BestEV: The design of China's first Crowed EV Ranking

The Innovation Center for Energy and Transportation

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Authors

Maya Ben Dror, Lanzhi Qin, Liping Kang, Feng An

Disclosure

The report does not represent the views of its funders nor supporters.

Innovation Center for Energy and Transportation

Room 1904, e-Tower Building
Guanghua Road no.12, Chaoyang District, Beijing
Tel: 010 -65857324

Email: info@icet.org.cn
Website: www.icet.org.cn

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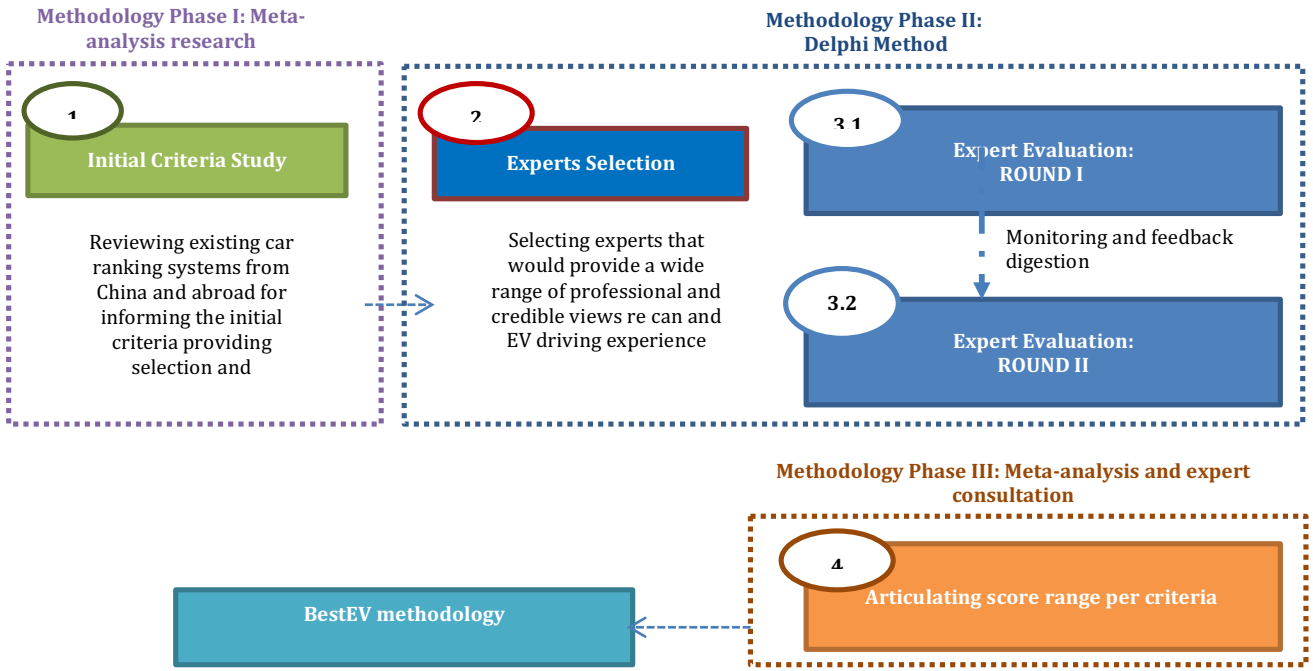
Executive Summary

In many mid- and large-sized cities in China, vehicle emissions have been identified as a primary source of air pollution. Since socio-economic mobility has not yet been decoupled from car ownership, and despite car purchase limitations in major cities, the automotive industry is a pillar economic engine and projected to continue performing as one for years to come. In order to improve air quality and reduce traffic emissions, national and local governments are promoting New Energy Vehicles (NEVs).

Central and local governments are providing financial and regulatory support for NEVs, but private demand faces a dilemma: On one hand, the ease of purchase and subsidies appeal to consumers, yet on the other hand incomplete infrastructure, limited selection options and battery concerns constitute obstacles to purchases in many cases. Moreover, the desires and tendencies of consumers (as well as retailers and auto marketing companies) when comparing NEV with ICE vehicles are somewhat misleading, because electric cars offer a very different ownership and driving experience.

The Innovation Center for Energy and Transportation (*i*CET), an independent think tank working in the area of low-carbon and clean transportation, air quality and climate change, has promoted general public awareness of clean cars and NEVs in recent years while also researching, studying and informing the public about the policy making process and car companies (e.g. fuel consumption, life-cycle analysis of vehicles etc.). Funded by the Energy Foundation and the Rockefeller Brothers Fund, the BestEV project is designed to educate consumers and help them choose the best performing electric car, as well as inspire manufacturers to supply consumers with new exciting purchase choices. BestEV is based on consumers' real driving experiences, evaluated through a system carefully designed in collaboration with many experts from the EV ecosystem.

Figure 1: BestEV methodology Development Process



The BestEV evaluation system relies on criteria selected and weighted trough a clear methodological process (**Figure 1**): first, initial criteria were selected based on an analysis of 10 global and local leading auto ranking systems (**Table 1** – Stage 1); then, 28 experts representing the auto and EV ecosystem were consulted through a Delphi Method for refining the criteria and setting their weights (**Table 1** – Stage 3); finally, a Consensus Development Conferencing (CDC) was employed for finalizing the criteria through consultation with 23 experts (**Table 2**).

Table 1: Advanced Criteria and Weighting Based on the Delphi Method Study Results

Suggested Criteria and Measurement Guidance		Initial Criteria Ranked via Meta-analysis [Stage 1]	Delphi Average weight (%) [Stage 3 - Weight]	Final Average weight (%) [Stage 4 - Weight]
1	**Range**	1	11.8%	12%
2	**Ownership Cost**	N/A	8.9%	N/A
3	**Slow Charging time**	N/A	5.9%	6%
4	**Energy efficiency**	8	4.7%	12%
5	**Acceleration**	2	4.6%	12%
6	**Max speed**	6	3.4%	8%
7	**Fast Charging time**	7*	2.9%	4%
8	**Warranty period**		2.6%	7%
9	**Battery Capacity**	5	2.3%	6%
10	**Vehicle weight**	3	1.6%	6%
*	**Max Power for e-Motor**	4	1.2%	N/A
*	**Insurance expenses**	N/A	0.4%	N/A
11+	**Real range**	N/A	N/A	12%
12+	**Real trickle charging time**	N/A	N/A	6%
13+	**Real fast charging time**	N/A	N/A	4%
14+	**Battery decay at low temperature**	N/A	N/A	5%
Sub-total（10）			50% (10 criteria)	100% (14 criteria)
11	**Reliability:** Volume of operation incidence	9	6.8%	14%

12	**Driving performance:** Does it feel like you are becoming one with the car? Braking, Steering, Handling, Drivability, Shift quality	1	6.2%	12%
13	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags	7	5.9%	12%
14	**Service:** After-sales -service quality, Purchase experience, Service and dealer facilities	11	4.5%	10%
15	**Charging convenience:** Charging compatibility, Charging infrastructure availability	13	4.4%	8%
16	**Exterior quality/mechanics:** How does it feel? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	6	2.8%	Added to #21
17	**Brand awareness and perception:** brand value	12	2.8%	5%
18	**In-car e-driving related telematics:** How indicative the car is of its own state of drive? Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc.	14	2.7%	8%
19	**Interior design and comfort:** How well is it serving your daily use? Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	2	2.7%	10%
20	**Technical Features and Instruments Panel (Add-ons):** Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies	10	2.4%	Added to #18
21	**Style/exterior design:** How does it look from the outside? Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring	5	1.7%	10%
*	**Chassis system quality:** Shock resistance system, durability and friction of tires	15	1.4%	3%
*	**Cargo/load space**	16	1.4%	3%
*	**In-car smart network system**	N/A	1.4%	Added to #18
*	**Car Driving Ergonomics:** How easy to use? complications/simplification of operation, logical and well placed control/function	3	1.3%	Added to #19
*	**Electric drive:** Motor (engine) and transmission quality for HPEV, Electric power	8	1.1%	N/A
Sub-total			50% (11 criteria)	100% (11 criteria)

Total		100% (21 criteria)	200% (25 criteria)

+ Criteria added in the final stage (Stage 4).

** Criteria yet to be included due to lack of consistency with the pre-defined requirements or since suggested by experts participating in the Delphi method.*

Table 2: Final Criteria and Weighting (including CDC results)

	Suggested criteria and Measurement Guidance	Final Weight (%)	Weighting rationale
	Quantitative criteria (official data)		
1	**Range**	12%	Core index for EVs, which is also most concerned by consumers
2	**Acceleration**	12%	Index influencing EVs' dynamic performance
3	**Energy efficiency**	12%	Influencing the economic and energy efficiency of EVs
4	**Max speed**	8%	Index related to driving experience and highway driving
5	**Warranty period**	7%	Influencing the economic efficiency and usage convenience of EVs
6	**Charging time**	6%	Important index for consumers using EVs
7	**Battery capacity**	6%	Index related to driving mileage
8	**Vehicle weight**	6%	Index related to the dynamics and economic efficiency of EVs
9	**Fast charging time**	4%	Important index for consumers using EVs
	Quantitative criteria (real data based on consumer reporting)		
10	**Real range**	12%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
11	**Real trickle charging time**	6%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
12	**Real fast charging time**	4%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
*	**Battery decay at low temperature**	5%	This can be an add-on criteria, consumers live in the place where the low temperature has severe impact on EVs think more about it; others can raise some other criteria
sub-summary (12)		100%	
13	**Reliability:** Volume of operation incidence	14%	Reflecting changes of dynamic system

14	**Driving performance:** Does it feel like you are becoming one with the car? Braking, Steering, Handling, Drivability, Shift quality	12%	Influencing driving experience and feelings
15	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags	12%	Core index for EVs, which is also most concerned by consumers
16	**Service:** After-sales -service quality, Purchase experience, Service and dealer facilities	10%	Reflecting convenience and promptness of service
17	**Interior design and ergonomics:** How well is it serving your daily use? Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	10%	Intuitive sense of consumers
18	**Exterior quality/mechanics and Style:** How does it feel and look? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	10%	Index considered more by young consumers, influencing EV usage
19	**Charging convenience:** Charging compatibility	8%	Influencing EV usage and reflecting the availability of EVs
20	**In-car e-driving related telematics and smart network system:** How indicative the car is of its own state of drive? Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc. Also add-ons that contribute to comfort of use and fun (e.g. stereo system etc.)	8%	Important index for EVs
21	**Brand awareness and perception:** brand value	5%	Influencing the purchase tendency of consumers
22	**Chassis system quality: Shock resistance system, durability and friction of tires**	3%	Index influencing safety and driving experience of EVs
23	**Cargo/load space**	3%	Index related to the practicality of EVs
*	**Other important criteria**	5%	This can be an add-on criteria, consumers can select other criteria they think important
Sub-summary (11)		100%	

By comparing the initial criteria (**Table 1** – Stage 1) with the results of Delphi round I (**Table 1** – Stage 3), it is clear that beyond the additional criteria suggested by experts ("fast charging", "warranty period", "insurance expenses"), a criteria originally considered to be qualitative was suggested to actually be quantitative ("ownership costs"). Some criteria were found to be too general and experts suggested more detailed evaluations ("in-car smart network system" – was extracted from the original criteria "Technical Features and Instruments Panel Add-ons"). Therefore the quantitative value rose from 8 to 11 following Delphi round I of experts review, while qualitative value stayed at 16. The results of round II of the Delphi

survey for determining the BestEV criteria and weights yielded mainly minor "sharpening" requirements for weighting. Some criteria that were found useful in Delphi round I failed to meet the majority recognition threshold ("insurance expenses", "in-car smart network systems") – e.g. did not reach 50% voting or 2% average weighting.

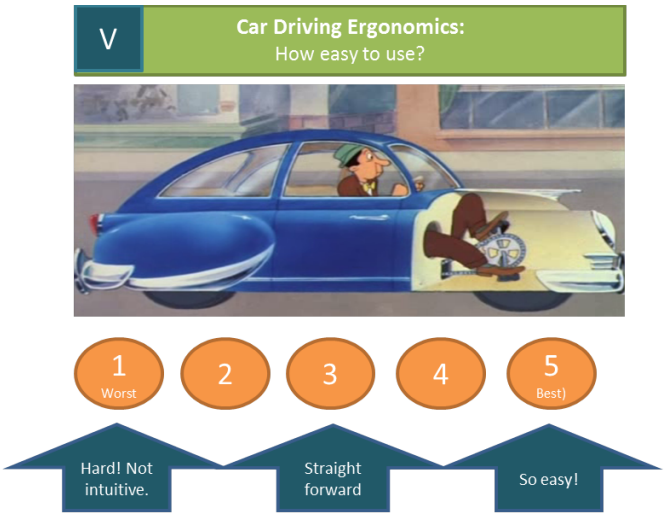
The CDC have yielded interesting insights that have informed the finalization of the criteria (**Table 2**), as well as inspired the creation of a steering committee for BestEV methodological improvements going forward. For example: *Vehicle cost range* criteria should be excluded, as it is an external factor the vehicle performance assessment: people tend to set on a price range before advancing their search for a suitable model to buy. Alternatively, the ranking results should be presented in groups – price range groups ("Luxury" for >400k RMB worth cars, "Economic" for <200k RMB worth cars, and "Standard" for the rest); The proportion of quantitative and qualitative indicators was redefined – from 50% to 100% each; then, for each car cost range, the interplay of qualitative and quantitative criteria could be adjusted according to the mainstream audiences' assumed preferences: Luxury (Quantitative : Qualitative = 40:60) , Standard (Quantitative : Qualitative = 50: 50), Economic (Quantitative : Qualitative = 60: 40); Some quantitative criteria scoring will be based on official information provided by auto companies and therefore may have credibility issues, so in order to overcome this challenge, new similar quantitative criteria were added to the qualitative evaluation process for enabling drivers to fill in based on their actual experiences. For example: *Vehicle driving range*, *Fast charging time*, *Slow charging time*.

Since the EV market is still nascent in China in terms of vehicle variety and consumers' familiarity of EVs, the BestEV methodology will be reconsidered on an annual basis and in accordance with the views of its standing committee members. The actual evaluation has a set methodology to it as well: quantitative indicators would be done internally by iCET according to a clear and transparent linear relative ranking of models (1-5 scale, see example in **Table 3**); qualitative evaluation will be subjective but directed by guiding illustrations (see example in **Figure 2**).

Table 3: BestEV Quantitative Evaluation Example

Suggested criteria and Measurement Guidance		★★★★★	★★★★	★★★	★★	★
Example	Max speed (km/h)	180-225	150-180	110-130	80-110	50-80

Figure 2: BestEV Qualitative Evaluation Example



The authors and supporters of this work invite you to take proactive part by joining our efforts through consultation and distribution of the BestEV marketing materials.

1. Introduction

Despite national and local policy efforts to accelerate NEV commercialization by continuously strengthening consumer benefits, Chinese consumers are still reluctant to vote for NEVs through their purchase choices. Studies point out that since consumers often compare EV performance to that of the better-understood ICE counterparts, major benefits of EV usage are typically overlooked. This can be added to the more well understood gap in infrastructure installation challenges posed by building management (should a potential EV owner own a property) and urban planners (should public charging be required for smoothing EVs' user experience). Other reasons include range anxiety and weak user incentives (e.g. preferential electricity rates, preferential status while driving through congestion or parking).

Although gaps for encouraging adoption exist, the national government places great importance on China's growing NEV technology and production capacity, attempting to not only combat air quality through its NEV focus but also to boost the competitive edge of one of its pillar industries – the auto industry. The national *Energy Saving and New Energy Vehicle Development Plan* (2012-2020) funnels funds amounting to $15 billion for R&D and demonstration projects and NEV production targets are set at 5 million by 2020[1]. Recently, the *Made in China 2025 plan* (中国制造 2025) anchored energy saving and new energy vehicle sector as one of China's 10 key sectors that should be at the forefront of development for the coming 10 years[2]. However, policy making targets the quantitative supply of EVs, instead of guiding technology and providing sufficient support to EV use-phase, both in terms of charging funds and infrastructure installation.

NEV sales soared in China during the last couple of years, from less than 20k in 2012 to as many as 74k in 2014, with the first half of 2015 already reaching the annual volume of last year[3] and an annual projection of 22-25 million units, making China the world 's largest new energy vehicle market[4]. New NEV models have flooded the market in the past year, including an increase of independent models like BYD, JAC, Chery, and Geely EV series[5]. NEV purchasers receive a national and often a local subsidy that reduce the price of an EV to even below that of the equivalent ICE vehicle. Furthermore, undergoing the long and expensive license plate permission process is typically avoided when purchasing an NEV. However, with a lack of charging facilities and incentives, usage of hybrid cars is often limited to its internal combustion engine, thus functioning almost as a conventional car[6].

Brand identity is claimed to be first in mind for the typical car purchaser in China. Yet new studies point at changing consumption methods that give light to more convenience-oriented consumers, mainly among young generations[7]. A recent Accenture study of EV perceptions shows Chinese are relatively aware of EVs

[1] The Central People's Government of the People's Republic of China, http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm
[2] China State Council, http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm
[3] CAAM, http://www.caam.org.cn/hangye/20150825/0905170167.html
[4] http://newenergy.in-en.com/html/newenergy-2252760.shtml
[5] http://www.ibgbuy.com/article-3311.html
[6] http://www.gkzhan.com/news/Detail/54572.html
[7] http://auto.gasgoo.com/News/2012/08/150541184118600784207 99.shtml

and feel they have sufficient knowledge for considering an EV purchase[8]. This gives hope that EVs, although not as well branded as conventional imported cars, may reach sufficient levels of demand and accelerate China's EV market development. Early adopters of EVs can share their experiences with other potential consumers and auto manufacturers to improve vehicle supply and demand. This project aims to create a credible and user-friendly platform, namely the China *BestEV* Ranking system, which would provide the general public and the auto sector with experience-based EV performance information collected through voluntary social-media from early adopters, in an attempt to improve EVs production and increase EVs purchase.

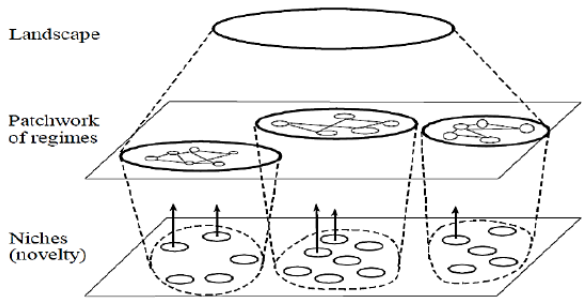
2. Consumer engagement role in accelerating EV adoption:

This chapter is aimed at supporting the argument that consumer engagement is crucial for accelerating EV adoption. Since this argument is at the heart of the BestEV conceptual approach, by supporting its robustness, the BestEV ranking system's relevancy and importance for EV promotion would be established.

