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## **Automotive Technologies Towards Low Carbon Society**

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For the past 100 years, vehicles have evolved as a useful and comfortable transportation along with the spread of low cost oil. Today however, vehicles carry many environmental and energy issues such as stable supply of oil, CO2 issues, and air pollution. As all of these issues need to be solved simultaneously, automobile industry is facing a big turning point.

Towards resolving these issues, we put our efforts in developing various technologies for oil saving. Downsizing and weight reduction technology, powertrain development that realize low fuel consumption and high output, and hybrid vehicles are part of those technologies.

At the same time, we are also putting our efforts in developing advanced technology vehicles to promote use of alternative fuels. Though there are various candidates for alternative fuels today, such as bio fuel, gaseous fuel, electric, and hydrogen, we believe automobile fuel of the future will not be narrowed down to one. Due to advantage and disadvantage of each fuel, we expect to make full use of several automobile fuels along with several powertrains that are adapted to each, depending on region and purpose.

Toyota's hybrid technology can not only be combined with various powertrains, such as vehicles powered with bio fuel and gaseous fuel and Fuel Cell Hybrid Vehicles powered by hydrogen, but can also improve efficiency of each. And also, this technology can be applied to Plug-in Hybrid Vehicles and Electric Vehicles that can be charged with external power source. We therefore position hybrid technology as the core technology of future vehicles.

Regarding reduction of CO2 emissions from transport sector, we automakers will further improve fuel efficiency and also introduce advanced technology vehicles.

At the same time, we would like to ask for social support such as promoting fuel infrastructure, improving traffic flow, educational campaigns of eco-driving, and implementing policies that encourage consumers, etc..

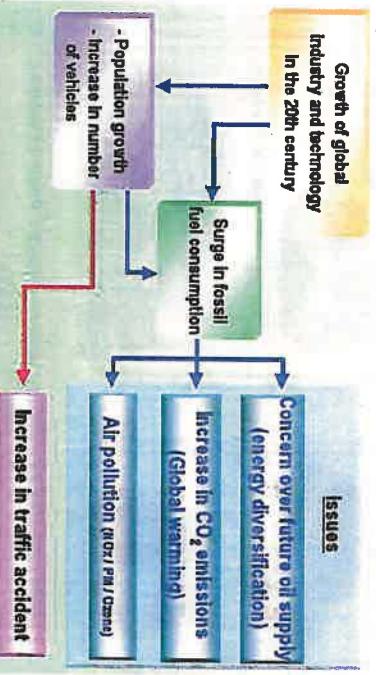
For global warming prevention, all major CO2 producing countries and all sectors need to participate.

# Automotive Technologies towards low carbon society

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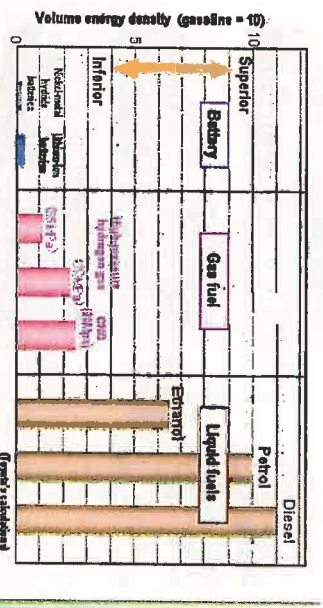
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## Issues surrounding Vehicle Use



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## Comparison of Energy Density



Liquid fuels are superior in terms of energy density

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## Vision of Response to Environmental and Energy Issues



HVs or PHEVs with internal combustion engines: wide use; EVs: short-distance compact commuters; FCHVs: medium-to-large vehicles or buses.

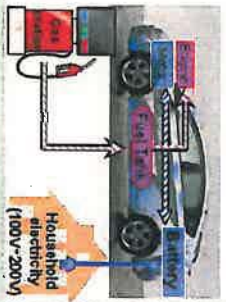
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## Electric Powered Vehicles : Plug-In Hybrid Vehicle(PHEV)

