Provaris advances Tiwi H2 project with completion of a Concept Design Study

SYDNEY: Provaris Energy Ltd (ASX.PV1, Provaris, or **the Company)** is pleased to announce it has completed a Concept Design Study for its proposed Tiwi H2 project on the Tiwi Islands (the **Tiwi H2 project**), Northern Territory, with targeted export volumes of 100,000 tonnes per annum of green hydrogen, beginning 2027.

Completion of the positive Tiwi H2 Project Concept Design Study (**Study**) establishes a clear pathway for Provaris to progress the project forward to Pre-FEED and FEED level technical, commercial, and economic studies and consideration of potential financing options. The Study reinforced several observations and outcomes from the 2021 Compressed Hydrogen Chain Scoping Study undertaken by Provaris.

Study highlights for the Tiwi H2 project include:

- Confirmation that the Tiwi H2 project is technically feasible for an integrated compressed hydrogen production and export project and utilises and proven technologies.
- First hydrogen production and export targeted for 2027, for an assumed 30-year project life.
- Total project capital cost estimate during construction is expected to be in the range of USD $4.5 to $5.2 billion, with ~70% of the project capital cost being non-compression related.
- Solar intensity on Tiwi is competitive to produce green hydrogen.
- Load following reduced additional requirement for battery and hydrogen storage.
- Compression required only 1.0 kWh per kg, this represents only a 2.0% loss in hydrogen for export.
- Desalination had a minor impact on the cost of hydrogen with <1% in terms of capex, opex and energy use or a 0.2% loss in hydrogen for export.
- Small footprint of <2 ha required for compression facilities.
- Proximity to markets benefited the delivered cost with respect to South-East Asian energy markets.
- Existing port and land access to save development time and capital.
- The Tiwi H2 project will utilise a fleet of Provaris' proprietary H2Neo GH2 carriers for distribution into South-East Asian energy markets, with the engineering and final Class approvals on track for 2023.
- Identification of social and economic benefits to the Munupi landowners and the broader Northern Territory economy, with the potential to generate ~500 construction jobs and ~100 operational roles.
- 100,000 tpa of green hydrogen export could offset ~900,000 tonnes of CO2 per annum across power generation, mobility and industrial applications.
- Provaris will now advance a partner process to seek interested groups in the areas of investment, offtake, construction and operational support to jointly develop the project.

Provaris' Managing Director and CEO, Martin Carolan, commented: *"The completion of the Concept Design Study marks a significant milestone for the Company. The continued development of the Tiwi H2 project demonstrates our confidence of the project's suitability and competitiveness as a compressed hydrogen production and export project.*

Completion of the Study enables Provaris to enter informed discussions with interested third parties about hydrogen offtake and development alternatives, including investment in or ownership of the upstream generation and hydrogen production or investment at the overall project level".

Provaris' Executive Director and Chief Development Officer, Garry Triglavcanin continued: *"Together with the lodgement of the EPA Referral, the Study delivers a detailed base case for the Tiwi H2 project to progress to further Munupi permissions, and then into the permitting, approvals, and pre-FEED for a staged development of a fully integrated green hydrogen project, with a target export volume of 100,000 tonnes per annum, level over 30 years.*

The combination of low environment impact, port infrastructure, proximity to market, and compression provides Provaris and the Tiwi H2 project with a potential first-mover advantage in the region, by targeting first exports in 2027, and has the potential to be Australia's first export project of gaseous green hydrogen."

In summary, the Study focussed on the technical parameters and estimated capital cost of the Tiwi H2 project and identified no material technical impediments to Provaris' ongoing progression of the Tiwi H2 project. Furthermore, the Study supported the merits of compression and the utilisation of Provaris' proprietary H2Neo carriers in transporting compressed hydrogen from the Tiwi H2 project to South-East Asian energy markets.

The timing and a decision to proceed to Pre-Feed level studies will be aligned with the outcome of the Tiwi H2 project's NT EPA Referral which is expected in October this year, together with further permissions and consultation on commercial terms with the Munupi Clan (the traditional landowners) on Melville Island (largest of the Tiwi Islands and location of the Tiwi H2 project).

Provaris acknowledges that its proposed Tiwi H2 Project is located on the traditional lands of the Munupi people. It is a privilege to have their support and such a close working relationship with the Munupi Landowners, Tiwi Land Council, Tiwi Plantation Corporation, NT Government, Office of Township Leasing and NT Port and Marine.

