Earth Dreams Technology – Future of Honda's Powertrain Technology

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AACHEN COLLOQUIUM 2013

EARTH DREAMS
TECHNOLOGY
- Future of Honda's Powertrain Technology -

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HONDA
The Power of Dreams

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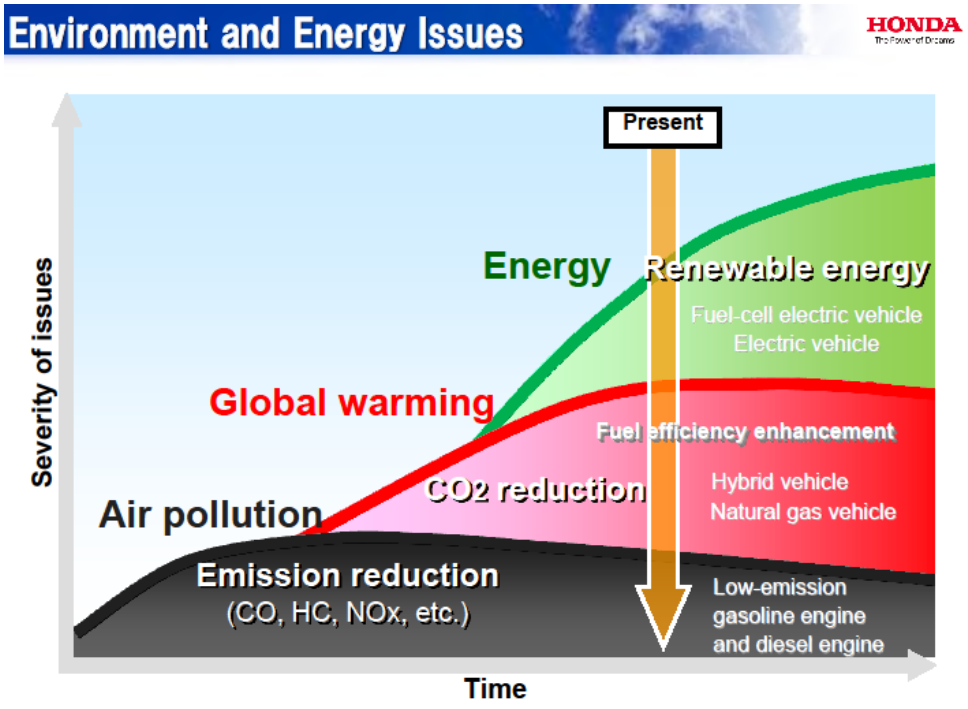
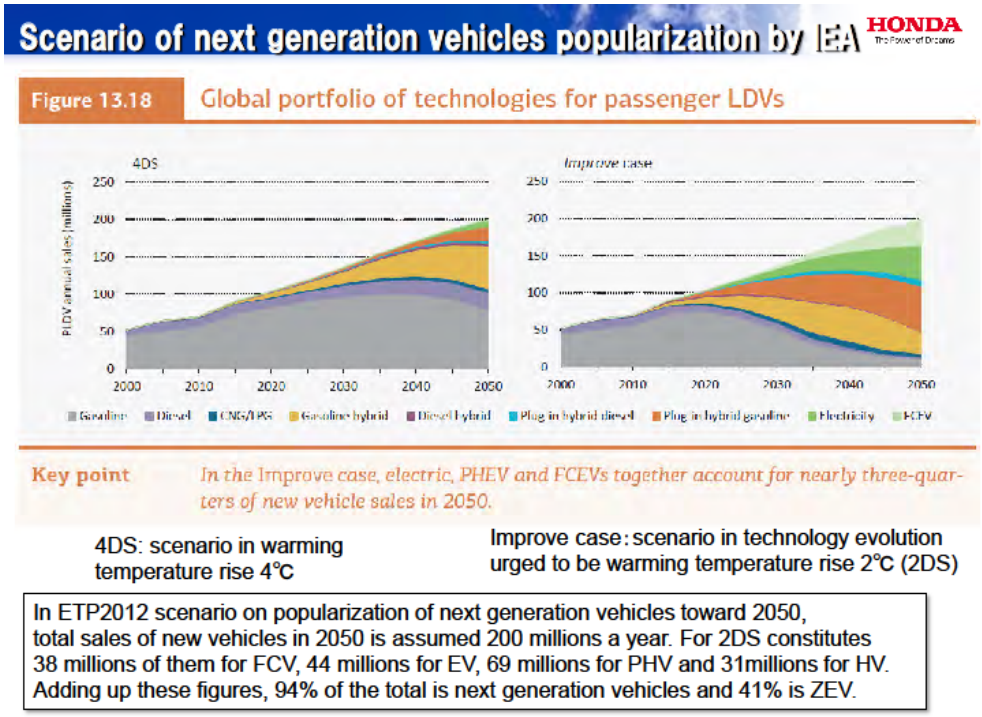
1 Recognizing environment and energy issues





4DS: scenario in warming temperature rise 4℃

Improve case: scenario in technology evolution urged to be warming temperature rise 2℃ (2DS)

In ETP2012 scenario on popularization of next generation vehicles toward 2050, total sales of new vehicles in 2050 is assumed 200 millions a year. For 2DS constitutes 38 millions of them for FCV, 44 millions for EV, 69 millions for PHV and 31millions for HV. Adding up these figures, 94% of the total is next generation vehicles and 41% is ZEV.

World petroleum outlook by IEA

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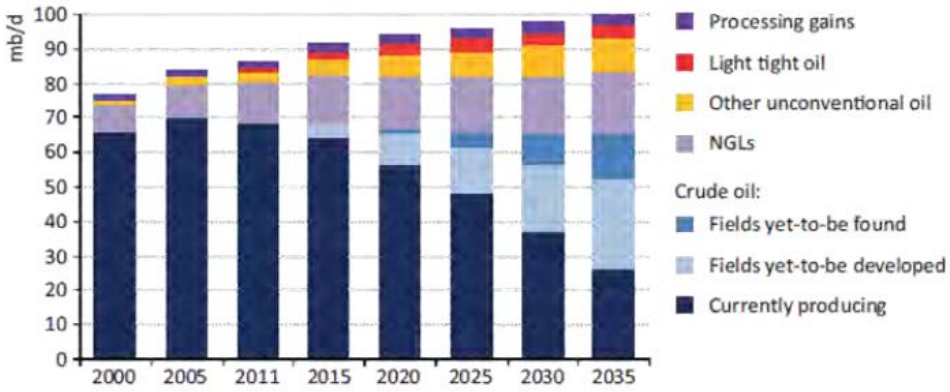
World liquids supply by type in the New Policies Scenario



