
TOYOTA
Let's Go Places
Michigan Operations and the Evolution of Toyota's Green Vehicles

TTC R&D Locations

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TOYOTA in MICHIGAN *LEED Certified*

2005

2008

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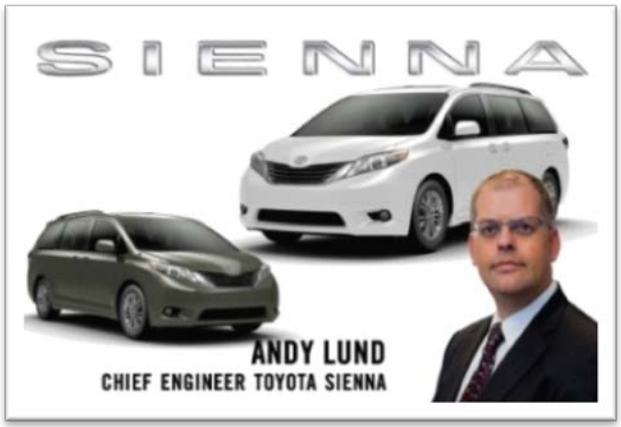
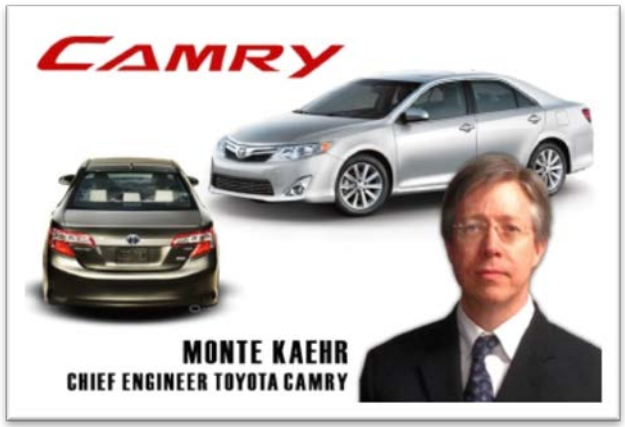
Greater Responsibility: Design & Engineering

North American Chief Engineers





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Toyota Technical Center Major Responsibility

Avalon

Tundra

Tacoma

Sienna

Rav4EV

Venza

Camry

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Toyota Technical Center Minor Responsibility

Sequoia

Corolla

Highlander

Lexus ES

Lexus RX

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2015 Camry Reveal
New York International Auto Show

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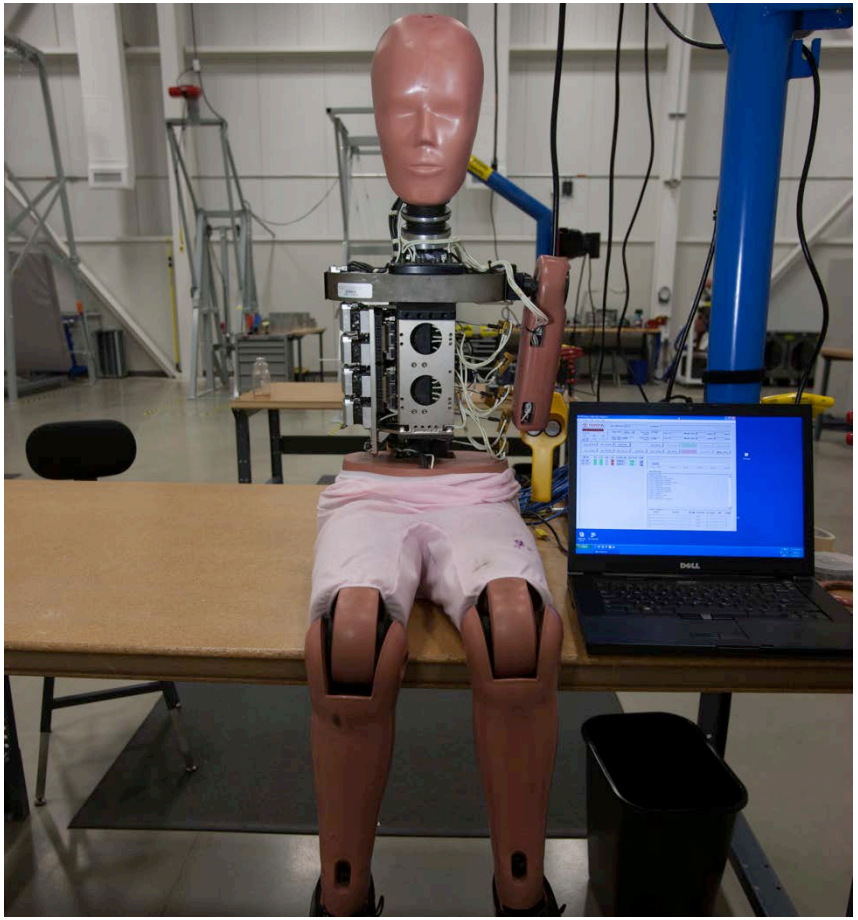
$1 Million Dollars An Hour



