



我国燃料电池汽车发展机遇与挑战

Opportunities and Challenges of Fuel Cell Vehicle in China

国家燃料电池汽车及动力系统工程技术研究中心

National Fuel Cell Vehicle and Powertrain System Engineering Research Center

2017年11月22日

- **燃料电池汽车发展趋势与现状**

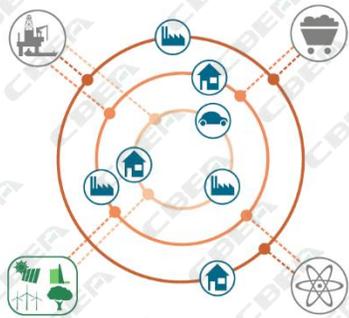
Overview of Fuel Cell Vehicle

- **中国燃料电池汽车产业面临的机遇与挑战**

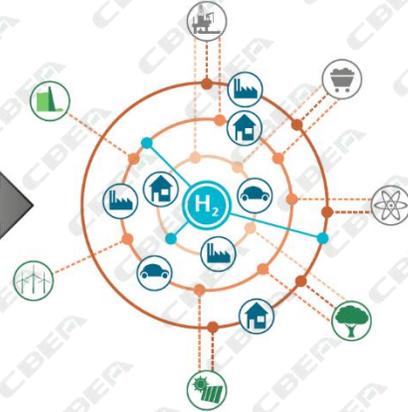
Opportunities and Challenges for Chinese Industry of Fuel Cell Vehicle

机遇—能源转型 Opportunity of Energy Revolution

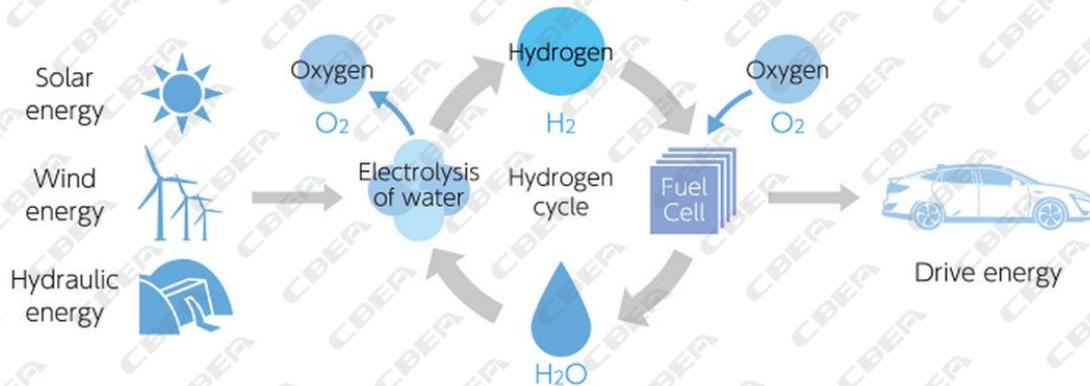
现阶段 Now



未来 Future



— Heat network — Electricity grid — Liquid and gaseous fuels and feed-stocks T&D — Hydrogen



Source: IEA Technology roadmap Hydrogen and Fuel Cells, 2015

- 氢作为能源载体将彻底改变传统能源结构，有效链接其它新能源和应用端，提高能源应用的灵活性

As an energy carrier, hydrogen will revolutionize the traditional energy structure, and enable new linkages between clean energy supplies and demands, enhancing overall energy system flexibility.

- 我国政府发布的《国家能源技术革命创新行动计划(2016-2030)》，将氢能和燃料电池列为重点任务，发布的《“十三五”国家科技创新规划》把发展氢能和燃料电池技术纳入到构建具有国际竞争力的现代产业技术体系中

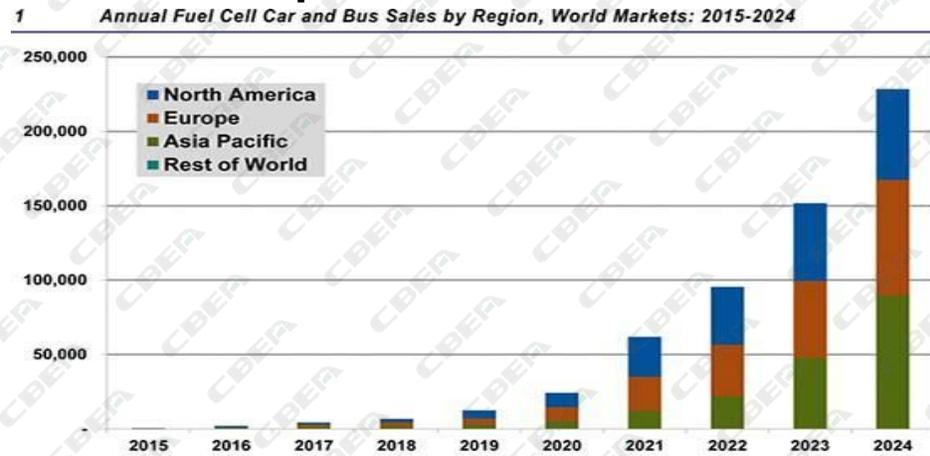
Chinese government have published two national plans, one is “National Action Plan for Innovation in energy technology revolution (2016-2030)”, and the other is “13th 5-years plan for national scientific and technological innovation plan”. They all highlight the hydrogen energy and fuel cell technologies.

机遇—动力转型：Opportunity of Power Revolution

新能源汽车发展路径 Pathway for Clean Energy Vehicles

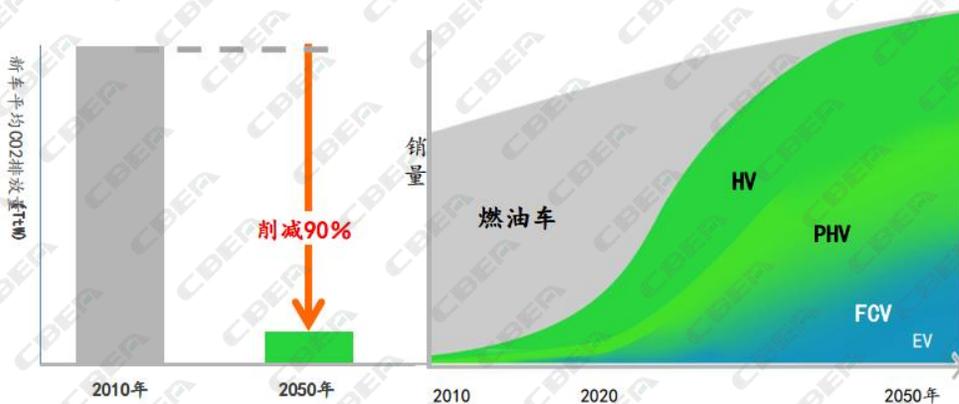


燃料电池汽车市场预测 Prospective Market for FCV



Source: "Fuel Cell Vehicles", Navigant Research, 2015

- 在大功率、长距离场景下燃料电池技术被认为是全面替代传统动力技术平台的终极新能源汽车技术，市场潜力巨大，有望在2024年达到22.8万辆，2050年占据汽车总量的25%以上。FCVs are regarded as the most promising solution for traditional powertrain in large power and long distance drive condition, and a self-sustaining market could be achieved. As predicted, the annual sales amount will reach to 228000 by 2024, and the total number will reach to 25% of all vehicles.



