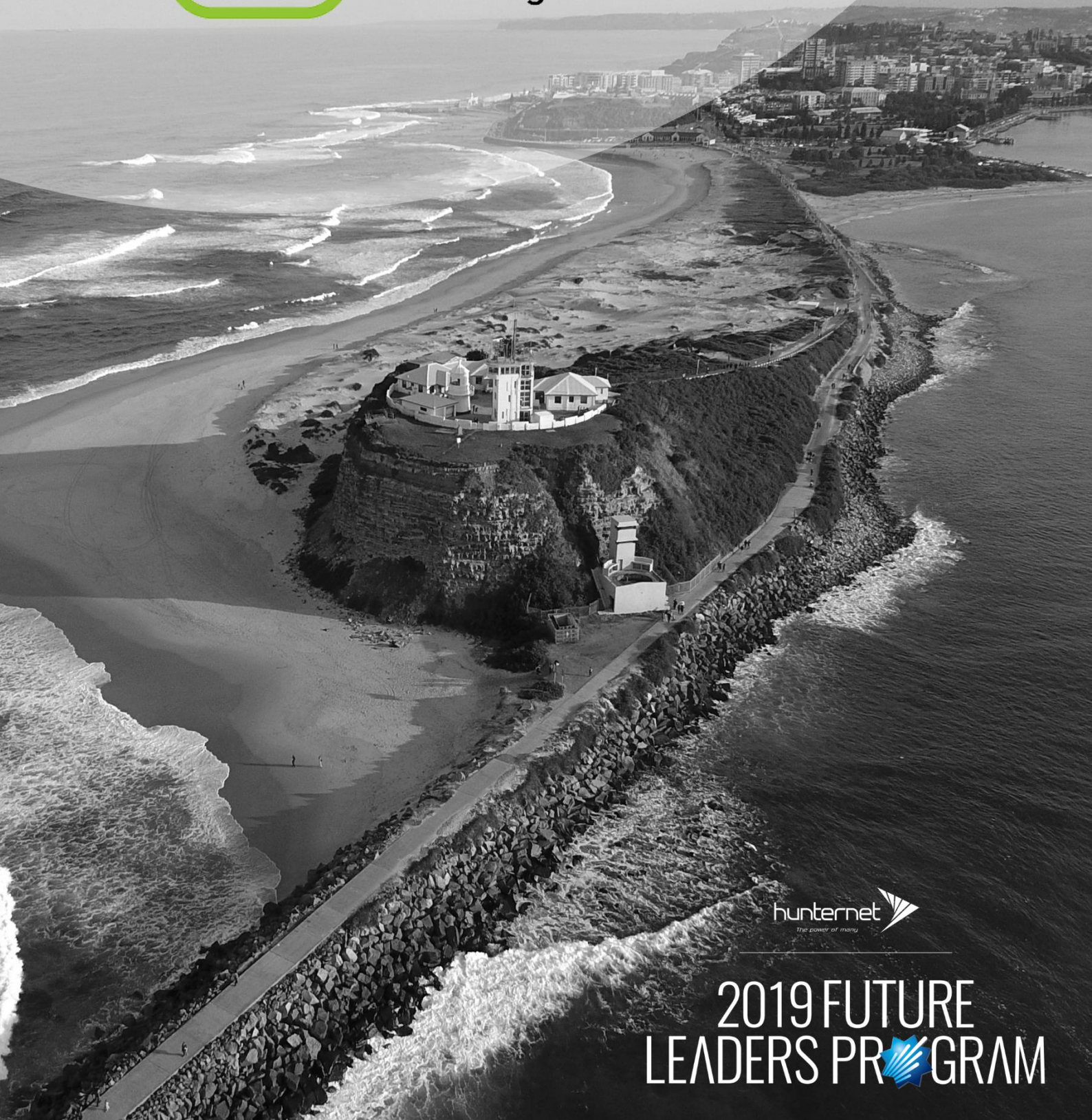




## Re-thinking the Hunter



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## Executive Summary

The H2-Hub proposal, outlined in this document, incorporates a triple helix model which integrates Greater Newcastle region businesses, educational institutions and governments to become a domestic and global powerhouse in the production and export of green hydrogen and ammonia. A key aspect of this strategy is leveraging the already established position of the region as an energy export hub. The increasing demand for these exports is primarily driven by Japan's 'National Hydrogen Strategy', which aims to reduce their reliance on fossil fuels by transitioning to a carbon neutral fuel source.

The H2-Hub proposal will be achieved through the creation of a complete energy ecosystem that incorporates the H2 Innovation Hub, renewable energy generation, green hydrogen and ammonia production, and local and international transport systems to facilitate export. The ecosystem has been staged over a 25 year lifespan through a four-stage approach, which will include pilot projects, innovation centres, production and export facilities, along with securing additional technology companies to move to the Greater Newcastle region.

Three specific projects exist within the four-stage approach: 1) Short term: City of Newcastle garbage truck fleet transitioned to hydrogen; 2) Medium term: an ammonia plant constructed at Liddell power station to transition mining haul trucks to ammonia fuel; 3) Long term: complete supply chain development from renewable energy generation to export facilities. On project completion and with the development of the H2 innovation Hub, the Greater Newcastle region will be ideally positioned to secure further multinational companies (MNC) in new and expanding industries to contribute to regional growth.

To implement the proposal, the region's education institutions, private and ASX listed companies will need to collaborate with large MNCs, such as Shell, to secure the capital investment required to make the proposal a reality. As the key stakeholder in development, Shell will need to create joint ventures with local companies to implement projects, with the H2-Hub having gained interest and support from multiple strategic companies including AGL, Orica and Callide Coal.

Along with private sector funding for the proposal, the early pilot projects will utilise grants from ARENA, with a hydrogen production and export ecosystem being incorporated into a City Deal for the region. In support, the AstroLabe Group, who successfully negotiated the Western Sydney City Deal, stated the H2-Hub proposal was feasible due to its focus on the transition of the Hunter energy sector and its emphasis on collaboration and innovation.



# 1 Introduction

As Australia’s seventh-largest city, Newcastle is located 160kms north of Sydney at the heart of the Greater Newcastle region which incorporates the 5 government areas of Newcastle, Cessnock, Lake Macquarie, Maitland and Port Stephens. With stunning beaches and coastline, world-class wineries, University, airport, an internationally recognised port and mining operations, The Greater Newcastle region is poised to cement its identity as a global second city.

In 2019, Greater Newcastle has a population of over 440,000 people<sup>1</sup>, with the combined Local Government Area (LGA) covering a land area of 186.8 sq. kms. The Greater Newcastle Region is Australia’s largest regional economy valued at over \$40 billion and incorporates the Port of Newcastle, the largest coal export port in the world, with its overall exports valued at almost \$18.5 billion in 2016-17

The Greater Newcastle Region has a developed mining and export industry, international airport and an extensive rail network which connects the Hunter Valley coal mining region and future connection to the planned inland rail network to the deep water port. The Newcastle international Airport, which serves approximately 1.2 million passengers annually,<sup>2</sup> places itself next to Williamstown RAAF Base (Figure 1.1).



Figure 1.1: Greater Newcastle Region<sup>3</sup>

H2 has a vision to create a renewable energy ecosystem focusing on the production and export of hydrogen in order to transform the image of the Greater Newcastle Region from its label as the ‘STEEL CITY’ to a globally recognised smart and environmentally sustainable city



## 2 Identity and Positioning Concept

### 2.1 Current Vision for the Greater Newcastle Region

The H2-Hub proposal, outlined in this document, expands on the published Greater Newcastle Metropolitan Plan 2036 (GNMP 2036) which was launched in September 2018 and is the first metropolitan plan developed for a noncapital city. H2's goal is to outline a long-term vision for the region as it faces growth and investment in new industries and technology such as energy, aviation, transport, education, health and tourism. The GNMP 2036 report sets a vision for the Greater Newcastle region to become:

*Australia's newest and emerging economic and lifestyle city, connected with Northern NSW and acknowledged globally as:*

- *Dynamic and entrepreneurial, with a globally competitive economy and the excitement of the inner city and green suburban communities;*
- *Offering great lifestyles minutes from beaches, bushland, the airport or universities and from the port to the lake; and*
- *A national leader in the new economy, with smart cities and carbon-neutral initiatives, and with collaborative governance that makes it a model to others in creating and adapting to change.*

The GNMP 2036 also aligns itself to help achieve the vision for the Greater Hunter region as set out in the Hunter Regional Plan 2036 (HRP 2036) - to be the leading regional economy in Australia with a vibrant new metropolitan city at its heart. The development of the GNMP 2036 report will guide the planning and investment of the 5 Greater Newcastle regional councils, with the expansion of existing industries and creation of new opportunities to cement the Greater Newcastle region's position as a global city.

### 2.2 H2 Vision for the Greater Newcastle Region

When considering the future of the region, H2 appreciates the importance of creating a long-term plan which creates economic diversity for the Greater Newcastle region, in order to retain the existing skill and knowledge base, and to leverage this to create new industries and job opportunities. Expanding on the GNMP 2036 report, Chapter 15 - "Plan for a Carbon Neutral Greater Newcastle by 2050", we have developed a plan for the Greater Newcastle region that builds on the existing mining and energy industry, with the overall goal to become a domestic and global powerhouse in the production and export of "green" hydrogen and ammonia, which will ultimately form the H2-Hub.



