Analysis of Implementation Results of the Standard "Limits of Fuel Consumption for Passenger Cars"

1 Introduction of the standard "Limits of Fuel Consumption for Passenger Cars"

GB 19578-2004 "Limits of Fuel Consumption for Passenger Cars" was issued in China in 2004, for the purposes of facilitating the development and application of automotive energy-saving technologies, improving the fuel economy of motor vehicles, controlling the fuel consumption of automobiles, and providing a solution to the energy and environmental issues arising from automotive fuel consumption. The Standard fully considers the technical characteristics of local automotive products and the actualities of China, and adopts the appraisal system of maximum fuel consumption per vehicle for each mass group, so as to "wash out outdated products and motivate technical progress"; as for the setting of limits, the strategy of "focusing on large vehicles" is taken to place restraints against the development of large-scale vehicles. According to the Standard, the limits related requirements are to be put into implementation in two phases: the Phase I requirements shall apply to the newly approved vehicles since July 1st 2005 and to all vehicles since July 1st 2006; while the Phase II requirements shall govern the newly approved vehicles since January 1st 2008 and the in-production vehicles since January 1st 2009.

For the comprehensive assessment of the roles played by the Standard in "eliminating outdated products and promoting technical progress", this research project is to adopt the comparative analysis methodology, i.e., probing into the technical conditions and fuel consumption level of passenger cars in China before and after the implementation of the Standard, comparing the results with the EU, American and Japanese data of the same period, and subsequently appraising, in an all-round way, the roles and effects of the national standard "Limits of Fuel Consumption for Passenger Cars" in washing out outdated products, motivating technical progresses, improving automotive fuel economy, saving energy and reducing emissions. Moreover, the research project is to adopt, for the first time, the sales weighting approach in calculating the company average fuel consumption of passenger car manufacturers and the average fuel consumption of each technology source in China, in addition to initially putting forward and calculating the nationwide average fuel consumption level of passenger cars in China.

2 Data preparation and processing

The effects exerted by the national standard "Limits of Fuel Consumption for Passenger Cars" on the product development and manufacturing of manufacturers have started even before the official implementation of the Standard; i.e., it has played the guiding role on the product planning of manufacturers even since the debut of its development stage. Therefore, for comprehensively, impartially assessing the role of the Standard, the reference year of the limits set out in the Standard shall be taken as the benchmark year, i.e., 2002, and the year in which the Standard is put into overall implementation, i.e., 2006, shall be regarded as another nodal point.

As for the sources of local data, the production and sales data primarily come from China Automobile Manufacturers Association, with a small portion supplied by manufacturers. In order to get rid of the impacts of varying standards relating to vehicle classification, the inverse deduction approach is followed to verify the data from 2006 to 2002; as for the data concerning vehicle types and fuel consumption, the sources are the NDRC announcements, declarations of manufacturers, results of testing agencies, and survey activities. In shall be noted that the fuel consumption data for 2002 are from manufacturer's declarations and results of testing agencies; the data of year 2006 are mainly originated from NDRC announcements, with a small portion from measurements of testing agencies. Also, some data are enhanced and supplemented based on the data supplied by manufacturers in the course of this research project (e.g., on symposiums/workshops held with manufacturers).

For comparison, this research project is to regard the nations with developed auto industry as its research targets, i.e., USA, Japan, and the two EU member states, UK and Germany. Concretely:

1) The UK data come from the fuel consumption information and related parameters publicized by Vehicle Certification Agency (VCA); upon data screening, without regard to CNG and LPG vehicles, only diesel and gasoline vehicles are considered.

2) The fuel economy data of USA come from two sources: the "FUEL ECONOMY GUIDE" data, and the test vehicle data made public over the EPA website. In consideration of the fact that the "FUEL ECONOMY GUIDE" data only provide displacement, with no mass parameter; while the EPA test data present mass parameter but without displacement. Therefore, it is

necessary to, based on the original highway cycle fuel consumption provided in the GUIDE, search for corresponding vehicle type in the EPA data, confirm the inertia mass of the vehicle type concerned, and retroactively find out the corresponding vehicle in the GUIDE.

3) The German data are originated from VDA. For the German data of year 2006, there is no parameter "complete vehicle kerb mass". Through analysis, it is decided to adopt (inertia mass-100kg) for the substitution.

4) The Japanese data of fuel consumption come from the "List of Automobile Fuel Fares" issued by Ministry of Land, Infrastructure and Transport (Japan).

In consideration that these nations adopt different test cycles, it is impossible to directly compare their fuel consumption, and corresponding conversions are demanded. Concretely:

1) According to the results of comparative tests conducted by the National Quality Supervision and Testing center for Passenger Cars, the deviation of fuel consumption resulted from Euro II and Euro III test cycles basically falls within 1%; that is, the effects of these two cycles on fuel consumption measurements may be disregarded.

2) As for the conversion between NEDC cycle and the American CAFE cycle or the Japanese 10-15 cycle, the factors provided by the "Comparison of Standards of Various Countries Concerning Fuel Economy and Greenhouse Emissions from Passenger Cars" are followed, that is, FC-NEDC/FC-CAFÉ=0.89, or FC_NEDC/FC_10-15=1.23.

Moreover, as stipulated in the standard "Limits of Fuel Consumption for Passenger Cars", this research project only considers two categories: AT and MT. CVT vehicles are regarded as non-AT type.

