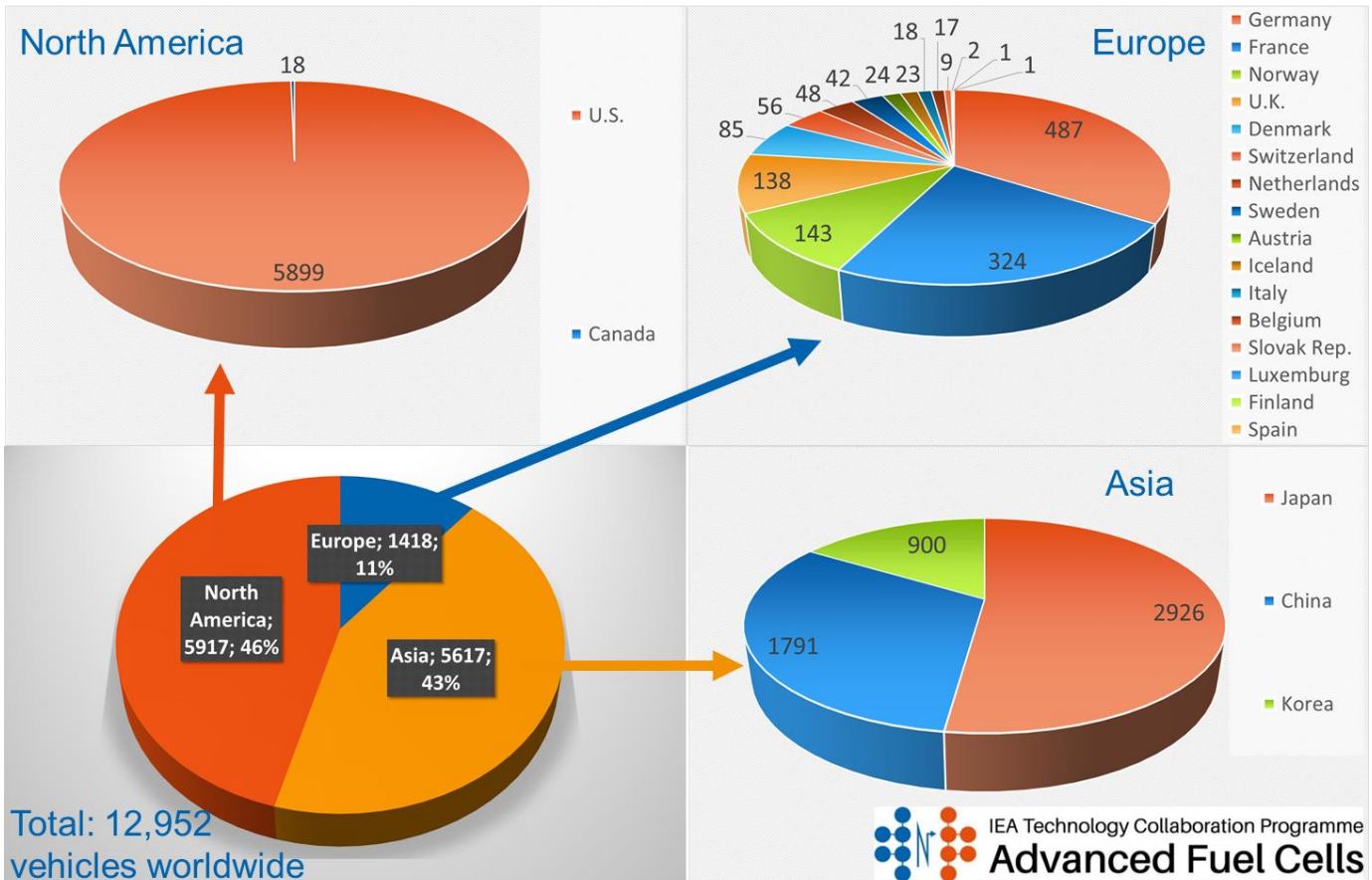


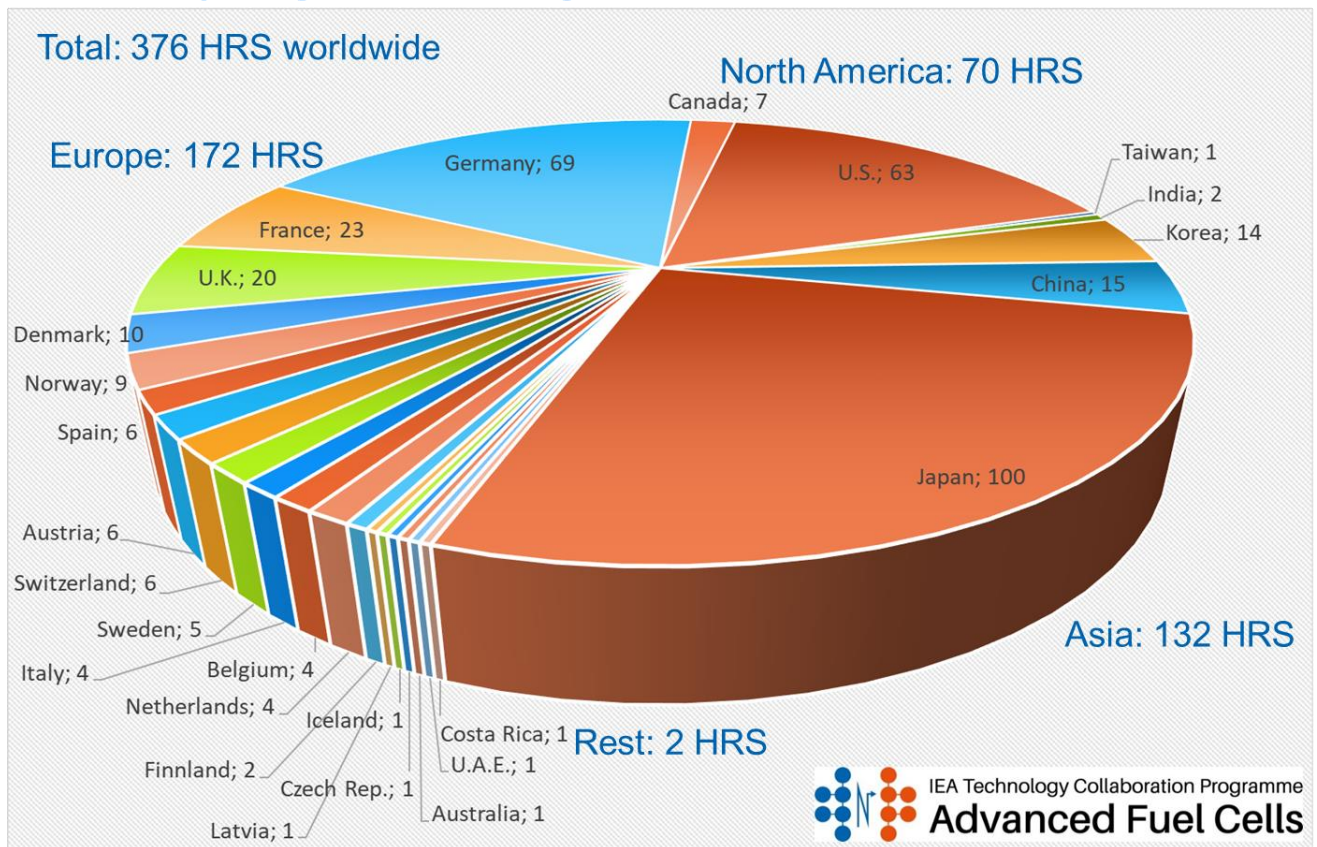
AFC TCP 2019 Survey on the Number of Fuel Cell Vehicles, Hydrogen Refueling Stations and Targets

Fuel Cell Vehicles as of End 2018



- Fuel Cell Vehicle stock exceeded 12,900 vehicles as of end 2018 showing 80% increase in 2018
- 46% of the vehicles are in the U.S., followed by Japan (23%) and China (14%)
- Most of the vehicles being passenger cars in the rest of the world, the Chinese stock is dominated by commercial vehicles

