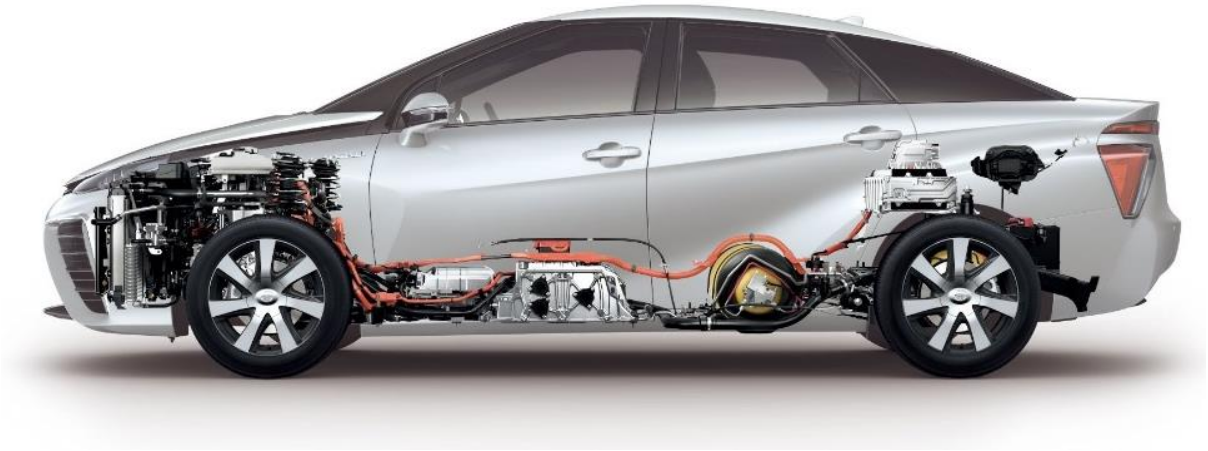
TOYOTA

TOYOTA AUSTRALIA – FUEL CELL PROJECT



Troy D'Souza
Senior Engagement & Education Specialist
Advanced Planning

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TOYOTA ENVIRONMENTAL CHALLENGE 2050

TOPICS

FUEL CELLS & TOYOTA

HYDROGEN CENTRE

ENGAGEMENT ACTIVITIES

HYDROGEN MOBILITY

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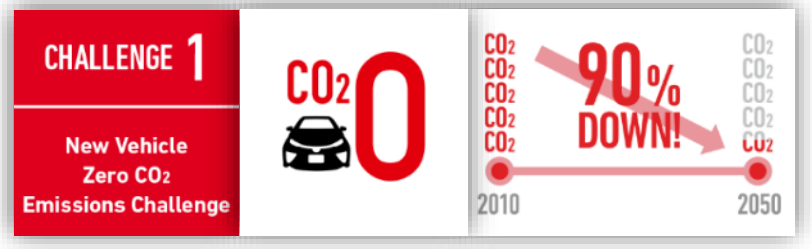
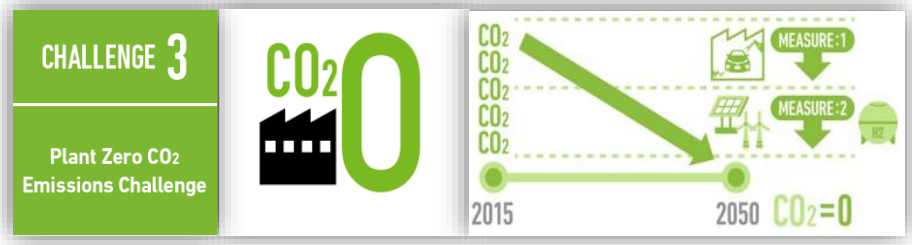
WHY FUEL CELLS?

