China: Automobiles

New credits/quota systems to boost NEV market; BYD well placed

**China to introduce NEV credits/quota systems similar to ZEV in US**
Recent proposals aimed at reducing fuel consumption and emissions in China underpin our bullish view on the market for New Energy Vehicles (NEV) and our Buy rating on BYD. In this note we untangle the proposed systems of NEV credits/quotas and look at how they could boost NEV output.

**Three new systems of credits/quotas**: The Chinese government has released draft regulation on (1) the Corporate Average Fuel Consumption (CAFC) credits system and (2) the parallel NEV credits system (most comparable to the Zero Emission Vehicle (ZEV) system in US). Under these 2 complementary systems OEMs will need to meet both CAFC and NEV targets to receive credits, meet minimum NEV mix in their output, and be able to trade surplus credits. (3) The government has also proposed a NEV carbon quota system (potentially to be integrated into a nationwide carbon quota trading system) in which OEMs with a carbon quota surplus/deficit can trade/transfer quotas in the open carbon market.

**New credits/quota systems to boost NEV market growth, especially after the expiration of purchase subsidies**
We believe these new credits/quotas have the potential to boost NEV industry growth as: 1) achieving a certain level of NEV volumes is now a ‘must’ for OEMs to meet the NEV credits requirement vs. previously ‘one of many options’ to meet CAFC standards; 2) OEMs with high NEV volumes could receive additional income from credit/quota trading; and 3) NEV credits can be purchased to make up for a deficit in CAFC credits, but not vice versa, which enhances the importance of NEVs as a method to meet both CAFC and NEV credits targets. In particular, the concerns over the sustainability of NEV growth after expiration of purchase subsidies in 2020 could be eased with contributions from NEV credits trading income.

**NEV leaders should benefit the most; Buy BYD**
We believe NEV industry leaders like BYD (1211.HK, Oct 5 close HK51.45) will benefit most given 1) potential extra income received from NEV credits trading; 2) they are less likely to pay financial penalties for failing to meet emissions standards; 3) less R&D/investment in NEV/engine improvements required vs. newcomers. We have a Buy rating on BYD with a 12-m SOTP-based TP of HK$61.93, 20% upside potential. Key risks: Scaling down of purchase subsidies; lower market share/OPM as competition increases; disruptive battery technologies impacting its competitive edge.

---

Goldman Sachs does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to www.gs.com/research/hedge.html. Analysts employed by non-US affiliates are not registered/qualified as research analysts with FINRA in the U.S.
Three separate systems of credits/quotas

China could eventually have three co-existing systems of credits/quotas related to fuel consumption standards/NEVs/carbon emissions: CAFC credits, NEV credits and NEV carbon quotas.

On September 22, the Ministry of Industry and Information Technology (MIIT) released draft regulation about the introduction of Corporate Average Fuel Consumption (CAFC) and the parallel New Energy Vehicle (NEV) credits systems. Key points: 1) OEMs will need to meet both CAFC and NEV targets, which are calculated separately, to receive credits; 2) OEMs with annual production volume of >50k units are required to meet a minimum NEV mix (8%/10%/12% in 2018-2020, no requirements for 2016-17); and 3) NEV credits can be purchased to make up for a deficit in CAFC credits, but not vice versa. Separately, on August 2, the National Development and Reform Commission (NDRC) proposed a NEV carbon quota system (potentially to be integrated into a nationwide carbon quota trading system) in which OEMs with a carbon quota surplus/deficit can trade/transfer quotas in the open Chinese carbon market. Details on the NEV carbon quota system are not available and it is unclear whether it will be implemented along with the CAFC/NEV credits systems in the future.

Exhibit 1: Potentially three different systems of credits/quotas to co-exist in China’s auto industry

Summary

<table>
<thead>
<tr>
<th>Date of issue</th>
<th>CAFC credits system</th>
<th>NEV credits system</th>
<th>NEV carbon quota system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 14, 2013/</td>
<td>MIIT</td>
<td>MIIT</td>
<td>NDRC</td>
</tr>
<tr>
<td>Sep 22, 2016</td>
<td>2016 (to-be-finalized)</td>
<td>2016 (to-be-finalized)</td>
<td>2017 (trial); 2018 (formal implementation)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanisms</th>
<th>CAFC credits system</th>
<th>NEV credits system</th>
<th>NEV carbon quota system</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. OEMs are required to meet government-set Corporate Average Fuel Consumption (CAFC) targets</td>
<td>1. OEMs with a certain annual production volume are required to meet a minimum New Energy Vehicle (NEV) mix</td>
<td>1. Government sets a minimum New Energy Vehicle (NEV) carbon quota</td>
<td></td>
</tr>
<tr>
<td>2. Credits surplus is allowed to be carried over or transferred</td>
<td>2. NEV credits surplus can be sold to those with NEV or CAFC credits deficit</td>
<td>2. Carbon quotas can be traded in the open Chinese carbon trading market</td>
<td></td>
</tr>
<tr>
<td>3. Credits deficit needs to be made up using credits carried over from previous years, credits transferred from related parties, or NEV credits purchased from others</td>
<td>3. NEV credits deficit can only be made up by purchasing NEV credits from those with NEV credits surplus</td>
<td>3. NEV carbon quota deficit needs to be made up by purchasing quotas from the market</td>
<td></td>
</tr>
</tbody>
</table>

