

Member Update Table as of Feb 2020
 Except for items in italics, which are from Feb 2019

Member	Recent In-Country Developments / Update on Policy	Highlights (R&D, Demo – budget included where possible)	Other News (market/commercial)
Australia	<ul style="list-style-type: none"> <i>COAG Energy Council agreed to develop a National Hydrogen Strategy by the end of 2019</i> <i>Implementation will be 2020 – 2030</i> <i>Western Australia (WA) Government establishes the WA Hydrogen Council</i> <i>WA Government planning 4 strategic focus areas on Hydrogen: Gas Blending, Export, Remote Applications (Mine site and communities) and Transport</i> 	<ul style="list-style-type: none"> <i>ARENA awarded \$22.1 M in funding for renewable hydrogen research</i> <i>Direct water electrolysis</i> <i>Solar hydrogen generation</i> <i>Solar thermochemical hydrogen</i> <i>Hydrogen to Ammonia</i> <i>Biological hydrogen production</i> <i>Photovoltaic electrolysis to generate hydrogen</i> <i>Waste biomass to renewable hydrogen</i> 	<ul style="list-style-type: none"> <i>Toyota Australia launched trial program of the Mirai with external stakeholders in November 2018</i> <i>Hyundai NEXO commercially launched in December 2018</i> <i>ACT Government to operate first Australian FCEV fleet (20 Hyundai NEXO) – Canberra refueling station currently in progress</i> <i>National Hydrogen Strategy commenced development in January 2019 and will scope potential to build refueling stations in every Australian state and territory with focus on heavy transport</i>
Austria	<p><u>Policy, Strategy, Priorities</u> The Austrian Ministry for Sustainability and Tourism, in agreement with other EU countries, on 18/09/2018 at Linz Conference signed "The Hydrogen Initiative", a policy document to support the development of sustainable hydrogen; signatory states and companies/organizations (25 EU Member States plus 86 companies/organizations) committed themselves to continue research and investment in the production and use of hydrogen as a future oriented technology.</p> <p><u>Governmental Programm 2020 – 2024 of the new Austrian Government</u></p> <ul style="list-style-type: none"> 100% renewable electricity by 2030 	<p><i>Projects are underway in the following areas</i> (1)=R&D (2)=Demo</p> <ul style="list-style-type: none"> Transport: ReFuel (2), HySnow (2), KEYTECH4EV (2), HyTruck (1), UpHy (1) Buildings: Autonomer Adler (2) Industry: H2Pioneer (2), H2FUTURE (2) Energy System level: Underground Sun Storage (2), Underground Sun Conversion (1), Renewable Gasfield (2), HydroMetha (1) Hydrogen Production & Purification: Wind (2) hydrogen (2), Hydrocell (1), HyLy pure (1), Hytechbasis (1) 	<p><u>WIVA P&G</u> Goal: Demonstrating the conversion of the Austrian economy to a highly hydrogen-based energy system.</p> <p>WIVA P&G focuses on three segments:</p> <ol style="list-style-type: none"> Green Energy Green Industry Green Mobility <p>WIVA P&G subsumes the experiences of more than 30 completed and ongoing projects and is going to implement 25 sub-projects within the energy model region.</p>

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	<ul style="list-style-type: none"> 45-50% share of renewables by 2030 Carbon-neutrality by 2040 High share of energy-intensive industry (e.g. steel) and feedstock for industry Seasonal storage and flexibility in electricity system Green Gas Grid <p><u>The Steering Committee has organized the following Hydrogen Strategy:</u></p> <ol style="list-style-type: none"> WG 1: Generation, infrastructure and storage WG 2: Greening the Gas (H2 and Bio-methane) WG 3: Hydrogen in industrial processes WG 4: Fuel cells and hydrogen in end use (4a Mobility, 4b Buildings) 		
Belgium	<ul style="list-style-type: none"> Off-shore wind targets 2020/2030: 2,3 / 4 GW Port of Zeebruges: 25 MW electrolyser (P2G) Port of Ostend (HYPORT): 50 MW electrolyser (P2X) is the world's first commercial green h2 project powered by surplus renewables unveiled Air Liquids Northern Europe pipeline network is 300km long and includes 870km of h2 pipeline, 600 km in Belgium 	•	<ul style="list-style-type: none"> John Cockerill Jinlgi Hydrogen inaugurates its new production center in Suzhou (China) a new major electrolyser manufacturer in Belgium (Liège region) was developed the world's largest single-stack alkaline electrolyses (7.5 MW) There are currently 3 HRS with another 4 planned in 2021 and 3 projected for 2022
Belgium (Flanders)	<ul style="list-style-type: none"> Manufacturing and demonstration of garbage truck on H2 by E-Trucks 	•	