The recently introduced concept of technological transition (TT) studies how the complexities of our socio-technical era are translated into concepts of development. It argues that technological improvements are evolutionary processes of a 'substitute nature': better fitted models replace previous models in a zero-sum game. Whereas in the neoclassical world, firms competed on the basis of price, in the evolutionary economics world, based in TT, firms compete on the basis on technologies (Devezas 2005, Grubler 1990, Nelson and Winter 1982). Three steps are identified in the introduction of new technologies: niche, regime, and socio-technical landscape, followed by a decline as new technology emerges (Geels, 2001).

For technology to break through the existing socio-technical landscape, and even regime, it "involves the breaking of established linkages and the creation of new ones" (Geels, 2001, p. 3; **Figure 2**). However socio-economic 'dependency-theory' suggests that people, institutions and existing technologies are fixed on routines and habits, creating a socio-technical 'lock-in' with increasing financial returns (Arthur 1994), and change is rejected even if it encompasses improved performance and/or reduced costs (Lebowitz and Margolis 1995).

Figure 3: Multilevel perspective on innovation mainstreaming process



Source: Geels, 2001

[8] https://www.accenture.com/us-en/~/media/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Industries_9/Accenture-Plug-in-Electric-Vehicle-Consumer-Perceptions.pdf

Socio-technical studies focused on efficiency solutions adoption often demonstrate the importance of public participation. For example, consumer engagement impact analysis over grid projects in Europe reveals that projects involving consumers gain deeper knowledge of consumer behavior (observing and understanding the consumer) and motivate and empower consumers to become active customers (Gangale, 2013). Studies aimed at improving business efficiency treat the importance of consumer interactions with a product directly and indirectly mainly through social media as an important element of customer's engagement value (CEV) formation (Kumar, 2010). Moreover, despite widespread agreement over today's consumer 'media fan' positioning, new studies suggest that every such media fan is likely to also be "a media producer, distributor, publicist, and critic" (Jenkins, 2002, p. 157).

Social media studies, primarily conducted by sociology and psychology scientists, assert the following implications of the web and social media on consumerism:

- The strengthening of consumption groups, which have an amplifying effect in terms of attracting more consumers. Furthermore, the individualism is to some extent replaced with the need to "belong" to a group.
- Often the group pursues similar goals and share motivations for collectively achieving greater results for relatively small investment. Social media and the web are therefore used for "comparing, refining, and negotiating understandings of their sociomotional environment" (Jenkins, 2002, p. 159).
- The age of the "collective knowledge", through the enablement of fast and vast knowledge accumulation and distribution, enables more informed thought-trough consumerism (Levy, 1997).
- The exchange of knowledge using social media and the web is pleasant on its own, going beyond knowing and showing you know (Baym, 1998). This contention has positive impact of early adoption of technologies: sharing unique personal experiences through social media may be a desirable objective on its own.

There is a limited number of studies that refer to consumer engagement in the case of EVs, and there is still much to be learnt. However existing knowledge suggests that mass acceptance of EVs is to a large extent reliant on consumers' perception of EVs (Rezvani, 2015). Several online news articles build on experts' interviews for asserting that consumer engagement has a pivotal role in accelerating EV adoption rates[9].

3. Existing Rankings Overview

This chapter is aimed at overviewing existing online rankings to extract the major criteria elements considered and the assessment methodologies used for evaluating vehicle performance. First, international rankings will be overviewed (chapter 3.1), followed by national rankings (chapter 3.2). For each geographical chapter, sub-chapters will review performance criteria and evaluation techniques for conventional cars (internal combustion vehicles) and electric cars (EVs) or hybrids.

Through a comparative summary of global and national rankings of cars and EV in particular, this chapter draws on best-practices and lessons that could assist the effective development of the BestEV ranking.

[9] E.g.: http://www.smartgridnews.com/story/user-engagement-may-be-key-ev-adoption/2015-03-03

3.1 International rankings

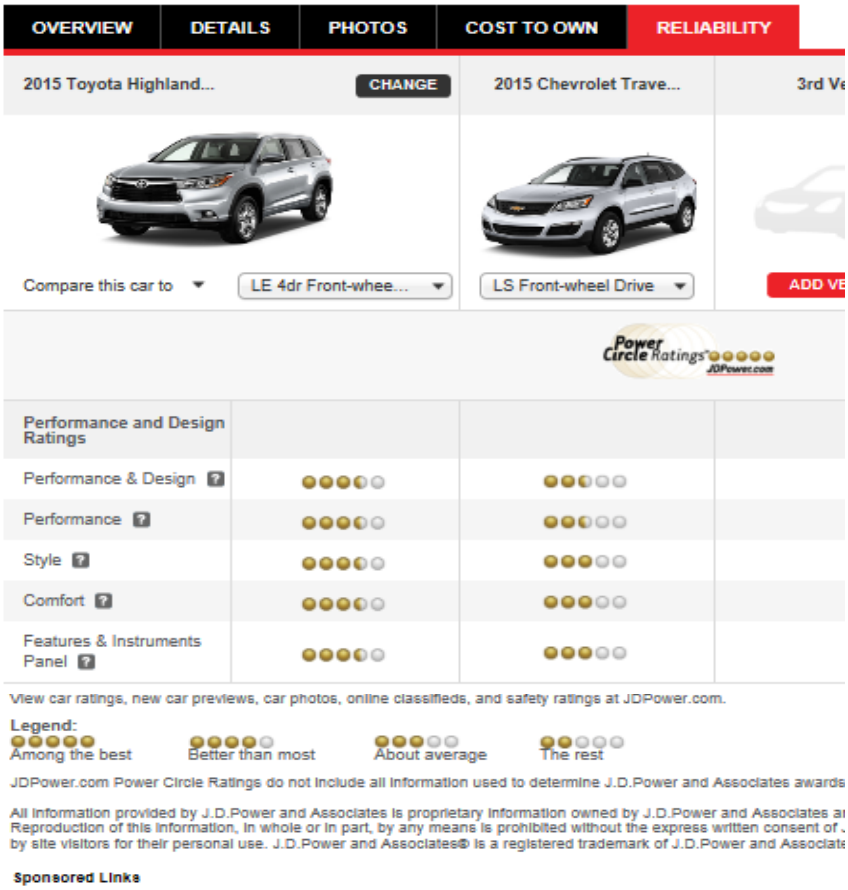
The rankings overviewed in this chapter were screened through desk-top search and in consultation with stakeholders involved in the car ranking study area.

3.1.1 AutoBlog

Autoblog is an American internet-based automotive news website owned and operated by AOL Inc. through their Weblogs, Inc. subsidiary. AOL reports 2.4 million visitors to the Autoblog website each month. Despite its name, Autoblog is not a traditional weblog run by an individual; rather, it is a fully staffed news outlet with complete editorial and photographic departments.

Major media outlets, such as U.S. News & World Report and Business Week, use Autoblog research in their publications. Autoblog also licenses its images to media outlets such as CNN Money. Therefore, AutoBlog has established its position as a global auto reviewer, using videos, articles, and forums to discuss new models driving experiences as well as to compare and rank cars.

Figure 4: AutoBlong Website Reliability Ranking



There are several subdivisions within Autoblog, including: Autoblog (main division) – covering mainstream automotive issues; AutoblogGreen - covering environmental developments and green vehicles within the automotive industry; Autoblog Black - covering the most indulgent, beastly vehicles on the market; Autoblog Military - covering recent developments in different types of military vehicles; Autoblog International - includes Autoblog Canada, Autoblog UK, Autoblog en Español, Autoblog Auf Deutsch, Autoblog En Français and Autoblog Japan. In May 2015, AOL Inc. decided to close some of its international editions, including Canada, France, Spain, and Germany after failing to develop a business model for these sites.

AutoBlog offers highly viewed reviews of new models, and covers comparative topic periodically (e.g. worst-selling cars, consumer satisfactions etc.). It provides ranking, as part of its car-compare feature, between vehicles that are on the best-selling AOL Auto list (**Figure 3**). The comparison includes five sections: **Overview** (comprises of prices and major features – engine size and fuel

economy on city-highway), **Details**, **Photos**, **Cost to Own**, and **Reliability**. Among these, only the reliability section ranks vehicles.

The **Reliability** ranking is comprised of three major sections: *Performance and Design Features*, *Initial Quality Rating*, and *Dependability Ratings*, based on methods articulated in **Table 5**.

Table 4: AutoBlog reliability ranking criteria

Section	Criteria	Method
Performance and Design Features	**Performance and Design**	Taken from the Automotive Performance, Execution and Layout (APEAL) Study, this measure is based on owner satisfaction with vehicle Performance, Style, Features and Instrument Panel, and Comfort.
	Performance	This component of APEAL is based on owner satisfaction with the vehicle's powertrain and suspension systems, including acceleration, handling stability, braking performance, and shift quality.
	Style	This component of APEAL is based on owner satisfaction with the vehicle's interior and exterior styling, uniqueness of styling, and exterior and interior colors.
	Comfort	This component of APEAL is based on owner satisfaction with the vehicle's comfort.
	Features and Instruments Panel	This component of APEAL is based on owner satisfaction with the vehicle's stereo system, gauges/instruments, and heating/air conditioning system.
Initial Quality Rating	**Overall Quality mechanical**	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems that have caused a complete breakdown or malfunction of any component, feature, or item (i.e., components that stop working or trim pieces that break or come loose).
	Powertrain quality-mechanical	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with the engine or transmission as well as problems that affect the driving experience (i.e., vehicle/brakes pull, abnormal noises or vibrations) only.
	Body and interior quality - mechanical	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with wind noise, water leaks, poor interior fit/finish, paint imperfection, and squeaks/rattles.
	Features and accessories quality - mechanical	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with the seats, windshield wipers, navigation system, rear-seat entertainment system, heater, air conditioner, stereo system, sunroof and trip computer.
	Overall quality – design	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems where controls or features may work as designed, but are difficult to use or understand (i.e., overly complicated controls/features that are difficult to operate due to poor location).
	Powertrain quality – design	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with the engine or transmission as well as problems that affect the driving experience (i.e., ride smoothness, responsiveness of the steering system and brakes, and handling/stability).
	Body and interior quality - design	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with the front-/rear-end styling, the appearance of the interior and exterior, and the sound of the doors

		when closing.
	Features and accessories quality - design	Taken from the Initial Quality Study (IQS), which looks at owner-reported problems in the first 90 days of new-vehicle ownership, this score is based on problems with the seats, stereo/navigation system, heater, air conditioner, and sunroof.
Dependability Ratings	**Overall**	Taken from the Vehicle Dependability Study (VDS), which looks at owner-reported problems in the first 3 years of new-vehicle ownership, this score is based on problems that have caused a complete breakdown or malfunction of any component, feature, or item (i.e., components that stop working or trim pieces that break or come loose).
	Powertrain	Taken from the Vehicle Dependability Study (VDS), which looks at owner-reported problems in the first 3 years of new-vehicle ownership, this score is based on problems with the engine or transmission as well as problems that affect the driving experience (i.e., vehicle/brakes pull, abnormal noises or vibrations) only.
	Body & Interior	Taken from the Vehicle Dependability Study (VDS), which looks at owner-reported problems in the first 3 years of new-vehicle ownership, this score is based on problems with wind noise, water leaks, poor interior fit/finish, paint imperfection, and squeaks/rattles.
	Features & Accessories	Taken from the Vehicle Dependability Study (VDS), which looks at owner-reported problems in the first 3 years of new-vehicle ownership, this score is based on problems with the seats, windshield wipers, navigation system, rear-seat entertainment system, heater, air conditioner, stereo system, sunroof and trip computer.

Source: AutoBlog

There are three studies that inform the AutoBlog reliability ratings, all of which are produced annually by J.D.Power: ***Automotive Performance, Execution and Layout (APEAL)***, ***Initial Quality Study (IQS)***, and the ***Vehicle Dependability Study (VDS)***. J.D.Power is a global marketing information services company providing performance improvement, social media and customer satisfaction insights and solutions. Their ratings are across various consumer products, including automotive, and are based on the opinions of a representative sample of consumers who have used or owned the product or service being rated. These ratings are therefore considered indicative of a typical buying or ownership experience.

The ***APEAL*** Study, entering its 20th year in 2015, is the industry benchmark for new-vehicle appeal, examining how gratifying a new vehicle is to own and drive. Owners evaluate their vehicle across 77 attributes, which combine into an overall APEAL Index score that is measured on a 1,000-point scale[10]. The ***IQS*** looks at owner-reported problems in the first 90 days of new-vehicle ownership. The focus of the study is model-level performance and comparison of individual models to similar models in respective segments, which helps manufacturers worldwide to design and produce higher-quality vehicles that exceed owners' expectations[11]. The ***VDS***, entering its 26th year in 2015, examines problems experienced during the past 12 months by original owners of recent model-year vehicles. Overall dependability is determined by the number of problems experienced per 100 vehicles (PP100), with a lower score reflecting higher quality[12].

The studies typically cover over 150 specific problem symptoms grouped into eight major vehicle categories and are updated periodically to address issues related to new vehicle technologies and features.

[10] http://www.jdpower.com/press-releases/2015-us-automotive-performance-execution-and-layout-apeal-study#sthash.kzeqgrr2.dpuf

[11] http://www.jdpower.com/resource/us-initial-quality-study-iqs#sthash.C6Dr8GBq.dpuf

[12] http://www.jdpower.com/press-releases/2015-vehicle-dependability-study#sthash.4mHHFxpK.dpuf

The 8 groups are: Exterior, Seats, Driving Experience, Engine/Transmission, Features/Controls/Displays (FCD), Interior, Heating, Ventilation, and Air Conditioning (HVAC), and Audio Communication Entertainment Navigation (ACEN).

The rating ranks from 1 to 5 points, and includes half-points. Using these measurements, Power Circle Ratings are calculated based on the range between the company or model with the highest score and the company or model with the lowest score. J.D. Power generates a Power Circle Rating of five, four, three, or two, as outlined in **Table 6**:

Table 5: AutoBlong (J.D.Power) circle rating of five

Rate	Note
Among the best ●●●●●	The highest-ranking company or brand in each segment receives five Power Circles. In highly competitive segments with many companies or brands, multiple companies or models scoring in the top 10% of the range from the highest score can also receive five Power Circles, indicating that consumers rate them "among the best" of all companies or models in the survey. However, only the highest-ranking company in each segment receives a J.D. Power award.
Better than most ●●●●○	Companies or models scoring 10% of the range above the industry or the segment but below the scores for 5 Power Circles receive a rating of 4 Power Circles, indicating that consumers rate them "better than most" among companies or models in the survey.
About average ●●●○○	Companies or models scoring between 10% of the range above the industry or the segment and 20% below the industry or the segment receive a rating of 3 Power Circles, indicating that consumers rate them "about average" among all companies or models in the survey.
The Rest ●●○○○	Companies or models scoring 20% of the range below the industry or the segment receive a rating of 2 Power Circles, indicating that consumers rate them lower than other companies or models in the survey. J.D. Power does not publish a rating lower than two Power Circles.

Source: J.D. Power

Since the bulk of comparison is focused on car costs, and this seems to be top of mind for potential car purchasers, we find it interesting to state the different costs this section includes: **MSRP**, Manufacturer's Suggested Retail Price, also known as "sticker price", is the suggested vehicle sale price as labeled by the automaker; **Invoice Price**, the price that the dealer theoretically (but not necessarily) paid the automaker; **Destination charge**, a non-negotiable fee that the manufacturer charges the dealer to deliver a new vehicle from the factory to the dealership. This fee is passed on from the dealer to the customer and appears prominently on the window sticker as part of the vehicle's pricing; **Monthly Car Payment**, an estimate based on 0% down, 5% interest rate for 60 months; taxes, dealer delivery and extras not included.

Hybrids and EVs are included in the AutoBlog by-segment search for cars. It first lists the best-selling hybrids and allows searching cars for viewing their features (**Figure 4**). Interestingly, Autoblog already enables surfers to add their own review (after subscription of course).

Table 6: AutoBlog Hybrid and EV Criteria

Type	Criteria	Comments
Overview	Open text	A textual summary of the review
Pricing	MSRP	Manufacturer announced price
	Market Price	
	Invoice Price	
	Monthly Payment	
Specs	Exterior	(1) Length, (2) body width, (3) body height, (4) wheelbase, (5) curb, (6) gross weight
	Interior	(1) Front headroom, (2) Rear headroom, (3) front shoulder-room, (4) rear shoulder room, (5) front hip room
	Performance	(1) Horsepower, (2) torque, (3) drive type, (4) turning radius
	MPG	(1) City, (2) Highway
Review	At a glance	(1) What reviewer likes most (2) what reviewers liked least (3) Comparisons (4) best one-liner about the model at stake
	Owner review	Reviews inserted by AutoBlog subscribers
Pictures		
Safety		26 features, of which the most significant are listed on top; e.g. airbag frontal, airbag- side impact, airbag- side curtain, airbag- knee protection, Occupancy sensor etc.

Figure 5: AutoBlog Hybrid/EV Criteria Level

Table 7: AutoBlog and its Ranking Summary (J.D. Power)

AutoBlog	
Website	http://www.autoblog.com/category/sports/
Slogan	We Obsessively Cover the Auto Industry
Entity type	Commercial (AOL Inc. owned)
Users	2.4 million
Car Ranking Establishment year	1983 (est.)
Car Ranking types	Reliability Rating divided into 3 major groups: performance, quality and dependability (17 sub-criteria in total)
Car Ranking method	5 Power Point ranking according to relative score ranging by % between the top performing and the least performing per segment (Ranking based on studies of **J.D. Power** consumer ranking and marketing company)
EVs/Hybrids	Hybrids' comparisons included

Table 8: AutoBlog Raking System Summary

Method →	Data →	Evaluators →	Outcome →	Distribution
Criteria: 17 reliability criteria (Table 1)	4/17 based on VDS: consumer reported problems per 100 cars in 12 months	Consumers paid surveys	5 Power Point Ranking per model	Website, Reports
Weighting: 5 Power Point rankings	5/17 based on APEAL: owners' assessment of 77 attributes on 1000 points scale.			
	8/17 based on IQS: issues reported during first 90 days of new-vehicle ownership			

3.1.2 MotorTrend

MotorTrend is an American automobile magazine. It first appeared in September 1949, issued by Petersen Publishing Company in Los Angeles, and bearing the tagline "The Magazine for a Motoring World." Petersen Publishing was sold to British publisher EMAP in 1998, who sold the former Petersen magazines to Primedia in 2001. As of 2007, it is published by TEN: The Enthusiast Network (formerly Source Interlink Media). It has a monthly circulation of over one million readers.

