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Global and China Hybrid Electric Vehicle (HEV) Research Report, 2023-2024

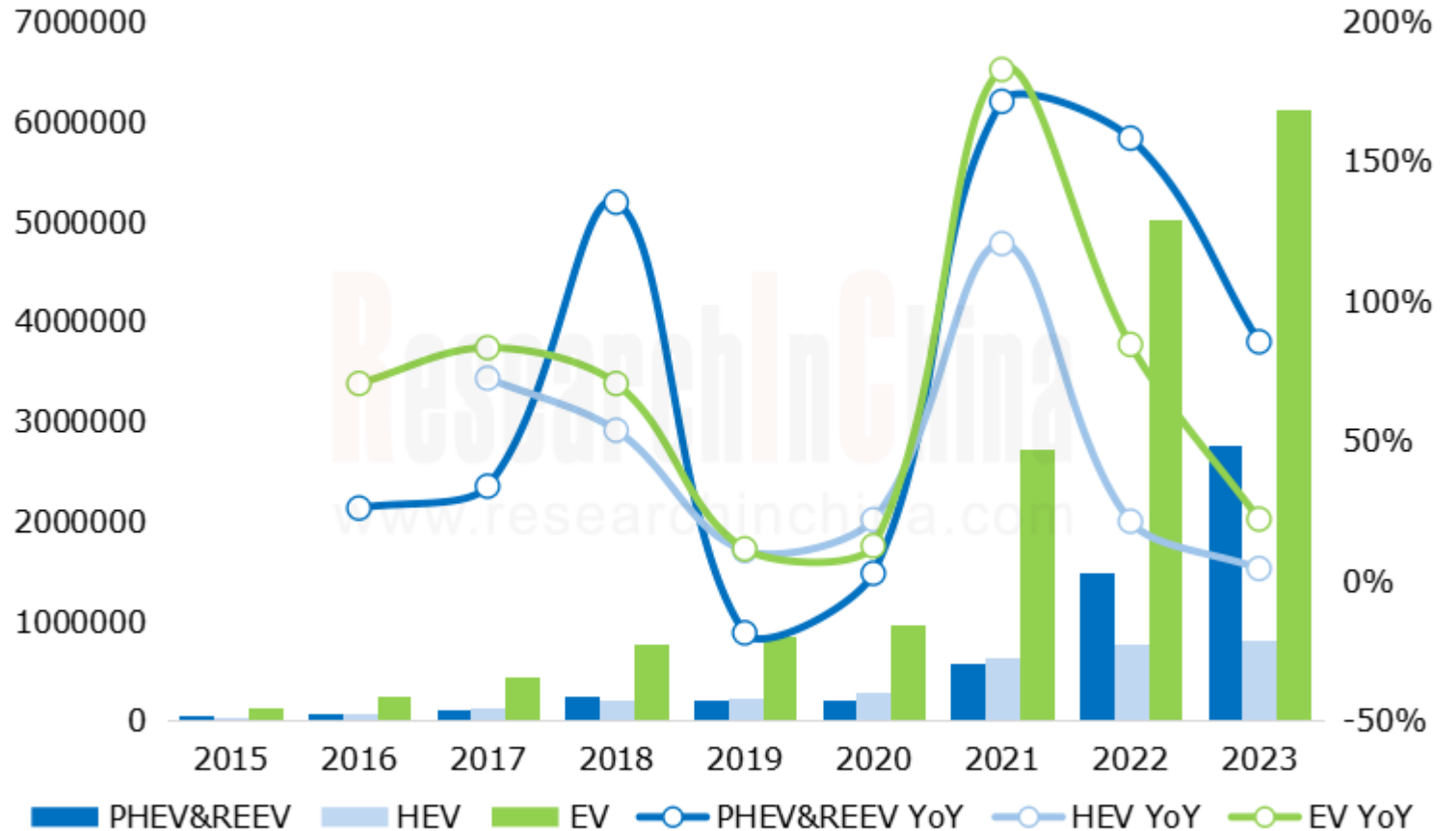
Jan. 2024

In 2025, the share of plug-in/extended-range hybrid electric passenger cars by sales in China is expected to rise to 40%

Sales and YOY Growth of New Energy Passenger Cars (EV&PHEV&REEV&HEV) in China, 2015-2023

1. In 2025, the share of plug-in/extended-range hybrid electric passenger cars by sales in China is expected to rise to 40%.

In 2023, China sold 2.754 million plug-in/extended-range hybrid electric passenger cars, a year-on-year spurt of 85.5%, a growth rate higher than battery electric passenger car models for five consecutive quarters, and the overall growth of the new energy vehicle market.

