TOYOTA'S VIEW ON AFIR (ALTERNATIVE FUELS INFRASTRUCTURE REGULATION) for H2

BACKGROUND

Multi-pathway (Technology neutrality): Our common enemy is CO2, not a specific technology. Toyota strongly believes in the role of many different solutions such as BEV, PHEV, HEV, CNF, H2-ICE and FCEV, and energy carriers like hydrogen and carbon neutral fuels, to reduce emissions as much as possible, leaving no one behind.

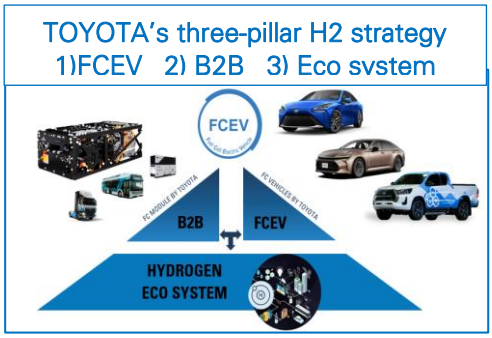
Toyota believes that the most efficient route to carbon neutrality is to develop and use every powertrain technology available, including Hydrogen, to enlarge the access to zero-emission mobility solutions.

Toyota started investing in fuel cell technology in 1992, before the hybrid technology. While hybrids became widely spread and allowed to reduce CO2 emissions globally, hydrogen can still play a determinant role in decarbonising the heavy-duty transport (critical for infrastructure) as well as light-duty transport segments.

HOW TOYOTA SUPPORTS HYDROGEN DEVELOPMENT

Our Fuel Cell development strategy is built on three pillars:

1) **FCEV: Fuel Cell electric vehicles by Toyota**, to drive innovation on the road: the Toyota Mirai is sold in Europe since 2014, and the Hilux pick-up FCEV is announced for 2028. In Japan, the Crown FCEV is also available.
2) **Fuel Cell Module systems supplied to partners**: initially developed for cars and LCVs, the technology has been re-packaged into fuel cell module systems, allowing many heavy-duty transport (trucks, buses, ships, etc) to also benefit from Fuel Cell technology, and to convert from diesel to zero-emission hydrogen (se ANNEX 1). We are sharing the technology with partners such as BMW (X5) or Daimler buses (E-Citaro), to expand the use base of hydrogen and help achieving scale.
3) **Ecosystem support**, to foster the balance between Supply & Demand and to accelerate the hydrogen economy.



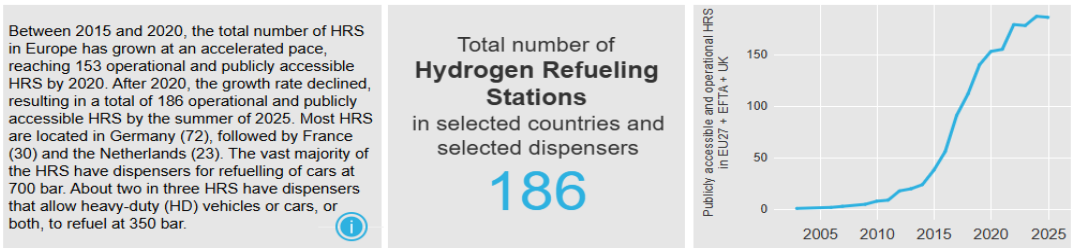
HYDROGEN MOBILITY ADVANTAGES

1) Contributes to **European zero-emission goals.**
2) Provides **short refuelling**, **long range and high payload capacity** (essential for long-haul applications e.g. trucks and buses)
3) **Reduces curtailed renewable power** and **relieve stress from electricity grids.**
4) **Reduces BEV infrastructure costs**: the costs of two supporting infrastructure for FCEVs and BEVs is cheaper than one infrastructure network[1], primarily due to the reduced peak loads and avoidance of costly upgrades on electricity grid.
5) **Job creation in Europe**: according to a Hydrogen Europe study[2], up to 500,000 skilled jobs can be created.
6) **Strategic goals: Hydrogen technology requires less critical raw materials**, contributing to European resilience and industrial independence. China officially incorporated hydrogen as an energy source in the country's Energy Law[3].

EVALUATION OF THE CURRENT AFIR

The introduction of the Alternative Fuels Infrastructure Regulation (AFIR) in April 2024 represents a major step towards European hydrogen resilience. As part of the European Green Deal and Fit for 55 Program, the aim is to create a nationwide, user-friendly and inter-operable infrastructure throughout Europe, by setting legally binding minimum targets for all member states for the first time.