The contents of *Motor Trend* magazines are divided up into sections, or departments: Road Tests, Car comparisons, Trends, Car Garage annual driving experiences results, the ***Best Driver Car (BDC)***, and the ***Cars of the Year (COTY)***.

The ***BDC*** is conducted annually in two locations: 4 miles of the California Highway 198 for road looping, and often a dedicated 2.5 mile race course (e.g. Mazda Raceway Laguna Seca in LA). Each manufacturer is asked to supply a clear plastic protector for the vehicles they send, to guard against stone chips and road debris of the models eligible for the competition. The cars are tested on both a canyon road and a racetrack driving conducted by a professional driver (Randy Franklin Pobst), and AutoTrend enthusiasts are invited to join the rides. The driving test experience is recorded and analyzed using two methods: (1) recordings of the text driver's subjective driving experience right after he ends a test round, and (2) video recordings of the drivers' face while driver and analyzing his expressions to extract experience note (in collaboration

with Center for Research in Intelligent Systems at University of California)[13]. The ranking tops the best 5 by order of subjective score.

The ***COTY*** award is claimed to be the first in the history of passenger cars. To be eligible for the award, a car must be an "all-new" or "substantially upgraded" vehicle that has been on sale within twelve months from the previous November, on sale now or before year's end in five or more European markets, with prospect of at least 5,000 foreseeable annual sales. The voting process has two stages. The first stage produces a short list of seven nominees, which are announced on the end of each year. The second stage determines the single winner that will be revealed on the eve of the Geneva Motor Show.

Between the contenders, it is not a comparison test; there are no categories, sub-divisions or class winners and the goal is to select a single winner. The Motor Trend judges, about 50 senior motoring journalists across Europe, debate and evaluate each vehicle against six key criteria detailed in **Table 10**. Technical innovation and value for money are particularly important factors. The reference data for the judges to base their debate upon is provided through several tests' results: standard car tests such as skid-pad ratings, acceleration and quarter-mile times, and evaluations of the interiors are combined with a track run conducted by Sport Club Car of America (SCCA) licensed testers and taking the cars out on normal roads to test their drivability under normal conditions, and fuel economy. Trucks and SUVs add towing capacity and speed, plus an off-road course, to the normal regimen. Each Jury member has 25 points to apportion to at least five cars, with a maximum of 10 points for any one of them, and produces a statement of justification for the vote.

Table 9: MotorTrend Car of the Year (COTY) criteria

Type/Criteria	Comments
Design Advancement	e.g. well-executed exterior and interior styling; innovative vehicle packaging; selection of materials
Engineering Excellence	e.g. vehicle concept and execution; clever solutions to packaging, manufacturing and dynamics issues; cost-effective technology that benefits the consumer
Efficiency	e.g. low fuel consumption and carbon footprint, relative to the vehicle's competitive set
Safety	e.g. active: help the driver avoid a crash; secondary: protect occupants from harm during a crash
Value	e.g. competitive price and equipment levels, measured against vehicles in the same market segment
Performance of Intended Function	e.g. how well the vehicle does the job its planners, designers, and engineers intended

MotorTrends features Hybrid cars and test results of selected hybrids cars. The hybrids main features are presented in **Table 11**. The test results are outlined in a rich text content that address all aspects of a traditional car as well as note on its battery type and power, electric range and acceleration.

Table 10: MotorTrends Hybrid and EV Criteria

Type/Criteria	Comments

[13] http://www.motortrend.com/features/performance/1409_2014_motor_trends_best_drivers_car/viewall.html#ixzz3k5L6qNu7

Engine	e.g.: 1.8L in-line 4 OHC with i-VTEC® variable valve timing
Fuel	e.g. Unleaded fuel
Fuel economy	e.g. Gasoline 28 MPG city, 36 MPG highway, 31 MPG combined and 409 mi. range
Fuel tank	e.g.: 13.2 gallon fuel tank, Multi-point fuel injection
Power (SAE)	e.g.: 143 hp @ 6,500 rpm; 129 ft lb of torque @ 4,300 rpm

Table 11: MotorTrend and its Ranking Summary

MotorTrend	
Website	http://www.motortrend.com/features/performance/
Slogan	N/A
Entity type	Commercial
Users	1.14 million
Car Ranking Establishment year	1949
Car Ranking types	Best Annually
Car Ranking method	Judge Debating based on 6 major Criteria (data stems from nominee car testing, conducted by **Sport Club Car of America** certified drivers) ; each judge is allocated limited points and the number of points that can be given to a single car is limited.
EVs/Hybrids	Hybrids information included

Table 12: MotorTrend Raking System Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: 6 major Criteria	Some quantitative data based on car testing (Sport Club Car of America certified drivers)	50 senior motoring journalists from across Europe	Single winning award	Award ceremony, website
Weighting: Subjective judgments for allocating up to pre-defined max points per nominee through debating				

3.1.3 US News Rankings

U.S. News & World Report is an American media company that publishes news, opinion, consumer advice, rankings, and analysis. Founded as a news weekly magazine in 1933, U.S. News transitioned to primarily web-based publishing in 2010. U.S. News is best known for its influential Best Colleges and Best Hospitals rankings, but it has expanded its content and product offerings in education, health, money, careers, travel,

and cars. Headquartered in Washington DC, the company is owned by media proprietor Mortimer Zuckerman.

Figure 6: US News Car Ranking for Hybrids

Since 2007, U.S. News has developed an innovative rankings system for new and used automobiles. The rankings span over 30 classes of cars, trucks, SUVs, minivans, wagons, and sports cars. Each automobile receives an overall score, as well as a performance, interior, and recommendation score to the nearest tenth on a 1-10 scale. Scores are based on the consensus opinion of America's trusted automotive experts, as well as reliability and safety data. U.S. News also produces annual "Best Cars for the Money" and "Best Cars for Families" awards across approximately 20 classes of cars, trucks, SUVs, and minivans. Money award winners are derived by combining vehicle price and five-year cost of ownership with the opinion of the automotive press, while family awards are tabulated by combining critics' opinions with the vehicle's availability of family-friendly features and interior space, as well as safety and reliability data. Money and family award winners are announced in February and March of each year, respectively.

US News car ranking combine two types of information: published reviews from respected automotive critics and safety and reliability data from third-party sources. For each new car in the U.S. News rankings, US News editors analyze arguably credible reviews about the new car to assign a score that represents what professional critics say about it. The reviews are gathered from major newspapers, magazines and automotive websites. For each third-party review, US News editors score the car on three different components, illustrated in **Table 14**. The score generated are combined in a formula that is based on what new car shoppers say matters to them most in a new vehicle. The rankings are continually updated based

on the latest information coming in from third-party reviews and data sources. As new cars enter the market, they are also added to the rankings and affect how the vehicles stack up against one another.

The ranking criteria specified in **Table 14** are also valid for hybrids and EVs. EVs, interestingly, can be found under the title "hybrids". Hybrids are divided to three sections: cars, luxury and SUVs. The output of the criteria ranking is illustrated in **Figure 5**.

Table 13: US News Raking Components and Sources

Criteria	Evaluation	Source
Performance*	The performance score represents the reviewer's written assessment of a car's handling, braking, acceleration, ride quality and other qualitative performance measures.	The reviews are gathered from major newspapers, magazines and automotive websites
Interior	The interior score represents the reviewer's written assessment of the car's interior comfort, features, cargo space, styling and build quality.	
Critics' Rating	This represents the overall tone and recommendation level reviewers place on a car.	
Safety	The safety score is based on a compilation of scores from leading safety rating sources, including the National Highway Traffic Safety Administration and the Insurance Institute for Highway Safety.	Third Party
Reliability	The reliability score contributing to the U.S. News rankings is the Predicted Reliability rating provided by J.D. Power and Associates. This score is based on the past three years of historical initial quality and dependability data from J.D. Power's automotive studies, specifically the Vehicle Dependability Study (VDS) and the Initial Quality Study (IQS).	

** Note: Cars that win major automotive industry awards, such as the Motor Trend Car of the Year and North American Car of the Year, receive a bump in their Recommendation score to reflect the importance of these awards.*

14: US News Rankings Summary

MotorTrend	
Website	http://usnews.rankingsandreviews.com/cars-trucks/rankings/Affordable-Small-Cars/
Slogan	Life's Decisions Made Here
Entity type	Commercial
Users	N/A
Car Ranking Establishment year	2007
Car Ranking types	Best performing: New, Used, for Family, and for money
Car Ranking method	Comparative score based on experts reviews and consumer preferences formula
EVs/Hybrids	Hybrids' comparisons included by segments: SUV, Luxury and general.

Table 15: US News Raking System Summary

Method →	Data →	Evaluators →	Outcome →	Distribution
Criteria: 5 criteria: Critic's Rating, Performance, Interior, Reliability, Safety	Reliability data	Experts consensus score is combined with a formula which is based on consumers preferences *(the formula is not specified)*	1-10 comparative score per model	Website, Magazines
Weighting: 1-10 scale	Safety data			
	Experts performance evaluation (for general critic, performance and interior result generation)			

3.1.4 Consumer Reports

Formed as an independent, nonprofit organization in 1936, Consumer Reports serves consumers through independent product testing and ratings, research, journalism, public education, and advocacy. Guided by the principle that consumer products and services must be safe, effective, reliable, and fairly priced, ConsumerReports is aimed at influencing policy makers, companies and consumers. Unconstrained by advertising or other commercial influences, ConsumerReports have relentlessly exposed landmark public health and safety issues and have strived to be a catalyst for marketplace changes. These issues have included increasing use of seat belts, reducing hospital-acquired infections, underscoring the dangers of cigarettes, spotlighting food- and water-safety issues, identifying vehicle-safety risks, advocating for consumer-finance protections and access to health care, etc.

ConsumerReports connect with consumers through channels including the flagship *Consumer Reports* magazine and ConsumerReports.org website, the policy and advocacy work of Consumers Union, and a range of issue-specific publications and campaigns. ConsumerReports experts put thousands of products to the test each year in our 50 state-of-the-art labs and 327-acre automotive testing track. Advocates in offices across the United States engage with more than 1 million online activists to push for improvements in the

consumer marketplace. ConsumerReports digital products team develops new concepts for consumer-focused products and services. ConsumerReports annual survey of more than 1 million subscribers captures vital feedback on purchasing decisions, experiences and shopping habits, helping ConsumerReports further its work to inform and protect.

Figure 7: CansumerReports Ranking for Hybrids and EVs

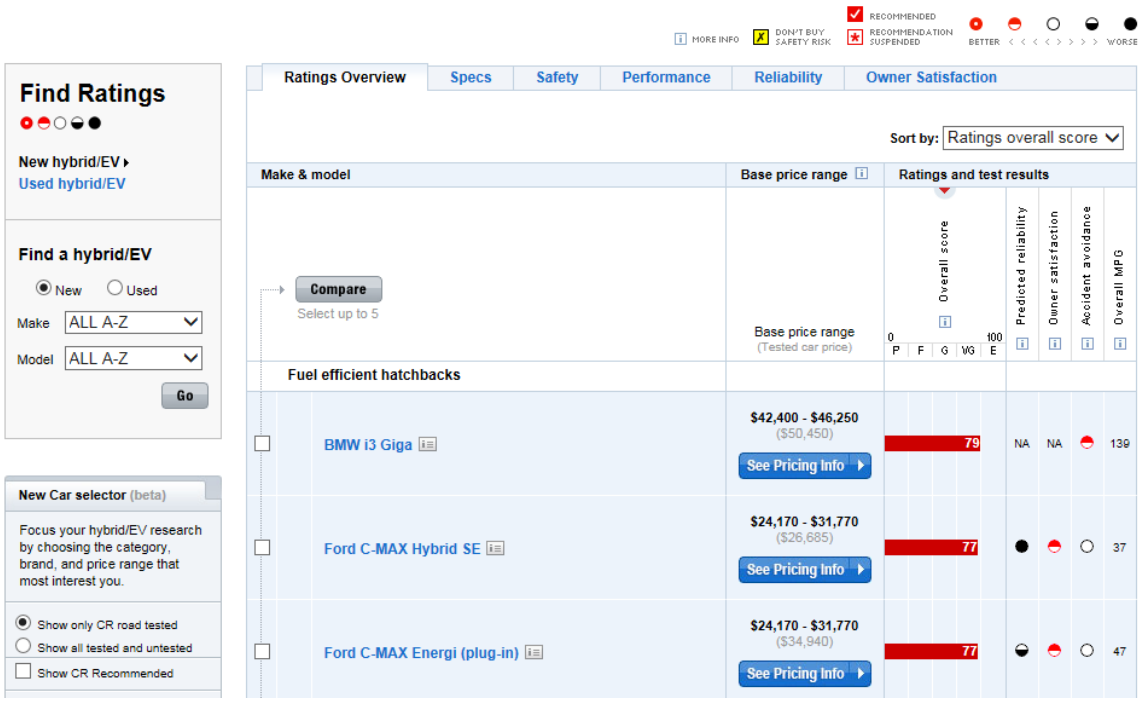


Table 16: ConsumerReports rating

Rate					
Note	Poor	Fair	Good	Very Good	Excellent
Value range	0-20	20-40	40-60	60-80	80-100

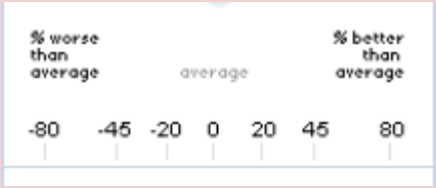
DON'T BUY SAFETY RISK

RECOMMENDED

RECOMMENDATION SUSPENDED

Table 17: ConsumerReports Hybrid and EV Criteria

Type	Criteria	Comments
Overview		The Highs, Lows, and Overall Rating refer to the model and trim line that Consumer Reports tested. A model earns the "CR Recommended" label by Consumer Reports when it has performed well in the tests, the subscriber -survey data indicate that it should be at least average in reliability, and has performed at least adequately in any government and/or insurance-industry crash tests or government

		rollover test, if tested. There are several reasons why a model would have no designation: It wasn't tested recently; it didn't test well; it did poorly in a crash test or tip-up in the rollover test; it has a below-average reliability record; it's too new to have reliability data; or we have insufficient reliability data.
Base price range		The base price is the manufacturer's suggested retail price (MSRP) without options or destination charge.
Predicted reliability	**16 criteria:** Engine, minor; Engine, cooling; Transmission (and clutch), major; Transmission (and clutch), minor; Drive system; Fuel system; Electrical system; Climate system; Suspension; Brakes; Exhaust; Paint/trim; Body integrity; Body hardware; Power equipment and accessories; Audio system (excluding aftermarket systems)	Predicted reliability is a forecast of how well a model is likely to hold up derived from the latest Annual Car Reliability Survey. ConsumerReports averaged a model's Used Car Verdict for the newest three years, provided the model did not change significantly during that time. 
Performance	**10 Criteria:** Transition; Horsepower (max by manufacturer); Engine; Overall MPG; Highway MPG; City MPG; Acceleration (0-60); Acceleration ¼ mi time; Wet braking from 60mph; AM-MAX Speed (avoidance maneuver indicates the max speed at which a vehicle successfully negotiated the course).	Except for the 45- and 65-mph passing test, "acceleration" runs are made from a standstill with engine idling. "Braking" figures are from 60 mph, with no wheels locked. "Other findings" include judgments of transmission characteristics and shift quality. RPM at 60 is the speed of the engine when the vehicle is traveling at 60 mph. Handling judgments reflect how agile the vehicle is both in routine driving and in emergency handling--how the vehicle performed when pushed to its limits on the track and in our emergency-avoidance maneuver. The avoidance-maneuver speed indicates the maximum speed at which a vehicle successfully negotiated the course. Braking from 60 mph gives the stopping distances in both dry and wet, but the braking score takes into account factors such as brake-pedal feel, fade, and stopping performance. Headlights are evaluated on moonless nights on our test track, which has no additional ambient lighting. Scores are based on a headlight's ability to illuminate flat black signs at varying distances and widths while the car is stationary; this is done for both low and high beams. Those that light more signs rate higher. Points are deducted for beam patterns which are not uniform; veiling glare light (illuminating precipitation); a sharp cutoff; or objectionable levels of glare. A short night drive is done in addition to the static test and gives an opportunity to view the lights during driving.

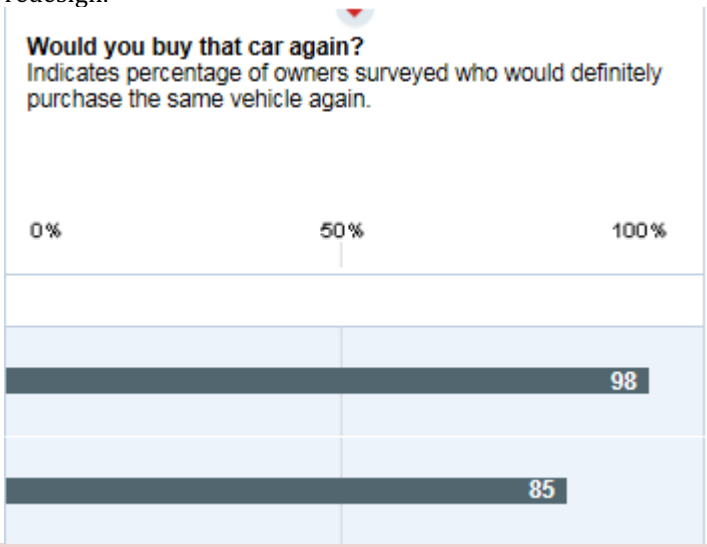
Safety	**3 criteria:** Accident Avoidance; Crash tests; Safety features	Accident Avoidance is composite score of CR's test results for braking performance, emergency handling, acceleration, driving position, visibility, and seat comfort. Braking and emergency handling carry the most weight. Crash results are based on NHTSA and IIHS.
Owner satisfaction	Average response of respondents	Indicates percentage of owners surveyed who would definitely purchase the same vehicle again. Based on data for the latest three model years. Models marked * are based on only one or two years worth of data because of limited data, model unavailability, or a major redesign. 
Specs	Interior and Exteriors dimensions	
Accident avoidance		A composite score of CR's test results for braking performance, emergency handling, acceleration, driving position, visibility, and seat comfort. Braking and emergency handling carry the most weight.
Overall MPG		Overall MPG (overall mileage) is CR's measurement based on a realistic mix of highway, country-road, and city driving.