3 Evolution of passenger car conditions

3.1 Uplifted vehicle velocity

During 2002~2006, the average value of maximum design velocity of local passenger cars has risen from 150km/h to 162km/h, i.e., increasing by 8%. The distribution of velocity, as far as the data of 2002 are concerned, the velocity section of 120km/h~160km/h constitutes the principal section where the local passenger cars fall within; in this velocity section, the vehicle types account for over half of the total of passenger cars, namely, 52%; in 2006, the vehicle types with maximum design velocity exceeding 160km/h account for over 58%, constituting the major velocity distribution section where the local passenger cars fall within, while those below 100km/h take up no more than 1%.

3.2 GVW declining slightly, complete vehicle kerb mass largely increasing

The GVW of local gasoline vehicles has been on a slight decrease during 2006, from 1,853kg to 1,813kg, 2% less than that in 2002.

While in the same period, the kerb mass has been uplifted from 1,230kg in 2002 to 1,356kg in 2006, i.e., increasing by 126kg. At the same time, in view of distribution in each mass group, generally vehicle types shifting toward higher mass groups. In 2002, the proportion of vehicle types with kerb mass less than 1,090kg is about 44%, which declines to 27% or so in 2006, i.e., for each group with kerb mass exceeding 1,090kg, the proportion of covered vehicle types rises, despite to different degrees: for the mass group of 1,090kg~1,540kg, the proportion rises from 32% to 38%, and for the mass group of 1,540kg~2,000kg, the proportion is lifted from 24% to 35%. The vehicle types with kerb mass exceeding 1,090kg increase, of which the proportion in the total vehicle types has been 73%, i.e., a relative majority.

As for the increase of kerb mass of passenger cars, China is no exception at all. In Germany, UK, USA and Japan, the kerb mass of passenger cars has increased to different extents. As presented in Figure, obviously China rises most rapidly, increasing by more than 10%, which is followed by the USA, i.e., increasing by about 8%; as for Japan and Germany, the variation is smaller, i.e., no more than 5%.

3.3 The power-to-mass ratio increases, and the gap from foreign countries diminishes, despite the absolute gap is still big

During 2002~2006, the power-to-mass ratio of all the local gasoline vehicle types has presented the rising tendency, and for MT and AT ones, the ratios have risen from 55.9w/kg and 65.7w/kg in 2002 to 61.6w/kg and 73.7w/kg in 2006, respectively, with the general rise extent exceeding 10%. In 2002, the power-to-mass ratio of local AT passenger cars is mostly below 60w/kg; the vehicle types with power-to-mass ratio > 80w/kg are merely 1.3%; in 2006, those between 60w/kg and 80w/kg rise largely from 9.3% to 55.0%, amongst all vehicle types, those exceeding 80w/kg have risen to 27%. AT vehicle types have presented the rise tendency with respect to power-to-mass ratio, despite the extent

is small, vehicle types falling within 40w/kg~60w/kg and within 60w/kg~80w/kg still constitute the main stream of MT vehicle types.

In 2002, the AT vehicle types with power-to-mass ratio >60w/kg take up more than 80% in Germany, while, in China, about 90% MT vehicle types have the power-to-mass ratio below 60w/kg. In 2006, the local AT vehicle types > 60w/kg have accounted for 82% or so, approaching to the German ratio 85.2%; as for the range >100w/kg, nevertheless, the proportions of China and Germany are sharply contrastive, i.e., 7.1% and 30.7%, respectively. Obviously, the big gap persists. A similar trend exists with MT vehicle types.

3.4 As a whole, engine displacement has increased slightly, and the proportion of small-displacement vehicles declines sharply

Amongst the total vehicle types in 2002 and 2006, the three groups (1,000ml~1,500ml, 1,500ml~2,000ml, and 2,000ml~2,500ml) account for 81% and 88%, respectively. Irrespective of in 2002 or in 2006, the group 1,500ml~2,000ml constitutes the most concentrated range of the local vehicle types, and the proportion of such a range has basically remained unchanged, i.e., about 40% of total vehicle types. A substantial reduction occurs with the proportion of vehicle types <1,000ml, i.e., the proportions of other groups have varied by 1.5~3.5% in comparison with 2006.

4 Evolution of fuel consumption

4.1 Classified by displacement, fuel consumption of vehicle types declining to different degrees, though the reduction rate of fuel consumption exceeds the foreign level in the same period, the gap from foreign level is still quite big

The fuel consumption of local AT gasoline passenger cars, when classified by displacement, has presented reduction to different degrees during 2002~2006. Concretely, those with small displacement have lower reduction, while those with large displacement present higher reduction; such a situation similarly applies to MT vehicles, despite that the difference of reductions is smaller between small and large displacements, and the reduction degree of large displacement vehicles is apparently less than that of AT vehicle types.

The variation of fuel consumption along with displacement has not been big in Germany, UK, Japan and USA: in some displacement groups, the average fuel consumption declines slightly, and in one or two displacement groups, the average fuel consumption even rises. In China, the variation is largely bigger, and the gap with foreign level is diminishing, despite the still high gap in the absolute view.