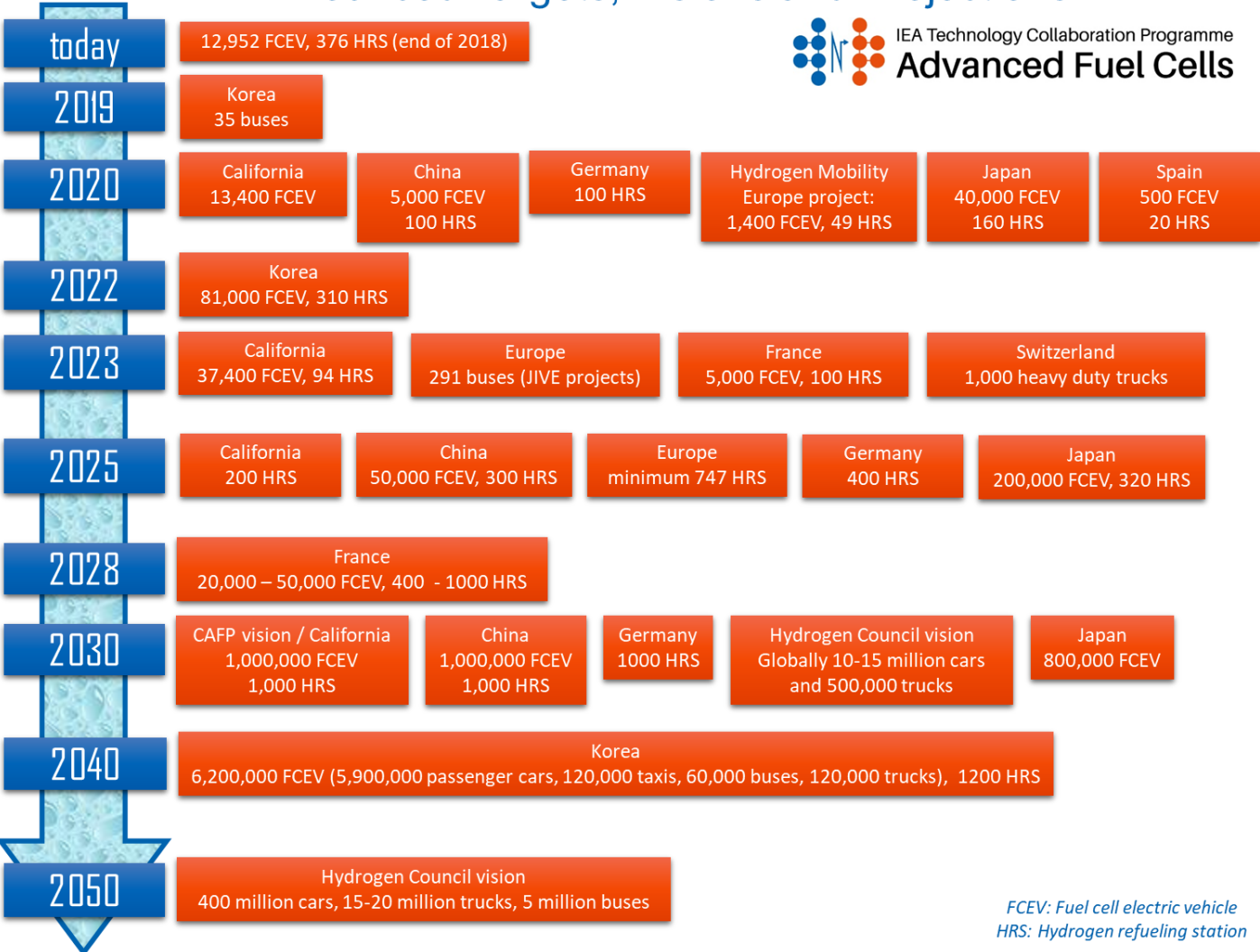
Hydrogen Refueling Stations as of End 2018



- Japan (100), Germany (60) and the U.S. (44) are the three countries with the highest numbers of publicly available Hydrogen Refueling Stations (HRS)
- 376 refueling stations in operation (public and non-public) worldwide

Sources: See page 7

Announced Targets, Visions and Projections



FCEV: Fuel cell electric vehicle
HRS: Hydrogen refueling station

Further details: See pages 4-5
Sources: See page 6

Targets, visions and projections (1/2)

Korea ^{[1], [2]}

- 2022: 81,000 vehicles (79,000 passenger cars and 2,000 buses) / 310 refueling stations
- 2040: 6.2 million vehicles (5,900,000 passenger cars, 120,000 taxis, 60,000 buses, 120,000 trucks) / 1,200 refueling stations
- 35 buses to be rolled out in 2019, ramp up to 2,000 by 2022 and 41,000 by 2040
- The government expects the hydrogen economy to become the driving force of innovation growth in 2040, generating 43 trillion won in added value annually and 420,000 new jobs

Japan ^[3]

