EUROPEAN COMMISSION

New Energy World IG
fuel cells & hydrogen for sustainability

Progress and Challenges for TOYOTA's Fuel Cell Vehicle Development

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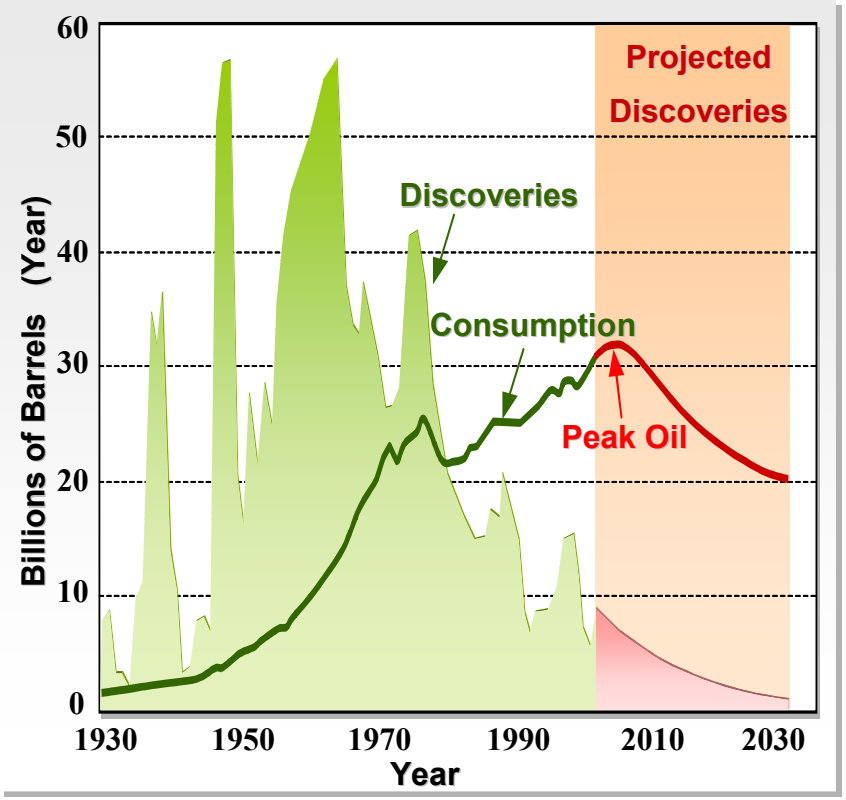
Toyota Motor Corporation

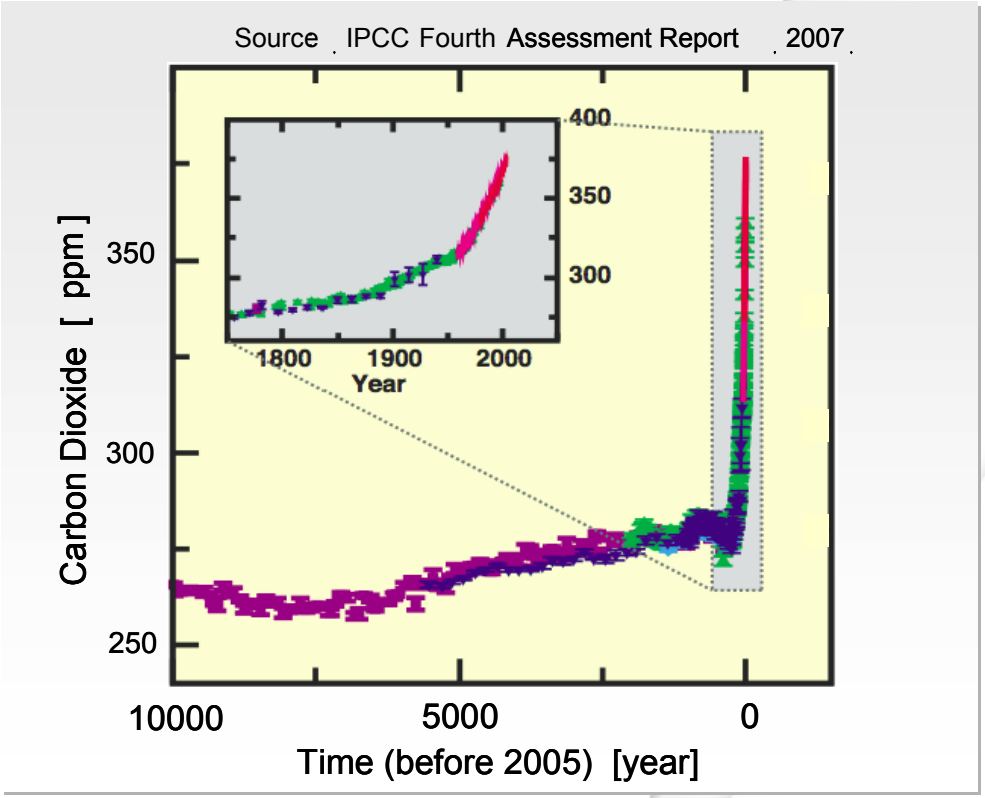
Prospect for Supply and Demand of Conventional Oil



Source:http://www.oilposter.org(Cautious Theory)

Since 1980, oil discoveries in new oil fields have lagged oil consumption, hence 'Peak Oil' seems to be inevitable.