Source: MIIT, NDRC.

1) CAFC credits system

The official CAFC calculation/definition was first released in 2013 (see Exhibit 2), and an amended and improved version was announced in Sept 2016. OEMs are now required to meet a set CAFC target and will be assigned credits if their fuel consumption comes in below target. They are allowed to carry over a credits surplus to the following year at a discount (80%, valid for 3 years) or transfer the surplus to related parties (>25% holding directly/indirectly). They would also need to make up any deficit by using CAFC credits carried over from previous years, CAFC credits transferred from related parties, self-generating NEV credits, or NEV credits purchased from other OEMs. OEMs who fail to comply could face penalties such as having to stop production of models with high carbon emissions.
October 5, 2016  China: Automobiles

Exhibit 2: An OEM’s CAFC is decided by each model’s fuel consumption and vol. weighting

Corporate Average Fuel Consumption (CAFC)  

\[ CAFC = \frac{\sum_{i=1}^{N} C_{i} \times V_{i}}{\sum_{i=1}^{N} V_{i}} \times W_{i} \]

- \( i \): passenger vehicle model
- \( C_{i} \): fuel consumption of model \( i \)
- \( V_{i} \): annual production/import volume of model \( i \)
- \( W_{i} \): weighting of model 
  1) For EV, FCV and PHEV with driving mileage > 50km, \( W_{i} = 5 \) in 2016-17, \( W_{i} = 3 \) in 2018-19, \( W_{i} = 2 \) in 2020 and beyond
  2) For PV with < 2.8L/100km fuel consumption, \( W_{i} = 5.5 \) in 2016-17, \( W_{i} = 2.5 \) in 2018-19, \( W_{i} = 2 \) in 2020 and beyond
  3) For all other models, \( W_{i} = 1 \)

Target Corporate Average Fuel Consumption (\( T_{CAFC} \))  

\[ T_{CAFC} = \frac{\sum_{i=1}^{N} T_{i} \times V_{i}}{\sum_{i=1}^{N} V_{i}} \]

- \( i \): passenger vehicle model
- \( T_{i} \): target fuel consumption of model \( i \)
- \( V_{i} \): annual production/import volume of model \( i \)

CAFC credits = \( T_{CAFC} \times R - CAFC \)

\[ \text{Source: MIIT, NDRC.} \]

According to the MIIT, the average fuel consumption standard targets for passenger car makers are 5.0/4.0 liter per 100 km respectively in 2020/2025, which implies a 29% fuel consumption cut by 2020 vs. 2015, followed by another 20% cut by 2025. As shown in Exhibit 4, car makers are required to satisfy CAFC targets yearly and eventually meet the 2020 target (phase IV standard). In 2015, 31 out of 116 OEMs did not meet 2015 government fuel consumption targets (average actual fuel consumption of 7.04L/100km vs. the 2015 target of 6.90L/100km); BYD products achieved the best fuel consumption among all OEMs in China in terms of actual 2015 fuel consumption gap vs. the 2020 target.

Exhibit 3: MIIT targets imply a 29% fuel consumption cut by 2020 followed by another 20% cut by 2025...

Fuel consumption target, liter/100km, 2012-2025

Exhibit 4: Car manufacturers are required to satisfy CAFC targets yearly and eventually meet the 2020 target