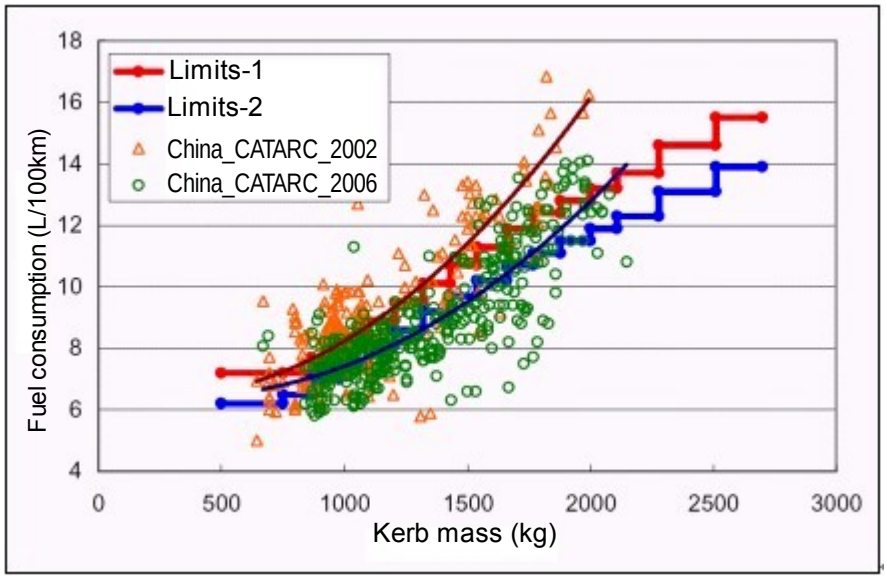
Along with the increase of displacement, the gap of average fuel consumption of AT vehicle types has expanding between China and foreign countries; noticeably, for the displacement group of 2,000ml~2,500ml, the gap between China and Japan exceeds 4L/100km.

In view of MT vehicles, the average fuel consumption of local vehicle types distributed with respect to displacement in 2006 declines to different degrees compared to the year 2002, though a big gap persists with Germany, UK, USA and Japan.

Irrespective of AT or MT vehicles, the average fuel consumption level of Japan for each displacement is apparently lower than China and other three nations.

4.2 For each mass group, generally the fuel consumption declines, and the strategy of "focusing on large vehicles" has acquired eye-catching results

As presented in Figure 1, compared to the data of year 2002, the fuel consumption of each group of passenger cars, irrespective AT or MT ones, has presented certain decrease. Though the declining extent differs slightly, the basic trend tells that, along with the increase of vehicle mass, the declining degree of fuel consumption is gradually intensified; that is, the vehicles in higher mass groups present a larger reduction, while those in lower mass groups present a smaller reduction. Such a result tallies with the pre-established target of the standard, i.e., "focusing on large vehicles".



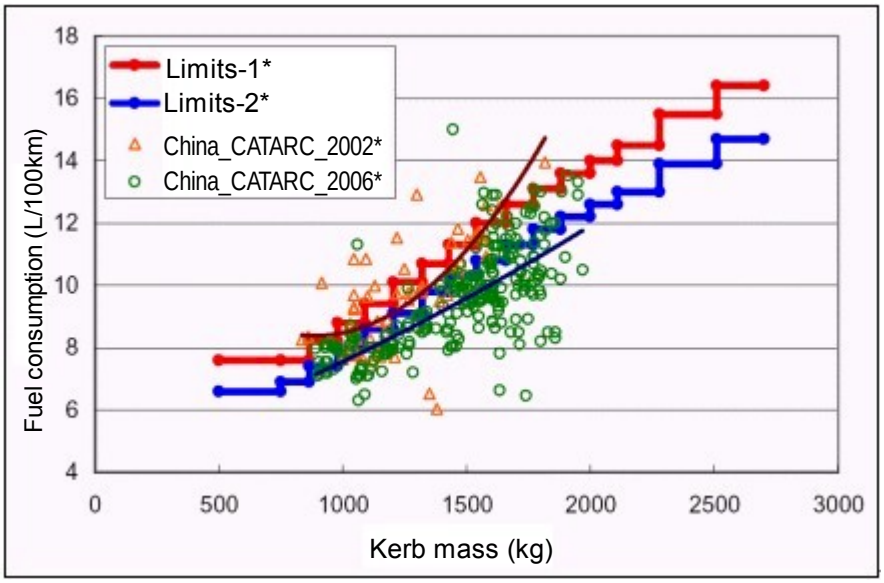
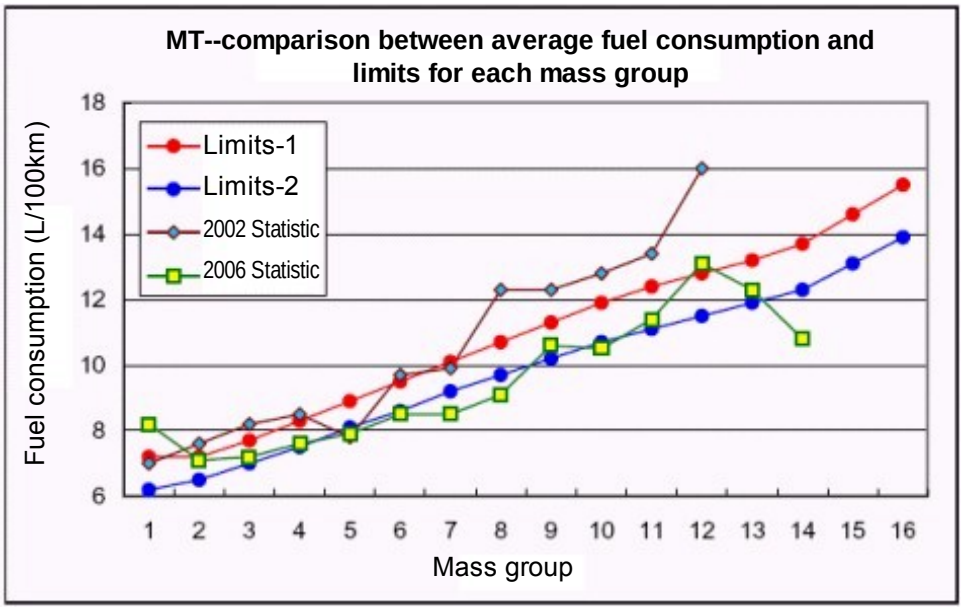


