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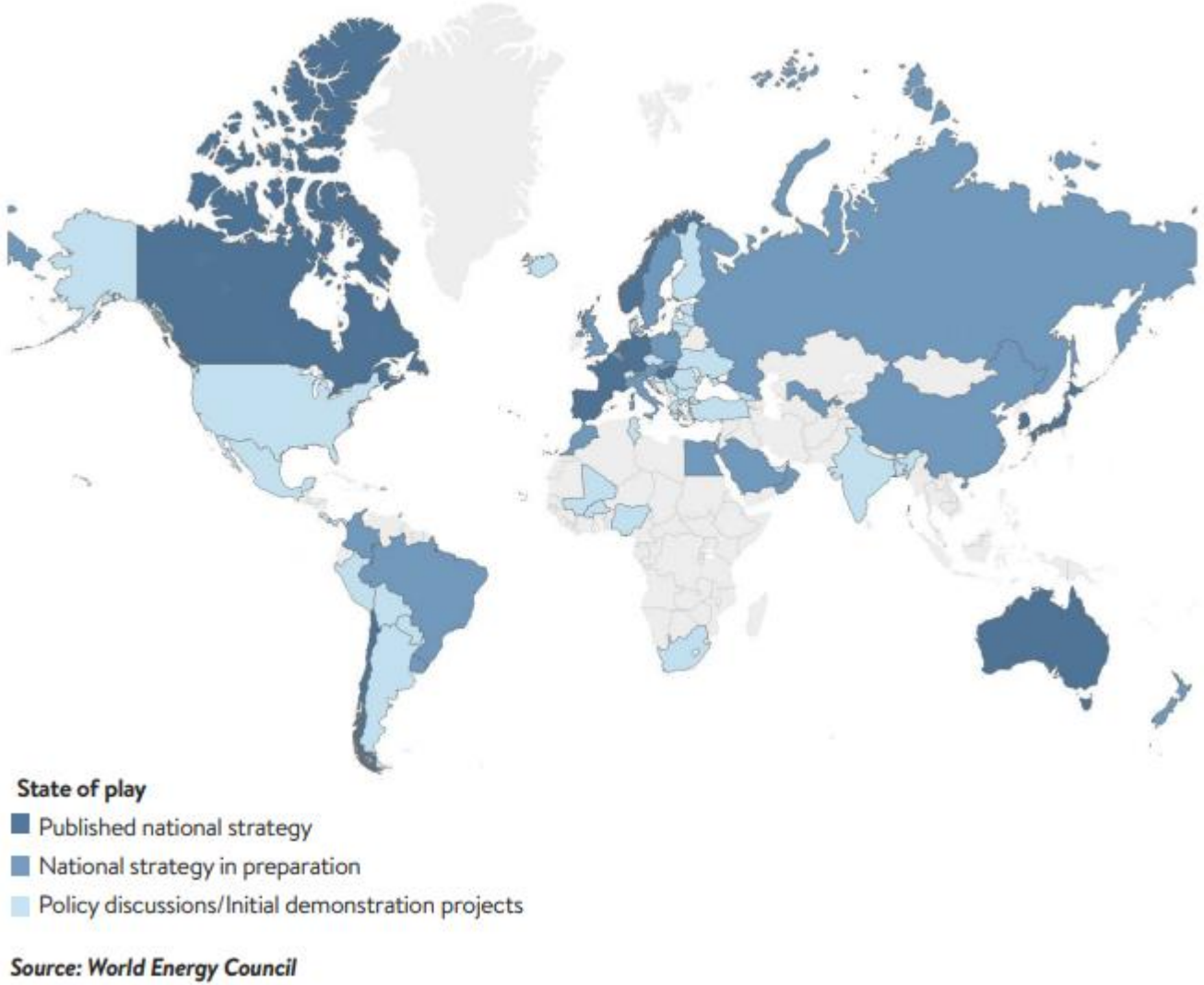
WORLD ENERGY COUNCIL
BusinessNZ
Energy Council
EXPLORING NEW ZEALAND'S
HYDROGEN POTENTIAL

Hydrogen Strategies

WORLD ENERGY COUNCIL | BusinessNZ Energy Council

Figure 1. Overview map of the countries activities towards developing a hydrogen strategy



Source: World Energy Council

Who wants hydrogen?
Hydrogen Demand Projections

<1.8°C

Acil Allen Report – High
BP Energy Outlook 2020 – Net Zero
IEA Energy Technology Perspectives 2020 –SDS
Shell – Sky Scenario
Powerfuels in a Renewable World
Hydrogen Economy Outlook – Strong Policy