Table 18: ConsumerReports Rankings Summary

ConsumerReports	
Website	http://www.consumerreports.org/cro/cars/new-cars/hybrids-evs/ratings-reliability/ratings-overview.htm
Slogan	We Work for You
Entity type	Commercial (originally an NGO)
Users	N/A
Car Ranking Establishment year	N/A
Car Ranking types	Best performing: New, Used; 9 Criteria Groups (25 sub-criteria).
Car Ranking method	Relative to average or numerical rate 0-100 based on testing (independent and dependent – NHSTA and IIHS), evaluations, or consumer surveys.
EVs/Hybrids	Yes

Table 19: ConsumerReports Raking System Summary

Method →	Data →	Evaluators →	Outcome →	Distribution
Criteria: 5 criteria: Critic's Rating, Performance, Interior, Reliability, Safety	**Performance**: Summary of all data collected	Testers, consumers, market available data	0-100 scale score, or/and 5 point score	Online, magazines
Weighting: 1-10 scale, 5 points ranking	**Safety**: Testing by ConsumerReports and by NHSTA and IIHS			
	Reliability: Reliability survey (derived from members using the car)			
	Owner satisfaction: Consumer surveys			
	Specs: Manufacturer published info			
	Accident avoidance: A composite of selected tests conducted by ConsumerReports			
	Overview: By ConsumerReports experts and members			
	Base price range: manufacturer's suggested retail price (MSRP)			

3.1.5 Edmunds.com: Dedicated EV performance rankings

Edmunds.com, Inc. is an American online resource for automotive information. The company is headquartered in Santa Monica, California and maintains an office outside of Detroit, Michigan. Edmunds.com is privately held, with the Steinlauf family holding a majority stake. The Edmunds.com web site includes prices for new and used vehicles, a database of national and regional incentives and rebates, dealer and inventory listings, vehicle test drive reviews, and tips and advice on all aspects of car purchases and ownership. In addition, the company circulates free e-mail newsletters to voluntary subscribers.

Edmunds.com provides data through its "True Market Value" pricing tools, which launched in 2000. The Edmunds.com True Market Value New Vehicle Calculator provides the estimated average price consumers are currently paying when buying new vehicles. It can also estimate the actual transaction prices for used vehicles bought and sold by dealers and private parties. In 2005, Edmunds.com launched Inside Line, a free online magazine for automotive enthusiasts. Inside Line delivered automotive content in the form of videos, photos, blogs, news articles, discussion boards and road tests. However, in 2013, the site was shut down.

The Edmunds Testing Team evaluates about 200 new vehicles each year. Each vehicle is driven on a standardized road-test loop and visits the test track for instrumented testing in controlled conditions. The teams' time behind the wheel is used to develop ratings that grade how a car stacks up against its direct rivals in its size and price class. The Edmunds.com Top Rated Awards are given to the vehicles that received an "A" rating. Edmunds.com offers one of the earliest EV ranking systems available online in English, developed through the same testing method with slightly different emphasize.

Figure 8: Edmunds rating

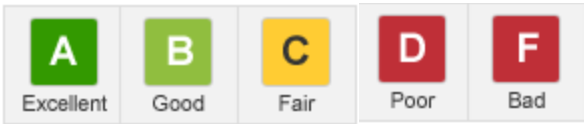


Table 20: Edmunds Hybrid and EV Criteria

Type	Criteria	Comments
Overview	Pros and Cons	Open text by experts
	Safety	NHTSA and IIHS crash test results (1-5 stars ranking)
	Reliability	3 ranking Minimal Problems Moderate Problems Significant Problems
Performance	Acceleration	e.g., for A: From a stop, acceleration is smooth and brisk. The torque from the electric motor gets you up to speed quickly without the noise and inefficiency of an unassisted four-cylinder.
	Braking	e.g. for B: The brake feel is, like in most hybrids, odd. The first phase of the pedal feels very synthetic. Precise and easy to use, but unusual. Full panic stops offer no ABS kickback.
	Steering	e.g. for B: Electric power steering offers adequate feel and feedback to prudently guide the car. Feels a cut above the steering found in other plug-in hybrids.
	Handling	e.g. for B: The additional weight of the hybrid battery doesn't really affect handling compared with the non-hybrid version.

		Heavier-duty rear shocks give a planted feel.
	Drivability	e.g. for A: Responsive to small throttle inputs and intuitive. Power can be metered very precisely, and is delivered with exceptional smoothness.
Comfort	Seating comfort	e.g. for B: Vastly improved over 2012 Accord, the seats of which had awkward lower back support.
	Ride comfort	e.g. for A: Few buyers will find fault here as the Accord hits a sweet spot between too firm and too soft. The hybrid battery's weight does not result in a bouncy ride.
	Quietness	e.g. for A: Very little road or engine noise, even during gasoline operation and gas/electric transition. EV mode is smooth and essentially noiseless.
Interior	Ergonomics	e.g. for A: Fewer buttons than before, which is appreciated. And just about every control is logical and well placed. Good driving position with a nice range of adjustment.
	Ingress/Egress	e.g. for B: Ingress and egress are never a problem in the Accord.
	Space/Room	
	Visibility	e.g. for B: Above average for the class. Its low beltline aids visibility from the rear seat.
	Cargo/Storage	e.g. for C: Due to its large battery pack, total cargo space is diminished in the Accord Hybrid and the rear seats are now fixed in place instead of foldable.
Value	Build Quality (vs. $)	Self-explanatory
	Features (vs. $)	Self-explanatory
	Cost	Self-explanatory
	MPG	Self-explanatory
	Warranty	Self-explanatory
	Ownership	Self-explanatory
Fun to Drive	Driving Experience	e.g. for A: Incredibly smooth and far more responsive than other hybrids. It's not the enthusiasts' first choice, but it isn't a dull pod either.
	Personality	e.g. for A: The 2014 Accord Hybrid could've been a silly, strange-looking futuristic thing that screamed HYBRID! Instead, it's a handsome sedan that just happens to get 47 mpg. We like that.

Table 21: Edmunds Rankings Summary

Edmunds	
Website	http://www.edmunds.com/fuel-economy/electric-car-comparison-test.html
Slogan	Buy smarter
Entity type	Commercial
Users	N/A
Car Ranking Establishment year	1995 (online version)
Car Ranking types	New Cars, Used Cars; Edmunds Confessions Series; Car Buying and Leasing; 10 Steps to Finding the Right Car for You; New Car Buying Guides; VIN

	Information; Fuel Economy and Green Cars; Ranking of 6 criteria (24 sub-criteria)
Car Ranking method	Experts review, third party tests, self-testing
EVs/Hybrids	Both included

Table 22: Edmunds Raking System Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: 6 criteria: Review (major 3 sub-criteria: pros, cons, safety), Performance, Comfort, Interior, Value, Fun to Drive	**Review**: NHTSA and IIHS crash test results, Experts testing and review results	Mainly in-house Testers, but also some consumers feedback and market available data	A-F based on evaluators' average	Online, reports – available for paying members only
Weighting: A-F (in some criteria weighting is slightly different, e.g. 3 rating for reliability)	**Performance**: Experts testing and review results			
	Comfort: Experts testing and review results			
	Interior: Experts testing and review results			
	Value: Official costs, subjective evaluation of worthiness			
	Fun to Drive: Experts testing and review results			

3.2 Chinese rankings

3.2.1 J.D. Power Auto Rankings

Founded in California in 1968, J.D. Power now has 12 offices globally and more than 700 professional analysts, statisticians, economists, consultants and experts in demographics and consumer behavior. J.D. Power Asia Pacific Company specializes in the investigation of customer satisfaction, providing consultation services for the automotive industry, financial industry and information technology industry. Their China office bases local ratings on the feedbacks of a representative sample of consumers who have been owning or using the product or service being rated. These ratings are considered indicative of a typical buying or ownership experience.

J.D. Power releases reports on eight aspects in China's automobile market annually, based on the feedbacks from consumers: New Vehicle Intention Study (NVIS), Initial Quality Study (IQS), Customer Satisfaction Index (CSI), Automotive Performance, Execution and Layout (APEAL), Vehicle Dependability Study (VDS), Service Loyalty Study (SLS), Sales Satisfaction Index (SSI) and Original Tire Satisfaction Index (OTSI)[14]. These rankings cover different aspects of vehicle performance, which informs wiser customer car purchase choices.

The APEAL study, IQS and VDS have been introduced in **chapter 3.1.1**. NVIS[15], entering its seventh year in 2015, focuses on the perceptions of potential consumers before they buy a car. NVIS analyzes the practical vehicle cross purchase mode with a segmentation of the consumer groups according to psychological and population characteristics. Index scores are measured on a 1,000-point scale. CSI was initialized 15 years ago, evaluating the car owners' degree of satisfaction, based on consumers' surveys during their first 12-24 months of car ownership. Five factors determine CSI[16], including service quality (22%), dealer facilities (20%), after-service car returning (20%), service consultation (19%) and service launching (19%). SLS[17] has entered its fifth year in 2015, evaluating the car loyalty based on 3-4 years of ownership according to 12 months maintenance reporting period. The investigation covers four driving factors, including confidence (32%), value (25%), quality (22%) and service (21%). SSI, entering its 16th year in China, determines the customer satisfaction to the initial purchase experience which is measured[18]. Since 1989, OTSI incorporates car owners' satisfaction rates from original car tires during the first 12-24 months of ownership[19]. The complete car ranking criteria of J.D. Power China is listed in **Table 24**.

Although each criteria is measured on a 1,000-point scale, J.D. Power classifies those rankings using a circle rating, namely "Power Point", of five circles which is easy to comprehend and compare (**Figure 8**). In China, J.D. Power Auto Ranking excludes hybrid and EVs. However, the international J.D Power does cover zero tailpipe emissions vehicles, as detailed in **chapter 3.1.1**.

Table 23 J.D. Power Auto Ranking criteria

Section	Criteria	Method

[14] http://www.doc88.com/p-9856609762155.html
[15] http://wenku.baidu.com/link?url=WvRAgxEsvPaqQAjy0qz9GiHygvM-HPHxu8asC4DOpxHt3JRaOmzVp1vzlaeee68BU8W235fkQiYC87Q7FzRyzIwUuh3eO99H4wuGfamQP23
[16] http://news.xinhuanet.com/auto/2014-08/01/c_126822144.htm
[17] http://www.jdpower.com/node/18461
[18] http://auto.sohu.com/20150630/n415931687.shtml
[19]

New Vehicle Intention Study	Brand Awareness	This component evaluates the consumers' attitude towards a certain vehicle brand and how much they know about it, to determine the purchase intention.
	Brand Perception	Brand perception is based on the cognition of consumers to a certain vehicle brand, to measure the matching degree between the brand and the consumers themselves.
	Purchase Consideration	This is based on the consumers' individual situation when buying a car, such as the price, car performance, etc.
	Information Source	This is based on the sources where potential buyers get the relevant information and what information they know, which affects the purchase intention and behavior to a large extent.
Customer Satisfaction Index	Service quality (22%)	This component is the key to determine CSI and has the largest proportion, which is based on the service quality the dealers can provide to the car owners.
	Dealer facilities (20%)	This is based on the infrastructure the dealers provide to the customers, which has an important influence on the possible after-service quality.
	After-service car returning (20%)	This is based on the time that the dealers take to finish the maintenance and other after-service operations.
	Service consultation (19%)	This is based on the consultation that the dealers can provide for the service demand, including the professional suggestions to the service as well.
	Service launching (19%)	This component is based on the time taken when the service appeal would be accepted, which impacts the consumers' first impression and receptivity to the service.
Service Loyalty Study	Confidence (32%)	This is based on the customers' recognition to certain dealers and whether they can rely on the overall service according to the past 12 months' service experience.
	Value (25%)	This can reflect what the customers can get from the after-service activity and help them decide the actual values of the service.
	Quality (22%)	Quality plays a key role in the after-service activity, which determines the customers' psychological characteristics.
	Service (21%)	This part includes not only the maintenance quality, but also the overall service quality and attitude during the whole process.
Sales Satisfaction Index	Car Receiving (23%)	This is based on the overall fluency a consumer buys a car and the time taken in the whole process.
	Purchase experience (21%)	This part is based on the customers' personal feelings when the real purchasing happens.
	Transaction process (20%)	This part includes all the stuff happen during the striking of a purchase deal.
	Dealers' facilities (19%)	This affects the customers' experience when buying a car, whether they can touch the ideal car or how much can be provided visually to know about the intentional vehicle.
	Sales staff (17%)	The individual comprehensive quality determines the explication they can provide to the consumers to help them know more about the intentional vehicles.
Original Tire Satisfaction Index	Layout	This is based on the design and styling of the original tires as well as the customers' tastes.
	Durability	This part is most important for tires, which is based on the consumers' driving experience for 1-2 years.
	Friction	This is based on the power outlet of a car from the perspective of tires and the performance variation after usage for 1-2 years.
	Driving	This is based on the overall performance of the tires and its matching

degree with the car.

Figure 9 J.D. Power SSI Ranking

Table 24 J.D. Power and its auto ranking summary

J.D. Power Auto Ranking	
Website	http://china.jdpower.com/zh-hans
Slogan	We Obsessively Cover the Auto Industry
Entity type	Commercial (AOL Inc. owned)
Users	2.4 million
Establishment year	1983 (est.), 2000 came to China
Ranking types	Reliability Rating
Ranking method	5 Power Point ranking according to relative score ranging by % between the top performing and the least performing per segment (Ranking based on studies of **J.D. Power** consumer ranking and marketing company)

EVs/Hybrids	Hybrids' comparisons included internationally

Figure 10 J.D. Power Auto Ranking System Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: 39 reliability criteria for 8 rankings (Table 21)	4/39 based on VDS; 5/39 based on APEAL; 8/39 based on IQS; 4/39 based on NVIS; 5/39 based on CSI; 4/30 based on SLS; 5/39 based on SSI; 4/39 based on OTSI	Consumers paid surveys	5 Power Point Ranking per model	Website, Reports
Weighting: 5 "Power Point" rankings (Figure 7)				

3.2.2 CPMAA China Car Billboard Ranking

Initiated in 2006 by the China Powerful Media and Auto Alliance (CPMAA), China Car Billboard (CCB) is designed to perform as China's car 'Oscar' to push the auto industry forth[20]. CCB members in 2014 included 20 auto and media partners, including *Southeast Express, HeFei Evening News, Urban Express, and www.315che.com*. Meanwhile, several network media and third party research agencies are involved in the selection to provide a more credible and influential results[21].

The selection process includes reviews collected from auto manufacturers themselves as well as consumers, which each weighted differently. Every city can conducts its own voting first, typically led by a local media company. Voting is enabled through an online platform, email, and hotline and requires a detailed reasoning[22]. After collecting feedback locally, a jury comprised of three auto experts and representatives of the CCB 20 ally members makes its final decision through a 3 month voting period. The jury votes are weighted 40% and 60% for experts and allies respectively. However should a model receive 11 votes out of the 20 ally votes it is automatically rewarded.

[20] http://auto.changsha.cn/h/10783/
[21] http://auto.sina.com.cn/news/2006-10-19/1507223218.shtml
[22] http://news.ifeng.com/a/20141107/42410090_0.shtml

The CCB award aims at selecting the most influential car manufacturers (including passenger vehicle owned, environmentally friendly vehicle owned, best domestic independent manufacturers, and best corporate fleet manufacturer vehicle enterprises), best car according to various classifications, and the person of the year in auto industry. Every year dozens of the prizes are generated, of which four are relatively popular: Car of the Year, Car Manufacturer of the Year, Auto Brand of the Year, and Domestic Independent Brand of the Year.

CPMAA CCB added New Energy Vehicles to its list of prizes as of 2012, namely, the Car of the Year for Environmental Protection. The evaluation criteria are focused on the car design, driving experience as well as its energy saving technologies.

Table 25 CPMAA China Car Billboard Hybrid and EV criteria

Type	Criteria	Comments
Overview		CPMAA CCB started Hybrids and EV ranking from 2011, aiming at selecting NEVs with high cost efficiency. CCB committee asks consumers and the jury to vote for the candidates through various channels annually and select the Annual Car based on voting results. No certain criteria are provided for the voting, but consumers and the jury may pay attention to different aspects for the selection.
Pricing	MSRP	Manufacturer announced price
	Market Price	May vary with different dealers and sales places.
Specs	Exterior	(1) Length, (2) body width, (3) body height, (4) wheelbase, (5) curb, (6) gross weight
	Interior	(1) Front headroom, (2) Rear headroom, (3) front shoulder-room, (4) rear shoulder room, (5) front hip room
	Performance	(1) Horsepower, (2) torque, (3) drive type, (4) turning radius
	MPG	(1) City, (2) Highway
Review	At a glance	(1) What reviewer likes most (2) what reviewers liked least (3) Comparisons (4) best one-liner about the model at stake
	Owner review	The vehicle owner's experience will strongly affect people's selection, especially for potential consumers. They stress more on the cost efficiency of vehicle products.
Safety		Covering many criteria similar to traditional vehicles, e.g. airbag frontal, airbag- side impact, airbag- side curtain, airbag- knee protection. For EVs, the safety of battery comes preferentially.
Service	Per-sales	Not only covering the dealers' facilities, but also their professional service and attitude.
	After-sales	(1) Warranty period (2) Brand recognition (3) Service loyalty (4) Technology and prices

Table 26 CPMAA CCB and its ranking summary

CPMAA CCB	
Website	http://bddsb.bandao.cn/data/20150114/html/15/content_1.html
Slogan	N/A
Entity type	Commercial

Users	N/A
Establishment year	2006
Ranking types	Car/Auto enterprise of the Year
Ranking method	Both consumers and professors vote for the candidates. The allied members have their separate lists at the first stage, and each of the allied members and several auto professors team up to vote for the main list.
EVs/Hybrids	Hybrids information included

Table 27 : CPMAA China Car Billboard Ranking Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: No certain criteria for the ranking;	Experts and consumers rank based on their subjective assessment and provide text-like feedback (which is incorporated into comparative quantitative results)	Consumers voting and jury voting	Car/Auto enterprise of the Year Award	Website, Award ceremony
Weighting: No weighting for criteria, only for source of evaluation: consumers have minor influence, while experts and 20 members have 40% and 60% of the final vote respectively.				