### PRUS PLUG-IN HYBRID Concept



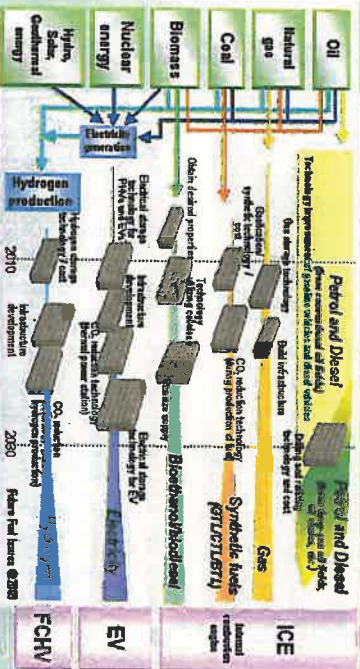
PHEV battery leasing starts from the end of 2009 in JPN, EU and US



Short range: Electric vehicle  
Battery charged by vehicle engine and external power source

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## Scenarios for Response to Environmental and Energy Issues



Each alternative energy has several issues  
→ Oil will remain the main energy for some time, liquid fuels and non-liquid fuels will co-exist.

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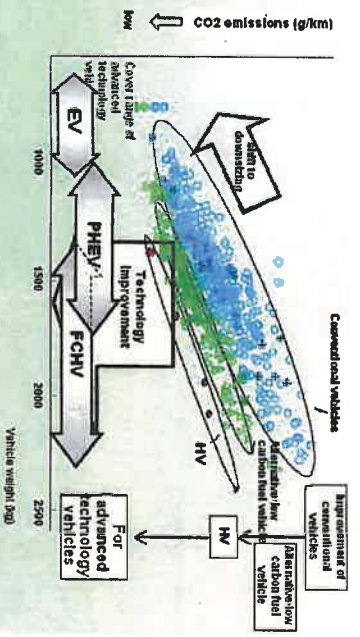
## Characteristics of Main Alternative Fuels

	Energy Density (Driving Range)	Well-to-Wheel CO <sub>2</sub> Emissions	Amount of Secure Supply
Natural Gas	★★	★	★★★★
Bio Fuels	★★★	★★★	★
Hydrogen	★★	depend on primary energy	★★★★
Electricity	★	depend on primary energy	★★★★

- Every alternative fuel have both merits and demerits.  
- Alternative fuels are expected to diversify since it cannot be narrowed down to one, due to energy situation/policy of each region and country.

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## Roadmap of advanced-technology vehicles



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## Electric-Powered Vehicles : PHV and EVs

**Toyota RAVA EV** 95~03

**Toyota econo** 99~01

**Short distance commuter EV** PHV

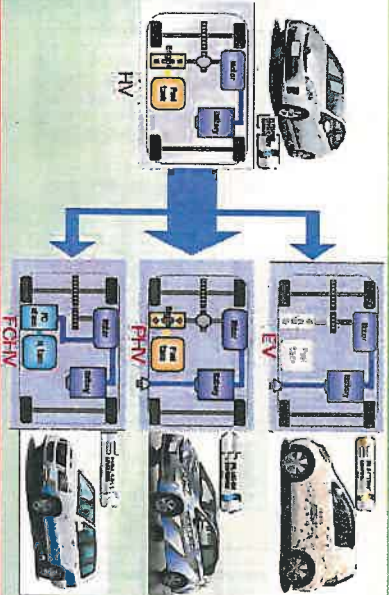
**New Generation EV** Mass production aimed by around 2012

United testing: from the end of '09

Toyota aims to be the leading company of Electric-Powered Vehicles with PHVs and EVs.

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## Response to Environmental and Energy Issues



Using hybrid technology for PHV, EV, and FCHV

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## Fuel Cell Vehicle Initiatives

< Cruising Range >

Long distance driving test from Osaka to Tokyo

a practical cruising range 800km for 10-15 test cycle

< Cold Weather Starting Performance >

Cold weather test in Canada (Trinny)

started and driven in temperatures as low as -30 Celsius

- Market introduction of Toyota FCHV : 2015.

- Toyota will actively cooperate with all the parties involved, to solve other important factors for market introduction, including the development of a hydrogen supply infrastructure.

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## Proposal for COP15

1. Reducing CO2 emissions from transport sector:
  - We, automakers will further improve fuel efficiency, and also develop and promote expanding of advanced technology vehicles.
  - At the same time, we ask for social support such as promoting fuel infrastructure, improving traffic flow, educational campaigns of eco-driving, and supporting policies (ex. Incentive).
2. For global warming prevention, all major CO2 producing countries and all sectors need to participate with responsibility.

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