



China Passenger Vehicle Fuel Consumption Development Annual Report 2016

The Innovation Center for Energy and Transportation
September, 2016



Executive Summary

One of the main drivers of the national increase of oil consumption, greenhouse gases and pollutant emissions is the rapid growth of passenger vehicles ownership in China over the past decade. International experiences demonstrate that fuel economy standards are one of the most effective policy initiatives for improving vehicle fuel efficiency, promoting technological development, and reducing greenhouse gas emissions.

China started implementing its fuel economy standards in July 2005. Since then, China's fuel economy standard regime has expanded the original by-vehicle weight-group fuel consumption limitation standard to also include by-vehicle weight-group fuel consumption targets, corporate average fuel consumption targets, also known as CAFC, and imported vehicles inclusion (as of Phase III, since 2012).

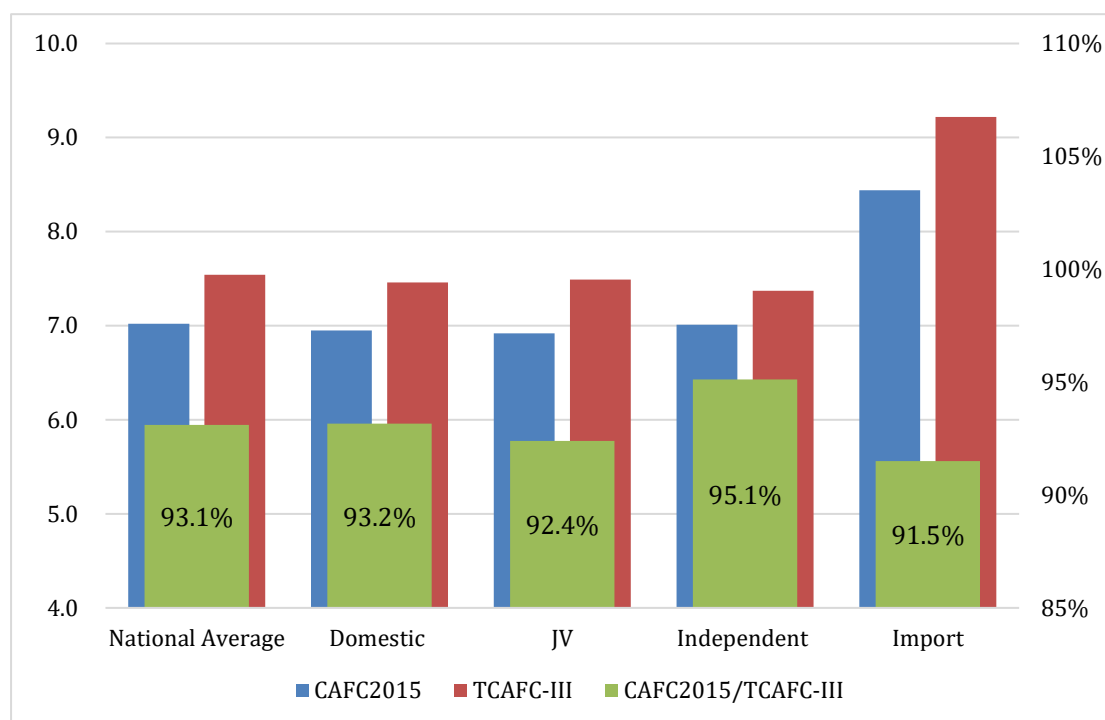
The Innovation Center for Energy and Transportation (*iCET*), as the only domestic non-governmental organization to participate in China's passenger car fuel consumption standards system development, continues to track and analyze development of China's passenger car fuel consumption standard implementation. *iCET*'s efforts are primarily aimed at advising policy-makers to design and enforce a robust and effective standard regime.

iCET's "2016 China Passenger Vehicle Fuel Consumption Development Annual Report" – the sixth report of its kind – analyzes the gaps of Phase III and IV of China's fuel consumption standard based on China's 2015 reported fuel consumption (FC) data and production of each auto manufactures, presents auto manufactures' individual FC performance, evaluates New Energy Vehicles' (NEVs) contribution to corporate and overall car market performance, and proposes recommendations towards the 2020 target of 5L/100km and translates to CO₂ emissions of 167kg/km (from the 2015 target of 6.9L/100km or about CO₂ 120kg/km). The report's key findings are highlighted below:

1. In 2015, domestic passenger vehicle manufacturers' CAFC reached an average of 6.95L/100km; after including FC credits from NEV production, the average CAFC decreased to 6.60L/100km, outperforming Phase III FC target.