1 TOYOTA GLOBAL ENVIRONMENTAL CHALLENGE





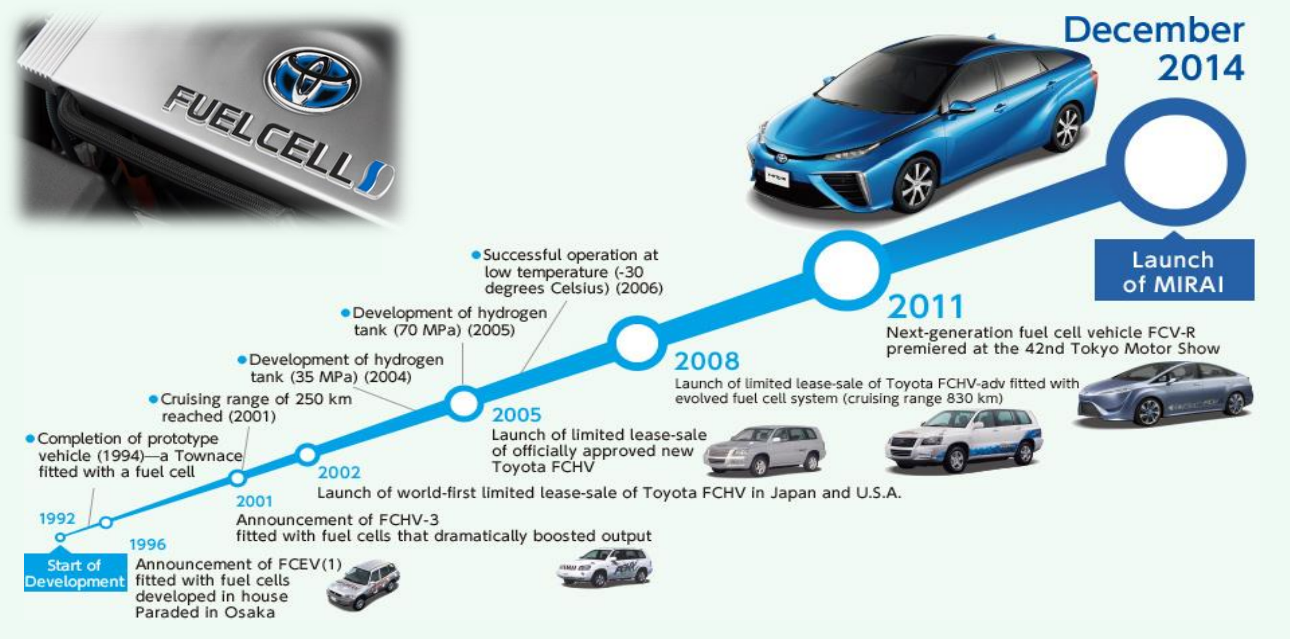
2 TMCA VISION & MISSION

"Creating Innovative Mobility Solutions for All Australians."

3 TMCA VISION FOR FUEL CELL VEHICLES

"Create Sustainable Mobility for Australia's future Hydrogen Society."

4 FUEL CELL VEHICLE DEVELOPMENT



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THE DRIVING FORCES OF FUEL CELL ADOPTION

Hydrogen Society
- Transportation
- Energy

Global CO_2 Targets
- Introduction of vehicle CO2 emission targets

TMC 2050 Environmental Targets
- ↓ 90% vehicle emissions
- ↓ 100% building emissions

Advantages of Hydrogen as a transport fuel
- Zero emissions
- Short refill time (3-5 mins for commercial refueller)
- Long range
- High energy density

Hydrogen Manufacture
- Can be made from many sources e.g. Waste, solar, wind, hydro, fossil fuel

- Industry Approach (together with Government)
- Fuel Costs should be Competitive with other Fuels
- Hydrogen should be “Green” in the mid-term
- Stations should be Near Users and Convenient
- Fuel Cells are not just for Cars but Forklifts, Buses, Delivery Trucks & Stationary Power
- Demonstrate Hydrogen & Fuel Cell through Pilot activities

Toyota is working to establish a Hydrogen Society to meet the Environmental challenges of tomorrow.

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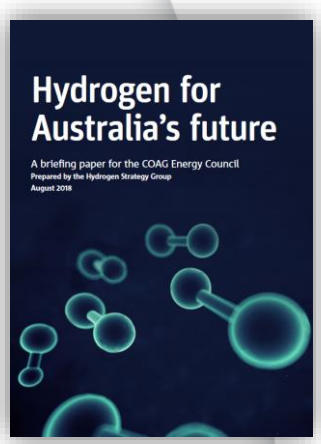
HYDROGEN INDUSTRY ANNOUNCEMENTS

2018 was a <u>big</u> year for hydrogen in Australia.

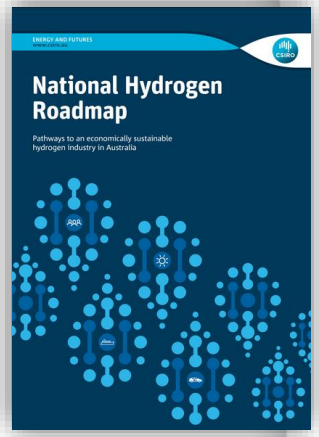
COAG Energy Council

- Dr Finkel presentation supporting hydrogen economy
- Consider starting with approx. 20 stations nationwide focusing in capital cities
- Established Hydrogen Working Group of the council following this meeting



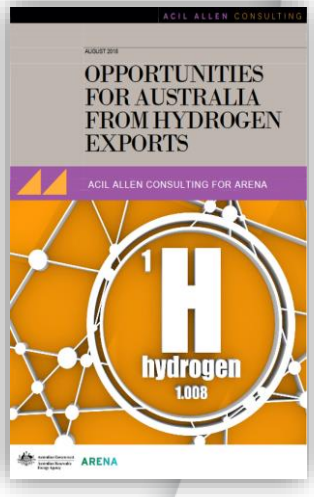
CSIRO Hydrogen Roadmap

- Provides a blueprint for the development of a hydrogen industry in Australia



ARENA Future Export Study

- Opportunities to meet future global demand
- Significant opportunity for Australia



CSIRO Ammonia Research

- Official launch in Brisbane (August 2018)
- 10 years developing process to extract hydrogen from Ammonia (NH3)
- Increases opportunity to support hydrogen export industry.