3.2.3 China Car Quality Ranking by *315che.com*

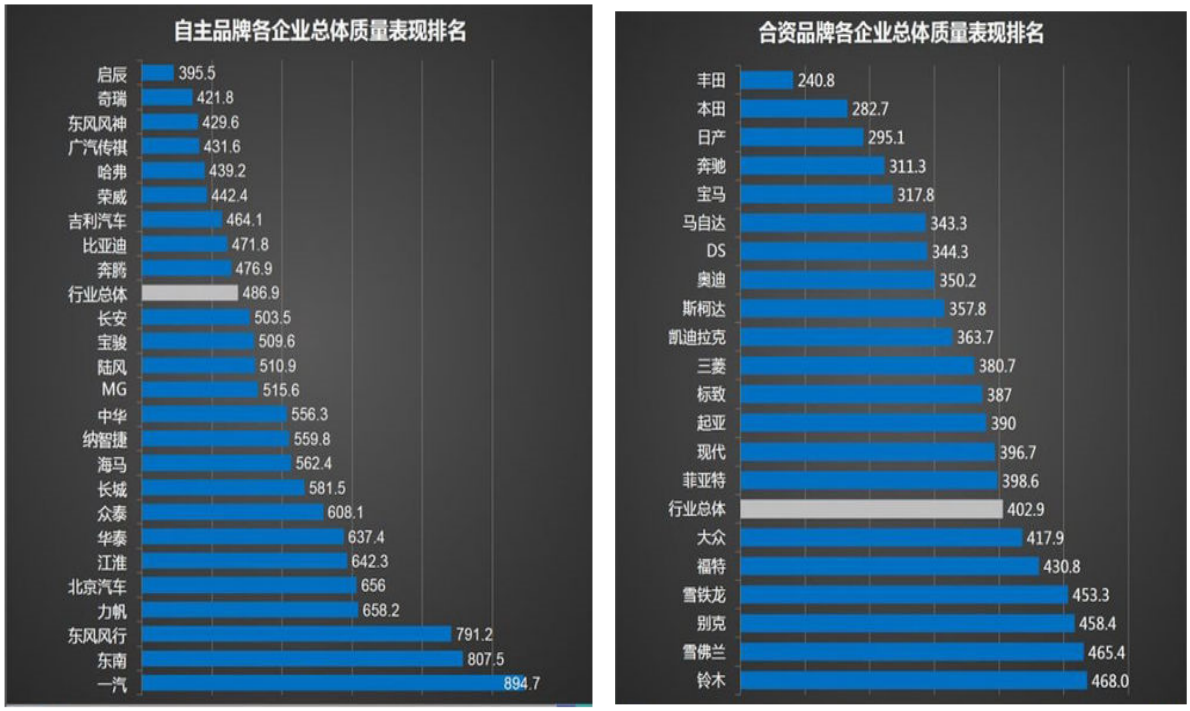
Launched by *315che.com* (che=car) jointly with Ipsos Auto, China Car Quality Ranking was first announced in 2014. *315che.com* is a commercial website aimed at providing the latest vehicle model, vehicle price, dealers' activates, etc. It is focused on consumers' complains related to vehicle usage. Five categories of evaluation index are adopted for quantifying the consumer feedback into comparable ranking of car quality,

with 60 secondary indexes. PPH (PP100) methodology is used in the evaluation, which is the failure occurrence frequency out of 100 vehicles[23] as illustrate in the below formula:

PPH=overall consumer complaints of specific vehicle model/sample size×100

In 2014 the database covered over 26,600 samples, including JV-brand, self-owned brand and imported brands[24]. The more complaints mean the lower the quality is. The ranking also shows the average performance of each vehicle segment, which helps consumers clearly recognize the models' relative position. The division of vehicle models is based on the criteria adopted by *Auto Home*. Rankings announced in the report only illustrate the models with sampling size of over 30 and PPH represent the percentage of samples per model.

Figure 11 2014 China Car Quality Ranking



Note: *Independent Brands on the left, JVs on the right; for each model a relative ranking out of a 0-100 scale is illustrated.*

Table 28 China Car Quality Ranking criteria25

Criteria	Note
Bodywork and exterior	Front and back door design; painting and body corrosion; side windows and

[23] http://baike.baidu.com/link?url=WdA3Lefno8qE-rn72FmMgje4nZN45B9sD_FW4pSwJLhlnCC63RV5n5mSy-71MxsRgZWeZX2EAkDtlFuQ2OG9AaYHrCKdB5U_JQi90S_hfiLLD6WTtO-D7RdFqyRG-D3n1YeXsX11UwqxLE45uNjAnOOdbvX9uQvGSk0JWzIWsRHGmeJz5xFoDUKLWwbRxUdy1RSdx_WPpySnTgrF4ahWv_

[24] http://www.360doc.com/content/14/1122/21/67242_427255612.shtml

[25] http://club.autohome.com.cn/bbs/thread-c-634-35420771-1.html

decoration	controlling; windscreen wiper and controlling, etc.
Interior decoration	Instrument panel and alarm lamp; interior storing space; safety belts and airbags; interior air quality, etc.
Driving experience	Vision field, steering wheel, driving assistance systems; braking performance; active safety systems, etc.
Inner electrical components and disposition	Air conditioning and controlling system; defogging performance; GPS; Music/video playing; communication……
Engine & gear box	Engine starting/firing; battery quality; fuel consumption; engine-idling……

Note: *The China Quality Ranking currently excludes EV and Hybrids ranking.*

Table 29 China Car Quality ranking and its summary

China Car Quality Ranking	
Website	http://tousu.315che.com/
Slogan	N/A
Entity type	Commercial
Users	Not clear
Establishment year	2014
Ranking types	Quality complaints rating
Ranking method	PPH methodology is adopted in the ranking system, based on five criteria classifications with 60 secondary indexes. Vehicle models larger than 30 samples are listed and ranked.
EVs/Hybrids	Not included

Figure 12 China Car Quality Ranking System Summary

Method →	Data →	Evaluators →	Outcome →	Distribution
PPH methodology **Criteria**: 5 criteria: Bodywork and exterior decoration, Interior decoration, Driving experience, Inner electrical components and disposition, engines & gearbox	Averaging of cumulative voluntary online complaints by consumers over the previous 12 months as a data source*	Random consumers*	Vehicle Quality Performance ranking,	Website

Weighting:
Averaging of samples (if >30)

** There is sensitivity to data dumping and circumvention.*

3.2.4 Annual Green Car Ranking by *d1ev.com*

Annual Green Car ranking, initialized in 2010 by *d1ev.com*, is considered the most authoritative evaluation of new energy vehicles (NEVs)[26]. *d1ev.com* is the largest information service and e-commerce platform for providing NEV related news, experts reviews, industry and regulatory updated[27].

The awards' evaluation may vary from year to year, based on the NEV industry development, the increase in consumer awareness and industry's technological capacity. Generally, awards are set according to vehicle classifications. In 2014 the awards were: Annual Green Car, Annual Passenger Green Car, Annual Motor Bus, Annual Minicar, Annual Delivery Car, Annual Innovative City, Annual Innovation Award for Charging Service, Annual Innovative Enterprise and Annual Innovation Leader. Similar to CPMAA CCB, the inputs of experts, manufacturers, and cities' representative (e.g. media outlets) are included in the rankings process.

The Annual Green Car Award ranking is derived from consumer and experts votes. Experts are people with vast experience in the auto study area either from an academic background, vast auto industry experience, or professional media track-record. **Appendix I** lists d1ev 2014 experts (21 in total), covering the academic, industrial and media sectors, based on their reputation and related experience. In the first stage, both consumers and experts vote for eligible candidates with voting weights of 60% and 40%, respectively. The next voting stage shortlists the Top 3 for each classification, however now with voting weights of 40% and 60% separately, providing more weight to experts' votes. Finally, the Car of the Year awards are selected through experts voting[28]. Evaluations are subjective, making voting criteria very fluid. Yet several criteria are at the heart of *d1ev* NEVs evaluation, as listed in **Table 31**, and are therefore typically being considered by experts. As for consumers, economics of scale may increase the credibility of the results despite conceptual unity issues and the subjective nature of performance experiences.

Table 30 Annual Green Car Award ranking criteria

Criteria	Note
Design	Well-executed exterior and interior styling; dynamic bodywork; visual effects
Driving power	The high-tech power design and outlet; acceleration performance and speed limits
Driving mileage	The cruising ability is important to EVs, reflecting the dependence degree on piles.
Battery quality	High capacity and excellent output; small in size and light in weight.

[26] http://www.d1ev.com/2014greencar/#page2
[27] http://www.d1ev.com/
[28] http://www.autoreport.cn/hyltzt/20140109/0006328163.html

Table 31 Annual Green Car Award and its ranking summary

Annual Green Car Award	
Website	http://www.d1ev.com/2014greencar/#page2
Slogan	N/A
Entity type	Commercial
Users	N/A
Establishment year	2010
Ranking types	Annual Green Car, Annual Passenger Green Car, Annual Motor Bus, Annual Minicar, Annual Delivery Car
Ranking method	Consumers and experts votes, with more weight gradually being given to the experts (3 voting rounds).
EVs/Hybrids	Covering all the new energy vehicle types

Figure 13 Annual Green Car Award Ranking System Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: 4 criteria: Design, Driving power, Driving mileage, Battery quality	Averaging of cumulative consumers and experts voting*	Consumers and experts voting	Annual Green Car Awards for different vehicle segments, as well as some character-related awards	Website, Award ceremony
Weighting: 60% and 40% voting weights for customers and experts, in the first round; 40% and 60% voting weights for customers and experts in the checking-round				

** There is sensitivity to data dumping and circumvention.*

3.2.5 Autohome EV Rankings

Established in 2005, Autohome is a global auto website. According to iUserTracker statistics[29], almost 80 million people visit Autohome monthly, resulting in a high influence on China's autos market. Currently, Autohome provides a variety of product services, including auto insurance quotes, information platform, data platform, interaction center, etc. The Autohome website is designed to guide consumer choices towards car purchasing. Recently, Autohome incorporated a new EV platform for providing references and suggestions enabling the evaluation of market-available EVs.

The Autohome EV ranking is based on consumers' rating, involving several criteria, each of which has a separate ranking as shown in **Table 33**. Autohome EV ranking adopts five-star (5 point scale) standard for each criteria and consumers can therefore grade a certain EV model according to their criteria of preference. An average score of various evaluators is generated and made available on the website. Data is constantly being updated; therefore scores may change from time to time.

Autohome ranking is still not well illustrative of the unique EV features (e.g. range, battery load). However key properties of different EVs, such mileage, subsidies, and tax exemptions are included.

Table 32 Autohome EV ranking criteria

Criteria	Note
Interior space	Driver's seat space which decides the driving experience to a large extent; passengers' seats space; space allocation, etc.
Powertrain	Acceleration performance and the maximum speed; for EVs, the mileage may be included.
Handling	Steering control; gearbox performance; suspension system; combining the controlling of a car and the driving pleasure.
Comfort	Riding performance; seat structure, sizes and layout patterns; vehicle body sealing performance; ventilation and heat retention, etc.
Exterior appearance	Resistance reduction design; the shape of car faces; aesthetic design
Interiors	Cushion design; containing box; seatbelts; illuminating system and acoustic system; dashboard system, etc, which accounts for over 60% of the design work of vehicles.
Cost	Cost involves various evaluation index individually, such as fuel economy, car maintenance, engine performance, acceleration performance, etc.

[29] http://baike.baidu.com/link?url=ASdxHzmiJUEskz3i5S9A7v_XmfGx7ykcmW0QnVMCkihGA1bjKGgM90NT3Q9mwHwKuVTcssof9DPUJjHB6vKPYMr4QK1ZDXh06AhAz3XG3X_

Figure 14 Autohome EV ranking

Table 33 Autohome EV and its ranking summary

Autohome	
Website	http://www.autohome.com.cn/
Slogan	N/A
Entity type	Commercial
Users	N/A
Establishment year	Jun 2005
Ranking types	Public Praise Rating, covering EVs and PHEVs
Ranking method	Five-star (5 point scale) is adopted while consumers grade a certain EV model based on several criteria, thus the ranking is changing in real time. The average scores are shown.
EVs/Hybrids	EVs as well as hybrids are included.

Table 34 Autohome EV Ranking System Summary

Method →	**Data →**	**Evaluators →**	**Outcome →**	**Distribution**
Criteria: 6 criteria: Interior space, powertrain, Handling, comfort, Exterior appearance, Interiors and cost performance.	Some quantitative data based on consumer delivering	Consumer ranking	1-5 scale for enabling comparative score	Website
Weighting: Averaging of data sample				

3.3 Conclusions

Multiple guiding sources of information both abroad and in China are meant to accompany car purchases. Ranking entities are typically commercial news and marketing agencies as well as some independent not-for-profit auto platforms. Global and national rankings can be differentiated in three ways: their ranking method, their ranking scope and results illustration, and their ranking criteria. This section attempts to highlight these differences and summarizes major criteria items, methods and ranking results illustration.

At the heart of each ranking method is its source of data. The data gathered for presenting consumers with informed rankings globally are comprised of official data provided by car manufacturers (e.g. specs, performances) and the regulators (e.g. safety, fuel economy). Most rankings also include novel data produced either through car testing to validate official data and adjusting it to realistic driving conditions (e.g. MGP combination of highway and city, acceleration) and to provide qualitative quantification of non-numerical car features (e.g. seat comfort, doors handling) or through meta-analysis of online reviews (e.g. US News). Besides car testing conducted by certified car testers or by a dedicated ranking team or individuals, large scale consumer surveys are also utilized and are often shared by several ranking systems (e.g. J.D.Power produced VDS and IQS are used by AutoBlog and US-News). In China, auto manufacturers provide most of the data rather than the public sector, most likely due to data accessibility issues. National rankings also include qualitative assessments by selected experts and consumers, and tend to give more weight to experts voting (e.g. d1ev, CCB). Consumer ranking seems to be less accessible in China and is therefore arguably less credible (e.g. CCB ranking is performed locally by local media partner), and consumers' inputs are typically collected and analyzed by each ranking system independently in timeframes and volumes which are not reported in as much detail as in global ranking systems. Table 32 summarizes the data sources utilized by each of the reviewed ranking systems, and presents a summary of both global and national data types.

Table 35: International Rankings Summary, and Criteria Evaluation Results

	Meta-analysis	Experts		Consumer reporting			Official		Testing
		Announced	Discrete	Independent	Paid	Third party	Auto manufacturer	Public data	Independent
AutoBlog					V	V		V	
MotorTrends		V							V
US-News	V				V	V		V	
ConsumerReports				V			V	V	V
Edmunds			V				V	V	V
Sub-summary	20%	20%	20%	20%	40%	40%	40%	80%	60%
J.D.Power				V	V			V	
CPMAA-CCB			V	V					
31cge.com				V					
diev.com		V		V			V		
AutoHome				V					
Sub-summary	0%	20%	20%	100%	20%	0%	20%	20%	0%
Summary	**10%**	**20%**	**20%**	**60%**	**30%**	**20%**	**30%**	**50%**	**30%**

Before analyzing the differences in ranking criteria, it is worth noting that Chinese and global rankings largely differ in their scope. Global rankings, perhaps due to their long history, typically cover new and used ICE vehicles and have slowly created somewhat adjusted rankings and comparison systems for roughly dealing with the increasing number of hybrid cars and electric vehicles available on the market. National rankings, on the other hand, place more emphasis on new cars in general, and, in particular, on electric cars. In fact, three of the five national ranking systems have dedicated rankings for EVs and hybrids (CCB, d1ev and AutoHome).

Global and national rankings differ in their ranking results illustration method. **Table 37** shows the way by which the ranking is illustrated. Clearly, the majority of global ranking are using a 5 points system, either through circles or letters, while in China, the majority of rankings arrive at a top performing model. Overall, half of the reviewed rakings use a short odd number ranking. This simple illustration method is therefore likely to deliver the most intuitive and simple ranking results to the general public, as assumed by half of the ranking systems examined in this report.

Table 36: International and National Rankings – illustration of ranking types

	Ranking	Type	Method	Example: 2nd best score
				Announced
Global	AutoBlog	Relative 5 Points: color circles	Relative score (top 10% etc.)	
	Motor Trends	Best 1	Two stages, 50 senior motoring journalists	N/A
	US-News	Numerical 1-10 scale, and top performing	Ongoing updating by editing team	N/A
	Consumer Reports	Relative 5 Points: Half/full/color circle (various types of scales used in data analyses)	Ongoing updating by editing team	
	Edmunds	Relative 5 Points: A-E	Annual ranking by 200 experts	
China	J.D.Power	Relative 5 Points: color circles	Relative score (top 10% etc.)	
	CPMAA-CCB	Best 1	20 CCB members, selected experts and consumers	N/A
	31che.com	Relative score full list (1-100 scale)	Voluntary data insertion	N/A
	diev.com	Best 1	Voluntary data insertion	N/A
	AutoHome	Relative 5 Points: colored stars	Voluntary data insertion, period scores updating by editors	

This report is meant to study the criteria used by international and national car rankings that are aimed at influencing consumer car purchase choices. Just as the identified rankings vary in their data collection and scoring methods, the rankings also vary in the criteria they chose to focus on and the importance attached to each criteria. While none of the rankings state having placed specific weight to each criterion, the

authors of this report attached placement of each criterion to its relative level of importance in each ranking system (for example, a criterion stated first would be considered as that of the highest importance). Not all the criteria carry the same explanation in all the rankings examined and some have grouped several criteria items under a single criteria title. The authors of this report, for the sake of criteria unity, have listed major criteria while detailing the most common explanation repeatedly used along the rankings.

Tables 38 and **39** present the criterion used in each of the international and national rankings and summarizes the total number of usage (out of 5 systems of rankings) and the average importance attached to each criterion. In order to conclude which criteria are used the most and receive relatively high importance, a simple calculation is made: (total usage out of 5 rankings) + (10 – the stated importance). The overall criteria importance in international rankings is detailed in the last column, where 1 represents the most important criteria and 13 represents the least important criteria.

In the international summary (**Table 38**), two criteria have been excluded from the final list as they failed to reach an evaluation score of above 6 points (out of 15). In the national summary, nine criteria were excluded (out of 18). This shows that criteria vary more widely in the various national ranking systems as opposed to the international rankings. This likely reflects the ambiguity in the understanding of Chinese consumers' preferences, indicating that there is still room to study current and future car consumerism in China.

The order of importance of the criteria, marked green in both tables, presents several interesting observations: safety and reliability, listed 2nd and 5th in the international ranking, are excluded from national rankings; while comfort is listed 3rd in international rankings, it is listed 7th in national rankings; while ownership cost is listed 4th in national rankings, it is listed 8th on international rankings; fuel economy is listed last in both rankings, although car cost of ownership is of relative importance at least in the national ranking, highlighting the gap that Chinese consumers (or car ranking systems' designers) attach to these two highly linked criteria items; while exterior elements of the car are listed 3rd in the national rankings, they are listed 11th from the end on the international ranking, supporting the well-acknowledged contention that branding and looks of a car is of relatively high importance in China.