The 2015 domestic passenger vehicle FC target of 6.9L/100km was first announced in the "Energy Saving and New Energy Automobile Industry development plan (2012-2020)". *iCET*'s analysis finds that, if calculating FC values and production volumes of internal combustion engines vehicles (ICE) alone, China's domestic passenger vehicle manufacturers' corporate average fuel consumption (CAFC) reached 6.95L/100km.

However, when accounting for new energy vehicles (NEVs, namely electric power engine vehicles) production and FC figures, the 2015 domestic average CAFC score improved by 0.35L/100km to 6.60 L/100km, well below the average FC target. On the other hand, importing enterprises' CAFC was much higher than that of domestic passenger car manufacturers, reaching 8.44L/100km if excluding NEVs, the national average fuel consumption was improving slightly to 7.02L/100km if excluding NEVs, still some 0.12L/100km higher than the national average fuel consumption. Generally, the Phase III target is still loose for manufactures to achieve.



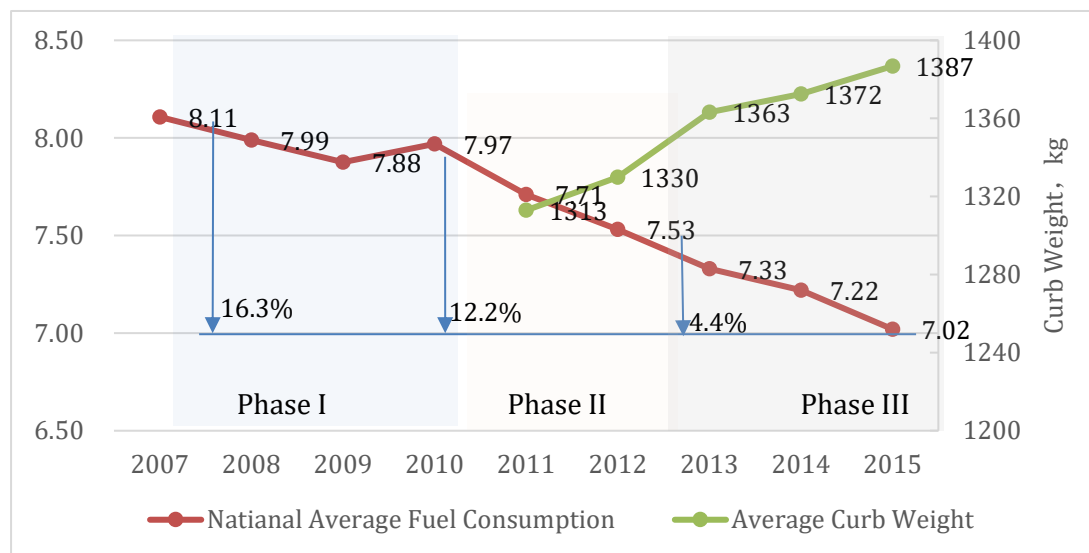
Note: TCAFE-III stands for Target CAFC for the year 2015, the last implementation year of Phase III; By definition, domestic manufacturers CAFC is inclusive of both joint ventures (JVs) and independent manufactures.