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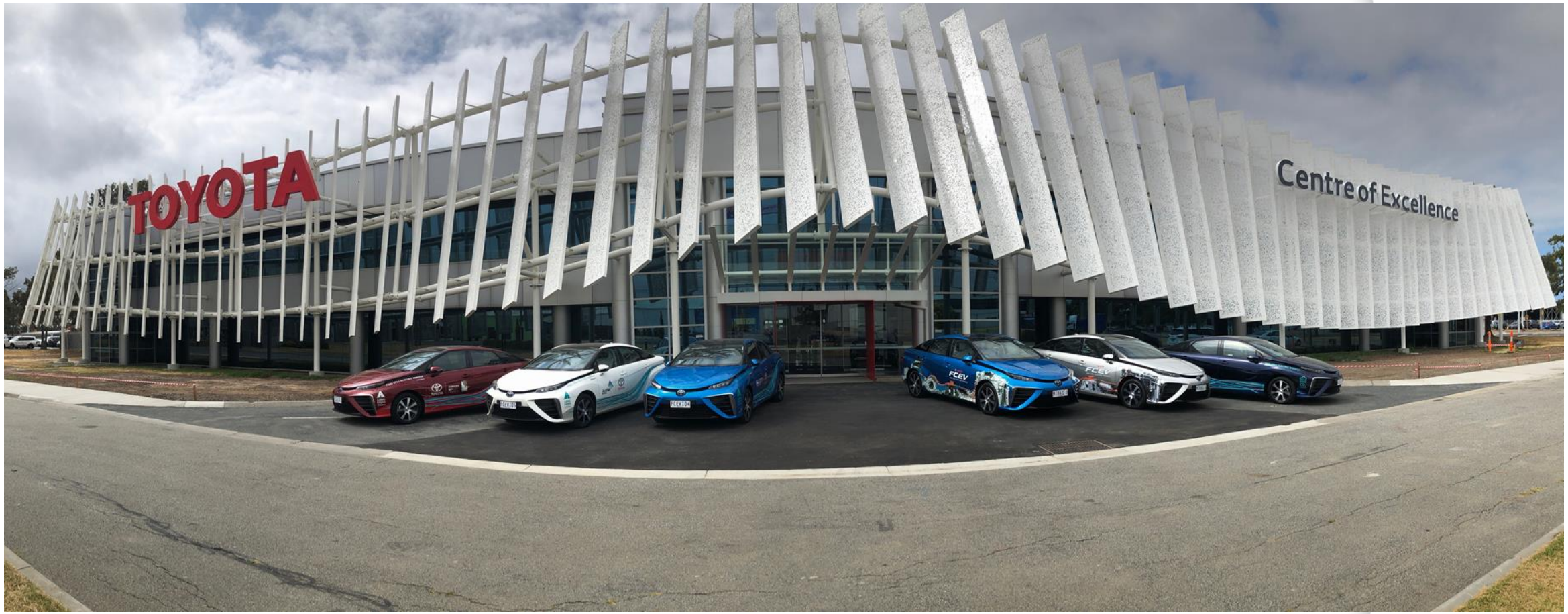
TOYOTA AUSTRALIA CENTRE OF EXCELLENCE: HYDROGEN CENTRE



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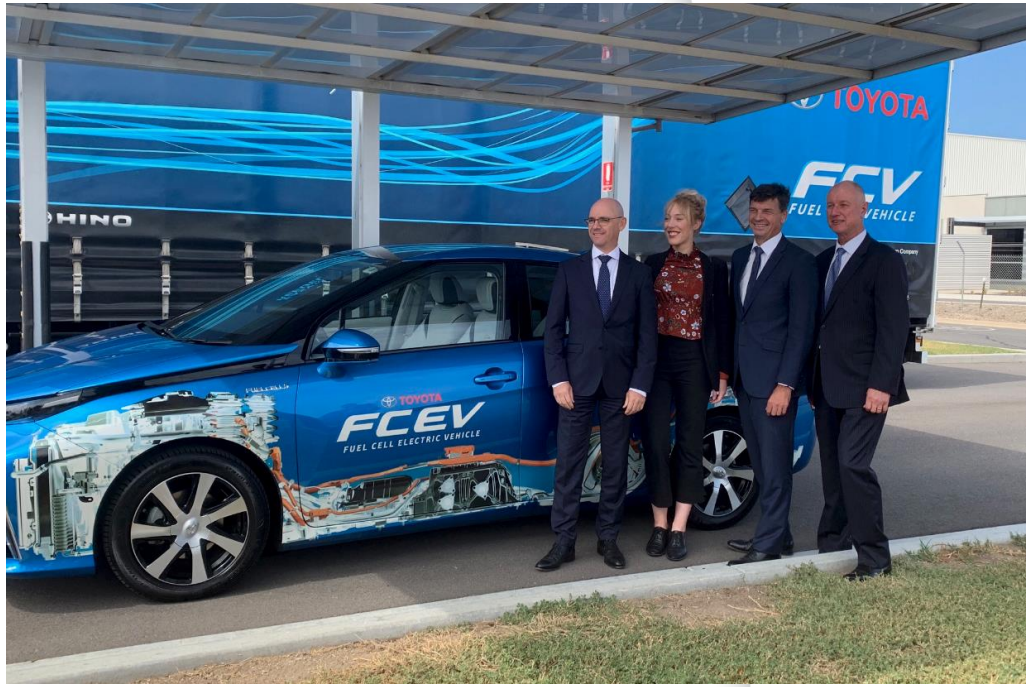
TOYOTA AUSTRALIA HYDROGEN CENTRE ‹1›

Formal Announcement – 19/3/19

- Attendance from Government and Industry including
- Federal Energy Minister Angus Taylor
- ARENA CEO Darren Miller
- Toyota VP Sales Sean Hanley
- Strong Media Attendance and Coverage
  - TV Spots
  - Print Media (Online)
  - Social Media