The development of a hydrogen industry in the Greater Newcastle region will drive new business ventures and investment opportunities, which will be used as a platform to position the region as an attractive location for a younger population. The Greater Newcastle region, similarly to Australia as a whole, is facing a problem with an aging population.<sup>4</sup> In considering current evidence, global cities that can effectively attract a younger demographic will be in a superior position to drive rapid economic growth and innovation. The development of a renewable energy innovation centre and a 'sustainable, eco-friendly' image for the Greater Newcastle region will attract and retain innovative companies specialising in modern industry, and in doing so, will attract a younger workforce to reside and work in the Greater Newcastle region, bringing with them the skills and business to facilitate economic growth.

### 2.3 H2 Vision Justification

The Greater Newcastle region has an engrained history with coal production which is inevitably going to have a reduction in demand due to climate change regulations resulting in limiting coal as an energy source. Along with coal, the ammonia production industry is facing shutdowns to its manufacturing facilities due to the amount of carbon dioxide by-product produced. Ammonia, which is formed by combining hydrogen and nitrogen, is one of the most highly produced inorganic chemicals worldwide for its use in plastics, fibres, explosives, nitric, dyes, pharmaceuticals and fuel. Hydrogen is currently produced via the process of steam methane reforming (SMR) and is responsible for the large amounts of carbon dioxide by-product released in the ammonia process, much of which is vented to atmosphere. Hydrogen is also a viable option as a future fuel source for the automotive industry; however, through the SMR process, it is no more environmentally friendly when compared to the utilisation of fossil fuels. The demand for hydrogen as a renewable fuel source to replace batteries and fossil fuels, along with its use in ammonia production worldwide, is increasing (Figure 2.1)<sup>5</sup> and the demand for environmentally sustainable production of both is going to be critical to meet this demand and reduce carbon dioxide output.

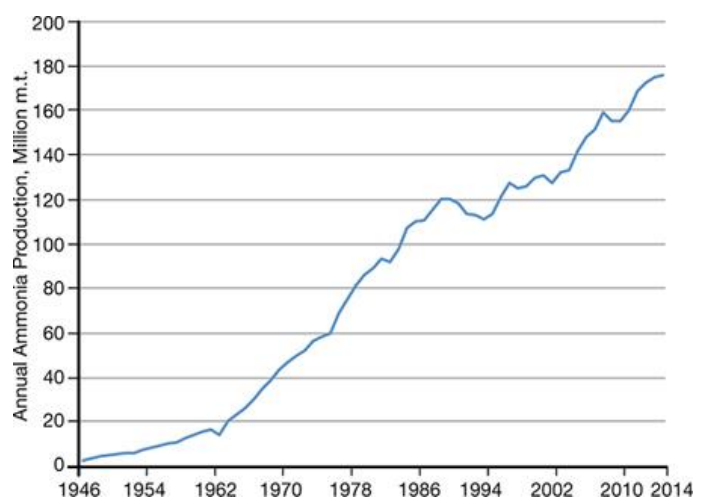


Figure 2.1: Annual Ammonia Production



The 2016 report commissioned by KPMG titled “The Futures of Cities - Creating a Vision”, highlighted a key idea that cities can attract or repel residents, visitors and business investment. It found it is critical for a city to develop a clear, long term vision and road map around why, when and how migration, ideas and investment will come to the region. The Greater Newcastle region, as with many other second cities, suffers from the overpowering attraction of capital cities, especially among the younger generation.

The Greater Newcastle<sup>6</sup> and the Hunter regions<sup>7</sup> have a lower population of residents between the ages of 20-44 (36.6%) when compared to both NSW state and Australian averages. The region also has a higher percentage of residents aged 45 and over compared to the same state and national averages. By comparison, 45.5% of Eindhoven City-Netherlands, who have gone through a similar industrial transformation, has a population that falls within the 20 to 49 age bracket and 35.5% are under 50. Similarly, the World Economic Forum’s most innovative global cities also have younger populations relative to the Greater Newcastle region, including but not limited to; San Francisco-America,<sup>8</sup> Munich-Germany,<sup>9</sup> Boston-America,<sup>10</sup> and Seattle-America.<sup>11</sup> See Figure 2.2 & Figure 2.3).

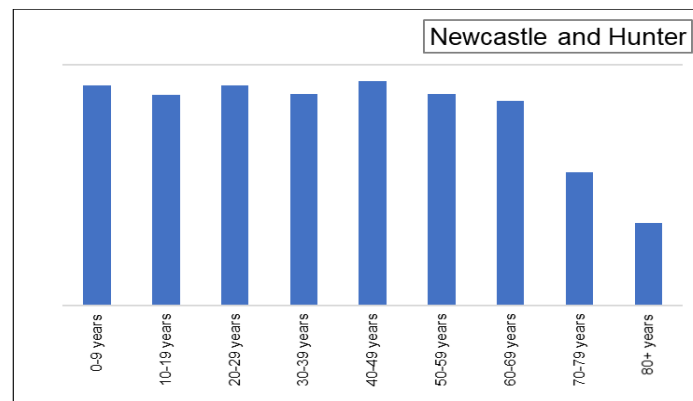


Figure 2.2: Newcastle & Hunter Population Distribution

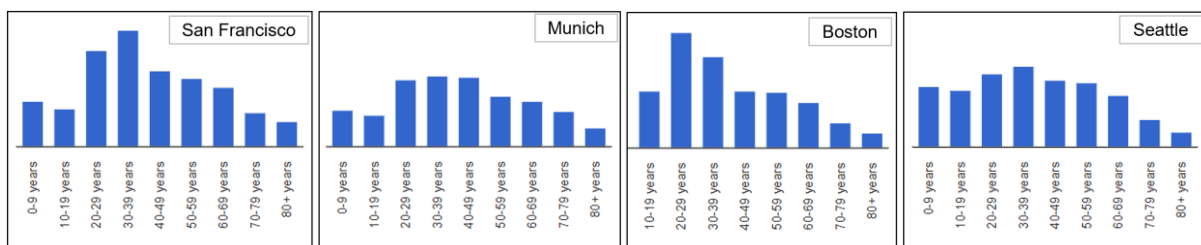


Figure 2.3: Population distribution of Global innovative cities

*“There is a strong correlation between the economic growth rate of a city and a high proportion of young wealth creators living within it. The net additional jobs they create also secure a city against any decline of its existing industries.” (KPMG 2016).<sup>12</sup>*





## 2.4 Vision Implementation

The H2 vision for the Greater Newcastle region encompasses a 25 year, four-stage approach for major collaboration within the region with the following guiding principles:

- 1) Expand and safeguard the economy through introduction of sustainable technology;
- 2) Alignment with national objectives to achieve a cleaner, safer future;
- 3) Developing domestic and export hydrogen opportunities through diversification of the local economy; and
- 4) On the success of the above principles, becoming a region for innovation for global energy and technology companies.

We have spoken to key stakeholders incorporating a triple helix approach for regional innovation with local businesses, research institutes and all levels of government from:

- Port operators, Orica, AGL;
- Local mayors through to Federal government Ministers;
- Education and research institutes; such as the University of Newcastle (UoN), CSIRO and the Newcastle Institute for Energy and Resources (NIER); *(For a full list of engagements see Appendix 8.3)*

Collaboration with the above stakeholders, including Shell aims to attract large MNCs, which will support investment opportunities to develop the H2-Hub.

Large technology companies such as Apple, Microsoft, Atlassian and Google have partnered with RE100, a corporate leadership initiative which aims to bring influential businesses together who are committed to 100% renewables. In 2017, Google achieved its goal of sourcing electricity globally from renewable sources. Microsoft realised the same goal in 2014, while Atlassian is aiming to achieve this by 2025. Salesforce, a cloud-based software organisation, believes clean sources of energy should power the cloud and are striving to do so by 2022. Salesforce avoids emissions by placing facilities on clean electricity grids.<sup>13</sup>

The Hunter region, with a tight clustering of mines within a 25km radius and encompassing a retiring power station and high voltage transmission network, is uniquely positioned as an ideal testing region for the use of green ammonia as a fuel source to replace diesel in heavy machinery. If all c.450 haul trucks in the Hunter region were converted to green ammonia, it would be equivalent to removing c.166,000 cars worth of CO<sub>2</sub>.



## 2.5 Outcomes for the Greater Newcastle Region

With an ever-critical focus on the impact of climate change on the future of our planet, the opportunity is now for the Greater Newcastle region to leverage off the existing local knowledge and infrastructure to develop new and economically diverse industries focussed on green hydrogen production and export.

Ultimately, implementation of H2's four-stage strategic action plan to achieve the H2-Hub, alongside the GNMP 2036 Plan and City of Newcastle smart city strategy, aims to transform the region's image and position it to attract new innovative energy, transport and technology business investment resulting in improved economic diversity.

Through the successful implementation of this vision and strategic action plan, the Greater Newcastle region will be:

- A world leader in the renewable energy economy;
- A carbon-neutral city;
- A well-connected city with a carbon-neutral public transportation network;
- A smart city which is recognised internationally for technology & innovation;
- A city that nurtures innovation;
- A city with a thriving young & creative community.