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	<ul style="list-style-type: none"> WaterstofNet owns mobile hydrogen refueling station for demonstrations Last phase of development trucks on hydrogen (27 ton, 40 ton) to be demonstrated early 2020 at Colruyt Van Hool manufactures H2 buses for Paul Active H2 industry cluster growing to 50 companies, covering the value chain Green Octopus: Large scale hydrogen production, making ports more sustainable; Organize a hydrogen backbone network to supply end-users with clean H Wallonia P2M-#2: "Waster to Wheel" HaYrport: a multi-modal refueling stations at Liege Airport 		
China	<ul style="list-style-type: none"> <i>Fiscal subsidy policies have been implemented by National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Finance and Ministry of Science and Technology</i> <i>There will be subsidies on bus, freight car, medium and heavy logistics vehicles and fueling station.</i> <i>Beijing, Shanghai, Guangdong, Wuhan and Chongqing have carried out local subsidies for FCEVs.</i> <i>Hydrogen energy will take at least 10% proportion of</i> 	<ul style="list-style-type: none"> <i>It is suggested that hydrogen energy should be included in the national energy system from different aspects.</i> <i>It is expected that China's hydrogen energy industry will develop a national roadmap, where goals and tasks of hydrogen development will be defined.</i> <i>At least 9 state key research programmes on hydrogen energy are listed on the website of MOST, and next five-year-plan on hydrogen energy will be prepared in 2019.</i> 	<p><i>Blue Books and Reports on Hydrogen Energy</i></p> <ul style="list-style-type: none"> <i>26th Sep. - Blue Book on China Automobile Hydrogen Industry</i> <i>11th Oct. - China Hydrogen Energy and Fuel Cell industry Development Report</i> <i>7th Nov. Pathway to Produce Hydrogen with Low Carbon and Low Cost - Blue Book on China Hydrogen Industry Infrastructure Development</i>

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	<i>China's terminal energy system.</i>		
Denmark	<ul style="list-style-type: none"> Friday 6th of December 2019, 8 out of the 10 parties in the Danish Parliament agreed on a national Climate Act, with a legally binding target to reduce greenhouse gas emissions by 70 percent by 2030 (compared to the 1990 level). The Climate Act commits current and future climate ministers to reach net zero emissions by 2050 at the latest. Furthermore, the Act will entirely overhaul Denmark's climate policy; every year, the Danish Government will present Climate Action Programmes with concrete political initiatives to decarbonize every sector from transport to agriculture and energy. 	<ul style="list-style-type: none"> R&D funding for Energy storage demonstration: In December 2019 € 27 million in public funding were allocated to two large-scale P2X demonstrations. ACT – Acceleration CCUS Technologies. Danish commitment on € 3 million funding. (ACT is an international initiative to facilitate RD&D and innovation within CO2 capture, utilization and storage: http://www.act-ccs.eu/) <p>The two projects that received funding from the energy storage programme are a collaboration between Danish Shell and Everfuel as well a project consisting of a wide partner-circle under the industrial business park GreenLab Skive.</p> <ul style="list-style-type: none"> In connection with Danish Shell's refinery in Fredericia, Everfuel will build a large-scale P2X-facility with an electrolysis capacity of 20MW and a storage capacity of 10 MW for a start – with the potential of an expansion to 1GW. The hydrogen will be produced on renewable energy and is to be utilized in among others the transport sector. GreenLab will build a 12 MW large-scale P2X-facility which will produce among others green methanol in Skive. 	<p>Status on FCV in Denmark</p> <ul style="list-style-type: none"> NEL H2Station factory opened in Denmark September 2018. Capacity is 300 filling stations per year. 7 open HRS, 1 planned Update on Danish FCV and HRS: https://brintbiler.dk/ 0 buses (200 planned) 85 registered passenger FCEV

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EC	<p>Political Guidelines focus on six headline ambitions for Europe over the next five years and well beyond:</p> <ul style="list-style-type: none"> • A European Green Deal, presented on 11 December 2019 • An economy that works for people • A Europe fit for the digital age • Protecting our European way of life • A stronger Europe in the world • A new push for European democracy <p>The European Green Deal</p> <ul style="list-style-type: none"> • Becoming the world’s first climate neutral continent by 2050 is the greatest challenge and opportunity of our times. To achieve this, the European Commission presented the European Green Deal, the most ambitious package of measures that should enable European citizens and businesses to benefit from sustainable green transition. • “Clean hydrogen can play a pivotal role for in EU energy transition”, European Commission First Vice President Frans Timmermans has said. <u>Download the full communication.</u> <p>Hydrogen Energy Network (HyENet)</p> <ul style="list-style-type: none"> • The Commission has set up an informal group of experts, composed by representatives from the 	<p>FCH 2 JU Studies</p> <ul style="list-style-type: none"> • Use of fuel cells and hydrogen in the railway environment • Independent Study on Use of Hydrogen and Fuel Cells for Aircraft Propulsion • Study on European Business Cases for FCH Trucks and Technology Development Roadmap 	<p>Infrastructure:</p> <p>FC Vehicles</p> <ul style="list-style-type: none"> • 78 FC buses in operation of which 50 through FCH JU, • 308 FCB in planning (mainly via FCH JU's JIVE1 and JIVE2), • 1730 FCEV (including range extenders) of which 726 through the FCH JU. 922 vehicles registered (357 in 2019). <p>Hydrogen Refueling Station (HRS)</p> <ul style="list-style-type: none"> • 185 HRS in operation, out of which 66 deployed by FCH JU. 136 HRS publicly available /prior arrangement. <p>FC Combined Heat and Power</p> <ul style="list-style-type: none"> • 3900 μCHPs contracted via FCH JU of which circa 1920 deployed.