Source: Toyota Report "丰田燃料电池车的研发和促进汽车社会可持续发展的努力", 2017

燃料电池汽车已经成为多国的重要战略产业

- 我国政府出台了一系列政策文件，将氢能和燃料电池产业作为**引领产业变革的颠覆性新一代能源技术**，纳入到构建具有国际竞争力的现代产业技术体系中，列入十三五发展的重点任务，明确通过政府补贴刺激有条件的汽车制造企业、燃料电池发动机及相关企业进行产业化的推进工作
- 日本政府在本世纪初已将氢能与燃料电池产业作为**国家战略**进行的重点规划和大力支持，不仅在应用领域的推广进行了规划，而且在基础设施、技术研发、应用端财政补贴、民众教育、标准法规等领域进行了全面的布局，是目前燃料电池汽车发展的**引领者**
- 欧盟针对氢能与燃料电池产业发展，在各国共同支持下进行了大量的研发和示范应用项目，培育了一大批具有国际竞争力的关键材料、关键零部件企业，通过各国对应用端进行补贴和基础设施规划与建设，目前已进入加氢站**基础设施建设的高潮期**
- 美国在其能源部推动下于上世纪末即开展了燃料电池技术的研究和规划，引领了国际燃料电池汽车产业**第一波的发展**，目前在加州地区形成一定规模的示范应用，形成了以PLUGPOWER为代表的**第一批燃料电池商业化应用的企业**和以Gore为代表的**关键材料和零部件企业**

燃料电池汽车商业化 Commercial FCVs are here Today

- 燃料电池汽车在过去几年取得了革命性突破，2015年被认为是燃料电池汽车商业化元年

Big leaps have been achieved in the past few years, and 2015 is regarded as the first year for fuel cell vehicle(FCV) being ready to enter to commercialization stage

- 燃料电池汽车基本实现了和传统汽车的无差别应用：几分钟内的燃料加注、500km以上的续驶里程、具备每加仑65英里的等效油耗和高功率输出能力，且更加环保

FCVs have almost met the requirements of substitute for traditional vehicles, which can be refueled in minutes, have a 330+miles driving range, get more than 65 miles per gallon (equivalent) , provide high power, with zero pollution from the tailpipe .



Hyundai Tucson



Honda FCV

Honda Clarity



Toyota Mirai

Toyota Mirai

燃料电池汽车商业化进程 Progress in Commercialization



2008年推出FCHV-adv，在日本开展为期两年的租赁业务



2014.12首先在日本销售量产燃料电池汽车Mirai，售价约为37万元

计划2017年销售3000辆



2008年量产FCX Clarity，日本和美国租赁销售，价格为600\$/月



2016年3月量产 FGV Clarity

计划在2015-2020年量产5000辆



2010年推出ix35燃料电池汽车
2013年量产下线，面向欧洲和美国租赁及销售



2007年推出B级F-Cell燃料电池汽车
完成“环球之旅”等一系列示范运行活动

戴姆勒、福特、日产计划
2017年联合推出量产车



2008年推出最新一代雪佛兰Equinox燃料电池汽车
完成示范运行，目前已完成累计500万公里的实际行驶里程

计划在2020年与本田联合推出量产车



上海汽车

2008年推出第一代功能样车



2014年计划推出荣威950小批量 插电式燃料电池汽车

2008年

2010年

2015年

2017年

2020年

- 2014-2016年，丰田、本田、现代等公司已推出量产燃料电池汽车，国内上汽推出示范验证车型。From 2014 to 2016, volume production FCVs had been launched by Toyota, Honda and Hyundai. In China, SAIC motor released the demonstration model FCVs.
- 2017-2020年，各主流车企纷纷计划推出量产版燃料电池汽车，燃料电池汽车逐步进入产业化初期阶段。Automakers release the volume production plan for 2017 to 2020, and the FCV is coming into commercial stage.

丰田燃料电池汽车

- 全球燃料电池汽车技术和产业化的**领导者**，于2014年12月15日开始在日本销售MIRAI燃料电池乘用车；于2015年秋在欧美开始销售同款车型,面向欧洲、美国、日本等具备加氢站基础设施建设计划的地区开始集中导入。在日本以四大城市圈(首都圈、中京圈、关西圈、福冈圈)为主
- 开放并免费允许使用大约**5680项**燃料电池汽车相关专利
- MIRAI燃料电池乘用车2015年产量700台、2016年约2000台、2017年约3000台；计划2020年后年销售量突破30000辆
- 2017年初开始正式销售丰田品牌**燃料电池巴士**，计划用于东京都公交线路；2018年开始扩大导入，计划面向2020年东京奥运会/残奥会导入100台以上



日本燃料电池产业规划 Plan of Japanese Fuel Cell Industry

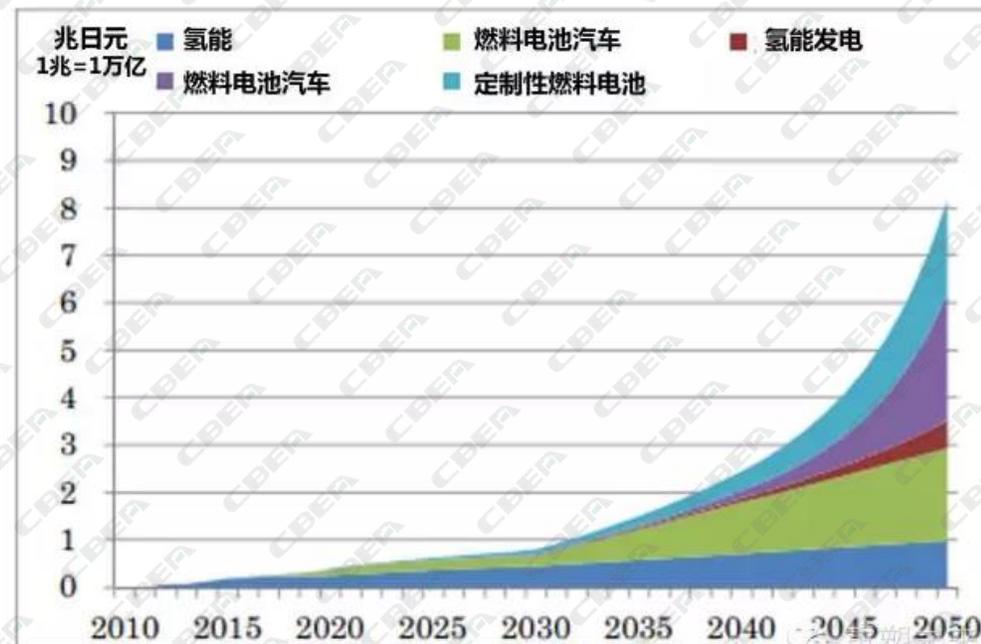
- 日本的氢能与燃料电池产业走在全世界的前列，得益于该国政府将氢能与燃料电池产业作为国家战略进行的重点规划和大力支持，有效整合了产业、学术和政府资源 Japanese is the leader in hydrogen and fuel cell industry owing to the government's supports. They had established a council, which had set up a close collaboration between industry, academia and government, and had published the industry plan and roadmap for hydrogen and fuel cell industry.