2015 CAFC versus 2015 Target CAFC (By manufacturer type)

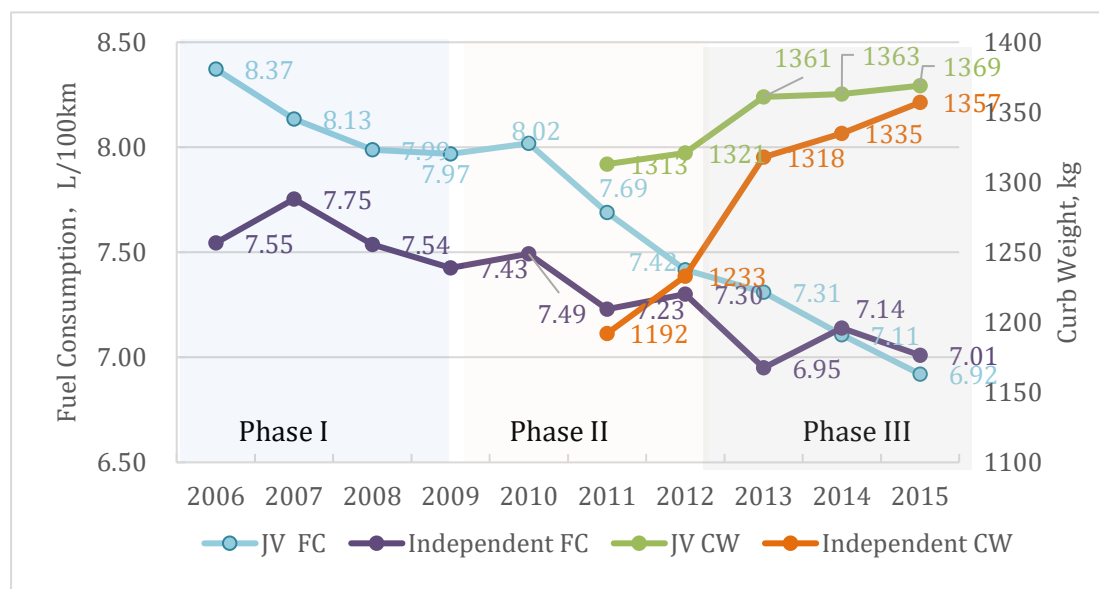
2. In the past decade, passenger car fuel consumption (excluding NEVs) has slowly improved, due in large part to a gradual increase in the production of larger and heavier vehicle models; thus, the standard and management regime could gain greater impacts on fuel consumption (and respected emissions) by encouraging lighter and smaller vehicle production.

Overall FC levels have shown an average annual decline of less than 2% over the past decade representing a very modest 0.10 to 0.25 L/100km annual reduction rate. Independent enterprises' FC reduction rates were the slowest, with an average annual decline of less than 1% (0.5L/100km decrease in the last decade). Increases in large weight-group models manufacturing helps to explain the annual slowing FC improvements. Statistics indicate that, between 2012 and 2015(phase III duration),

domestic passenger cars' average curb weight increased by 70kg while that for independent passenger cars increased by 150kg. Generally, a 100kg increase in curb weight is accountable for an increase of about 0.4-0.6L/100km. Therefore, independent enterprises' FC performance declines 0.6-0.9L/100km due to an increase in curb-weight., Better FC results could be achieved through an increased attention to model type and production volumes in China's FC standards regime.



2006-2015 national average fuel consumption and curb weight trends

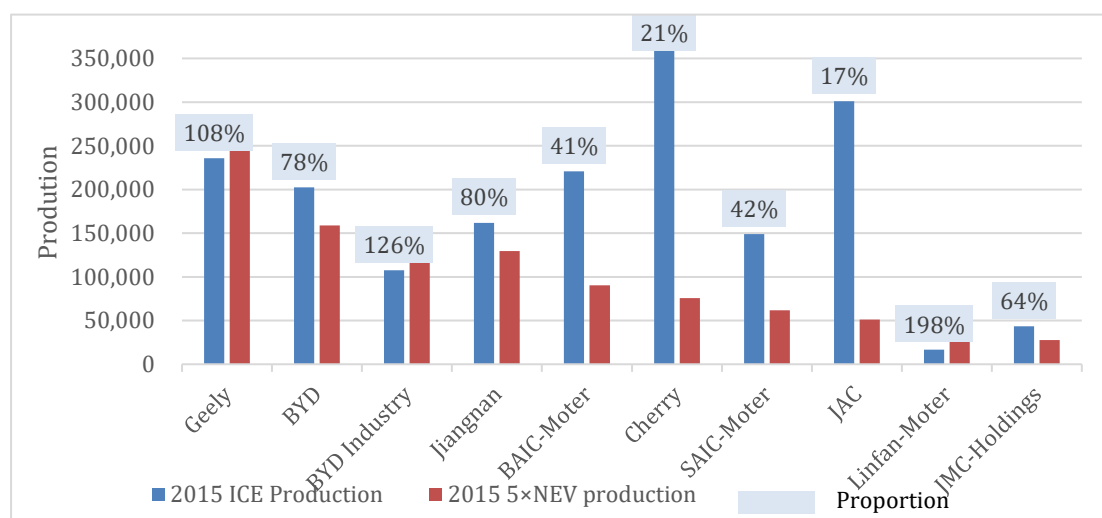


2006-2015 fuel consumption and curb weight trends for JVs and independent manufacturers