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	<p>ministries in charge of energy policy in EU Member States.</p> <ul style="list-style-type: none"> This expert group aims to support national authorities in charge of energy policy to develop on the opportunities offered by hydrogen as an energy carrier. HyENet will act as an informal platform of exchange of information, sharing of good practices, experiences and latest developments as well as joint work on specific issues. <p>Clean Mobility: The Commission is completing its agenda for a low-emission mobility system by putting forward the first ever CO2 emissions standards for heavy-duty vehicles: In 2025, average CO2 emissions from new trucks will have to be 15% lower than in 2019. For 2030, an indicative reduction target of at least 30% compared to 2019 is proposed.</p>		
France	<p><i>National Plan on hydrogen, 1/6/18</i></p> <ul style="list-style-type: none"> Decarbonize industry develop hydrogen storage of renewable energies starting in 2019, 100 M Euro will be devoted to hydrogen in sectors of industry, mobility and energy 	<p><i>Hydrogen Train: enthusiasm in a lot of Regions in France</i></p> <p><i>"SNCF will order during the summer 201`9 the first prototypes of h2 trains to start at the beginning of 2022.</i></p> <p>The aim is the final stopping of diesel powered trains in 2035"</p>	<ul style="list-style-type: none"> <i>Hype taxis company - 600 hydrogen taxis in end of 2020 (2018: 100 taxis in Paris) with fast refueling - 400km range - 24 h in operation</i> <i>8 bus on a high service line in Pau - there will be 30 buses end of 2019</i>

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Israel	<p>Hydrogen Strategy</p> <ul style="list-style-type: none"> Plan to introduce a hydrogen roadmap in 2020, including a techno-economic assessment for Hydrogen Economy in Israel <p>Hydrogen Round Table</p> <ul style="list-style-type: none"> End of Dec 2019 - Kickoff meeting with stakeholders (Companies, Academy and Regulators) Review global status of Hydrogen market, regulation and standards Create a central knowledge base Map expected barriers in Israel <p>Research Planning and Programs</p> <ul style="list-style-type: none"> Continue supporting R&D on production, storage and fuel cells Examine the need for a governmental hydrogen research center 	<ul style="list-style-type: none"> There is a total Support of 12.3M NIS for 12 Hydrogen related Projects in 2019 	<ul style="list-style-type: none"> There is currently 1 HRS project under way

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Italy	<p>In October 2019 the speech of the Italian Prime Minister at “the Hydrogen Challenge” Conference confirmed the endorsement of the Italian Government for hydrogen, now a topic in the agenda to achieve the targets of the so-called “Green New Deal” “Hydrogen Working Table” was opened by the Ministry for the Economic Development in June 2019, gathering industries, institutions, stakeholders, suppliers and developers, to enable hydrogen technologies</p> <ul style="list-style-type: none"> Italy is supporting the introduction of Hydrogen in the program IPCEI Important projects of European Common Interest» with the Strategic Value Chains «Hydrogen based and other low carbon Energy conversion About 480,000 ton of Hydrogen (16,000 GWh) has been produced in Italy in 2019 However, today less than 2% is distributed (in pipelines or gas/liquid vessels). The remaining being used on-site for oil refinery <p>On 31/12/2018 the Italian Government submitted to the EC the “National Plan for Energy and Climate” (PNIEC): the plan targets the utilization of 21.6% RES in the transport sector by 2030, about 1% covered by hydrogen:</p>	<ul style="list-style-type: none"> Italy is one of the leading EU countries in terms number and funding of H2 & FC R&D projects, with 139 projects (29 coordinated) financed by the European Commission under the Fuel Cells and Hydrogen Joint Undertaking (FCH 2 JU) in the period 2008-2018, involving over 121 Italian beneficiaries and mobilizing over 90 M€ funding. Increasing interest on Power-to-Gas projects, now included by the Italian Ministry for the Economic Development in the National Project for the Electric System (2019-2021) to store excess power produced by nonprogrammable RES in liquid and gaseous fuels In March 2019 ENI & COREPLA (National Consortium for the Collection and Recycling of Plastic packages) signed an agreement to implement research projects to produce hydrogen from plasmix (= non-recyclable plastic wastes) 	<p>H2IT is the Italian Association on Hydrogen and Fuel Cells with main stakeholders from Industry, Research and Innovation with expertise and activities on hydrogen involved. On 2019 H2IT has lunched several missions, including:</p> <ul style="list-style-type: none"> Support to the Ministry of Economic Development on the Strategic Forum for the EU Strategic Value Chain Hydrogen Technologies and Systems à this initiative is creating the ground for an IPCEI project on Hydrogen in EU Position Paper on Hydrogen at Italian level, participated by many industrial and rtd performers Revision of the Strategic Plan for Hydrogen Mobility for the EU Directive DAFI, transferred to the Italian Ministries for formal update Launched tables on Laws, Regulations, Standards and Incentives on Hydrogen at the National level <p>Currently, n.8 HRS built in Italy (n.3 in operation):</p> <ul style="list-style-type: none"> Bolzano, in operation, with 180 Nm3/h capacity H2 at 700 bar for busses and cars Milano & Catania: for public busses refueling at 350 bar