The current AFIR is a good base as it sets a minimum number of HRS across Europe, encouraging investors towards a long-term hydrogen society. However, the HRS deployment is not evolving according to original plans. After a fast start, it is stagnating[4]:



[1] Transport-Study-Full-Report-Hydrogen-Council-1.pdf
[2] Hydrogen Europe and GHMA, Driving Europe's H2 future
[3] FCHEA – Th rise of China in the Global Hydrogen
[4] Hydrogen Refuelling Station stations

The stagnation of HRS deployment is due to several reasons:

1. High Costs and Economic Viability

- **Infrastructure Costs:** Building, operating, and maintaining hydrogen refuelling stations, along with necessary safety equipment, is currently too high for private operators without significant subsidies.
- **High Fuel Costs:** The cost of green hydrogen is currently too high, making the Total Cost of Ownership (TCO) for hydrogen trucks higher than diesel or electric alternatives. Current EU support schemes often require renewable fuels of non-biological origin (RFNBO) molecules, which are scarce, expensive, and contracted to refineries under RED III scheme (RED III mandates strict criteria for RNFBO such as green hydrogen).
- **Declining Subsidies:** In some regions, such as Germany, government funding for hydrogen refuelling stations has been reduced due to budget constraints, stalling expansion.

2. The "Chicken-and-Egg" Dilemma

- **Lack of Vehicles:** There are few hydrogen-powered vehicles on the road, limiting the demand for public fuelling stations.
- **Investor Reluctance:** Due to low demand, investors are hesitant to fund infrastructure, which in turn limits the adoption of hydrogen vehicles.

3. Regulatory and Technical Challenges

- **Strict Green Hydrogen Rules:** EU requires renewable hydrogen must be used. However, complex regulations make it difficult to produce and source this hydrogen, increasing costs.
- **Slow Technology Standardization:** The market has not fully converged on a single refuelling technology (e.g., 350-bar for some busses and trucks vs. 700-bar for cars and trucks).
- **Slow Permit Process:** The long planning and construction times slow down deployment in the TEN-T road network.

4. Shift in Strategic Focus

- **Battery Electric Dominance:** Many manufacturers are prioritizing battery electric vehicles (BEVs) for short- to medium-haul transport, reducing the immediate urgency for a nationwide hydrogen network, particularly for passenger cars.
- **Focus on Industrial Hubs:** The initial rollout is focused on urban nodes and specific corridors rather than a nationwide, blanket coverage, which is a more conservative approach than early, more ambitious projections.

The Alternative Fuels Infrastructure Regulation (AFIR) is not establishing Hydrogen Refuelling Stations (HRS) as quickly or extensively as initially planned.

We would like European and National authorities to support AFIR to keep the Hydrogen infrastructure deployment robust and predictable, ensuring European independence on this zero-emission energy source.

WHY HYDROGEN INFRASTRUCTURE IS CRUCIAL

The switch to hydrogen mobility is a global movement (+54% investment in H2 projects globally in '25 vs '24 [3]). Major automotive players like BMW, Hyundai, Daimler buses, Toyota Europe, over 30 hydrogen station manufacturers, and hydrogen producers like Air Liquide, Lhyfe, Orlen and dozens of others, aim to position hydrogen as a key component to EU's zero-emission transport strategy. While Toyota Europe is ready to scale-up fuel cell module production in Europe, **hydrogen infrastructure is lagging behind**, and consequently there are multiple risks:

- **Missed investment opportunities** in hydrogen production.
- **Slower economic development** with a risk towards European station manufacturers financial viability due to lack of demand and be replaced by Chinese manufacturers.
- **Loss of competitivity in the EU hydrogen value chain** (while China is accelerating[5]): In an uncertain geopolitical environment, hydrogen is a key energy source to support European economics' resilience.

To fully exploit hydrogen strategic benefits mentioned above, infrastructure consolidation and policies supporting hydrogen de-risking are needed to provide predictability for European long-term investment.

The right hydrogen technology exists; the supply chain is ready. **But without a simple and predictable infrastructure policy framework being established, Europe could cede the market to China and the US**.

[5] China targeting hydrogen as a strategic "frontier technology"

TOYOTA MOTOR EUROPE

WHAT IS REQUIRED TO ESTABLISH A ROBUST HYDROGEN NETWORK IN EU?

1) **AFIR CONFIRMATION**
The successful uptake of hydrogen mobility in Europe requires a publicly accessible refuelling infrastructure in line with the Alternative Fuel Infrastructure Regulation (AFIR) requirements. **Member States should confirm and deliver on their 2030 targets** with a credible plan, including the necessary intermediate steps. **The EU Commission should control and enforce** the correct AFIR establishment among member states.