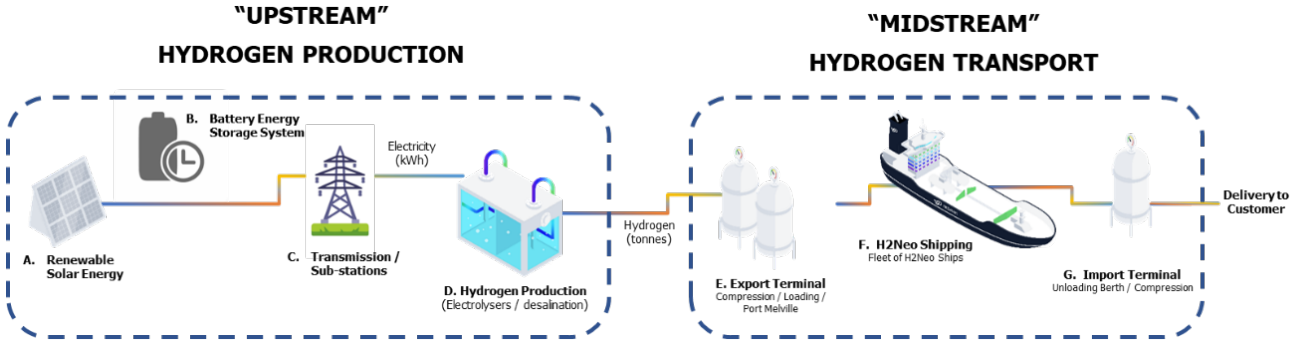
Tiwi H2 - Project Overview

The Tiwi H2 project comprises the proposed development of a 100,000 tpa green hydrogen production and export facility on Melville Island (being part of the Tiwi Islands), which is located in the most north-western part of Australia (~80km north of Darwin), Northern Territory, Australia.

Tiwi H2 Project comprises two distinct components, the first being the development of the "Upstream hydrogen production" and the second being the "Midstream hydrogen transport" to market, which under the Study is assumed to be Singapore, ~1,800 nautical miles (nm) shipping distance.

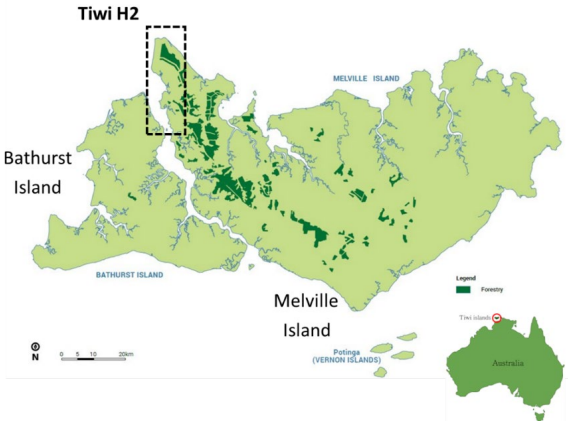
It is important to note the "Upstream" components are required regardless of the hydrogen transport option selected (compression, ammonia, liquefaction, etc.), however, it is optimized for the site location and integration of a compressed hydrogen transport solution using a fleet of Provaris' proprietary H2Neo carriers, which enables Provaris to be particularly competitive for shipments to the Asian region.

Figure 1 Scope of the Tiwi H2 Project Concept Design Study



The Tiwi H2 project site is on the northern tip of Melville Island (see below), being the largest island of the Tiwi Islands. The Tiwi Islands provide a strategic location for regional shipping to the emerging hydrogen markets across the South-East Asian region, including Singapore, Indonesia, South Korea, and Japan.