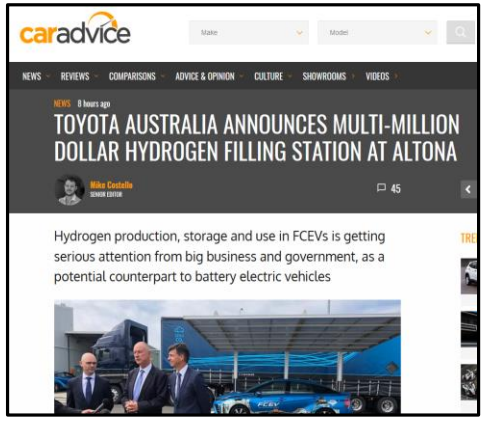
News Politics National Renewables Print article

Oh what a feeling! Toyota receives $3.1m for hydrogen plant

Six years after ending assistance for the car industry, the Morrison government has given a $3.1 million grant to Toyota to produce hydrogen at its old car plant in Melbourne.

The money will come from the Australian Renewable Energy Agency, which

Phillip Coorey
Political editor



caradvice

NEWS REVIEWS COMPARISONS ADVICE & OPINION CULTURE SHOWROOMS VIDEOS

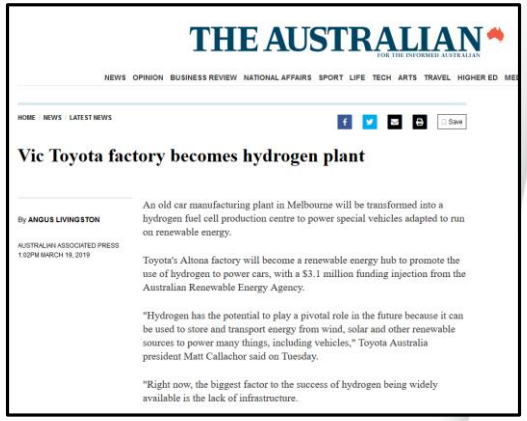
NEWS 8 hours ago

TOYOTA AUSTRALIA ANNOUNCES MULTI-MILLION DOLLAR HYDROGEN FILLING STATION AT ALTONA

Mike Costello
SENIOR EDITOR

45

Hydrogen production, storage and use in FCEVs is getting serious attention from big business and government, as a potential counterpart to battery electric vehicles



THE AUSTRALIAN

NEWS OPINION BUSINESS REVIEW NATIONAL AFFAIRS SPORT LIFE TECH ARTS TRAVEL HIGHER ED

HOME NEWS LATEST NEWS

Vic Toyota factory becomes hydrogen plant

By ANGUS LIVINGSTON

AUSTRALIAN ASSOCIATED PRESS
1:02PM MARCH 19, 2019

An old car manufacturing plant in Melbourne will be transformed into a hydrogen fuel cell production centre to power special vehicles adapted to run on renewable energy.

Toyota's Altona factory will become a renewable energy hub to promote the use of hydrogen to power cars, with a $3.1 million funding injection from the Australian Renewable Energy Agency.

"Hydrogen has the potential to play a pivotal role in the future because it can be used to store and transport energy from wind, solar and other renewable sources to power many things, including vehicles," Toyota Australia president Matt Callachor said on Tuesday.

"Right now, the biggest factor to the success of hydrogen being widely available is the lack of infrastructure.

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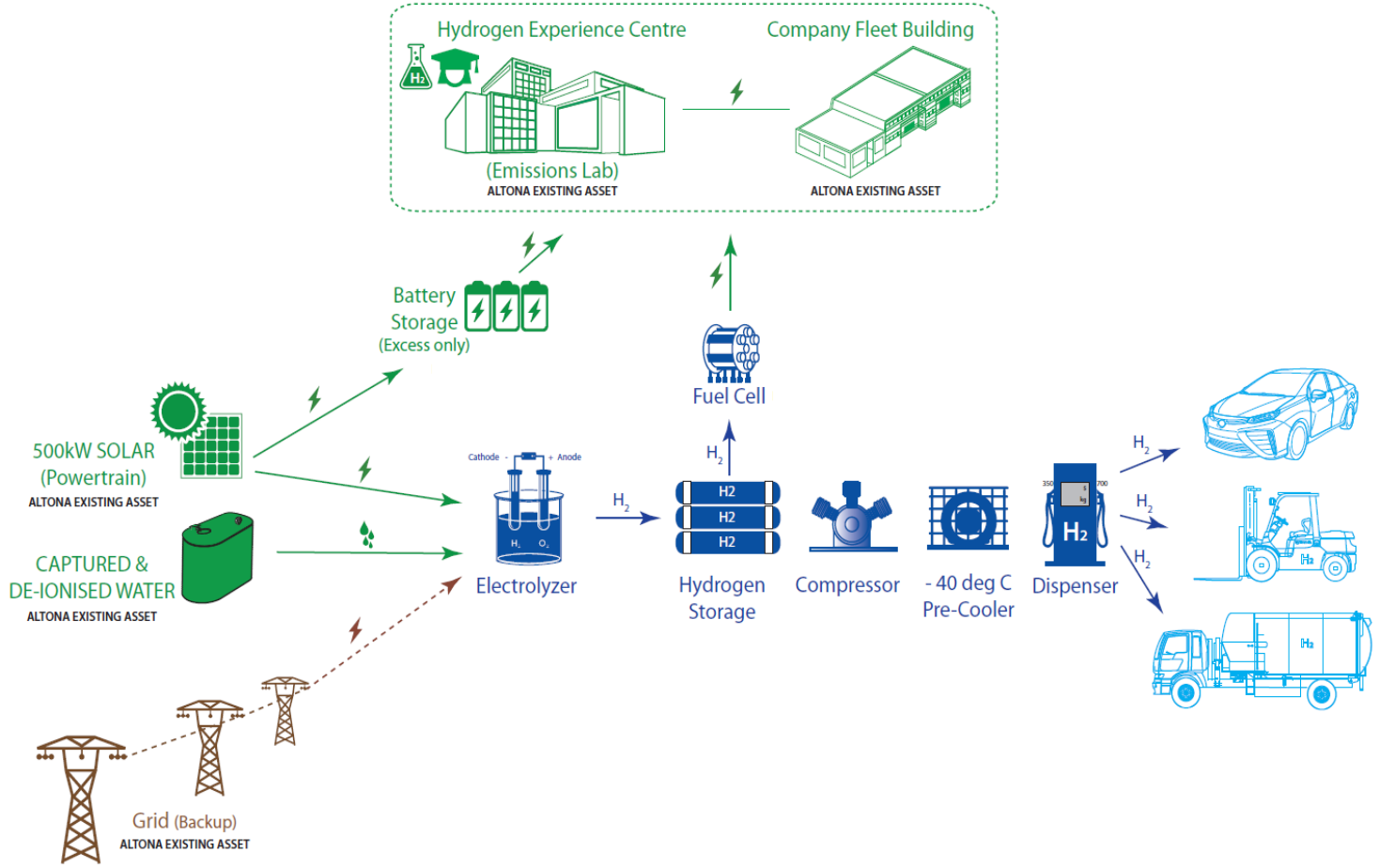
TOYOTA AUSTRALIA HYDROGEN CENTRE ‹2›