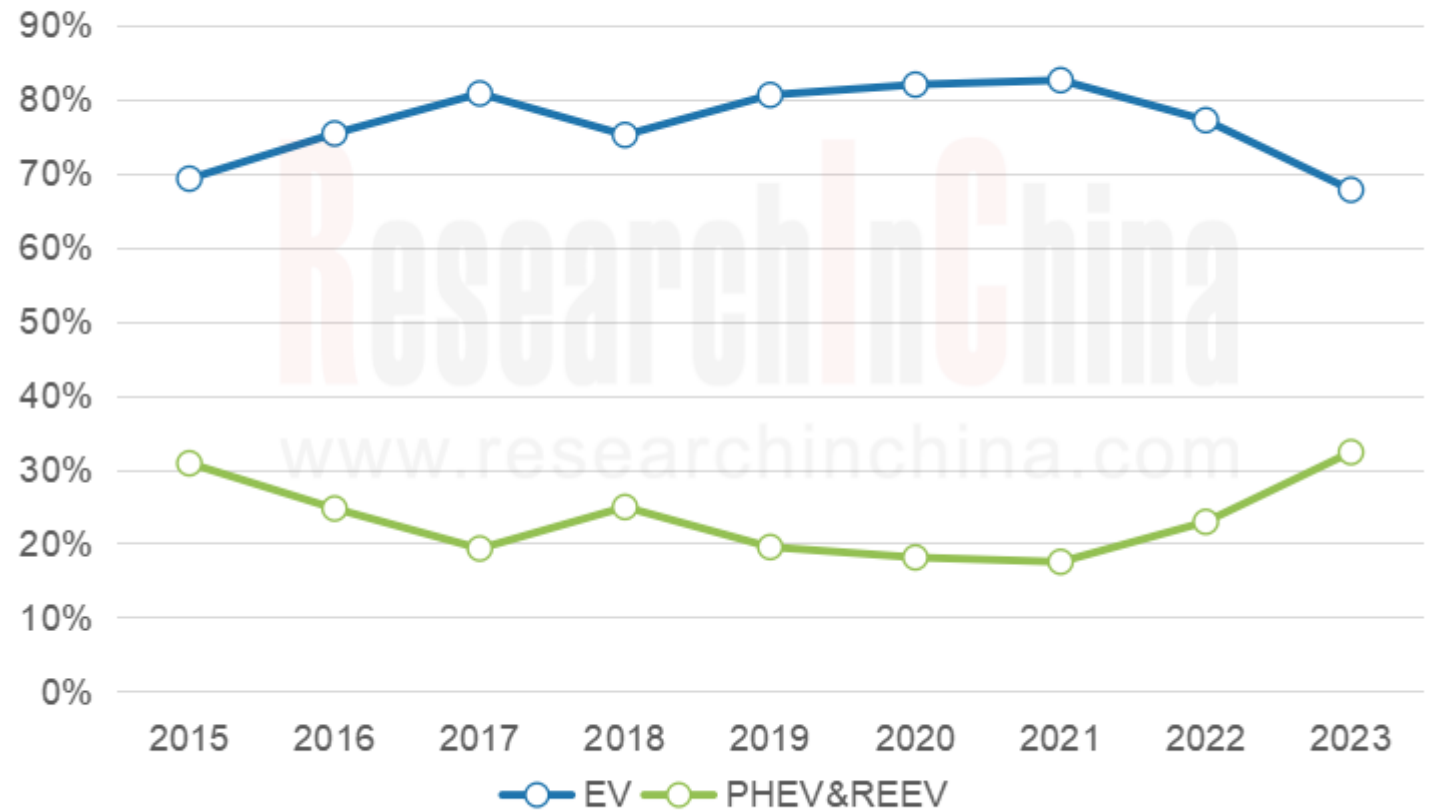


Source: ResearchInChina

Sales Structure of New Energy Passenger Cars (EV, PHEV & REEV)

In China, plug-in/extended-range hybrid electric passenger cars already make up 30.6% of new energy passenger cars. In 2023, automakers in China launched more than 30 new plug-in/extended-range hybrid electric vehicle models. As new models continue to emerge, the sales of plug-in/extended-range hybrid electric passenger cars will be on the rise. It is expected that by 2025, plug-in/extended-range hybrid electric passenger cars will take up 40% of the new energy passenger car sales in China.

Sales Structure of New Energy Passenger Cars (EV, PHEV & REEV) in China, 2015-2023



Source: ResearchInChina

“Electrification plans” are set back globally, and hybrid technology ushers in a boom period

2. “Electrification plans” are set back globally, and hybrid technology ushers in a boom period.

As battery electric vehicles (BEV) see a lower-than-expected growth in sales, major global automakers concentrate more on hybrid electric vehicle (HEV) models to meet customers’ demand and the need for a gradual transition to electrification. By combining conventional internal combustion engine (ICE) system with electric systems, HEV models can help to reduce fuel consumption and emissions in the short term. Also they are very superior in adapting to consumers’ driving habits and alleviating range anxiety.

From the transformation into electrification by global OEMs, it can be seen that GM, Ford and Audi have all postponed their electrification plans. Volkswagen has scaled down its BEV production in Europe. The reasons for the delays and adjustments are reduced orders and lower-than-expected sales. HEV models, especially PHEV & REEV, have become a compromise of automakers in transformation into electrification. It is expected that the launch of new BEVs will slow down in 2024, and PHEV & REEV models will be rolled out in quantities.

New Hybrid Plans of Major Global OEMs

Global Automaker	New Hybrid Strategy
Toyota	Toyota has been working on conventional HEV models.
KIA	In the transition to full electrification, Kia’s near- and mid-term goals are set on HEV and plug-in hybrid electric vehicle (PHEV) models.
Ford	In September 2023, Ford announced a plan to double the sales of its HEV model V-6 in the US to about 20% of its vehicle sales in 2024.
Stellantis (Chrysler’s parent company)	Its electrification strategy will be carried out through HEV models before starting launching a range of electric vehicles in 2024.
Audi	In December 2023, to stay in business and stabilize profits, Audi announced that it would slow its pace of transformation into electrification and push on with promotion of internal combustion engine and plug-in hybrid electric vehicles in the short term.

Source: ResearchInChina

3. The boom of hybrid electric passenger cars gives a big boost to the downstream components market.

3.1 Multi-motor/electronically controlled hybrid power systems become mainstream, favoring the rapid development of the industry chain.

In hybrid power systems, dual-motor hybrid power systems have great advantages in fuel consumption, especially paired with long-range batteries. BYD, Li Auto, Geely and Great Wall among others therefore have launched their own hybrid power systems and quickly seized the market with plug-in hybrid or extended-range energy types.

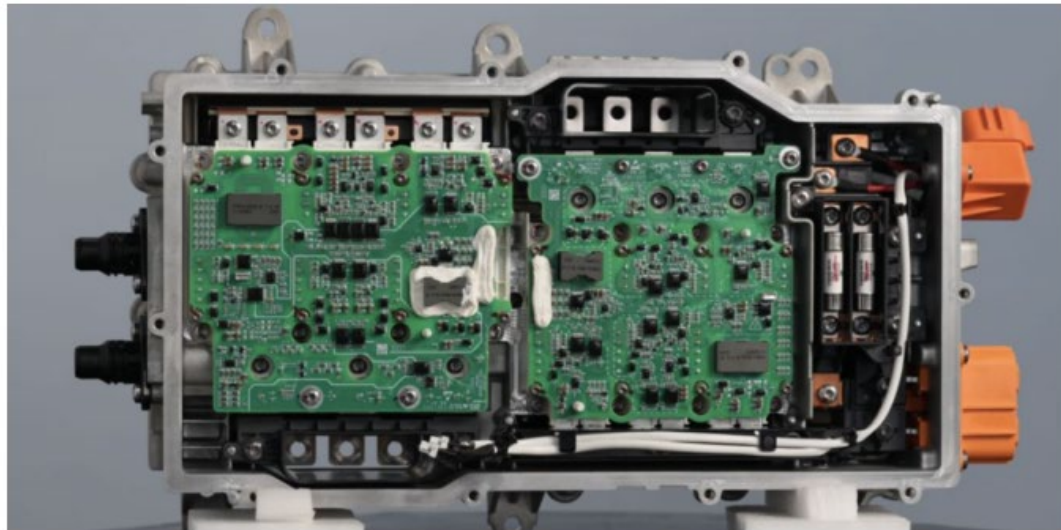
The ratio between hybrid vehicle and motors is generally 1:2/1:3. When HEVs replace ICE vehicles and rapidly increase in volume, they will be a great driving force in the development of the motor industry chain. In the case of the P1+P3 hybrid configuration, P1 is the input shaft with a motor (generator), and P3 is the output shaft with a motor (drive motor). The P1+P3 configuration actually means installation of two motors. To achieve the four-wheel drive performance, HEV models add a motor to the position of P4. This is the P1+P3+P4 configuration, namely, three motors.