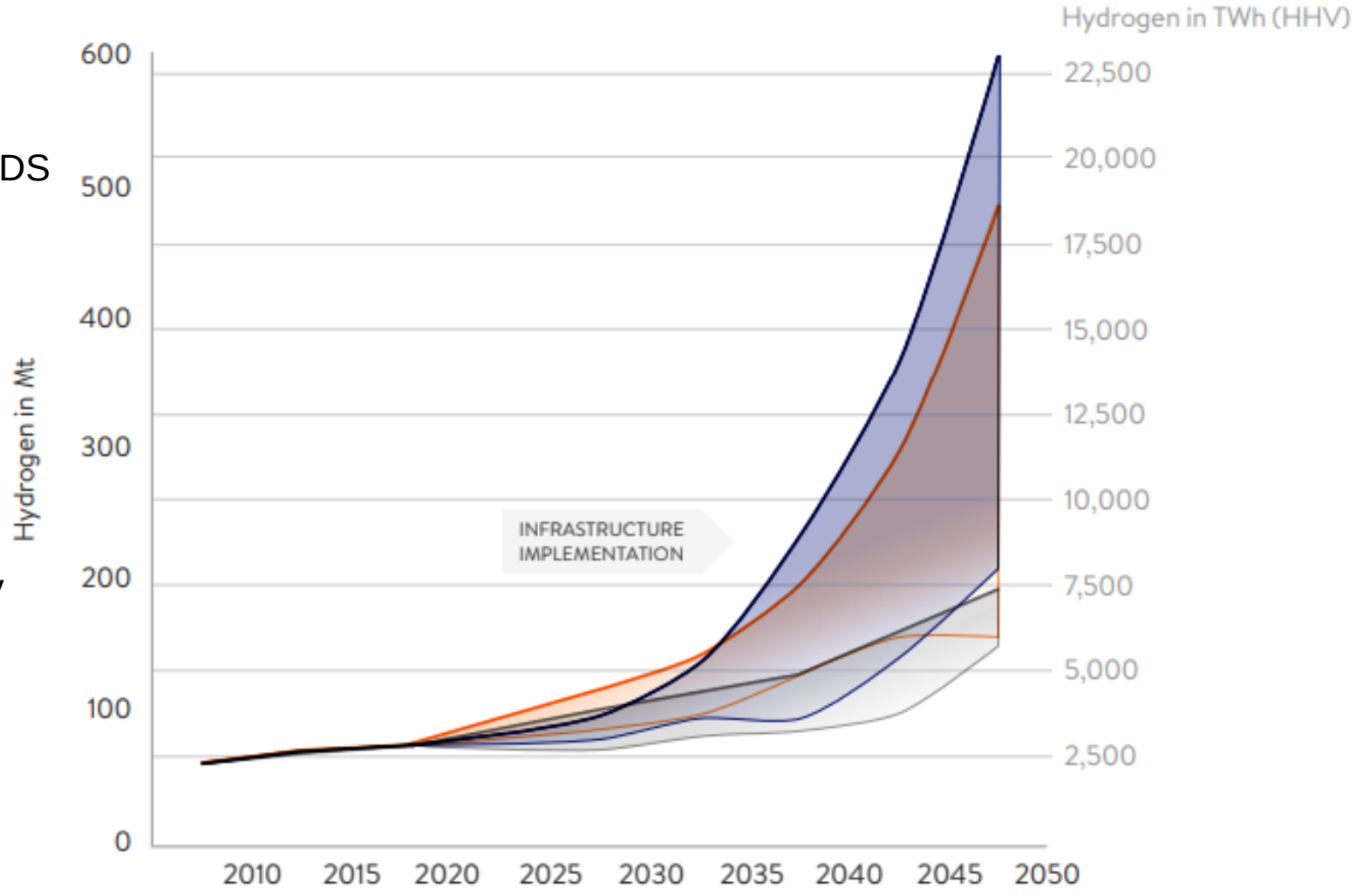
1.8 – 2.3°C

Acil Allen Report – Medium
BP Energy Outlook 2020 – Rapid
Hydrogen Council – 2DS
World Energy Council – Unfinished Symphony

>2.3°C

Acil Allen Report – Low
World Energy Council – Modern Jazz
Hydrogen Economy Outlook – Weak Policy

Figure 1. Range Of Hydrogen Demand Assessment By 2050



SOUTHERN GREEN HYDROGEN

Business New Zealand - 18th Nov 2021

Large scale Green Hydrogen Plant in Southland, New Zealand

PRIVILEGED AND COMMERCIALLY SENSITIVE

contact | Meridian.

