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The Emerging Hydrogen Economy: Regulation, Policy, and Industry Update

*By Michael Joyce and Euan Strachan**

In this article, examining the emerging hydrogen economy, the authors take a closer look at regulation and policy in the sector, highlighting recent developments and some of the key aspects of legislation in those countries that are leading the way in the field of hydrogen development.

Regulation of the use of hydrogen is not a new concept. There exist a range of international standards which may apply to hydrogen, including those developed by:

- The International Standards Organisation (“ISO”);
- The International Electrotechnical Commission (“IEC”); and
- The European Industrial Gases Association (“EIGA”).

Technical Committee 197 “Hydrogen Technologies” of the ISO (“TC 197”) was established in 1990 with the objective of developing international standards in the field of systems and devices for the production, storage, transport, measurement, and general use of hydrogen. To date, TC 197 has published 17 ISO standards relating to hydrogen, with a further four under development. In order for global market acceptance of new hydrogen technologies to be achieved, the hydrogen industry will need to ensure the implementation of a uniform set of standards ensuring the safety of its products and systems—TC 197 has a key role to play in achieving this.

The IEC, through Technical Committee 105 “Fuel Cell Technologies,” operates to prepare international standards regarding fuel cell technologies for all fuel types and various associated applications such as:

- Stationary fuel cell power systems for distributed power generators and combined heat and power systems;
- Fuel cells for transportation such as propulsion systems;
- Range extenders, auxiliary power units;

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- Portable power systems, micro power systems; reverse operating power systems; and
- General electrochemical flow systems and processes.¹

The EIGA, is a technical and safety-oriented organization representing the majority of European, as well as a number of non-European, companies, producing and distributing industrial, medical and food gases. The member companies are encouraged to co-operate on safety and technical matters concerning production, transport, storage, and applications with a view to achieving the highest levels of safety and environmental care in the handling of gases.

The EIGA also works to develop appropriate standards and provides standardization bodies with technological knowledge. In addition, EIGA co-operates with national and regional industrial gas associations from around the world.²

REGULATORY FRAMEWORK

As is the case with any emerging industry, developing a robust regulatory framework is a key hurdle that must be overcome and the hydrogen sector is no different. In this section, we take a closer look at work being undertaken by those nations at the forefront of the developing hydrogen economy, to put in place the required regulatory frameworks.

Australia

In November 2019, Australia released its National Hydrogen Strategy³ (the “Strategy”) setting out a “vision for a clean, innovative, safe and competitive hydrogen industry.”⁴ The key objective of the Strategy (developed by the Hydrogen Working Group established by the Council of Australian Governments (“COAG”) Energy Council⁵) is to promote the development of Australia’s hydrogen industry to help ensure that its potential is realized, both at global and national levels.

¹ https://www.iec.ch/dyn/www/?p=103:7:0:::FSP_ORG_ID,FSP_LANG_ID:1309,25.

² <https://eiga.eu/>.

³ <https://www.industry.gov.au/data-and-publications/australias-national-hydrogen-strategy>.

⁴ *Ibid.*

⁵ The Hydrogen Working Group was established by the COAG Energy Council in December 2018 with the key goals of developing a national hydrogen strategy for 2020–2030 and a coordinated approach to projects and programs that support hydrogen industry development.

The Strategy sets out 57 joint actions to be undertaken across Australia in order to achieve this goal. The joint actions are spread across 21 key areas, including:⁶

- An adaptive pathway to clean hydrogen growth;
- Large-scale market activation;
- Hubs and sector coupling;
- Assessing hydrogen infrastructure needs;
- Supporting research, pilots, trials, and demonstrations along the supply chain;
- Using clean hydrogen in Australian gas networks;
- Initial steps towards using hydrogen for transport;
- Responsive regulation;
- Shared principles for nationally consistent regulation;
- A coordinated approach to planning and regulatory approvals for hydrogen projects;
- Integrating hydrogen into energy markets;
- Hydrogen's role in secure and affordable energy supply;
- Certainty around taxation, excise and other fees or levies for hydrogen;
- Bilateral partnerships to build markets;
- Hydrogen certification;
- Building community knowledge and engagement;
- Responsible industry development;
- Skills and training for the hydrogen economy;
- Hydrogen training for Australian energy emergency services;
- Hydrogen training for regulators; and
- National coordination.

