ENGINEERING SOLUTIONS AND RECOMMENDATION FOR UN COP 15

The Strategy of JAPAN SOCIETY OF MECHANICAL ENGINEERS (ISME)

Mutsuhiro ARINOBU
President of JSME

TARGETS

The most essential principle in engineering solutions and recommendation for UN COP 15 would be to do our best for reducing the emission of carbon dioxide not only in Japan but also all over the world. We should concentrate all our efforts on the research to realize challenging energy technologies, the development and the wide application of high efficiency energy systems, and the estimation and evaluation of future improvement of energy efficiencies and emerging technologies. Consequently, to produce various kinds of promising energy technologies, innovative improvement in the energy efficiency of the various energy systems and reliable estimation of financial payback period of energy systems would be our foremost targets to accelerate the prevention effect for global warming.

MEASURES

As the role of academic and engineering society of JSME, we should stress the following important activities: 1) For evaluating the technological innovation correctly in the near future, we should continue to make the engineering technological roadmaps (JSME Technology Roadmaps for Sustainable Society) and disseminate them to all over the world for promoting the necessary researches of challenging energy technology, for promoting quantitative discussions of energy usage and CO2 emissions and for accelerating the prevention effect for global warming. 2) We should produce the quantitative engineering data of energy usage and CO2 emission for promoting the discussion about the importance of various activities of our daily life and various kinds of engineering industries. 3) We should produce various kinds of quantitative estimations, such as economical payback period of energy technologies, quantitative CO2 emission reduction and the amount of energy saving and necessary total budget of energy policy.

Hence, we should contribute to reduce the amount of energy usage and the CO2 emission as much as possible by disseminating the JSME Technology Roadmap for Sustainable Society and related engineering data and economical estimations, which would be extremely useful measures for providing the engineering solutions and recommendations.

NEW FINDINGS

The systematic organization of JSME Technology Roadmaps for Sustainable Society by various engineering divisions of JSME has been produced over several years.

Two good results have been obtained in the discussions by combining the several technological roadmaps as the new findings.

1) Energy Usage and CO2 Emission Reduction for the Automobiles

According to the JSME Technology Roadmaps, there would be several improvement factors for the reduction of CO2. Fig.1 shows the specific strength of materials and new materials such as Aramic fiber would be useful for reducing the weight of automobiles. As shown in Fig.2, the thermal efficiency of engines has been increased gradually by many kinds of technological breakthrough. Furthermore, the average traveling speed has been increased by the improvement of traffic control technology. The total amount of CO2 reduction potential would be 100MT/year and the most effective method would be the increase of the traveling speed.

2) Energy Saving for Air-conditioning and Hot Water Supply by Utilizing High Efficiency Heat Pump Systems

Fig.3 showed the roadmap of heat pump hot water supply systems, which showed the COP of supplying hot water would have the value of 5 or higher. By considering the efficiency of electric power generation of about 40%, over twice of the total heat release by combustion would be useful for heating and hot water supply by utilizing high efficiency heat pump. Thus, the use of high efficiency compression heat pump systems would be effective for reducing the CO2 emission. The CO2 reduction potential by replacing the boiler, heater and absorption heat pumps would become the order of 200MT/year. This value would be over 10% of the total CO2 emission in Japan.

RECOMMENDATIONS

Our role would be to do our best for promoting energy saving and for reducing CO2 emissions, and therefore we recommend the following.

1) By utilizing our engineering specialty, we should produce the reliable technology roadmaps for estimating the future technological performance, for selecting the future energy and environmental policy and for accelerating the prevention effect for global warming.

2) By presenting the comprehensible engineering data of energy usage and CO2 emission in public, we should promote the quantitative discussion for accelerating the reduction of the CO2 emission which would assure enjoyable daily activities of members of our global community also in the future.