## 3 Strategy & Implementation

### 3.1 Overview

To realise our vision, H2 proposes a four-stage strategic action plan to develop an innovative renewable energy production and export region (H2 Hub) in which hydrogen and ammonia will be foundational. This strategic action plan requires collaboration between industry, communities, government and the University to implement projects to achieve our vision. A long-term approach over a 25 year period is needed to 'court' a significant strategic organisation to the region to act as an anchor tenant within the energy ecosystem. Alignment and collaboration with large organisations already within the area and is crucial to attracting new companies. Established companies have the knowledge, skillsets and deployable capital to invest in the development of the sector with increased investment from these companies creating an image that the region is an investment opportunity. While the vision for the region requires investment from multiple national and international companies, the strategic company key to the development of the region's renewable proposal is Shell.



### 3.2 ASX:200 Company Justification – Shell

Shell is acquiring ASX listed company ERM Power (ASX:EPW), while not ASX:200, ERM Power has a market capitalisation equivalent to that of smaller companies on the ASX:200. The acquisition is for the 100% share purchase of ERM Power which will result in them becoming a Shell Group company, herein will collectively be referred to as Shell in our proposal. Shell is the 3<sup>rd</sup> largest company in the world by revenue,<sup>14</sup> generating c.\$575 billion (US\$388.4bn)<sup>15</sup> in 2018. By comparison Commonwealth Bank of Australia, the largest company on the ASX by capitalisation had \$24.3 billion (2019) in revenue.<sup>16</sup> When Shell acquires ERM Power as another ASX dual listing, this will make Shell the largest company on the ASX by revenue with a magnitude greater than our largest company. This proposal and expanded rationale for the use of ERM Power as a proxy for Shell can be found in appendix 8.1 and was approved by the Future Leaders project committee.

To realise our vision of H2-Hub, expertise is required in multiple sectors, including the proven capability to develop upstream energy sources in remote locations. Shell has this experience in developing oil & gas fields and through the management of 10,000MW of energy generation, with one-third being renewable.<sup>17</sup> For comparison, AGL has 10,413 MW of generation currently in service.<sup>18 19</sup> Through their gas, oil refineries and liquefaction plants, Shell have experience funding, building and operating large scale chemical plants required to manufacture green hydrogen and ammonia. Shell can market the product globally through its global customer network, transportation/shipping networks and established trading divisions (Figure 3.1).<sup>20</sup>

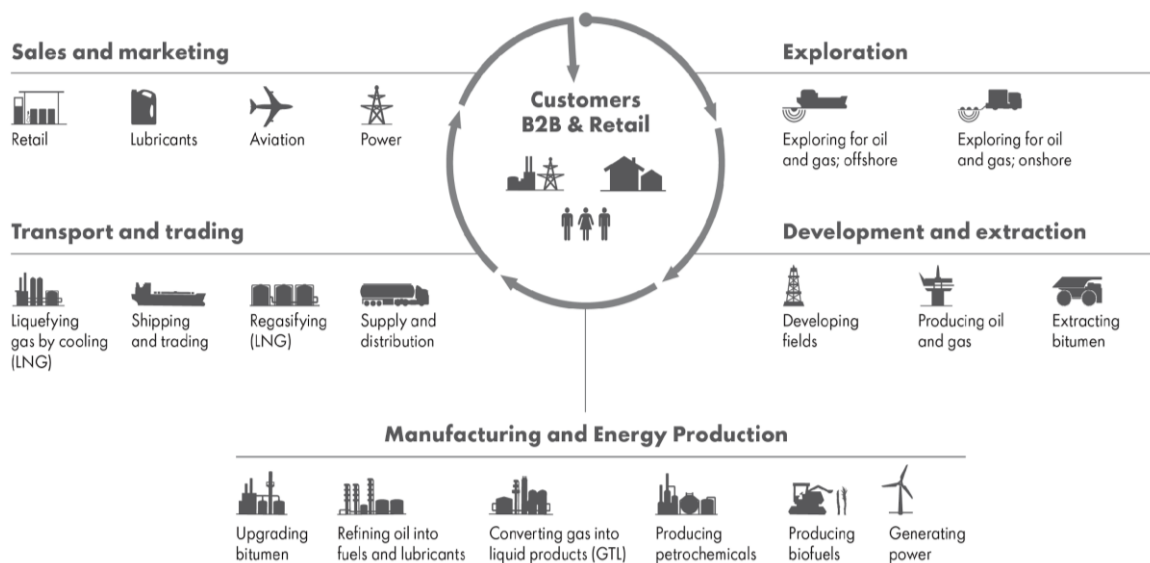


Figure 3.1: The depth of Shell's market reach and supply chains<sup>21</sup>



In 2016 Shell established the 'New Energies' division which has two primary focuses; to develop new fuels, for transport including biodiesel and hydrogen; and power, inclusive of generation, buying, selling and customer supply. Shell intends to leverage its size and strengths to push rapidly into the renewable energy industry. They acquired 49% of CleanTech Solar in January 2019 with the option for further investment in 2021, they also acquired 43% of Silicon Ranch in 2018 to develop Shell's solar portfolio.<sup>22</sup>

To realise our vision and develop the H2-Hub, the below Figure 3.2 summarises our four-stage strategic action plan:



Figure 3.2: H2's Vision Overview

### 3.3 Stage 1 – Developing an Energy Ecosystem

To realise our vision of H2-Hub, the region must first take smaller steps to foster early development of an energy ecosystem. Starting with smaller projects, will enable the region to be nimble and adapt according to developing global renewable trends and keep the initial upfront capital expense down, allowing the sector to grow organically. The region has been unable to attract and keep an ASX:200 company in over a decade;<sup>23</sup> therefore, the slow build-up will allow the region to 'court' key strategic companies to later become anchor tenants as the H2 innovation Hub grows. The below two steps will be staged out to more significant projects independently.





### 3.4 Stage 1a – Hydrogen Conversion of Newcastle Garbage Trucks

To start the region’s development of the H2-Hub, local government will lead, through policy and investment, with private business engaged to follow. In line with City of Newcastle Council’s vision of a carbon-neutral city, the council’s garbage truck fleet will transition to a hydrogen fuel source. Achieving this will allow access to funding for the project more easily within the current budget breakdown.

With regard to feasibility and implementation, funds can be drawn from more ‘buckets’ within the budget including; waste, smart cities and environment which make up 37% of the annual spend (Figure 3.3).<sup>24</sup> The city also runs 175 buses and 2 ferries through a partnership with Keolis Downer under a 10-year partnership<sup>25</sup> which could form part of the strategic action plan.<sup>26</sup> The conversion of garbage trucks has been proposed by the Moorelands regional council in Victoria; however, the project was suspended due to issues securing an economically viable source of hydrogen as a fuel source. For a pilot project in Newcastle existing manufacturer Orica would be used.

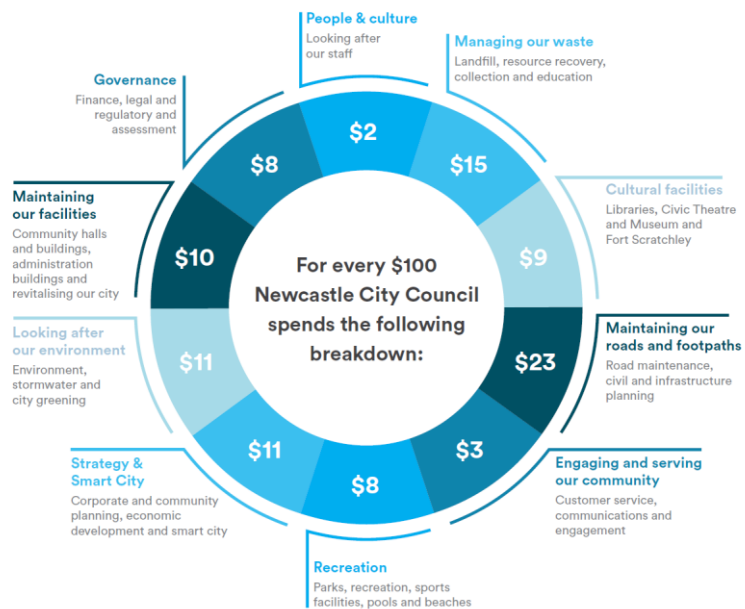


Figure 3.3: Newcastle Council Budget 2018-19

Orica has a SMR (blue) hydrogen stream at Kooragang that can be used to supply fuel for the fleet and there is currently a submitted proposal to build the ‘Newcastle Offshore Windfarm’ (NOW) in Stockton Bight to potentially transition Orica’s output to green hydrogen/ammonia.<sup>27</sup>

Shell is experienced in installing hydrogen refuelling networks<sup>28</sup> and will be engaged to build a refuelling station for the pilot project. Japanese car manufacturers such as Toyota or Nissan, which both have hydrogen models, will be engaged to complete the powertrain conversion of the trucks. Beginning to develop business relationships between Shell and Japanese car manufacturers in the region will be advantageous for later steps. In 2018 Shell



and Nissan announced a Formula E partnership in the all-electric racing series.<sup>29</sup> Shell is also in collaboration with Toyota to combine their expertise to develop a large-capacity hydrogen truck refuelling station in California.<sup>30</sup> Funding will be the responsibility of the local government and private business in conjunction with the Australian Renewable Energy Agency (ARENA) to show commitment to the long term vision. Upon successful implementation of the pilot program, it will be expanded to the councils within the Greater Newcastle region.