WEO2012 Figure 3.15

Alternative fuel around the world

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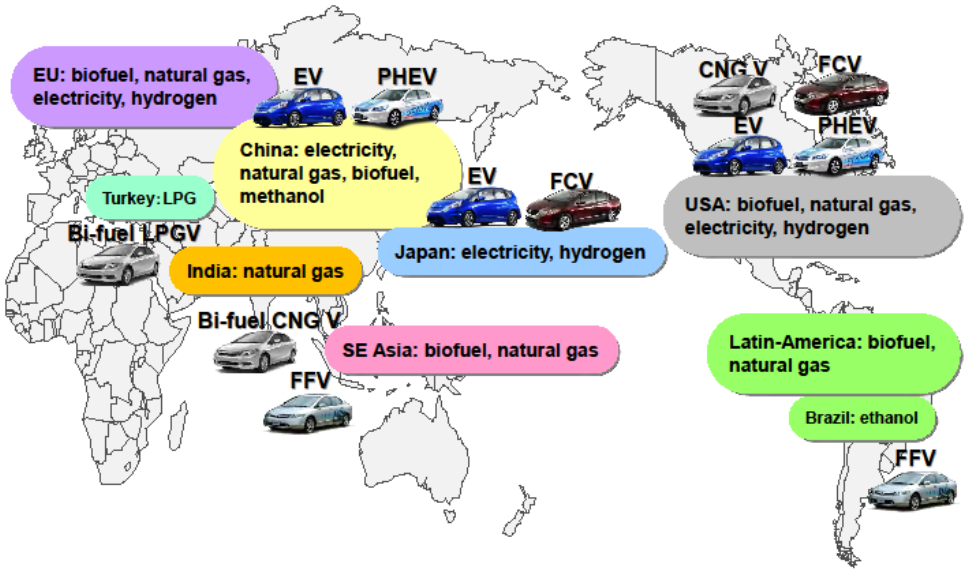
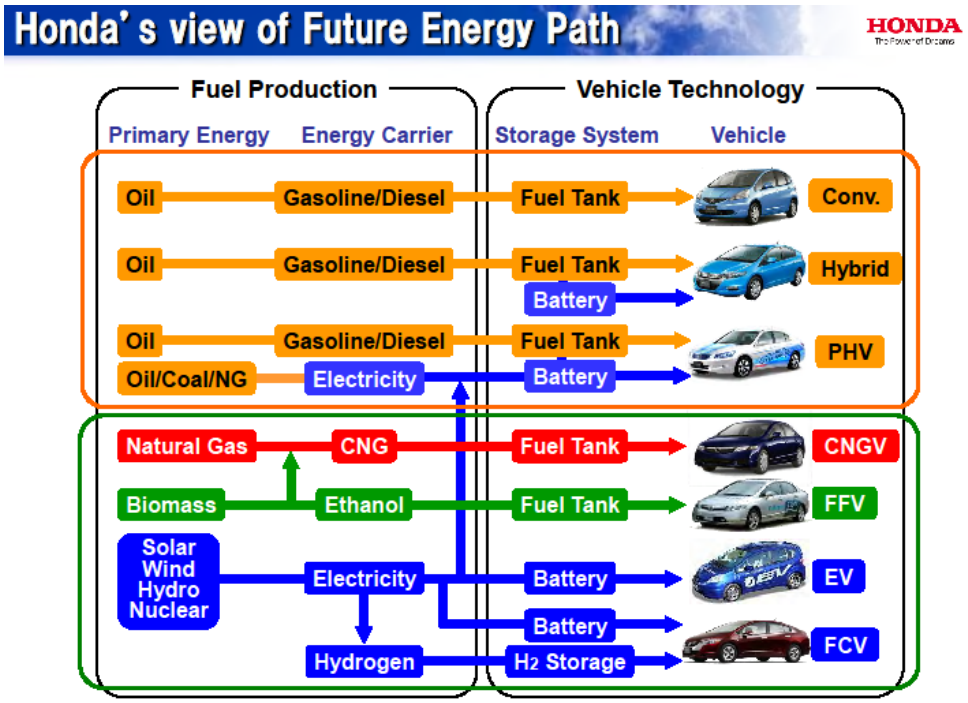
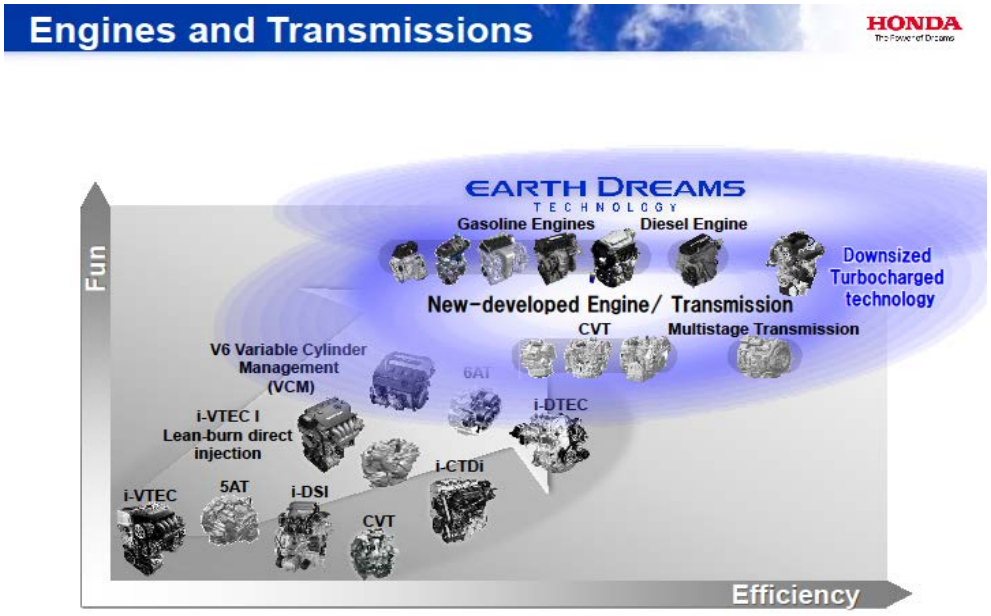