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	<ul style="list-style-type: none"> hydrogen is mentioned to contribute decarbonization as alternative renewable non-biological fuel, to be mixed to NG in the pipeline and/or as transport fuel (for cars, busses and trains) Power-to-Gas options are mentioned too to store excess power produced from direct (non-programmable) RES <p>The Italian Association for Hydrogen and Fuel Cells (H2IT) has developed the “National Plan for Hydrogen Mobility” targeting the installation of 197 HRS (141 for cars + 56 for busses) large enough to sustain the circulation of 27,000 FC cars and 1,100 busses over the country by the end of 2025; trucks and H2 trains are considered too in the hydrogen mobility plan.</p>		<ul style="list-style-type: none"> Roma, Mantova, Livorno & Sanremo: built but not operational, yet Milano (San Donato): Toyota Motor Italia to supply a FCEV fleet with 10 cars (Mirai) <p>Coming soon n.1 HRS: Venice: Toyota Motor Italia to supply a FCEVs fleet with 10 cars (Mirai)</p>

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Japan	<p><u>“Basic Hydrogen Strategy” (Dec, 2017)</u></p> <ul style="list-style-type: none"> H2 Cost target < JPY 20/Nm3 (in future) METI will revise their H2 Roadmap (in Mar, 2019) <p><u>international collaboration</u></p> <ul style="list-style-type: none"> G20 (Jun, 2019), 2nd Hydrogen Energy Ministerial (Sep, 2019) Compiled “Global Action Agenda” <p>Large scale demonstration will start</p>	<ul style="list-style-type: none"> Large scale demo: may complete construction in 2019 <ul style="list-style-type: none"> Japan/Australia (LH2), Japan/Brunei (MCH) Supply Chain 10MW Electrolysis Power to Gas in Fukushima Continue 1MW H2 gas turbine demo project in 2019 Start International collaboration on RCS for HRS, FCV <p>Budget in JFY 2020 (Apr-Mar) (in million US\$ (US\$1 = JPY 110))</p> <ul style="list-style-type: none"> Subsidy for Stationary FC 36M USD Subsidy for FCV 120 M USD Subsidy, R&D, RCS for HRS 136 M USD Basic Research 61 M USD Demonstration 128 M USD 	<ul style="list-style-type: none"> Tokyo Metropolitan Government increase number of FC-Bus Kyocera released 0.4kW SOFC Ene-Farm of installation Toyota unveiled new Mirai prototype JOC announced to use hydrogen as the fuel for its Olympic flame <p>FCEV</p> <ul style="list-style-type: none"> Buses: 22 (Dec, 19) (FC dominant) passenger cars: 3,500 (Dec, 19) <p>Stationary FC</p> <ul style="list-style-type: none"> Residential: approx. 300K (0.7 kW) Commercial: approx. 35 (3kW, 4.2kW, 250 kW) <p>HRS Infrastructure</p> <ul style="list-style-type: none"> Open 112 Planned TBC Projected 160 (in 2020)
	<p>“Hydrogen Economy Roadmap” (Jan. 2019)</p> <ul style="list-style-type: none"> Set the target of 6.2M FCV, 1,200 HRS and 15GW capacity of Fuel Cell power plant by 2040 <p>“Hydrogen Economy Standard Roadmap” (May 2019)</p> <ul style="list-style-type: none"> Plan to harmonize domestic standard with international standard, build certification scheme and propose Hydrogen related international standard <p>“Strategy on Future vehicle industries” (Oct. 2019)</p>	<p>IGFC(Integrated Gasification Fuel Cell) Demonstration</p> <ul style="list-style-type: none"> Using the purified Syn-gas(hydrogen) from IGCC power plant to Fuel-Cell 5,000 ton of Hydrogen production per year and 100kW of PEMFC <p>HYUNDAI Motors unveiled Hydrogen truck (Nov. 2019)</p> <ul style="list-style-type: none"> From passenger car “NEXO” to Hydrogen Bus and Truck <p>App “H2Care”</p> <ul style="list-style-type: none"> Shows location of HRS from the nearest and provides address, price, phone 	<p>Hydrogen Refueling Station (HRS) (as of year-end 2019)</p> <ul style="list-style-type: none"> HRS Early market station open to public or fleet: 26 Private Research Lab and/or company site: 8 HRS subtotals: 34 Under Construction 20, Preparing construction 100 with budget confirmed <p>FCV(as of year-end 2019)</p> <p>Buses: 17</p> <p>Passenger cars</p> <ul style="list-style-type: none"> 5,080 of vehicles 9,177,517 of registered vehicles
Korea			

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	<ul style="list-style-type: none"> • Announce the strategy on future mobility with connectivity, autonomous, sharing, electrification <p>“Measure for Hydrogen Infrastructure and Hydrogen Refueling Station” (Oct. 2019)</p> <ul style="list-style-type: none"> • To meet the increasing demand of Hydrogen, Diversify the resources of hydrogen, Increase the infrastructure for hydrogen storage and transportation and Stabilize the price of hydrogen <p>Ulsan city designated to attract the project of “Regulation-Free Area on Hydrogen Green Mobility”(Nov. 2019)</p> <ul style="list-style-type: none"> • 1,420,000 m², 4.7 M US\$ of investment in 2020 and 2021 • Demonstration on Hydrogen logistics machineries (forklift, unmanned luggage vehicle and etc.), Hydrogen ships and Large-scale tube trailers. • Ulsan city is well-known for Chemical Industrial Complex with hydrogen pipe network, manufacturing of NEXO in Hyundai Motor’s Ulsan Factory and other hydrogen demonstration & testing infrastructure. <p>“Promotion of Hydrogen Economy and Hydrogen safety Act” passed at National Assembly (Jan. 2020) and will be published soon</p> <ul style="list-style-type: none"> • The Act contains Hierarchy for Hydrogen Economy, Promotion on 	<p>number, waiting time, operation hours, etc. }</p> <ul style="list-style-type: none"> • Connects navigation app to guide you to the HRS that you want to go 	