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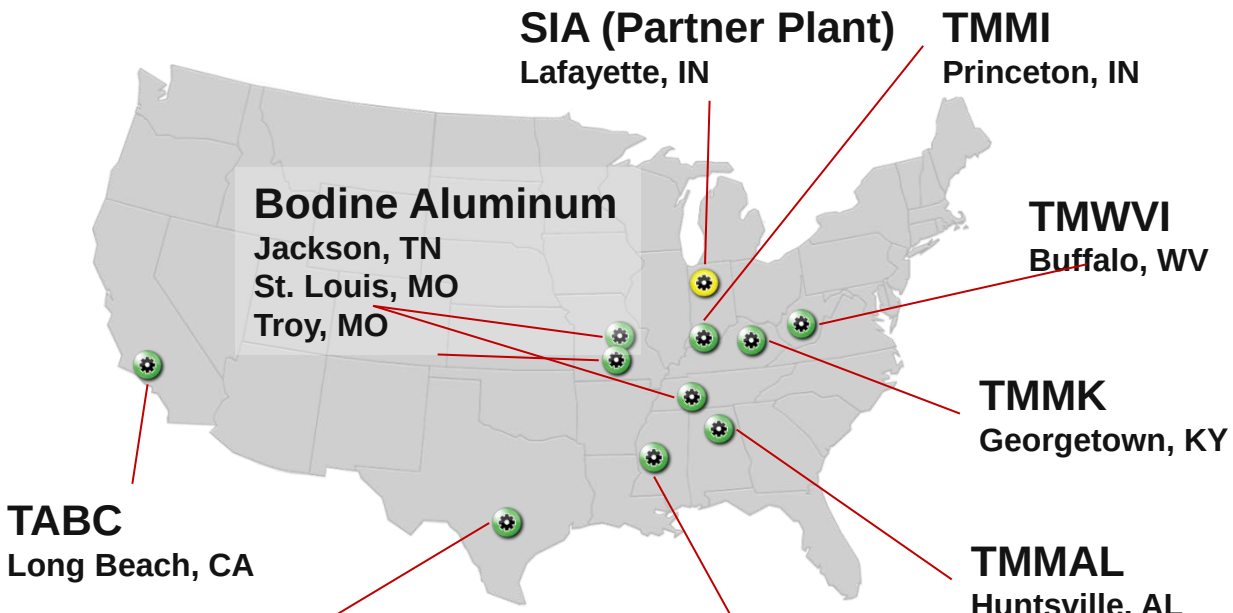
TOYOTA US Manufacturing Operations



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TOYOTA: the evolution of *GREEN*

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TOYOTA: the evolution of *GREEN*

- **1995 Prototype Prius at Tokyo Auto Show**
- **2000 US Sales Begin**
- **5,600 units**

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- **Total US sales 1.25M**
- **Global Sales 3.8M**

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Rav4EV

FCHV

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Role of Fuel Cell Vehicles in a Sustainable Transportation System

Justin Ward

Toyota Motor Engineering

& Manufacturing North America, Inc.