WHAT IS IT? WHY ARE WE DOING IT?

- Demonstrate the Hydrogen Economy in Australia



DEMONSTRATION

- Hydrogen Economy
  - Sector Coupling
- Generate Green H2
- Cost Effective

EDUCATION

- Safety
- Benefits
- "Mythbusting"

COLLABORATION

- Industry Support
- Research Opportunity

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TOYOTA AUSTRALIA HYDROGEN CENTRE

Toyota Australia's Hydrogen Centre will include two key areas:

- **Hydrogen Demonstration Plant:**
  - Demonstrate the production of hydrogen and utilisation through renewable energy on a fully functioning and operational site
  - Promote the reduced reliance on grid sourced electricity through the use of solar energy with battery storage, however not fully "Off-Grid" to ensure back up energy supply
  - Demonstrate a functional model of the hydrogen society from stationary power to a refuelling station

- **Hydrogen Experience Centre:**
  - Build awareness and knowledge of Hydrogen Fuel Cell Technologies
  - Highlight the benefits and opportunities using this technology
  - Provide insights into the end user perspectives: transportation, energy storage and power generation
  - Resource for future hydrogen research projects and STEM opportunities
  - Discuss challenges and opportunities for Hydrogen in Australia

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TOYOTA AUSTRALIA HYDROGEN CENTRE: Lessons Learnt

1. General lack of awareness with hydrogen infrastructure, safety requirements and refuelling stations.
2. Policies, standards and guidelines need to be developed for hydrogen based technologies as they don't exist in some areas
3. Hydrogen Centre equipment has been sourced from overseas suppliers, therefore there can be issues/delays/costs with understanding compliance requirement specific to Australia.

Example : Requirements for Permitting to establish a Hydrogen Project

This area is very new to most Government entities (including State and Local)

- What are we approving?
- How to we approve it?
- Who should we talk to in order to confirm?
- What documents are required?

What's the Effect? : Permit approval timing varies between councils and can take months, causing delays to projects

Lesson 1 : Project schedules MUST allow time for councils to review, query and review again (multiple iterations)

Lesson 2 : Early Engagement and Information is key. Bring the right people on the journey from the very beginning

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TOYOTA AUSTRALIA HYDROGEN CENTRE: Opportunities

1. Hydrogen Demonstration Plant utilises “Off-The-Shelf’ equipment (e.g. Fuel Cell, High Pressure Storage) rather than a Toyota proprietary component to demonstrate how a hydrogen plant can be developed in Australia by anyone not just by Toyota
2. Development or Selection of control systems to integrate established and emerging technologies and monitor plant production and energy consumption to demonstrate how the plant functions. In some cases, “bespoke” solutions may be required, enabling local business opportunities for systems engineering companies.
3. Promote educational and learning opportunities using the Hydrogen Experience Centre as way to build the awareness and knowledge of the technology

Example : Industry collaboration for education / information material.

> There are multiple companies (local and international) with experience in this field who can support development of the content.

Example : Local Equipment Sourcing

> Majority of H2 specific equipment is from overseas, however it *could* be built in Australia if suppliers establish sites here.