日本燃料电池产业规划
Plan for Hydrogen and Fuel Cell



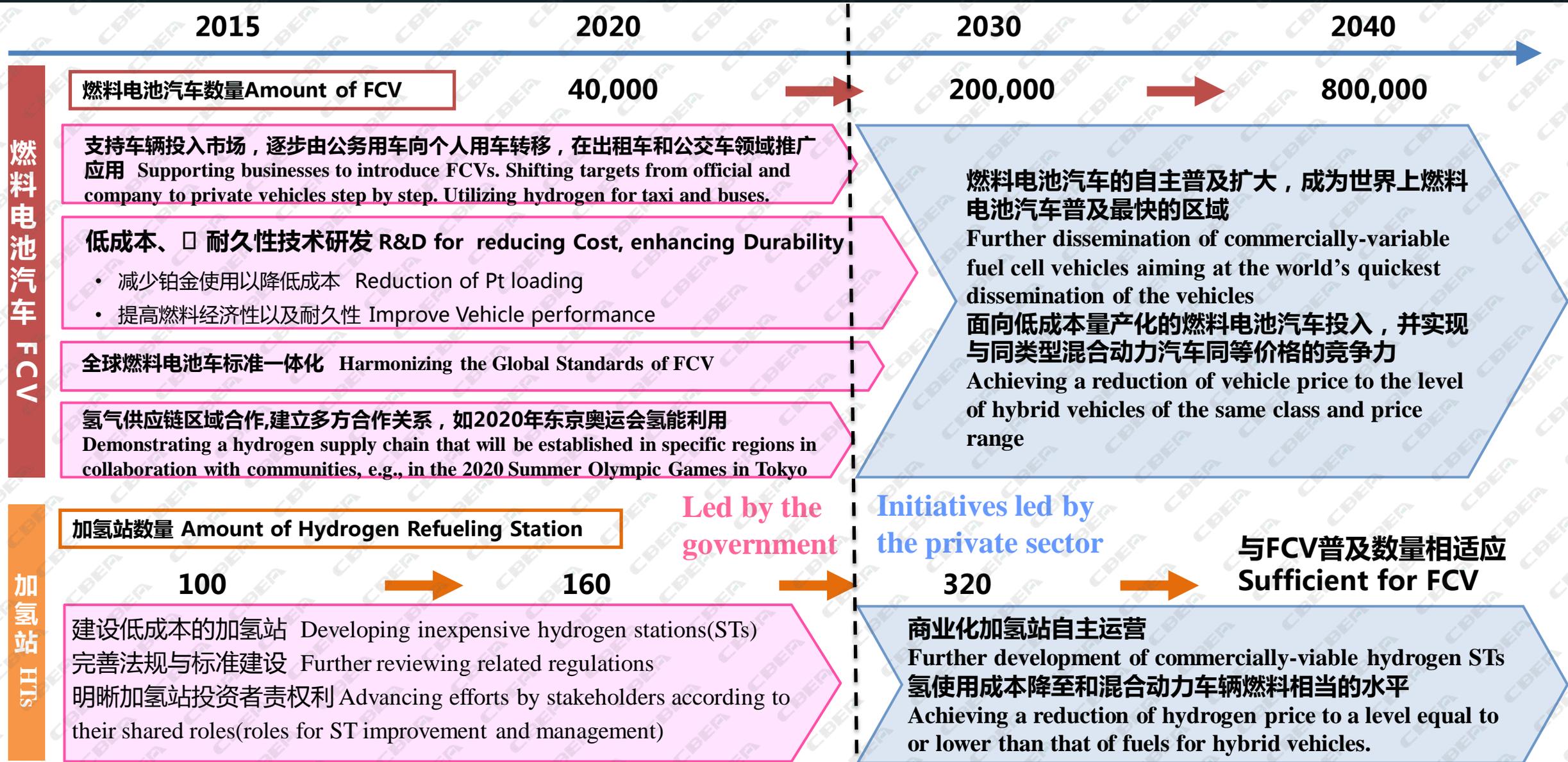
Source: Agency for Natural Resources and Energy METI, 2014

日本氢能燃料电池市场规模预测
Market Prediction



Source: NEDO 2015

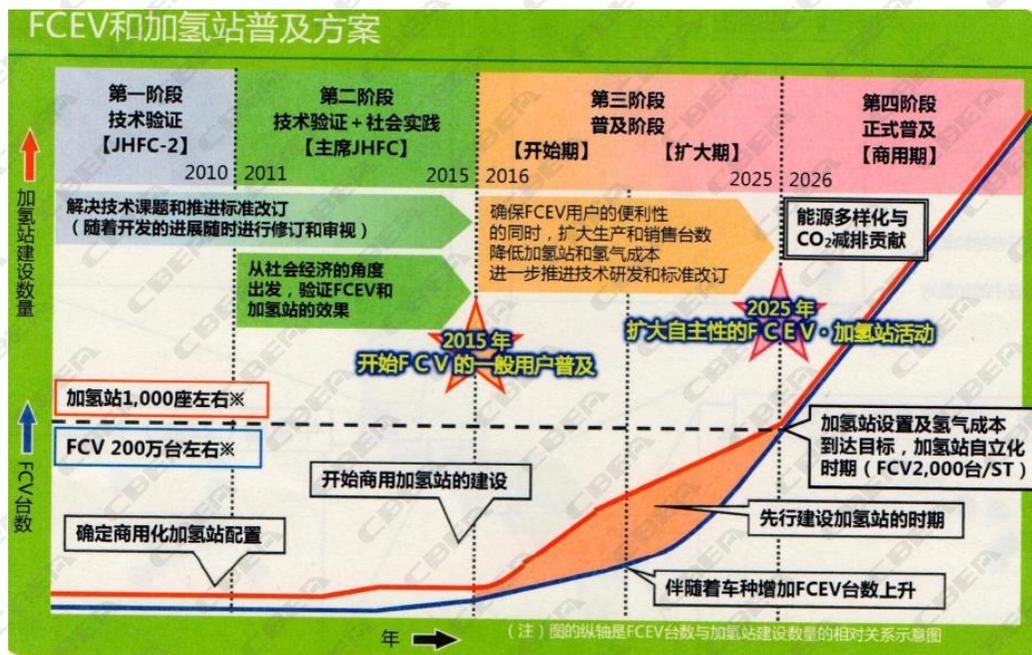
日本燃料电池汽车产业发展路线图 Roadmap for FCV of Japan



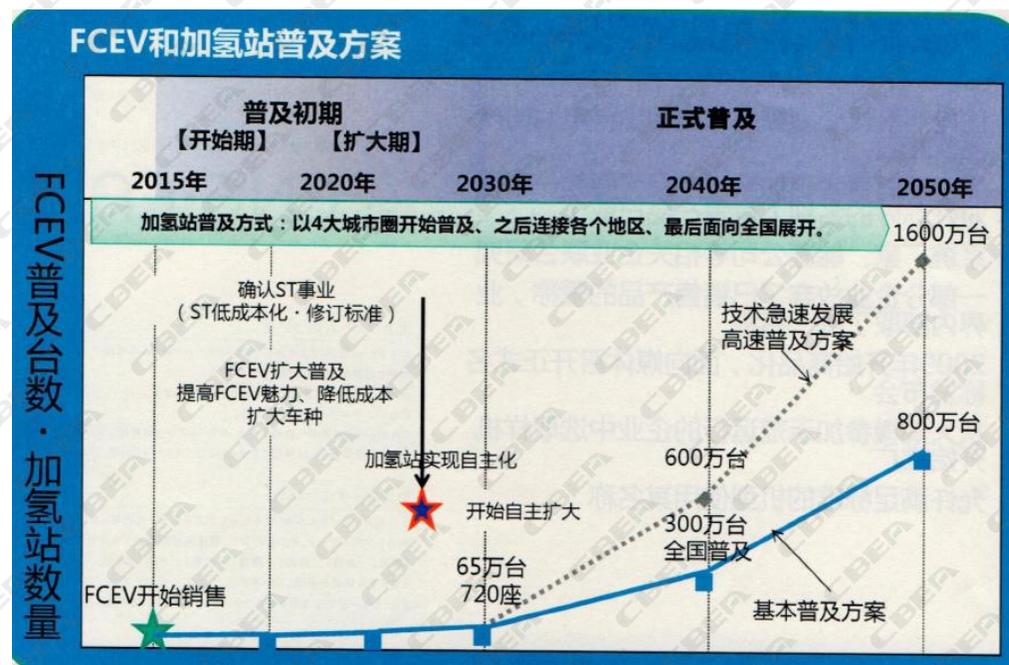
燃料电池实用化推进委员会

- 日本燃料电池实用化推进委员会由政府资源环境厅建议成立，包括114家企业团体，覆盖了日本主要的氢能和燃料电池**产业链资源**；目标主要是面向燃料电池**实用化普及**课题进行研究、总结**政策提案内容**，促进政府、民间企业的交流合作
- 针对政府设定的燃料电池汽车产业发展目标，推动标准建设，细化实施方案，包括2008年、2010年和2016年的“**导入和普及燃料电池汽车、氢能基础设施方案**”

2010年方案



2016年修订方案



实用化推进方案变化分析

- 和政府规划路线图相比，2016年修订的实施方案在燃料电池汽车普及数量和加氢站建设数量上更加乐观，如2030年燃料电池汽车的普及数量增加为原规划的**3.25倍**，加氢站数量增加为**2.25倍**；按照技术高速发展的普及方案，2040年燃料电池汽车普及数量增加为原规划的**7.5倍**；
- 和2010年推进方案相比，2016年修订版的实施方案在加氢站和燃料电池汽车自主扩大发展期**延后5年**，由2025年延期至2030年；
- 导致上述变化的原因主要包括：
 - 燃料电池汽车技术在过去6年内的快速进步，克服了实用化的瓶颈，对车辆发展保持乐观
 - 加氢站基础设施建设和氢能源产业链体系完善成为燃料电池汽车推广应用的主要瓶颈，依然需要政府提供政策支持
 - 国家法规和管理部门职责需要面向氢能和燃料电池汽车发展进行调整