Dual-electronic control systems include two sets of modules that simultaneously control the generator and drive motor to implement the strategies for the entire hybrid power system. As Chinese independent automakers launch more projects, ever more electronic control suppliers participate in the competition in the dual-electronic control system market. Sungrow E-Power, BorgWarner and other suppliers have forged long-term partnerships with automakers like Geely and Great Wall on dedicated hybrid transmission (DHT) vehicles. The dual-electronic control system market thus keeps growing accordingly.

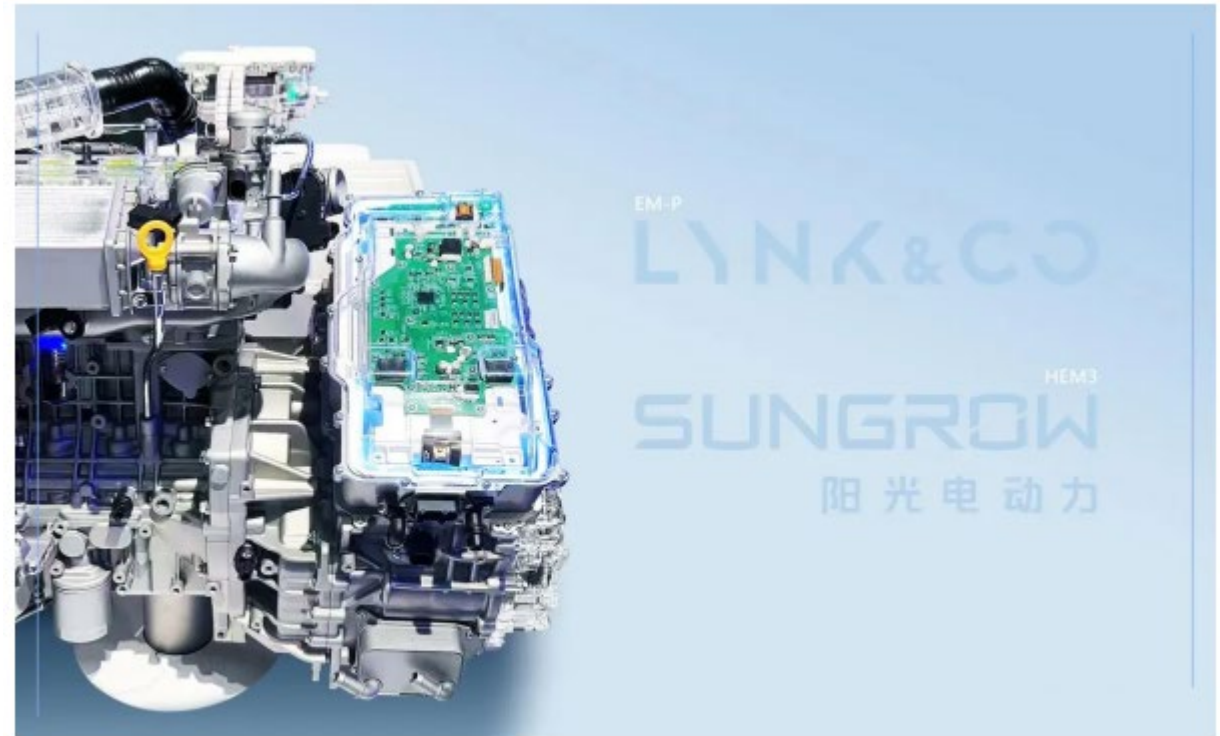
In Changan's P1+P3 hybrid architecture, the drive system uses TC387, a quad-core chip with computing power of 300 megabits per core, for high-precision dynamic torque response control and real-time active noise reduction. It adopts dual 4-core high-compute electronic control chips, and the core is the optimal A-ECMS intelligent energy consumption algorithm for high-precision control and real-time monitoring.

Sungrow E-Power introduced a hybrid dual-motor controller along with Lynk & Co EM-P

At the 2023 Munich Motor Show (IAA MOBILITY) in Germany, Sungrow E-Power introduced a hybrid dual-motor controller along with Lynk & Co EM-P, a super extended-range electric solution that uses Sungrow's HEM hybrid dual-motor controller and applies the new-generation power device parallel technology.



Source: Changan Automobile



Source: Sungrow E-Power

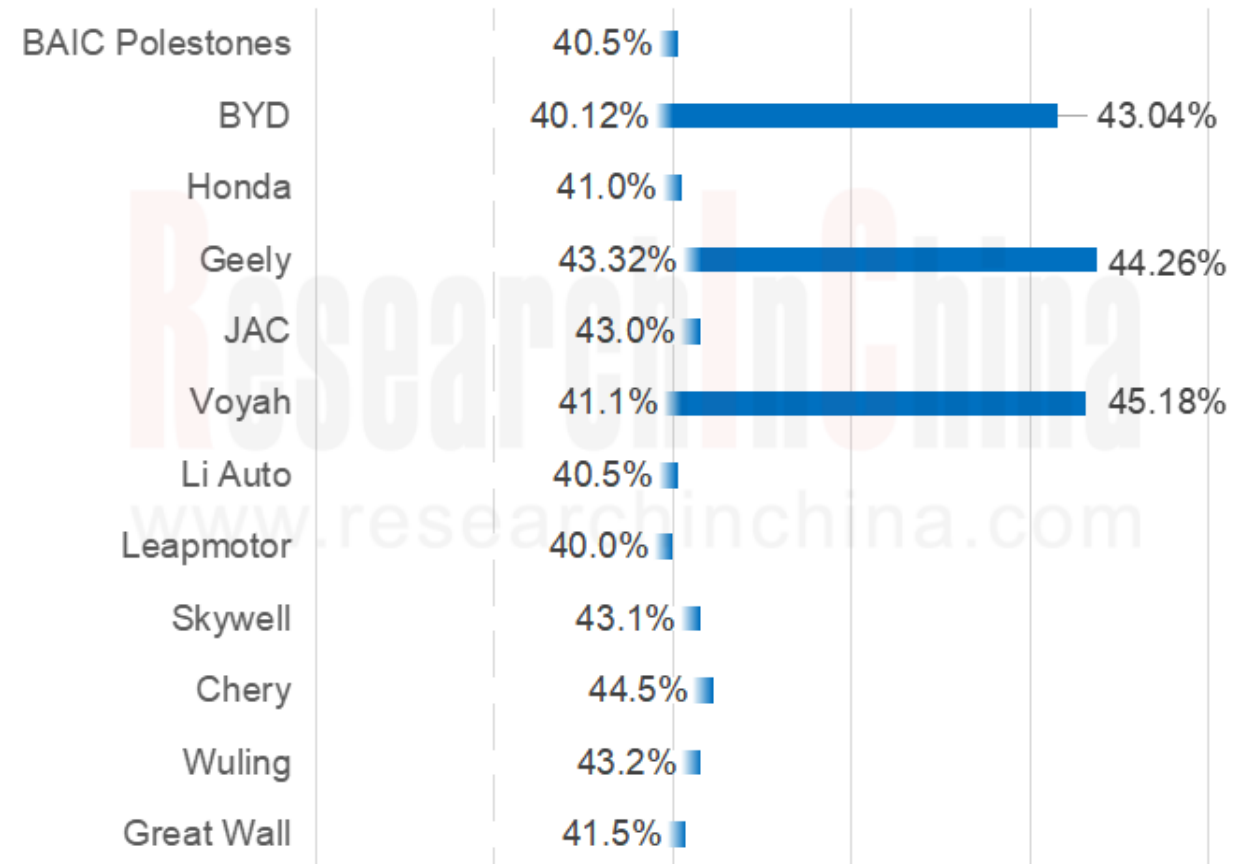
Dedicated hybrid engines (DHE) with thermal efficiency of 45% have been mass-produced, and industrial upgrade is imminent