The development of hydrogen-specific regulation is a key component of the Strategy. The joint actions call for each state and territory government, as well as the federal government, to review its existing legislation, regulations, and standards in order to determine whether their respective legal frameworks can support hydrogen safety and hydrogen industry development. The review of legal frameworks should be coordinated to:

⁶ *Ibid.*

- (1) Support the development of standards for the hydrogen industry, including technical safety standards, noting the role of Standards Australia.⁷
- (2) Consider and evaluate regulatory models to address and support:
 - (a) Hydrogen safety (noting the role of SafeWork Australia and state-based safety agencies); and
 - (b) Hydrogen industry development,

with the ultimate aim being to develop a consistent national approach to the regulation of the hydrogen sector. Thereafter, and to the extent necessary, existing legislation and regulations should be amended, or new legislation drafted in order to address hydrogen safety and support hydrogen industry development.

Other joint actions linked to the development of regulation in the hydrogen sector include:

- (1) Agreeing to seek national regulatory consistency for any new regulations associated with hydrogen, that follows the COAG principles of Best Practice Regulation.
- (2) Agreeing to develop and incorporate “hydrogen-ready” capabilities into planning and regulatory approvals mechanisms where required.
- (3) Agreeing to review training and upskilling arrangements for regulators to ensure they have adequate understanding of hydrogen infrastructure, projects and technologies.

A preliminary legal review across Australia’s jurisdictions has identified approximately 730 pieces of legislation and 119 standards potentially relevant to the hydrogen industry and supply chain development.⁸ The refinement of existing legislation (or, to the extent required, the introduction of new laws) to contemplate hydrogen, is undoubtedly a significant challenge for the state, territory and federal governments in Australia.

However, with the introduction of the Strategy, Australia has, effectively, established a clear path towards the fulfilment of hydrogen’s potential as an energy source. In this regard, Australia is somewhat ahead of the curve in comparison to other nations looking to explore the possibilities that hydrogen presents.

⁷ Standards Australia is a standards organization established in 1922 and is recognized by the Australian Federal Government as the primary nongovernment standards development body in Australia. Standards Australia recently announced the adoption of eight international standards to facilitate the safe use, transportation, and trade of hydrogen across Australia.

⁸ *Ibid.*

European Union

Taking a similar approach to Australia, the European Commission released its own hydrogen strategy in July of last year (“EU Strategy”). The EU Strategy envisages three phases of development of the hydrogen economy in Europe:⁹

- Phase 1 (2020–2024)—the objective is to decarbonize existing hydrogen production for current uses such as the chemical sector, and promote it for new applications. Phase 1 relies on the installation of at least six Gigawatts of renewable hydrogen electrolyzers in the EU by 2024, with the goal of producing up to one million tons of renewable hydrogen.
- Phase 2 (2024–2030)—hydrogen needs to become an intrinsic part of an integrated energy system with a strategic objective to install at least 40 Gigawatts of renewable hydrogen electrolyzers by 2030 and the production of up to 10 million tons of renewable hydrogen in the EU. Hydrogen use will gradually be expanded to new sectors including steel-making, trucks, rail and some maritime transport applications.
- Phase 3 (2030 onwards and towards 2050)—renewable hydrogen technologies should reach maturity and be deployed at large scale to reach all sectors (including those that are difficult to decarbonize) where other alternatives might not be feasible or have higher costs.

The EU Strategy is seen as a crucial part of the “European Green Deal,” a wide-reaching strategy with the ultimate goal of achieving climate neutrality in Europe by 2050. The outbreak of the COVID-19 pandemic gave rise to calls from some quarters for the Green Deal to be scrapped as European nations grappled with the economic fallout of the virus. In July 2020, however, EU leaders approved a €1.8 trillion package geared towards boosting EU economic recovery post-COVID-19, with the Green Deal now seen as a key element of the recovery strategy.¹⁰

In terms of regulation, the EU Strategy focuses on the following in Phase 1:¹¹

- Accelerate the deployment of different refueling infrastructure by revising the Alternative Fuels Infrastructure Directive¹² and the Regu-

⁹ “Questions and answers: A Hydrogen Strategy for a climate neutral Europe,” July 8, 2020, https://ec.europa.eu/commission/presscorner/detail/en/QANDA_20_1257.