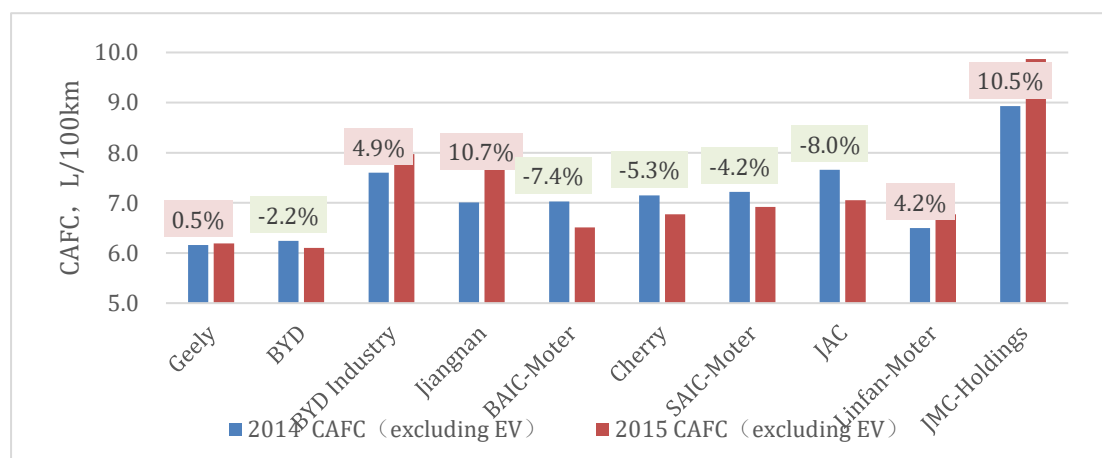
3. The NEV super credits in CAFC calculation helps independent manufacturers to reach short-term targets, but also weakens the

motivation for technological upgrades in traditional cars, undermining the standards' long-term goals.

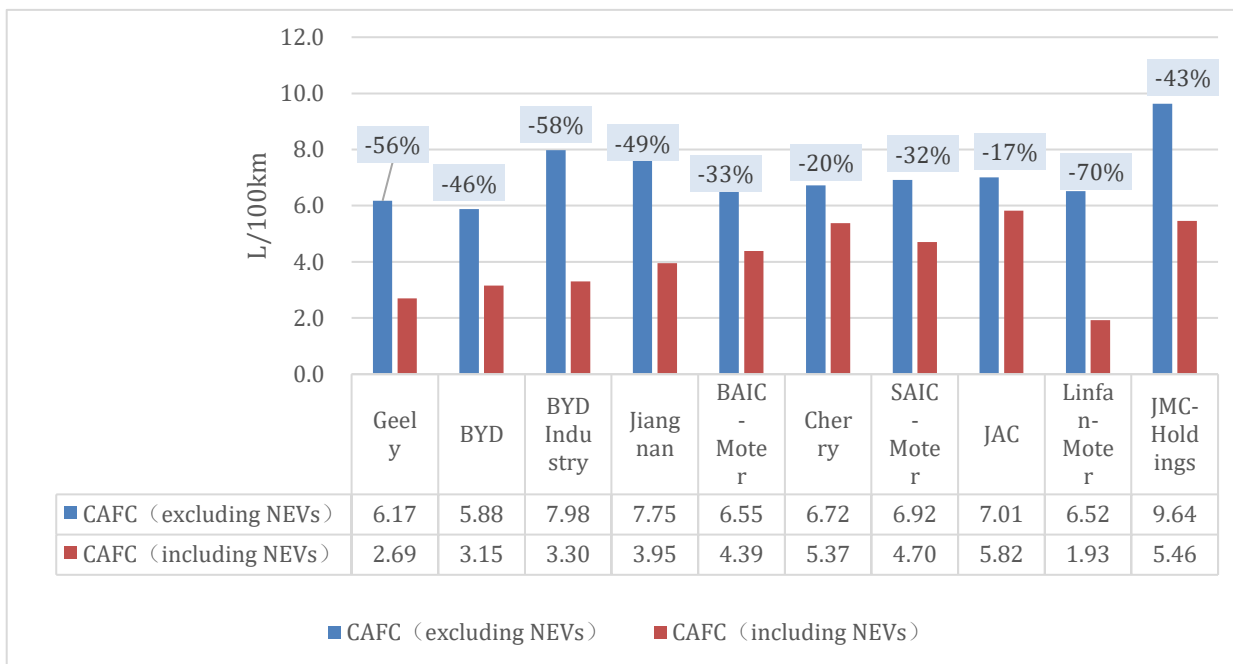
In 2015, independent car enterprises produced about 95% of the NEVs (including imports) in China, delivering a 17% FC decline from 7.01L/100km to 5.82 L/100km, as opposed to a more modest decline of 0.5 L/100km achieved through technological upgrading of ICE vehicles. Over the past two years the average fuel consumption of independent brand cars didn't do any improvement, some manufactures CAFC even rebounded. Based on iCET analysis, some independent NEV manufacturers has almost abandoned fuel saving technological upgrading after reaching a critical production volume of NEVs. For example, Jiangnan Auto and Jiangling Motors' FC levels increased by 10% in 2015, followed by BYD Auto, with a 5% FC increase, as illustrated in the below figures. The two biggest independent car producers Chongqing Chana and Great Wall were also increased the fuel consumption in 2015.