Figure 1 Evolutional trend of mass vs. fuel consumption curve for MT and AT vehicles during 2002~2006



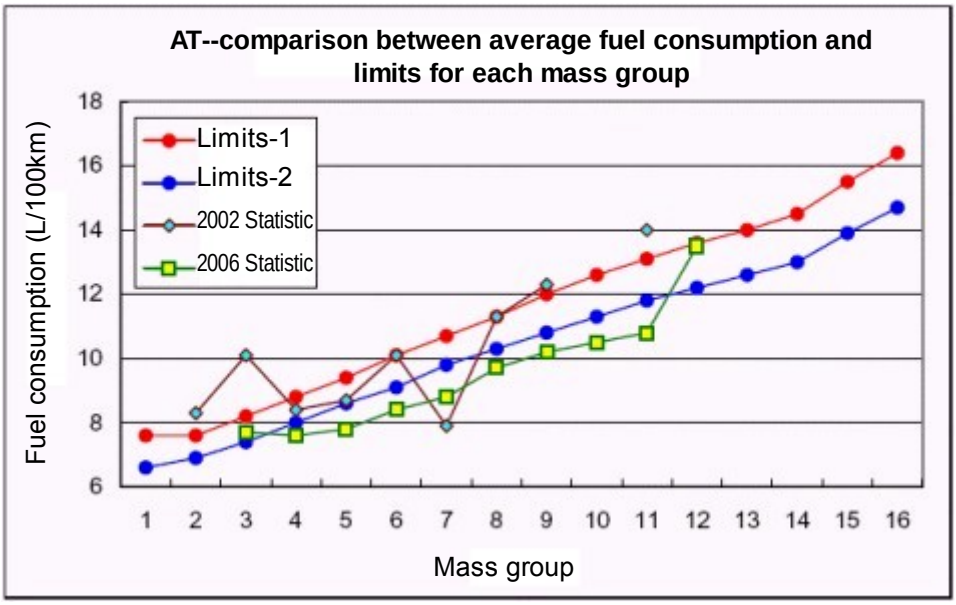


Figure 2 Comparison between average fuel consumption and fuel consumption limits for each mass group of AT vehicles

Figure 2 compares the average fuel consumption against corresponding limit requirement for each mass group of AT and MT vehicles. When compared against the Phase I limits, it could be found out that, as for MT vehicles, the average fuel consumption of each mass group is below the required limits, except for the 1st and the 12th groups where the Phase I limits are exceeded. As for AT vehicles, the average fuel consumption of each displacement group is below the Phase I limits. When compared against the Phase II limits, it could be found that the average fuel consumption curve of MT vehicle types is roughly crossed over and overlapped with the curve of Phase II limits. As for AT vehicle types, the fuel consumption is below the Phase II limits, except for the 3rd and the 6th groups. Consequently, it could be believed that, in 2006, the average fuel consumption of local passenger cars roughly tallies with the Phase II limits.

According to the targets established upon development of the Standard, the Phase I limits as specified in the standard "Limits of Fuel Consumption for Passenger Cars" roughly run parallel to the average fuel consumption level of vehicle types in 2002, and the Phase II limits are above 10% stricter than the Phase I ones. Based on available analysis results, the average fuel consumption level of each mass group in 2006 approaches or runs below the Phase II limits. So, the average fuel consumption of local passenger cars has been uplifted by at least 10% during 2002~2006.

5 Application of new technologies and Results

For the analysis on application of new technologies, we select 12 main manufacturers of passenger cars, of which the technologies are from EU, USA, Japan, South Korea and China itself. Consequently, energy-saving technologies favorable for improving fuel economy have acquired more extensive application in passenger cars during 2002~2006, e.g., OHC, VVT, multi-gear ratio transmission, and multi-valve:

1) The OHC technology has obtained extensive application and popularization, involving nearly 100% passengers, especially sedans. Concretely, the share of the single overhead camshaft technology (SOHC) reaches 23% or so, and that of double overhead camshaft technology (DOHC) is about 87%.

2) The application of VVT has expanded sharply, rising from 3.3% in 2002 to 28.5% in 2006.

3) The application of CVT and multi-gear ratio transmission is improved, the proportion of vehicle types using 6 or more gear rations has increased from 1.3% to 7.5%, and that using the CVT technology has increased from 0.4% to 2.4%.

4) The 4-valve technology is turning into the main stream of passenger car engines, with the penetration rate rising from 57.2% in 2002 to 80.4%, while the vehicle types using the 2-valve technology have declined from 38.6% to 15%.

Based on their application proportions in 2002 and in 2006, calculate the overall effects of these technologies on improving the fuel economy. As shown in Table 1, CVT has the most outstanding

effects in improving fuel economy. According to the calculation results, nevertheless, CVT have made quite small contributions in improving fuel economy due to its low application; having been applied most extensively, OHC contributes the most in meliorating fuel economy, about 2%~5%. Collectively, the 5 technologies mentioned above have made 3.4%~7.8% contributions in improving the fuel economy.