http://www.abysse.co.jp/world/map/images/miller_asi_on.gif



2 Direction of powertrain technological evolution

EARTH DREAMS TECHNOLOGY



2 Direction of powertrain technological evolution

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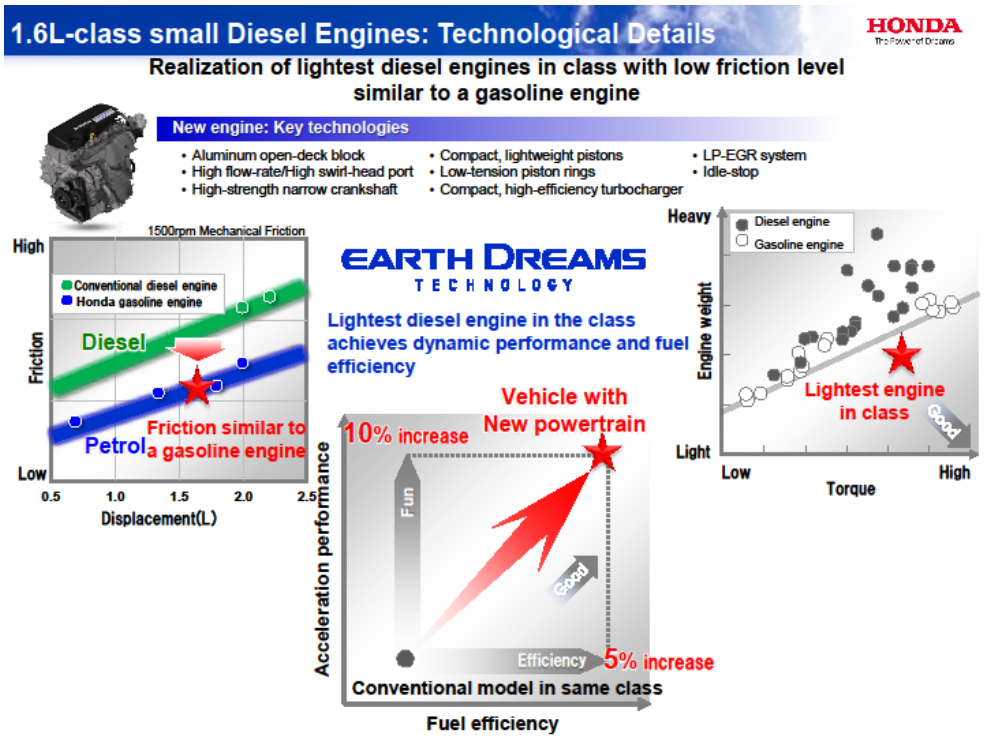
Diesel engine