Fuel consumption target

<table>
<thead>
<tr>
<th>Year</th>
<th>CAFC/T_CAFC 2020</th>
<th>Annual reduction rate (percentage points)</th>
<th>CAFC (L/100km)</th>
<th>CAFC annual reduction (L/100km)</th>
<th>Annual reduction rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>140%</td>
<td>3</td>
<td>7.1</td>
<td>0.2</td>
<td>-2.8%</td>
</tr>
<tr>
<td>2015</td>
<td>138%</td>
<td>3</td>
<td>6.9</td>
<td>0.2</td>
<td>-3.1%</td>
</tr>
<tr>
<td>2016</td>
<td>134%</td>
<td>4</td>
<td>6.7</td>
<td>0.2</td>
<td>-2.9%</td>
</tr>
<tr>
<td>2017</td>
<td>128%</td>
<td>6</td>
<td>6.4</td>
<td>0.3</td>
<td>-4.5%</td>
</tr>
<tr>
<td>2018</td>
<td>120%</td>
<td>8</td>
<td>6.0</td>
<td>0.4</td>
<td>-6.3%</td>
</tr>
<tr>
<td>2019</td>
<td>110%</td>
<td>10</td>
<td>5.5</td>
<td>0.5</td>
<td>-8.3%</td>
</tr>
<tr>
<td>2020</td>
<td>100%</td>
<td>10</td>
<td>5.0</td>
<td>0.5</td>
<td>-9.1%</td>
</tr>
</tbody>
</table>

CAFC average annual decline rate during 2016-2020: -6.2%

\[ \text{Source: MIIT.} \]
Exhibit 5: BYD achieved the best fuel consumption among all OEMs in China in 2015
Actual FY2015 fuel consumption vs. 2020 fuel consumption government target (phase IV standard)

Source: MIIT, iCET.
In order to meet the strict phase IV fuel consumption targets by 2020, i.e., reduce fuel consumption by 29% between 2015 and 2020, we believe OEMs might adopt a combination of the following measures:

- **Improve fuel efficiency of internal combustion engine (ICE) cars**: Fuel efficiency improvement could be improved via light-weighting, turbo-charging, engine-downsizing, transmission optimization and other related technologies.

- **Introduce more HEVs (Hybrid Electric Vehicles)**: HEVs have been around for a long time and were rolled out in car markets to reduce fuel emissions globally given their relatively low costs versus pure electric vehicles (EVs), but the level of electrification is lower than EVs/PHEVs (plug-in hybrid vehicles). The Chinese government excludes hybrids from the definition of NEVs.

- **Introduce more NEVs to lower the weighted average fuel consumption levels**: the draft measures propose allocating a “super credit” for NEV cars when calculating the CAFC (see Exhibit 6). As the costs of complying with the required improvement in fuel efficiency for ICE (internal combustion engine) cars grow, we believe that increasing the amount of NEVs in the sales mix (with the help of the “super credit”) would make sense to OEMs in term of cost-efficiency.

See Exhibit 7 for our view on how the three measures above could be leveraged to meet 2020 fuel consumption targets.

We consider two additional factors which could also influence the evolution of car industry fuel consumption between 2015 and 2020:

- **Consumption preferences for SUV to lead to higher fuel consumption**: In China, the SUV volume mix increased from 11% in 2010 to 34% in 1H16, and we expect it to increase further to ~40% in 2020 on consumer preference and new product offerings. Comparing a SUV sharing the same chassis as a sedan, we observe that fuel consumption is higher for the SUV. For example, FAW Toyota’s RAV 4 SUV is equipped with a 2.0L/2.5L engine and its fuel consumption is 7.3-8.7 liter/100km, while the Corolla sedan (based on a similar platform) is equipped with a 1.6L/1.8L engine and its fuel consumption is 5.9-6.3 liter/100km. Hence, we expect that a consumption trend towards SUVs will increase fuel consumption of the industry by 0.17 liter/100km in 2015-2020.

- **A potential buffer for compliance with fuel efficiency standards**: In line with practices in developed countries, e.g., the US which provides a scheme of TLAAS (Optional Temporary Lead-time Allowance Alternative Standards) to give more time for certain OEMs to meet CO2 emissions standards, it is possible the authorities could provide a buffer for selective OEMs (e.g., luxury car importers) before requiring their full compliance. This could be around 5% of the required emissions level, in line with the number of imported passenger cars in 2015 as a percentage of the total new car market in China, as these cars tend to be high in fuel consumption and may need longer to comply.

Our forecast of 1.4mn units of NEV passenger car sales volume in 2020 is primarily based on the 0.88 liter/100km fuel consumption reduction needed from NEV roll-out for the auto industry to meet the MIIT fuel consumption target (See *BYD Co. (1211.HK) Buy: Electrifying the world’s largest new car market; reinstate at Buy*, Aug 31, 2016 for more details).
Exhibit 6: With the help of the super credits, more NEVs in the sales mix would improve OEM's cost efficiency
Weighting of models for CAFC calculation

<table>
<thead>
<tr>
<th></th>
<th>EV, FCV and PHEV with driving mileage &gt;50km</th>
<th>PV with &lt;2.8L/100km fuel consumption</th>
<th>All other models</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-2017</td>
<td>5X</td>
<td>3.5X</td>
<td>1X</td>
</tr>
<tr>
<td>2018-2019</td>
<td>3X</td>
<td>2.5X</td>
<td>1X</td>
</tr>
<tr>
<td>2020 and beyond</td>
<td>2X</td>
<td>1.5X</td>
<td>1X</td>
</tr>
</tbody>
</table>