欧美燃料电池汽车发展状况

- 欧盟燃料电池汽车产业发展的特点是：政府主要以CLEAN HYDROGEN IN EUROPEAN CITIES (CHIC)项目支持**燃料电池大巴的示范**运行和加氢站基础设施建设，燃料电池乘用车以企业为主要推动力量。目前欧盟的加氢站基础设施规划和建设进度处于全球领先水平
- 美国政府高度重视燃料电池产业发展，将10月8日定义为**国家氢能和燃料电池日**，政府通过能源部、交通部等机构对燃料电池的商业化进行推进，基于H2USA项目为燃料电池分布式能源、燃料电池叉车、燃料电池汽车以及加氢站基础设施建设提供研发基金、税收和财政支持。现阶段在分布式电源、叉车等领域的商业化应用处于全球领先，燃料电池汽车则主要针对示范应用推动加氢站设施建设
- 欧美燃料电池汽车企业主要和日本相关企业结成产业联盟共同开发
 - 丰田/宝马: 面向2020年联合开发下一代燃料电池汽车平台
 - 福特/尼桑-雷诺/戴姆勒：面向2017年联合开发燃料电池电堆和系统
 - 通用/本田：面向2020年联合开发下一代燃料电池和储氢系统，已在美国建立合资工厂

CHIC项目

- CHIC项目于2010年至2016年进行，共**54辆**燃料电池大巴在**9个城市**进行了超过**900万公里**的示范运行；累积运行时间超过50万小时；部分燃料电池电堆运行超过2万小时；运行工况为每天近20小时、350km的续驶里程；对于12m大巴的氢气消耗率约为9kg/100km，等效燃油效率提升了26%，减少了85%的二氧化碳排放，即减少6800吨二氧化碳排放



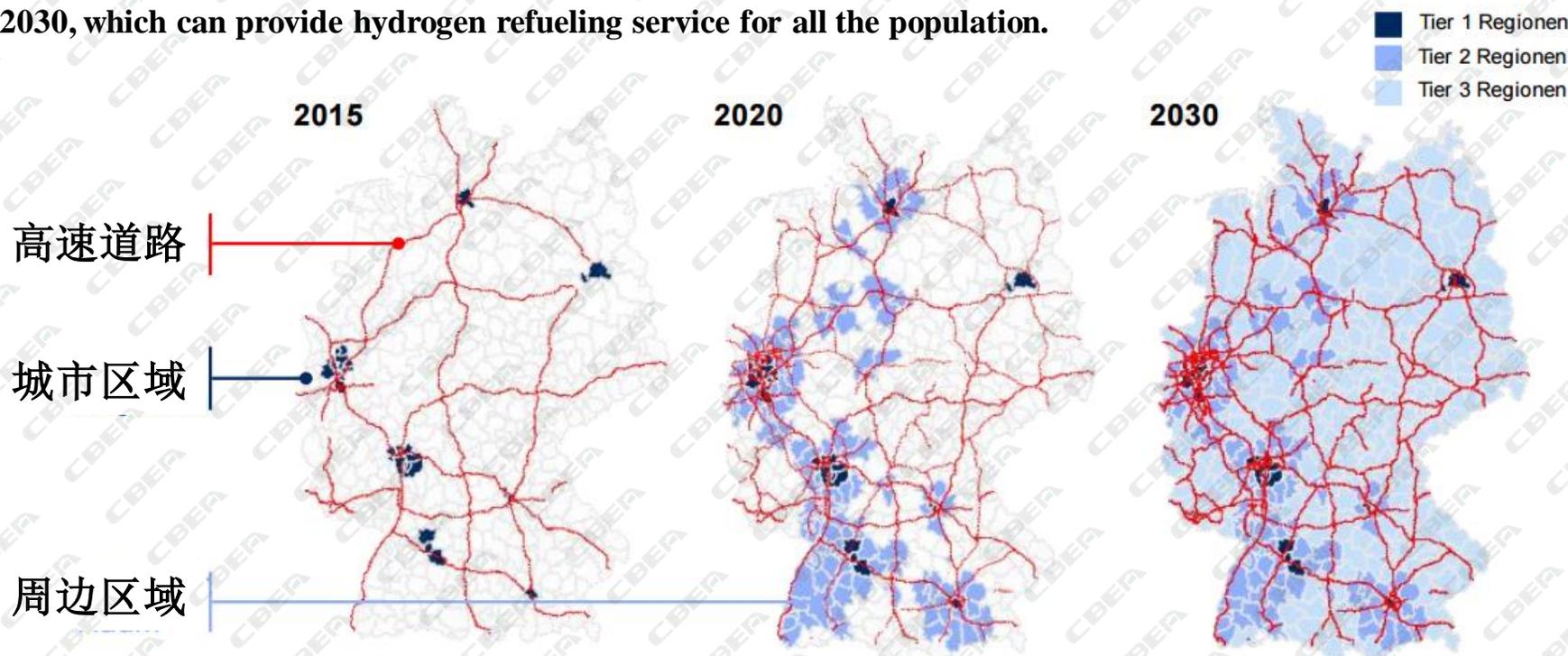
Van Hool 燃料电池大巴



参与单位

欧洲氢能与燃料电池产业发展 Status in the EU

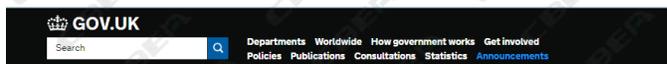
- 在欧盟和各国共同支持下进行了大量的研发和示范应用项目，由各国对应用端进行补贴和基础设施规划与建设 Many programs on research or demonstration have been funded by the EU and member states, and financial subsidies are provided by each member to applications and infrastructures.
- 德国制定了详细的加氢站基础设施建设规划，目前已建成加氢站100座，计划在2023年完成400座加氢站，于2030年完成1000座加氢站建设，覆盖100%的人口。German is the leader in developing infrastructures. More than 100 units will be setup by 2017, and 400 units by 2023, and 1000 units by 2030, which can provide hydrogen refueling service for all the population.



加氢站(座) STs	50	~400	~1000
燃料电池汽车(辆) FCVs	~5000	~150,000	~1,800,000

欧洲禁售燃油车计划

- 2015年12月初，一些欧洲国家就加入了“**国际零废气排放汽车联盟**（International Zero-Emission Vehicle Alliance）”，承诺将在2050年以前让所售新车全部为新能源车型
- **英国**政府宣布将于**2040年**起停止销售汽油和柴油汽车来减轻空气污染，到2050年，行驶在英国道路上的汽车将全部实现零排放；
- 从2040年开始，**法国**将全面禁止采用内燃机动力的汽车上路。法国新任环境部长尼古拉斯·霍洛（Nicolas Hulot）宣布法国在2050年前成为碳零排放国家；



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News story

UK government pledges bold ambition for electric cars

From: Department for Transport, Office for Low Emission Vehicles, and Andrew Jones MP
Part of: Transport emissions
Published: 3 December 2015

Government reaffirms UK's commitment for almost all cars and vans to be zero emission by 2050 at Paris COP21 conference.



The UK government has continued to lead global efforts to cut vehicle emissions at the international climate conference in Paris today (3 December 2015).

The UK was one of 13 international members of the Zero Emission Vehicle (ZEV) Alliance to sign a [commitment to promote cleaner motoring and slash transport emissions](#), alongside Germany, the Netherlands, Norway and California. It includes an agreement to make all passenger vehicle sales zero emission vehicles by 2050.

Transport Minister Andrew Jones said:

"The UK already has the largest market for ultra-low emission vehicles in the EU, and the fourth largest in the world and today's pledge reaffirms our commitment to ensuring almost every car and van is a zero emission vehicle by 2050.

