

## Pathway to significant increase in green hydrogen production identified in expansion study

**Frontier Energy Limited (ASX: FHE; OTCQB: FRHYF) (Frontier or the Company)** is pleased to announce results from its Renewable Expansion Technical Assessment (the “**Expansion Study**”) completed by Xodus Group for the Company's 100% owned Bristol Springs Project (the “**Project**”) located 120km from Perth in the South West region of Western Australia.

The Expansion Study incorporated the total land under the Company's control (846ha) and assessed the various renewable energy solutions available. It concluded the optimal outcome was a solar-only solution that would produce at least 438MW.

The Company's long-term ambition is to generate in excess of 1GW of renewable energy as part of its green hydrogen strategy. Discussions regarding additional land opportunities in the region are ongoing.

The Expansion Study followed the Stage One Hydrogen Pre-Feasibility Study<sup>1</sup> (114MW solar farm) (the “**Hydrogen Study**”) that estimated production of approximately 4.4 million kilograms of green hydrogen per annum at a low-cost estimate (inclusive of capital)<sup>1</sup> of \$2.83 per kilogram of hydrogen produced.

This is expected to place the Project as one of the lowest cost producers of green hydrogen in Australia

Future expansion (past Stage One) will likely see a further reduction in costs given economies of scale and shared associated infrastructure.

### HIGHLIGHTS

- The Expansion Study outlined future renewable energy of 438MW, inclusive of Stage One (114MW), across the Company's Project area (846ha)
- The Expansion Study assessed both wind and solar renewable energy solutions, but concluded wind was not competitive and a solar-only option provided the optimal outcome
- The Expansion Study scenarios are expected to see a reduction in future capital and operating costs (in comparison to Stage One) given existing infrastructure in place, shared facilities and increased economies of scale
- Importantly, the Expansion Study highlighted expansion can occur gradually, due to the significant supporting infrastructure surrounding the Project

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<sup>1</sup> ASX Announcement – 4 August 2022

- The Company is reviewing additional land opportunities in the region, given its long-term ambition to produce >1GW of renewable energy for green hydrogen production
- The Expansion Study followed the Hydrogen Study that assessed the proposed Stage One (114MW) solar farm powering a 36.6MW alkaline electrolyser, with estimated production of 4.4 million kilogram of green hydrogen per annum
- Total unit cost<sup>2</sup> (inclusive of capital) for Stage One hydrogen production is estimated at \$2.83 per kg of hydrogen produced
- Accessible infrastructure includes the Landwehr Terminal, existing water sources as well as infrastructure that would be utilised by likely early offtake partners such as the Dampier Bunbury Natural Gas Pipeline

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**Executive Chairman Grant Davey commented:** “Our strategy aligns with the federal and state governments’ drive to decarbonise energy supply to industry and households. Our expanded footprint allows for relatively cheap expansion as we are strategically located around existing infrastructure. Our Expansion Study indicates the potential for lower cost of green hydrogen production through economies of scale and world class infrastructure in the area.

We will continue to assess additional opportunities in the region as our long-term strategy is to have renewable green energy generation of more than 1GW.”