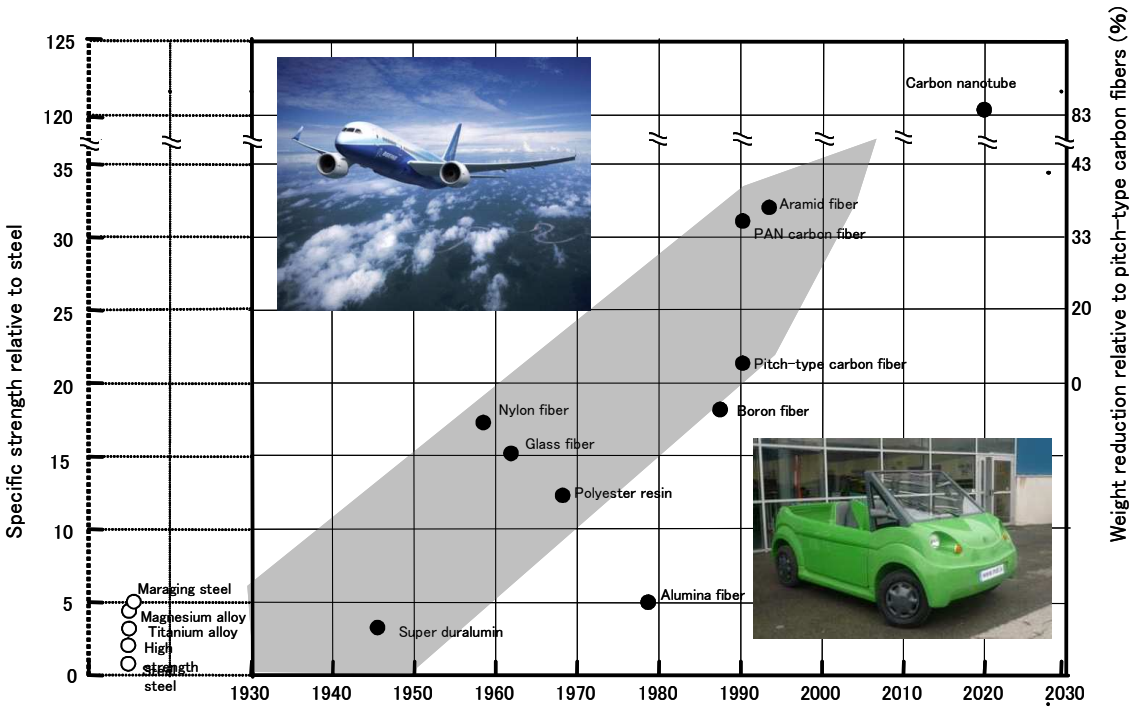


Fig.1 JSME Technological Roadmap for Specific Strength of Materials

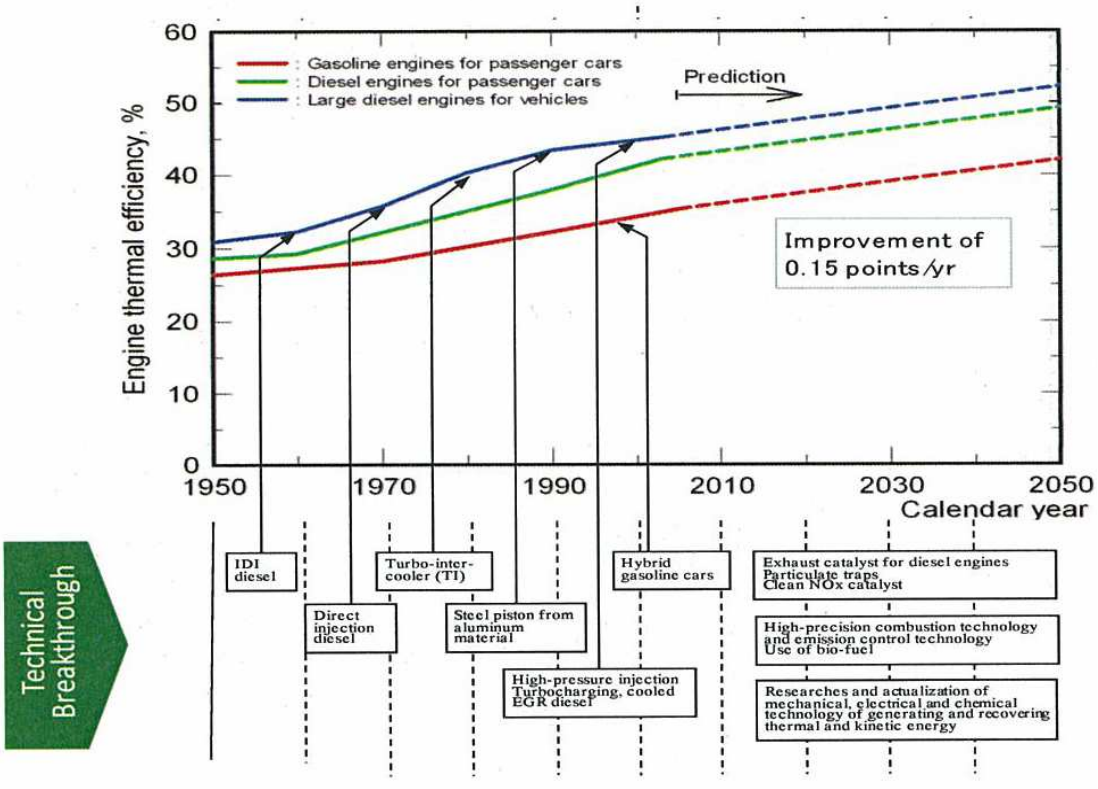
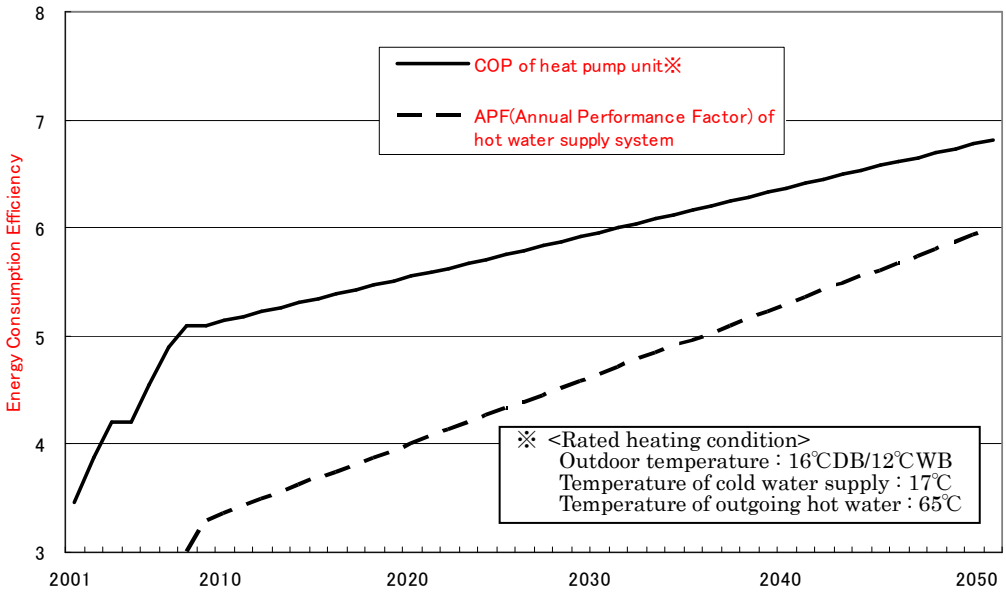