¹⁰ “Europe’s moment: Repair and prepare for the next generation,” May 27, 2020, https://ec.europa.eu/commission/presscorner/detail/en/ip_20_940.

¹¹ A Hydrogen Strategy for a Climate Neutral Europe, July 8, 2020.

¹² The Alternative Fuels Infrastructure Directive was adopted by the European Parliament on

lation on the Trans-European Transport Network¹³ (scheduled for 2021).

- Design enabling market rules for the deployment of hydrogen, including removing barriers for efficient hydrogen infrastructure development (e.g., via repurposing) and ensure access to liquid markets for hydrogen producers and customers and the integrity of the internal gas market, through upcoming legislative reviews (e.g., review of the gas legislation for competitive decarbonized gas markets (2021)).

In Phase 2, increasing hydrogen demand is anticipated, meaning that production, use and transport of hydrogen will need to be optimized. As a result, longer-range transportation will likely be required in order to ensure efficiency of the entire system through the revision of the Trans-European Networks for Energy and the review of the internal gas market legislation for competitive decarbonized gas markets.¹⁴

Fragmented regulation regarding the admissible concentration of hydrogen in the European natural gas network has also been identified as a potential issue in the development of Europe's hydrogen economy.¹⁵ Currently, neither international nor European standards define rules for the admissible concentration of hydrogen in the natural gas network and this generally varies significantly between EU member states. Moreover, a significant number of EU-countries prohibit hydrogen injection into the gas network. The absence of a harmonized EU regulation leads to a fragmentation of the gas market, which inhibits the potential for hydrogen demand and may create problems at

September 29, 2014 and provides for the following:

- Requires Member States to develop national policy frameworks for the market development of alternative fuels (including hydrogen) and their infrastructure.
- Foresees the use of common technical specifications for recharging and re-fueling stations.
- Paves the way for establishing appropriate consumer information on alternative fuels, including a clear price comparison methodology.

¹³ The Trans-European Transport Network policy, (as implemented by the Regulation on the Trans-European Transport Network (Regulation (EU) No 1315/2013)) is a policy for the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals, with the ultimate objective of closing gaps, removing bottlenecks and technical barriers, as well as strengthening social, economic and territorial cohesion in the EU. In addition to the construction of new infrastructure, the policy also supports the application of innovation and new technologies to all modes of transport.

¹⁴ *Ibid.*

¹⁵ Hydrogen Europe Secretariat, "*Hydrogen Europe Vision on the Role of Hydrogen and Gas Infrastructure on the Road Toward a Climate Neutral Economy*," April 2019.

cross-border connection points. It is therefore critical that common rules are agreed and adopted EU-wide for hydrogen content in natural gas networks.¹⁶

Japan

Japan was the first country to adopt a focused approach to the development of its hydrogen sector when the government released its “Basic Hydrogen Strategy” in 2017, with the aim of becoming the world’s first “hydrogen society.” Japan has taken significant strides toward the achievement of this goal, with Japanese entities (both public and private) at the forefront of some of the highest profile hydrogen projects globally including such as the Hydrogen Energy Supply Chain Project in Australia and the recent opening of the Fukushima Hydrogen Energy Research Field—presently the world’s largest hydrogen production facility.¹⁷

In terms of regulatory reform, the Japanese government determined to accelerate existing initiatives based on the “Implementation Plan for Regulatory Reform,”¹⁸ to give consideration to a regulatory system based on hydrogen use. The Japanese government also plans to adopt reforms to current regulations to facilitate additional construction of hydrogen stations in Japan. For example, in February 2018, Japan’s Ministry of Economy, Trade and Industry in Japan (“METI”) took action to relax certain provisions in existing fire safety legislation that inhibited the expansion of such stations.

United States of America

In July 2020, the U.S. Department of Energy’s (“DOE”) Office of Fossil Energy released its hydrogen strategy, setting out a strategic plan to “accelerate research, development, and deployment of hydrogen technologies in the United States.”¹⁹ The DOE strategy identifies safety and regulatory issues as key components in the development of the hydrogen industry in the US.

The strategy notes that, globally, the state of existing regulations and standards currently limits hydrogen uptake, with certain regulations being “unclear or not written with new uses of hydrogen in mind”²⁰ and that such

¹⁶ *Ibid.*

¹⁷ “*Giant Leap Towards a Hydrogen Society*,” <https://www.japan.go.jp/tomodachi/2020/earlysummer2020/hydrogen.html>.