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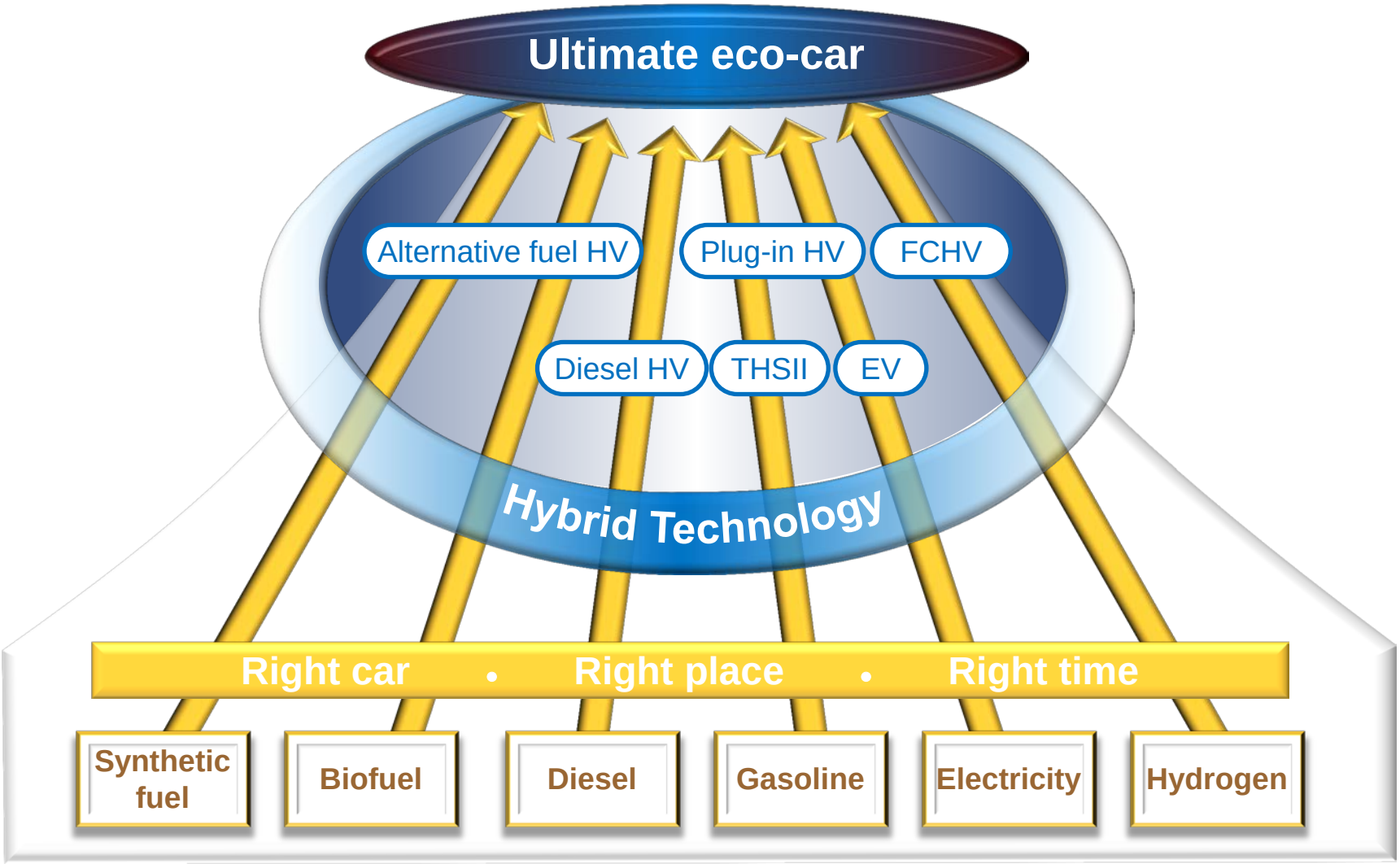
Pathway to Sustainable Mobility