2 Direction of powertrain technological evolution

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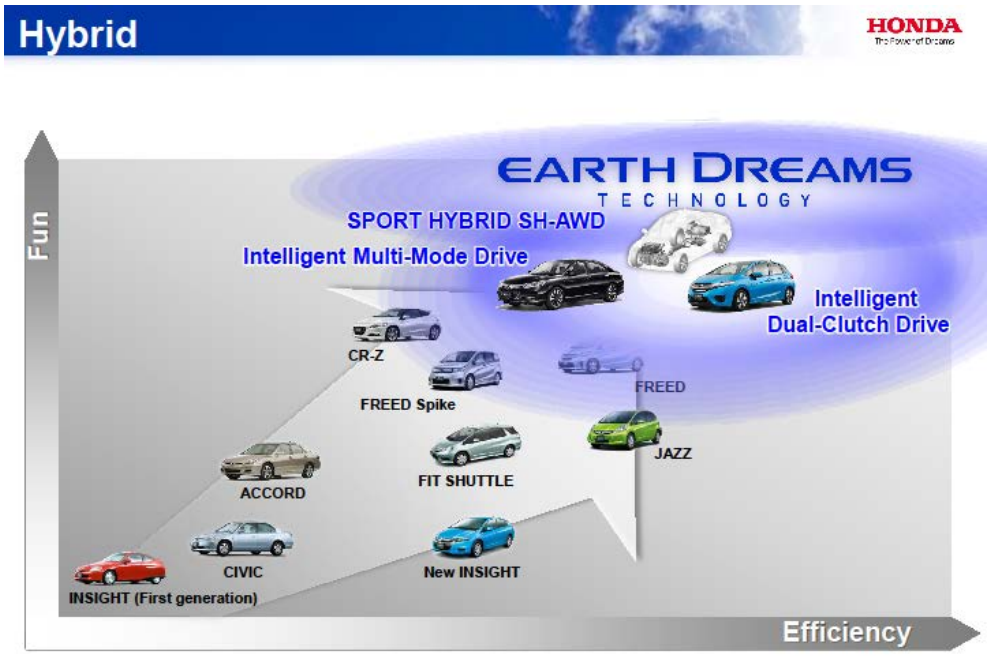
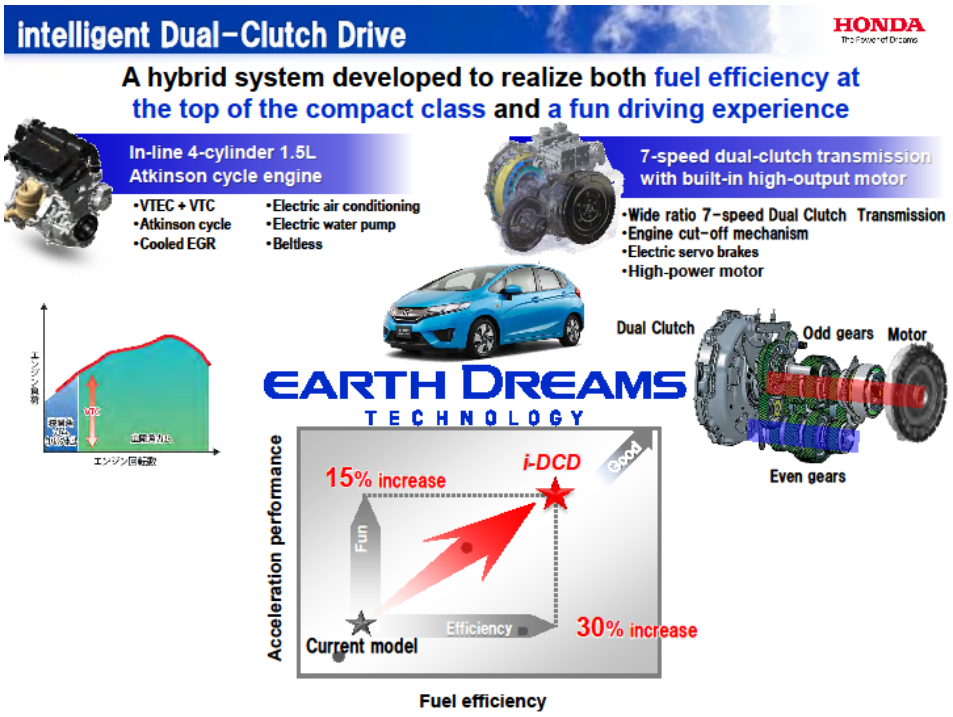
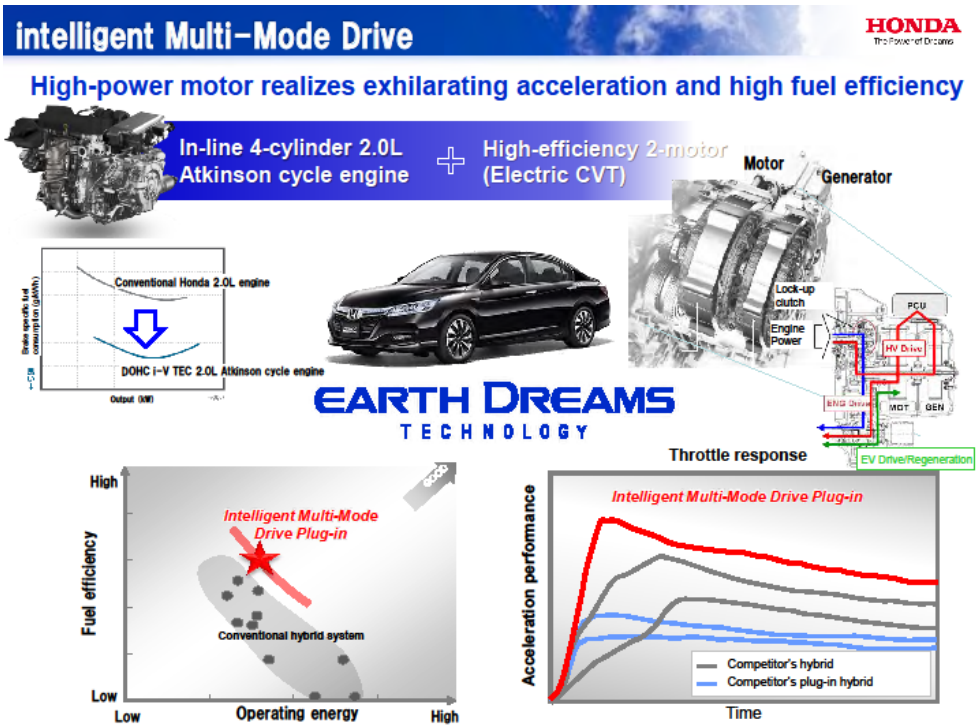
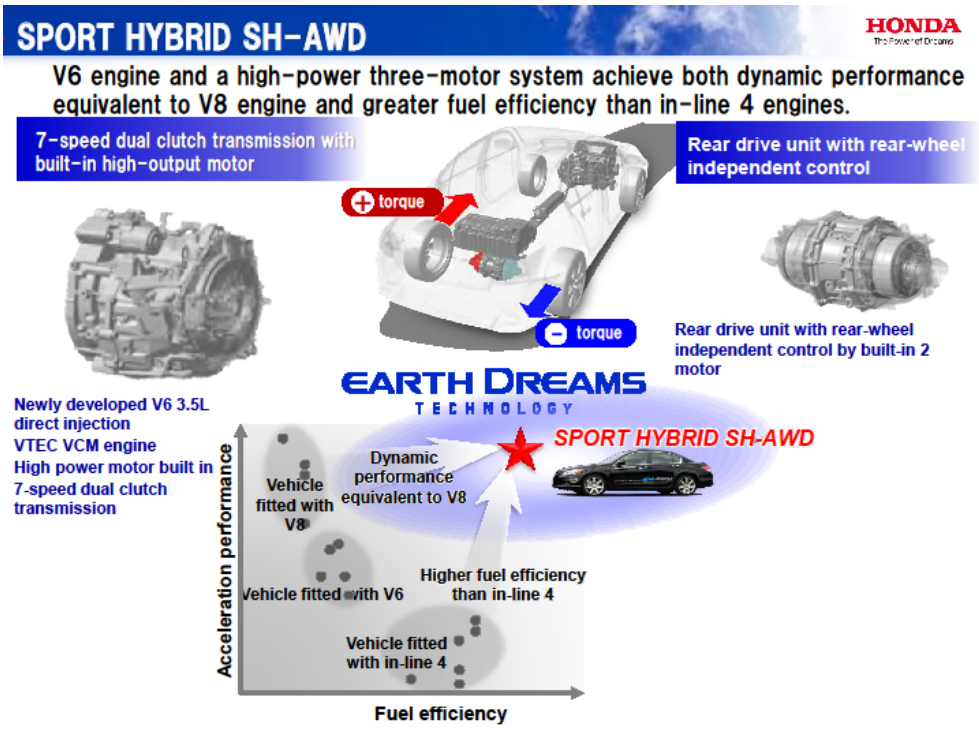
Hybrid powertrain