Exhibit 7: We expect emissions reduction in China to mainly be driven by ICE improvement and NEV roll-out
Walkthrough from 2015 actual fuel consumption to 2020 target, liter/100km

Exhibit 8: Overall NEV credits are decided by NEV credits per model, sales volume and target NEV mix

NEV credits = \sum_{i=1}^{k} NEV credits_i \times V_i - V_{non NEV} \times Target NEV mix

Note: 1) \(NEV \ credits_i\) : the NEV credits for a car model (depends on the NEV type and mileage); 2) \(V_i\) : production/import volume of car model \(i\); 3) \(V_{non NEV}\) : the total production/import volume of non NEVs

2) NEV credits system

In September 2016, the draft NEV credits system, which is most comparable to the long-standing Zero Emission Vehicle (ZEV) regulation in California, was proposed along with a modified CAFC credits system. Under the MIIT proposals, the CAFC and NEV credits systems will run in parallel and be mutually complementing. OEMs with a certain annual production volume (>50k units) are required to meet a minimum NEV mix (8%/10%/12% in 2018-2020) regardless of their compliance with CAFC standards. NEV credits surpluses can be sold to those OEMs with NEV or CAFC credit deficits, while a deficit of NEV credits can only be made up by purchasing NEV credits from those with surplus NEV credits. OEMs who fail to comply with NEV credits requirements could face penalties such as stopping production of models with high carbon emissions.

Exhibit 9: Our NEV penetration forecast is below the government’s target NEV mix

GHe NEV mix vs. govt target NEV mix (% of NEV/total output)

Note: MIIT does not clearly define the government target NEV mix calculation, but irrespective of which denominator (total vehicles volume or total non-NEV volume) we use to calculate the mix, our NEV penetration forecast is lower than the government’s target NEV mix

Source: MIIT, Gao Hua Securities Research.
3) NEV carbon quota system

The draft of the NEV carbon quota system was released in August 2016, and it could become part of the nationwide carbon quota trading system. The government will set a minimum NEV carbon quota for each OEM based on vehicle volumes, product mix, as well as a target NEV mix. The carbon quota can be traded in the open Chinese carbon trading market, and OEMs with deficits are required to make those up by purchasing quota from the market. OEMs that fail to comply face financial penalties. OEMs with high NEV volumes could potentially receive extra income from NEV carbon quota trading. Details of the NEV carbon quota system (e.g., how to calculate the carbon saving per NEV model) are not available, and it is unclear whether it will be implemented in parallel with the other two (CAFC/NEV) systems of credits.

Of the 3 systems, the CAFC and NEV credits systems are to be executed in parallel, while the connection to the NEV carbon quota system is not clear yet

As discussed earlier, the CAFC and NEV credits systems are to be executed in parallel, and we expect this to amplify the importance of NEVs in lowering the fuel consumption of the auto industry as: 1) OEMs with a certain annual production volume (>50k units) are required to meet a minimum target NEV mix (8%/10%/12% in 2018-2020, no requirements for 2016-17), thus making it compulsory to produce a certain percentage of NEVs regardless of CAFC compliance; 2) with the help of the “super credit” increasing the denominator when calculating CAFC, increasing the amount of NEVs in the sales mix would make sense for OEMs in terms of cost-efficiency; 3) Surpluses of NEV credits can be purchased to make up for the deficit in CAFC credits, but not vice versa, which enhances the importance of NEVs in cutting fuel emissions further.

Exhibit 10: CAFC and NEV Credits systems are to be executed in parallel to amplify the importance of NEVs in reducing fuel consumption across the Chinese auto industry

Source: MIIT.
On the other hand, the details of the NEV carbon quota system are not available yet, so we do not know whether or not the three systems will work simultaneously; if yes, then we still see the potential for inconsistencies between them.

Potential risks and inconsistencies

Complication in implementation and potential conflicts among the three systems
The CAFC credits system/NEV credits system /NEV carbon trading system all target different purposes which overlap but are not exactly the same. We see potential complications in implementation (e.g., 3 sets of different calculations to each OEM) as well as potential conflicts among the 3 systems, e.g., an OEM might promote HEV sales and achieve very good fuel efficiency (good for CAFC credits) but fail to comply with NEV credits as HEVs are excluded from the scope of NEVs.