EV: Electric vehicle THS: Toyota Hybrid System HV: Hybrid vehicle FCHV: Fuel cell hybrid vehicle

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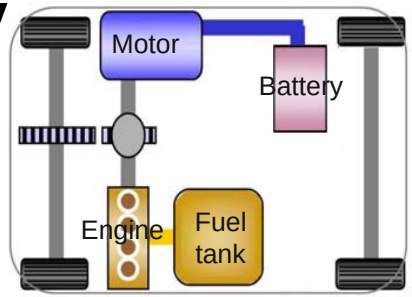
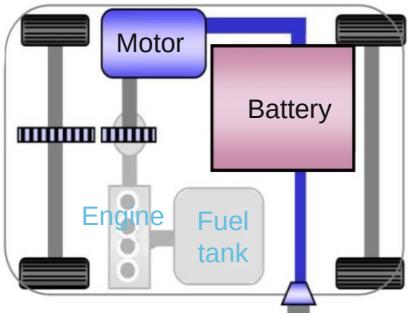
Role of Hybrid Technology in Advanced Powertrains

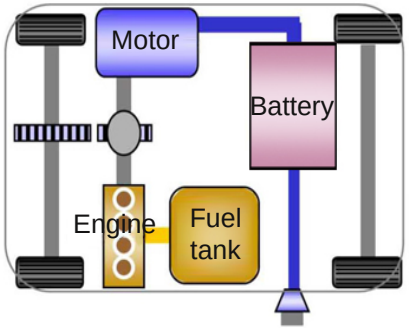
HV



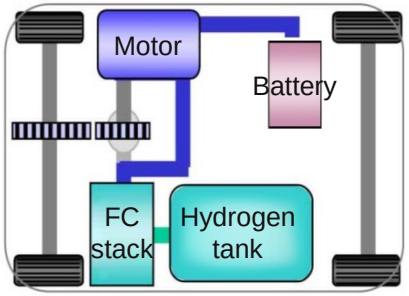
EV



PHV



FCV



Hybrid technology is the core technology

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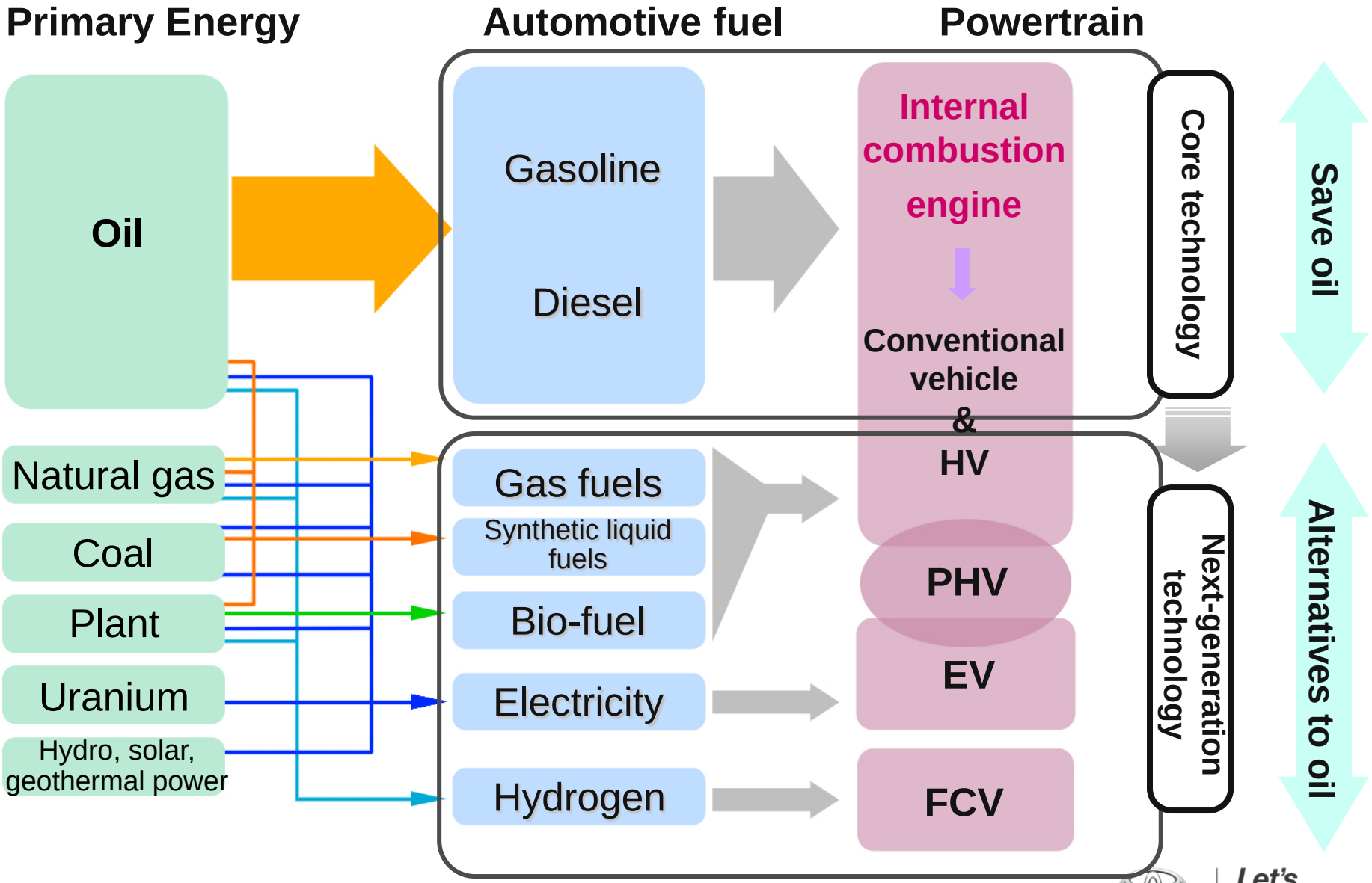
Diversification of Automotive Fuels and Powertrains



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Comparison of Total Efficiency
(in Japan using feedstocks available in Japan)

	Energy pathway	Well-to-Tank (0% – 50%)	Tank-to-Wheel (0% – 50%)	Well-to-Wheel *1 (0% – 20% – 40%)
Fuel Cell Vehicle (FCHV-adv)	**Natural gas** → Membrane separation → **Hydrogen** *3	67% *2	59%	40%
Electric Vehicle	**Natural gas** → Gas-fired power gen. → **Electricity**	39%	85%	33%
	Natural gas → Refine → **Electricity**	84%	40%	34%
Gasoline Hybrid (Prius)	**Crude oil** → Refine → **Gasoline**	84%	23%	19%
Gasoline ICE	**Crude oil** → **Gasoline**			

*1 Tank-to-Wheel efficiency: measured in the Japanese 10-15 test cycle
*2 Efficiency difference between 35MPa and 70MPa: approx. 2%
*3 Hydrogen at 70MPa

System Cost Comparison Between EV and FCV

EV has the advantage for short-to-mid range applications

FCV has the advantage for mid-to-long range applications

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On the Path to FCV Commercialization

~300 mi

3 – 5 min refuel

Coming to Market 2015

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Key for Success: Hydrogen Infrastructure

AB 118 (2007) and AB 8 (2013) funds allocated to build stations

⇨ **100 stations by 2020**

Support from State and Federal Government has been and will continue to be one of the key enablers for Fuel Cell Vehicles.