¹⁸ The Implementation Plan for Regulatory Reform sets out the Japanese government’s intention to implement regulatory reform in the field of fuel cell vehicles (“FCVs”) and their re-fueling infrastructure (i.e., hydrogen stations).

¹⁹ U.S. Department of Energy, Office of Fossil Energy, “*Hydrogen Strategy—Enabling a Low-Carbon Economy*,” July 2020.

²⁰ *Ibid.*

regulations need to be updated in order for hydrogen to fulfill its potential. The DOE highlights that gaps have been identified in the existing framework and these should be addressed in coordination with the Office of Energy Efficiency and Renewable Energy.

HYDROGEN ECONOMY UPDATE

In this section, we highlight some of the recent developments in the global hydrogen market across a number of jurisdictions.

United States of America

The developers of three natural gas-fired generation projects in New York, Ohio, and Virginia announced the selection of Mitsubishi Power Americas Inc. to supply hydrogen-compatible gas turbines, along with associated equipment for the generation and storage of hydrogen from renewable sources for the planned power stations.

The projects, with a proposed aggregate capacity of 3,000 MW, are being developed by Danskammer Energy LLC, Balico LLC, and EmberClear and scheduled to complete in 2022 and 2023. It is intended that all three projects (with an estimated aggregate value of US\$3 billion) will, gradually, transition to 100 percent green hydrogen, while at the same time utilizing excess renewable energy to produce and store hydrogen on-site.²¹

United Kingdom

The UK's hydrogen strategy was debated in the House of Lords in September following pressure from members of Parliament and industry. Hydrogen Strategy Now, a cross-industry campaign group, that includes Vattenfall, Siemens, Orsted, and Uniper said it was "calling on the Government to move fast" to realize the hydrogen opportunity and "achieve maximum economic benefit."²²

The businesses forming Hydrogen Strategy Now have apparently pledged to invest GBP 1.5 billion in UK hydrogen technologies and projects. During the debate, Lord Callan (Parliamentary Under-Secretary of State, Department for Business, Energy and Industrial Strategy) confirmed that a UK hydrogen strategy would be published in early 2021, ahead of the next UN Climate Change Conference.

Increasing numbers of hydrogen-related projects are now coming to the fore in the United Kingdom. For example, the Acorn Project (backed by Pale Blue

²¹ S&P Global Platts, "*Mitsubishi lands 3.3 GW of new US hydrogen-compatible gas turbine orders*," September 3, 2020.

²² ReNews.Biz, "*House of Lords to debate 'UK hydrogen strategy'*," September 3, 2020.

Dot Energy, industry partners (Chrysaor, Shell, and Total), the UK and Scottish Government, as well as the European Union) has been designated as a European Project of Common Interest.²³ Located at the St. Fergus Gas Terminal in North East Scotland, the Acorn Project has two elements:

- Carbon capture and storage (“CCS”)—existing gas pipelines will be repurposed to take CO₂ (captured directly from the gas processing units at the St. Fergus Gas Terminal) directly to Acorn’s offshore CO₂ storage site (the depleted Goldeneye reservoir).
- Hydrogen—The second phase of the Acorn Project is focused on hydrogen production. Acorn Hydrogen will utilize North Sea natural gas as feedstock and reform it into hydrogen, with the CO₂ emissions being removed and stored using the CCS infrastructure.²⁴ The first Acorn Hydrogen plant is scheduled to come online in 2025.

Germany

The German federal government recently announced its “National Hydrogen Strategy,” demonstrating its commitment to the EU Green Deal. In addition, as part of a €130 billion economic stimulus package, the German federal government has allocated €9 billion for the hydrogen sector, in addition to existing hydrogen-related projects in Germany. These developments have provided a welcome boost to Germany’s hydrogen market and the government is now targeting five GW of electrolyzer capacity by 2030, with an additional five GW to follow.

Germany is also looking to collaborate with other international players in the hydrogen space. Germany and Australia recently signed an agreement to conduct a joint feasibility study in order to investigate a prospective supply chain between the counties in respect of hydrogen produced from renewable energy. The study will cover production, storage, transport and use of renewable hydrogen, as well as the assessment of current technology and research.²⁵

Australia

Following on from the introduction of the Strategy, the Australian federal government announced in May that it had directed the Clean Energy Finance Corporation (“CEFC”) to make available approximately AUD 300m to support growth in the hydrogen industry. The CEFC is required to prioritize projects that focus on one, or more, of the following:

²³ <https://theacornproject.uk/about/>.