Potentially low credits income for OEMs due to decrease in value
With the help of the “super credit”, OEMs might find it easy to meet emissions standards by actively developing NEVs. With significant benefits of producing NEVs, we might observe NEV credits oversupply which could lead to a drop in the value of credits, thus lowering the potential credit income to OEMs. Taking Tesla as an example, its average ZEV revenue per electric vehicle decreased from USD4,938 in 2010 to USD3,337 in 2015, with NEV volumes ramping up fast.

Shelter for import vehicles with high fuel consumption
According to the CAFC credits system, OEMs are allowed to transfer positive credits to related parties (>25% holding directly/indirectly), which raises a concern that, within a group, one or two OEMs that actively produce NEVs could transfer credits to its related OEMs with poor fuel emissions compliance or be able to import vehicles with high fuel consumption, thus counteracting the overall reduction in fuel emissions.

Lack of credit systems for commercial vehicles
Currently, all credit systems in China are only designed for passenger vehicles and there is no fuel emissions standard or credits system for commercial vehicles. In 2015, most government subsidies went to commercial vehicles, which are supposed to play an important role in reducing fuel consumption. Therefore, we expect more policies around commercial vehicles’ fuel emissions standards and a related credits system to be released.
New credits/quotas should boost China’s NEV market

In conclusion, we believe the three systems of credits/quotas have the potential to boost the NEV market as: 1) achieving a certain level of NEV volumes is now a ‘must’ for OEMs to meet the NEV credits requirement vs. previously ‘one of many options’ to meet CAFC standards; 2) OEMs with high NEV volumes could receive additional income from credit/quota trading; and 3) NEV credits can be purchased to make up for a deficit in CAFC credits, but not vice versa, which enhances the importance of NEVs as a way of meeting targets for both CAFC and NEV credits.

Per the government’s policy, NEV purchase subsidies are scaling down and they are due to fully expire by the end of 2020, which has led to investors’ concerns on the sustainability of NEV market growth in China. We expect contributions from the proposed NEV credits trading to partially offset the negative impact of declining NEV purchase subsidies. The income from NEV credits trading will not be paid by the government but traded between OEMs who fail to comply (a penalty) and those who achieve better than the required NEV mix (a bonus).

Even so, as discussed in BYD Co. (1211.HK) Buy: Electrifying the world’s largest new car market; reinstate at Buy, Aug 31, 2016, we believe the impact of purchase subsidies expiration should be limited given we expect: i) subsidies to shift from purchase to usage, such as NEV license plate value, charging infrastructure rewards etc., and ii) the price of NEVs to drop with declining battery costs.

We remain positive on the long-term growth outlook for China’s NEV industry. As discussed in our BYD report mentioned above, we expect China’s NEV market to sustain a 27.9% CAGR (2015-2025E) to reach 3.9mn units sold in 2025E, more than 10X the 331k units sold in 2015. This growth should be primarily driven by: 1) stricter 2020/2025 passenger car fuel consumption standards, 2) our expectation that the continuation of preferential policies and sustained total cost of ownership should remain an advantage for NEVs beyond 2020E after expiration of the current purchase subsidy scheme, and 3) new demand from electric logistic (e-logistic) vehicles, which we believe is the fastest growing sub-segment in the new energy commercial vehicle space.

Exhibit 11: We expect NEV sales volume to grow at a CAGR of 27.9% in 2015-25 in China

Sales volume of new energy CV, PHEV cars and EV cars (‘000) in China

<table>
<thead>
<tr>
<th>Year</th>
<th>New energy CV sales volume</th>
<th>PHEV car sales volume</th>
<th>EV car sales volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2015-2025E CAGR: 27.9%

Source: CAAM, Gao Hua Securities Research
NEV leaders to benefit most from the new regulations

NEV leaders in China like BYD and JAC look set to benefit the most from the new regulations mainly because: 1) they could sell NEV credits to others to gain additional revenue; 2) they are less likely to pay financial penalties for failing to meet emissions standards; 3) with front-loaded R&D/investment in NEV and engine improvements, they are likely to have to invest less than newcomers to meet the government’s CAFC/NEV requirements, thus impacting their margins less.

Exhibit 12: BYD, BAIC and Jianghuai are top three new energy passenger car makers in China in terms of sales volume

New energy passenger car sales volume (units) and market share (%), 2016H1

![Exhibit 12](image-url)

Source: CPCA.

Of the companies under our coverage, BYD, JAC and Geely had the highest exposure to new energy passenger cars in 2016H1. For BYD, around 25% of passenger cars it sold in the first half of 2016 were NEVs, much higher than competitors (Exhibit 13). Separately, JAC is also actively developing NEVs, and it signed a joint venture agreement with Volkswagen on September 8, 2016 to produce NEVs. We would expect these NEV leaders to benefit the most from the proposed systems of credits and quotas.