Fig.2 JSME Technological Roadmap for Thermal Efficiency of Engines



Technical Breakthrough

2001～2010	・Development of CO_2 refrigerant Heat Pump Water Heater
	④ High-efficiency ejector cycles
	⑤ Optimum design of high-efficiency. Small-size DC motors
	⑥ SiC power devices
	⑨ Vacum heat insulators
	⑬ Utilization of underground heat
2010～2020	① High-efficiency refrigerant circuit design technology
	⑥ High-efficiency matrix converter
	⑫ Exhaust heat recovery
	⑩ Load forecast control
	⑬ Using solar heat panels together
	① Advanced refrigerant control technology
	② Further size reduction using surface tension
	③ Micro-channel type heat exchangers
	④ Power recovery compressors with integrated expanders
	⑬ Decompressed-boiling solar panel evaporators
2020～2030	① Development of new refrigerant
	⑤ Next-generation sensor-less PM motors
	⑨ High-density thermal storage and latent thermal storage
	① Water refrigerant double-bundle condenser hot water supply systems (heat recovery syste
	⑫ Heat recovery from wastewater

Fig.3 JSME Technological Roadmap for Heat Pump Hot Water Supply System (Trends of COP & Technical Breakthrough)

Appendix B: Data sheet for the climate plans

Country:JAPAN	Population(2008) 127.8million, Area377,923km2,GDP:4384billion$					
			Baseline			
			2007	**2015**	**2030**	**2050**
GHG emissions (tons CO2-eq.)	CO_2					
	Total		1,371MT			
GHG emissions by sector (tons CO2-eq.)	Transportation fuels					
	AUTOMOBILES					
	FIG.1	New Materials: such as Aramic Fiber (Specific Strength Relative to Steel) Weight Reduction[%]	0%	0.35%	1.00%	1.30%
	Fig.2	Engine Thermal Efficiency (Gasoline Engine)	36%	37.20%	39.50%	42.50%
		Average Traveling Speed by Traffic Flow Control Tecnology	20km/h	30km/h (20% Red CO2)	40km/h (30% Red CO2)	50km/h (40% Red of CO2)
		Estimated Total CO2 Emission from Automobiles	222MT	178MT	151MT	122MT
		CO2 Reduction Potential		44MT	71MT	100MT
	Residential, commercial and other sources					
	HEAT PUMP HEATING & HOT WATER SUPPLY	CO2 Reduction Potential		50% Replace	100% Replace	COP=6 100% Replace
	Fig.3	Heat Pump Hot Water Supply (COP=5) for Houses replacing Boiler and Heater		33MT	66MT	77MT
		Heat Pump Heating (COP=5) for Houses replacing Boiler and Heater		25MT	51MT	59MT
		Heat Pump Hot Water Supply (COP=5) for Buildings replacing Boiler and Heater		17MT	34MT	39MT
		Heat Pump Heating & Cooling (COP=5) for Buildings replacing Boiler and Heater, Absorption Heat Pump		20MT	40MT	47MT
		Total CO2 Reduction Potential		95MT	190MT	222MT
	Total		270MT	175MT	80MT	58MT
Energy intensity - total energy consumption per GDP (MJ/US $)						