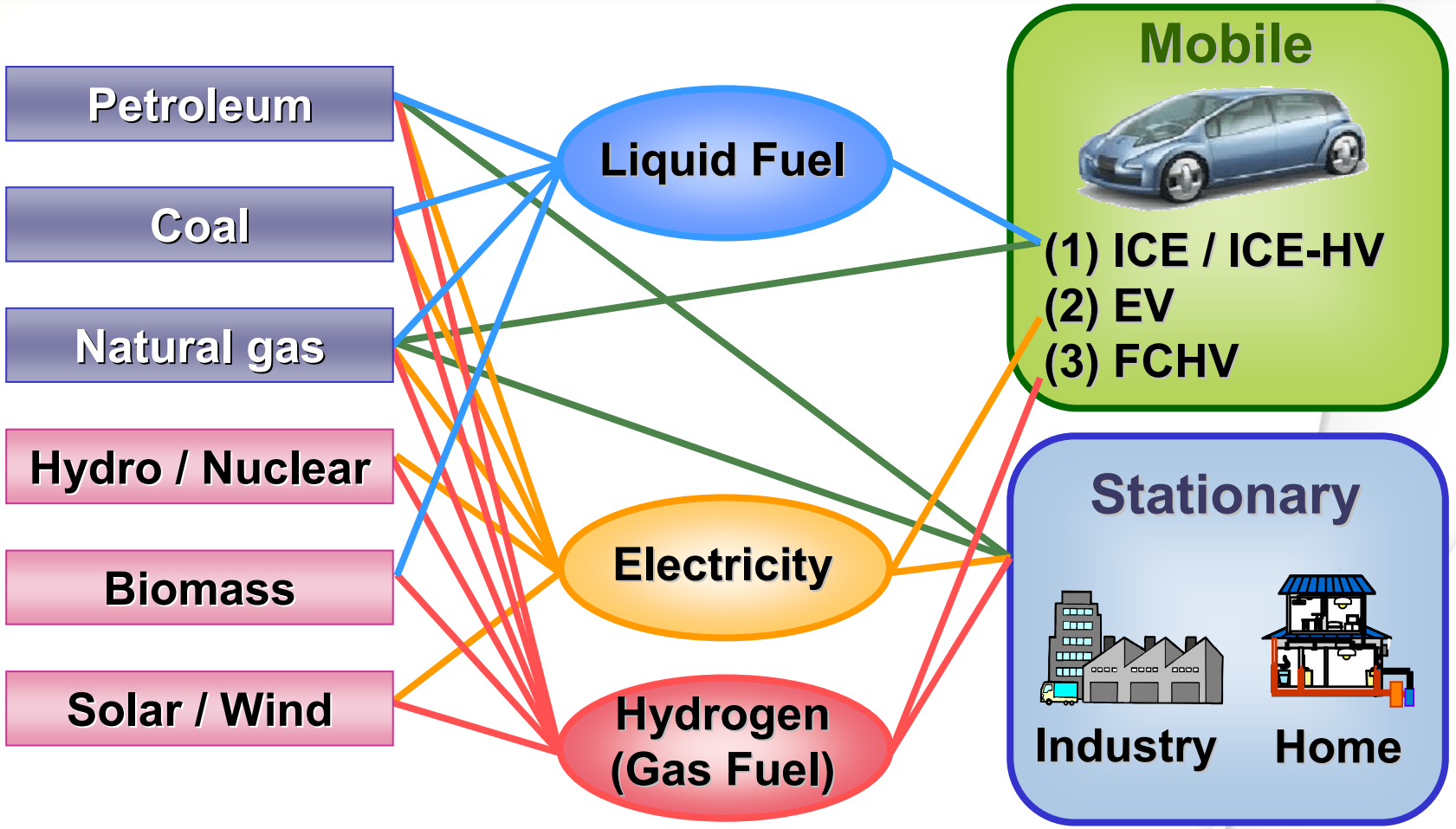
Changes in CO_2 Concentration



Atmospheric CO_2 concentration has dramatically increased since the 20th century.

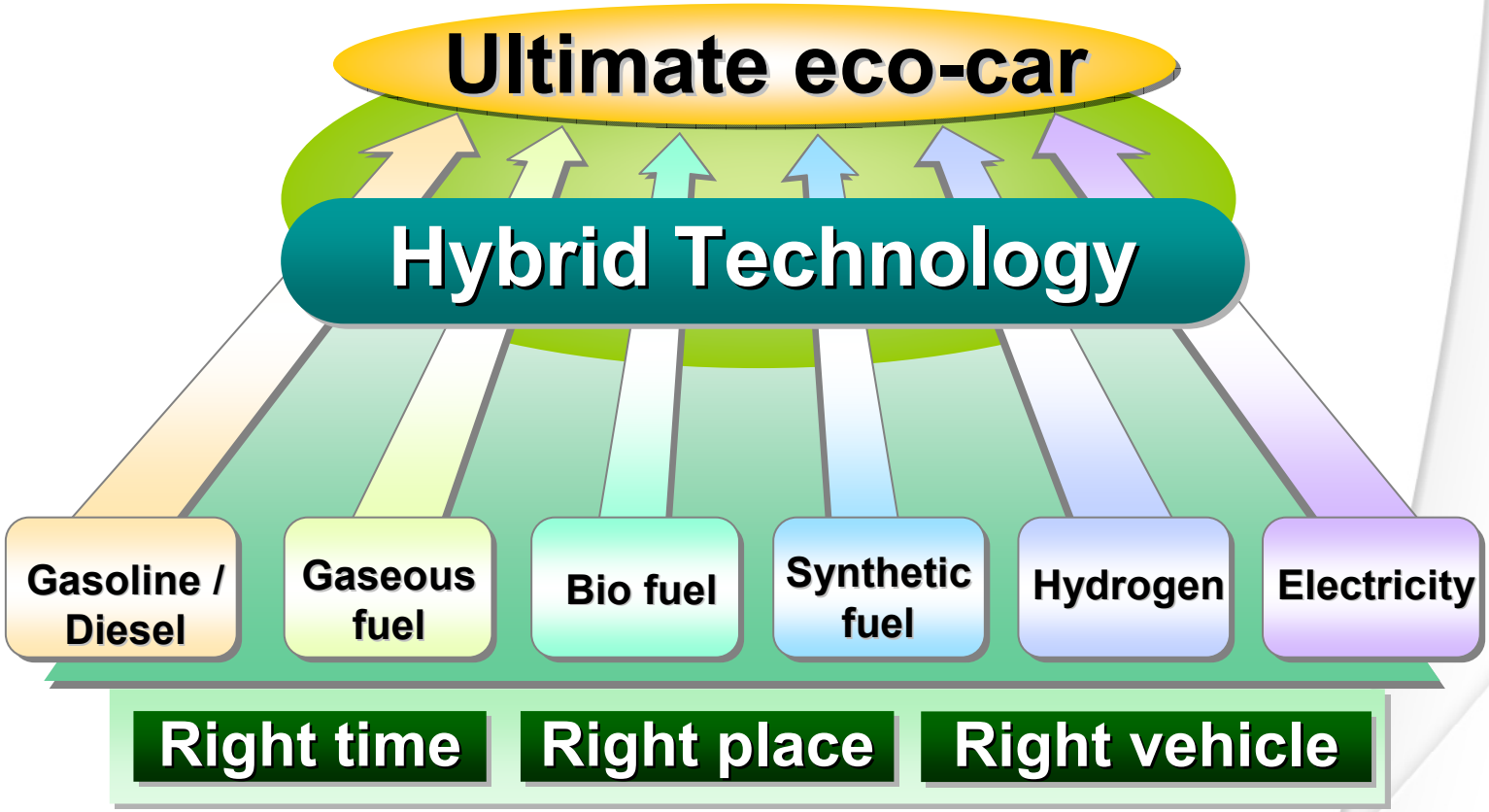
Prompt countermeasures and significant technology innovation are vital.