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	<p>Hydrogen Business, Support on HRS and Fuel cell, Infrastructure and Responsible Organization, Authorization and Inspection on Hydrogen facilities and related product.</p>		
<p align="center">NZ</p>	<p><u>National Energy strategy</u> In November 2018 legislation ends new offshore oil and gas exploration in New Zealand with the following targets:</p> <ul style="list-style-type: none"> • GHG emissions to 5 per cent below 1990 levels by 2020 • Paris COP21 commitment to reduce GHG emissions to 30 per cent below 2005 levels by 2030 equivalent to 11 per cent below 1990 levels. • 90% renewable energy by 2025 and 100% by 2035 in a normal hydrological year. • Net zero emissions by 2050 <p><u>Government policy incentives</u></p> <ul style="list-style-type: none"> • A target of doubling the number of electric vehicles in New Zealand every year to 2021 or about 2% of the fleet. • Tax exemptions on electric vehicles until they make up two percent of the fleet. • US\$700k annually for a nation-wide electric vehicle information and promotion campaign over five years <p>In Dec 18 the newly established NZ Hydrogen Association was accepted as one of 7 global associations to work with the Hydrogen</p>	<ul style="list-style-type: none"> • Sep 2019 First Gas’ received a government Provincial Growth Fund (PGF) grant to assess whether hydrogen can be transported via the existing gas pipe network as well as its application in heating, transport, power generation and integration with other renewable generation sources. Costs of the \$520,000 phase one project will be evenly split between First Gas and the PGF. • Professor Shusheng Pang of the University of Canterbury has received \$1m over 3 years to 2022 for developing advanced biomass gasification with carbon capture. • Professor Richard Blaikie of the University of Otago, has received \$1m over three years to 2021 to develop a cost-effective solution for large-scale production of hydrogen gas. 	<ul style="list-style-type: none"> • Ports of Auckland have called tenders for NZ’s first hydrogen refilling station with project partners Auckland Transport, Auckland Council and KiwiRail, and have been awarded a 14% subsidy for the purchase of a hydrogen fuel cell (HFC) bus and three HFC cars. • Tuaropaki Trust and commissioned Hydrogenics to develop a pilot 1.5 MW hydrogen production electrolysis plant that utilizes heat from the Mokai geothermal field Japan’s Obayashi Corporation have. • In June 2019 Hiringa Energy and Ballance Agri-nutrients announced the signing of a Joint Development Agreement to develop 16 MW of renewable energy for production of green hydrogen and ammonia at the Kapuni industrial complex in Taranaki. • Hiringa Energy has moved into detailed design of a hydrogen refilling network with the selection of four central North Island regions/cities (Palmerston North, Taranaki, Hamilton and

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	<p>Council. The NZHA has 35 members and growing.</p> <p>In Nov 2019 a letter of intent was signed with South Korea to investigate the feasibility and core technology required to develop a liquid hydrogen supply chain for green hydrogen.</p> <p>In Sep 2019 the green paper “A Vision for Hydrogen in New Zealand” was launched by government seeking feedback on the potential for hydrogen production, export, and utilization in the New Zealand economy. https://img.scoop.co.nz/media/pdfs/1909/Hydrogen_Discussion_Paper.pdf</p> <p>In March 2019 “H2 Taranaki Roadmap” for the energy province of Taranaki and beyond, was released by Hiringa Energy in conjunction with Venture Taranaki, New Plymouth District Council, Ministry of Business Innovation and Employment. https://about.taranaki.info/Taranaki2050/Work-Group-Files/H2-Taranaki-Roadmap.pdf</p> <p>Hiringa Energy is working to have initial heavy FC pilot vehicles available in 2020 with fleet roll-outs in 2021.</p>		<p>Tauranga) as the first priority regional refilling stations in its Phase 1 network enabling coverage of over 95% of the North Island’s heavy road freight routes.</p> <ul style="list-style-type: none"> • Concept Consulting’s report of Jan 2019 ‘Hydrogen in New Zealand’ found applications for hydrogen in niche freight and heavy transport, and energy intensive on-site transport operations such as forklifts and cranes. The report was funded by Contact Energy, the Energy Efficiency Conservation Authority, First Gas, Meridian, Energy, the Ministry of Business Innovation and Employment, and Powerco. http://www.concept.co.nz/uploads/2/5/5/4/25542442/h2_report1_summary_v4.pdf
	The Netherlands	<p>Dutch Climate Agreement (June 2019) Main Elements</p> <ul style="list-style-type: none"> • 49% CO2 reduction in 2030/84 TWh of renewable 	<ol style="list-style-type: none"> 1. Innovation program on Hydrogen: <ul style="list-style-type: none"> • Part Top Consortium Knowledge and Innovation on Gas (TKI Gas)