3.2 Dedicated hybrid engines (DHE) with thermal efficiency of 45% have been mass-produced, and industrial upgrade is imminent.

The thermal efficiency of engines is closely related to the fuel consumption and cruising range of HEVs. The higher the engine thermal efficiency, the lower the carbon emissions and user fuel consumption in the same power output. DHEs use deep electromechanical coupling to change the operating conditions from the surface to the domain or line, favoring ultra-high fuel efficiency.

As OEMs like Geely, Dongfeng, BYD, GAC, Great Wall, and Chery lavish on research and development, hybrid electric passenger car models with thermal efficiency higher than 43% have been mass-produced by the end of 2023, especially the 2024 Voyah Dreamer carrying the new Lanhai Power hybrid engine (a 1.5T engine with front and rear dual motors) with thermal efficiency up to 45.18%. It is expected that in 2025, DHEs with thermal efficiency of 45% will find massive industrial application.

Thermal Efficiency of Dedicated Hybrid Engines (DHE) for Hybrid Electric Passenger Cars of Some Automakers



Source: ResearchInChina

Table of Content (1)

1 Introduction to Hybrid Electric Vehicles (HEV)

1.1 Overview of HEV

1.1.1 Definition and Structure of HEV

1.1.2 Working Steps of HEV

1.1.3 Introduction to Hybrid Solutions

1.1.4 Development Advantages of HEV

1.1.5 HEV Industry Chain

1.1.6 Development Trends of HEV

1.2 Global and Chinese Carbon Emission Policies

1.2.1 Carbon Neutrality Process in Major Countries

1.2.2 Electrification Goals of Major Countries/Regions

1.2.3 Electrification Policies of Major Countries/Regions

1.2.4 China's Vehicle Emission Regulations

1.2.5 The Opening of China's Carbon Emissions Trading Market Facilitates the Realization of Carbon Neutrality Goals

1.2.6 China's Vehicle Carbon Emissions

1.3 China's Policies Concerning HEV

1.3.1 Technology Roadmap 2.0 for Energy-Saving and New Energy Vehicles

1.3.3 Development Plan for New Energy Vehicle Industry (2021-2035)

1.3.4 China's Passenger Car CAFC&NEV Credits Policy

1.3.6 China's Supportive Policies for New Energy Vehicles in 2023

1.4 Policies Guide the Development of HEV Models

1.4.1 The Higher Demand for New Energy Vehicle Credits Drives the Development of HEV Models

1.4.2 Hybrid Models Help to Reduce the Pressure on Conventional Automakers in China Average Fuel Consumption (CAFC) Credits

1.4.3 HEV Models Are Rapidly Replacing Fuel-powered Vehicles

2 HEV Industry Policies and Status Quo

2.1 Global New Energy Vehicle Market

2.1.1 Light Vehicle Policies and Incentives in Major Countries/Regions

2.1.2 Global Electric Vehicle and Power Battery Forecast

2.1.3 Global New Energy Vehicle Sales

2.1.4 Global New Energy (EV+PHEV) Passenger Car Sales

2.1.5 Global New Energy (EV+PHEV) Passenger Car Sales - by Brand

2.1.6 Global New Energy (EV+PHEV) Passenger Car Sales - by Model

2.1.7 The HEV Sales Were Far Higher Than Battery Electric Vehicles (BEV) in the US in 2023

2.1.8 The HEV Sales Were Far Higher Than PHEVs in Europe in 2023

2.2 China New Energy Vehicle Market

2.2.1 China's Vehicle Sales

2.2.2 Motor Vehicle/Automobile Ownership in China

2.2.3 Overall Production and Sales of New Energy Vehicles in China

2.2.4 Overall Production and Sales of New Energy Vehicles in China - by Fuel Type

2.2.5 New Energy Passenger Car Sales in China - PHEV&EV

2.2.6 Hybrid Electric (HEV & PHEV) Passenger Car Sales Grow Faster Than EV Passenger Cars in China

2.2.7 In 2023 the New Energy Vehicle Launches in China's Passenger Car Market Exceeded Fuel-powered Vehicles

2.2.8 New Energy Commercial Vehicle Sales in China

2.3 Micro Hybrid Market (12V Start-Stop System)

2.3.1 China's Micro Hybrid Market (12V Start-Stop System) - Installation Rate of Automatic Start-Stop

Table of Content (2)