### 3.5 Stage 1b – Ammonia Conversion of Mining Haul Trucks

AGL (ASX:200) is seeking business cases for future utilisation of the Liddell site with a current proposal to transition it into the Upper Hunter energy integration hub.<sup>31</sup> AGL is committed to exiting coal generation by 2050<sup>32</sup> and is already involved in hydrogen R&D projects such as the Latrobe Valley brown coal plant.<sup>33</sup> The site has high voltage transmission lines which will become underutilised once generation stops, annual water entitlements of 106GL, onsite storage of 218GL, and a large landholding.

Orica (ASX:200) produces and holds the majority of ammonia nitrate supply contracts for Hunter mines and is the region's specialist in ammonia. With their local customer base, Orica will be able to develop ammonia fuels to replace any explosives revenue lost if the coal sector was to decline.

Through a joint venture between AGL and Orica, a 35MW ammonia plant will be developed at Liddell to draw green energy from western NSW and also act as an excess energy buffer to Liddell and Bayswater. Initially, Muswellbrook Coal's (Idemitsu) 10 mining haul trucks will be transitioned to 100% ammonia combustion. Idemitsu is a Japanese company with mining, fuel and renewable divisions of which, the ammonia transition aligns to their core business along with Japan's national hydrogen strategy.

The mine consumes c.\$21m worth of diesel a year and could save more than \$8m a year in fuel by switching to ammonia combustion engines. Assuming each truck would require \$1m for an engine retrofit and another \$2m for an onsite storage/refuelling station, the mine could pay back the investment within two years (Appendix 8.2). Engaging with Shell to build refuelling stations will further strengthen business relationships and collaboration.



Idemitsu is not only investing in fossil fuel energy; it's also investing in renewable energy supply. Idemitsu has installed a hydrogen refuelling station at Narita Airport Japan, operates a wind farm and three solar farms in Japan.<sup>34</sup> They are looking to develop a 250MW off-river pumped hydro at the Muswellbrook Coal site as their first renewable investment in Australia.

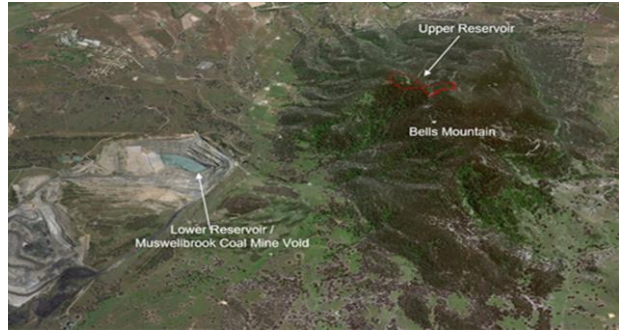


Figure 3.4: Location of Idemitsu and AGL's off-river pumped hydro

Idemitsu and AGL have signed a memorandum of understanding committing to a joint engineering feasibility study on the project (Figure 3.4).<sup>35</sup> Collaboration between these two companies shows why they have been strategically targeted as key stakeholders in the H2-Hub.

Caterpillar (CAT) would be an additional key stakeholder to the pilot as they already have patents on ammonia combustion engines which could allow CAT the opportunity for next-generation haul truck engine R&D.<sup>36</sup> CAT has produced over 7000 haul trucks, and the development of new technologies from this region could be exported globally.<sup>37</sup> The high number of haul trucks in the hunter regions tight clustering of mines would allow the continued development of CAT ammonia combustion engines which align with the H2-Hub's energy



Figure 3.5: Hunter Valley mine clustering.

Fuel Consumption: Haul Truck to Car Equivalent			
Haul Truck Burn Rate (L/hr)	200	(L/100km) 'as proxy for	10
Target Utilisation	92%	Average utilisation	5%
Effective Burn Rate (L/hr)	184	Effective Burn Rate (L/hr)	0.5
# Cars Equivalent to Haul Truck	368		
# Cars Equivalent to 450 Haul Trucks	165,600		

Table 3.6: Fuel Consumption Comparison

innovation objectives. Following Muswellbrook Coal's transition, the H2-Hub can be used to stage upgrades to the ammonia plant with a peak output of c.1,450MW which would allow the entire Hunter Valley's c.450 haul trucks to be transitioned. These trucks would consume 1.25m tonnes of ammonia annually, equivalent to 0.7% of the 2018 global supply of



ammonia (Appendix 8.2). This is a phenomenal amount of consumption within a 25km radius which is equivalent to the fuel consumption of 165,600 cars (Figure 3.5 and Table 3.6) without the need to install extensive transport infrastructure. The level of concentrated use and revenue will drive further R&D within the region, with conversion of the Hunter Valley coal trains becoming a logical progression.

Stages 1a and 1b both involve significant collaboration and R&D between companies who will form the beginnings of region’s H2-Hub. The key companies involved in these early stages will; 1) increase the prospects of being involved in later steps, and 2) introduce them to the region to set up R&D headquarters facilitating working on larger projects within the H2-Hub. The size of the project proposed for Liddell Power station and the future scope to expand this will form the basis of the first innovation hub.

### 3.6 Stage 2 – H2 Innovation Hub.

R&D involved in the first stage will actively develop strong education, business and government connections within Australia and internationally, which will set the scene for the development of the H2 innovation Hub. We will use the first hydrogen and ammonia projects to showcase the region’s potential and attract anchor tenants. These tenants will invest in the region and set up their Australian renewable R&D headquarters here. Using Julia Palmer's networked organisations chart for single companies<sup>38</sup> and adapting it to how a networked organisation of companies would look with Shell at the centre of the H2 Innovation Hub (Figure 3.7).

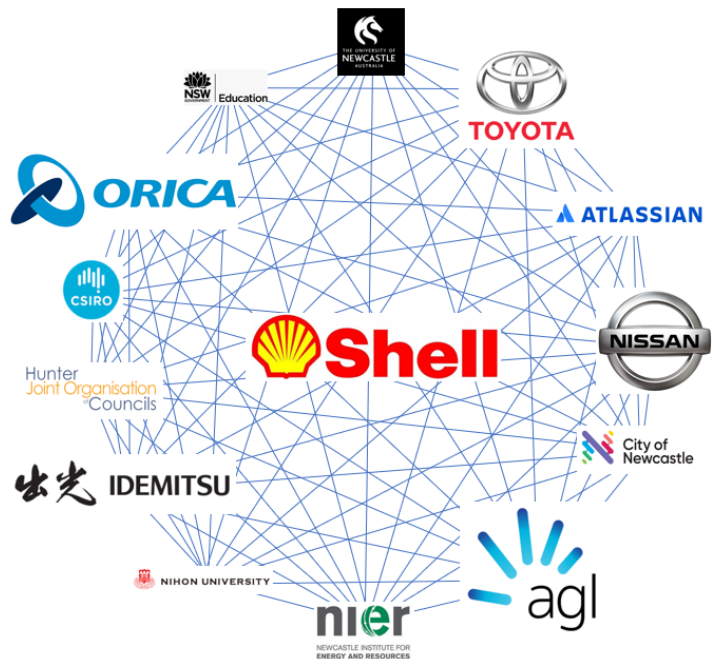


Figure 3.7: Networked Organisation of Companies

The second innovation hub will be situated in a triangular area extending from the University to Tomago and the Port creating an energy precinct (Figure 3.8). Both hubs can be aided through funding by inclusion within the regions City Deal proposal. The Launceston City Deal includes c.\$320m to develop a new campus and accommodation to connect the





University of Tasmania to the CBD.<sup>39</sup> The three levels of government will work in unison with Shell, to develop a feasibility study for the entire hydrogen and ammonia supply chain through to export. Further, other private funding avenues exist such as Breakthrough Energy Ventures (BEV) set up by Bill Gates, Jack Ma and Jeff Bezos who will collectively invest US\$1bn into “next generation energy technologies”.<sup>40</sup>