Figure 2: Location of Melville Island and the Tiwi H2 Project



Why the selection of Melville Island as an export hydrogen location:

- **Proximity to market** with the Tiwi Islands being located along the most north-western part of Australia, providing a strategic location for regional shipping. The Tiwi Islands is
  - less than 1,000 nm from Indonesia;
  - ~1,800 nm from Singapore (export market assumed in Study); and
  - less than 3,000 nm from South Korea and Japan.
- **Solar generation** with the proposed solar site being located in a region of high solar intensity.
- **Defined process for land access** as the Munupi Clan are the traditional and legal landowners.
- **Social and economic** benefits to the Tiwi landowners including sustainable employment and regional benefits.
- **Land availability** with the proposed solar site to be built on existing plantation land, previously cleared of native vegetation, and currently used for commercial plantation. There is 32,000 ha of existing plantation area on Melville Island.
- **Access to water** using seawater for small-scale desalination for de-mineralised water supply to the electrolysers.
- **Port availability** and potential access to the operational industrial precinct at Port Melville (currently owned by AusGroup Limited), capable of berthing Provaris' H2Neo carriers. Alternatives and options to fixed berthing could also be considered.

Scope of the Concept Design Study

The Study defined the key precincts for the Tiwi H2 project which are provided in Figure 3. The precinct areas are also outlined in the project's NT EPA Referral submission made on 30 June 2022.

1. Solar Precinct: solar farm (of sufficient capacity for 100,000 tpa hydrogen export) to be developed on existing, poor performing, plantation land, together with a battery energy storage system and a step-up substation.

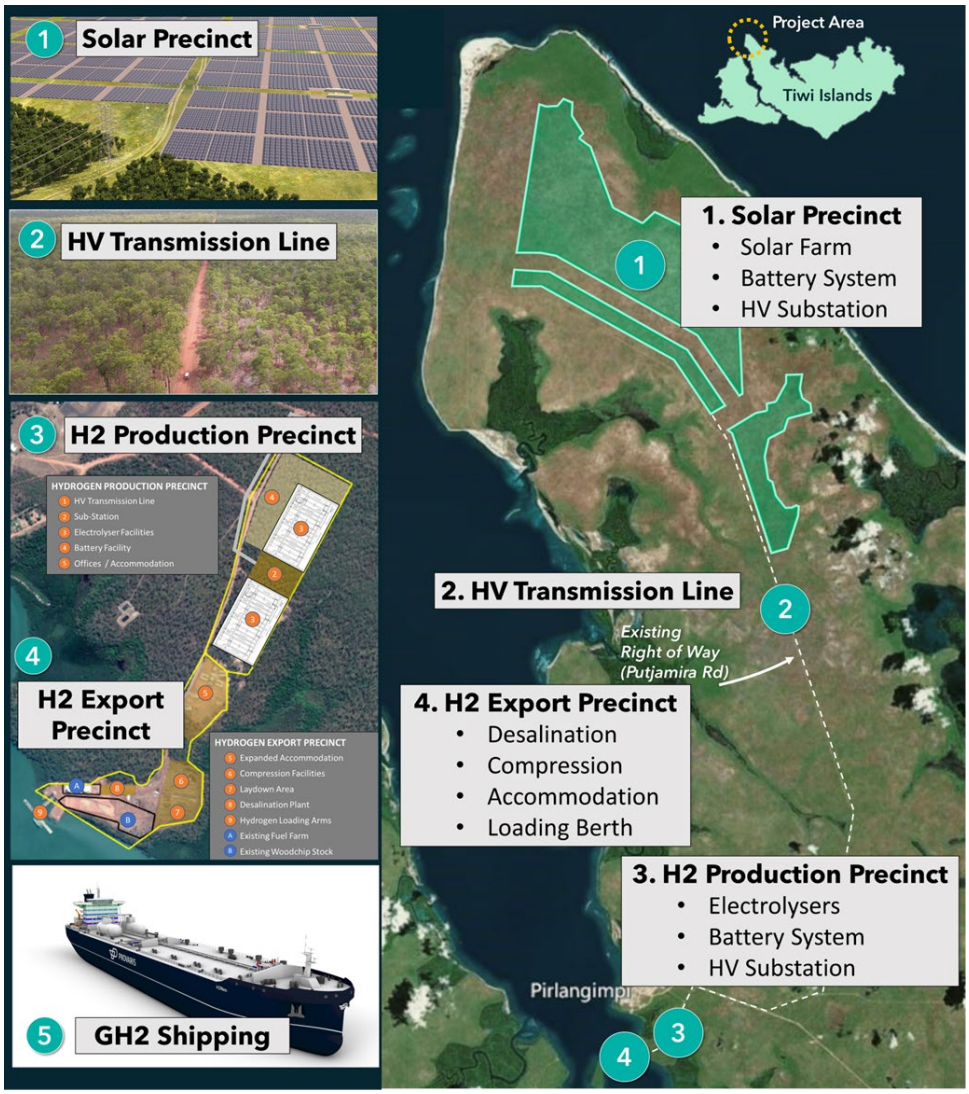
2. HV Transmission Line: 30 km, dual circuit, 275kV transmission line, adjacent to an existing road, to deliver electricity from the Solar Precinct to the existing Port Melville.