> Toyota’s project aims to promote the H2 Economy, encouraging others to do the same and show the developing market in Australia

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ENGAGEMENT MIRAI IN AUSTRALIA

- TMCA introduced 3 Mirai vehicles to Australia in June 2016 to build awareness into the technology
- TMCA established its own Mobile Refuelling and Service facility in Altona in October 2016
- TMCA has been engaging with Government, Participants in the Hydrogen Industry, Customers and the General Public to increase awareness of Fuel Cell technology and encouraging the establishment of Infrastructure

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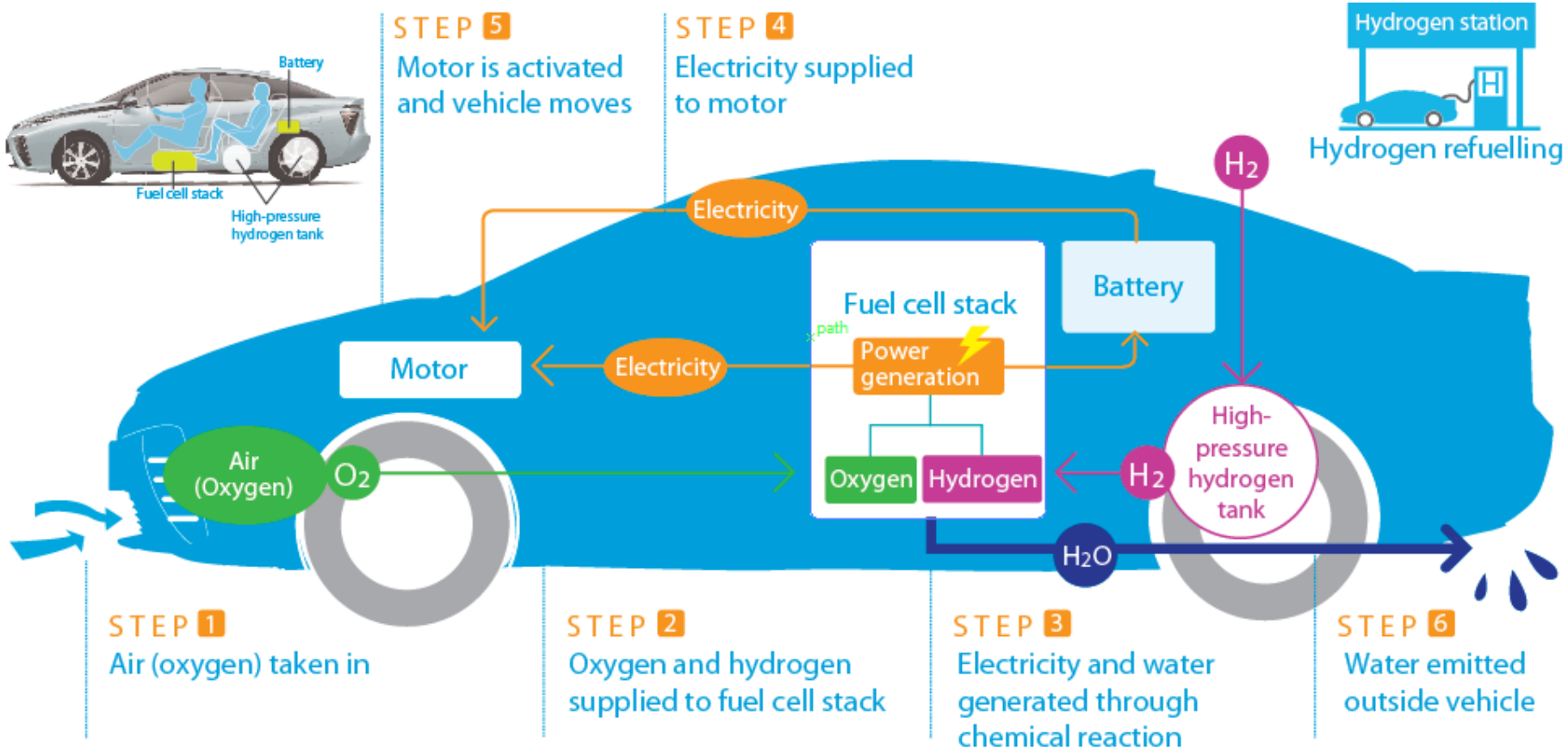
HOW THE MIRAI FUEL CELL SYSTEM WORKS



FC stack generates electricity on demand through a chemical reaction between hydrogen and oxygen. Water vapour is the only emission from the vehicle