Our vision

SOUTHERN GREEN HYDROGEN

Meridian Energy Limited (**Meridian**) and Contact Energy Limited (**Contact**) share a vision to establish a world class large-scale, low cost, green hydrogen facility in the lower South Island of New Zealand.

We believe a large-scale green hydrogen facility, focused on the export market, will accelerate the development of a domestic hydrogen economy and strengthen New Zealand’s platform to decarbonise our transport and industrial sectors.

The collaboration

Contact and Meridian are jointly undertaking a feasibility study with a view to developing a Green Hydrogen production facility in the lower South Island.

Contact and Meridian are working together due to the anticipated nature, scale, investment requirements, complexity and risk profile of the project. Neither party is likely to be able to progress a project of this nature independently.

The parties are mindful of their Commerce Act 1986 obligations and have been operating, and will continue to operate, in compliance with a competition law communications protocol ("**Protocol**") that governs all discussions in relation to this collaborative activity. The Protocol is subject to regular review by Russell McVeagh and Bell Gully to ensure that it remains fit for purpose as the project develops.

Given that this is a joint briefing, today's meeting will be conducted in accordance with this Protocol and so there may be some topics that we are unable to discuss today.

"Developing a plant of a scale that doesn't exist anywhere at the moment, intended to sell a product into a market that doesn't exist yet, under a contract form that no-one can describe & also doesn't currently exist in a similar context anywhere"… Energy News.

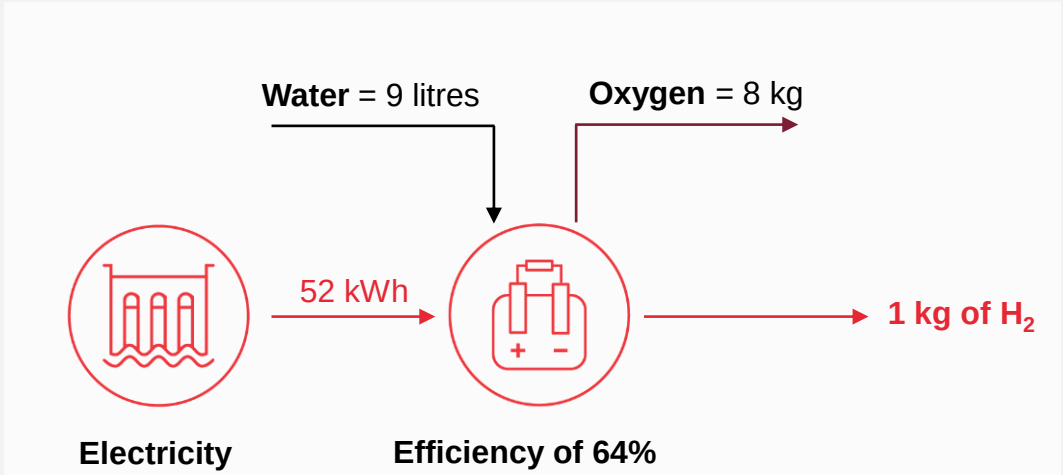
SOUTHERN GREEN HYDROGEN

Background information

What is green hydrogen?

Green hydrogen can be delivered in different forms with liquid hydrogen and ammonia being the most likely

Green hydrogen production via electrolysis



Three core building blocks

All derived from green electrolysis

Liquid hydrogen	▪ Widest range of potential applications, however markets will take time to develop ▪ Liquefaction currently very expensive – costs expected to fall ▪ Large scale transport not yet proven ▪ Fewer energy losses to produce compared with green ammonia
Ammonia	▪ Existing markets - 80% of ammonia currently used to produce fertilisers ▪ Proven technology ▪ Smaller range of applications ▪ Established global logistics and supply chain
Methanol	▪ Existing market with established global logistics and supply chain Transport markets ▪ Derivatives can be used in transport markets (including aviation) ▪ Requires the addition of carbon (e.g. biomass) Direct air capture technology still being developed

What are the uses of green hydrogen?

Hydrogen is the only green solution to decarbonize “hard-to-abate” sectors, which account for approximately 30% of global energy emissions

Heavy transport

+

Fertiliser

+

Steel

+

E-fuels

+

Marine Fuel

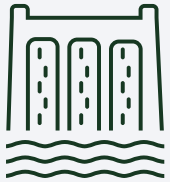
+

Electricity generation

+

Aviation

Southern Green Hydrogen is unique



600 MW of base-load hydro generation from existing assets

+

Existing high voltage transmission connection assets

+

Access to industrial land

+

Access to fresh water

+

Deep water port

+

Development time

Southern Green Hydrogen

Partners – what's important to Contact and Meridian?