2.3.2 Energy-saving Effect and Usage Cost of Automotive Start-Stop System

2.4 Mild/Medium Hybrid Market (48V+BSG/ISG System)

2.4.1 Models (Incl. Imported Ones) Equipped with 48V Mild Hybrid Power System in 2023

2.4.2 Challenges in the Development of 48V Mild Hybrid Power System

2.5 Full Hybrid Market (HEV)

2.5.1 Sales of HEV Passenger Cars in China

2.5.2 Competitive Landscape in HEV Passenger Cars in China

2.5.3 HEV Passenger Car Sales in China by Model

2.5.4 Development Trends of HEV Passenger Cars in China

2.5.5 HEV SWOT Analysis

2.6 Plug-in Hybrid Market (PHEV 150V+)

2.6.1 Sales of PHEV Passenger Cars in China

2.6.2 Competitive Landscape in PHEV Passenger Cars in China

2.6.3 PHEV Passenger Car Sales in China by Model

2.6.4 Parameters of PHEV Passenger Car Models in China

2.7 Range-extended Hybrid Market (REEV)

2.7.1 REEV Passenger Car Sales in China

2.7.2 REEV Passenger Car Sales in China by Brand

2.7.3 REEV Passenger Car Sales in China by Model

2.7.4 China's Major Suppliers of Key Components for REEV Models

2.8 Forecast on HEV Development in China

2.8.1 HEV Sales in China

2.8.2 HEVs Help Automakers Become Profitable Early in New Energy Transformation

2.8.3 Chinese Independent New Energy Vehicle Companies Accelerate Their Pace of Deploying Off-road HEVs

2.8.4 China's Vehicle Exports Soared, Becoming A Key Growth Driver for New Energy Vehicle Sales

2.8.5 Cost Structure and Localization Rate of New Energy Passenger Cars

3 HEV Technology Roadmaps and Key Components

3.1 Classification of Hybrid Power System Technologies (by Power Structure)

3.1.1 Principle of Classification of Hybrid Power System Technologies - by Power Structure

3.1.2 Comparison between Hybrid Power Systems with Differing Power Structures

3.1.3 Series Hybrid Electric Vehicle (SHEV) - Structural Composition

3.1.4 Series Hybrid Electric Vehicle (SHEV) - Working Mode

3.1.5 Parallel Hybrid Electric Vehicle (PHEV) - Structure

3.1.6 Parallel Hybrid Electric Vehicle (PHEV) - Drive Mode

3.1.7 Parallel Hybrid Electric Vehicle (PHEV) - Working Mode

3.1.8 Parallel Hybrid Electric Vehicle (PHEV) - Single Motors in Parallel

3.1.9 Parallel Hybrid Electric Vehicle (PHEV) - Dual Motors in Series and Parallel

3.1.10 Parallel-Series Hybrid Electric Vehicle (PSHEV) - Structural Composition

3.1.11 Parallel-Series Hybrid Electric Vehicle (PSHEV) - Working Mode

3.2 Classification of Hybrid Power System Technologies (by Drive Motor Power Ratio)

3.2.1 Principle of Classification of Hybrid Power System Technologies - by Drive Motor Power Ratio

3.2.2 Start-Stop, BSG and ISG

3.2.3 Classification of HEV (12V Start-Stop System)

3.2.4 Mild Hybrid (48V System)

3.2.5 Mild Hybrid (48V System)

Table of Content (3)

- 3.2.6 Medium Hybrid (ISG Architecture)
- 3.2.7 Full Hybrid (HEV, PHEV)
- 3.2.8 Classification of Hybrid Power System Technologies (by Drive Motor Power Ratio) - Summary and Comparison

- 3.3 Classification of Hybrid Power System Technologies (by Motor Layout Position)
 - 3.3.1 Principle of Classification of Hybrid Power System Technologies - by Motor Layout Position
 - 3.3.2 Classification of Hybrid Power System Technologies - P0 Motor
 - 3.3.3 Classification of Hybrid Power System Technologies - P1 Motor
 - 3.3.4 Classification of Hybrid Power System Technologies - P2 Motor
 - 3.3.5 Classification of Hybrid Power System Technologies - P3 Motor
 - 3.3.6 Classification of Hybrid Power System Technologies - P4 Motor
 - 3.3.7 Classification of Hybrid Power System Technologies - P2.5 Motor
 - 3.3.8 Classification of Hybrid Power System Technologies - P0+P1 Configuration
 - 3.3.9 Classification of Hybrid Power System Technologies - P0+P2 Configuration
 - 3.3.10 Classification of Hybrid Power System Technologies - P1+P3 Configuration
 - 3.3.11 Classification of Hybrid Power System Technologies (by Motor Layout Position) - Summary

- 3.4 Classification of Hybrid Power System Technologies (by Hybrid Degree/Fuel Saving Rate)
 - 3.4.1 Hybrid Power Systems Can Be Divided into 6 Types by Hybrid Degree/Fuel Saving Rate

- 3.5 Hybrid Power System - Electric Drive System
 - 3.5.1 Hybrid Power System - Key Components
 - 3.5.2 Hybrid Power System - Classification of Electric Drive Systems
 - 3.5.3 Hybrid Power System - Electric Drive System: Planetary Row Structure

- 3.5.4 Hybrid Power System - Electric Drive System: Single-axis Parallel Structure (PII)
- 3.5.5 Hybrid Power System - Electric Drive System: Power Split Structure (PIII and PIV)
- 3.5.6 Hybrid Power System - Electric Drive System: Inter-shaft Coupling Structure
- 3.5.7 Hybrid Power System - Motor Controller Structure
- 3.5.8 Hybrid Power System - Classification of Control Strategies
- 3.5.9 Hybrid Power System - DHT System
- 3.5.10 Summary of Hybrid Power Systems of Major Automakers

- 3.6 Hybrid Components - Drive Motor
 - 3.6.1 Hybrid Drive Motor: Structure
 - 3.6.2 Permanent Magnet Synchronous Motors Become Mainstream in HEVs
 - 3.6.3 New Energy Drive Motor Industry Chain
 - 3.6.4 Hybrid Drive Motor: Business and Product Progress of Core Suppliers
 - 3.6.5 Installation of Dual-drive Motors in Hybrid Electric Passenger Cars

- 3.7 Hybrid Components - Generator
 - 3.7.1 Hybrid Generator - Classification
 - 3.7.2 Hybrid Generator - Working Mode
 - 3.7.3 Hybrid Generator - Market Competitive Landscape

- 3.8 Hybrid Components - Dedicated Hybrid Engine (DHE)
 - 3.8.1 Development Trends of Thermal Efficiency of DHE
 - 3.8.2 DHE - Features
 - 3.8.3 DHE VS Fuel Engine
 - 3.8.4 DHE - Unique Technologies and Thermal Efficiency of Models on Sale
 - 3.8.5 DHE: Business and Product Progress of Core Suppliers

Table of Content (4)

- 3.9 Hybrid Components - Dedicated Hybrid Transmission (DHT)
 - 3.9.1 Hybrid Power System Transmission - Introduction/Working Mode
 - 3.9.2 Installation of DHT
 - 3.9.3 DHT Electromechanical Coupling
 - 3.9.4 OEMs' DHT Products (1)
 - 3.9.5 OEMs' DHT Products (2)
 - 3.9.6 OEMs' DHT Products (3)
 - 3.9.7 OEMs' DHT Products (4)
- 3.10 Hybrid Components - Power Battery
 - 3.10.1 Installations of Power Batteries in HEVs
 - 3.10.2 Installations of Power Batteries in HEVs - by Vehicle Type
 - 3.10.3 Installations of Power Batteries in HEVs - Electric Charge Per Vehicle
 - 3.10.4 HEV-specific Batteries Have Both Energy and Power
 - 3.10.5 HEV-specific Power Batteries: Business and Product Progress of Core Suppliers
 - 3.10.6 HEV-specific Battery Product Cases
- 3.11 Hybrid Components - Low Voltage Battery
 - 3.11.1 Automotive Low-voltage Battery
 - 3.11.2 Lead-acid Batteries Pose High Entry Barriers
 - 3.11.3 Start-Stop Battery for 12V Lead-acid Battery
 - 3.11.4 12V Lead-acid Battery
 - 3.11.5 Competitive Landscape in Lead-acid Battery
 - 3.11.6 Low-voltage Lithium Batteries Replace Lead-acid Batteries
 - 3.11.7 Low-voltage Lithium Battery for New Energy Vehicles
 - 3.11.8 Structure of 12V Lithium Battery
 - 3.11.9 Market Demand for 12V Power Supplies
 - 3.11.10 48V Lithium Battery