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	<p>electricity by 2030 (70 % of the mix)</p> <ul style="list-style-type: none"> subsidy scheme for CO2 reduction techniques Phasing out coal in power plants by 2030 CO2 levy in industry above ETS All new cars in 2030 electric <p>Hydrogen in the Climate Agreement</p> <ul style="list-style-type: none"> Broad perspective: built environment, transport, industry and energy sector (storage) National Hydrogen Programme Green hydrogen ambition: <ul style="list-style-type: none"> 500 MW 2025 3-4 GW in 2030 40 million euro/year subsidies for innovation, scale-up and cost reductions (DEI) Mobility: 50 HRS, 15,000 FCEV cars and 3,000 heavy vehicles with a fuel cell hydrogen in 2025, 200+ HRS and 300,000 FCVs (all) in 2030 Blue H2 needed in the transition; green hydrogen ultimate goal <p>Hydrogen Government Vision (March 2020)</p> <p>Renewable gases are indispensable in 2050: 30-50% final energie use (350-750 PJ) Hydrogen is produced and used on large quantities in NL (175 PJ in 2019)</p> <ul style="list-style-type: none"> Concentrated mainly in the five industrial clusters 	<ul style="list-style-type: none"> 2019 2.2 M€ (2018 2.2 M€ project, 2017 0.75 M€ project and 0.1 M€ studies) <ol style="list-style-type: none"> Demonstration energy innovation (DEI), 2019-2020 <ul style="list-style-type: none"> Flexibilization of energy system 33 M€ (incl. H2 in industry), 1.5 M€ max per project CO2 reduction industry 25 M€ (f.i. CCUS) Natural gas free building area's 11 M€ Arrangement demonstration climate technologies and innovations for transport <ul style="list-style-type: none"> Budget 2019 33M € for all fuels, but major part allocated to hydrogen projects <ul style="list-style-type: none"> 2017/2018 17 M€ <ol style="list-style-type: none"> Fiscal incentive programs (rebate on investments) Electrochemical conversion and Materials, ECCM, 2020. 25,7 M€ for: <ul style="list-style-type: none"> Tenure Track Call: 5,8 M € Storage and conversion: 3,8 M € TNO Faraday Lab en VoltaChem programma (TRL 3-7): membrane and coating testing ISPT- HydroHub MW Test Centre (TRL 4-7): green hydrogen production via electrolysis MOOI (Mission driven Research, Development and Innovation), 2020 <ul style="list-style-type: none"> 65 M€ available for integral innovations in 4 themes: Wind energy at sea, renewable in land, built environment and industry: 	<ul style="list-style-type: none"> Up to 800 MW plans for electrolysis until 2025 f.i. Tatasteel/Nouryon 100 MW, Engie/ Gasunie (100MW). Hydrogen Valley in Northern Netherlands (HEAVENN project, 2020-2026), grant from the FCHJU of 20 million euros, with private-public funding co-finance of 70 million euro DJEWELS 20 MW electrolyser in Delfzijl (Nuryon and Gasunie): 11 M€ grant from FCHJU for the production of 3 kton/year green hydrogen and use in green methanol production

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	<ul style="list-style-type: none"> Need of making this production more sustainable <p>Main points</p> <ul style="list-style-type: none"> System role in energy and feedstock system Major economic opportunity Achieving cost reduction and up-scaling green hydrogen production: new instruments Outlines of market organization and conditions such as safety and certificates. International cooperation 	<p>hydrogen could potentially apply in all of them.</p> <p>7. Netherlands Energy Research Alliance (NERA)</p> <ul style="list-style-type: none"> Platform for knowledge sharing, coordination and cooperation 	
NOW	<ul style="list-style-type: none"> <i>2018 politically successful for hydrogen on a European level with a strong impact on the national level of the member states</i> <i>Renewable Energy Directive II (REDII)</i> <i>Hydrogen technology named as IPCEI projects</i> <i>National Innovation program for hydrogen and fuel cells with regional projects HYLAND</i> <i>7th energy framework program with special call for large scale hydrogen projects (Reallabore)</i> 	<p><i>Integrated large-scale projects</i></p> <ul style="list-style-type: none"> <i>Mission Innovation IC#8</i> <i>H2 Valley</i> <i>Reallabore / HYLAND projects</i> <p><i>Potential of the initiatives</i></p> <ul style="list-style-type: none"> <i>Story line for hydrogen technologies</i> <i>Stakeholder network</i> <i>Including existing initiatives</i> <i>Including national stakeholders in international activities</i> <i>Link between national and international activities</i> 	<ul style="list-style-type: none"> <i>First serial passenger cars with a fuel cell by Daimler are delivered to costumers</i>