Electric cars are greener and cheaper to run and we are making them more affordable, spending more than £600 million between 2015 and 2020 to support the uptake and manufacturing of ultra-low emission vehicles here

MEMBERS

British Columbia
California
Connecticut
Germany
Maryland
Massachusetts
The Netherlands
New York
Norway
Oregon
Québec
Rhode Island
The United Kingdom
Vermont

THE ZEV ALLIANCE PARTICIPATION STATEMENT

The jurisdictions seek to collaborate with other governments to expand the global zero-emission vehicle (ZEV) market and enhance government cooperation on ZEV policies, in order to strengthen and coordinate efforts to combat air pollution, limit global climate change, and reduce oil dependence by establishing an International Zero-Emission Vehicle Alliance (ZEV Alliance) to increase ZEV deployment.

Each participating jurisdiction is a participant.

AREAS AND FORMS OF COOPERATION

The Participants will cooperate in the following areas, on the basis of the principle of equality and mutual benefit:

Setting deployment targets

- Sharing existing targets for ZEV deployment;
- Setting ambitious, achievable targets for further ZEV deployment in line with their long-term goals;
- Working to establish a shared vision and target for ZEV leadership jurisdictions;
- Encouraging one another to consider ambitious targets that drive ZEV deployment.

Acting together

- Creating and sharing action plans to achieve ZEV adoption targets;
- Sharing data, best practices, and other information to inform target-setting and planning;
- Taking actions to achieve our targets as appropriate in each jurisdiction;
- Looking for opportunities to act together to achieve our individual and collective targets

美国燃料电池发展以分布式发电为引领

■ 美国燃料电池**分布式发电**企业主要包括：

- Bloom Energy (SOFC)
- Doosan Fuel Cell America (PAFC)
- Fuel Cell Energy (MCFC)
- LG Fuel Cell Systems (SOFC)
- Plug Power (PEMFC)