Table 1 Effects on fuel economy of applying new technologies and their costing analysis

Effects on fuel economy of applying new technologies and their costing analysis									
	Theoretical effects		Cost		Share			Actual effects	
	Min.	Max.	Min.	Max.	2002	2006	Variation	Min.	Max.
Overhead camshaft	2%	5%	820	1,120	0%	100%	100%	2.0%	5.0%
VVT	3%	5%	280	1,120	3%	29%	25%	0.8%	1.3%
CVT	4%	8%	1,200	3,000	0%	2%	2%	0.1%	0.2%
Multi-gear ratio	1%	3%	560	1,200	1%	8%	6%	0.1%	0.2%
Multi-valve	2%	5%	820	1,120	61%	85%	24%	0.5%	1.2%
Total	12%	26%						3.4%	7.8%

6 Sales-weighted average fuel consumption

6.1 Company average fuel consumption

By definition, definition of company average fuel consumption (CAFC) refers to the average fuel consumption of all types of passenger cars manufactured and sold within the Chinese market by one car manufacturer within one model year.

According to the statistical analysis to the local market of passenger cars, 34 manufacturers of passenger cars are selected as the targets for analysis, for which the company average fuel consumptions in 2002 and 2006 are separately calculated. The results are plotted on Figure 3. In the figure, the horizontal red dotted line refers to the Chinese sales-weighted NAFC in 2002, while the horizontal blue dotted line refers to the sales-weighted NAFC in 2006. For the sake of confidentiality, each manufacturer is designated as a numeral.

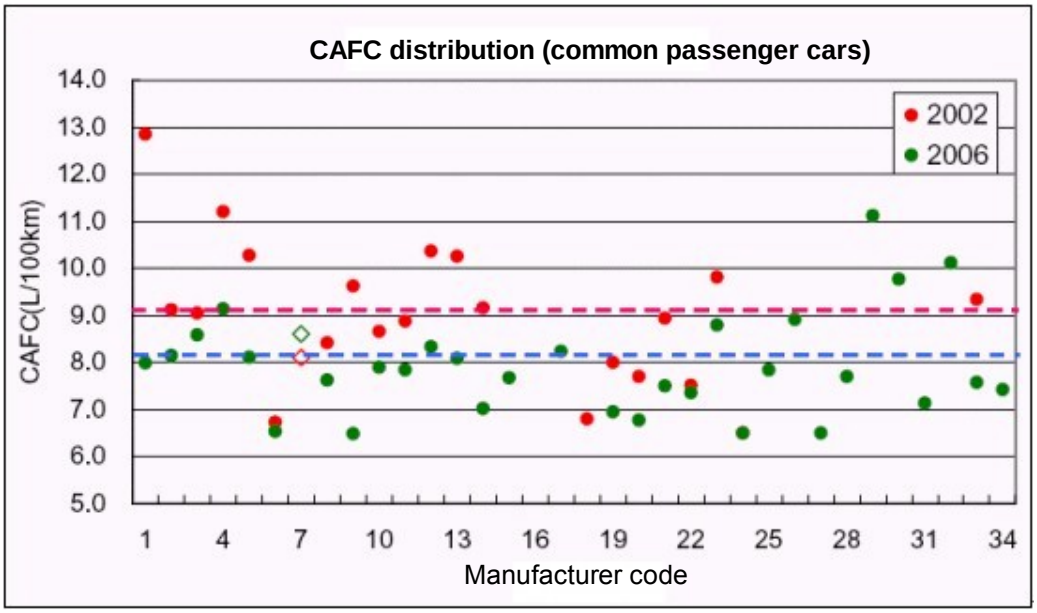


Figure 40 CAFC of passenger car manufacturers in China during 2002~2006

As shown in Figure 3, for the year 2002, the local CAFC data differ largely, with the maximum value at 12.9L/100km and the minimum one at 6.7L/100km, having the difference of 6.2L/100km. Provided the NAFC is set as the national standard level, the conforming rate reaches 63.6%. Except for quite few manufacturers, the CAFC in 2006 is somewhat reduced compared to 2002, with the maximum reduction arriving at 38%. Despite the relative gap is diminishing, the absolute gap among manufacturers is still quite big, with the maximum CAFC at 11.1L/100km and the minimum one at 6.5L/100km, having the difference of 4.6L/100km. Provided the NAFC is set as the national standard

level, among the 34 manufacturers for study the conforming rate reaches 58.8%.

For the comparison purpose, we, from the 2005 list of brands of clean cars issued by the European Federation for Transport and Environment, select 13 transnational manufacturers that have products on both the Chinese and European markets (including EU, American, Japanese and S. Korean manufacturers), for each of which the average fuel consumption is calculated for its joint venture in China, and comparative analysis is unfolded. As indicated in Figure 4, the joint venture in China of each of the 13 companies present a higher average fuel consumption compared with the EU market, with the indent averaged at 20% or so; For their Chinese joint ventures, only 2 have lower CAFC (in 2006) than the 1997 level of respective European companies, and, as for the rest 11 joint ventures, the CAFC exceeds such 1997 level, with the maximum gap approaching 30%. There are two reasons:

China adopts the appraisal system of single-vehicle maximum fuel consumption limit for each mass group, which features a fleet-focused appraisal system of fuel economy. In order to conform to the rigorous provisions concerning CO_2 reduction as specified in the EU agreements, manufacturer may meet the requirements through adjusting its product mix. The situation is quite different in China, where most joint ventures orient their products on the mid- and high-end markets, and, as a result, all the vehicle mass, displacement and fuel consumption level are higher.