Concept of Energy Source Utilization



Electricity and hydrogen are expected to be alternatives to liquid fuel.

TOYOTA's Plan for Sustainable Mobility



Toyota is actively developing hybrid technology to serve as a core technology applicable to all powertrains

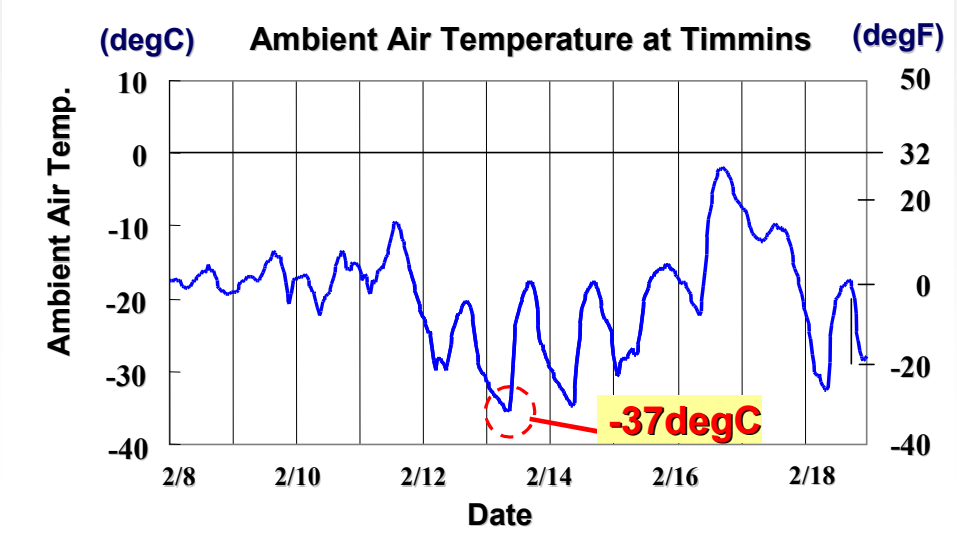
TOYOTA FCHV Progress

	Present	2015
Vehicle	 Dec. 2002 ~ '02 FCHV (lease model)  Jul. 2005 ~ '05 FCHV (lease model)  '08 FCHV-adv (lease model)	FCCJ* Target * Fuel Cell Commercialization Conference of Japan
Technical Challenges		
1. Cold Start / Driving Capability	0degC ~ / 0degC~	-30degC ~
2. Actual Cruising Range	210km / 230km	500km or more
3. FC Stack Durability		15 years or more
4. Cost reduction		1/10 or less (design / materials)

- Toyota has significantly improved actual cruising range and cold start / driving capability.
- Toyota continues its efforts especially on FC stack durability and FC system cost reduction, targeting commercialization in 2015.