■ 美国分布式发电装机容量大于**230MW**，备用电源使用数量大于**6000**个；

FedEx Panasonic verizon Google SoftBank

ebay inc COX ENTERPRISES HONDA The Power of Dreams delmarva power

Adobe The Coca-Cola Company NOKIA Walmart

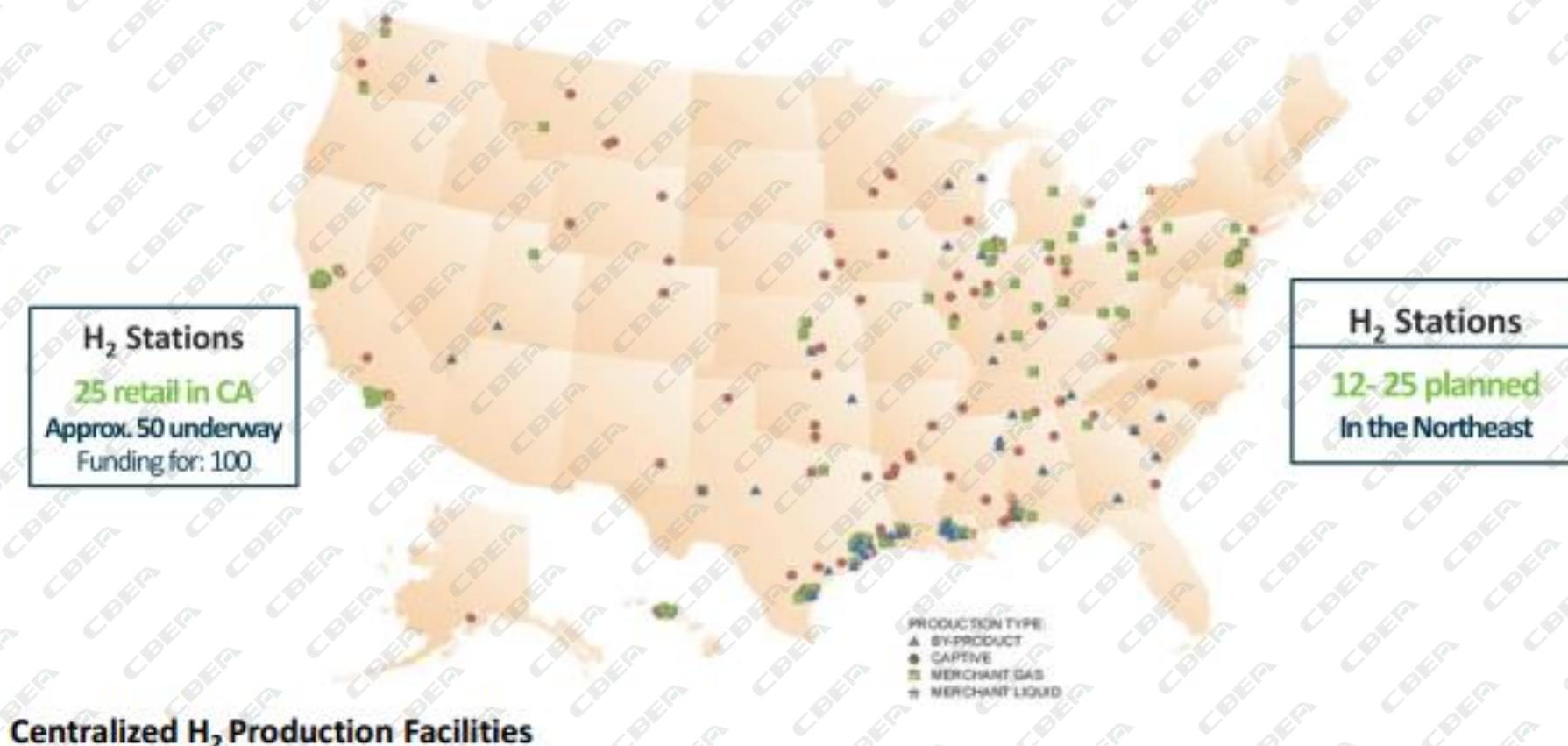
Sprint AT&T [CSX] metroPCS

主要用户



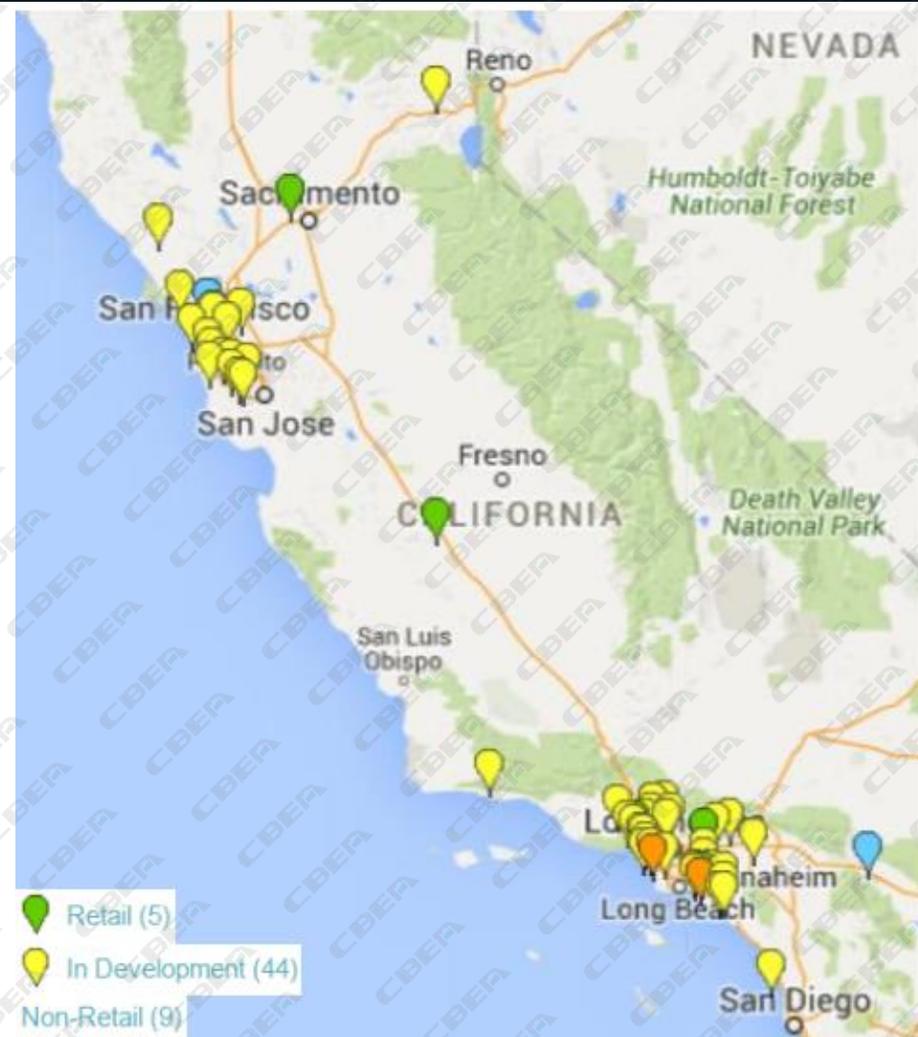
美国氢生产概况

- 每年生产约**1000万吨**氢气
- 已建成**1600英里**(约1900公里)氢气管道



美国加氢站基础设施

- 活跃区域包括加利福尼亚、纽约、新泽西和马萨诸塞州
- 加州区域运营加氢站约**5座**，建设中加氢站约为**44座**
- 东部地区运营加氢站2座



全球加氢站概况 Hydrogen Refueling Stations Worldwide

- 加氢站建设客观反映了氢能与燃料电池汽车发展的状况，目前热点主要是欧盟、日本和美国 Development of hydrogen refueling station reflects the activities of fuel cell vehicles, the hottest flashpoints including Japan, EU and the USA.



截止2017年1月，全球正在运营的加氢站达到274座，2016年全球新增92座加氢站
Up to the Jan. 2017, the total number of hydrogen refueling station in operation is 274, and 92 units were built up in 2016.

目录 Agenda

- **燃料电池汽车发展趋势与现状**

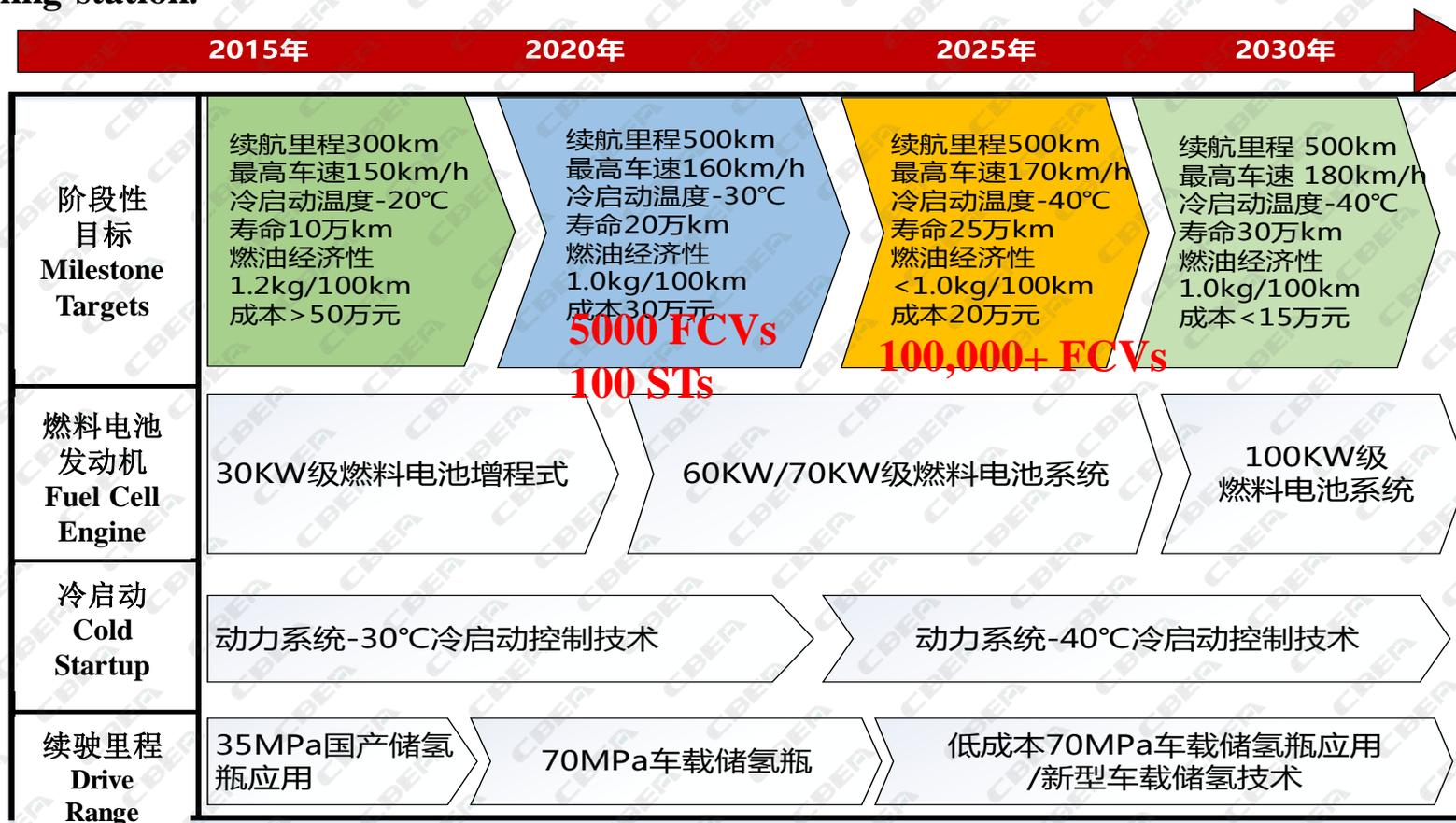
Overview of Fuel Cell Vehicle

- **中国燃料电池汽车产业面临的机遇与挑战**

Opportunities and Challenges for Chinese Industry of Fuel Cell Vehicle

中国燃料电池汽车产业路线 Roadmap for Chinese FCV industry

- 国家产业政策导向清晰，技术发展的路线图和宏观目标已发布，为支撑产业的高速发展，需要对产业规模、支撑配套条件进行深入的规划 The guidance of Chinese national government is very clear, and the technical roadmap and milestone are released. To support the high-speed growth of fuel cell vehicle industry, there should be more supporting conditions, such as hydrogen refueling station.



中国燃料电池汽车补贴政策 Financial Subsidy Policy for FCV

- 燃料电池汽车补贴将持续至2020年 The Financial subsidy policy for FCV will be stably last to 2020
- 加氢能力在200kg的加氢站将补贴400万人民币 The subsidy for hydrogen station with the capability more than 200kg per day is 4 million RMB
- 燃料电池汽车补贴额度如下表所示，地方政府额外补贴50%~120%。要求燃料电池输出功率大于驱动电机功率的30%，续航里程大于300km。 The subsidy for each type vehicle is shown in the following table, and the local governments will provide a extra subsidy of 50%~120%. The requirements for the vehicles are: FCE rated output power is greater than 30% of drive motor's rated power, and the drive range should be grater than 300km.

车辆类型 Vehicle Type	补助标准（万元） Subsidy in 10thousand RMB
燃料电池乘用车 Passage Car	20
燃料电池轻型客车、货车 Light Duty Commercial Vehicle	30
燃料电池大中型客车、中重型货车 Heavy Duty Commercial Vehicle	50

GEF/UNDP第三期项目 3rd Phase UNDP FCV Program

- 在GEF支持下实施的UNDP第三期燃料电池汽车项目，初步选定五个城市进行示范运行。The 3rd UNDP FCV demonstration program supported by GEF is been carrying out in five cities, including 112 vehicles, in which there are 36 buses, 41 passage cars, 30 logistic cars and 5 trucks.



中国燃料电池汽车发展历程 Experience of Development FCV in China

- 16年燃料电池研发经验 16 years experience on fuel cell
- 300余辆燃料电池汽车开发 300+ fuel cell vehicles developed
- 百万小时的数据积累 1,000,000+ hours operation data
- 第四代燃料电池动力系统 4th Generation fuel cell powertrain



2001

2005

2008

2009

2010

2011

2012

2014

2016



燃料电池汽车产业发展模式 Driving Force for FCV Development



- 2001~2005: Supported by National Research Programs
- 2006~2010: Driven by National Demonstration Programs
- 2011~2015: Led by automaker, especially by SAIC MOTOR
- Now: The direction is not clearly, but it is definite that the commercial vehicle will be the breakthrough for commercialization of FCVs. Maybe it will be driven by capital investment, or National financial subsidy policy, or by the market demands.