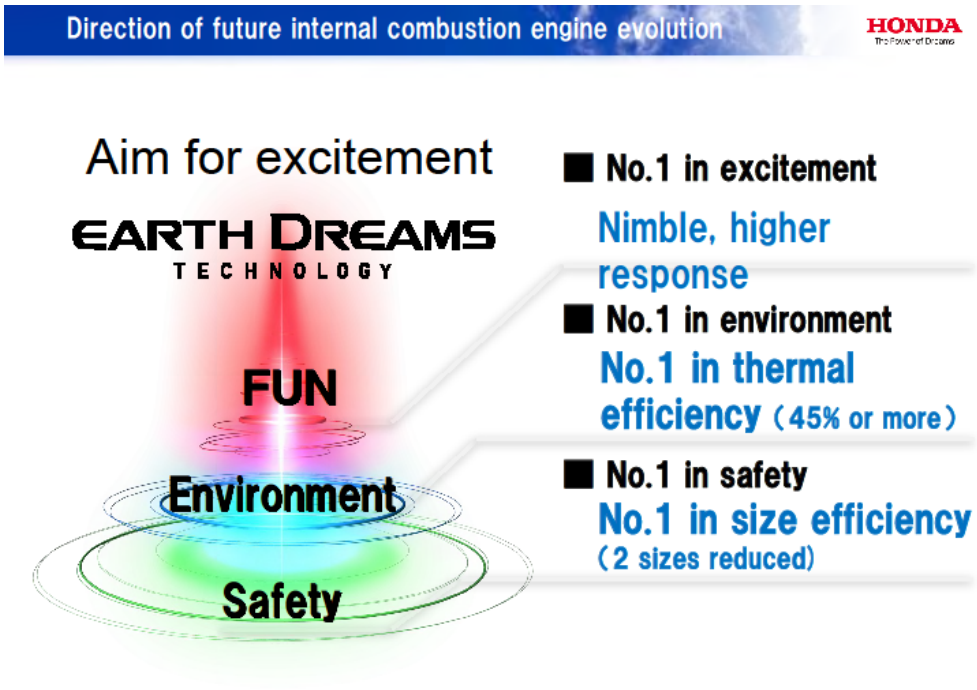


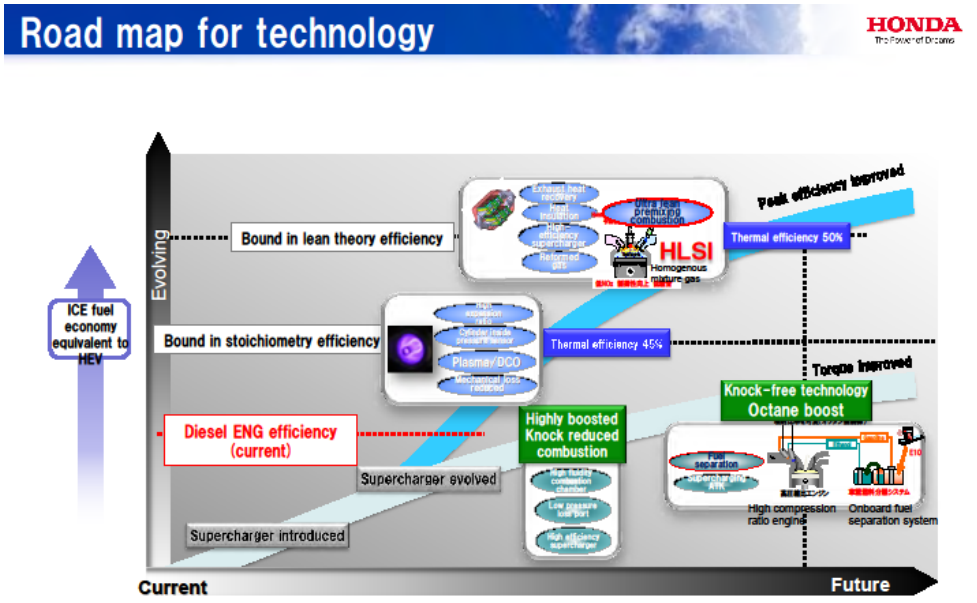


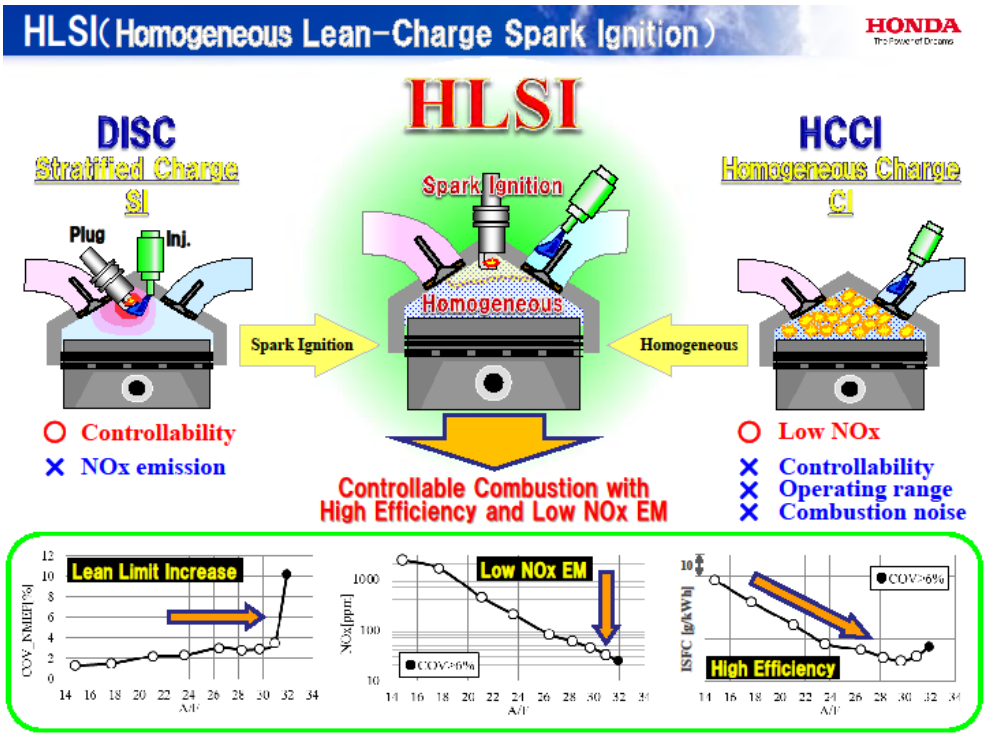

intelligent Multi-Mode Drive
HONDA
High-power motor realizes exhilarating acceleration and high fuel efficiency
In-line 4-cylinder 2.0L Atkinson cycle engine
High-efficiency 2-motor (Electric CVT)
Motor
Generator
Conventional Honda 2.0L engine
DOHC i-V TEC 2.0L Atkinson cycle engine
Lock-up clutch
Engine Power
PCU
HV Drive
ENG Drive
MOT
GEN
EV Drive/Regeneration
EARTH DREAMS TECHNOLOGY
Throttle response
Intelligent Multi-Mode Drive Plug-in
Fuel efficiency
High
Low
Intelligent Multi-Mode Drive Plug-in
Conventional hybrid system
Low
Operating energy
High
Acceleration performance
Intelligent Multi-Mode Drive Plug-in
Competitor's hybrid
Competitor's plug-in hybrid
Time


SPORT HYBRID SH-AWD
HONDA
V6 engine and a high-power three-motor system achieve both dynamic performance equivalent to V8 engine and greater fuel efficiency than in-line 4 engines.
7-speed dual clutch transmission with built-in high-output motor
Rear drive unit with rear-wheel independent control
torque
torque
Rear drive unit with rear-wheel independent control by built-in 2 motor
Newly developed V6 3.5L direct injection VTEC VCM engine
High power motor built in 7-speed dual clutch transmission
EARTH DREAMS TECHNOLOGY
SPORT HYBRID SH-AWD
Dynamic performance equivalent to V8
Vehicle fitted with V8
Vehicle fitted with V6
Higher fuel efficiency than in-line 4
Vehicle fitted with in-line 4
Acceleration performance
Fuel efficiency