1. Cold Start / Driving Capability Performance Test in Canada

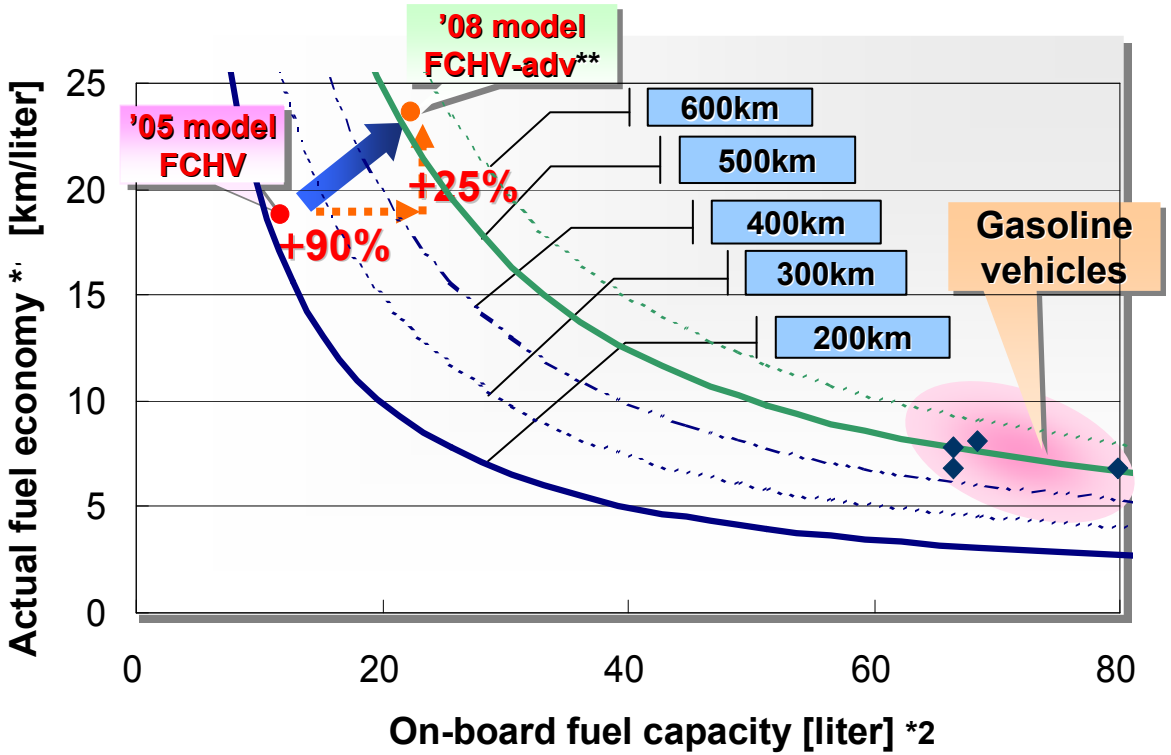
Timmins, Canada



Yellowknife, Canada

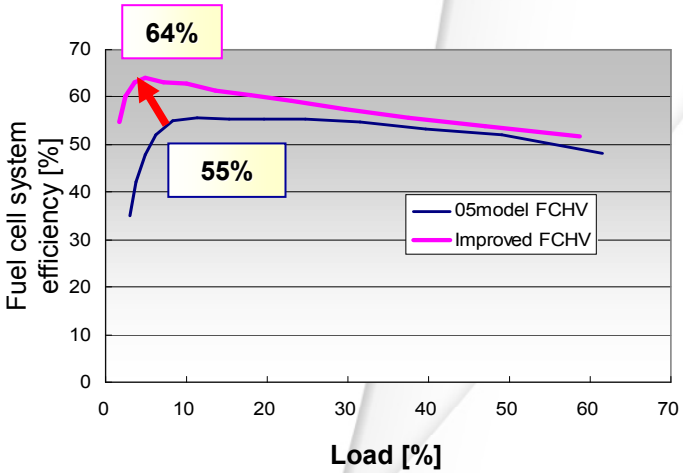
The cold-weather performance tests verified that the cold start and driving performance of the TOYOTA FCHV-adv was equivalent to that of gasoline-powered vehicles.

2. Cruising Range
TOYOTA FCHV-adv



Actual driving cycle *1	> 500 km
10-15 Japanese test cycle	830 km
LA#4 test cycle	790 km