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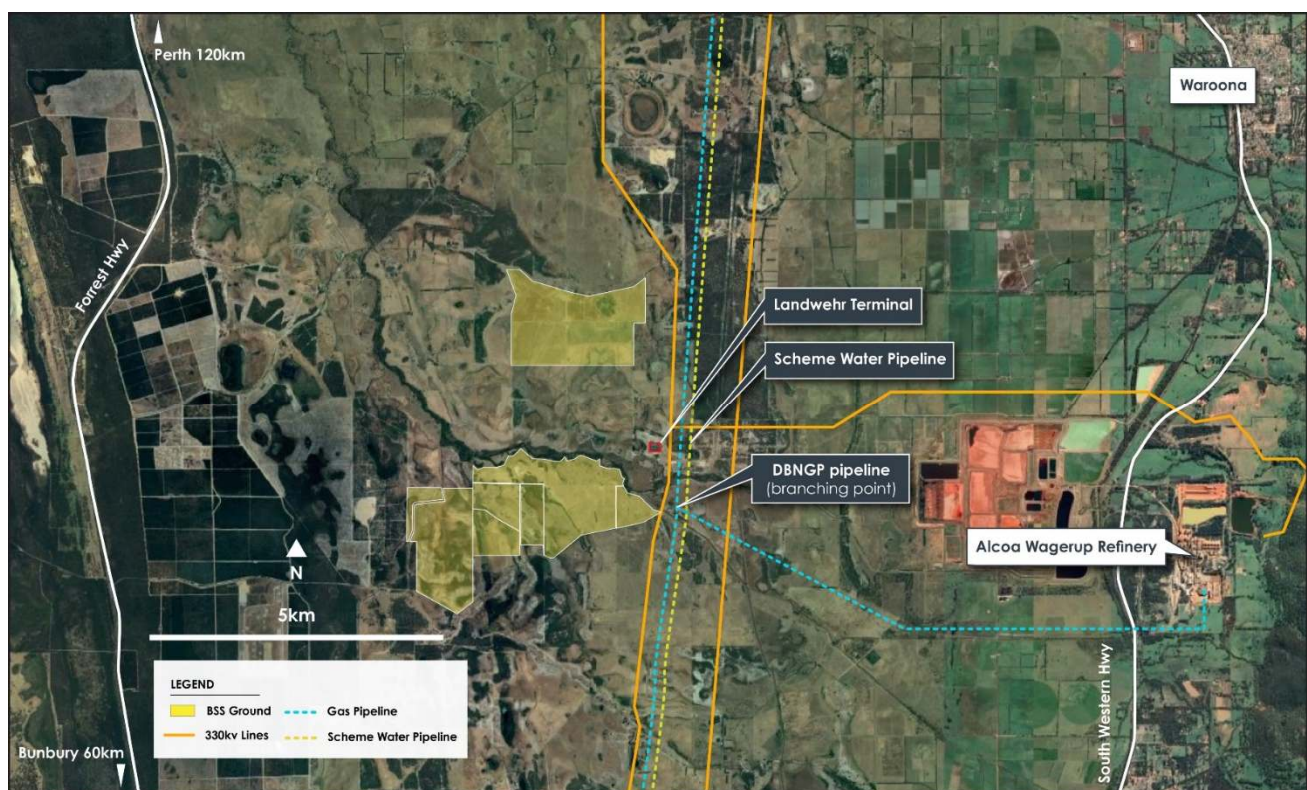
<sup>2</sup> Total unit costs = (total operating costs direct (annual) / annual production) + (total initial capital + total sustaining capital / life of operation production)

## Expansion Study - Overview

The Project is located in the South West region of Western Australia approximately 120km from Perth and 8km from the town of Waroona. Frontier controls 846ha of ground in this region as highlighted in Image 1 below.

The Company engaged Xodus Group (Xodus) to undertake the following studies on the Project.

1. **Hydrogen Study** – to assess the opportunity to develop a green hydrogen production facility based on an initial 114MW solar farm (Stage One); and
2. **Expansion Study** – to assess the long-term growth potential of the Project based on the land under the Company's control and to consider the optimal mix of renewable energy solutions (wind and solar) for the Project.



**Image 1: Project location with surrounding infrastructure**

The Expansion Study assessed both solar and wind-power solutions. It concluded that, whilst wind could be viable given its potential to produce energy in periods when solar is restricted (ie: night and winter) a number of factors made it a less competitive, including:

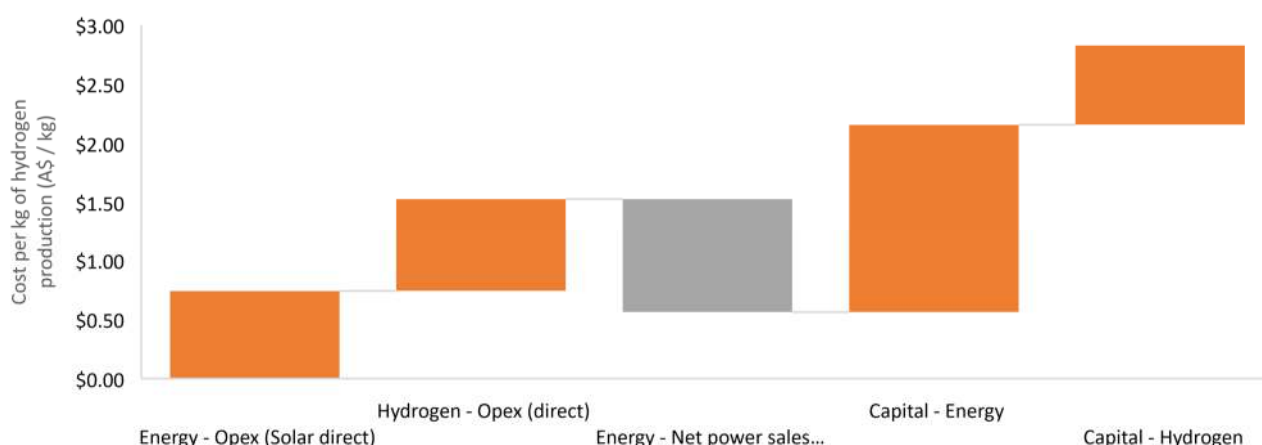
- the relatively low wind resource (capacity factor 33%)
- relatively high cost of infrastructure