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Portugal	<p><u>Law and Regulation</u></p> <p>Decree-Law 162/2019 (25 oct): Self-consumption of renewable energy; low scale renewable energy production; energy communities;</p> <p>Decree-Law 60/2017 (9 jun): The implementation framework for the alternative fuels infrastructure (QAN), where H2 , CH4 and synfuels are included;</p> <p>RCM 88/2017 (26 jun): Conditions defined for the QAN setup; Hydrogen is addressed in section 5 (pg. 3220-3221);</p> <p>Regulation ERSE (2018): The service quality in the electricity and the natural gas sectors is defined; Establishes in Art.1º the service quality standards of commercial nature, when applicable both to the National Electric System and the National Natural Gas System; Establishes (Art.2º) this application to the concrete production of power energy, to transport and distribution (Elect, NG), to underground storage (NG), to reception, storage and regasification (LNG), and to marketing.</p> <p>Expected improvements in the legal framework: To enable the strengthening of the decarbonization strategy, being key to the development of the sector (e.g. certification and guarantee of the origin of renewable gases like hydrogen and methane) and their incorporation in natural gas.</p> <p>New Decrees Law and Ordinances: Specific and adapted legislation (renewable fuels, NG, safety, ...) due to</p>	<p>Comercial scale immediate expectations:</p> <ul style="list-style-type: none"> • EDP – Central termoelétrica do Ribatejo – Carregado: demo electrolyzer 1 MW capacity, 12 MWh storage, investment 2M€ (2020-2022). • GALP – First HRS in Lisbon to be installed in 2020, dedicated to Buses and fleets. • Hydrogen use to upgrade biogas to biomethane (sludges digestion from WWTP/STP), for NG network injection <p>Pre-commercial scale :</p> <ul style="list-style-type: none"> • Innovative production process of H2 and solid C, from CH4. • Photo electrochemical H2 production – industrial pilot 0,5MW. • Micro power-to-power installation, using H2 as power storage 	<p><u>CaetanoBus H2.CITY GOLD</u></p> <ul style="list-style-type: none"> • Prototype test in 2019 • Commercialization in 2020

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	<p>expected accelerated development and a turning point for H2 adoption; New Regulations: specific regulations addressing hydrogen production, transport, distribution and use.</p> <p><u>In Country Developments</u></p> <p>Renewable energy production & use: Dedicated PV capacity available at 14,76 €/ KWh (world record in jul'019, recently broken by Qatar); Portugal has achieved a RES share of 30.3% in the final energy consumption; Target for 2020 is 31%, which compares with the target for 2030 (47%); Portugal is the 6th country in the EU in terms of RES incorporation into final energy consumption;</p> <p>National gas grid: aprox. 70% of the grid as a whole is able to carry hydrogen; massive potential of renewable energy integration (0% at present).</p> <p>The Portuguese Roadmap for Hydrogen: It is adopting a value chain approach developed by DGEG – Directorate General for Energy and Geology (PT), by using energy analysis and comprehensive LCA; by the end of March it will be submitted to approval by the Government, and next submitted to public consultation;</p>		

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RIL	<ul style="list-style-type: none"> India’s supreme court has directed the Indian Government to explore hydrogen-based fuel technology to mitigate pollution issues in the country (13 November 2019) Ministry of petroleum and natural gas has instructed oil-and-gas public sector companies to explore the feasibility of hydrogen fuel for India (6 December 2019) <p>Ministry of new and renewable energy (MNRE) has invited proposals to run four hydrogen fuel cell buses in Delhi NCR area (2019)</p>	<p>Polymer exchange membrane Fuel cell (PEMFC) technology development – CSIR / RIL</p> <ul style="list-style-type: none"> Developed in-house low- and high-temperature fuel cell technologies for stationary applications Collaborative effort with CSIR National lab and an engineering/manufacturing company <p>PEMFC for telecom towers</p> <ul style="list-style-type: none"> India has second largest and fastest growing telecom market with >450,000 towers presently in the country Many towers with > 12 h/day backup requirement Presently use DG sets, 8760 litres diesel/year/tower 10 MT/year of CO2 emission, USD 3 bn on import of diesel TRAI mandate: move to hybrid power Power requirement: >5 kW @ 48 V DC <p>safe, reliable, low maintenance, start-up time < 5 min</p>	<ul style="list-style-type: none"> Hyundai Motor India limited is currently evaluating the feasibility of bringing fuel cell electric vehicles for India IOC and Tata motors have launched the trial demonstration of India’s first hydrogen fuel cell bus Indian railways are planning to install hydrogen powered engines for select passenger trains by end of 2021 <p>There are two HRS deployed in India</p> <ul style="list-style-type: none"> The first commercial HRS was using Air Products Smartfuel® technology (2015) hydrogen blended CNG (up to 18% v/v H-CNG) stations deployed by Indian Oil corporation (IOC) in select locations around Delhi area India is planning to spend ~ \$10 bn to expand natural gas pipeline network to promote gas-based economy with potential hydrogen blend (2019)