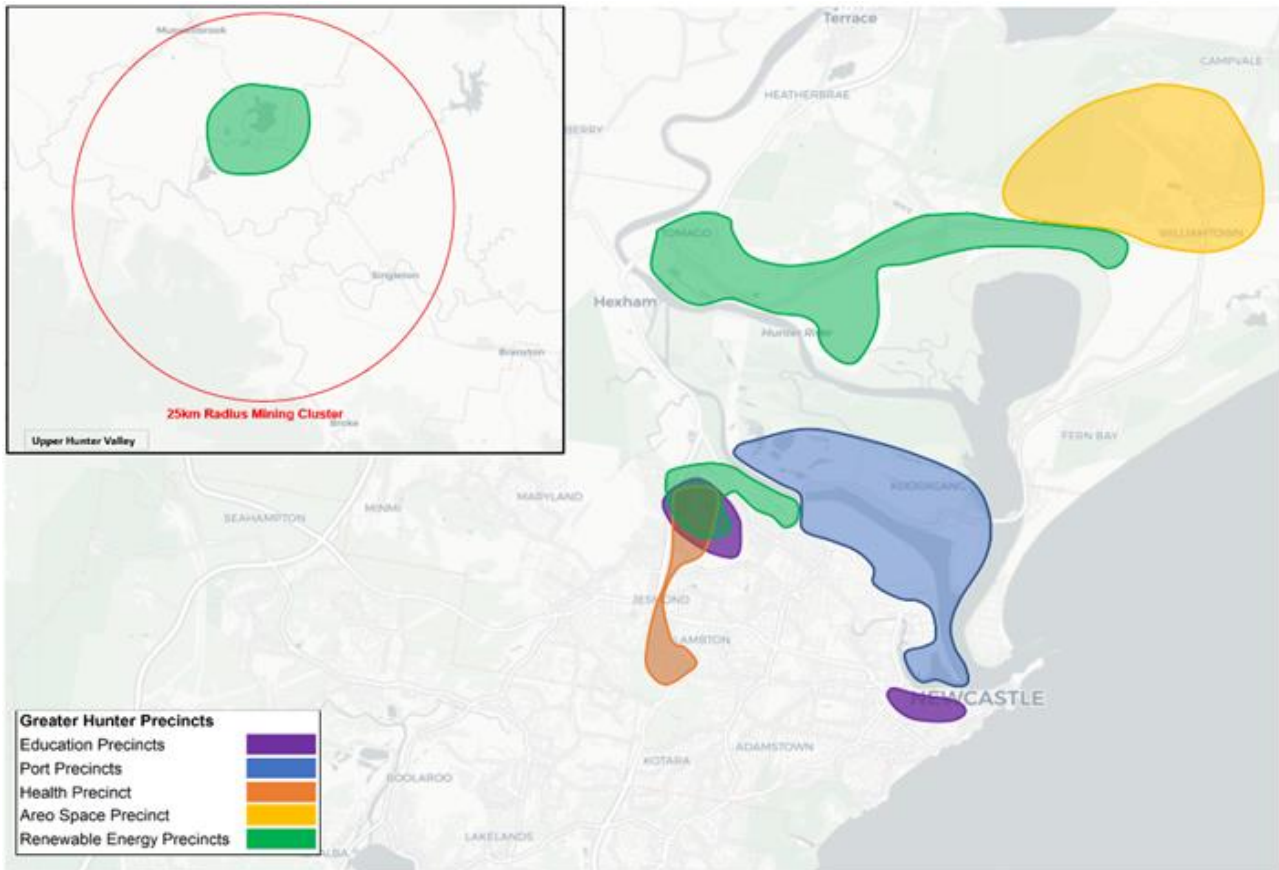


Figure 3.8: Greater Hunter Precincts

The region can create a regional differentiator by setting up programs to facilitate and encourage our region’s students to study Japanese. Setting up a long-term vision of bilingual STEM students will be a key skillset to develop strong cross ties with Japan. These cross ties will attract Japanese businesses such as car manufacturer R&D facilities to our region as anchor tenants within the H2-Hub. As a proven test market, the Greater Newcastle region will facilitate the development of renewable powertrains and will be a pilot site outside of Japan for smart cars and other high tech innovation trials. The appealing and high-tech nature of the car R&D industry will also attract a younger demographic to the region.

Graduates from the University of Newcastle and proposed Japanese university will provide additional knowledge within the H2-Hub. High-end smart manufacturing and innovation will attract young graduates and experienced professionals to the region. By developing a long-



term framework and strategy, we will build up a renewable energy R&D innovation hub over 25 years.

### 3.7 Stage 3 – Hydrogen Production & Export



Through the collaboration of companies based at the H2 innovation Hub and throughout the energy precinct with a feasibility study will be conducted into the development of production facilities and export passages for green hydrogen and ammonia. Utilising the energy and manufacturing precinct, Tomago is a suitable location to construct a production plant as it is located to utilise the existing high voltage power transmission lines. Upstream infrastructure will include renewable energy from Western and Northern NSW, which will include solar, wind and off-river pumped hydro (Figure 3.9).

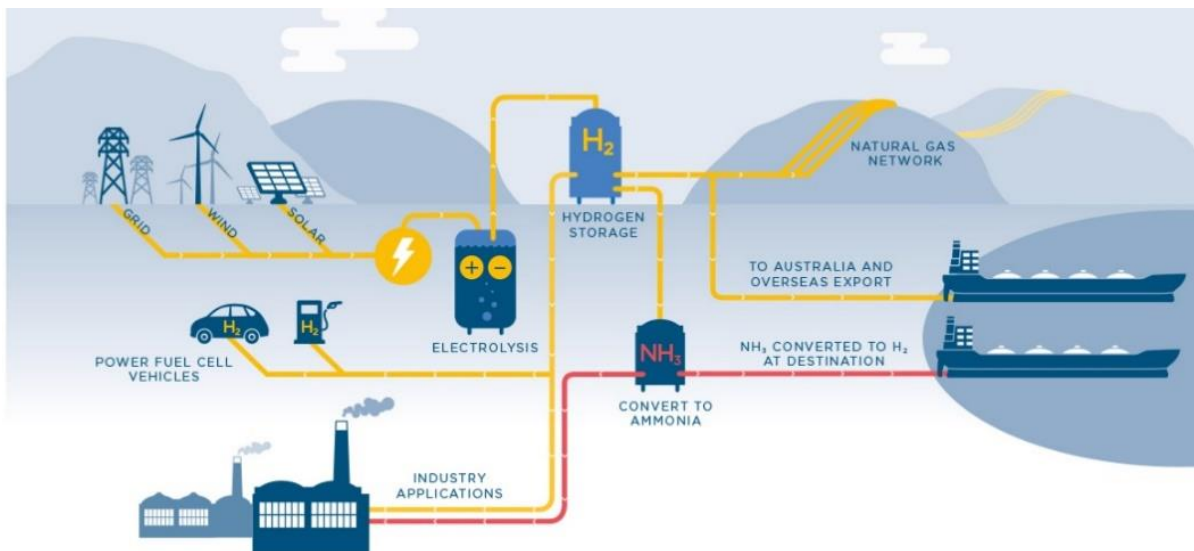


Figure 3.9: Green Hydrogen Value Chain<sup>41</sup>

With a successful feasibility studies the final capital investment decision would be required by a joint venture between Shell / Orica / Japanese consortium to execute and construct the necessary infrastructure to see the project come to life. Through investment from companies



like Shell, Newcastle will become an international hydrogen hub, similar to the way Gladstone has been recognised for its LNG export capabilities. Shell entered as the critical anchor tenant to the development of that project; we see Shell taking a similar approach here. The critical leverage in this hydrogen network for Shell is their global trade connections to take the product to the global market utilising the Newcastle port infrastructure which currently sees 95% of the cargo exiting the port as coal and as a whole is only at 50% utilisation, allowed for the rapid expansion of an export market to diversify the port's cargo.<sup>42</sup>

Justification for the regions production and export facilities is to become a key supplier of hydrogen in line with Japan and Australian respective national hydrogen strategies. Without the physical space to build a renewable energy network and hydrogen production facility in Japan to create the amount of green hydrogen needed to transition their auto-industry to a net-carbon neutral fuel source by 2050.

The Japanese–Australasia Economic Partnership Agreement (JAIPA) will be fully implemented by 2034, allowing for the export of Australian resources, energy and manufacturing to enter Japan duty-free. Australia plays a key role in Japan's 2050 energy goals. There are currently no international hydrogen transport routes, due to the high energy requirements to create and store liquid hydrogen. To combat this, it will be possible in the short term to convert hydrogen to ammonia utilising the Orica processing plant. This will enable utilisation of the current ammonia transport system until a suitable hydrogen transport system can be developed without putting a stop to hydrogen as a feasible energy source.

### 3.8 Stage 4 – Attracting New Companies to the Greater Newcastle Region

As the Greater Newcastle region transitions to a renewably focused 'smart and green city' with a successful innovation and R&D hub, the regions image will attract new organisations with a focus on environmental social responsibility. A paper in the Journal of International Business Policy<sup>43</sup> (also cited by World Economic Forum<sup>44</sup>) studied whether "it pays for cities to be green" in relation to the relocation strategy of multinational enterprises and foreign direct investment. The study found; 1) "*international firms prefer to invest in greener cities because of their increasing commitment to employees' wellbeing*" and therefore liveability, and 2) "*by choosing greener cities, international firms aim to bolster their reputation and show their corporate responsibility in times of increasing environmental awareness and stakeholder pressure*".



Newcastle offers an attractive alternatives for organisations over its capital and regional counterparts for business and employees with minimal traffic congestion, lower land and housing costs and improved lifestyle. Traffic congestion is a factor which results in higher costs to businesses; which by 2031 in Sydney, is forecast to increase from \$8bn (2019 Audit) to \$15.7bn<sup>45</sup>. In 2017 Google shelved plans to build its Australian HQ adjacent to the Anzac Bridge citing transport concerns<sup>46</sup>.