We have received significant international interest in the Opportunity. This interest has ranged from multinational corporations and global green investment funds through to Green Hydrogen technology providers and Green Hydrogen end users. A successful partner or partners will need to align with the values outlined below.

Capability

Respondents will have capability, HSE/ESG credentials and experience in either:
The development and operation of hydrogen, chemicals, or large-scale industrial plant,
and/or
the sale, distribution or use of chemicals.
This experience will be supported by sound financial capability.

Alignment of vision

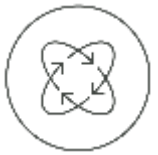
Respondents will have a willingness to partner and genuine ambition to lead the market as the hydrogen economy develops over time.

Long term focus

Respondents will act as long-term partners with the Issuers and the broader community of Southland.

Timing

The plant will be operational and consuming electricity as close to 1 January 2025 as practicable.



Dry year flexibility

Respondents will be required to reduce the demand for, or production of, green hydrogen to meet the project's dry year flexibility requirements.

Value

Respondents are expected to be trading in high value markets.

Development Timeline

- **Jul 2021** — Registration of Interest
- **Sept 2021** — Three-part study completed
- **Dec* 2021** — Request for Proposal (issued to ROI shortlist)
- **Late 2023** — Final Investment Decision
- **2025** — Target initial tranche of production from 2025

Seeking responses from:

- Participants interested in purchasing Green Hydrogen
- Participants interested in purchasing large volumes of electricity
- Participants with technology solutions
- Investors in the Green Hydrogen value chain
- Providers of engineering, procurement and construction services

1 Market scan

- Products
- Transportation costs
- Domestic and international markets
- NZ's possible role
- Economics
- Carbon policies

2 Technology & engineering

- Development costs
- Technology options
- Transportation / storage options
- Possible locations
- Health and safety implications

3 Dry year role

- Market requirements
- Implications for technology
- Comparison with Onslow / NZ Battery
- Implications for downstream H_2 markets

* Expected release date

Advisory Board
Japan/UK/USA/Australia


Shigeru Muraki


Diana Raine


Joe Powell


Tim Buckley


Gary Smith

A hydrogen production facility can support a dry-year solution

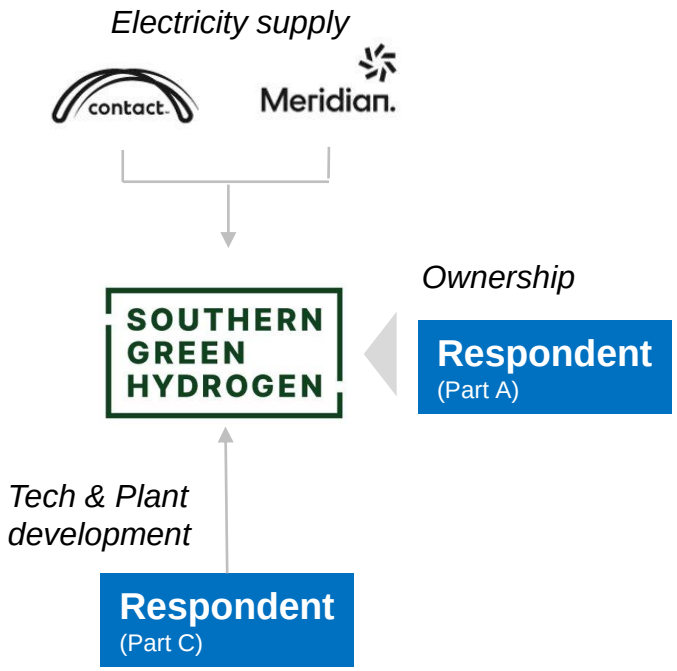
A green hydrogen plant can be designed to vary its production to suit conditions within the NZ electricity system. During dry years, production can be reduced, therefore providing dry year reserve. During times of energy surplus, production can be increased to capture renewable spill (from wind and hydro generation). This flexibility could offer a substantial and valuable contribution to support NZ's decarbonisation goals. Given its importance, a complementary piece of detailed analysis has been undertaken to quantify this opportunity.