Exhibit 13: BYD, JAC and Geely have the highest exposure to new energy passenger cars

New energy passenger car volume as % of total passenger car volume by list companies under our coverage, 2016H1

![Exhibit 13](image-url)

Source: CPCA, company data.
BYD snapshot: No. 1 market share in both NEV sales volume and NEV battery

BYD was the biggest NEV maker globally in 2015, selling 58k units and capturing an 11% market share. BYD Qin and BYD Tang both ranked in the Top 10 most popular NEV models globally in 2015. In China’s NEV market, BYD is a clear leader, with an 18% market share of new cars sold in 2015. We expect the company to sustain its leadership position and to grow its market share to 20% by 2020E thanks to its strong product cycle in the NEV space and also its first-mover advantage.

As well as its leading position in NEVs globally, BYD also has leading EV battery capacity market share in China as well. We expect its battery capacity to expand to 34 GWh in 2020E (vs. 10 GWh currently), taking 26% share in China.

We note also that BYD achieved the best fuel consumption among all OEMs in China in 2015.

Exhibit 14: BYD is a clear NEV leader in China
BYD NEV sales volume (‘000) and market share (%) in China

Exhibit 15: BYD has leading auto battery capacity and market share in China as well
BYD battery capacity (GWh) and market share (%) in China

Source: Company data, CAAM, Gao Hua Securities Research.
Appendix: Case study: Proposed China NEV credits system most comparable to US ZEV regulation

California introduced ZEV regulations in the 1990s in order to lower emissions of vehicles

The Zero Emission Vehicle (ZEV) regulation was introduced by the California Air Resources Board (ARB) in the 1990s to reduce vehicles’ fuel emissions, and, with continuous improvements, it has progressed to be one of the most successful (in terms of promoting the low emission vehicle) and well-known systems on vehicle emissions tightening globally. Besides California, 11 other states in the US have adopted the ZEV regulation.

Exhibit 16: ZEV regulation is a successful system in the US to tighten fuel emissions of vehicles
An illustration of the ZEV credits program in California, US

The regulations apply to auto OEMs with a certain annual production volume which are required to meet a certain ZEVs percentage of total vehicles. According to different emission levels, the regulations classify vehicles into five categories (see Exhibit 17), and corresponding credits are granted to OEMs for each qualifying vehicle they produce.
Exhibit 17: The regulations classify vehicles into five categories; with tightening regulation, ATPZEV (incl. NEV) and PZET will not receive ZEV credits from 2018
5 categories in ZEV classifications and credits details

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ZEV (Zero Emission Vehicle)</td>
<td>Battery Electric Vehicle (BEV), Hydrogen Fuel Cell Vehicle</td>
<td>1-9 (by mileage range)</td>
<td>1-4 (by mileage range)</td>
<td>Nissan LEAF</td>
</tr>
<tr>
<td>TZEV (Transitional Zero Emission Vehicle)</td>
<td>Plug-in Hybrid (PHEV) or Extended Range Electric Vehicle (EREV), Hydrogen Internal Combustion Engine Vehicle</td>
<td>1-3 (by technology)</td>
<td>0.4-1.3 (by mileage range)</td>
<td>Chevrolet Volt</td>
</tr>
<tr>
<td>NEV (Neighborhood Electric Vehicle)</td>
<td>Short-range, Low-speed Battery Electric Vehicle</td>
<td>0.3</td>
<td>0.15 if specific requirements met</td>
<td>Polaris GEM</td>
</tr>
<tr>
<td>AT PZEV (Advanced Technology Partial Zero Emission Vehicle)</td>
<td>Natural Gas Vehicle, Hybrid Electric Vehicle (HEV)</td>
<td>0.2-3 (by technology)</td>
<td>×</td>
<td>Toyota Prius</td>
</tr>
<tr>
<td>PZEV (Partial Zero Emission Vehicle)</td>
<td>Extremely Clean Conventional Vehicle (with a 15-year or 150,000-mile warranty on its emission-control components and zero evaporative emissions)</td>
<td>0.2</td>
<td>×</td>
<td>Ford Focus</td>
</tr>
</tbody>
</table>

Source: ARB, Center for Climate and Energy Solutions.

Under the regulation, excess ZEV credits could be traded and transferred between auto OEMs through confidential agreements (the value of credits is determined by the market supply-demand situation and is negotiated between the buyer and seller of credits), or “banked” for future use. Revenue from ZEV credits could make considerable revenue/profits contribution to electric vehicle makers like Tesla or other OEMs that produce a high volume of ZEVs.

Exhibit 18: ZEV credits revenue could make considerable revenue/profits contribution to electric vehicle makers
Tesla ZEV/Other Credits revenue (USD mn) and as % of total revenue

Source: Tesla.