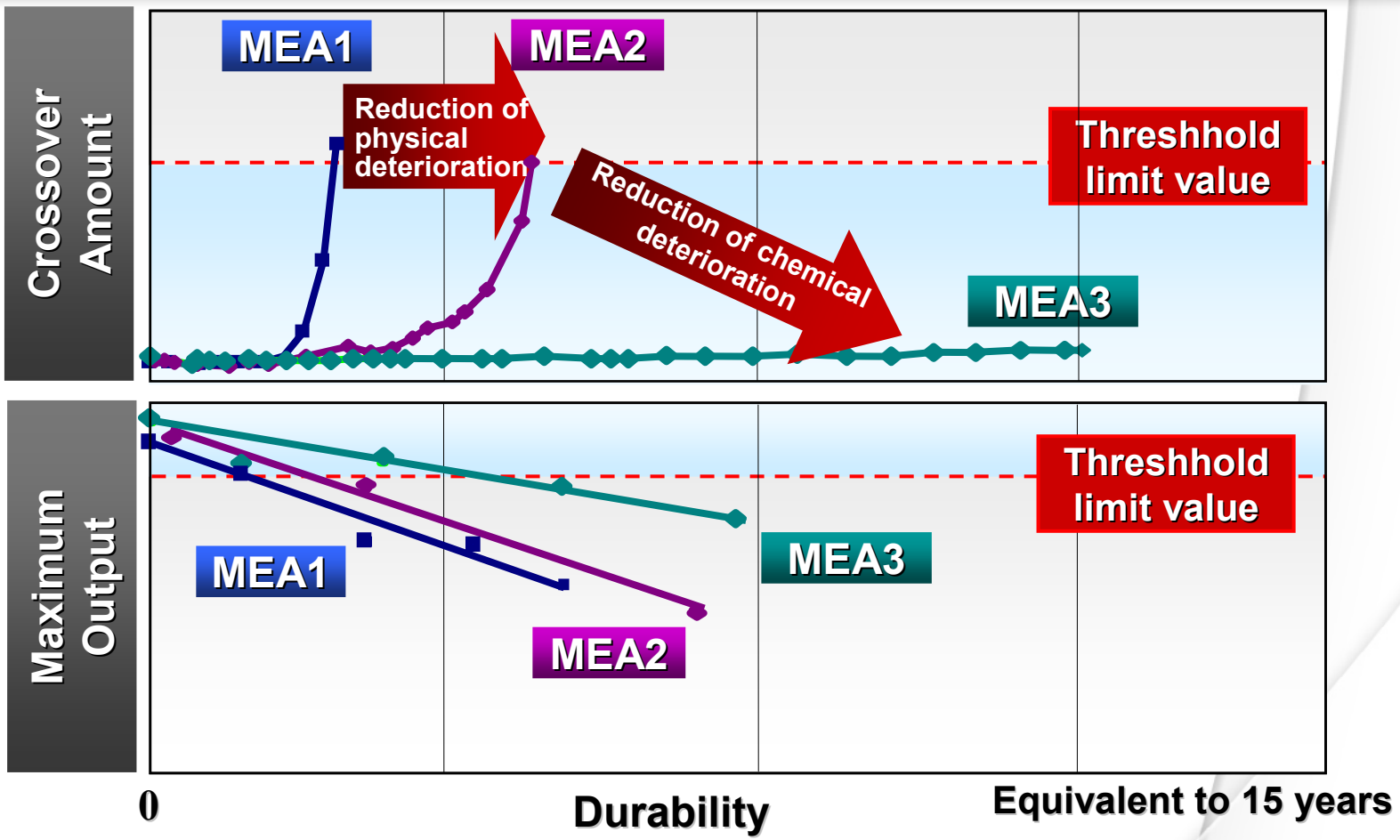
In-house test



*: measured by internal test cycle
**: Gasoline equivalent

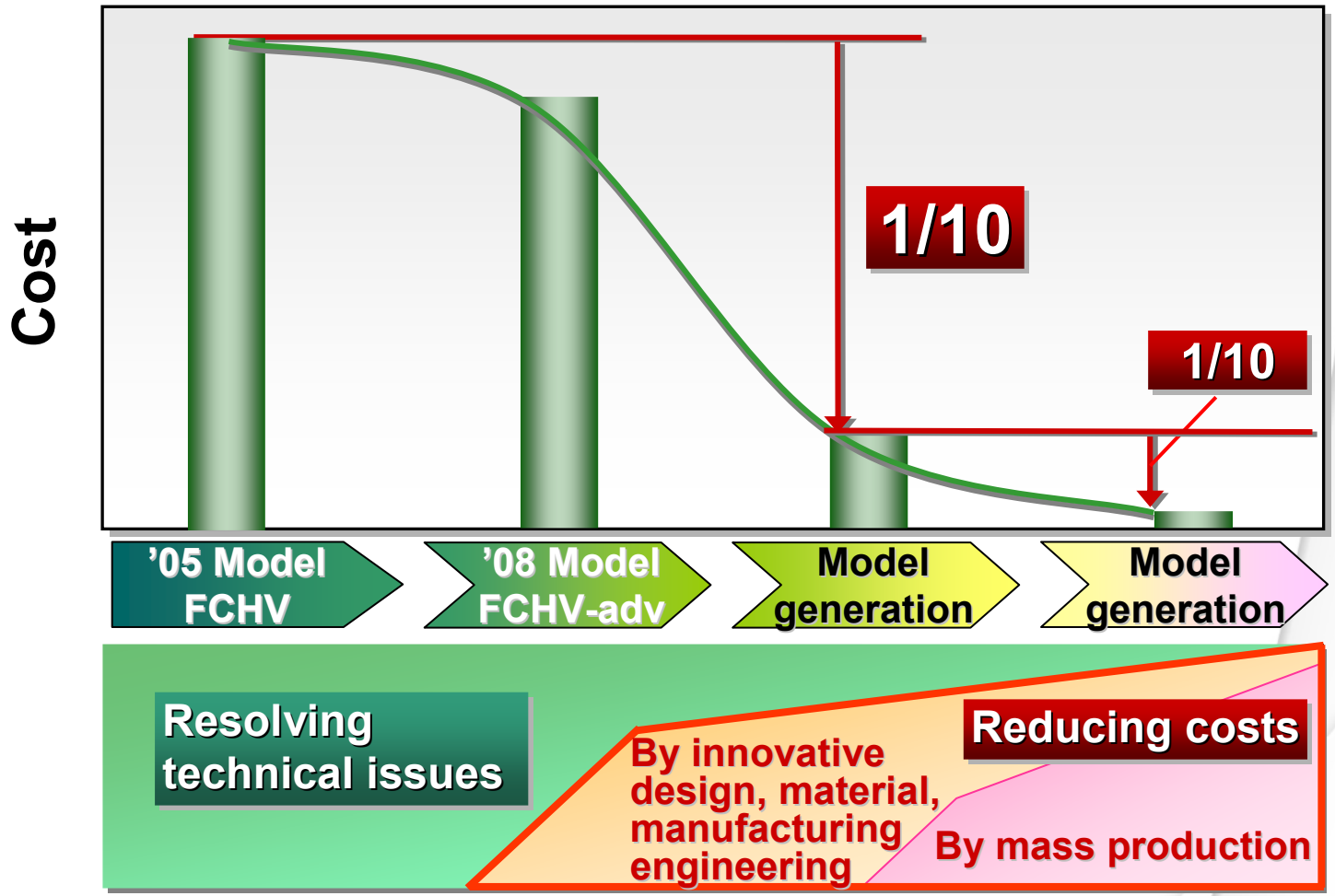
The FCHV-adv achieved an actual cruising range of over 500 km with increased fuel cell system efficiency.

3. FC Stack Durability



- Durability has been improved by more than three times.
- Further efforts are being made especially for reduction of MEA deterioration under real-world conditions.

4. Cost Reduction



As an initial step, we aim to reduce the cost to 1/10 of the current level by design / manufacturing engineering and materials improvement.