- potential approval complexities due to nearby wetlands; and
- the ability for the Project to be able to draw power from the SWIS via Landwehr Terminal.

Based on the land under the Company's control (846ha), the total power generation possible from solar energy was estimated at 438MW.

## Hydrogen Study

The Hydrogen Study (ASX Announcement 4 August 2022) found that the Project would produce approximately 4.4 million kilograms of hydrogen per annum. Based on the key inputs this would result in a total cost<sup>3</sup> of approximately \$2.83 per kilogram of hydrogen produced. The breakdown of the key inputs is illustrated in the image below.



**Image 2: Forecast costs per kilogram of hydrogen produced (A\$ / kg)**

The key highlight of the Hydrogen Study is the low cost for hydrogen production. This low cost is due to the Project's location being surrounded by existing infrastructure, which lowers the capital cost, whilst also allowing for additional income to be generated (through excess energy sales and Reserve Capacity Credits via connection to the SWIS at the Landwehr Terminal).

Full details of the Hydrogen Study can be found on the Company's website.

<sup>3</sup> Total unit costs = (Total Operating Costs Direct (Annual) / Annual Production) + (Total Initial Capital + Total Sustaining Capital / Life of operation production)

## Expansion Study

### Solar:

The Expansion Study concluded that the Project site is relatively well-suited to solar expansion given the land is flat. The expansion plan proposes to use bifacial solar cells to collect sunlight on both the front and rear side of the solar panels. Resulting energy yield is outlined below in Table 1<sup>4</sup>.

| Land Parcel         | Solar          |              | Panels  |
|---------------------|----------------|--------------|---------|
|                     | Capacity (MWp) | Energy (GWh) |         |
| Stage 1             |                |              |         |
| Land Parcel 1       | 114.4          | 247.9        | 179,580 |
| Expansion           |                |              |         |
| Land Parcel 2 and 3 | 190.3          | 409.4        | 299,700 |
| Land Parcel 4       | 133.7          | 287.7        | 210,600 |
| Totals              | 438.4          | 945          | 689,880 |

**Table 1: Solar Expansion Metrics**

The Project's expansion is estimated to generate total energy yield of 945 GWh/yr from an aggregated nominal power of 438MW installed giving a performance ratio of 86%. This relatively high solar efficiency has been enabled by strategic application of the following:

- 1) Optimisation of tracker operation.
- 2) Implementation of backtracking.
- 3) Implementation of bifacial panels (with correct Albedo<sup>5</sup>).
- 4) Increased inverter efficiencies from Maximum Power Point Tracking (MPPT) parameter optimisation.

### Wind:

Xodus developed a number of wind farm concepts over a number of land parcels and carried out early energy yields assessments for each. The proposed wind farm configurations were aimed to supplement solar farm concepts developed across the site, before optimising the split of the overall development between wind and solar for the optimal energy yield and lowest levelised cost of hydrogen (LCOH).

As part of the Expansion Study, Xodus undertook a wind resource analysis, performed wind flow modelling, generated proposed layouts, undertook energy yield modelling and CAPEX and OPEX modelling.

<sup>4</sup> Expansion study, EPCT Report, J000169A0002 Rev 22/07/2022, page 7

<sup>5</sup> Albedo is the amount of sunlight (solar radiation) reflected by a surface and is usually expressed as a percentage or a decimal value, with 1 being a perfect reflector and 0 absorbing all incoming light.



Xodus concluded that the low wind resource, relatively high cost of infrastructure and potential approval complexities associated with a nearby RAMSAR wetland area in addition to having the option of drawing energy from the grid, meant wind was not a competitive proposition.

On this basis, Xodus recommended that the Project pursue a solar-only development for all planned expansion.