A big gap exists with technical level of passenger cars between China and EU, products claimed to be synchronously launched with foreign countries are "synchronous merely in appearance" (but with inferior engines). With outdated engines. Wherefore, it is of course common to fall behind foreign countries in view of fuel consumption.

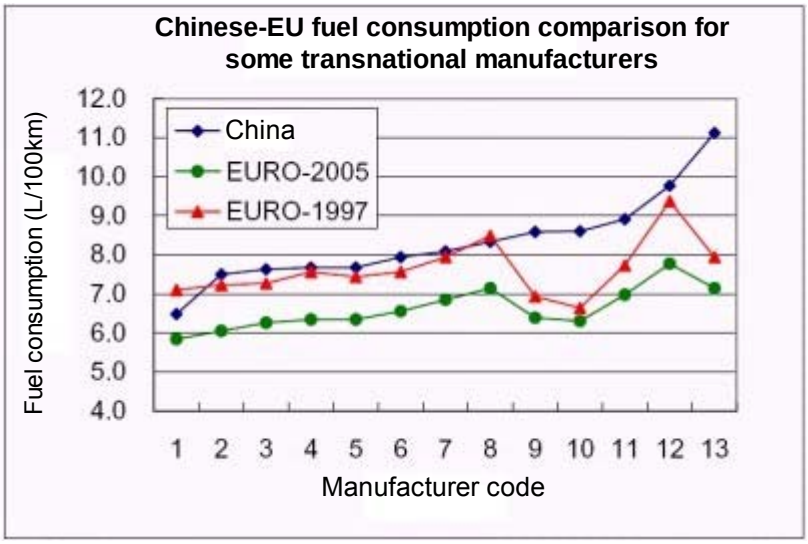


Figure 4 Comparison of CAFC of some transnational manufacturers between the Chinese and the European markets

6.2 Nationwide average fuel consumption and methods of calculation

By definition, nationwide average fuel consumption means the sales-weighted average fuel consumption of all vehicle types manufactured and sold on the local market within a model year. NAFC may be computed either with the fuel consumption of all vehicle types manufactured within the current year by the sales weighting method, or with the CAFC of all the manufacturers.

This research project adopts the second approach: based on the company average fuel consumption of the 34 passenger car manufacturers as calculated above as well as the total sales of passenger cars of each manufacturer, calculating the nationwide average fuel consumption of passenger cars (shortly, "PC-NAFC"). As indicated in Figure 5, in 2002 the local PC-NAFC reaches 9.11L/100km, while that in 2006 is 8.06L/100km, dropping by 11.5% compared with 2002.

As shown in Figure 6, for China, since the implementation of the standard "Limits of Fuel Consumption for Passenger Cars", the results have been eye-catching: the declining rate during 2002~2006 has reached that of EU and Japan during recent 10 years. As a whole, however, here is still a long way to go for China to catch up with EU and Japan in this regard. The local average fuel consumption of passenger cars in 2006 exceeds that of EU and Japan in 1995 by 2% and 22%, respectively, about 14% higher than that of EU in 2006, with the absolute difference exceeding 1L/100km, and about 50% higher than that of Japan in 2005, with the absolute difference approaching 2L/100km.