- 3.11.11 Low-Voltage Lithium Battery: Business and Product Progress of Core Suppliers
- 3.11.12 Low-voltage Lithium Battery: Tesla 12V Lithium Battery
- 3.11.13 Low-voltage Lithium Battery - 12V Lithium Battery for BYD HEV Models
- 3.12 Hybrid Components - Engine Exhaust Gas Recirculation (EGR) System
 - 3.12.1 Hybrid Engine EGR System Can Reduce Shock/Emissions and Save Energy
 - 3.12.2 Structure of Hybrid Engine EGR System
 - 3.12.3 Hybrid EGR: Business and Product Progress of Core Suppliers
 - 3.12.4 BYD's Low-temperature EGR System
 - 3.12.5 BorgWarner's EGR of HEV Models
- 3.13 Hybrid Components - Electronic Control System
 - 3.13.1 Classification of New Energy Vehicle Electronic Control Systems
 - 3.13.2 HEV Electronic Control System VS EV Electronic Control System
 - 3.13.3 Configuration of Electronic Control Systems in HEV
 - 3.13.4 Hybrid Dual-Electronic Control Design Architecture
 - 3.13.5 Hybrid Electronic Control System: Business and Product Progress of Core Suppliers (1)
 - 3.13.6 Hybrid Electronic Control System: Business and Product Progress of Core Suppliers (2)
 - 3.13.7 Hybrid Dual-Electronic Control Product Cases

4 HEV Technology Suppliers

- 4.1 Valeo
 - 4.1.1 Profile
 - 4.1.2 Vehicle Energy Saving and Hybrid Business Strategy
 - 4.1.3 Vehicle Energy Saving and Hybrid Business Layout

Table of Content (5)

- 4.1.4 Hybrid Operating Company
- 4.1.5 Hybrid Product Line
- 4.1.6 Vehicle Hybrid Product Composition
- 4.1.7 Introduction to Start-Stop System
- 4.1.8 Vehicle Electric Supercharger
- 4.1.9 Full Hybrid System Application
- 4.1.10 48V Mild Hybrid System
- 4.1.11 HEV Projects
- 4.1.12 Hybrid Layout in China
- 4.1.13 Hybrid Strategic Development Goals

- 4.2 Bosch
 - 4.2.1 Profile
 - 4.2.2 Overall After-Sales Solution for New Energy Vehicles
 - 4.2.3 High Voltage Hybrid
 - 4.2.6 High Voltage Hybrid: 3rd Generation Power Electronics
 - 4.2.7 High Voltage Hybrid: Independent Motor-Generator
 - 4.2.8 High Voltage/48V Hybrid: Electronic Engine Control Unit
 - 4.2.9 48V Hybrid Solution
 - 4.2.11 48V Hybrid Solution: 48V DC/DC
 - 4.2.12 48V Hybrid Solution: 48V Battery
 - 4.2.13 48V Hybrid Business Strategy
 - 4.2.14 Electric Drive System
 - 4.2.15 Thermal Management System
 - 4.2.16 Intelligent Decoupled Braking System
 - 4.2.17 Steer-by-wire System
 - 4.2.18 Hybrid Business in China

- 4.3 Continental/Vitesco Technologies

- 4.3.1 Profile
- 4.3.2 Product Line of Hybrid Business
- 4.3.4 48V High Power Hybrid System
- 4.3.8 Electric Drive System
- 4.3.10 Electric Drive System Application
- 4.3.11 Power Device Product Cooperation and Outlook
- 4.3.12 Global Layout
- 4.3.13 New Energy Layout in China

- 4.4 BorgWarner/Delphi
 - 4.4.1 BorgWarner/Delphi - Profile
 - 4.4.2 BorgWarner - HEV Layout
 - 4.4.3 BorgWarner - Hybrid Products
 - 4.4.4 BorgWarner - HEV Components
 - 4.4.5 BorgWarner - P2 Hybrid Module
 - 4.4.6 BorgWarner - P3 Hybrid Architecture
 - 4.4.7 BorgWarner - P4 Hybrid Architecture
 - 4.4.8 BorgWarner - PS Hybrid Architecture
 - 4.4.9 BorgWarner - 48V Power Electronics
 - 4.4.10 BorgWarner - Silicon Carbide (SiC) Inverter
 - 4.4.11 BorgWarner - Thermal Management System
 - 4.4.12 BorgWarner - Production Bases in China

- 4.5 Schaeffler
 - 4.5.1 Profile
 - 4.5.2 Hybrid Development
 - 4.5.3 Hybrid Components and Systems
 - 4.5.4 Hybrid Development Strategy
 - 4.5.5 2030 Hybrid Development Plan

Table of Content (6)

- 4.5.6 Automotive Technology Division
- 4.5.7 Three-in-one Power System Combination
- 4.5.8 P2 Hybrid Module System
- 4.5.9 P2 Hybrid Module System Application
- 4.5.10 Electric Drive Axle
- 4.5.11 Thermal Management System
- 4.5.12 Application of Hybrid Products
- 4.5.13 Hybrid Product Customers
- 4.5.14 Schaeffler and Vitesco Signed A Business Combination Agreement

- 4.6 GKN
- 4.6.1 Profile
- 4.6.2 Modular Electronic Drive System
- 4.6.3 800V Electric Vehicle Technology
- 4.6.4 Multimode Dedicated Hybrid Transmission
- 4.6.5 Torque-vectoring Twinster? eDrive system
- 4.6.6 Hybrid Application
- 4.6.7 Hybrid Business Strategy
- 4.6.8 Global Distribution

- 4.7 Corun
- 4.7.1 Profile
- 4.7.2 Equity Structure
- 4.7.3 Operating Business
- 4.7.4 CHS System Solution
- 4.7.7 CHS1800/2800 Series (Applicable to Passenger Cars)
- 4.7.10 CHS18000 System
- 4.7.11 Main HEV Power Batteries
- 4.7.12 Parameters of Vehicle Power Battery

- 4.7.13 Business Model
- 4.7.14 Hybrid Business Strategy
- 4.8 Lincontrol
- 4.8.1 Classification of New Energy Vehicle Components
- 4.8.2 Hybrid EMS Products
- 4.8.3 HEV Controllers
- 4.8.4 Electronic Control Platform Research Projects
- 4.8.5 Hybrid EMS Orders