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Spain	<p><u>Law and Regulation</u></p> <ul style="list-style-type: none"> The law RD 639/2016 published in December 2016 regulates the specifications of alternative fuels refill stations, in which hydrogen is included. The Government published recently the “Energy and Climate Integrated National Plan (PNIEC)” intended for 2021-2030. It defines the global objectives in energy efficiency, green-house gases emission reduction and renewable energies implementation. A draft version is currently open for public enquiries and will be send to the European Commission in March-April before its final approval. The final goal is to get in 2030 a 40% reduction in CO2 comparing with 1990 emissions and a totally renewable electric system. 	<p><u>Projects</u></p> <ul style="list-style-type: none"> According to official data on 2019, Spain has participated in 27 projects funded by FCH JU, among a total of 92 projects, during 2014-2018. 32 institutions involved. 102,763.718 € budget. Interests cover transport, industry, energy and cross-cutting issues. <p><u>Transport sector</u></p> <ul style="list-style-type: none"> Inn-Balance (2016) intends to create a platform of experts to develop advanced components for the balance of plant of fuel cell electric vehicles, hence reducing cost and improving efficiency and reliability. Fundación AYESA and the University of Barcelona (UPC) collaborate in the Project. Abengoa participated in NewBusFuel (2017) to resolve the knowledge gap for establishing a large scale hydrogen refueling infrastructure for fuel cell buses. FLHYSAFE (2017) has the ambition to demonstrate that a cost efficient modular fuel cell system can replace the most critical safety systems and be used as an eemergency power unit (EPU) aboard a commercial airplane providing enhanced safety functionalities. INTA is one of the partners of this undergoing project. 	<ul style="list-style-type: none"> In Spain there are 2 lab site HRS (Puertollano and Walqa in Huesca), 4 privates HRS (Albacete, Hues and 2 in Sevilla). In 2020 there are 3 HRS under construction (Madrid, Zaragoza and Mallorca). There are currently (January 2020) only 2 FCEV registered in Spain: one Toyota Mirai and one Hyundai Nexu. Enagas has announced the acquisition of 12 FC cars in total in Madrid to operate thanks to its new HRS.

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		<ul style="list-style-type: none"> • PEGASUS (2017) is a project with the collaboration of CSIC to substitute Pt for other elements. • HEAVEN (2018) aims to design, develop and integrate a powertrain based on high power fuel cell and cryogenic technology into an existing 2-4 seats aircraft for testing in flight operation. Its modular architecture enables to scale-up to other sizes of aircrafts and UAV. Fundación AYESA coordinates this Project. 	
CH	<ul style="list-style-type: none"> • H2 Mobility Switzerland is establishing a nationwide network of HRS thru 2023 which focus on a pay per use model for Hydrogen trucks across the country. It has 15 members with a goal of 2000 filling stations and 4000 trucks. • The Swiss Association for Standardization has developed HRS development guidelines (available at https://www.snv.ch/de/). • Hyundai and H2E have partnered in a plan called Hyundai Hydrogen Mobility to deliver 1600 FC powered heavy trucks from 2019 to 2025. The first 50 4x2 FC electric rigid Hyundai trucks arrived in February 2020 with 5X2 electric rigid trucks coming in 2021. • indirect subsidy in the form of an exemption from performance-related 		<ul style="list-style-type: none"> • There is currently one HRS (https://hydrospider.ch/en/filling-stations/) in operation in Hunzenschwil and six HRS under construction/planned. Gösgen 2 MW electrolysis plant, located at Alpiq's Gösgen run-of-river hydroelectric power station (https://hydrospider.ch/en/locations/), produces 300 tons of H2 per year, sufficient for approximately 40-50 trucks or 1700 cars. • Nel ASA has been awarded a purchase order for 2 MW PEM electrolyzers in Switzerland and has entered into a 30 MW framework contract

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	<p>heavy vehicle charge (Euro 50k to 100k per year and truck) and an exemption from petroleum tax.</p>		
UK	<ul style="list-style-type: none"> The UK is hosting COP 26 in November. Hydrogen very likely to have a part to play in the narrative and some displays. PAS 4444 public consultation completed. BSI is now finalizing the standard which makes recommendations on how appliance manufacturers should design hydrogen fueled equipment to comply with Gas Appliance Regulations. Delivery of Hy4Heat WP7 Quantitative Risk Assessment (QRA) is central to any potential future trials, Hy4Heat is presenting results to the UK Health & Safety Executive (HSE). New UK energy strategy white papers are due to be published this year. 	<p>The UK government has currently allocated £108m for innovation in low carbon hydrogen. Includes:</p> <ul style="list-style-type: none"> Up to £20m for industrial fuel switching to low carbon fuels. Up to £20m for novel clean hydrogen supply methods. £25m to develop the safety case of using 100% hydrogen through Hy4Heat £23m for deployment of hydrogen vehicles and to grow HRS infrastructure. <p>UK government announced an additional £100m for Low Carbon Hydrogen Production in August 2019.</p> <p>H21 project has been granted £6.8m of Ofgem funding for phase 2.</p> <p>Hy4Heat hydrogen fired appliances are showing promising results.</p>	<p>In January Worcester Bosch made a strong push for hydrogen ready boilers to be required from 2025 in the UK media.</p> <p>Growing numbers of local councils are announcing climate emergencies requiring them to become carbon neutral by a commitment date. These represent strong opportunities for hydrogen equipment manufacturers.</p> <p>ITM power, a UK HRS manufacturer has attracted additional investment from Linde and are scaling up electrolyser production capabilities towards 1GW per year.</p> <p>Growing interest in hydrogen across government in the UK.</p> <p>Infrastructure is still growing in the UK with 11 public HRS operating and an additional 8</p>

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			<p>planned for this year. The largest has a capacity of 360kg/day though one with a capacity of 1200kg/day is planned.</p> <p>FCV</p> <ul style="list-style-type: none"> • Total of 260 FCV in January 20 • 20 buses • 179 passenger cars • 61 commercial vehicles