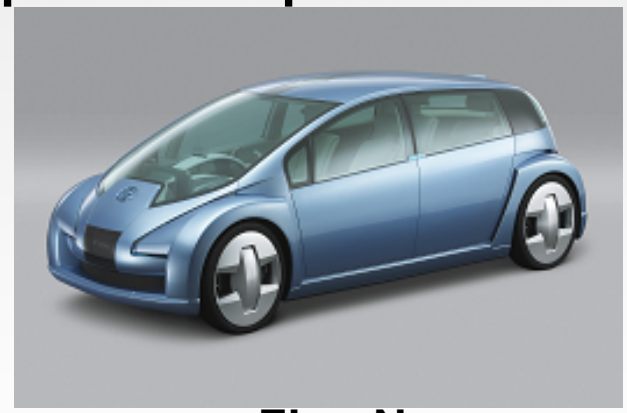
Factors for Successful Commercialization of FCVs

1. Increased societal acceptance of various energy sources

Global warming, depletion of resources, energy security

2. Vehicle marketability

Resolving technical challenges, reducing cost, and adding new appeal to the products



Fine-N
2003 Tokyo Motor Show

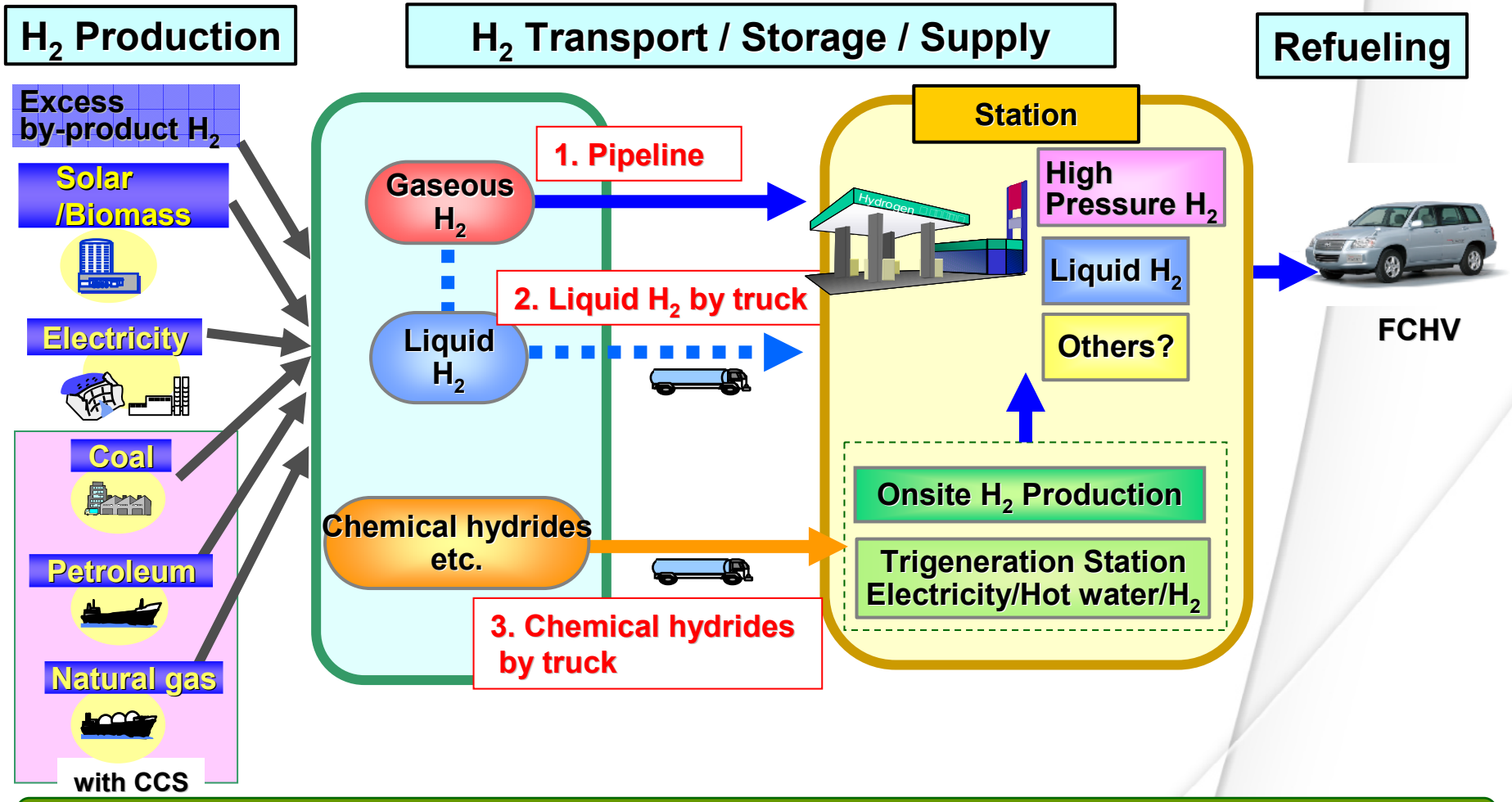
Fine-X
2005 Tokyo Motor Show

3. Hydrogen infrastructure development

H_2 production, transport & supply;