3. H2 Production Precinct: comprising of step-down substation, electrolyser facility and option for additional battery energy storage system (if required).

4. H2 Export Precinct: comprising of desalination plant (supply of demineralised water to the electrolyser facility), compression and hydrogen loading facilities to facilitate Provaris' H2Neo carriers.

5. H2 Shipping – transport of gaseous compressed hydrogen to South-East Asian energy markets via a fleet of Provaris' proprietary H2Neo carriers with a capacity of 26,000m3. The H2 Import Terminal was included in the Study scope (comprising of unloading berth and facilities; and scavenging compression to accommodate the unloading of Provaris' H2Neo carriers).

Figure 3: Outline of the proposed Tiwi H2 Project



The Study base case assessed the development of a fleet of H2Neo carriers for the hydrogen market in Singapore, some 1,800 nautical miles from Port Melville. Fleet simulation has been undertaken across multiple markets that will require a use case for gaseous hydrogen to be employed for decarbonization, such as mobility, power generation and heat and can include multiple locations and distances in South-East Asia.

Concept Design Study Outcomes

The Study reinforced several observations and outcomes from the 2021 Compressed Hydrogen Chain Scoping Study undertaken by Provaris. It underpins the technical feasibility of the Tiwi H2 project, and supports Provaris' continuing progression of the Tiwi H2 project. Key Study outcomes include:

- **Solar intensity on Tiwi is competitive**. PVsyst solar reports commissioned for the Study confirmed that the proposed Solar Precinct on Melville Island is a **competitive solar resource** to produce green hydrogen.
- **Load following reduces additional requirement for battery and hydrogen storage**. The benefit of the compressed hydrogen supply chain, being able to load-follow the variable generation profile of renewable energy sources (i.e., solar in the case of the Tiwi H2 project) is significant to reduce additional battery and hydrogen storage required for other transport methods.
- **Degradation of solar and electrolyser has an impact to LCOH**. To maintain a level 100,000 tpa export volumes over the 30 year life of the project, the Study includes the capital cost for additional solar farm capacity to compensate for solar panel degradation, as well as, electrolyser efficiency degradation prior to stack replacement.
- **Electrolyser utilisation was optimised at ~40%**. The optimal utilisation rate of the electrolyser facility was found to be ~40%, as the cost to increase the utilisation rate above this figure (i.e., additional battery energy storage facility) delivered a higher levelized cost of hydrogen (LCOH).
- **Compression required only 1.0 kWh per kg**. External commissioned report confirmed the simplicity of compression, with only 1.0 kWh required per kg of hydrogen loaded. This represents only a **2.0% loss** in hydrogen for export. Based on a 20 bar outlet electrolyser pressure.
- **Desalination a minor impact on the LCOH**. External reports confirmed that desalination has a minor impact on the LCOH with <1% in terms of capex, opex and energy use. Energy use was only 0.1 kWh required per kg of hydrogen loaded (only a 0.2% loss in hydrogen for export).
- **Small footprint of <2 ha required for compression.** The footprint of the compression facilities of the Tiwi H2 project has been determined to be **less than 2 ha** for the loading of a H2Neo carrier in ~12 hours.
- **Proximity to markets benefits delivered cost.** The selection of the Tiwi Islands as a location for production and export of green hydrogen provides a significant benefit as the delivered LCOH is sensitive to distance to market, and the Tiwi Islands location minimised this impact with respect to South-East Asian energy markets.
- **Existing port and land access to save development time and capital.** Our assumption that Port Melville is suitable for use remains valid, although other loading options were considered in the Study, and availability of existing plantation land for the solar precinct also remains valid subject to completion of commercial negotiations with the Munupi Clan landowners. A structural review of Port Melville facilities has been completed and indicates there is sufficient infrastructure to accommodate Provaris' H2Neo carriers. Furthermore, the proposed location of the solar farm on existing plantation land provides a major benefit in that all native vegetation has already been cleared and the site is within an acceptable distance for the transmission of electricity to the proposed hydrogen production facilities.
- **~70% of the project capital cost is non-compression related**, being the upstream capital cost component, and ~30% in the export and import terminals (together the non-compression components). This is reflected in two-thirds of the overall LCOH being non-compression transport related, with the balance being compression, ports and the H2Neo fleet.

