



# Hazer Process

## Commercial Demonstration Plant

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ARENA Lessons learnt report #1

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## PROJECT DETAILS

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## PROJECT OVERVIEW

The Hazer Process is a novel method to produce low emissions hydrogen from a renewable form of methane. The process utilises methane as a feedstock to produce hydrogen – without producing CO<sub>2</sub> in the reaction process – instead capturing the carbon in the feedstock as solid graphite.

The Hazer Process Commercial Demonstration Plant (CDP) is the first scaled-up, fully integrated deployment of the Hazer Process. The CDP will use biogas from the Woodman Point municipal wastewater treatment plant as feedstock to create hydrogen and solid graphite.

The Project is situated within the boundaries of the Woodman Point wastewater treatment plant, located in the suburb of Munster in the City of Cockburn, Western Australia. Woodman Point wastewater treatment plant is owned and operated by the Water Corporation – Western Australia's public water utility responsible for potable water supply and the collection, treatment, and disposal of wastewater amongst other things. The treatment plant is the largest wastewater treatment plant in Western Australia, it currently treats wastewater for a population of about 680,000 (approximately 135 Megalitre per day) living in the south metropolitan area of Perth.

## KEY LEARNINGS

### Lesson learnt No. 1: Contracting Strategy

**Category:** Technical / Commercial / Risk

**Objective:**

Demonstrate the full integration of all required process operations on a continuous operational basis to produce commercial grade hydrogen and graphite products from biogas.

**Detail:**

As a first of kind processing facility based on a novel process, the initial process design of the plant was developed fully in-house by Hazer's Engineering Team, based on the experimental data obtained through our laboratory program and pilot testing program. As the Project progressed, a Basis of Design for the CDP was developed by

the Hazer team, and used to engage with external engineering providers to access additional engineering skills and resources.

Hazer engaged with a number of Engineering Services and Engineering Procurement & Construction (EPC) companies to assess engineering providers and also to develop contracting strategies for the Project. After careful consideration, Primero Group Ltd was engaged in July 2019 to provide engineering services via an Early Contractor Involvement (ECI) contract to develop a detailed, site-specific FEED study and commence early detailed design engineering works. During this phase Primero and Hazer jointly undertook design activities to further progress project definition based on a specific site and biogas feedstock composition, to allow the project to develop an advanced flowsheet and material & energy balance capable of supporting a well-founded project estimate and schedule. This work was undertaken on rates for service basis under an open book methodology.

In July 2020, Primero Group Ltd was appointed as the EPC contractor. The EPC contract is based on a hybrid model, with key equipment package contracted directly by Hazer, while Primero retains carriage of overall engineering and construction activities. To reflect this hybrid approach, Hazer has invested in a well-resourced and experienced Owner's Team that will ensure that project interfaces (e.g. between packages and balance of plant engineering) are well managed, and additionally ensure that engineering learnings and improvements are fed through to the ongoing process development work Hazer is undertaking (and ensure close linkages with Hazer's ongoing R&D program).

The key learnings on this item for this phase of the project are as follows:

- Engaging an experienced EPC contractor under an ECI contract provided the Hazer owner's engineering team with the required, additional resources to progress the project from initial design through to full EPC contract award;
- Due to the CDP's pioneering nature and the need for Hazer, as the process technology owner, to be closely involved in design and procurement decisions the hybrid EPC model was adopted in order to find the required balance with regard to project risks, budget and schedule certainty etc.
- An experienced and well-resourced project team can greatly reduce project risk and ensure that engineering improvements are well captured for future developments.

#### **Implications for future projects:**

As a first of kind project, with high complexity and a relatively modest budget, the choice of engineering strategy to balance risk, cost and ability to collaborate was considered essential by the Board of Hazer. The early engagement with a well-aligned engineering and construction partner allowed early project definition that supported the funding process. Engagement under a hybrid contract model recognised that a lump-sum EPC was unrealistic given the unknowns, size and scope of the project, while also providing the most transparency in changes are required during project scope.

Hazer would recommend that the contracting strategy and partner selection for emerging technology projects is closely assessed by the sponsoring companies, and that is doing so consideration is given to the full range of factors and uncertainties that may be encountered through a project's execution.

## **Lesson learnt No. 2: Approvals and Permitting**

**Category:** Social / Regulatory / Risk

#### **Objective:**

Demonstrate the full integration of all required process operations on a continuous operational basis to produce commercial grade hydrogen and graphite products from biogas.

**Detail:**

During the contract development stage between the project host (Water Corporation) and project owner (Hazer) it was identified and mutually agreed that the most appropriate approach in terms of Regulatory Approvals and Permits would be to create a so-called licence within a licence. Under this arrangement Hazer is fully and solely responsible for obtaining all Approvals and Permits required to develop, construct and operate the Hazer Commercial Demonstration Plant.

In order to mitigate any potential future risk (such as schedule delay or budget increase), Hazer engaged an external specialist consultant to assist with the development of a strategic plan to obtain required regulatory approvals and permits, as well as the subsequent execution of the developed plan. The engagement of the consultant started in November 2019, as the project progressed from the Early Contracting Involvement (ECI) towards the Engineering, Construction and Procurement (EPC) stage.

The key learnings on this item for this phase of the project are as follows:

- The engagement of a specialist, external consultant to assist with this part of the activities was very useful and valuable to create clarity on requirements, removing ambiguity and ensuring the right processes were followed correctly;
- The early engagement with relevant authorities resulted in approvals being obtained well within the estimated time frame. This contributed to significant de-risking of the Project, in particular with regard to schedule;
- The COVID-19 pandemic has impacted certain elements of the overall process to obtain required Approvals and Permitting. To date, this has not impacted the critical path of the Project schedule;
- Due to the Hazer Process being a very novel processing method, compared to existing industrial processes, in the engagement with respective authorities on this topic it was not always very straightforward to appropriately and/or correctly classify the proposed facility. This was addressed by providing additional clarification and explanation.

**Implications for future projects:**

Early engagement with regulators on well-prepared, open and genuinely transparent approach can support securing approvals in a timely manner. The early progress of project definition (see LL1 above) also allowed Hazer to engage in a meaningful way early, so that we were always able to work within established approval methodologies and processes.

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