2) **AFIF BUDGET FOR 2026-27**
HRS deployments should be supported by the necessary public support, from the Commission's Alternative Fuels Infrastructure Fund **(AFIF-which budget requires 2026-2027 to be replenished**) and where necessary, national/regional/local funding.

3) **HYDROGEN COLOUR PRAGMATISM**
Current EU support AFIF schemes often require renewable fuels of non-biological origin (RFNBO) molecules, which are scarce, expensive, and contracted to refineries under RED III scheme. **Europe should adopt the same pragmatic approach it used for battery cars,** which let vehicles and infrastructure scale first, then decarbonise the supply in parallel. In other words, **allow unabated, low-carbon and renewable hydrogen to activate the market now**, with a mandated shift to fully clean hydrogen later, once a critical-mass infrastructure is set (China has >600 hydrogen stations in operation while Europe remains locked at 'under-200'. Hydrogen refuelling stations in China are currently dominated by grey hydrogen, primarily derived from coal gasification, though the country is rapidly shifting towards green hydrogen).

4) **ECOSYSTEM SUPPORT required for all Fuel Cell Vehicles (LDV & HDV).**
Hydrogen eco-clusters are geographical areas where production, storage, distribution and end-users are integrated into a local "mini-hydrogen economy". **They are fundamental to bring supply & demand together in a collaborative, risk-sharing basis**. Initiatives such as **SWiM in the Netherlands are successful** and need to be replicated. In Germany, the **state-owned NOW programme also combines supply & demand**. Also, the **CfD (Contract for Difference) like deployed in China**, is a suitable mechanism to rapidly accelerate the hydrogen mobility market.

5) **FAST PERMITTING**
Regulatory simplification for HRS permitting across the EU and prioritization in planning procedures are needed to create a faster HRS rollout. Member states should benefit from clarified and streamlined procedures.

6) **PAN-EU CLEAR PROTOCOLS**
HRS roll-out requires clarity on standards that will be adopted across Europe for the safety requirements and design of HRS stations, as well as mandatory certification by a notified body or independent 3rd party, **to ensure safety and compliance**.

7) **HYDROGEN PRICE / KG AT DIESEL-PARITY**
To ensure hydrogen ecosystems to flourish and achieve investment return as well as diesel decarbonisation, the **TOTAL COST OF OWNERSHIP (TCO) must make business sense: the hydrogen price per kg must be at diesel-parity[6]**. Hydrogen trucks, for instance, are technically ready but economically blocked. A true technology shift can only work if such pre-condition is respected.

8) **FULL PRICE TRANSPARENCY AND EASY-TO-USE**
Operators must provide consumers full information on availability, waiting time and price, and be able to pay easily without a need for a subscription.

9) **AFIR REVIEW AMBITIOUS ROADMAP (Q4' 2026)**
The current AFIR HRS targets for 2030 will only create a minimum viable network, and these should be long-term oriented to secure EU investment. The upcoming **AFIR review should establish a** clear and ambitious Roadmap towards 2035 and 2040: **'Shift from 200 to 100km':** Member States shall ensure that by 31 December 2035 publicly accessible hydrogen refuelling stations are deployed with a **maximum distance of 100 km** between them along the TEN-T comprehensive network (TEN-T highway network is about 100.000 km, such shift increases HRS from current under 200 to above 1,000 of HRS, plus additional 431 urban nodes).

[6] Driving Hydrogen, €8 hydrogen at nozzle or Europe loses the truck race

ANNEX 1 – TOYOTA's 'GAIHAN' (B2B), a story of successful collaborations to develop hydrogen in Europe

- **Multi-pathway (technological neutrality)**

People have different needs and no one knows the future – we must remain flexible.
Our common enemy is CO2, not a specific technology. Toyota is investing in many different solutions such as BEV, PHEV, HEV, CNF, H2-ICE and FCEV, to make sure no one stays behind.

- **Hydrogen society**

Toyota is investing in hydrogen technologies since 1992, and we believe that it will strongly contribute to a sustainable, carbon-neutral society. Also, hydrogen requires less critical materials and has a **role to play in Europe's energetic independence**.

- **FCEV development**

Toyota started the development of fuel cell technology in 1992 (before the hybrid technology). It launched the FCEV Toyota Mirai in 2015, with the 2nd generation launched in 2020. The pick-up truck Toyota Hilux with fuel cell technology was announced for 2028 (see here). More models should arrive but need the establishment of a robust hydrogen infrastructure.