NZ's hydrological storage over the last five years

Range of possible ownership models

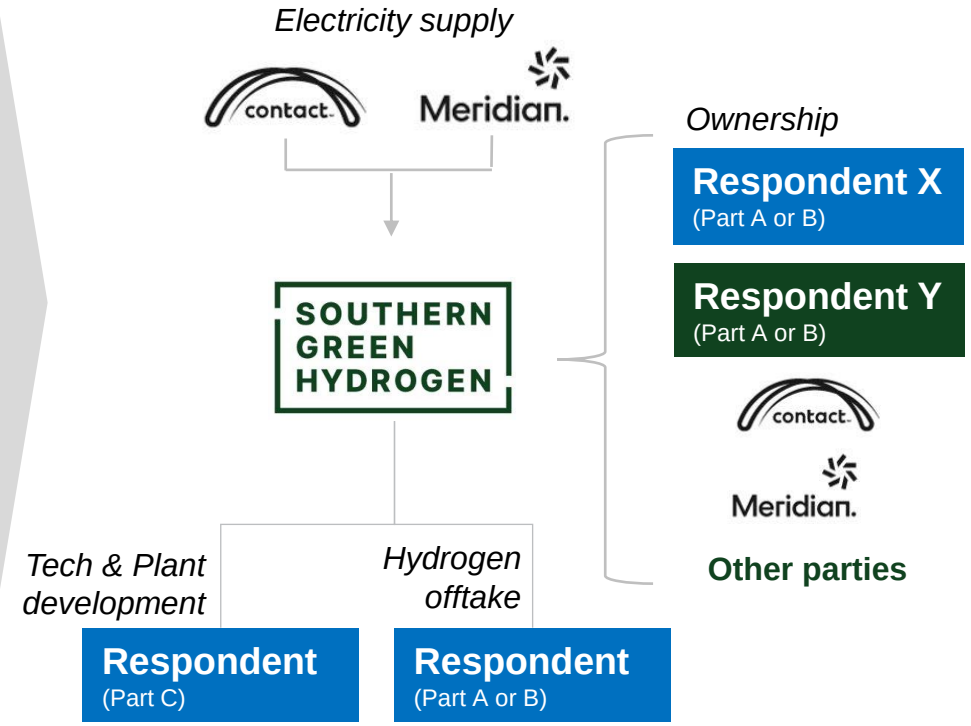
Single ownership model

100% respondent



Joint ownership model

Contact, Meridian and Respondents



Note the ROI process sought responses from 3 different categories of Respondent:

- *Part A Respondent – H2 supply chain participant (including product off-takers) willing to invest equity in the project*
- *Part B Respondent – Product off-takers not willing to invest equity in the project*
- *Part C Respondent – Project services and technology providers interested in contracting to deliver the project*

Domestic work programme

Managed by Contact & Meridian in all models

- Electricity market and transmission connection
- Iwi relationships
- Water supply
- Land and easements
- Consents, permits and regulatory approvals
- Access to the South Port
- Stakeholder relationships

Part A Respondents

Responsibilities in all models

- End use customers
- Transport to customers

SOUTHERN GREEN HYDROGEN

Project benefits

The potential for transformational economic change

New Zealand's competitive advantage provides an opportunity to create an entirely new industry with long-term economic value. This industry could help decarbonise both international and domestic markets.

1 Export market

Establish a world class green hydrogen export facility in Southland

2 Domestic market

Use the immediate scale of the export facility to develop a domestic hydrogen market

Economic benefits for Southland

- **Jobs** – Develop high value direct and indirect jobs
- **Investment** - Potential to develop an innovation hub and new renewable generation

Benefits for New Zealand

- **Investment –** Attract ESG focused investors to NZ
- **Reduced emissions –** Decarbonise "hard to abate" sectors
- **Dry years –** improved energy security

Domestic decarbonisation, accelerating H2 capability

The fertiliser industry and heavy transport are two domestic sectors that are considered 'hard to abate'. Hydrogen can play a significant role in supporting decarbonisation of both.

Fertiliser – 80% of ammonia produced globally (all from fossil fuel) is used as a feedstock to produce nitrogen-based fertilisers such as urea, ammonium sulphate and diammonium phosphate (DAP). New Zealand applies over 800k tonnes of urea to farms annually. In this sector, Southern Green Hydrogen is:

- assessing opportunities to support the production of domestic urea from a green ammonia feedstock produced by the Southern Green Hydrogen project.

Heavy Transport – this sector accounts for some1.5Mt of CO2 emissions annually. Fuel cell trucks and buses powered by gaseous or liquid hydrogen are likely to play a significant role in transforming this sector in the future. In this sector, Southern Green Hydrogen is:

- investigating dual-fuel technology that will allow gaseous hydrogen to displace up to 40% of fuel in existing diesel engine fleets. If this technology is secured, an early pilot project will be progressed with fleet partners to prove and assess the concept. This will also provide Southern Green Hydrogen an early opportunity to build capability in the supply and operational management of hydrogen.
- investigating distributed hydrogen refuelling stations alongside local partners to support the introduction of fuel cell heavy vehicle and dual-fuel fleets.

Question time