On the other hand, an OEM with a ZEV deficit is given additional two years to make up for the deficit by either purchasing credits from other OEMs or getting extra credits itself by producing more ZEVs. However, if it still fails to comply after the grace period, the manufacturer is subject to a penalty of USD 5,000 for each vehicle that does not meet the emission standards.
**ZEV regulations are tightening from 2018, with HEVs excluded; PHEVs, EVs and FCVs to gain importance**

The ZEV credit system includes hybrids (HEVs) through 2017, but from 2018 HEVs will be excluded and credits will only be available for PHEVs, EVs, and FCVs. The ZEV system is also set to change in accordance with the UDDS (Urban Dynamometer Driving Schedule) range and the length of charge time – the longer the UDDS range and the faster the charge, the more credits a vehicle is eligible for. Several other states, including New York, are planning to introduce ZEV regulations, making the technical hurdles for automakers even higher.

**Exhibit 19: ZEV regulations head for a new phase, with HEVs excluded, and only PHEVs, EVs, and FCVs included after 2018**

California ZEV regulation schedule and credit requirements (ZEVs production volume as a percentage of total vehicle production volume)

<table>
<thead>
<tr>
<th>Year</th>
<th>ZEVs</th>
<th>TZEV/NEVs</th>
<th>AT-PZEV</th>
<th>PZEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>4%</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009-2011</td>
<td>5%</td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012-2014</td>
<td>2.2%</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015-2017</td>
<td>3%</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>ZEV</td>
<td>TZEV/NEV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
<td>12%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td></td>
<td>14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td></td>
<td>16%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CEPA.

**Proposed NEV credits system in China is most comparable to the US ZEV system**

ZEV regulation in the US is most comparable to the proposed NEV credits system in China. The Chinese government has learnt from the experiences of the ZEV system and proposes to introduce the NEV credits system in parallel with CAFC credits to further enhance the importance of NEVs in cutting fuel emissions.

In line with the positive effect of the ZEV system on US NEV sales, we believe the potential introduction of three different credit/quota systems from the Chinese government might boost the NEV industry in the medium-to-long-term, especially with purchase subsidies scaling down.
Disclosure Appendix

Reg AC

We, Yipeng Yang, Yuqian Ding and Longjin Li, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Investment Profile

The Goldman Sachs Investment Profile provides investment context for a security by comparing key attributes of that security to its peer group and market. The four key attributes depicted are: growth, returns, multiple and volatility. Growth, returns and multiple are indexed based on composites of several methodologies to determine the stocks percentile ranking within the region’s coverage universe.

The precise calculation of each metric may vary depending on the fiscal year, industry and region but the standard approach is as follows:

Growth is a composite of next year's estimate over current year’s estimate, e.g. EPS, EBITDA, Revenue. Return is a year one prospective aggregate of various return on capital measures, e.g. CROCI, ROACE, and ROE. Multiple is a composite of one-year forward valuation ratios, e.g. P/E, dividend yield, EV/FCF, EV/EBITDA, EV/DACF, Price/Book. Volatility is measured as trailing twelve-month volatility adjusted for dividends.

Quantum

Quantum is Goldman Sachs’ proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

GS SUSTAIN

GS SUSTAIN is a global investment strategy aimed at long-term, long-only performance with a low turnover of ideas. The GS SUSTAIN focus list includes leaders our analysis shows to be well positioned to deliver long term outperformance through sustained competitive advantage and superior returns on capital relative to their global industry peers. Leaders are identified based on quantifiable analysis of three aspects of corporate performance: cash return on cash invested, industry positioning and management quality (the effectiveness of companies’ management of the environmental, social and governance issues facing their industry).

Disclosures

Coverage group(s) of stocks by primary analyst(s)

Yipeng Yang: China Autos. Yuqian Ding: China Autos.


Company-specific regulatory disclosures

The following disclosures relate to relationships between The Goldman Sachs Group, Inc. (with its affiliates, “Goldman Sachs”) and companies covered by the Global Investment Research Division of Goldman Sachs and referred to in this research.

Goldman Sachs beneficially owned 1% or more of common equity (excluding positions managed by affiliates and business units not required to be aggregated under US securities law) as of the second most recent month end: BYD Co. (HK$51.45)

Goldman Sachs has received compensation for investment banking services in the past 12 months: BYD Co. (HK$51.45)

Goldman Sachs expects to receive or intends to seek compensation for investment banking services in the next 3 months: BYD Co. (HK$51.45)

Goldman Sachs had an investment banking services client relationship during the past 12 months with: BYD Co. (HK$51.45)

Goldman Sachs had a non-securities services client relationship during the past 12 months with: BYD Co. (HK$51.45)

Goldman Sachs makes a market in the securities or derivatives thereof: BYD Co. (HK$51.45)

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

<table>
<thead>
<tr>
<th>Rating Distribution</th>
<th>Buy</th>
<th>Hold</th>
<th>Sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>31%</td>
<td>54%</td>
<td>15%</td>
</tr>
</tbody>
</table>

As of July 1, 2016, Goldman Sachs Global Investment Research had investment ratings on 2,963 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See ‘Ratings, Coverage groups and views and related definitions’ below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

Goldman Sachs Global Investment Research
The price targets shown should be considered in the context of all prior published Goldman Sachs research, which may or may not have included prior price targets, as well as developments related to the company, its industry and financial markets.