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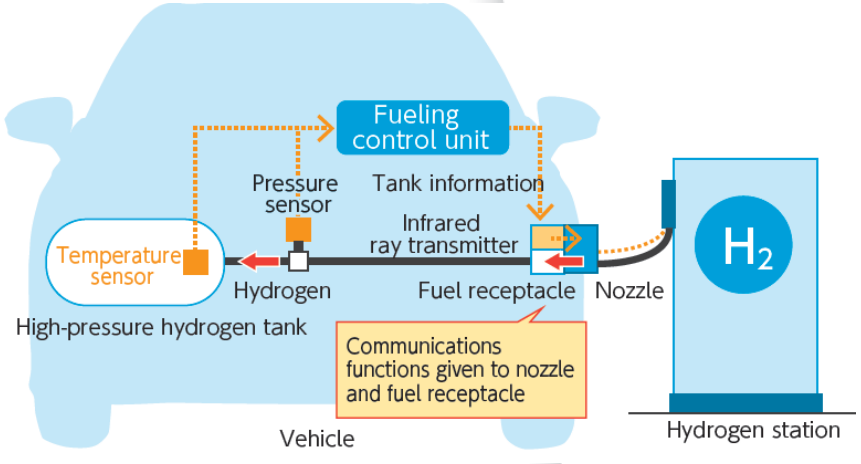
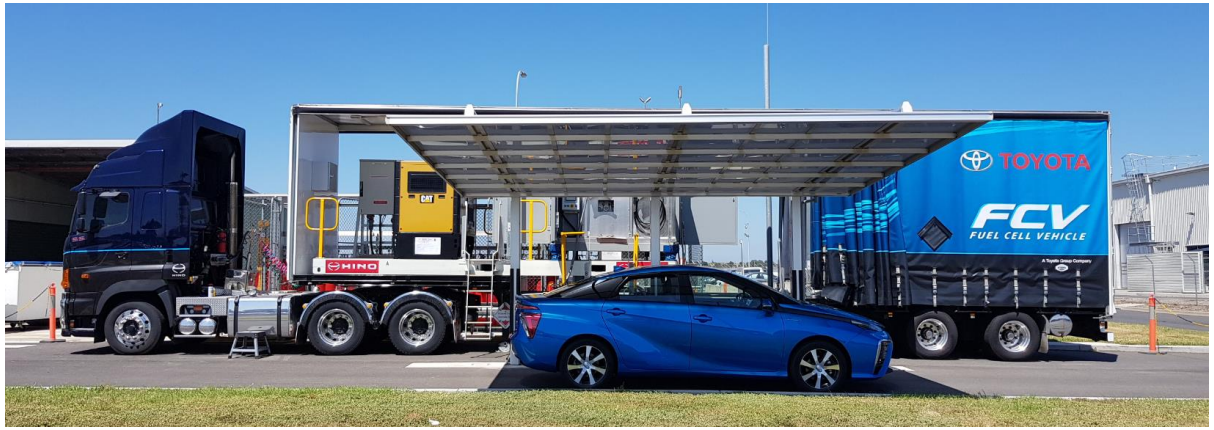
REFUELLING THE MIRAI

- Hydrogen refuelling stations operate similar to that of a conventional petrol station.
- An infrared transmitter near the fuel receptacle communicates with the refuelling station which allows for an efficient fuelling process.
- Once the system checks for a tight seal, fuelling takes approx 3-5 mins
- The filling port is standardised for Fuel Cell vehicles



TOYOTA AUSTRALIA'S MOBILE REFUELLER

- Refuel Mirai (and other Vehicles) throughout Australia
- Demonstrate Refuelling Infrastructure/Technology



REFUELLER SPECIFICATION

Supplier:	The Linde Group
Compressor Type:	Linear 3-Stage GH_2
Discharge Pressure:	Up to 900 bar at 5kg/h
Delivery Pressures:	350 bar and 700 bar
Pre-cooling Temp:	-20 Deg C

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MIRAI IN AUSTRALIA - MARKETING & ENGAGEMENT

- TMCA not actively marketing the vehicle → Building awareness and knowledge of the vehicle technology and the opportunities for hydrogen utilisation
  - Government – Federal, State and Local
  - Industry Groups
  - Fleet and Dealership events
  - Universities, Schools and Research Institutes
  - STEM Events
  - Media
  - First Responders (e.g. Police, Fire & Rescue)
  - General Public

FEDERAL GOVERNMENT & ARENA

VICTORIAN GOVERNMENT

SOUTH AUSTRALIAN GOVERNMENT

HYDROGEN MOBILITY AUSTRALIA DRIVE EVENT

LOCAL COUNCIL EVENTS

TOYOTA DEALERSHIP OPENING

STEM
SPARK ENGINEERING CAMP

ENERGY STORAGE CONFERENCE

VACC EVENT

EMERGENCY SERVICES

LOCAL COMMUNITY FESTIVALS

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MIRAI LOAN PROGRAM

Why?

- Continue building on achievements since initial vehicle import in 2015.
- Positive engagement with Government and Industry
- Short Drive Opportunities provide only insights into the technology
- Focus on development of supporting infrastructure
- Normalise Fuel Cell Technology through “real world” usage
- Maintain focus on Mirai (FC) during limited product availability

Australian First Fuel Cell Electric Vehicle Trial

- Ten Fuel Cell vehicles in public hands, on public roads

Challenges:

- Refuelling
- Vehicle Importation and Registration

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CURRENT PROGRAM STATUS

Participants so far include:

HOBSONS BAY CITY COUNCIL
HYDROGEN MOBILITY AUSTRALIA
FLEET BETTER BUSINESS SENSE
TOYOTA
ENGIE
AusNet services
mondo
wyndhamcity
Moreland City Council
Australian Gas Infrastructure Group
H2H ENERGY PTY. LTD.

Some Key Points

- This is a paid program – all participants want to be part of the trial as it supports their environmental & sustainability strategies
- So far, we've travelled well over 10,000km using Fuel Cell technology
- Social Media is playing a key role with highlighting the availability of this technology and how it can be used in "daily" life.
- Education & Engagement is important in raising the profile of FCEVs as a viable contributor to reducing transport emissions.