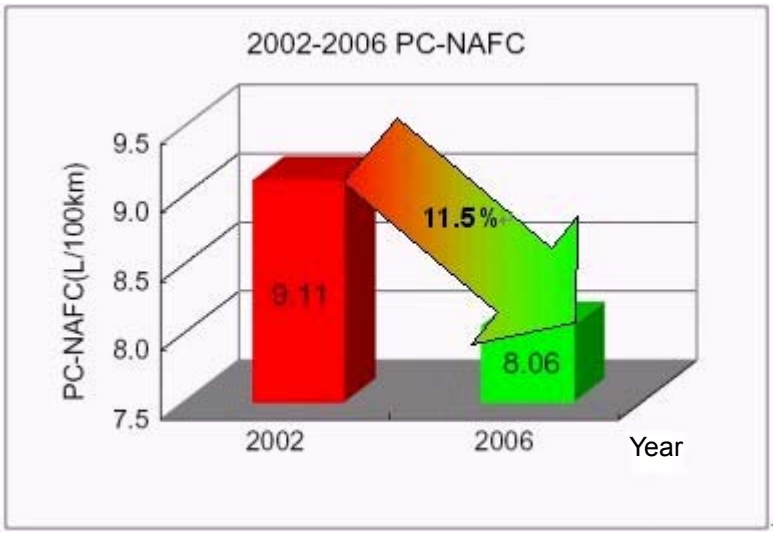


Figure 5 Evolution of PC-NAFC in China

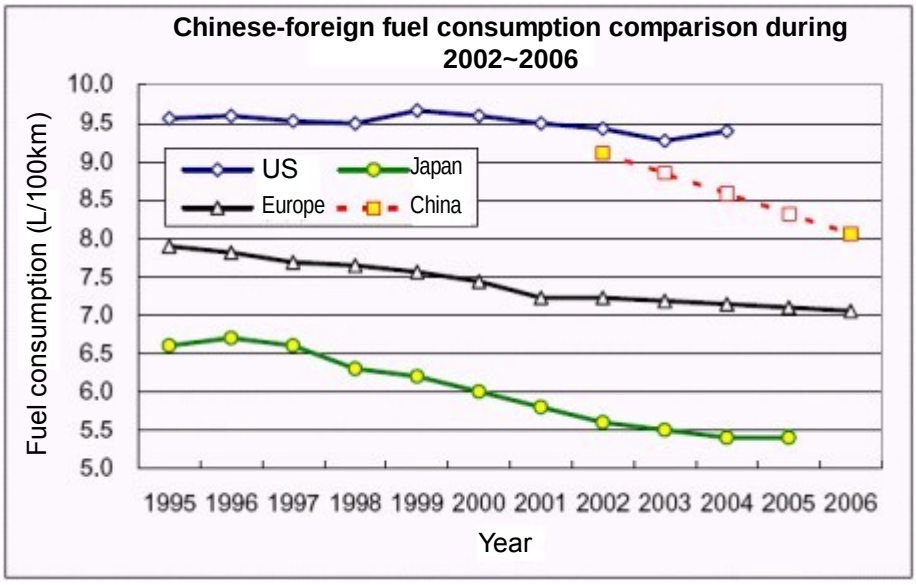


Figure 6 Comparison of Chinese-foreign average fuel consumption during 2002~2006

6.3 Technology source average fuel consumption

By definition, TSAFC means the sales-weighted average fuel consumption of all passenger car vehicle types manufactured and sold on the Chinese market within one model year by all passenger car manufacturers falling within a technology source, similar to the ACEA average fuel consumption.

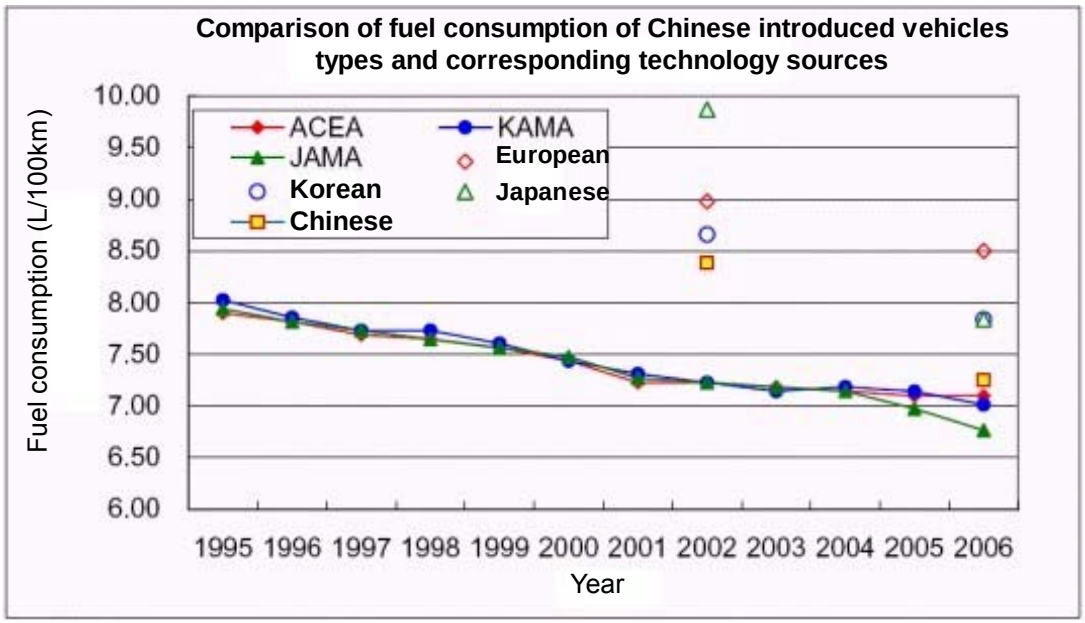


Figure 7 Comparison of TSAFC corresponding to the vehicle types introduced by China

As indicated in Figure 7, in 2006, the local average fuel consumption declines compared to 2002, for each technology source, the declining rate varies, The vehicles based on Japanese technology enjoy the highest reduction (18%), declining from 9.87L/100km in 2002 to 8.14L/100km in 2006. The second place is taken up by the local independent brands, having the reduction rate of 14%, declining from 8.39L/100km to 7.25L/100km in 2002. The vehicles based on South Korean and American technologies share a similar reduction, i.e., 9% or so. Those based on Europe technology present the least reduction, merely 5%, far below the average value (11.5%). The relative relation with respect to average fuel consumption among vehicle types of different technology sources have basically remained unchanged, which are ranked (from lowest to highest) as below: China, South Korea, Japan, Europe and USA.

On the EU market, ACEA, JAMA and KAMA are similar with respect to the average fuel consumption, sharing a basically same varying tendency. in 2006, the values of ACEA, JAMA and KAMA on the EU market are 7.10L/100km, 7.01L/100km, and 6.76L/100km, respectively, contrasting 8.5L/100km, 7.84L/100km, and 7.84L/100km in China, with the average difference exceeding 10%, as for the products of three associations on the Chinese market, the average fuel consumption is higher than that in EU.

7 Energy saving and overall results

7.1 Since the implementation of the standard "Limits of Fuel Consumption for Passenger Cars", cumulatively 1.61 billion liters (equivalent to 1.18 million tons) of gasoline has been economized; given the price of RMB 6,000 yuan per ton, in total RMB7.08 billion yuan has been saved. Assuming:

1) No matter whether the standard concerning fuel consumption limits is issued, the increase tendency of sales of passenger cars would not be altered during 2002~2006; that is, the standard concerning fuel consumption limits exerts no impact on the sales of passenger cars.