Basis of Capital Cost Estimate & Levelised Cost of Hydrogen (LCOH)

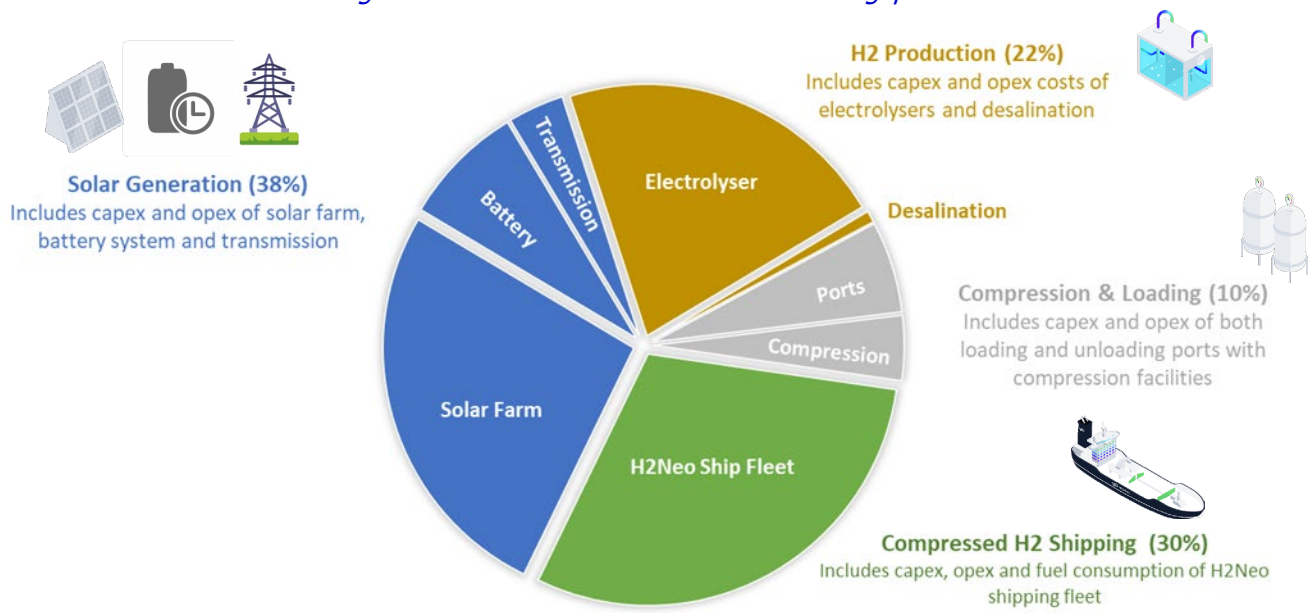
The total project capital cost estimate during construction ranges from USD $4.5 to $5.2 billion for 100,000 tpa of hydrogen export volumes and first production in early 2027. This cost estimate was derived from an aggregation of supplied estimates and studies. The upper range is based on current cost estimates of all capital equipment.

The project economics were considered by Provaris to be estimated in the accuracy range of +/- 30%. The Study also made no allowance for grant funding or other subsidies.

The breakdown of the LCOH is depicted in Figure 4 below. The cost of power and electrolysis are the two most significant cost drivers for future optimisation. LCOH was calculated as the delivered (landed) cost at Singapore, including shipping capex, O&M, port fees, and fuel.

The breakdown of the LCOH assumed a 30-year project life, 5.0% discount rate, 2.0% escalation of operational costs, and a staged development over two phases of 50,000 tpa of hydrogen, and first export in 2027.

Figure 4: LCOH breakdown - delivered to Singapore



Market Demand

Green hydrogen is a leading contender to fill the energy gap in the hard-to-abate sectors where electrification cannot meet de-carbonisation requirements. This includes sectors such as heavy industry, power generation, heating, and diesel/heavy transport. Due to its unique properties, green hydrogen, as either a gas or liquid (and in some cases as a chemical), requires the development and commercialisation of storage and transport supply chains.