- 4.9 Camel Group
- 4.9.1 Lead-acid/Lithium Battery Business Layout
- 4.9.2 Lead-acid Battery Business
- 4.9.3 Lead-acid Battery Products
- 4.9.4 12V/24V/48V Lithium Battery Project
- 4.9.5 Low-voltage Battery Layout in OEM Market
- 4.9.6 Low-voltage Battery Layout in Aftermarket
- 4.9.7 Overseas Market Layout
- 4.9.8 Vehicle Model-Battery Correspondence Table (1)
- 4.9.9 Vehicle Model-Battery Correspondence Table (2)

- 4.10 Jing-Jin Electric
- 4.10.1 Profile
- 4.10.2 Range Extender Generator
- 4.10.3 DHT Hybrid Drive System

- 4.11 Longsheng Technology
- 4.11.1 Hybrid EGR

Table of Content (7)

5 HEV OEMs

5.1 Toyota

5.1.1 Profile

5.1.2 Hybrid Route Planning

5.1.3 Development History of Toyota Hybrid System (THS)

5.1.4 5th-generation THS II Dual-engine Hybrid System

5.1.5 THS: Technical Features

5.1.8 THS: PHEV vs HEV

5.1.11 Toyota RAV4 THS II System

5.1.12 Sales of HEV Models

5.1.13 Layout in New Energy Vehicles

5.1.14 Global Layout of Automotive Business

5.1.15 Hybrid Development in China

5.1.16 Sales of HEV Models in China

5.1.17 Sales of PHEV Models in China

5.2 Honda

5.2.1 Profile

5.2.2 Hybrid System Layout

5.2.3 Hybrid Route Planning

5.2.4 i-MMD Hybrid System Structure

5.2.5 i-MMD Hybrid System Parameters

5.2.6 i-MMD Hybrid System Parameters

5.2.7 i-MMD Configuration: Working Mode

5.2.8 i-MMD Configuration: Fuel-saving Mode

5.2.9 i-MMD Configuration: Actual Fuel Consumption Measurement

5.2.10 i-MMD Configuration: 4th-generation Dual-Motor Hybrid Power System

5.2.11 4th-generation i-MMD VS 3rd-generation i-MMD

5.2.12 i-DCD Configuration

5.2.13 SH-AWD Configuration

5.2.14 HEV Power Battery

5.2.15 Global Layout

5.2.16 Sales of HEV Models in China

5.2.17 Sales of PHEV Models in China

5.3 Nissan

5.3.1 Profile

5.3.2 2050 Carbon Neutrality Goals

5.3.3 Hybrid Route Planning

5.3.4 1st generation e-Power and 2nd generation e-Power Systems

5.3.5 Structure of 2nd-generation e-POWER System

5.3.6 2nd-generation e-POWER Components

5.3.7 Energy Utilization Rate of 2nd-generation e-POWER System

5.3.8 Comparison between 2nd-generation e-POWER System and Counterparts

5.3.9 DD-i Super Hybrid System

5.3.10 e-4ORCE Electric 4WD System

5.3.11 e-POWER System Layout in China

5.3.12 Sales of HEV Models in China

5.4 Volkswagen

5.4.1 Profile

5.4.2 Hybrid Route Planning

5.4.3 DHT System Structure

5.4.4 Core Components of DHT System

5.4.5 DHT System Adapts to HEV/PHEV

5.4.6 Plug-in Hybrid Technology Structure

5.4.7 Drive Mode of Plug-in Hybrid Technology

5.4.8 Working Mode of Plug-in Hybrid Technology

Table of Content (8)

5.4.9 PHEV Models

5.5 GM

5.5.1 Profile

5.5.2 Hybrid Route Planning

5.5.3 2nd-generation Voltec Electric Drive System

5.5.4 2nd-generation Voltec Electric Drive System: Parameters of HEV Models

5.5.5 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL -Hybrid System

5.5.6 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL -Engine

5.5.7 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL - Motor

5.5.8 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL -Electronic Control

5.5.9 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL -Battery

5.5.10 HEVs with 2nd-generation Voltec System: LaCrosse/Malibu XL -Working Mode

5.5.11 PHEV with 2nd-generation Voltec System: GM Cadillac CT6

5.5.12 REEV with 2nd-generation Voltec System: GM Chevrolet Volt

5.5.15 Buick eMotion Technology: Buick Velite 6 PHEV

5.6 Volvo

5.6.1 Profile

5.6.2 Hybrid Route Planning

5.6.3 Plug-in Hybrid System - T8

5.6.4 Plug-in Hybrid System - T5

5.6.5 PHEV Models

5.6.6 48V Mild Hybrid System

5.7 BMW

5.7.1 Profile

5.7.2 Hybrid Route Planning

5.7.3 Plug-in Hybrid Technology

5.7.4 PHEV Models

5.7.5 48V Mild Hybrid System

5.7.6 BMW M High Performance Hybrid

5.7.7 eDrive System Development Plan

5.7.8 Electrification Platform - 5th-generation eDrive System

5.8 BYD

5.8.1 Profile

5.8.2 Hybrid Business Strategy

5.8.3 Hybrid Route Planning

5.8.4 Parameter Comparison between Hybrid Systems

5.8.5 DM-p VS DM-i

5.8.6 Key Features of DM-p Technology

5.8.7 DM-p Technology Positioning

5.8.8 DM-i Super Hybrid Technology - Composition

5.8.9 DM-i Super Hybrid Technology - Configuration

5.8.10 DM-i Super Hybrid Technology - Battery

5.8.11 DM-i Super Hybrid Technology - Working Mode

5.8.12 DM-i Super Hybrid Technology - Power Source

5.8.13 Advantages of DM-i Super Hybrid Technology

5.8.14 Models Equipped with DM-i Super Hybrid Technology

5.8.15 Hybrid Platform DMO/Yisifang Platform Hybrid

5.8.16 DMO Super Hybrid Off-road Platform

5.8.18 Models with DMO Super Hybrid Off-road Platform

5.8.19 Yisifang 4-Motor Drive Technology

5.9 Geely

Table of Content (9)

- 5.9.1 Profile
- 5.9.2 Hybrid System Strategy
- 5.9.3 Hybrid Route Planning
- 5.9.4 Thor Hybrid
- 5.9.5 New-generation Thor Electric Hybrid Platform
- 5.9.6 Thor Hi·X
- 5.9.7 Lynk & Co - Lynk E-Motive Intelligent Electric Hybrid Technology
- 5.9.8 1st-generation Hybrid System GHS1.0
- 5.9.9 2nd-generation Hybrid System GHS2.0
- 5.9.10 Volvo Hybrid System
- 5.9.11 48V-BSG Mild Hybrid
- 5.9.12 7DCT/H Gearbox
- 5.9.13 P2.5 Architecture Efficient Intelligent Hybrid Powertrain/Extended Range Hybrid Technology