- **Toyota Fuel Cell Modules, the beginning of 'Gaihan' business-to-business phase**

To accelerate hydrogen potential and to ensure constant fuel cell development, Toyota has pushed the technology beyond cars. For this purpose, the Mirai's fuel cell technology has been adapted for heavy-duty use and re-packaged into 'Toyota Fuel Cell Modules' (TFCM). The TFCM is being fitted to multiple applications like buses, trucks, boats, generators and so on, contributing to decarbonise and to expand hydrogen's usage. **The TFCM is assembled in Europe** (see here), in Toyota Europe's R&D facilities in Zaventem, Brussels.

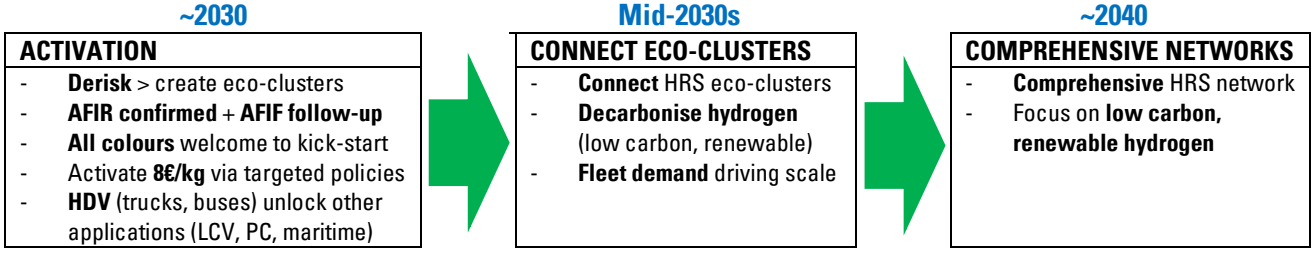
Below are examples of successful projects involving different applications and Toyota's investment to promote hydrogen:

Theme	Link for information	Date
Bus	Toyota Motor Europe to supply Toyota Fuel Cell Module to second bus OEM, **Daimler**	02 May 2022
	Toyota co-brands zero-emission buses (FCEV + BEV) with **CaetanoBus**	09 Jul 2021
Truck	Toyota Motor Corporation joins Daimler Trucks and Volvo in Cellcentric JV	31 Mar 2026
	Toyota Motor Europe starts zero tailpipe emissions logistics with fuel cell trucks	19 Jun 2025
	Toyota joins Coca-Cola and Air Liquide for heavy duty hydrogen fuel cell truck test programme	24 Jul 2024
	VDL Groep reveals fuel cell truck for Toyota's European logistics	12 Sept 2023
	Toyota to supply its fuel cell modules to European truck company **Hylico**	22 Feb 2023
Testing at races	Toyota Gazoo Racing debuts hydrogen Rally2 car at Rally Finland	08 Jul 2025
	Evolved liquid hydrogen-powered GR Corolla to participate in Super Taikyu Fuji 24-hrs race	24 May 2024
	Toyota showcases experimental hydrogen-powered GR Yaris	02 Dec 2021
Cars	Toyota Motor Corporation and **BMW** Group Strengthen Collaboration	05 Sep 2024
Train	Toyota Motor Europe delivers 6 fuel cell modules for **FCH2Rail** project in Spain	17 Jan 2022
Refuelling infrastructure	Toyota Motor Europe partners with **ENGIE** for fast and cost-efficient H2 refuelling infrastructure	28 Jan 2025
Eco-cluster development	Toyota announces 500 fuel cell Mirai for official fleet in Paris Olympic a Paralympic Games 2024	20 Sept 2023

- **Promotion of eco-clusters: building-up an European hydrogen Ecosystem**

As part of its strategy to promote hydrogen society, Toyota Europe is partnering with like-minded partners to create hydrogen eco-clusters: geographical areas where production, storage, distribution and end-users are integrated into a local "Mini-hydrogen economy". The aim is to stimulate eco-clusters which can be progressively combined in a continental hydrogen Ecosystem.

ROADMAP to H2 SOCIETY



Abbreviations:

B2B: Business to business
BEV: Battery Electric Vehicle
CNF: Carbon-Neutral Fuels
FCEV: Fuel Cell Electric Vehicle
HEV: Hybrid Electric Vehicle
H2-ICE: Hydrogen Internal Combustion Engine
HRS: Hydrogen Refuelling Station
PHEV: Plug-In Electric Vehicle
TFCM: Toyota Fuel Cell Module