Business overheads are significantly cheaper in Newcastle with Mark Hickey from DWF Australia, a multinational law firm, stating they're about half the cost of Sydney. Similarly, residential housing is more affordable with a 2018 CoreLogic housing affordability report outlining dwelling price to income ratio in Sydney as 9.1 compared to 8.4 in Newcastle and 5.7 in the Lower Hunter.<sup>47</sup>

In a 2019 survey conducted by the Committee for Economic Development of Australia (CEDA), 72% of people surveyed believe businesses should place equal importance on economic, environmental and social performance. This sentiment is echoed by companies like Atlassian, stating "Companies like ours have a responsibility to act on climate". Organisations such as; Atlassian, Google, Apple, Amazon, Microsoft, Intel, Adobe, Dell, and Sony<sup>48 49</sup> have all been making significant investments in green energy to support their companies. This trend appears to be prevalent in the technology and communications sector. Our vision to transform Greater Newcastle to a global green smart city aligns perfectly with the likes of Atlassian who are trying to start 'Silicon Valley' tech hubs for innovation in Australia<sup>50</sup> and are extremely vocal about climate change and investing in renewable technology. Reviewing the median age for mining, health, financial, manufacturing and information/communication sectors on the Australian Government: Labour Market Portal<sup>51</sup> shows that the information and communications sector has the lowest median age. As technology and communication companies start moving to the area seeking to utilise the regions R&D knowledge base, looking to collaborate with and support more substantial organisations, economic diversity will increase. This increased diversity will offer further opportunities to attract professionals and a younger workforce to the Hunter.

The readiness to react to large scale non-energy organisations seeking to operate in the Hunter is the final piece to the City Deal across all three levels of Government. Smart city services and sufficient regional infrastructure must be in place while providing open communication lines to universities and local government to ensure companies interested in the region successfully relocate with minimal 'red tape'. Ultimately, the successful





implementation of H2-Hub will result in rapid growth and economic diversity with the hubs business attraction becoming one of the region's main assets.

## 4 Planning & Governance

To increase the economic diversity within the Greater Hunter region on a large scale, it is essential to attract not only the R&D headquarters of a major ASX listed company but draw on investment from other major companies. To leverage this, a large-scale funding and incentive arrangement will be required with a 25 year vision which strongly aligns with the Australian City Deals funding mechanism. A City Deal can be set up in conjunction with the ARENA funding focused on smaller projects within the overall vision. We will pitch to the regions education institutions and public companies to be part of a major Private Public Partnership (PPP) with local, states and federal governments.

### 4.1 Federal

The Federal Government has committed via the Renewable Energy Target (RET) to achieve a minimum 20% renewable energy generation by 2020,<sup>52</sup> further committing to developing hydrogen as an energy source. Two government reports 1) CSIRO's Low Emissions Technology Roadmap and Hydrogen Roadmap and 2) The Chief Scientist's Hydrogen for Australia's Future report both found "Australia could potentially be the world's largest hydrogen producer"<sup>53</sup> and supplier of choice to Japan. "With the right policy settings, Australian hydrogen exports could contribute A\$1.7 billion and provide 2,800 jobs by 2030".<sup>54</sup> To date, the federal government has partnered with industry investing >\$100m into hydrogen projects<sup>55</sup> These investments are a powerful leading indicator of the government following through on strong Joint Ministerial Statements, such as:

*"We, the Commonwealth, state and territory energy and resources ministers, strongly support the development of a hydrogen industry in Australia. We believe that hydrogen has a key role to play in an economically, socially and environmentally sustainable and prosperous future".<sup>56</sup>*

### 4.2 State

The NSW Government has emphasised the state's ability to leverage the abundant resources and R&D capacity and invest in renewable technologies. The government similarly sets out a road map to maximise the benefits in transitioning to electric and hybrid vehicles for NSW, inclusive of regional areas such as Newcastle and the Hunter. These



initiatives were outlaid in the NSW Renewable Energy Action Plan 2013,<sup>57</sup> Energy Efficiency Action Plan 2018<sup>58</sup> and the Future Transport 2056 Plan 2019.<sup>59</sup>

### 4.3 Regional

To work towards achieving an ambitious long-term vision, the regional government needs to develop a concept that widely consults community and industry to gain acceptance. The Greater Newcastle region is already undertaking strategies such as The Newcastle smart city strategy 2017 – 2021,<sup>60</sup> Newcastle 2030 strategic plan,<sup>61</sup> The Greater Newcastle Metropolitan Plan 2036,<sup>62</sup> and the Hunter Region Plan 2036.<sup>63</sup> In discussions with Simon McArthur<sup>64</sup> (SMA Tourism), it is important for local governments to lead with trialling, running workshops, organising speeches from experts and building awareness within the community on new ideas and innovation. This is displayed through City of Newcastle programs such as, but not limited to; the smart cities 'IQ' stakeholder engagement sessions and Newcastle's Living Labs.<sup>65</sup> The work the Greater Newcastle region is undertaking has been recognised with the City of Newcastle winning Smart City of the Year 2019 and Lake Macquarie City Council being shortlisted finalist.<sup>66</sup> The work that regional, state and federal governments are currently undertaking aligns with our 25 year vision for the region and are therefore eligible for large national funding programs such as City Deals.

## 5 Funding Avenues

### 5.1 City Deals

City Deal partnerships are the largest funding arrangement to facilitate work towards a shared vision in securing the future prosperity and liveability of our country's cities and regions. There are currently seven City Deals in Australia including; Townsville (>\$1bn,>15yrs), Launceston (>\$400m,>10yrs), Darwin, Hobart, Geelong, Adelaide and Western Sydney.<sup>67</sup> "City Deals focus on leveraging a city's unique strengths" within the long-term vision for a city enabling regional transformation. There are three primary criteria for a successful City Deal, including; 1) partnership with all three levels of Government. 2) opportunities to unlock regional economic potential. 3) leverage government investment to further national policy goals<sup>68</sup>.

If the Hunter region is not able to secure a City Deal, our ability to compete for investment and attract large companies will diminish relative to other regions implementing these deals. In a meeting with Bob Pysent (Mayor of Cessnock and Chair of the Hunter Joint Organisation of Councils), Bob provided information on the Greater Newcastle and Hunter City Deal



proposal which is currently being reviewed to incorporate the Upper Hunter transition. As Bob highlighted, one of the regions, key strengths is “One Voice” as illustrated by seven Mayors jointly going to Canberra to discuss regional issues. This type of collaboration is an essential part of a successful Hunter City Deal bid. As a requirement of a City Deal, Newcastle's unique strengths will also be leveraged, including but not limited to; deep water port, heavy manufacturing/industrial industries, regional logistic/transport hub, long history of very strong trade-based workforce, very strong science and engineering graduate base and international capable airport. H2 engaged Michael Comminos (Astrolabe group) as he was heavily involved with the application for the Western Sydney City Deal. In correspondence with Michael on the hydrogen and ammonia innovation hub and manufacturing concept, Michael indicated that it is possible to include the proposed concept within a City Deal, as it is targeted towards the ‘energy transition’ of the region. Similarly from a meeting with Pat Conroy MP (Federal Member of Shortland),<sup>69</sup> Pat agrees the H2-Hub proposal could be included within a City Deal and is very credible.

## 5.2 ARENA

ARENA's funding is focused on accelerating Australia's shift to affordable and reliable renewable energy and has to date invested \$5.49bn across 478 renewable projects. ARENA recently (Sep 2019) released the new investment focus of the agency<sup>70</sup>, which includes three investment areas 1) Integrate renewables into the electricity system, 2) Accelerating Hydrogen, and 3) Supporting industry to reduce emissions. Our hydrogen and ammonia projects fall within the ARENA's current funding framework focus, with; 1) hydrogen garbage trucks aligns to ‘demonstration-scale projects 1-10MW electrolysers. 2) Ammonia for haul trucks aligning with ‘commercial-scale 10-40MW electrolysers with large potential demand’, and 3) entire hydrogen value chain to export aligns with ‘feasibility studies for projects 100+MW electrolysers.



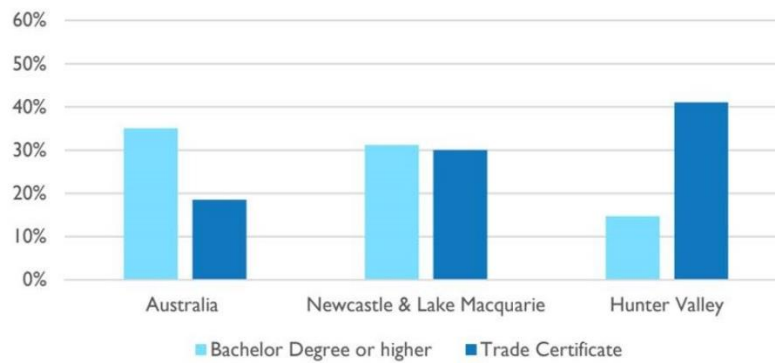
## 6 Workforce and Education

There are numerous small or isolated hydrogen and ammonia projects currently being started within Australia. The vision for the Greater Newcastle hydrogen economy looks at the entire value chain from energy generation to product export. To be successful in attracting internal investment and foreign direct investment from places such as Japan, the region needs to leverage as many assets as possible. The region already has a world-class education system, and by incorporating this into the 25 year vision will create another differentiator for the region to leverage.