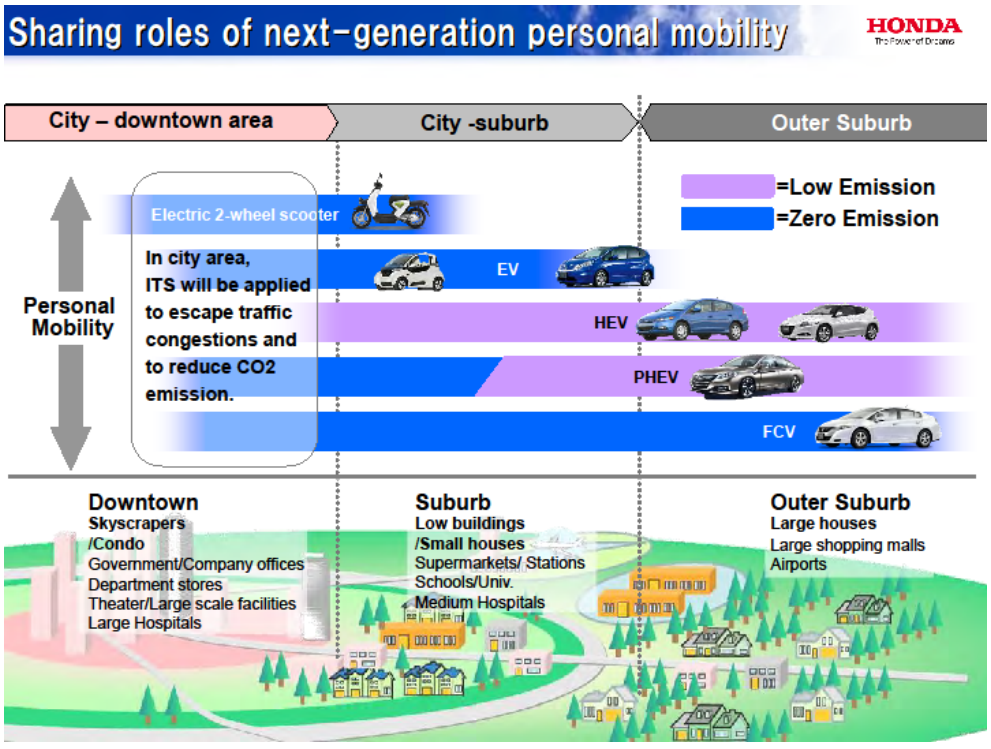
3 Future direction of internal combustion evolution