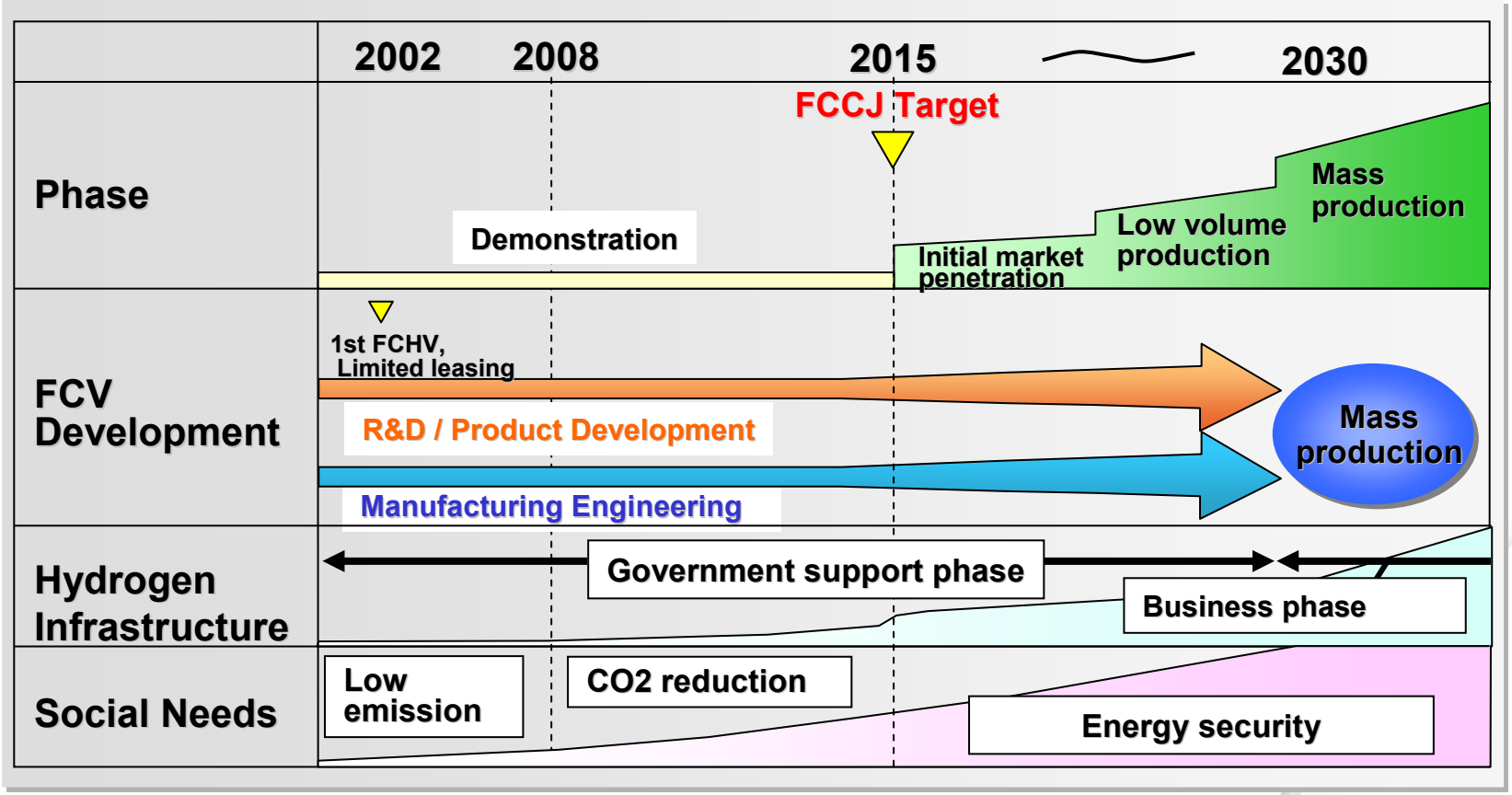
CO_2 sequestration technology; Codes & Standards

Challenges of Infrastructure Development, Hydrogen Pathways



What is the optimum pathway?
In terms of right timing, right place, and right technologies.

Towards Popularization of FC Vehicles



In Japan, FCCJ has agreed that automakers and energy companies promote technology development and codes & standards establishment targeting 2015.

Summary

1. For the diversification of energy sources and CO_2 reduction, early commercialization of FCVs are urgent and vital matters.

2. The popularization of FCV requires:
   1) Increased societal acceptance of various energy sources
   2) Vehicle marketability
   3) Hydrogen infrastructure development

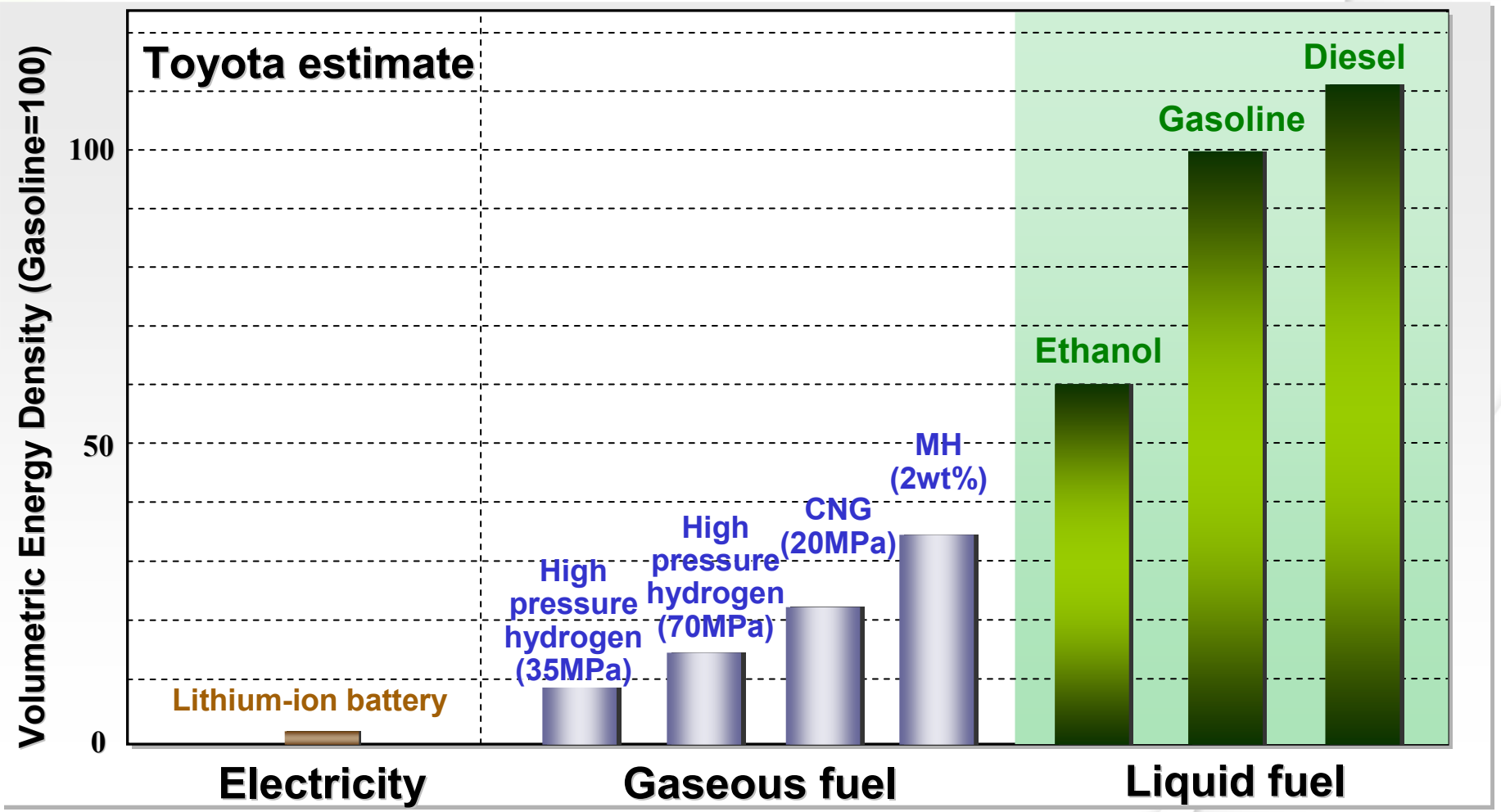
3. Toyota is overcoming the technical challenges of:
   1) Actual cruising range of 500 km or more
   2) Cold start capability at -30degC

