, and include a blast-resistant management building and production area enclosure, ventilation and the avoidance of locations where gas 'pocketing' presents a risk. Active safety systems include audible leak detection and infrared flame detection, all interconnected with remote shut-off systems.



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SPECIFIC DETAILS OF OUTCOME

At the time of writing Arthian and GreenPower Hydrogen are watching the development move through the Scottish planning system. It is not unrealistic to imagine that, by the time of inaugural Hydrogen Awards, the development will have secured planning consent.

In the meantime, we look forward to engaging in the discussions that a unique development such as this engenders. We anticipate further questions from the local authority, suppliers and other interested parties and to addressing those using Arthian's extensive experience in new build and inspection and maintenance works in high-hazard environments and the renewables sector and GreenPower Hydrogen's experience in the operation of renewables sites.

The submission of a planning application for a development of this nature is, in itself, a significant step in realising future sustainability-centred developments, with the discussion and valid technical scrutineering the proposals will receive paving the way for accelerated progress from concept to reality for this and future green hydrogen delivery projects.

Arthian first engaged with GreenPower Hydrogen in October 2022 and evidenced the skills, experience and technical capability to deliver our first green hydrogen scheme. Their multi-disciplinary team joined us on a learning journey which has resulted in an innovative scheme which we're happy to have tested by Argyll and Bute Council while we map out our future steps towards commencement of construction and commissioning of Argyll Hydrogen Hub."



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