Table 37: International Rankings Summary, and Criteria Evaluation Results

	Auto Blog	Motor Trends	US-News	Conusmer Reports	Edmunds	Criteria Summary		Criteria evaluation result	
	Importance	Importance	Importance	Importance	Importance	Total usage	Average Importance	Total Usage+ (14- Average importance)	Criteria importance
	1=most	1=most	1=most	1=most	1=most	5=most	1=most	14=best score	1=most
Driving performance: Braking, Steering, Handling, Drivability, Acceleration	1	6	1	3	3	5	2.8	**12.2**	**1**
Safety	N/A	5	6	4	1	4	4.0	**10.0**	**2**
Comfort: Overall, Seating, Ride	3	N/A	3	N/A	4	3	3.3	**9.7**	**3**
Interior: Space, Room, Visibility, Cargo	8	2	2	N/A	6	4	4.5	**9.5**	**4**
Reliability	N/A	N/A	7	2	2	3	3.7	**9.3**	**5**

Style: Personality, Driving experience	2	1	N/A	N/A	10	3	4.3	**8.7**	**6**
Cost Effective Technologies that bring benefit to the consumer	N/A	3	N/A	N/A	N/A	1	3.0	**8.0**	**7**
Cost of ownership: Cost (MSRP), Warranty	N/A	N/A	N/A	1	8	2	4.5	**7.5**	**8**
Features and Instruments Panel: Stereo system, Gauges/instruments, Heating/air conditioning system	4	N/A	N/A	6	7	3	5.7	**7.3**	**9**
Powertrain: Engine, Transmission	5	N/A	5	N/A	N/A	2	5.0	**7.0**	**10**
Exterior: Doors handling and noise, Design	7	N/A	4	N/A	N/A	2	5.5	**6.5**	**11**
Ergonomics: Complications/simplification of operation	6	N/A	N/A	N/A	5	2	5.5	**6.5**	**12**
Fuel Economy: Overall, Highway, City	N/A	4	N/A	7	9	3	6.7	**6.3**	**13**
Dependability: 3 year ownership over interior, powertrain, features and accessories	9	N/A	N/A	N/A	N/A	1	9.0	**2.0**	**No**
Owner Satisfaction	*	N/A	N/A	5	N/A	1	5.0	**6.0**	**No**

Table 38: National (China) Rankings Summary, and Criteria Evaluation Results

	J.D.Power	CPMAA-CCB*	31che.com	d1ev.com*	AutoHome*	Criteria Summary		Criteria evaluation result	
	Importance	Importance	Importance	Importance	Importance	Total usage	Average Importance	**Total Usage+ (14-Average importance)**	**Criteria importance**
	1=most	1=most	1=most	1=most	1=most		1=most	**14=best score**	**1=most**
Driving performance: Braking, Steering, Handling, Drivability, Acceleration	1	4	3	3	3	5	2.8	**12.2**	**1**
Interior: Space, Room, Visibility, Cargo	8	3	2	2	1	5	3.2	**11.8**	**2**
Exterior: Doors handling and noise, Design	7	2	1	1	5	5	3.2	**11.8**	**3**
Cost of ownership: Cost (MSRP), Warranty, national subsidies for EVs	N/A	1	N/A	N/A	N/A	1	1.0	**10.0**	**4**
Powertrain: Engine, Transmission, battery quality (if electric)	5	N/A	5	5	2	4	4.3	**9.8**	**5**
Style: Personality, Driving experience	2	N/A	N/A	N/A	N/A	1	2.0	**9.0**	**6**
Comfort: Overall, Seating, Ride	3	N/A	N/A	N/A	4	2	3.5	**8.5**	**7**

Features and Instruments Panel: Stereo system, Gauges/instruments, Heating/air conditioning system	4	N/A	4		6	3	4.7	**8.3**	**8**
Fuel Economy: Overall, Highway, City / or driving mileage if for EVs	N/A	5	N/A	4	N/A	2	4.5	**7.5**	**9**
Safety	N/A	6	N/A	N/A	N/A	1	6.0	**5.0**	**No**
Ergonomics: Complications/simplification of operation	6	N/A	N/A	N/A	N/A	1	6.0	**5.0**	**No**
Dependability: 3 year ownership over interior, powertrain, features and accessories	9	N/A	N/A	N/A	N/A	1	9.0	**2.0**	**No**
Cost Effective Technologies that bring benefit to the consumer	N/A	N/A	N/A	N/A	7	1	7.0	**4.0**	**No**
Brand Awareness and perception	10	N/A	N/A	N/A	N/A	1	10.0	**1.0**	**No**
Consumer Satisfaction Index: service and dealer facilities	11	N/A	N/A	N/A	N/A	1	11.0	**0.0**	**No**
Service: confidence, value, quality, service	12	8	N/A	N/A	N/A	2	10.0	**2.0**	**No**
Car purchase experience: transaction process, staff, sales facility	13	7	N/A	N/A	N/A	2	10.0	**2.0**	**No**
Tire: durability, friction, driving etc.	14	N/A	N/A	N/A	N/A	1	14.0	**-3.0**	**No**

* EV tailored

Tables 40 and **41** show the sources of data and the ranking method used in each of the international and national rankings. The international summary confirms that data is typically based on qualitative reporting rather than quantitative information, excluding five cases of official data usage (out of a total of 13 criteria). In many cases, car testing is conducted before the qualitative assessment is generated, and, in many cases, official data published by auto manufacturers and on government websites (public data) is utilized. The assessment is, of course, relative and subjective; however, the role of large numbers of respondents, as stated by various rankings' overview, increases the credibility and statistical value of these subjective evaluations. In the national ranking, a combination of experts and consumers' scoring is abundant. In most cases, experts' reviews are being given higher importance (apart from AutoHome). The selection process of experts, their identity, and their scoring method are not transparent in most cases (apart from d1ev), signaling that there may be credibility issues.

Table 39: International Rankings Results List of Sources

		Auto Blog	Motor Trends	US-News	Consumer Reports	Edmunds	Conclusions
1	**Driving performance: Braking, Steering, Handling, Drivability, Acceleration**	APEAL	50 senior motoring journalists	Reviews of magazines and automotive websites	CR testing	Experts testing and review results	**Qualitative**

2	**Safety**	N/A	50 senior motoring journalists	NHTSA	CS own test results, NHTSA and IIHS	NHTSA and IIHS crash test results	**Official data**
3	**Comfort: Overall, Seating, Ride**	APEAL	N/A	Reviews of magazines and automotive websites	N/A	Experts testing and review results	**Qualitative**
4	**Interior: Space, Room, Visibility, Cargo**	IQS	50 senior motoring journalists	Reviews of magazines and automotive websites	N/A	Experts testing and review results	**Qualitative**
5	**Reliability**	N/A	N/A	VDS and IQS	Based on consumer reporting: average-comparison	Experts testing and review results	**Qualitative**
6	**Style: Personality, Driving experience**	APEAL	50 senior motoring journalists	N/A	N/A	Experts testing and review results	**Qualitative**
7	**Cost Effective Technologies that bring benefit to the consumer**	N/A	50 senior motoring journalists	N/A	N/A	N/A	**Official data**
8	**Ownership: Cost (MSRP), Warranty**	N/A	N/A	N/A	MSRP	Official costs, subjective evaluation of worthiness	**Official data**
9	**Features and Instruments Panel: Stereo system, Gauges/instruments, Heating/air conditioning system**	APEAL	N/A	N/A	CR evaluation	Experts testing and review results	**Qualitative**
10	**Powertrain: Engine, Transmission**	IQS	N/A	Reviews of magazines and automotive websites	N/A	N/A	**Official data**
11	**Exterior: Doors handling and noise, Design**	IQS	N/A	Reviews of magazines and automotive websites	N/A	N/A	**Qualitative**
12	**Ergonomics: Complications/simplification of operation**	IQS	N/A	N/A	N/A	Experts testing and review results	**Qualitative**
13	**Fuel Economy: Overall, Highway, City**	N/A	50 senior motoring journalists	N/A	Realistic mix - CR assuming	Official data	**Official data**

Table 40: National (China) Rankings Results List of Sources

		J.D.Power	CPMAA-CCB*	31che.com	d1ev.com*	AutoHome*	Conclusions
1	**Driving performance: Braking, Steering, Handling, Drivability, Acceleration**	APEAL	Auto Manufacturers and Consumer initiate ranking, 3 experts and CCB 20 members finalize the ranking	overall consumer complaints of specific vehicle model (average of past 12 months) /sample size ×100	Combination of consumers and experts scores with increasing weights to experts voting	Website visitors voluntary ranking	Qualitative
2	**Interior: Space, Room, Visibility, Cargo**	IQS	Same as above	Same as above	Same as above	Same as above	Qualitative
3	**Exterior: Doors handelling and noise, Design**	IQS	Same as above	Same as above	Same as above	Same as above	Qualitative
4	**Cost of ownership: Cost (MSRP), Warranty, national subsidies for EVs**	N/A	Same as above	N/A	N/A	N/A	Qualitative
5	**PowerTrain: Engine, Transmission, battery quality (if electric)**	IQS	N/A	Same as above	Same as above	Same as above	Qualitative
6	**Style: Personality, Driving experience**	APEAL	N/A	N/A	N/A	N/A	Qualitative
7	**Comfort: Overall, Seating, Ride**	APEAL	N/A	N/A	N/A	Same as above	Qualitative
8	**Features and Instruments Panel: Stereo system, Gauges/instruments, Heating/air conditioning system**	APEAL	N/A	Same as above	N/A	Same as above	Qualitative
9	**Fuel Economy: Overall, Highway, City / or driving mileage if for EVs**	N/A	Same as above	N/A	Same as above	N/A	Qualitative

* EV tailored

Overall, the criteria summary exemplifies the tendency to consider conventional vehicles' performance and ownership experience and a clear neglect of EV specific performance and experiences, which are substantially different in some cases. Chapter 4 of this report will strive to tailor the widely used ranking criteria identified in this chapter to the case of electric (full-electric and hybrid) cars in China.

4. BestEV methodology

After understanding what online car rankings, and EV rankings in particular, are available and studying the area of consumption sensitivity with emphasize on EV adoption, this chapter will conceptualize the methodology behind the BestEV ranking.

4.1 Methodology employed

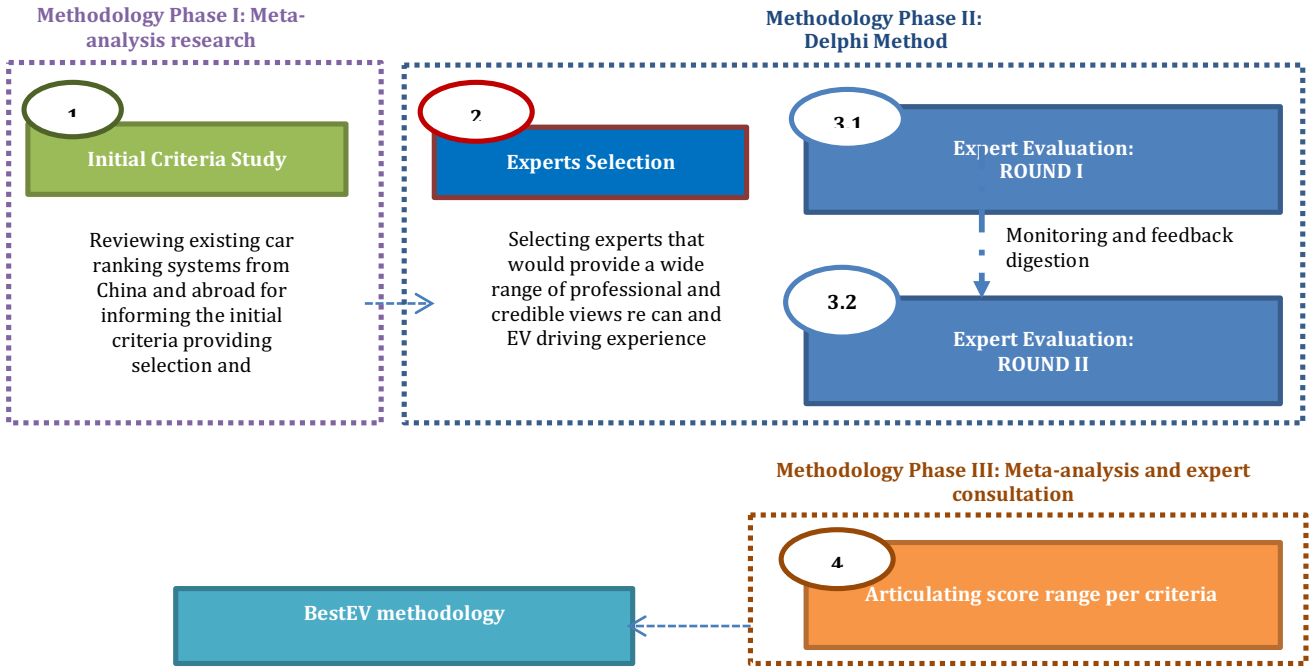
Consensus Development Methods (CDM) are increasingly being used for defining levels of agreement on controversial subjects, such as in national regulatory reforms and corporate sector decisions (Fink, Kosecoff, Chassin, & Brook, 1984). Advocates suggest that consensus strategies often create structured environments that allow solutions to be more justifiable and credible than otherwise. Major consensus development methods include the numerical method, consensus development conferencing, and the Delphi Method.

Applied to issues in social services, government organization, and industry since the 1960s, the nominal group process is a structured meeting that attempts to provide an orderly procedure for obtaining qualitative information from target groups (Fink, Kosecoff, Chassin, & Brook, 1984). Consensus development conferencing is a common method used for disseminating the outcomes of the above methods and for enabling an open discussion for achieving consensus. The open, costly and casual characters of a typical conference can arguably result in biased outcomes that largely depend on the organization, management and funding sources of the conference.

Originating in the 1950s, the Delphi method is meant to obtain expert opinion for an array of problems in a systematic manner. Participating experts are polled individually and anonymously, usually using self-administered questionnaires distributed by mail or email. The survey is conducted over two rounds or more, while each round's results are elicited and reported to the group. By reaching convergence of opinion or diminishing returns, the survey is considered complete. The main advantages of Delphi are its unlimited geographical outreach to experts and its ability to allow opinion shaping processes on the individual level (something seldom reached in an open debate). Its flexibility in terms of experts' group selection and its inability to supervise experts' participation reliability are thought to be its main weaknesses (Sackman, 1975).

The Delphi method is often used for predicting and evaluating future trends and will therefore be employed in the development of BestEV to form structured and credible EV performance evaluation criteria for ultimately increasing the adoption of EVs through participatory (and hopefully viral) public surveying (Step 1, **Figure 14**). The criteria would then be placed in an online survey format that would enable the insertion of preferences by independent individuals of the China's EV user's community (Step 2, **Figure 14**). It is hoped that authentic sharing of people's perceptions and preferences will be more impactful than the performance ranking created by interests groups (e.g. EV manufacturers, retailers, industry opposition actors etc.). The calculation method of the initial criteria would be articulated by the authors of this work (Step 3, **Figure 14**).

Figure 15: BestEV methodology development: process and methods employed



4.2 BestEV evaluation criteria

The EV performance criteria design process includes two steps: meta-analysis review of other rankings available (Step 1, **Figure 14**; chapter 3 and chapter 4.2.1), and later on a re-examination of the initial criteria and weighting determination through *i*CET's expert inputs and two rounds of experts consultation utilizing the Delphi Method (Step 3, **Figure 14**; chapter 4.2.1 and 4.2.2).

4.2.1 Initial ranking criteria [Methodology part 1]

The existing rankings overview presented in chapter 3 attempts to understand the common perceptions of car performance elements both abroad and in China. Although clearly there is a market for car performance information in both, each of these markets seems to have different pulling forces: one is more concerned with safety, reliability and comfort while the other is more concerned with exterior elements and cost. The sources of data that the rankings are derived from also differ: one is more informative and analytical and supports the sharing of data between entities, while the other is more inductive and less transparent. The results however are more or less the same – either arriving at a best performing relative list, or a five circle relative scoring. The variety of criteria presented across national rankings signals that the study of consumers' car purchase perceptions may still be in a relative nascent stage, as opposed to international rankings that seem more aligned in their criteria selection. Therefore, in order to create a robust BestEV ranking system, criteria from both international and national rankings will be considered at the initial stage.

Table 42 presents the initial BestEV ranking criteria based on international and national rankings, with a weighting of 45% and 55% respectively. The weighting in favor of national rankings, despite its relatively nascent ranking know-how, stems from the recognition of the uniqueness of national consumerism. Also, rankings that are tailored for EVs and were excluded from the by-geography evaluation (chapter 3.3) are nevertheless included in the initial BestEV criteria list. This is because such criteria items may be unique for the case of EVs and therefore are of relevance to the BestEV ranking system.

Table 41: BestEV Initial Criteira Evaluation Result

	Intl' ranking evaluation result (weight: 45%)	National ranking evaluation result (weight: 55%)	Criteria evaluation result**	Criteria evaluation ranking
	1=most important	1=most important	Intl'*0.4 + National*0.6	1=most important
Driving performance: Braking, Steering, Handling, Drivability, Acceleration, Shift quality	1	1	1	1
Interior design: Seating Space/Room, Visibility, Cargo/load space, quality of interior materials e.g. looks and durability	4	2	2.9	2
Comfort: Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	3	7	5.2	3
Ownership Cost: Purchase Price (MSRP), Warranty Length, Insurance Cost	8	4	5.8	4
Style/exterior design: Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring	6	6	6	5
Exterior quality/mechanics: Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	11	3	6.6	6
Powertrain: Engine, Transmission, Battery quality for EVs	10	5	7.25	7
Technical Features and Instruments Panel: Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies	9	8	8.45	8
Fuel Economy: Overall (average), Highway, City/ or driving mileage if for EVs	13	9	10.8	9
Safety: ABS, Belts, Baby-seat inner holders, Airbags	2	No	12.2	10***
Reliability: Volume of operation incidence	5	No	13.4	11***
Car Driving Ergonomics: complications/simplification of operation, logical and well placed control/function	12	No	16.2	12***

* EV tailored ranking;
** The evaluation result is providing national criteria with 55% weighting and international with 45%.
*** Where the ranking is tailored for EVs, even if the sub-total arrives at a "no" result it receives the least important score (score = 19).

While international and national rankings are useful for understanding consumer perceptions and preferences in the case of the traditional car, these rankings provide little value for the special case of evaluation of the electric car. The authors of this work have been involved in various EV regulatory studies, conferences, and car rankings, from which key EV performance considerations were learnt. These potential criteria are specified in **Table 43** and are meant to be added to the criteria outlined in **Table 42** for inspiring experts to share their respective EV car ownership perceptions during the Delphi method.