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or related derivatives) of issuers discussed in this report.

The following are additional required disclosures: Ownership and material conflicts of interest: Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst’s area of coverage. Analyst compensation: Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. Analysts are prohibited from discussing with an analyst or director of Goldman Sachs policy prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director, advisory board member or employee of any company in the analyst’s area of coverage. Non-U.S. Analysts: Non-U.S. analysts may not be associated persons of Goldman, Sachs & Co. and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Distribution of ratings: See the distribution of ratings disclosure above. Price chart: See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at http://www.gs.com/research/hedge.html.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. Australia: Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for “wholesale clients” within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the issuers the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. Brazil: Disclosure information in relation to CVM Instruction 483 is available at http://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 16 of CVM Instruction 483, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. Canada: Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above). Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. Hong Kong: Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C., Seoul Branch. New Zealand: Goldman Sachs New Zealand Limited and its affiliates are neither “registered banks” nor “deposit takers” as defined in the Reserve Bank of New Zealand Act 1989 in New Zealand. This research, and any access to it, is intended for “wholesale clients” (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. Russia: Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Singapore: Further information on the covered companies referred to in this report may be obtained from Goldman Sachs (Singapore) Pte. Co. Number 198902165W. Taiwan: This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. United Kingdom: Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.


Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms.

Goldman Sachs Global Investment Research
Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage groups and views and related definitions

Buy (B), Neutral (N), Sell (S) - Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's return potential relative to its coverage group as described below. Any stock not assigned as a Buy or a Sell on an Investment List is deemed Neutral. Each regional Investment Review Committee manages various regional Investment Lists to a global guideline of 25%-35% of stocks as Buy and 10%-15% of stocks as Sell; however, the distribution of Buys and Sells in any particular coverage group may vary as determined by the regional Investment Review Committee. Regional Conviction Buy and Sell lists represent investment recommendations focused on either the size of the potential return or the likelihood of the realization of the return.

Return potential represents the price differential between the current share price and the price target expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage groups and views: A list of all stocks in each coverage group is available by primary analyst, stock and coverage group at http://www.gs.com/research/hedge.html. The analyst assigns one of the following coverage views which represents the analyst's investment outlook on the coverage group relative to the group's historical fundamentals and/or valuation. Attractive (A). The investment outlook over the following 12 months is favorable relative to the coverage group's historical fundamentals and/or valuation. Neutral (N). The investment outlook over the following 12 months is neutral relative to the coverage group's historical fundamentals and/or valuation. Cautious (C). The investment outlook over the following 12 months is unfavorable relative to the coverage group's historical fundamentals and/or valuation. Not Rated (NR). The investment rating and target price have been removed pursuant to Goldman Sachs policy when Goldman Sachs is in an advisory capacity in a merger or strategic transaction involving this company and in certain other circumstances. Rating Suspended (RS). Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining, or there are legal, regulatory or policy constraints around publishing, an investment rating or target. The previous investment rating and price target, if any, are no longer in effect for this stock and should not be relied upon. Coverage Suspended (CS). Goldman Sachs has suspended coverage of this company. Not Covered (NC). Goldman Sachs does not cover this company. Not Available or Not Applicable (NA). The information is not available for display or is not applicable. Not Meaningful (NM). The information is not meaningful and is therefore excluded.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce equity research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; in Canada by either Goldman Sachs Canada Inc. or Goldman, Sachs & Co.; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198802168W); and in the United States of America by Goldman, Sachs & Co. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman Sachs AG and Goldman Sachs International Zweigniederlassung Frankfurt, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also distribute research in Germany.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman, Sachs & Co., the United States broker dealer, is a member of SIPC (http://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst’s published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage group as described herein.

We and our affiliates, officers, directors, and employees, excluding equity and credit analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them...
may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options disclosure documents which are available from Goldman Sachs sales representatives or at http://www.theocc.com/about/publications/character-risks.jsp. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data available on a particular security, please contact your sales representative or go to http://360.gs.com.

Disclosure information is also available at http://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.

© 2016 Goldman Sachs.

No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.