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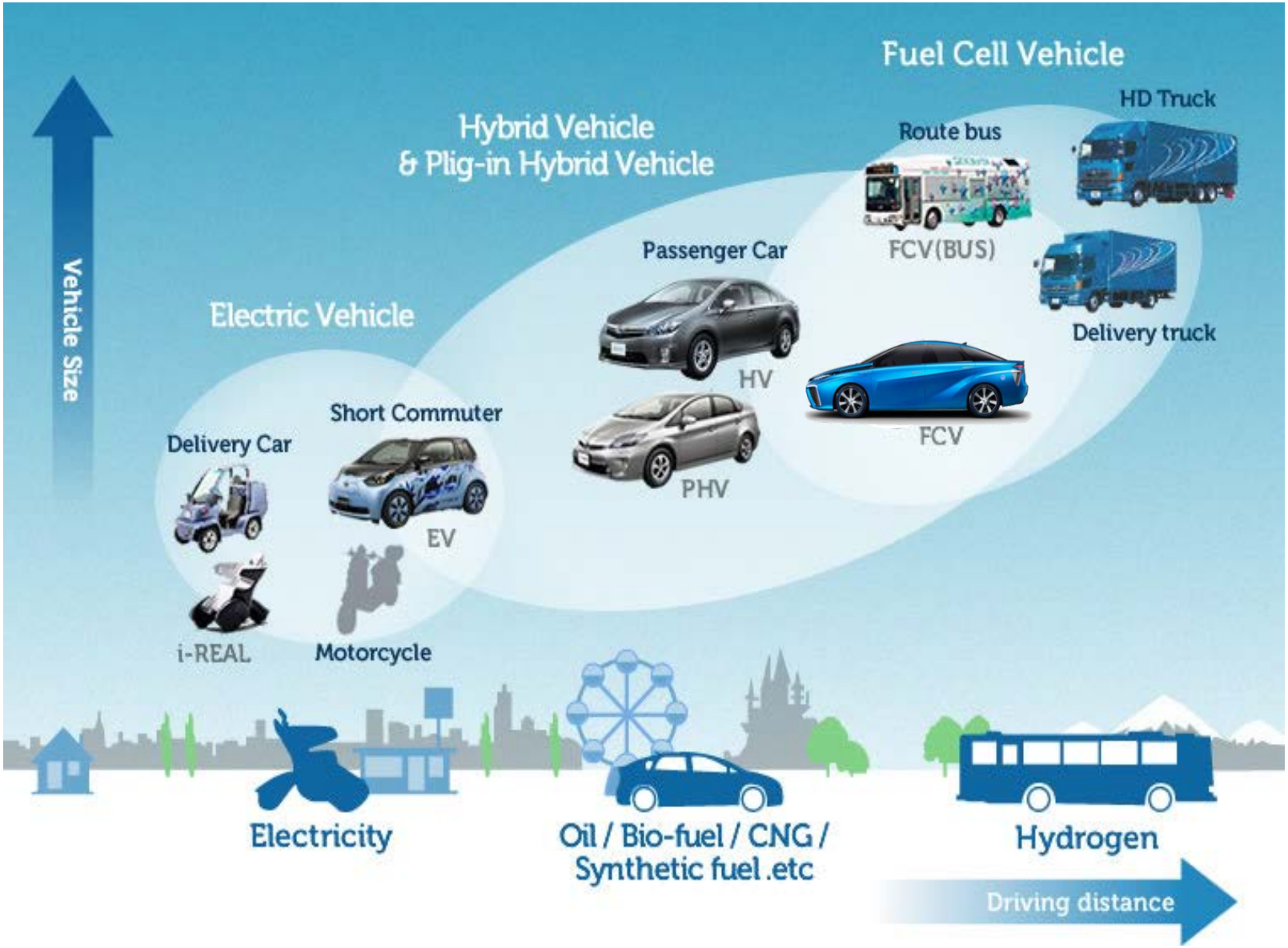

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