The University of Newcastle is a critical business to consider when discussing the future of Newcastle as it is currently home to approximately 37,000 students; of this, there were 7082 international students in 2018.<sup>71</sup> The school of engineering ranks as one of the best in the world producing high-quality graduates. Given further opportunities such as within a developing hydrogen and ammonia sector within the region would increase the retention of graduates. The University is also undertaking world-class energy research within the Newcastle institute for energy and resources (NIER), Priority Research Centre for Frontier Energy Technologies and Utilisation, whose research is also currently taking place on Transportation and Energy Fuels. Further to this, in October 2019 the University was awarded \$35M from the Australian Research Council (ARC) to form a Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals. This clearly shows their commitment to sustainability and aligns well with their commitment to becoming the first Australian university powered 100% from renewable power from Red Energy along with its onsite solar installation.<sup>72</sup>

Looking at education across all institutions within the LGA the 2016 census indicates engineering and related technologies, and management and commerce rank as the top two fields of study at 16.2% and 17% of students respectively.<sup>73</sup> In a meeting with Professor Alan Broadfoot, he highlighted the regions extremely strong trade skill base from legacy trade trainee programs from BHP steelwork and the mining industry.<sup>74</sup> Comparing the regions strong engineering and trade skill base to international locations such as Cleveland's universities specialisations in health facilitated the development of the 'health tech corridor',<sup>75</sup> the Hunter region could leverage its strengths in engineering in energy R&D and developing a new economic sector in hydrogen and ammonia.





Source: Australian Bureau of Statistics, 2016 Census - Employment, Income and Education

Figure 6.1: Greater Newcastle region education statistics<sup>76</sup>

The H2-hub has benefits for the university with the ability to increase the number of multinational research connections and leverage programs such as the Australian Government initiative “New Colombo Plan” to provide scholarships for Australian undergraduate students to study and undertake internships in countries across the Asia-Pacific.<sup>77</sup> Further, the government also facilitates the Destination Australia Program to attract and support international and domestic students to study in regional Australia, to grow and develop regional Australian tertiary education providers and offer students a high-quality learning experience.<sup>78 79 80</sup> As part of the education precinct, the Department of Planning, Industry and Environment is currently responding to submissions in relation to Japan’s Nihon University building a language studies and student exchange campus at the historic former Newcastle courthouse. It obtained the property in December 2016 for \$6.6 million.<sup>81 82</sup> The University of Newcastle already has partnerships with 14 Japanese universities for student exchange programs.<sup>83</sup> These types of partnerships will not only strengthen the knowledge base within the Hunter region but through the students, experiences also increase the global awareness of Greater Newcastle in Japan, and vice versa.

The educational ties between the Greater Newcastle region and Japan could be further strengthened through companies within the H2-Hub. International undergraduate internships within companies participating in H2-Hub, research will not only benefit education within their chosen discipline but also provide opportunities for further bi-lingual studies. These students will be highly sought after within companies operating in both regions. Further, setting up targeted graduate programs with alternative years between countries will entrench bi-lingual professionals within the region. With potential co-government funding through City Deal partnerships, other funding avenues for international education could be included to strengthen international ties with Japan.



## 7 Conclusion

The implementation of the H2-Hub proposal will incorporate a triple helix model which integrates Greater Newcastle region businesses, educational institutions and governments to become a domestic and global powerhouse in the production and export of green hydrogen and ammonia. The proposal will leverage the already established position of the region as an energy export hub. The increasing demand for these exports has been primarily driven by Japan's 'National Hydrogen Strategy', which aims to reduce their reliance on fossil fuels by transitioning to a carbon neutral fuel source.

The H2-Hub proposal will be achieved through the creation of a complete energy ecosystem that incorporates the H2 Innovation Hub, renewable energy generation, green hydrogen and ammonia production, and local and international transport systems to facilitate export creating the H2-Hub. The H2-Hub plan will be staged over a 25 year lifespan through a four-stage approach, which will include three specific projects:

- 1) Short term: Transition of the City of Newcastle garbage truck fleet to hydrogen fuel sourced from Orica. To gain support from local government will be a critical step lead though policy and investment for the region.
- 2) Medium term: Transition mining haul trucks to ammonia fuel with the development of an ammonia plant at AGL's Liddell power station. The 32MW ammonia plant would be required to transition 10 haul trucks at Idemitsu Muswellbrook Coal. Transitioning all haul trucks within the Hunter would be equivalent to consuming 0.7% of the global ammonia production (2018). This would be a phenomenal amount of consumption within a 25km radius in the Valley and a perfect testing ground to develop ammonia combustion engines
- 3) Long term: Development of the entire supply chain from renewable generation to export facilities to produce large scale green hydrogen and ammonia. Shell is the key project partner as they have the capital to develop upstream renewable assets in conjunction with manufacturing and liquefaction terminals.

With successful completion of the H2-hub, the Greater Newcastle region will be ideally positioned to secure further multinational companies (MNC) in new and expanding industries to contribute to regional growth and diversity. This growth of a Silicon Valley style technology hub will develop of the back of a global trend for technology and communications companies to align themselves with green smart cities



## 8 Appendix

### 8.1 Request to HunterNet Future Leaders Project Committee - ERM Power

Hi Merran and Project Committee,

We have a question regarding our company selection

It was suggested to us heading into this project to ‘Think Big, Think Bigger and then Bigger Again’. We have been somewhat innovative in how we have approached the problem and looked at it from well and truly outside the box. We would like to double check our rationale for company selection will be accepted before we take the idea further. We believe our selection is still within the spirit of the assignment and presents a very plausible story to not only attract one large anchor company to the region, but several large companies to the region. Nevertheless, we wanted to double check with you and the project committee.

We would like to select ERM Power (ASX: EPW). ERM Power ASX listed, but not ASX:200, EPW has a market capitalisation of \$615,700,000. This would place EPW between Emeco Holdings (ASX:200: EHL) and Orocobre Limited (ASX:200: ORE) within the bottom 10 or so companies in the ASX:200.

Below is a list of the bottom companies within the ASX:200 list by market capitalisation

#### ASX 200 List (1 September 2019)

 Excel (CSV): [Download](#)

[Click here for the current Share Prices \(and Stock Charts\)](#)

Code	Company	Sector	Market Cap	Weight(%)
SDA	Speedcast Int Limited	Telecommunication Services	185,799,000	0.01
GXY	Galaxy Resources	Materials	472,790,000	0.02
ALG	Ardentleisuregrpltd	Consumer Discretionary	494,097,000	0.03
ECX	Eclixp Group Limited	Financials	513,017,000	0.03
EHL	Emeco Holdings	Industrials	610,871,000	0.03
ORE	Orocobre Limited	Materials	641,111,000	0.03
PLS	Pilbara Min Limited	Materials	648,190,000	0.03
API	Australian Pharm	Health Care	650,144,000	0.03

<https://www.ASX:200list.com/>

Further, Shell Australia has just put a proposal to acquire ERM Power which is unanimously recommended to shareholders to accept the proposal by the ERM Power board with the backing of the major shareholder. As such short of an act of god to block it (in our opinion) the acquisition will go through.

The Global Shell Group has revenues of USD397bn and is the 3<sup>rd</sup> largest company in the world.

The acquisition proposal for ERM Power is for 100% of the shares via ‘scheme of arrangement’. It is still unclear exactly what Shell intends to do with the ASX listing it will acquire in the acquisition, but;



- ERM Power already has sufficient capitalisation to be included within the ASX:200 index
- Should Shell decide to delist the company, for a period of time between finalisation of the acquisition and delisting, ERM Power will remain listed on the ASX and be a proxy for Shell. While it would not be included into the indexes it will still be comparable to the top companies on the ASX, i.e. the ASX listed company with the highest capitalisation and the highest revenue.
- While unlikely, but not impossible. Shell may choose to use ERM Power's ASX listing as another 'dual listing' for Royal Dutch Shell in Australia. In which case it will enter at and stay as the top ASX Company on the ASX. Shell is already listed on the London Stock Exchange (primary listing), New York Stock Exchange (Secondary listing) and the Euronext (Secondary listing).
- It is not uncommon for companies of this size to hold multiple listings throughout the world to facilitate global expansion, current and former companies with dual listings include; Rio Tinto, BHP Biliton, Brambles, Unilever, Reed Elsevier, ABB, SmithKline Beecham, Fortis, Dexia, Norbanken, Allied Zurich to name a few [\[1\]](#)

We intend to weave several other ASX:200 companies into our vision and concept for the Hunter including AGL, Orica, Incitec Pivot along with ERM Power/Shell and other private companies. Though considering the limited pages we have to convey our concept we are hoping to start the concept/vision with ERM Power.

As this is a little out of the box, in the spirit of 'Fair Play', if you allow us to use ERM Power we would be happy for you to tell the other teams we are either; using an ASX listed (but not ASX:200) company comparable in market capitalisation to ASX:200 companies AND/OR tell them we are using ERM Power.

<sup>[1]</sup> Reserve Bank of Australia: Dual-Listed Companies 2002

Thanks for your time and consideration.