Table 42: iCET Suggested EV-specific Ranking Criteria

Criteria	Comments
Range	Real-world EV mileage per full charge.
Charging comfort	Comprised of: (i) charging socket types (e.g. AC/DC), and (ii) charging infrastructure availability (e.g. a single charging provider or adequacy to multiple providers, charging flexibility).
In-car telematics	Hardware and software elements in the car for providing the driver with information regarding the vehicle (e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc.)
Wheels system	Comprised of: (i) since EVs tend to weight 30% more than ICE vehicles, their tires are recommended to be adjusted accordingly, and (ii) shock resistance system should be equip accordingly as well.
Cost of electric drive	Comprised of: (i) purchase subsidy – national and local, (ii) cost of charging (e-km compared with gasoline-km fee), (iii) maintenance cost (preferential insurance fees apply? Per-mileage treatment, etc.)

By combining the two sets of criteria, the one developed through international and national rankings review and the one contributed by *i*CET based on its respective work, a single set of criteria ready for expert review is presented in **Table 44**. Overall, 8 quantitative criteria (1-8) and 16 qualitative criteria (9-24) were identified.

Table 43: Initial BestEV Criteria - Delphi Survey 1 Format

		Suggested Criteria and Measurement Guidance	Yes/No	Weight (%)	Rationale
Example		Driving performance: Braking, Steering, Handling, Drivability, Acceleration, Shift quality	Yes	10%	Performance is signaling the vehicle's abil perform on the road in relation to other ca key performance indicator on global ranki well is common people's minds is the cars acceleration potential (although hardly experimented in daily life).
		[Typically measured through driving experience, better in comparison to other models of the same segment]			*Should be based on official acceleration spe*
Quantitative criteria	1	**Range**: mileage per charge (Total km range for full battery)			
		[Typically by assessing the official range in comparison to similar segment cars' average; Better basing on own average experience under typical daily driving conditions at average temperatures and altitudes]			
	2	**Acceleration** (second to reaching 50km/h)			
		[Typically by examining vehicle specs and real-world experience…]			

	3	**Vehicle weight** (kg) *[Typically according to vehicle specs]*		
	4	**Max Power for e-Motor** (kW) *[Typically according to vehicle specs]*		
	5	**Battery Capacity** (kWh) *[Typically according to vehicle specs]*		
	6	**Max Speed** (km/h) *[Typically according to vehicle specs]*		
	7	**Charging time** (time for charging zero-full) *[Typically by examining vehicle specs and real-world experience…]*		
	8	**Energy Efficiency**: Overall average including Highway, City/ or driving battery consumption rate for Evs (27kWh/100km or e-km/l) *[Typically by checking the official FC label, but better by averaging 3 full-tank rides km driven under a typical daily driving conditions; There are helpful Apps e.g. OilBear App!]*		
Qualitative criteria	9	**Driving performance**: **Does it feel like you are becoming one with the car?** Braking, Steering, Handling, Drivability, Shift quality *[Typically measured through driving experience, better in comparison to other models of the same segment]*		
	10	**Interior design and comfort: How well is it serving your daily use?** Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments *[Typically measured by touring the car and examining load volumes and sight, experiencing the car and exploring its wheel and seating specs]*		
	11	**Car Driving Ergonomics: How easy to use?** complications/simplification of operation, logical and well placed control/function		

	[Typically measured by operating the car while driving, assessing adequacy to one's logic as well as comparing to other cars]
12	**Ownership Cost: How much do you spend on it?** Purchase Price (MSRP), Warranty Length, Insurance Cost
	[Typically measured by average cost in relation to other cars of the same segment]
13	**Style/exterior design: How does it look from the outside?** Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring
	[Typically measured by comparing the car to other cars' looks of the same segment]
14	**Exterior quality/mechanics: How does it feel?** Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.
	[Typically measured by experiencing the car and assessing its design specs in comparison to other cars of the same segment]
15	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags
	[Typically measured by checking the car specs, and comparing with the average car available on the market]
16	**Electric drive**: Motor (engine) and transmission quality for HPEV, Electric power
	[Typically measured by evaluating official info against the average powertrain features for that segment, and the feel of the power of the car while driving it]
17	**Reliability**: Volume of operation incidence
	[typically measured by consumer complains/problems over vehicle ownership in comparison to other cars' incidents over a similar period of time – can be by comparing with friends that maintain other car models or based on previous experiences]

18	**Technical Features and Instruments Panel (Add-ons):** Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies *[Typically measured by checking the car s specs or simply trying out its add-ons]*			
19	**Service**: After-sales -service quality, Purchase experience, Service and dealer facilities *[Typically by comparing the purchase experience and after-service support with other experiences]*			
20	**Brand awareness and perception:** brand value *[Typically by assessing brand familiarity and model reputation]*			
21	**Charging convenience**: Charging compatibility, Charging infrastructure availability *[Typically measured by actual charging options availability, with some weighting to future options should have high internalization certainty]*			
22	**In-car e-driving related telematics: How indicative the car is of its own state of drive?** Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc. *[Typically assessed through car specs and driving experiences, better in relation to other EVs available on the market]*			
23	**Chassis system quality**: Shock resistance system, durability and friction of tires *[Typically by examining tires specs and driving the car on a bumpy road]*			
24	**Cargo/load space** *[Typically by examining vehicle space]*			
Total weighting [Please ensure the accumulating weighting is 100%]		100%	0%	

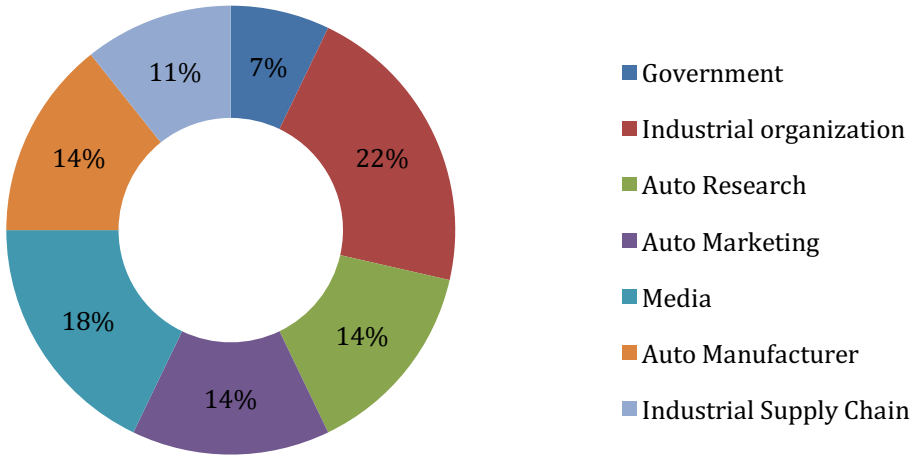
***Note**: This table summarizes the background review of international and national remaking, as well as comments provided by iCET regarding EV specific criteria that found to be missing from general well-known car rankings. Experts of the Delphi method were presented with this table in the first survey round. Empty rows were added to the list for enabling the insertion of new criteria.*

4.2.2 Delphi Method: Experts selection [Methodology part 2]

The Delphi method, explained in more detail in section 4.1, can be comprised of two or more revision rounds of an initial criteria list and weighting, by a selected group of experts. The initial criteria items were concluded in the above section. Shortlisting of experts will therefore be the first goal of this section, after which the Delphi method results could be presented for arriving at a final criteria item and weighting list.

As in most rankings, journalists and researchers are the majority of experts selected for ranking car performance – in the BestEV ranking's methodology development process, journalists represent 32% of experts, of which 14% are auto researchers and 18% are auto-specific media journalists. Since BestEV is meant to create simple criteria that reflect auto performance, auto sector experts would comprise another group of experts, comprising 28% of the total number of experts, of which 14% are auto manufacturers and 14% are auto marketing experts. Vehicle suppliers (11%) and industrial organizations (22%), which may have interesting insights into auto parts and industrial competitiveness, comprise another 33% of experts. Government officials comprise the remaining 7% of experts views. Just as both international and national ranking systems have advised the initial criteria selection, both international and national experts' views are considered. Here as well as in the initial criteria selected in chapter 4.2.1, national experts comprise the majority of experts (25 out of 28).

Figure 16: Experts divide



National experts were approached via email and phone to explain the background of the survey, its purpose, and its process. The authors of this study believe the phone calls played an important role in engaging national experts. International experts were approached via email, and therefore received very limited response rate. **Table 44** lists the experts that participated in the Delphi method.

Table 44: List of experts

Name	Category	Organization/Title
Xin-chao Xu	Government	Head of New Energy and New Material Division, Beijing Science Association
Xiang-zhen Lu	Government	Director of Major Affairs Office, Shenzhen Development and Reform Commission
Cuneyt Oge*	Industrial organization	Chairman of SAE (2016)
Yong-wei Zhang	Industrial organization	Secretary-General of EV100
Hui-ming Gong	Industrial organization	Director of Clean Transportation Program of Energy Foundation & Member of EV100
Zhen-hua Yu	Industrial organization	President of Zhongguancun Energy Storage Industry Alliance & Battery Expert
Feng An*	Industrial organization	Executive Director of Innovation center for Energy and Transportation
Yu-wu Fu	Industrial organization	President of SAE-China
Quan-shi Chen	Auto Research	Director of Automotive Research Institute of Tsinghua University & Member of EV Professional Board, National Auto Standardization Committee
He-wu Wang	Auto Research	Associate Professor of Automobile Department, Tsinghua University
Yi-shan Pan	Auto Research	Executive vice-president of NEV Research Institute, Hefei University of Technology
Cheng Wang	Auto Research	Vice director of CATARC Beijing Department
Qi Lu	Auto Marketing	Tsing Capital-Manager of NEV Industry Research
Cun Wang	Auto Marketing	Senior Manager of China Import and Export Company of Auto Industry
Chun Chang	Auto Marketing	Senior Manager of Policy Research Office, BAIC ROCAR
Lei Wang	Auto Marketing	Manager of Auto Sales Department, Wanbang NEV Group
Tamara Warren*	Media	Senior Journalist of the Verge Clean Transportation & Judge of World Car of the Year (WCOTY)
Kai-jun Zou	Media	Chief Editor of D1EV
Chen Guo	Media	Journalist of NEV Special Issue, China Automotive News
Jian Zhou	Media	Director of NEV department of Changzhou Daily, Journalist
Dan Zhu	Media	Executive Associate Editor-in-Chief of Auto Expo Magazine, AMS
Hao Luo	Auto Manufacturer	Director of overseas Marketing Department, BYD
Bo-shi Tian	Auto Manufacturer	Dean of Beijing New Energy Research Institute
You-cheng Deng	Auto Manufacturer	Technical Advisor of Lifan Group (former VP)
Xiang Gao	Auto Manufacturer	Director of Charging and Public policy Department, Tesla
Wei Cai	Industrial Chain-Motor	Founder and CTO of Jingjin Electric Company (Beijing)

Zhen-fei Wang	Industrial Chain-Charging	Founder and Manager of Shenzhen Chargelink Company
Hao Su	Industrial Chain-Charging	Manager of Charging Department, Wanbang New Energy Group

** International expert.*

4.2.3 Delphi Method: BestEV criteria and weighting [Methodology part 3]

The first round of the Delphi method was held between October 26th and November 7th and distributed to 25 Chinese experts and 2 international experts (please refer to section 4.2.2 for more details). The results were compiled through two steps: first, only criteria that have been voted "Yes" by majority of experts (>50%) were included in the Delphi I criteria summary; then, the average of weights given to every valid criteria was extracted, and should it fail to meet 2% in Delphi, it was removed; finally, the rationale behind experts' choices was summarized. Should new criteria was suggested, after ensuring the new suggested criteria is not overlapping with already existing ones, it was included in the results should it have been suggested by more than one experts. Table 45 details the Delphi analysis guidelines.

Table 45: Delphi analysis technique

Delphi round I	**Step 1 – A criteria must have >50% "Yes" (majority voting); New criteria included if suggested by >2 experts.**
	Step 2 – Average of weighting for approved criteria; if below 1% consider removing.
Delphi round II	Step 1 – A criteria must have >50% "Yes" (majority voting); New criteria included if suggested by >2 experts.
	Step 2 – Average of weighting for approved criteria; if below 2% consider removing.

Table 46 presents Delphi round I results, which was also presented to experts during Delphi round II for allowing them to revisit their round I choices. By comparing the initial criteria (**Table 44**) with the results of Delphi round I (**Table 46**), it is clear that beyond the additional criteria suggested by experts (criteria number 10, "fast charging"; criteria number 11, "warranty period"; and criteria number 12, "insurance expenses"), a criteria that was originally considered to be qualitative was suggested to be quantitative (criteria number 2, "ownership costs"). Some criteria were found to be too general and experts suggested more detailed evaluation (criteria number 28, "in-car smart network system" – was extracted from the original criteria number 18, "Technical Features and Instruments Panel Add-ons"). Therefore the quantitative criteria rose from 8 to 11 following Delphi round I of experts review, and the qualitative criteria volume stood at 16.

Table 46 Round I Results

Suggested Criteria and Measurement Guidance			Yes/No? (how many experts approve)	Average weight(%)	Rationale summary
Quantitative Criteria	1	**Range**	100%	12.7%	Core index for EVs, which is also most concerned by consumers
	2	**Ownership cost**	93%	8.2%	Influencing consumers' choice and purchasing of EVs
	3	**Trickle charging time**	86%	6.7%	Index for evaluating the technical level of battery, influencing usage efficiency of EVs
	4	**Acceleration**	93%	5.4%	Index influencing EVs' dynamic performance
	5	**Energy efficiency**	96%	5.2%	Influencing the economic and energy efficiency of EVs
	6	**Max speed**	86%	4.4%	Index related to driving experience and highway driving
	7	**Battery capacity**	64%	3.3%	Index related to driving mileage
	8	**Max Power for e-Motor**	54%	2.1%	Influencing power output of EVs, which is now beyond consideration for consumers
	9	**Vehicle weight**	50%	1.9%	Index related to the dynamics and economic efficiency of EVs
	10*	**Fast-charging time**	New criteria	0%	Important index for consumers using EVs
	11*	**Warranty period**	New criteria	0%	Influencing the economic efficiency and usage convenience of EVs
	12*	**Insurance expenses**	New criteria	0%	Index related to the usage cost of EVs, but most experts don't think it's important at present
		Sub-total		49%	
Qualitative	13	**Driving performance:** Does it feel like you are becoming one with the car? Braking, Steering, Handling, Drivability, Shift quality	96%	6.4%	Influencing driving experience and feelings
	14	**Reliability:** Volume of operation incidence	96%	6.0%	Reflecting changes of dynamic system
	15	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags	89%	5.5%	Core index for EVs, which is also most concerned by consumers
	16	**Charging convenience:** Charging compatibility, Charging infrastructure availability	86%	4.3%	Influencing EV usage and reflecting the availability of EVs
	17	**Service:** After-sales -service quality, Purchase experience, Service and dealer facilities	82%	3.8%	Reflecting convenience and promptness of service
	18	**Exterior quality/mechanics:** How does it feel? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	79%	2.9%	Intuitive sense of consumers, especially for young generation
	19	**Brand awareness and perception:** brand value	68%	2.9%	Influencing the purchase tendency of consumers

20	**Interior design and comfort:** How well is it serving your daily use? Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	79%	2.8%	Intuitive sense of consumers
21	**Technical Features and Instruments Panel (Add-ons):** Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies	75%	2.8%	Reflecting the comprehensive performance of EVs
22	**In-car e-driving related telematics:** How indicative the car is of its own state of drive? Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc.	68%	2.7%	Important index for EVs
23	**Style/exterior design:** How does it look from the outside? Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring	71%	2.3%	Index considered more by young consumers
24	**Chassis system quality:** Shock resistance system, durability and friction of tires	68%	2.0%	Index influencing safety and driving experience of EVs
25	**Car Driving Ergonomics:** How easy to use? complications/simplification of operation, logical and well placed control/function	61%	1.8%	Influencing driving experience of EVs
26	**Electric drive:** Motor (engine) and transmission quality for HPEV, Electric power	46%	1.7%	Index influencing quality and durability of EVs
27	**Cargo/load space**	57%	1.6%	Index related to the practicality of EVs
28*	**In-car smart network system**	New criteria	0%	Reflecting the difference between ICE and EVs
	Sub-total		51%	
	Total		100%	

***Note**: The table presents the results of Delphi round I; the table was presented to experts during round II for enabling them to revisit their round I inputs. Empty rows were added to the list for enabling the insertion of new criteria.*

Round II of the Delphi survey for determining the BestEV criteria and weights yielded mainly minor "sharpening" of criteria weighting. Some criteria that were found useful in Delphi round I failed to meet the majority recognition threshold (criteria number 12, "insurance expenses"; criteria number 27, "in-car smart network systems"). **Table 49** presents the 2nd and final Delphi round weighting results, under the premise that the second round enabled experts with more informed and countable inputs. Criteria that

failed to reach 2% weighting were removed, in accordance with the pre-defined Delphi analysis technique (**Table 42**).

Table 47: Round II and Final Results

Suggested Criteria and Measurement Guidance		Yes/No? (how many experts approve)	Average weight(%)	Rationale summary
1	**Range**	100%	11.8%	Core index for EVs, which is also most concerned by consumers
2	**Ownership Cost**	100%	8.9%	Influencing consumers' choice and purchasing of EVs
3	**Trickle charging time**	93%	5.9%	Index for evaluating the technical level of battery, influencing usage efficiency of EVs
4	**Energy efficiency**	96%	4.7%	Influencing the economic and energy efficiency of EVs
5	**Acceleration**	96%	4.6%	Index influencing EVs' dynamic performance
6	**Max speed**	93%	3.4%	Index related to driving experience and highway driving
7	**Fast charging time**	78%	2.9%	Important index for consumers using EVs
8	**Warranty period**	74%	2.6%	Influencing the economic efficiency and usage convenience of EVs
9	**Battery Capacity**	74%	2.3%	Index related to driving mileage
10	**Vehicle weight**	74%	1.6%	Index related to the dynamics and economic efficiency of EVs
*	**Max Power for e-Motor**	56%	1.2%	Influencing power output of EVs, which is now beyond consideration for consumers
*	**Insurance expenses**	26%	0.4%	Index related to the usage cost of EVs, but most experts don't think it's important at present
Sub-total（10）			50%	
11	**Reliability:** Volume of operation incidence	100%	6.8%	Reflecting changes of dynamic system
12	**Driving performance:** Does it feel like you are becoming one with the car? Braking, Steering, Handling, Drivability, Shift quality	100%	6.2%	Influencing driving experience and feelings
13	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags	96%	5.9%	Core index for EVs, which is also most concerned by consumers
14	**Service:** After-sales -service quality, Purchase experience, Service and dealer facilities	96%	4.5%	Reflecting convenience and promptness of service

15	**Charging convenience:** Charging compatibility, Charging infrastructure availability	96%	4.4%	Influencing EV usage and reflecting the availability of EVs
16	**Exterior quality/mechanics:** How does it feel? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	93%	2.8%	Intuitive sense of consumers, especially for young generation
17	**Brand awareness and perception:** brand value	85%	2.8%	Influencing the purchase tendency of consumers
18	**In-car e-driving related telematics:** How indicative the car is of its own state of drive? Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc.	89%	2.7%	Important index for EVs
19	**Interior design and comfort:** How well is it serving your daily use? Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	**89%**	**2.7%**	Intuitive sense of consumers
20	**Technical Features and Instruments Panel (Add-ons):** Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies	89%	2.4%	Reflecting the comprehensive performance of EVs
21	**Style/exterior design:** How does it look from the outside? Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring	81%	1.7%	Index considered more by young consumers
*	**Chassis system quality:** Shock resistance system, durability and friction of tires	74%	1.4%	Index influencing safety and driving experience of EVs
*	**Cargo/load space**	74%	1.4%	Index related to the practicality of EVs
*	**In-car smart network system**	48%	1.4%	Reflecting the difference between ICE and EVs

*	**Car Driving Ergonomics:** How easy to use? complications/simplification of operation, logical and well placed control/function	70%	1.3%	Influencing driving experience of EVs
*	**Electric drive:** Motor (engine) and transmission quality for HPEV, Electric power	59%	1.1%	Index influencing quality and durability of EVs
Sub-total（11）			50%	
Total（21）			100%	

** The criteria failed to meet the threshold of majority experts' recognition.*

In total, there are 10 criteria comprising the quantitative portion of the evaluation (50% of the ranking scoring process), and 11 criteria comprising the qualitative portion of the evaluation (the remaining 50% of the ranking scoring). While some new EV-tailored criteria were excluded from the Delphi results due to low voting or weighting, the authors of the methodology suggested re-evaluating the final criteria reduction through Consensus Development Conferencing (CDC), further elaborated in the following section.