Compression, being the technology used by Provaris' proprietary H2Neo carriers for storage and delivery, has been a proven technology for many decades and is scalable. Other benefits supporting the potential early-mover status of the Tiwi H2 project for first production and export in 2027 include:

- Commerciality attained at low volumes and enables progressive or staged development.
- A small footprint enables 'plug and play' deployment for greenfield markets.
- Load can follow the generation profile which minimises storage and battery requirements.

Preliminary discussions have identified offtake interest for green hydrogen with prospective demand starting from 2026 and significant growth in demand indicated from 2030. Target customers of the Tiwi H2 project produced green hydrogen are in Japan, Singapore, South Korea, and potentially Indonesia, with Provaris currently working to secure hydrogen offtake agreements.

Commercial Risks

The Study considered key project risks, as well as potential barriers to progressing the project.

- Early green hydrogen projects face challenging economics and are unable to take advantage of the cost equipment reduction curve (in particular electrolysers) which many in the industry are forecasting to occur as the industry scales up.
- The project is unable to secure the required approvals and permissions from the Munupi Landowners, NT Government and Federal Government.
- Delay in the availability of capital equipment from equipment manufacturers related to solar generation.
- Delay in the completion of all H2Neo carrier engineering and class approvals, currently targeted for mid-2023.
- The project is unable to execute binding agreements with hydrogen customers without certainty on generation and electrolysis within time frame and price ranges.
- There may be a difference between projected LCOH ranges and market expectations of the delivered hydrogen price.

Approach to Project Development & Environmental Approvals

Partner Process for Development and Funding: Provaris will commence a partner process to seek interested groups in the areas of investment, offtake, construction and operational support to jointly develop the project, in particular the Upstream components that include solar generation, transmission and electrolysis.

NT EPA Approvals: Provaris has been advised by the NT EPA of the following indicative schedule, with details of the Referral available in the ASX release made by the Company on 30 June 2022 (available here).

Referral accepted by the NT EPA:	29 July 2022
Public consultation opens on NT EPA webpage:	2 August 2022
Public consultation closed:	3 September 2022
Commencement of NT EPA Consideration:	4 September 2022
End of statutory timeframe:	11 October 2022
NT EPA decision:	On or before, 11 October 2022

Next Steps for the Tiwi H2 Project

Summary of next steps and key milestones are as follows:

Present NT EPA Referral Outcomes to Munupi Clan	August 2022
Engage Lead Engineering Group & decision to proceed to pre-FEED	October 2022
Commence Solar Monitoring at Site	2nd Half 2022
Hydrogen Offtake & Project Investment	2nd Half 2022/Early 2023
Project Financing & EPC Contractor	2023
Financial Investment Decision	Late 2023
Targeted First Hydrogen Exports	Early 2027

- END -

This announcement has been authorised for release by the Board of Provaris Energy Ltd.

For further information please contact:

Norm Marshall
Company Secretary
+61 481 148 629 | nmarshall@provaris.energy

Martin Carolan
Managing Director & CEO
+61 404 809 019 | mcarolan@provaris.energy

Simon Hinsley
Investor Relations
+61 401 809 653 | simon@nwrcommunications.com.au

ASX.PV1 @ProvarisEnergy Provaris Energy Ltd. info@provaris.energy

To receive all company updates subscribe here

Perth: Unit 19, 40 St Quentin Avenue Claremont, WA 6010, Australia

Sydney: Level 14, 234 George St, Sydney NSW 2000, Australia

About Provaris Energy

Provaris Energy Ltd (ASX: PV1) is the leading developer of integrated compressed hydrogen projects for export to regional markets. Our purpose is to develop green hydrogen supply chains that are simple and efficient to enable the global transport of zero-carbon energy.

Provaris is developing a portfolio of integrated green hydrogen projects, leveraging our innovative compressed hydrogen GH2 Carrier with a focus on value creation through innovative development that aligns with our business model of simplicity and efficiency.

The choice to support all development phases of a project is in line with Provaris' strategic desire to develop and invest in profitable hydrogen projects across the value chain, with a measured risk profile, and to retain an equity position of these assets over the long term.