- 2020: 40,000 vehicles / 160 refueling stations
- 2025: 200,000 vehicles / 320 refueling stations
- 2030: 800,000 vehicles
- Make hydrogen stations independent by the second half of the 2020s

U.S. ^{[4] [5] [6]}

- California Air Resources Board projects a total of 13,400 FCEVs in California by 2020 and 37,400 by 2023
- 94 refueling stations are anticipated by the end of 2023 in California, 200 stations by 2025
- California Fuel Cell Partnership 2030 vision: 1,000,000 vehicles, 1,000 refueling stations
- 12-25 refueling stations are planned in the Northeast

Targets, visions and projections (2/2)

China ^[7]

- 2020: 5,000 vehicles / 100 refueling stations
- 2025: 50,000 vehicles / 300 refueling stations
- 2030: 1,000,000 vehicles / 1000 refueling stations

Europe ^{[8] [9] [10] [11] [12] [13] [14] [15]}

- Minimum of 747 hydrogen refueling stations are targeted in 2025
- Hydrogen Mobility Europe project is planning to place more than 1,400 fuel cell cars in customer hands and deploy 49 hydrogen refueling stations across Europe until 2020
- JIVE projects are planning to put 291 FC buses on the road by 2023
- France: 2023: 5,000 vehicles and 100 refueling stations; 2028: 20,000-50,000 vehicles and 400-1,000 refueling stations
- Germany: 2020: 100 refueling stations; 2025: 400 refueling stations; 2030: 1,000 refueling stations. Up to October 2018 the requested funding for fuel cell trains amounted to €200 Million with up to 164 trains in Germany
- Spain: 2020: 500 vehicles, 20 refueling stations
- Switzerland: Starting with 2019, Hyundai Motor and H2 Energy will bring 1,000 heavy-duty fuel cell electric trucks to Swiss commercial market over a period of 5 years

Hydrogen Council vision ^[16]

- 2030: 1 in 12 cars in Germany, Japan, South Korea and California powered by hydrogen; globally 10-15 million cars and 500,000 trucks
- 2050: Hydrogen powers more than 400 million cars, 15-20 million trucks, and around 5 million buses

Sources: See page 6

Sources for announced targets, visions and projections

- [1] Korean Government Announces Roadmap to Become the World Leader in the Hydrogen Economy by FuelCells Works, January 17, 2019 <https://fuelcellsworks.com/news/korean-government-announces-roadmap-to-become-the-world-leader-in-the-hydrogen-economy/>
Access date 06.02.2019.
- [2] National goals, compiled by KIST. February 2019.
- [3] Compilation of the Revised Version of the Strategic Roadmap for Hydrogen and Fuel Cells, Ministry of Economy, Trade and Industry, Japan, March 22, 2016.
- [4] 2017 Evaluation of Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network Development. CEPA ARB, August 2017.
- [5] Presentation by S. Satyapal, AMR 2018, Washington D.C., U.S., June 13 2018.
- [6] Presentation by CARB: Assessment of a Hydrogen Station Verification Requirement for Public Hydrogen Stations, California Air Resources Board, Public Workshop on the Hydrogen Station Verification Process, Sacramento, CA, U.S., November 29, 2018.
- [7] Hydrogen Fuel Cell Vehicle Technology Roadmap, developed by the Strategy Advisory Committee of the Technology Roadmap for Energy Saving and New Energy Vehicles and SAE China, October 2016. English version.
- [8] French National Hydrogen Plan, 2018.
- [9] Commission Staff Working Document: Detailed Assessment of the National Policy Frameworks Accompanying the Document Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions. Towards the Broadest Use of Alternative Fuels - an Action Plan for Alternative Fuels Infrastructure under Article 10(6) of Directive 201/94/EU, Including the Assessment of National Policy Frameworks under Article 10(2) of Directive 2014/94/EU. Brussels, November 8, 2017.
- [10] Fuel Cells and Hydrogen Joint Undertaking (FCH JU); Hydrogen Mobility Europe, <https://h2me.eu/> Access date 10.01.2018.
- [11] Joint Initiative for hydrogen Vehicles across Europe 2. <http://www.fch.europa.eu/project/joint-initiative-hydrogen-vehicles-across-europe-2> Access date 28.02.2018.
- [12] Presentation by K. Bonhoff, WHEC 2018, Rio de Janeiro, Brazil, June 21 2018.
- [13] National goals, compiled by CNH2, February 2019.
- [14] Presentation by T. Herbert, acatech, Themennetzwerk Energie & Ressourcen, Berlin, Germany, October 18 2018.
- [15] Press release of H2 Energy, <https://h2energy.ch/en/hyundai-motor-and-h2-energy-will-bring-the-worlds-first-fleet-of-fuel-cell-electric-truck-into-commercial-operation/> September 19, 2018.
- [16] Hydrogen scaling up. A sustainable pathway for the global energy transition, Hydrogen Council, November 2017.