2) Given the non-implementation of the standard concerning fuel consumption, the fuel consumption of passenger cars would continue retaining the 2002 level.

3) In 2002, the local average fuel consumption of passenger cars is 9.11L/100km, and in 2006 it declines to 8.06L/100km at the rate of 11.5%. For the ease of analysis, it is assumed that the standard has brought effects since its development, that is, during 2003~2006, the newly added vehicles had been presenting an identical rate of reduction in fuel consumption each year.

4) The fuel consumed by newly added vehicles after 2002 is taken into account only. Concretely, the newly added vehicles in 2003 have operated for 4 years during 2003~2006, those in 2004 have operated for 3 years, and so on and so forth (those newly added in 2006 have operated for 1 year);

5) The actual fuel consumption of each vehicle type is as same as the "announced" fuel consumption;

6) The yearly traveled distance of vehicles is 10,000km.

7.2 Based on the correlation between the fuel consumed during vehicle travel and the emissions of CO_2, i.e., 1 L/100km≈23.8g/km, it may be determined that, since the implementation of the standard "Limits of Fuel Consumption for Passenger Cars", cumulatively 38,400 tons of CO_2 have been reduced from the emissions.

7.3 Effects of varying vehicle conditions on the implementation effects

According to related conclusions of European researches, this research project attempts to use power function in depicting the relation between complete vehicle kerb mass and fuel consumption, consequently acquiring the formula: $\frac{dFC}{FC} = 0.6601 \times \frac{dM}{M}$.

In China, the average kerb mass of passenger cars in 2002 is 1,230kg, and, in 2006, 1,356kg. Taking 1,230kg as the start point of kerb mass, for which the corresponding fuel consumption is 9.11 L/100km, it may be deducted that, when the kerb mass rises to 1,360kg, the fuel consumption would be 9.73L/100km. That is, without regard to other factors, during 2002~2006, the fuel consumption of passenger cars in China would have increased by 6.8% merely because of the mass increase.

8 Summary and suggestions

8.1 Anticipated targets upon development of the standard are basically reached

1) Playing an active role in eliminating outdated products and promoting technical progress, in total 444 non-conforming vehicle types have been eliminated from the announcement, and some low-efficiency engines have been washed out, lots of new technologies helpful in improving fuel economy have been put into extensive application, including OHC, VVT, multi-valve, multi-gear ratio transmission and CVT technologies.

2) Acquiring favorable results in restraining growth of high energy-consumption SUVs. Since the implementation of the Standard, the rise rate of SUVs has been obviously lower than that of MPVs and common passenger cars in the same period. The slow-down of the increase of SUVs is attributed to lots of factors.

3) The strategy "focusing on large vehicles" acquires satisfactory results. Based on the evolution of vehicle parameters and fuel consumption since the implementation of the standard, it could say that such a strategy has gained quite favorable results, With the rise of vehicle mass, the declining extent of fuel consumption is gradually intensified; that is, the higher mass groups present a high decrease degree, while the lower ones present a small decrease degree. Such a result tallies with the anticipated target of the standard, i.e., "focusing on large vehicles". The analysis taking displacement as reference parameter has also reached a similar conclusion.

4) Improved fuel economy of passenger cars: In 2006, each mass group in China experiences reduction of average fuel consumption ratio with 2002, with the decrease ranging between 10% and 20%. According to the sales-weighted calculation result of local passenger cars, in 2006 the NAFC is 8.06L/100km, dropping by 11.5% from 9.11L/100km in 2002.

5) Substantial results in energy saving and emission reduction: since the implementation of the standard, cumulatively 1.61 billion litres (equivalent to 1.18 million tons) of gasoline has been saved; RMB7.1 billion yuan has been economized, cumulatively 3.84×10^4 tons of CO_2 emissions have been avoided.

6) The Standard "Limits of Fuel Consumption for Passenger Cars" has been the critical basis for exercising administration over motor vehicle products, in its "Notice on Recent Key Work for Building a Saving-oriented Society", the State Council definitely proposes to "motivate the implementation of the national standard 'Limits of Fuel Consumption for Passenger Cars', and restrain the growth of high fuel consumption vehicles from source". On the report of the State Council Research Office titled "Urgency in Strictly Implementing the Standard 'Limits of Fuel Consumption for Passenger Cars'". Premier Wen Jiabao gives his instruction as follows: "It's a good suggestion.

8.2 Existing issues and suggestions

1) Due to administrative functions, Insufficient implementation of the standard "Limits of Fuel

Consumption for Passenger Cars" for imported vehicles;

2) The clear-cut tendency toward large vehicles partially offsets the implementation results of the standard;

3) Whereas joint ventures orient their products on mid- and high-end market segments, featuring higher fuel consumption, they have made no eye-catching achievements with respect to small, low-fuel consumption vehicles. Related guiding policies are necessary.

4) With the strategy of "focusing on large vehicles", the declining rate of fuel consumption is low for small vehicles, and the technical progresses are insufficient, which shall be taken into account upon development of the standard for next-phase limits.

5) Presently the local fuel consumption level of passenger cars is merely equivalent to the EU and Japanese level 10 years ago, and such a big gap needs to be leveled off.