4.2.4 Consensus Development Conferencing: BestEV criteria and weighting determination [Methodology part 3]

While some new EV-tailored criteria were concluded to have little impact on the overall evaluation (received a weight smaller than 2%) or received less than majority votes and were required to be removed according to the pre-defined Delphi analysis technique, the authors of the methodology development suggested re-evaluating the final criteria reduction process. For that purpose, a consensus Development Conferencing (CDC) was held in Beijing on December 3rd, 2015, to introduce participating experts and stakeholders with the methodology and concerns stemming from the reduction technique that may result in the neglect of meaningful criteria for the case of EVs.

Under discussion were the following two questions:

I. General evaluation of the methods employed for developing the BestEV methodology
II. The validity of specific quantitative and qualitative criteria, and finalization of the BestEV (V1) criteria

I. General comments and suggestions on the method employed and its results included the following:

- *Vehicle cost range* should be excluded, as it is an external factor the vehicle performance assessment: people tend to set on a price range before advancing their search for a suitable model to buy. Alternatively, the ranking results should be presented in groups – price range groups ("Luxury" for >400k RMB worth cars, "Economic" for <200k RMB worth cars, and "Standard" for the rest).
- The proportion of quantitative and qualitative indicators was redefined – from 50% to 100% each; then, for each car cost range, the interplay of qualitative and quantitative criteria could be adjusted according to the mainstream audiences' assumed preferences: Luxury (Quantitative : Qualitative = 40:60) , Standard (Quantitative : Qualitative = 50: 50), Economic (Quantitative : Qualitative = 60: 40).

- Some quantitative criteria scoring will be based on official information provided by auto companies and therefore may have credibility issues; in order to overcome this challenge, new similar quantitative criteria were added to the qualitative evaluation process for enabling drivers to fill in based on their actual experiences. For example: *Vehicle driving range*, *Fast charging time*, *Slow charging time*.
- Some criteria may be added to reflect EV users concerns, such as: *Battery depletion rate*, *Battery warranty period*. Such criteria were added to existing criteria, for refining their meaning.
- The overall number of criteria seems high; therefore it would be worthwhile merging criteria where possible for simplifying the evaluation process. For example: *Smart network* and V*ehicle gadgets*, *Vehicle style* and *Vehicle exterior design*, *Vehicle interior design* and *Vehicle ergonomics*.
- PHEV may be considered for at least quantitative evaluation as it may advise market options visible to consumer, the evaluators.

II. Specific comments and suggestions on the criteria are described in Table 48:

Table 48: Quantitative and Qualitative criteria under discussion at the CDC

Suggested Criteria and Measurement Guidance		Initial Criteria Ranked via Meta-analysis [Stage 1]	Delphi Average weight (%) [Stage 3 - Weight]	Final Average weight (%) [Stage 4 - Weight]
Quantitative				
2	**Ownership Cost**	N/A	8.9%	Extracted; Evaluations re-designed to meet 3 cost ranges
*	**Max Power for e-Motor**	4	1.2%	Excluded
*	**Insurance expenses**	N/A	0.4%	Excluded
11+	**Real range**	N/A	N/A	Added (12% out of 100%)
12+	**Real trickle charging time**	N/A	N/A	Added (6% out of 100%)
13+	**Real fast charging time**	N/A	N/A	Added (4% out of 100%)
14+	**Battery decay at low temperature**	N/A	N/A	Added (5% out of 100%)
Qualitative				
16	**Exterior quality/mechanics:** How does it feel? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	6	2.8%	Added to #21
20	**Technical Features and Instruments Panel (Add-ons):** Stereo system, Gauges/instruments, Heating/air conditioning system, Application of cost-effective technologies	10	2.4%	Added to #18

21	**Style/exterior design:** How does it look from the outside? Personality/Uniqueness of the car's looks, Ability to adjust to one's taste e.g. coloring	5	1.7%	Included (10% out of 100%)
*	**Chassis system quality:** Shock resistance system, durability and friction of tires	15	1.4%	Included (3% out of 100%)
*	**Cargo/load space**	16	1.4%	Included (3% out of 100%)
*	**In-car smart network system**	N/A	1.4%	Added to #18
*	**Car Driving Ergonomics:** How easy to use? complications/simplification of operation, logical and well placed control/function	3	1.3%	Added to #19
*	**Electric drive:** Motor (engine) and transmission quality for HPEV, Electric power	8	1.1%	Excluded

In accordance with the decisions described in **Table 48**, the criteria list has been adjusted as illustrated in **Table 49**. Criteria that have been merged have maintained their cumulative relative weighting. The below table has been distributed among Delphi experts participants and CDC participants, and have received their majority agreement.

Table 49: BesEV V1 Final Criteria List

Suggested criteria and Measurement Guidance		Final Weight (%)	Weighting rationale
	Quantitative criteria (official data)		
1	**Range**	12%	Core index for EVs, which is also most concerned by consumers
2	**Acceleration**	12%	Index influencing EVs' dynamic performance
3	**Energy efficiency**	12%	Influencing the economic and energy efficiency of EVs
4	**Max speed**	8%	Index related to driving experience and highway driving
5	**Warranty period**	7%	Influencing the economic efficiency and usage convenience of EVs
6	**Charging time**	6%	Important index for consumers using EVs
7	**Battery capacity**	6%	Index related to driving mileage

8	**Vehicle weight**	6%	Index related to the dynamics and economic efficiency of EVs
9	**Fast charging time**	4%	Important index for consumers using EVs
	Quantitative criteria (real data based on consumer reporting)		
10	**Real range**	12%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
11	**Real trickle charging time**	6%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
12	**Real fast charging time**	4%	Collecting consumers' actual experience; if the consumer will not know the answer the default will be rank 3 for avoiding impacting on the result
*	**Battery decay at low temperature**	5%	This can be an add-on criteria, consumers live in the place where the low temperature has severe impact on EVs think more about it; others can raise some other criteria
sub-summary (12)		100%	
13	**Reliability:** Volume of operation incidence	14%	Reflecting changes of dynamic system
14	**Driving performance:** Does it feel like you are becoming one with the car? Braking, Steering, Handling, Drivability, Shift quality	12%	Influencing driving experience and feelings
15	**Safety:** ABS, Belts, Baby-seat inner holders, Airbags	12%	Core index for EVs, which is also most concerned by consumers
16	**Service:** After-sales -service quality, Purchase experience, Service and dealer facilities	10%	Reflecting convenience and promptness of service
17	**Interior design and ergonomics:** How well is it serving your daily use? Seating Space/Room, Visibility, quality of interior materials e.g. looks and durability; Seating quality (e.g. back support), Driving position, availability of a range of seat and wheel positioning adjustments	10%	Intuitive sense of consumers
18	**Exterior quality/mechanics and Style:** How does it feel and look? Doors handling, Noise of car operation (from door handling to driving), Quality of Design e.g. length, width, body height, wheelbase, curb, etc.	10%	Index considered more by young consumers, influencing EV usage
19	**Charging convenience:** Charging compatibility	8%	Influencing EV usage and reflecting the availability of EVs
20	**In-car e-driving related telematics and smart network system:** How indicative the car is of its own state of drive? Hardware and software elements in the car for providing the driver with information regarding the vehicle e.g. state of battery, depletion rate, charging network and its availability, route selection for enabling charging on-the-go etc. Also add-ons that	8%	Important index for EVs

	contribute to comfort of use and fun (e.g. stereo system etc.)		
21	**Brand awareness and perception:** brand value	5%	Influencing the purchase tendency of consumers
22	**Chassis system quality: Shock resistance system, durability and friction of tires**	3%	Index influencing safety and driving experience of EVs
23	**Cargo/load space**	3%	Index related to the practicality of EVs
*	**Other important criteria**	5%	This can be an add-on criteria, consumers can select other criteria they think important
Sub-summary (11)		100%	

4.3 BestEV performance score [Methodology part 4]

This chapter finalizes the BestEV methodology by articulated the BestEV performance score calculation references.

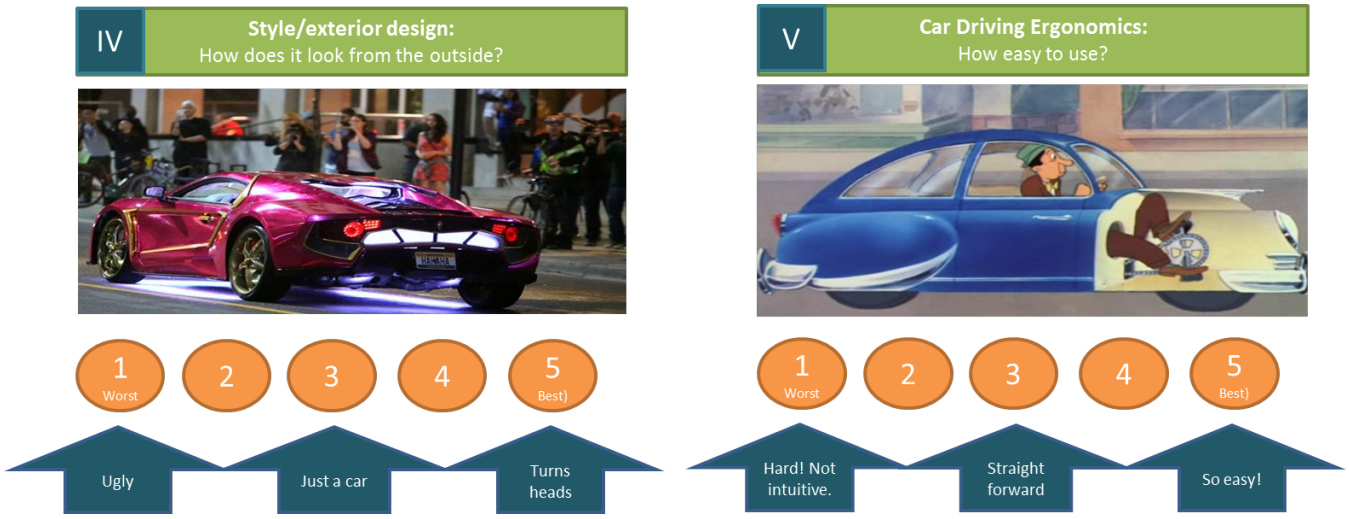
The quantitative portion of the BestEV evaluation will be based on linear scoring normalized to ranks of 1-5. The least performing would be the lowest score available in the market, and the best performing would be based of the best score achieved in the market (last year's scores). **Table 50** lists the quantitative performance data of 2014.

Table 50: Quantitative criteria scoring data, based on 2014 values

Suggested criteria and Measurement Guidance		★★★★★	★★★★	★★★	★★	★
Example	Max speed (km/h)	180-225	150-180	110-130	80-110	50-80

The qualitative scoring system is more complex, as it is based on consumers' personal experiences and perceptions. In order to advance unity of responses, the BestEV is illustrating the meaning of a best-performing and a least-performing score in a simple and easy to understand method, utilizing diagrams and pictures. **Figure 17** suggested such potential illustrations, which is projected to be finalized by December 2015 based on consultation with marketing experts.

Figure 17: Qualitative scoring method illustration



***Note**: The above illustration of qualitative scoring guidelines is tentative and partial; it is projected to be finalized by December 2016.*

5. Conclusions and Next steps

In order to engage consumers with national efforts to increase NEV adoption in China, *i*CET have formed the BestEV platform, an open ranking system to which any person with experience driving an EV can contribute. The system is aimed at tackling three major gaps: (1) consumers do not know how to evaluate an EV without comparing it to an ICE (and these are two fundamentally different machines!), (2) people do not have an accountable ranking to rely on when making the bold step of buying an EV, and (3) the selection of models is of poor quality… the ranking may inspire auto manufacturers to improve their products!

Amid the nascent stage of consumer-based rankings in China and transparency issues associated with existing Chinese auto rankings, the BestEV evaluation system relies on criteria selected and weighted trough a clear methodological process. First, initial criteria were selected based on an analysis of 10 global and local leading auto ranking systems, then, 28 experts representing the auto and EV ecosystem were consulted through a Delphi Method for refining the criteria and setting their weights, finally, a Consensus Development Conferencing (CDC) was employed for finalizing the criteria through consultation with 24 experts.

The meta-analysis demonstrated the need for a bottom-up transparent platform for auto assessment in China, and has enabled the drafting of initial criteria based on global (40%) and national (60%) common criteria used by leading platforms. The two rounds employing Delphi method that included nearly 30 well established experts from the industry, government, research and media sectors, helped refining these criteria. They also inspired the divide of criteria to 11 qualitative and 12 quantitative criteria with each having received 50% in total based on experts' weighting average. The consultation that marked the final methodological stage on the criteria process contributed greatly not only by re-evaluating criteria that nearly failed to meet the requirement (50% majority or >2% average weight) but also by revisiting the robustness of the BestEV criteria results as a whole. Among the final conclusions were: removal of car cost from the criteria list and re-setting three types or evaluation systems to meet three typical price ranges with their own qualitative-to-quantitative criteria ratio as well as a simplification and unification of criteria items.

The first version of the BestEV methodology will be tested in 2016, and its results and progress will be consulted with a steering committee comprised of leading experts in the auto and EV ecosystem.

References

AdlerM., & Ziglio E. (1996). Gazing into the oracle: The Delphi method and its application to social policy and public health. Jessica Kingsley Publishers.

Arthur, W. B. (1994). *Increasing returns and path dependence in the economy.* University of Michigan Press, Ann Arbor.

BaymN.K. (1998). Cybersociety 2.0: Revisiting computer-mediated communication and community. 出处 (Ed.)S.Jones, The emergence of online community . Thousand Oaks: Sage.

Devezas, T. C. (2005). Evolutionary theory of technological change: State-of-the-art and new approaches. *Technological forecasting and social change*, pp. 72 (9) 1137-1152.

FinkA., KosecoffJ, ChassinM., & BrookR. H. (1984). Consensus methods: characteristics and guidelines for use. American journal of public health, 74(9), 979-983.

GangaleMengolini, A., & Onyeji, I.F.,. (2013). Consumer engagement: An insight from smart grid projects in Europe. Energy Policy, 60, 621-628.

Geels, F. (2001). *Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study.* Aalborg, Demark.

Grubler, A. (1990). *The rise and fall of infrastructures.* Springer, Heidelberg.

JamesD., & Warren-ForwardH. (2015). Research methods for formal consensus development. Nurse Researcher, 22(3), 35.

JenkinsH. (2002). Interactive audiences? The collective intelligence of media fans. From JenkinsH., The new media book (157-170).

KumarAksoy, L., Donkers, B., Venkatesan, R., Wiesel, T., & Tillmanns, S.V.,. (2010). Undervalued or overvalued customers: capturing total customer engagement value . Journal of Service Research, 13(3), 297-310.

LevyPierre. (1997). "Collective Intelligence: Mankind's Emerging World in Cyberspace". Cambridge: Perseus.

Liebowitz, J. S., & Margolis, E. S. (1995). Path dependence, lock-in, and histroy. *The Journal of Law, Economics and Organisation*, pp. 11(1), 205-226.

Nelson, R., & Winter, S. G. (1982). *An Evolutionary Theory of Economic Change.* Cambridge & London: Harvard University Press.

RezvaniJansson, J., & Bodin, J.Z.,. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. Transportation research part D: transport and environment, 34, 122-136.

SackmanH. (1975). Summary evaluation of Delphi. Policy Analysis, 693-718.

Appendix I: Name list of experts for d1ev annual green car ranking (2014)

Name	Title
Wang Binggang	Team leader of National 863 Project "New energy fueled vehicles"
Chen Quanshi	Professor at the Automotive College in Tsinghua University
Ye Shengji	Deputy Secretary General of ANFIA
Wang Qing	Researcher at DRC
Lin Cheng	Deputy Director of Electric Vehicle NEL, Beijing Institute of Technology
Miao Wenquan	Deputy Chief Engineer of Shanghai Auto Test Center
Jiang Jiuchun	Dean of Electrical Engineering College, Beijing Jiaotong University
Yin Chengliang	Associate Dean of Automotive Engineering Research Institute, Shanghai Jiaotong University
Liu Gang	Deputy Director of Economic Institute, Nankai University
Wei Xueqin	Vice-president and Secretary of Shandong Automation Alley
Sun Liqing	Associate Professor at Machinery & Vehicle College, Beijing Institute of Technology
Liu Yongdong	Deputy Director of Standardization Management Center, China Electricity Council
Gu Jianguo	Executive Editor of *People's Public Transportation* Magazine
Yuan Jianguang	Deputy Secretary General of China Civil Engineering and City Public Transportation Society
Hu Jianping	Deputy Director of Urban Passenger Transportation Branch, China Road Transportation Association
Pan Yishan	Executive Vice President of Hefei Institute of New Energy Vehicles
Pang Yicheng	CEO of d1ev
Zhao Yi	Founder and CEO of AutoLab, Chief Writer of *Social Entrepreneur* Magazine
Jia Ke	Editor in Chief of *Auto Business Review* and *Auto Consumir Report* Magazine
Xing Wenjun	Chief Editor and Issuer of CBU/CAR
Qiu Kaijun	Chief Editor of d1ev