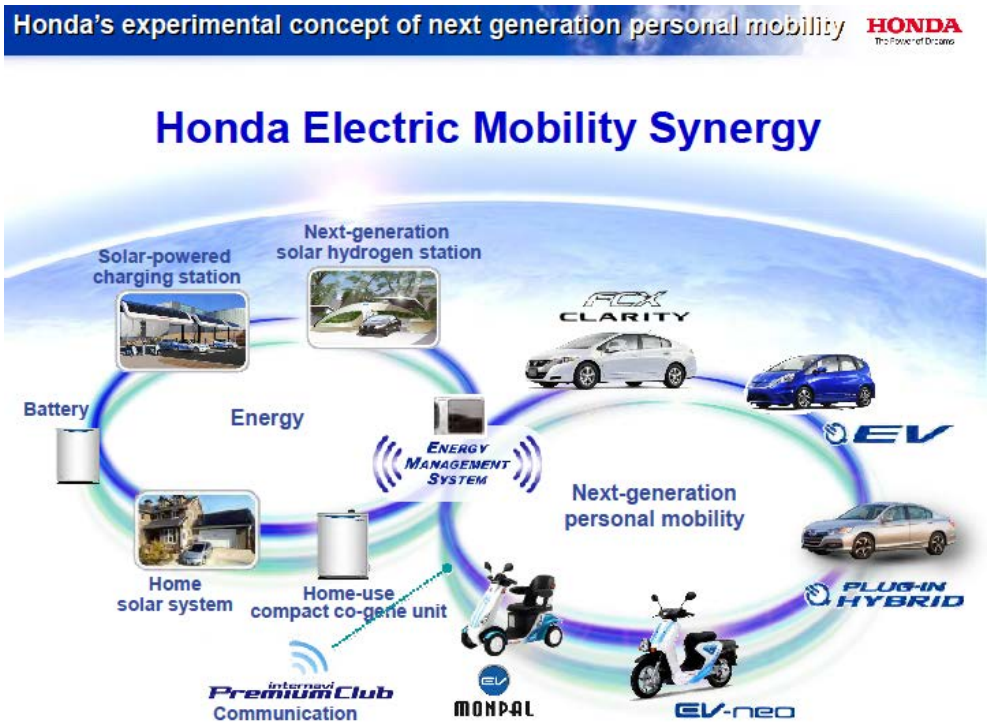


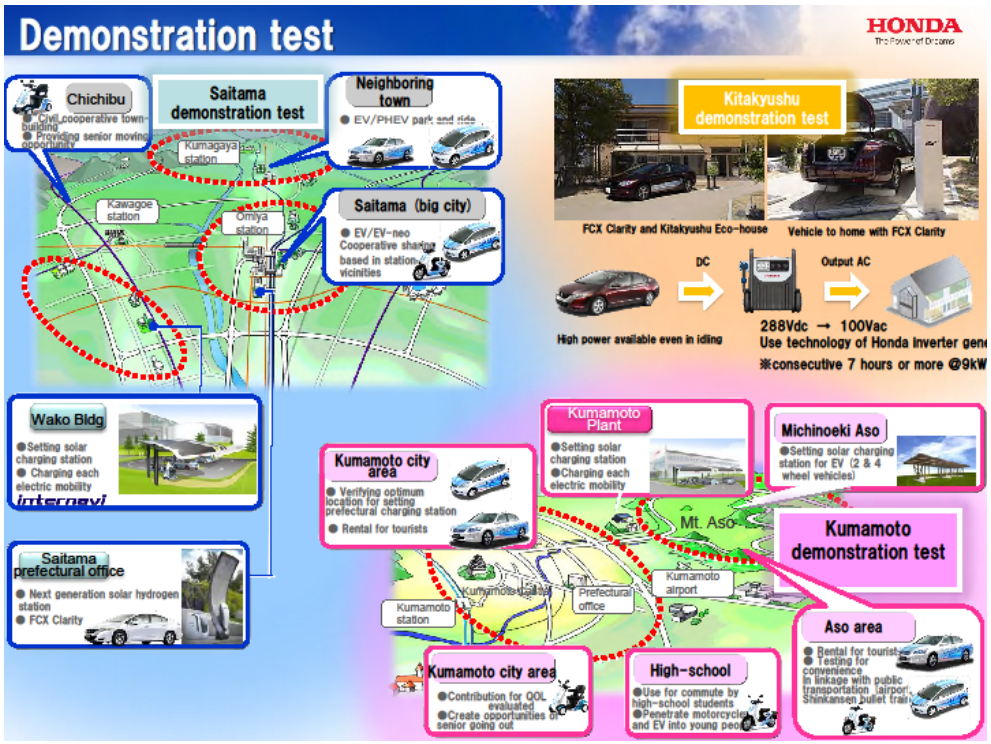


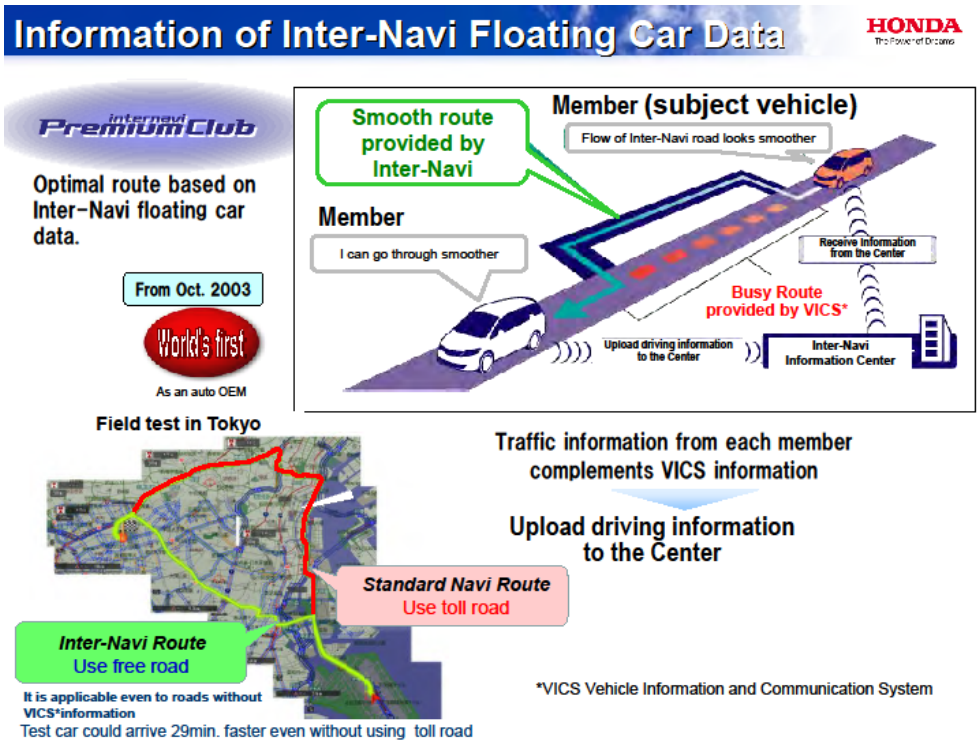


4 Toward low CO2 emission society




Honda's experimental concept of next generation personal mobility
HONDA
Honda Electric Mobility Synergy
Solar-powered charging station
Next-generation solar hydrogen station
FCX CLARITY
Battery
Energy
ENERGY MANAGEMENT SYSTEM
EV
Next-generation personal mobility
PLUG-IN HYBRID
Home solar system
Home-use compact co-gene unit
internavi PremiumClub Communication
MONPAL
EV-neo


Demonstration test
HONDA
Chichibu
Saitama demonstration test
Neighboring town
EV/PHEV park and ride
Kumagaya station
Kawagoe station
Omiya station
Saitama (big city)
EV/EV-neo Cooperative sharing based in station vicinities
Kitakyushu demonstration test
FCX Clarity and Kitakyushu Eco-house
Vehicle to home with FCX Clarity
DC
Output AC
High power available even in idling
288Vdc → 100Vac
Use technology of Honda Inverter gen
※consecutive 7 hours or more @9kW
Wako Bldg
Setting solar charging station
Charging each electric mobility
internavi
Kumamoto Plant
Setting solar charging station
Charging each electric mobility
Michinoeki Aso
Setting solar charging station for EV (2 & 4 wheel vehicles)
Kumamoto city area
Verifying optimum location for setting prefectural charging station
Rental for tourists
Mt. Aso
Kumamoto demonstration test
Kumamoto airport
Kumamoto station
Prefectural office
Saitama prefectural office
Next generation solar hydrogen station
FCX Clarity
Kumamoto city area
Contribution for QOL evaluated
Create opportunities of senior going out
High-school
Use for commute by high-school students
Aso area
Rental for tourists
Testing for convenience in linkage with public transportation (airport, Shinkansen bullet train)