²⁴ *Ibid.*

²⁵ Australian Government, Department of Industry, Science, Energy and Resources, “*Australia, Germany working together on renewable hydrogen*,” September 11, 2020.

- (1) Advancing hydrogen production projects;
- (2) Developing export and domestic hydrogen supply chains, including hydrogen export industry infrastructure;
- (3) Establishing hydrogen hubs; and
- (4) Other projects that assist in building domestic demand for hydrogen.

Parties seeking to increase the likelihood of their projects being supported by the CEFC have been encouraged to give consideration to submitting an expression of interest to the Australian Renewable Energy Agency's ("ARENA") Renewable Hydrogen Deployment Funding Round ("Hydrogen Funding Round"). The CEFC stated that it will seek to invest in, and give priority of investment to, projects included in the Hydrogen Funding Round. The Hydrogen Funding Round is a competitive process by which ARENA intends to grant a minimum of two hydrogen projects a combined total of AUD 70 million to assist those projects advance the hydrogen industry in Australia.²⁶

In May, ARENA announced that seven hydrogen-related projects proposed by the following companies had been shortlisted:

- APT Management Services;
- ATCO Australia;
- Australian Gas Networks (part of Hong Kong's Cheung Kong Group);
- BHP Billiton Nickel West;
- Engie Renewables Australia;
- Macquarie Corporate Holdings; and
- Woodside Energy.

Shortlisted applicants had until January 2021 to submit their respective grant applications and ARENA aims to select two preferred projects by mid-2021.

South Korea

In July, South Korea formally opened the world's first byproduct hydrogen power plant which utilizes hydrogen gas produced in petrochemical processing as feedstock. The plant, located at the Daesan Industrial Complex in Seosan, South Chungcheong, is rated at 50 MW and will produce enough electricity to supply 160,000 households.²⁷

²⁶ <https://arena.gov.au/renewable-energy/hydrogen/>.

²⁷ Korea JoongAng Daily, "World's first byproduct hydrogen power plant opened," July 28, 2020.

Saudi Arabia

The major U.S. industrial gas player, Air Products & Chemicals, recently announced plans to construct a green hydrogen plant in Saudi Arabia with hydrogen produced via four GW of wind and solar power, the largest announced in the world to date. The US\$5 billion plant, to be located at NEOM, Saudi Arabia's new mega-city development, will be jointly owned by Air Products, ACWA Power, and NEOM. The facility is projected to produce 650 tons of green hydrogen daily, enough to power approximately 20,000 hydrogen-fueled buses.²⁸

Spain

The Spanish government has approved a hydrogen roadmap with the primary objective of achieving 4GW of green hydrogen capacity by 2030. If successful, Spain will play a key role in the EU Strategy as Madrid aims to invest approximately EUR 8.9 billion (US\$10.5 billion) in meeting its own hydrogen targets.²⁹ Spain hopes that its well-developed gas storage and transport system, combined with favorable conditions for siting renewable energy plants, will ultimately help Spain to become an exporter of hydrogen.³⁰

LOOKING FORWARD

The development of the hydrogen economy continues to gather momentum, with the announcement of new projects becoming more frequent. In addition, the scale of projects appears to be increasing, hinting at increased levels of confidence in hydrogen technologies. National governments are also increasingly focusing their attention on hydrogen, as new strategies for the development of hydrogen continue to be released by countries around the globe. Indeed, there is a sense that some countries are racing to ensure that they are either at the industry's forefront or not left behind as development of the hydrogen economy begins to gather pace.

However, the common view across these strategies is that work needs to be undertaken to update, harmonize and supplement existing legislation and regulations in order to ensure that hydrogen can fulfill its potential as a widely used, global energy source.

²⁸ Green Tech Media, "World's Largest Green Hydrogen Project Unveiled in Saudi Arabia," July 7, 2020.

²⁹ Energy Voice, "Spain sets a \$10.5 billion goal for green hydrogen," October 6, 2020.

³⁰ Reuters, "Spain Approves hydrogen strategy to spur low-carbon economy," October 6, 2020.