2015 NEVs production vs. ICE production by major domestic NEV producers



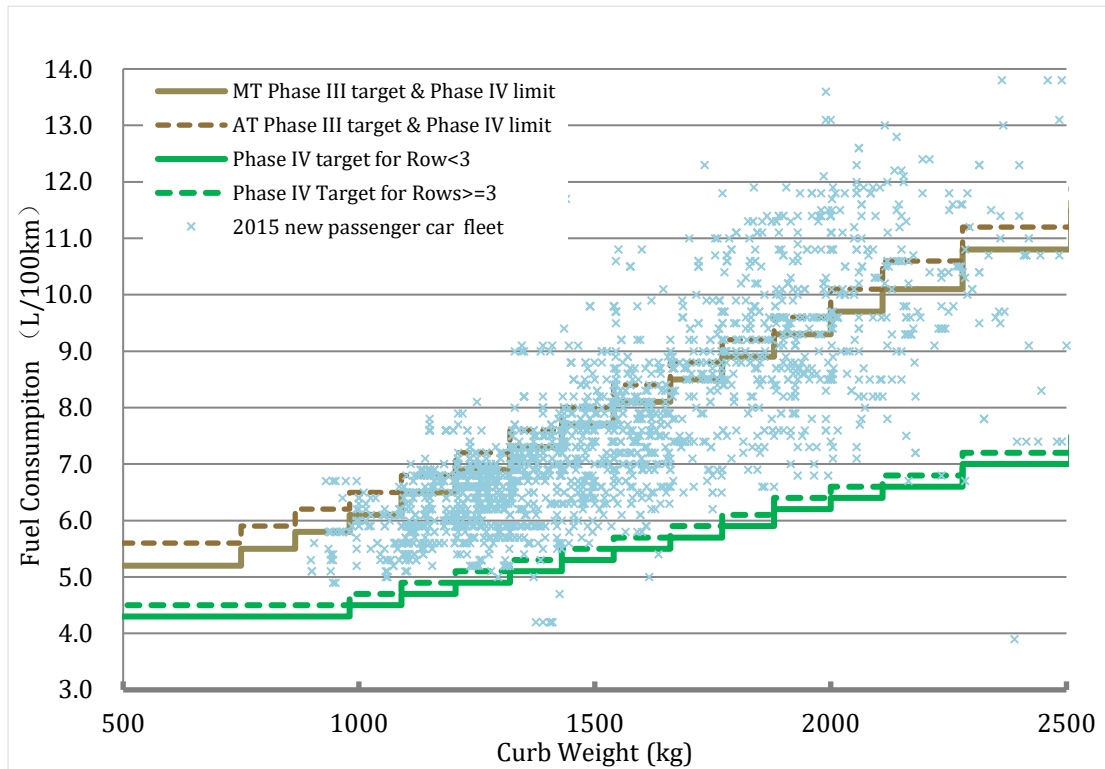
2015 vs. 2014 CAFC performance (excluding EVs) of major domestic NEV producers



2015 NEVs CAFC credits effects on CAFC of major domestic NEV producers

4. Greater FC improvements, on the vehicle and corporate levels, are still in need and fuel saving technologies could effectively deliver the necessary FC improvements on the vehicle and corporate levels. CAFC Phase IV's increased stringency requires profound strategic changes in corporate technological development.