Information of Inter-Navi Floating Car Data
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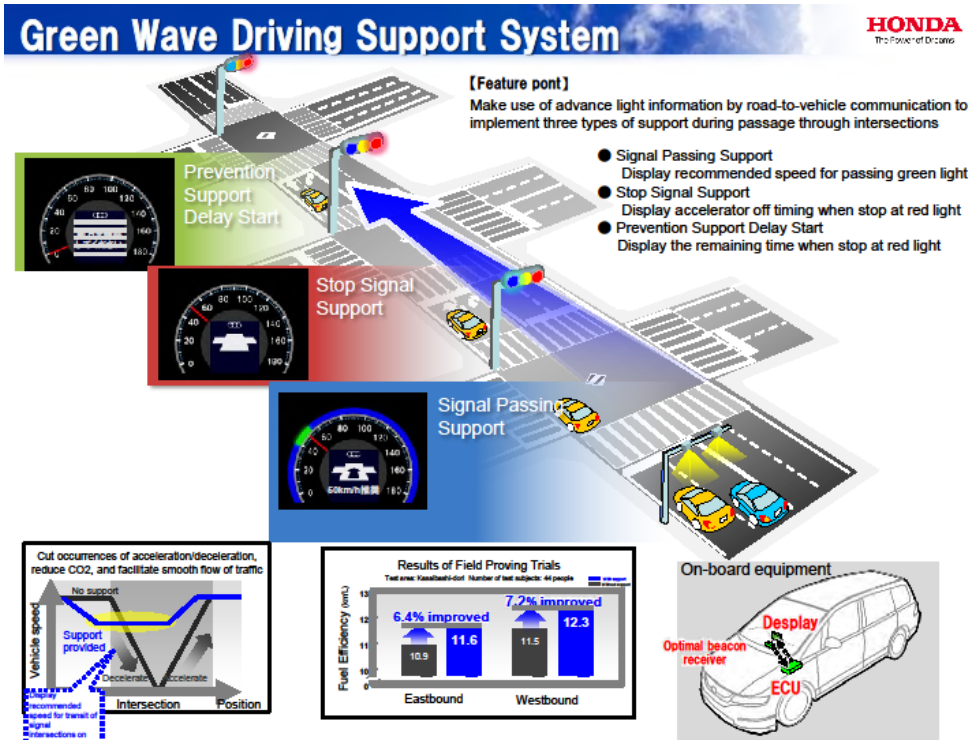
internavi Premium Club
Optimal route based on Inter-Navi floating car data.
From Oct. 2003
World's first
As an auto OEM
Smooth route provided by Inter-Navi
Member (subject vehicle)
Flow of Inter-Navi road looks smoother
Member
I can go through smoother
Receive information from the Center
Busy Route provided by VICS*
Upload driving information to the Center
Inter-Navi Information Center
Field test in Tokyo
Standard Navi Route
Use toll road
Inter-Navi Route
Use free road
It is applicable even to roads without VICS*information
Test car could arrive 29min. faster even without using toll road
Traffic information from each member complements VICS information
Upload driving information to the Center
*VICS Vehicle Information and Communication System


Green Wave Driving Support System
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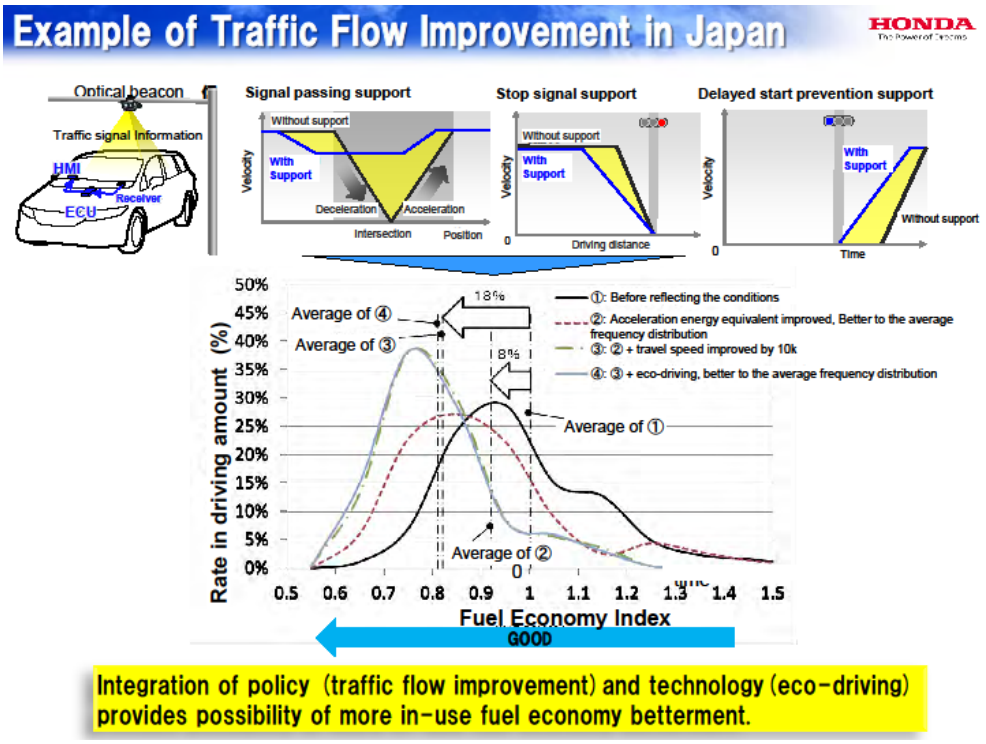
【Feature pont】
Make use of advance light information by road-to-vehicle communication to implement three types of support during passage through intersections
● Signal Passing Support
Display recommended speed for passing green light
● Stop Signal Support
Display accelerator off timing when stop at red light
● Prevention Support Delay Start
Display the remaining time when stop at red light
Prevention Support Delay Start
Stop Signal Support
Signal Passing Support
Cut occurrences of acceleration/deceleration, reduce CO2, and facilitate smooth flow of traffic
No support
Support provided
Vehicle speed
Decelerate
Accelerate
Intersection
Position
Results of Field Proving Trials
Fuel Efficiency (km/L)
6.4% improved
7.2% improved
10.9
11.6
11.5
12.3
Eastbound
Westbound
On-board equipment
Desplay
Optimal beacon receiver
ECU



4 Summary

Technology component	Effects (VS 2010, internal combustion engine)		Challenges in technology development			Challenges in popularization		
	Reduction of CO2	Gasoline consump-tion	Safety	Durability	Toughness to temperature	Infra-structure	function	Cost image
Improvement of ICE efficiency (including addressing fuel)	-12%	-12%						
CNG	-25%	-100%				Additionally set CNG stand.		
HEV	-40%	-40%					Towing performance	
PHEV	↑	-50%				Add electrifiable garage	High-speed cruising Towing performance	Capacity of onboard battery
BEV	-60%	-100%				Add electrifiable garage	Range	
FCEV	↑	↑		Mature mass-prod. technology	Mature mass-prod. technology	Develop and popularize hydrogen infra-structures		

Summary

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1. The internal combustion engine for passenger car will continue even in 2030s in adapting to each of expansion of the developing country's markets and popularization of next generation vehicles (HEV, PHEV) in the advanced countries.

2. The automobile manufacturer side is required to react accordingly the diversified energy used in the world, and Honda will also keep on addressing technology developments on alternative fuels and use of a variety of fuels for internal combustion engine.

3. Honda is carrying out future technology studies of power train aiming at the limit of thermal efficiency and conducting demonstration tests to verify for effective use of the next generation vehicles.

4. For the countermeasures against global warming, the lead time is needed for quantitative spread of new technology in parallel with improvement of engine efficiency, and readiness including the infrastructure is imperative. Therefore, the collaboration across the industries is required.

BLUE SKIES FOR
OUR CHILDREN