### **Battery Energy Storage:**

Battery storage has been deemed uneconomic due to the high capital cost against limited duration. The duration of battery storage is up to around 4 hours. Matching battery capacity to the maximum solar capacity results in storage of approximately 2,330MWh (4 hours at 582MW), which would involve capex of ~\$1.1bn. As the Project has the alternative of power from the grid when needed, use of battery storage is not economic.

**Authorised for release by Frontier Energy's Board of Directors.**

### **ENDS**

To learn more about the Company, please visit [www.frontierhe.com](http://www.frontierhe.com), or contact:

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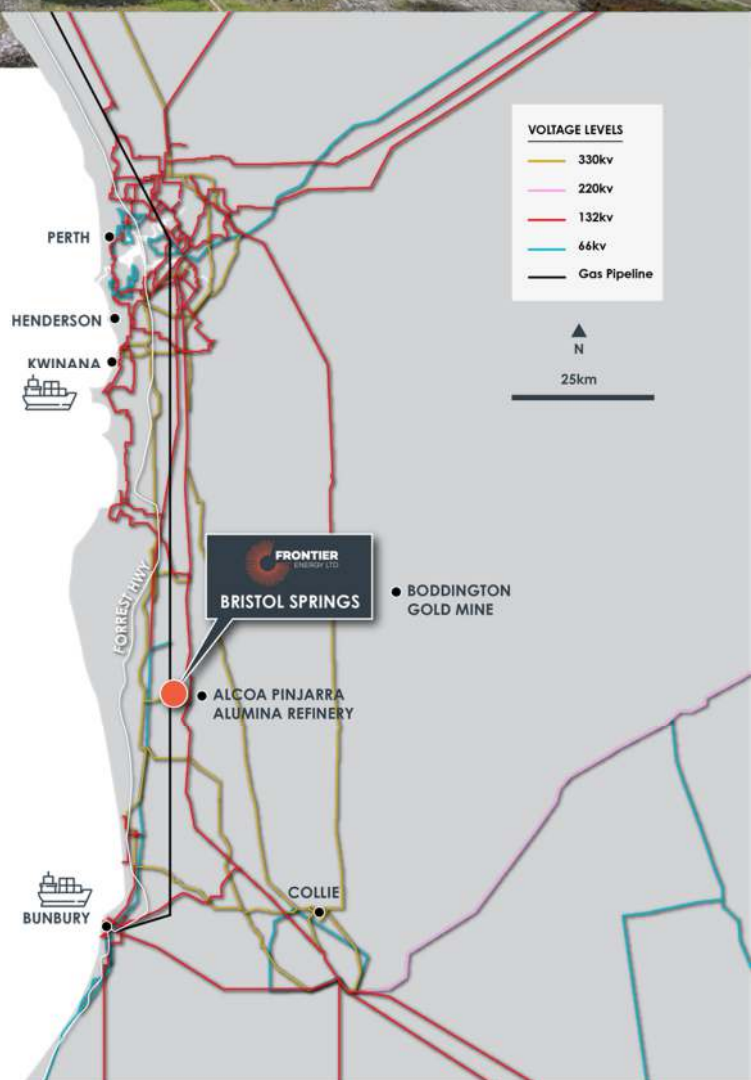
## About Frontier Energy

**Frontier Energy Ltd (ASX: FHE; OTCQB: FRHYF)** is developing the Bristol Springs Green Hydrogen Project (the Project) located 120km from Perth in Western Australia.

The Company completed a Pre-Feasibility Study<sup>1</sup> that outlined the Project's potential to be one of the earlier mover and lowest cost hydrogen assets in Australia.

The Project benefits from its unique location which is surrounded by major infrastructure. This reduces both the operating and capital costs compared to more remote hydrogen projects, whilst also being surrounded by likely early adopters into the hydrogen industry in the transition from fossil fuels.

<sup>1</sup>ASX Announcement 4<sup>th</sup> August 2022



### Directors and Management

**Mr Grant Davey**  
Executive Chairman

**Mr Chris Bath**  
Executive Director

**Ms Dixie Marshall**  
Non-Executive Director

**Ms Amanda Reid**  
Non-Executive Director

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For a comprehensive view of information that has been lodged on the ASX online lodgement system and the Company website, please visit [asx.com.au](http://asx.com.au) and [frontierhe.com](http://frontierhe.com), respectively.