- 5.10 SAIC
- 5.10.1 Profile
- 5.10.2 Hybrid Business Strategy
- 5.10.3 Hybrid Route Planning
- 5.10.4 Introduction to 1st-generation EDU Hybrid System
- 5.10.5 1st-generation EDU Hybrid Principle
- 5.10.6 2nd-generation EDU Hybrid
- 5.10.7 2nd-generation EDU Hybrid System: Gearbox Upgrade
- 5.10.8 2nd-generation EDU Hybrid System: Intelligent Energy Management System
- 5.10.9 2nd-generation EDU Hybrid System: 10-speed Intelligent Electric Drive Transmission
- 5.10.10 2nd-generation EDU Hybrid System: Working Mode
- 5.10.11 2nd-generation EDU Hybrid System: Model Comparison
- 5.10.12 2nd-generation EDU Hybrid System: Summary

- 5.10.13 DMH System
- 5.10.14 DMH Hybrid System: Engine
- 5.10.15 DMH Hybrid System: Controller/Battery
- 5.10.16 DMH Hybrid System Working Mode
- 5.10.17 Global R&D Centers/Manufacturing Bases

- 5.11 GAC
- 5.11.1 Profile
- 5.11.2 Hybrid Technology
- 5.11.3 Hybrid Route Planning
- 5.11.4 Julang Power Hybrid System
- 5.11.5 Julang Power Hybrid System - Platform Structure
- 5.11.6 Julang Power Hybrid System - Engine
- 5.11.7 Julang Power Hybrid System - Technical Benefits of the 4th Generation 2.0ATK Engine
- 5.11.8 Julang Power Hybrid System - Engine Thermal Efficiency
- 5.11.9 Julang Power Hybrid System - Transmission
- 5.11.10 Julang Power Hybrid System - Dedicated Hybrid Transmission
- 5.11.11 Julang Power Hybrid System - Applied Models

- 5.12 Great Wall Motor
- 5.12.1 2025 New Energy Vehicle Overall Plan
- 5.12.2 New Energy Vehicle Electronic Architecture, 2021-2024
- 5.12.3 Hybrid Route Planning
- 5.12.4 Hybrid Layout
- 5.12.5 Three Major Hybrid Systems
- 5.12.7 L.E.M.O.N DHT Hybrid System
- 5.12.8 L.E.M.O.N DHT Hybrid System: Power Form
- 5.12.9 L.E.M.O.N DHT Hybrid System: Engine Parameters

Table of Content (10)

- 5.12.10 L.E.M.O.N DHT Hybrid System: Battery Electric Drive Parameters
- 5.12.11 L.E.M.O.N DHT Hybrid System: Working Mode
- 5.12.12 L.E.M.O.N DHT Hybrid System: Control Logic
- 5.12.13 L.E.M.O.N DHT Hybrid System: Application Scenarios
- 5.12.14 L.E.M.O.N DHT Hybrid System: Installed Models
- 5.12.15 L.E.M.O.N DHT Supplier
- 5.12.16 L.E.M.O.N DHT Gearbox
- 5.12.17 P2 Hybrid System
- 5.12.18 Intelligent 4WD Electric Hybrid Technology - Hi4
- 5.12.19 Hi4: Dual-Motor Series-Parallel Electric 4WD
- 5.12.20 Hi4: Power Components
- 5.12.21 Hi4: Working Mode
- 5.12.22 Hi4: Typical Models
- 5.12.23 Off-road Super Hybrid Architecture - Hi4-T
- 5.12.24 Hi4-T: Tank Off-road Edition
- 5.12.25 Hi4-T: Typical Models
- 5.12.26 Global R&D and Production System

- 5.13 Chery
- 5.13.1 Hybrid Technology Planning
- 5.13.2 Kunpeng Fuel and Hybrid Development Strategy
- 5.13.3 Hybrid Route Planning
- 5.13.4 Kunpeng Power
- 5.13.5 Kunpeng Super Performance Hybrid C-DM Technology
- 5.13.6 Kunpeng Super Performance Hybrid C-DM Technology: Models
- 5.13.7 ET-i Full Engine Super Hybrid
- 5.13.8 Kunpeng DHT
- 5.13.9 Kunpeng DHT: Key System
- 5.13.11 Kunpeng DHT: Dedicated Hybrid Engine

- 5.13.13 Kunpeng DHT: DHT Gearbox
- 5.13.14 48V BSG Micro Hybrid System
- 5.13.17 Models with Automatic Start-Stop
- 5.13.18 PHEV Models
- 5.13.19 Hybrid System Development Plan

- 5.14 BAIC
- 5.14.1 BLUE Plan
- 5.14.2 Hybrid Route Planning
- 5.14.3 Hybrid Technology Planning
- 5.14.4 1.5T Dedicated Hybrid Engine and Integrated Starter Generator (ISG)

- 5.15 Changan
- 5.15.1 Hybrid Route Planning
- 5.15.2 Force Super Range Extended Technology
- 5.15.3 Digital Intelligent Electric Drive Hybrid System
- 5.15.4 Digital Intelligent Electric Drive Hybrid System: 1.5L Blue Core Hybrid Engine/Battery
- 5.15.5 Digital Intelligent Electric Drive Hybrid System: Working Mode
- 5.15.6 Intelligent Dual Drive (iDD) Hybrid System
- 5.15.7 iDD Hybrid System: Blue Core Engine
- 5.15.8 iDD Hybrid System: Electric Drive Transmission
- 5.15.9 iDD Hybrid System: Battery System
- 5.15.10 iDD Hybrid System: Thermal Management System
- 5.15.11 iDD Hybrid System: Working Mode

- 5.16 Li Auto
- 5.16.1 Hybrid Route Planning
- 5.16.2 Intelligent Range Extension System REV 3.0

Table of Content (11)

5.16.3 REV 2.0 System

5.16.4 REV 2.0 System: Li L9

5.16.6 Li ONE REEV

5.17 Seres

5.17.1 Hybrid Route Planning

5.17.2 New-generation Hyper-converged Golden Power Platform - DriveONE

5.17.3 Super Electric Drive Intelligent Technology Platform - DE-i 3.0

5.17.4 Huawei DriveONE All-electric Range Extender: AITO M5

5.17.5 Huawei DriveONE All-electric Range Extender: Oil Cooling 2.0

5.18 Voyah

5.18.1 Hybrid Route Planning

5.18.2 Electric Smart Secure Architecture (ESSA)

5.18.3 Electric Smart Secure Architecture (ESSA): Range Extension System

5.18.4 Electric Smart Secure Architecture (ESSA): Lanhai Power Intelligent Multimode Hybrid Technology

5.19 Neta Auto

5.19.1 Haozhi Range Extension System

5.19.2 Haozhi Range Extension System: Range Extender

5.20 Leapmotor

5.20.1 Extended Range Hybrid Route

5.21 Summary of Hybrid Technology Roadmaps of OEMs

5.21.1 Summary of Hybrid Technology Roadmaps of OEMs



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