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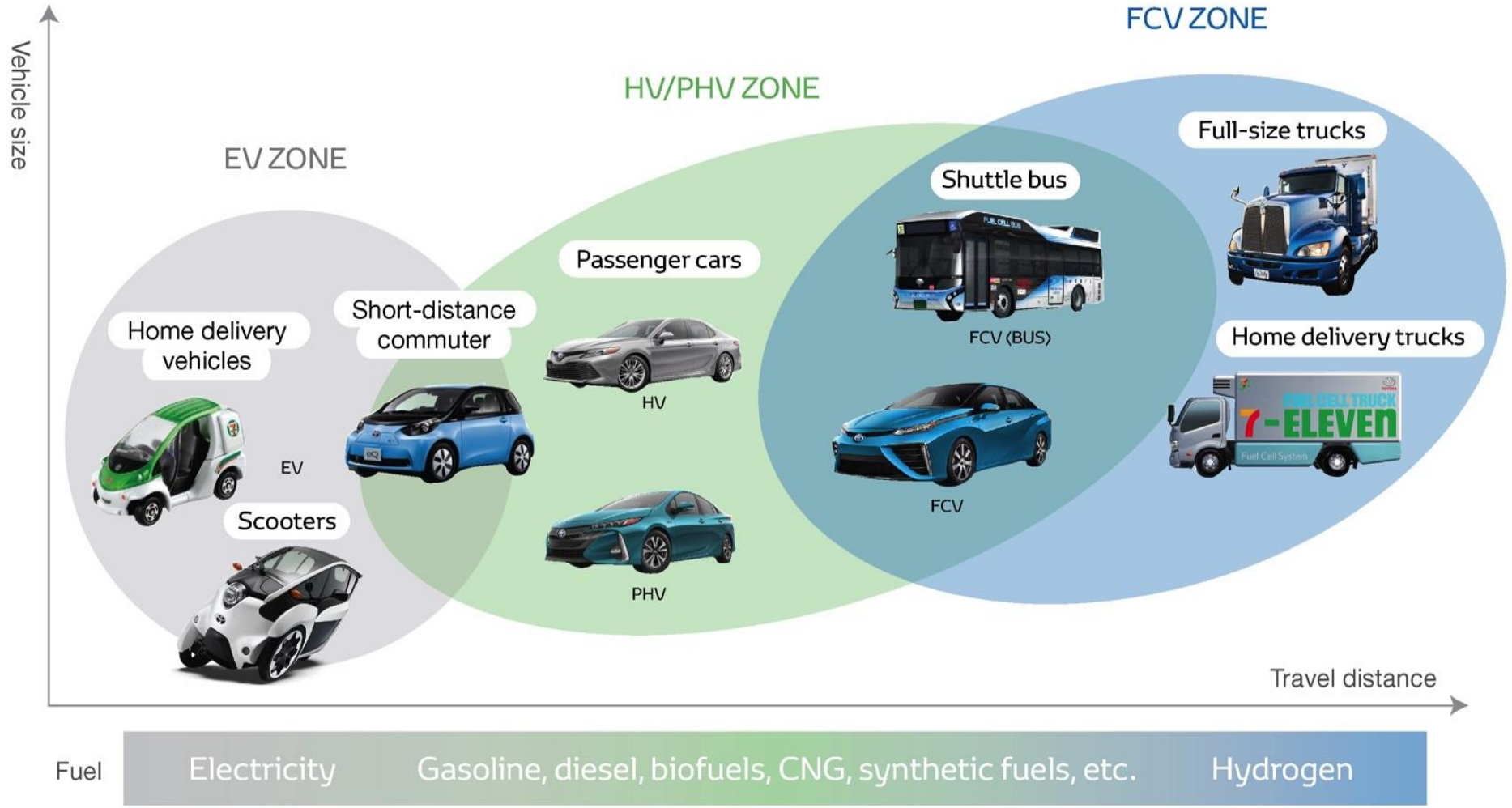
IS HYDROGEN THE ONLY SOLUTION?



EV: Short-distance, HV & PHV: Wide-use, FCV: Medium-to-long distance

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FUEL CELL INITIATIVES IN THE TOYOTA GROUP – Commercial Vehicles

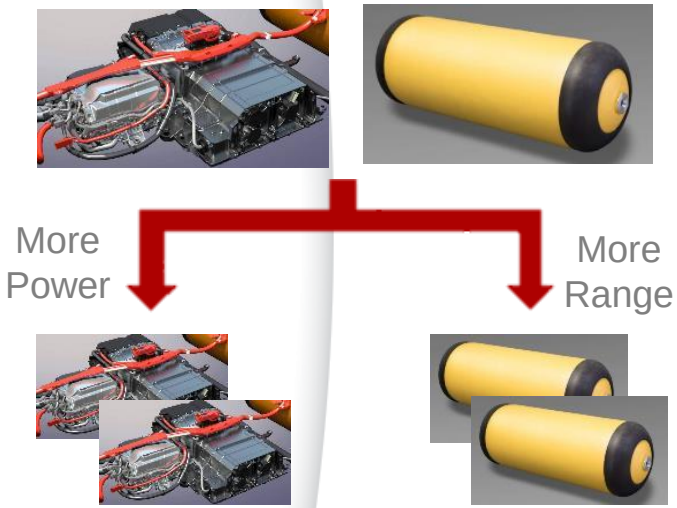
Fuel Cell technology is “scalable”

BUSES

- Tokyo Metropolitan Dep’t of Transportation took delivery of 2x Toyota FC buses in Q1 2017
- March 2018, Toyota launches “Sora” Fuel Cell bus in Japan
- Plans to introduce 100 units prior to 2020 Olympic Games

TRUCKS

- Project Portal is a Toyota USA project which demonstrates a Class 8 truck converted to run on Toyota Mirai Fuel Cells
- Toyota USA and PACCAR (Kenworth) agree to develop ten more trucks for an expanded trial
- 7-Eleven delivery trucks in Japan have also been converted to run on Toyota Mirai Fuel Cells



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Thank You.

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