Regards

Aaron, Rachel, Haylee, Rob, Scott & Jarrod



## 8.2 Muswellbrook Coal Ammonia Case study

Case Study: Muswellbrook Coal (Idemistu) Mine Haul Truck Conversion to Ammonia			
<b>Idemistu Muswellbrook Coal (MC)</b>			
# Muswellbrook Coal Trucks	10	Annual (\$)	
<b>Annual Diesel Consumption (L/yr)</b>	<b>16,118,400</b>	<b>\$</b>	<b>21,711,485</b>
Annual Ammonia Consumption Equivalent (L/yr)	40,915,938		
Annual Ammonia Consumption Equivalent (t/yr)	27,929		
MC Annual Energy Cost of Ammonia			
Global Spot Price per tonne		\$	9,500,313
Current QLD energy prices (energy only)		\$	12,888,243
CSIRO LCOE 2030 (energy only)		\$	10,194,164
<b>Australian Market Price Assumption (\$/t)</b>	<b>\$</b>	<b>465</b>	
<i>(Australia not globally competitive due to power. Assumption used = \$465/t in near future)</i>			
MC's Assumed total cost of ammonia		<b>\$</b>	<b>13,000,000</b>
<b>PAYBACK: Muswellbrook Coal</b>			
Annual (\$)			
Cost of diesel truck engine (\$)	\$	600,000	
Assumption: Cost ammonia engine install (\$)	\$	1,000,000	
Cost of all trucks converted to ammonia (\$)		\$	10,000,000
Assumption: mine site refuelling infrastructure (\$)	\$	2,000,000	\$
			2,000,000
<b>TOTAL COST OF CONVERSION (\$)</b>		<b>\$</b>	<b>12,000,000</b>
Annual fuel savings (10 trucks) (\$)		\$	8,711,485
<b>Years for Conversion Payback (yr)</b>			<b>1.4</b>
<b>Ammonia Plant Required for Muswellbrook Coal</b>			
Energy Requirement @ 10MWh/t (MWh)	279,292		
<b>Liddell Ammonia Plant Size Required (MW)</b>	<b>31.9</b>		
<b>Ammonia Assumptions</b>			
Ammonia MJ/kg	22.5	<b>Ammonia Costs per Tonne</b>	
Ammonia MJ/L Approx.	15.6	Power Costs MWh	
Ammonia L/kg	1.46	<b>Spot Market</b>	NH3 (\$/t)
Ammonia Lt	1,465.0	NSW Electricity Price	\$ 90 \$ 901
Ammonia Avg Spot Price AUD/t	340.2	<b>QLD Electricity Price</b>	<b>\$ 45 \$ 454</b>
Water required per tonne NH3	9.0	<b>CSIRO LCOE 2030</b>	<b>\$ 37 \$ 365</b>
Energy required via coal (MWh/t)	10.6	CSIRO LCOE 2040	\$ 31 \$ 310
Energy required via gas (MWh/t)	7.6		
Energy required via electrolysis (MWh/t)	10.0		
<b>Diesel Assumptions</b>			
Diesel MJ/kg	45.0	<b>Mine Haul Truck Diesel Burn Rate</b>	
Diesel MJ/L approx.	39.6	Trucks burn rate (L/hr)	200
Diesel Lt	1,175.0	Target utilisation	92%
Diesel \$/L (After Rebates) 18th Sep	\$ 1.19	Effective burn rate (L/hr)	184
		Daily fuel consumption (L)	4,416
		Annual Fuel Consumption (L/yr)	1,611,840
		Ammonia Energy Equivalent (L/yr)	4,091,594
<b>Litres of Ammonia Equivalent to Diesel</b>	<b>2.5</b>		
<b>Hunter Valley (HV) Market Scale</b>			
Annual (\$)			
The Approx. Haul Truck Fleet in HV	450		
Radius Encompassing Most Mines in Valley (km)	25		
Total Diesel Consumption (L)	725,328,000	\$	977,016,816
Equivalent Ammonia Consumption (L)	1,841,217,231		
<b>HV Ammonia Consumption Potential (t)</b>	<b>1,256,815</b>		
Consumption Value via Global Spot Price (\$)		\$	427,514,074
Ammonia Plant Size Required (MW)	1,435		
Global Ammonia Consumption 2018 (t)	168,056,000		
<b>% of Global Market within 25km radius in HV</b>	<b>0.75%</b>		

**NOTE:** The AFR (Sep 5<sup>th</sup>)<sup>84</sup> article the influx of solar onto the market is putting downward pressure on QLD prices. In Aug 2019 there is currently 362.5MW installed commercial solar in NSW vs 633MW in QLD.<sup>85</sup> With a further 1,289.5MW committed in NSW, NSW prices will also experience downward pressure comparable to QLD in the coming years. Further out the CSIRO forecasts the solar Levelised Cost of Energy (LCOE) to drop from an average of \$54MWh in 2020 to \$36.5 and \$31 per MWh in 2030 and 2040 respectively.<sup>86</sup>



### 8.3 Interview Reference List

Name	Organisation	Role	Meeting Date
<b>Adam Clarke</b>	City of Newcastle	Program Coordinator – Strategy & Engagement	11 <sup>th</sup> September 2019
<b>Aleksandar Mitreski</b>	Muswellbrook Shire Council	Policy Analyst Economic Transition and Innovation	1 <sup>st</sup> October 2019
<b>Amer Hussein</b>	AGL	Senior Manager Liddell Transition	3 <sup>rd</sup> October 2019
<b>Anna Chubb</b>	Hunter & Central Coast Development Corporation	Director of Strategy	26 <sup>th</sup> August 2019
<b>Ben (<i>Can provide more info if req.</i>)</b>	Callide Coal	Controlling Shareholder	30 <sup>th</sup> September 2019
<b>Clint Bruin</b>	ResTech	R&D Manager	Multiple Conversations
<b>Geoffery Beuzeville</b>	The Renewable Group	Founder	11 <sup>th</sup> September 2019
<b>Geoff Rock</b>	Monteath & Powys	Director & Development Services Manager	9 <sup>th</sup> October 2019
<b>Hennie du Plooy</b>	Port Waratah Coal Services & Hunter Business Chamber (HBC)	Chief Executive Officer & HBC President	16 <sup>th</sup> August 2019
<b>Kira McGrath</b>	Orica	Senior Chemical Engineer	15 <sup>th</sup> September 2019
<b>Louise Pavey</b>	Newcastle Uni - Centre for English Language and Foundation Studies Academic Division	ESL (English as a Second Language) Teacher	Multiple Conversations
<b>Mayor Bob Pynsent</b>	Cessnock City Council & Hunter Joint Organisation of Councils (HJO)	Cessnock Mayor & Chair HJO	1 <sup>st</sup> October 2019
<b>Mayor Martin Rush</b>	Muswellbrook Shire Council & Hunter Joint Organisation of Councils (HJO)	Mayor of Muswellbrook	1 <sup>st</sup> October 2019
<b>Meryl Swanson MP</b>	Australian Government	Federal Member for Paterson	Assisted organising a meeting



<b>Michael Comninos</b>	Astrolabe Group	Founding Director, Practice Lead Strategy	2 <sup>nd</sup> October 2019
<b>Owen Redman</b>	Newcrest	Senior Mechanical Engineer	Multiple Conversations
<b>Pat Conroy MP</b>	Australian Government	Federal Member of Shortland	9 <sup>th</sup> October 2019
<b>Peter McGrath</b>	Orica	Ammonia Technology & Asset Specialist	2 <sup>nd</sup> October 2019
<b>Prof. Alan Broadfoot</b>	NIER	Director	19 <sup>th</sup> August 2019
<b>Prof. Will Rifkin</b>	University of Newcastle – Hunter Research Foundation	Chair in Applied Regional Economics	17 <sup>th</sup> September 2019
<b>Richard Finlay-Jones</b>	Pilbara Solar, EcoEnviro, The Clean Energy Association of Newcastle and Surrounds & RESS Australia	Director, Director, co-founder and project development contractor	Multiple Conversations
<b>Robbie McNaughton</b>	CSIRO	Team Leader - Solar Thermal Processes at CSIRO	Multiple Conversations
<b>Rod Murphy</b>	R&R Murphy	CEO	10 <sup>th</sup> September 2019
<b>Ryan Boslem</b>	WesTrac	Manager	14 <sup>th</sup> September 2019
<b>Simon McArthur</b>	SMA Tourism	Managing Director	21 <sup>st</sup> August 2019
<b>Tim Snell</b>	IMC Control	Managing Director	Multiple Conversations
<b>Eddie Hoade</b>	Ampcontrol	Marketing Advisor	Throughout



## 9 References

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- <sup>1</sup> Newcastle population data <http://www.population.net.au/newcastle-population/>
- <sup>2</sup> Newcastle Airport passenger numbers <https://www.newcastleairport.com.au/corporate/about/media-releases/19-07-19>
- <sup>3</sup> Greater Newcastle <https://www.planning.nsw.gov.au/Plans-for-your-area/Greater-Newcastle-metropolitan-planning/Map>
- <sup>4</sup> Australian Gov 2019: Australia's Ageing Population [https://www.aph.gov.au/About\\_Parliament/Parliamentary\\_Departments/Parliamentary\\_Budget\\_Office/Publications/Research\\_reports/Australias\\_ageing\\_population\\_-\\_Understanding\\_the\\_fiscal\\_impacts\\_over\\_the\\_next\\_decade](https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Budget_Office/Publications/Research_reports/Australias_ageing_population_-_Understanding_the_fiscal_impacts_over_the_next_decade)
- <sup>5</sup> Annual Ammonia Production <https://www.aiche.org/resources/publications/cep/2016/september/introduction-ammonia-production>
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