   → Towards commercialization of FCV, Toyota focuses on improving durability/reliability and reducing costs.

4. Toyota is working together with energy companies and the government towards creating a hydrogen society, including codes & standards development and hydrogen infrastructure preparation.


TODAY for TOMORROW

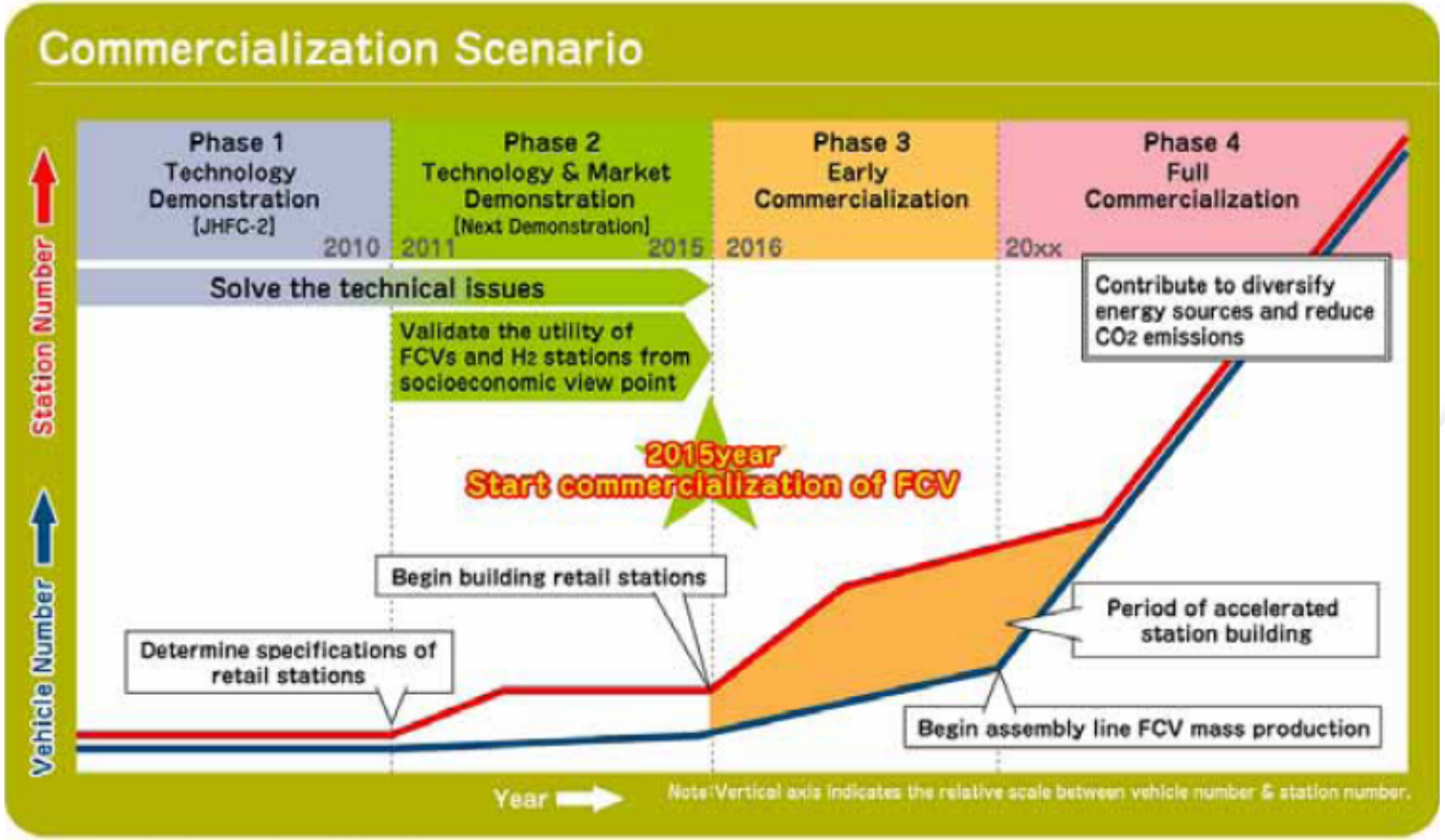
Volumetric Energy Density of Various Fuels



Hydrogen has lower volumetric energy density than liquid fuels.
Li-ion batteries have even lower energy density.

FCCJ Commercialization Scenario

Press release issued by FCCJ (July 4, 2008)
“Commercialization of fuel cell vehicles and hydrogen stations to commence in 2015”



Source: Fuel Cell Commercialization Conference of Japan (FCCJ)