iCET's 2016 CAFC analyses reveals that the $CAFC_{2015}/T_{CAFC-IV}$ ratio is 136% and decreases to 129% only after including NEVs. Moreover, about 25% of the vehicle models produced in 2015 do not reach the FC limits of CAFC Phase IV, despite the fact that the new FC limits should have been met by 1st Jan 2016 for newly certified models, and by 1st Aug 2018 for produced models. While the first implementation years of Phase IV allow for some flexibility, with a 5-fold calculation privilege for NEVs (with FC counted as 0 for EVs), the task of meeting the standards that increase in stringency over time will be tough. From 2018 to 2020, the required 10% decrease in $CAFC_{2015}/T_{CAFC-IV}$ ratio (annual FC decline of 0.5L/100km on average) will suffice fuel saving technologies. The projected 3 or 2-fold calculation privilege for NEVs replacing the current 5-fold in later stages of Phase IV, or re-considerations of NEVs' energy consumption (from the current value of 0), poses a great challenge in meeting the CAFC target. Furthermore, iCET's scenario analysis reveals that a 40-80% FC decline can be obtained through fuel saving technologies, and another 5-25% FC decline can be gained through off-cycle energy saving technologies (e.g. kinetic energy recovery systems, efficient air conditioning, idle start-stop system, and shift reminder). That means 65-85% FC declines for CAFC Phase IV still depends on energy saving technologies, making it essential for the corporate sector to advance its traditional manufacturing lines.

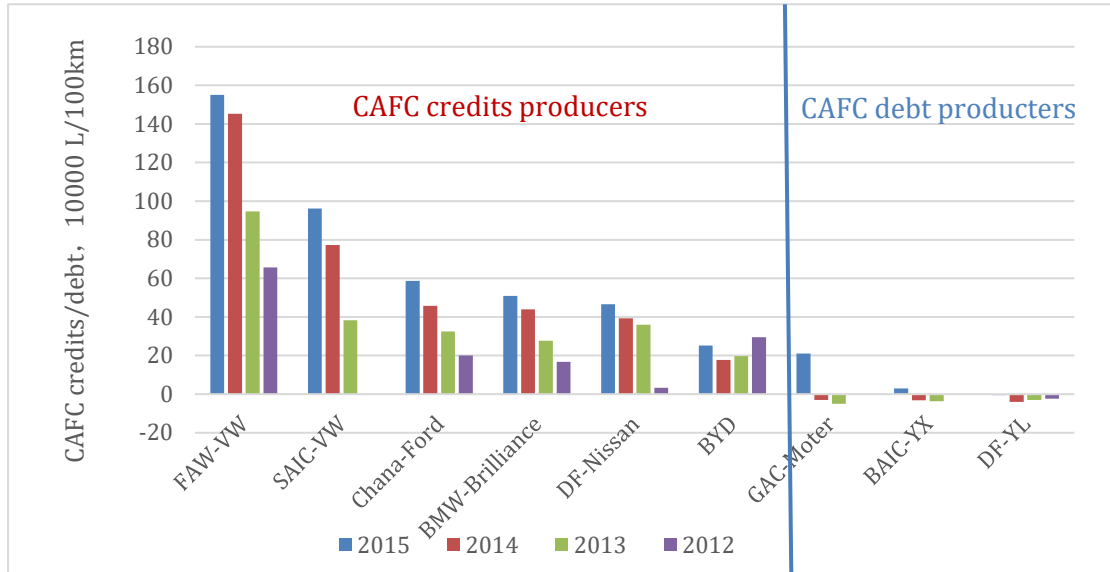


2015 China New Passenger Car Fleet Fuel Consumption Distribution

5. An effective CAFC credits exchange mechanism that reward first movers are believed to be useful in advancing commercial technological advancements; however, lack of enforcement and information gaps may lead to discrepancies and ineffectiveness of such market mechanisms, therefore iCET calls for the separation of CAFC credits from any other NEV-related credits mechanism (e.g. the highly debated ZEV-credits inspired program).

The CAFC credits mechanism was introduced three years ago to allow manufacturers greater flexibility in meeting their targets. However, because the standards' lead authority, the Ministry of Industry and Information Technology (MIIT), lacks any clear management and enforcement mechanisms, the flexibility mechanisms are accused of unfairly serving the corporate sector by enabling them to avoid incurring higher costs. iCET's 2016 CAFC analyses show that CAFC credits and debts are limited to a mere number of market players, and that credit volumes are higher than debt – implicating that the CAFC credits mechanism is toothless. More effective and comprehensive CAFC mechanism needs to be put in place before advanced energy saving technologies are promoted, translating to a long-term impact on China's overall auto sector fuel consumption. CAFC credits and NEV credits (ZEV-like credits) differ greatly in their policy goals and credits allocation mechanism. Moreover, potential mutual offsetting and adverse effects of the two different systems, should they be linked, calls for the independency of each of these regulatory tool at early stages. After reaching

maturity and proving their effectiveness, an integration of some sort should be considered.



2012-2015 Main CAFC Credits/Debts Producers for Domestic Car Companies