Sources for the numbers of fuel cell electric vehicles

- Austria: Statistik Austria, December 31, 2018.
- Canada: Innovation, Science and Economic Development Canada / Government of Canada, December 15, 2017.
- China: China Association of Automobile Manufacturers, February 18, 2019.
- France: H2 Mobility France, December 31, 2018.
- Germany: Presentation by T. Herbert, acatech, Themennetzwerk Energie & Ressourcen, Berlin, Germany, October 18 2018.
- Italy: IIT Bolzane, car registrations 2018.
- Japan: METI, as of December 31, 2018.
- Luxemburg, Slovak Rep.: Commission Staff Working Document: Detailed Assessment of the National Policy Frameworks. Accompanying the Document Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions. Towards the Broadest Use of Alternative Fuels - an Action Plan for Alternative Fuels Infrastructure under Article 10(6) of Directive 201/94/EU, Including the Assessment of National Policy Frameworks under Article 10(2) of Directive 2014/94/EU. Brussels, November 8, 2017.
- Republic of Korea: "Roadmap for Hydrogen Economy", MOTIE, MIST, MOLIT, MOFET, www.h2korea.or.kr, January 2019.
- Spain, Belgium, Finland, Switzerland, Netherlands, Denmark, U.K., Norway, Iceland: FCH 2 JU Programme Office, February 12, 2019.
- Sweden: Hydrogen Sweden, January 25, 2019.
- U.S.: California Fuel Cells Partnership, based on HybridCars.com, Carsalesbase.com & Baum and Associates as of December 31, 2018.

Sources for the numbers of the hydrogen refueling stations

Australia, Costa Rica, Taiwan, U.A.E, India: h2stations.org, an info service of Ludwig-Bölkow-Systemtechnik GmbH and TÜV SÜD.

Access date February 20, 2019.

Austria: H2 Mobility - Tankarte, ÖAMTC, FCH 2 JU Programme Office.

Canada: Innovation, Science and Economic Development Canada / Government of Canada, December 15, 2017.

China: SAE China, survey data statistics, February 18, 2019.

Denmark: <http://brintbiler.dk/> January 18, 2019.

France: H2 Mobility France, December 31, 2018.

Germany: H2 Mobility, <https://h2.live/> Access date January 14, 2019 and FCH 2 JU Programme Office, February 12, 2019.

Italy: Stations in Bolzano, Milano, Capo d'Orlando and Sanremo, information compiled by ENEA, February 6, 2019.

Japan: METI, December 31, 2018.

Norway: Scandinavian Hydrogen Partnership, <http://www.scandinavianhydrogen.org/> Access date February 13, 2019.

Republic of Korea: "Roadmap for Hydrogen Economy", MOTIE, MIST, MOLIT, MOFET, www.h2korea.or.kr, January 2019.

Sweden, Spain, Italy, Iceland, U.K., Netherlands, Latvia, Czech Republic, Finland, Belgium,; FCH 2 JU Programme Office, February 12, 2019.

Switzerland: H2 Mobility, <https://h2.live/> January 14, 2019 and FCH 2 JU Programme Office, February 12, 2019.

U.S.: Alternative Fuels Data Center, Access Date: February 25, 2019.

Disclaimer

Data collection by Advanced Fuel Cells Technology Collaboration Programme (AFC TCP) Executive Committee Members, coordinated by the core group (L. Antoni, N. Garland, J. Han, M. Rex and R.C. Samsun).

The results are originally provided to IEA Global EV Outlook 2019 publication.

The presented data intends to give an overview of the current status and perspectives, was prepared using available sources. AFC TCP does not claim that the data provided is complete.

AFC TCP functions within a framework created by the International Energy Agency (IEA). The activities of the AFC TCP are coordinated by the IEA's Working Party on Energy End-use Technologies (EUWP). Views, findings and publications of the AFC TCP do not necessarily represent the views or policies of the IEA Secretariat or of its individual member countries.