燃料电池汽车产业链发展 Achievements on Industry Chain



- 已形成较为一定规模的燃料电池汽车技术产业链集聚 Agglomeration effect on industry chain has been formed
- 专注燃料电池与氢能研发、制造的企业数量超过200个，小微企业为主 More than 200 enterprises are focused on fuel cell, most of them are in small scale.
- 由科研院所、产业联盟、检验检测服务平台等构成较完善的产业支撑体系 An comprehensive support system for the FCV industry is being built up, which includes academia, industry alliances and service platforms.

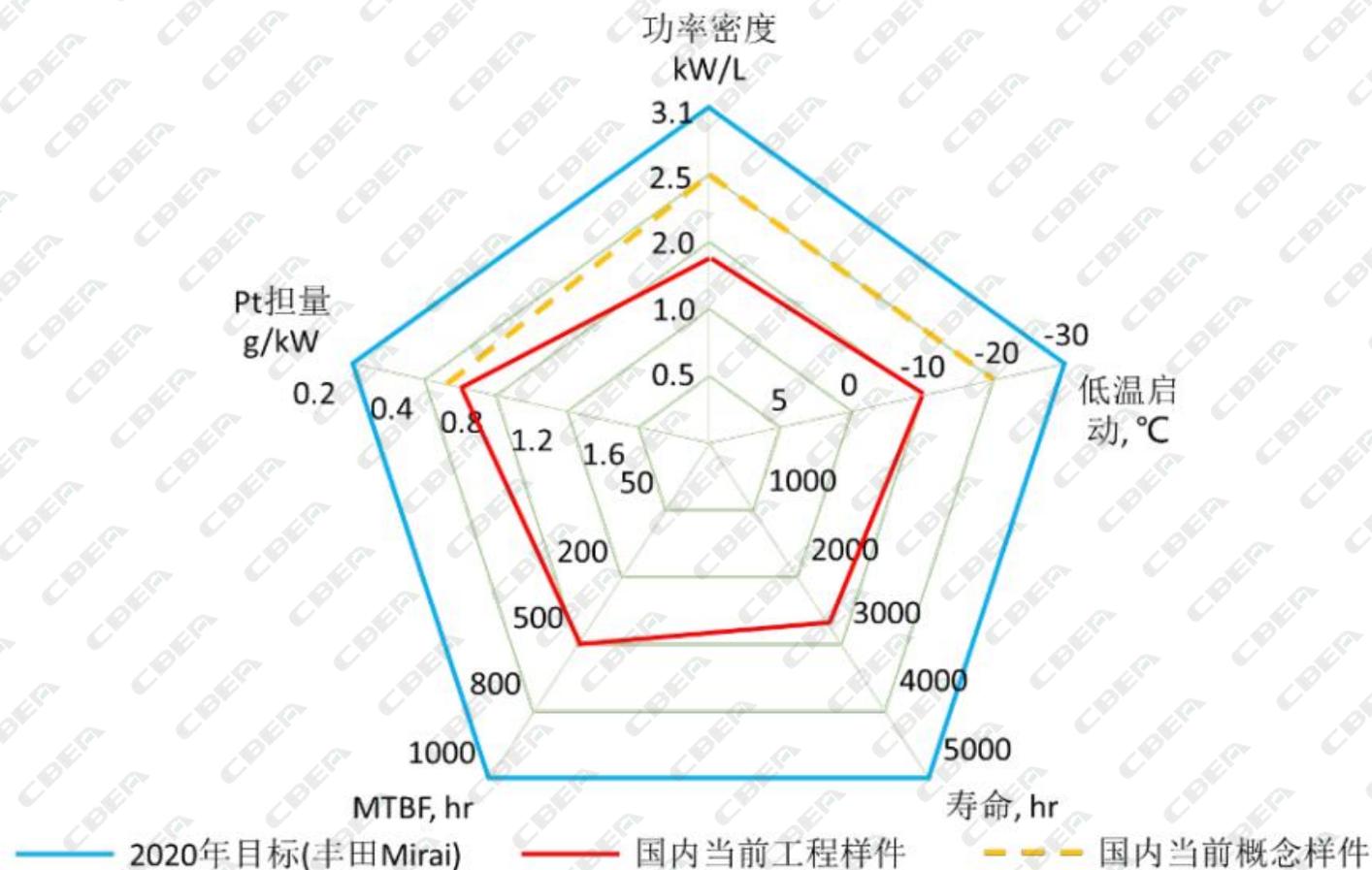
燃料电池汽车技术对标 Compare on FCV performance

典型车		丰田 MIRAI	本田 Clarity	现代 ix35	荣威950	通用 Equinox
车型图片						
整车基本参数	长/宽/高, mm	4870/1810/1535	4895/1875/1475	4420/1820/1660	4996/1857/1502	4771/1842/1684
	轴距, mm	2780	—	2640	-----	—
	整备质量, kg	1850	1890	2290	2080	2010
电机	峰值功率, kW	113	130@500V	100	----	94
动力电池		镍锰电池, 1.6kWh	锂离子电池	锂聚合物电池(LG)	锂离子电池, 11kWh	镍氢电池
燃料电池系统		自主, 114kW	自主, 100kW	自主110kW@450V	40kW	93kW
动力性	最高车速, km/h	160	161	160	160	160
	100km/h加速, s	10	10	12.5	12	12
经济性	续驶里程, km	650 (JC08), 483	750	415	430	320
储氢罐	储氢质量, kg	约5kg(前62.4L, 后60L)	—	5.64(144L)	4.2	4.2
动力系统构型		全功率型	全功率型	全功率型	PLUG IN	全功率型
上市时间		2014.12	2016.3	2013.12	2015	—
售价, 万元 (人民币)		37 (日本可补贴10)	48 (日本可补贴10)	42	—	—

现状：整车续驶里程和丰田、本田差距较大，但整车动力性能指标基本持平 There is a big gap in drive range and fuel cell engine's output power, but the vehicle dynamic performance is very close.

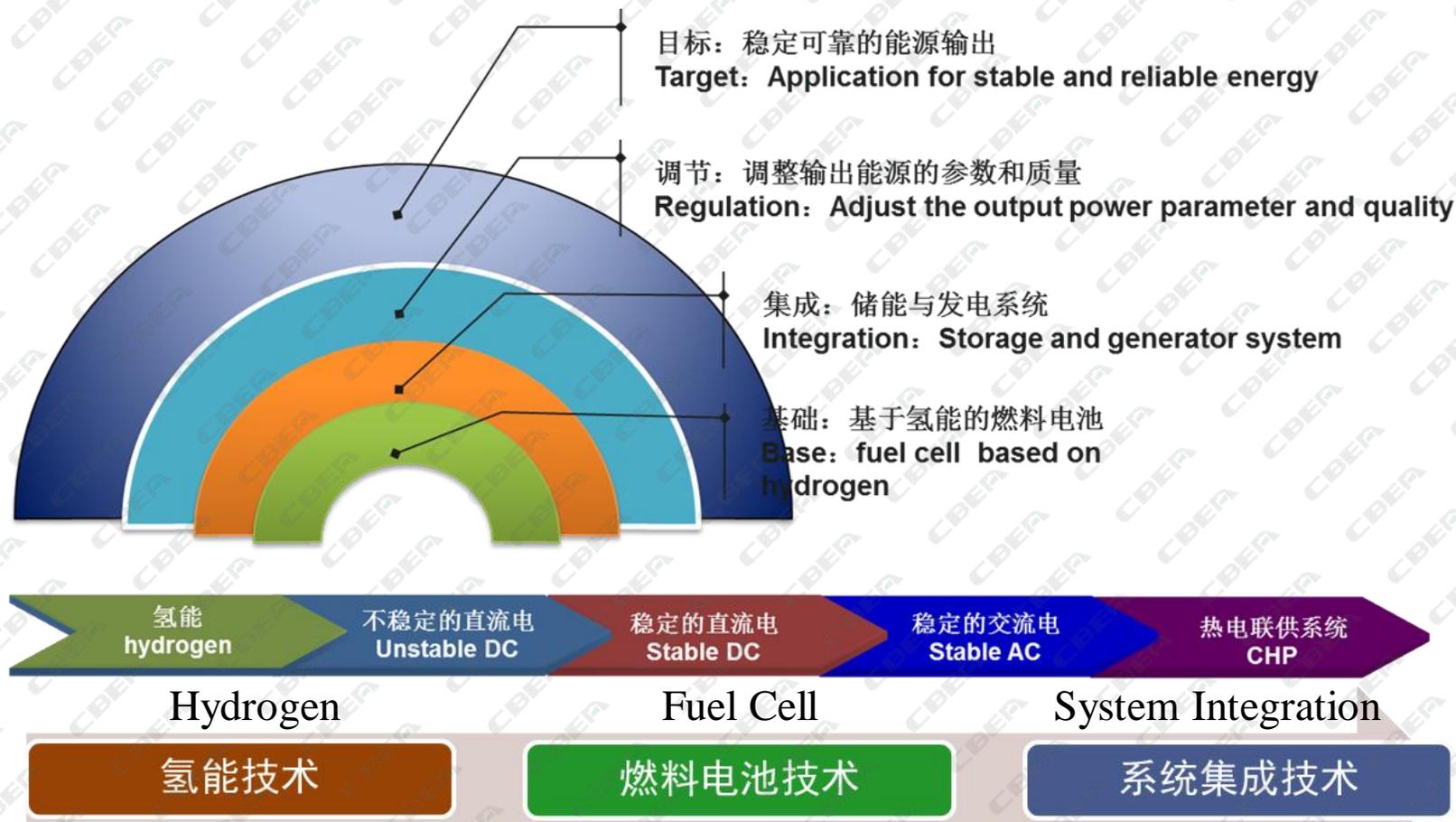
发动机与零部件对标 Compare on FCE and Components

- 燃料电池材料和关键零部件技术基础与国际先进水平差距较大，耐久性、低成本等指标显著落后，其中电堆是目前最为显著的短板。



产业链对比分析 Compare on Technical Readiness Level

- 国际燃料电池汽车技术总体水平处于TRL8~TRL9级之间，正在进入商业化应用阶段；我国在系统集成领域则处于TRL6~TRL7之间，即处于模拟测试和示范验证阶段；在关键材料和部分关键零部件领域则主要处于TRL3~TRL4之间，即仅仅实现了功能验证。The internal TRL of fuel cell vehicle is TRL8~TRL9, and the industry is entering the commercial stage. While in China, the TRL of fuel cell system is TRL6~TRL7, is under the demonstration stage. And the TRL of some key materials and components is TRL3~TRL4, is still research and development.



燃料电池汽车产业挑战 Challenges for Chinese FCV Industry



挑战 Challenges

I

国家的宏观规划缺乏详细实施规范的支撑，需要加强政府和企业间联动

The national macroplanning should be supported by detail local government's regulations, and close collaboration between the government and enterprise should be built up.

II

关键材料和关键零部件技术不成熟

Domestic technologies of key material and components can't meet the commercialization requirement.

III

缺乏应用驱动，小微企业不足以拉动产业发展

Small scale enterprises lack the driving force for the FCV industry, large scale demonstration should be supported by the government.

IV

加氢站基础设施建设速度不足以支撑产业高速发展

The speed of hydrogen refueling station construction should be accelerated or new technology should be adopt.

发展模式建议 Suggestion on Develop Model

- 中国政府和企业应当借鉴纯电动汽车在国内的成果经验，面向燃料电池汽车优势应用领域，探索互联网+定制班车的共享班车商业运营模式、分时租赁运营模式及物流车区域示范运营模式，牵引燃料电池汽车产业链快速发展

Reference to the success of EV, Chinese government and enterprises should make full use of the advantages of FCVs by investigating the Internet+ commercial mode, such as shared shuttles, time-share rental, and regional logistics demonstration. So will promote the FCV's industry chain quickly.

定制及共享班车 Shared Bus



分时租赁 Time-share Rental



区域物流 Regional Logistics



- 通过国际合作健全关键材料和关键零部件的技术链和产业链，实现燃料电池汽车产业化技术突破。

Develop the technical chain and industry chain of key material and components by international cooperation to realize the breakthrough in the FCV commercial technologies.



燃料电池电堆
Fuel Cell Stack

- Low cost
- High durability
- High specific power



系统集成
与控制技术
Integration
and Control

- Cold startup
- Robust
- Online diagnosis



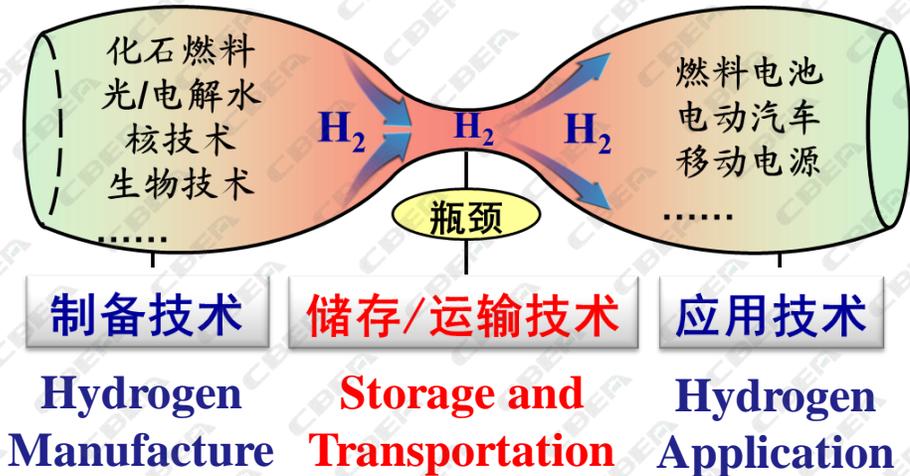
辅助系统关
键零部件
BOPs

- Compressor
- Hydrogen recirculation
- Humidifier

- Durability > 5000hrs and 10000hrs
- MTBF > 1000hr
- MBRC > 5000km
- Cost < \$200/kW@10k units
- Operation Ambient Temp. : -35~50°C
- Specific Volume > 400W/L
- Specific Weight > 500W/kg

氢能应用瓶颈 Bottleneck for Hydrogen Utilization

- 氢气运输及存储效率 and 安全性 Efficiency of storage and transportation of hydrogen, besides its security.
- 加氢站需求数量巨大且成本较高 Large number of infrastructures are required and will cost too much.



Evaluation on Demand of Hydrogen Infrastructures

国家 Nation	成本(万美元) Cost (10k \$)	加油站数 Existing gasoline station	加氢站数 Existing Hydrogen Station	需建加氢站数 HST to be Built
美国USA	150-200	114,000	~63	72,960
日本 Japanese	500	40,357	~100	25,828
德国 German	300	14,300	~100	9,152
中国 China	120	97,000	5	62,080

- **我国已初步具备大规模发展燃料电池汽车的基础和良好的政策环境** China have already had the primary condition to develop the fuel cell vehicle industry, and good policy support conditions.
- **通过国际合作是实现燃料电池汽车产业化技术突破的必由之路** It is necessary for China to realize the commercial technology breakthrough by international cooperation.
- **加强政府与企业、社会资源之间的合作，通过应用驱动模式牵引燃料电池汽车发展完全可行** It is reasonable to accelerate the development of fuel cell vehicle industry by application driven model, based on close cooperation between the government, enterprises and social resource.
- **探索新型储氢技术，推动加氢站与加油站的共建，是加速我国燃料电池汽车发展的前提条件** Promotion the construction of hydrogen refueling station is the precondition for the development of Chinese fuel cell vehicle industry. Which can be achieved by the convergence with traditional gasoline station by using new hydrogen storage technology.

衷心感谢您的倾听！

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