

Electric and Range Extended Electric Light-Vehicle Report

Description: This new 158 page report analyses the market drivers, market challenges and market dynamics and forecasts for electric and range extended electric light-vehicles. Available electric vehicles are also featured.

Furthermore the report examines enabling technologies including batteries and energy storage, new anode technologies, electric motors, transmissions, range extenders and electric vehicle supply equipment.

Background to this research

Currently, there is a range of established and emerging technologies competing for a place alongside the gasoline- and diesel-fuelled ICE in the road transportation sector. Natural gas is widely established as an alternative fuel, particularly in developing countries. Ethanol is well established in Brazil, for example, and its use elsewhere, particularly in the US, is increasing. Biodiesel production and use is increasing worldwide.

Hybrid-electric drivetrains are well established in the market and other hybrid technologies, such as hybrid-hydraulic and hybrid-kinetic, are being investigated; several OEMs are conducting hydrogen fuel cell vehicle trials; and the first mass-production EVs and REEVs are now on the market.

Contents: Introduction

A Brief History Of Electric Vehicles
Electric Drive As Part Of A Range Of Powertrain Solutions

Market Drivers

- Fuel Economy And CO2 Emissions
 - The United States
 - The European Union
 - Japan
 - China
 - Other countries
- Noxious Emissions And Health Concerns
- Fuel Prices
- Energy Security
- Incentives
 - The United States
 - The European Union
 - China
 - Japan
 - South Korea
 - Canada
 - India

Market Challenges

- Recharging Infrastructure
- OEMs
- Recharging technology companies
- Grid Capacity
- Standards
- Cost
- Range
- Recharging Time

Consumer Preferences

- Global

- Europe
- The United States

Resource Supplies

- Lithium
- Rare earth elements
- Potential Technology Issues

Market Dynamics And Forecasts

- New Players, Relationships And Collaborations
- New Markets
- Market Forecasts

Enabling Technologies

- Batteries And Energy Storage
- Energy and power density
- Cycle life
- Technology cost
- Safety
- Cell components and construction
- Lithium Cobalt Oxide - LiCoO₂
- Lithium Manganese Oxide Spinel - LiMn₂O₄
- Lithium Iron Phosphate - LiFePO₄
- Lithium (NCM) - Nickel Cobalt Manganese - LiNiCo MnO₂
- Future cathode development

New Anode Technologies

- Graphene based anode technology
- CoS₂ hollow spheres
- Cobalt oxide
- Silicon based anode technology
- Tin based anode technology
- Electrolyte materials

Chemistry Development

- Other battery chemistries
- Super-capacitors and ultra-capacitors
- Energy storage membrane

Energy Harvesting

Electric Motors

- Direct-current (DC) Motors
- Asynchronous alternating-current (AC) motors
- Synchronous AC motors
- Switched reluctance motors
- Axial-Flux Motors
- In-wheel motors
- Electric corner modules

Transmissions

- Antonov
- BorgWarner
- Fallbrook Technologies
- Getrag
- IAV
- Oerlikon Graziano and Vocis
- Wrightspeed
- Xtrac
- Zeroshift

Range Extenders

- Fuel cell range extenders

Electronic Components

- Electrically-Driven Ancillaries
- Power steering
- Climate control
- Regenerative Braking
- Brakes
- Grid Connectivity And Recharging Infrastructure

Electric Vehicle Supply Equipment

- Europe
- The United States
- China
- EVSE suppliers
- Inductive charging
- Battery exchange

Telematics

- Thermal Management

Available Electric Vehicles

- Low-Speed 'Neighbourhood' Electric Vehicles
- Three-Wheel Electric Vehicles
- Electric Cars And Light Commercial Vehicles
- Range-Extended Electric Vehicles

LIST OF TABLES AND FIGURES

Figure 1: GM's EV 1 Source: Auto Evolution

Figure 2: Vehicle size and duty cycle aligned to powertrain Source: Toyota

Figure 3: Well-to-wheel CO₂ emissions by powertrain including source considerations Source: Eduardo Velasco Orosco, UAEM & GMM

Figure 4: Comparative drivetrain costing per percentage point CO₂ reduction Source: Toyota

Figure 5: Well-to-wheel powertrain costs relative to conventional Source: Eduardo Velasco Orosco, UAEM & GMM

Figure 6: Future light vehicle fuel mix forecast to 2030 Source: Various including PRTM Research and OICA(April 2011)

Figure 7: Fuel economy standards to 2015 for selected countries (US mpg) Source: Various

Figure 8: CO reductions in the EU, Japan and the US, 2000 – 2010 Source: Implats

Figure 9: NO_x reductions in the EU, Japan and the US, 2000 – 2010 Source: Implats

Figure 10: HC reductions in the EU, Japan and the US, 2000 – 2010 Source: Implats

Figure 11: Diesel PM reductions in the EU, Japan and the US, 2000 – 2010 Source: Implats

Figure 12: Lifecycle emissions and fuel use per mile for light gasoline and electric cars Source: US Department of Energy

Figure 13: WTI crude oil spot price (USD), 1985 – November 2011 Source: US Energy Information Administration

Figure 14: US all grades retail gasoline price (USD), 1995 – November 2011 Source: US Energy Information Administration

Figure 15: Comparison of average well-to-wheel CO₂ emissions of ICEs with those of EVs powered by the average EU electricity mix Source: C E Delft

Figure 16: Fuel chain efficiency rates for ICE and EV vehicles Source: SupplierBusiness

Figure 17: Rapidly converging powertrain costs Source: McKinsey

Figure 18: European and US consumer expectations of plug-in hybrid range (miles) Source: AutoTECHCAST

Figure 19: EV driving range as a function of ambient temperature Source: GM

Figure 20: 1990 US driving patterns (miles) Source: 1990 Nationwide personal transportation survey

Figure 21: Percentage of daily journeys (km) by country Source: Nissan

Figure 22: Lithium demand forecast to 2020 Source: TRU Group

Figure 23: Principal uses of selected rare earth oxides Source: Avalon Rare Metals

Figure 24: Rare earth oxide prices (USD), 2008 - November 2011 Source: Lynas Corporation

Figure 25: Global rare earth production (tons) forecast to 2014 Source: D. Kingsworth (Industrial Miner) in PRTM April 2011

- Figure 26: Growth of EV charging facilities in China Source: Research China
Figure 27: Changes and opportunities in the value chain Source: Ricardo
Figure 28: EV market forecast by region, 2011 – 2017 Source: IHS Automotive
Figure 29: REEV market forecast by region, 2011 – 2017 Source: IHS Automotive
Figure 30: Total plug-in, electric drive vehicles forecast, 2011 – 2017 Source: IHS Automotive
Figure 31: Plugged-in vehicle market forecast – business-as-expected scenario Source: IHS Automotive
Figure 32: Installed EV charging stations worldwide 2010 to 2015 Source: Pike research
Figure 33: A simple comparison of electrical energy storage systems Source: Bosch
Figure 34: Specific power (W/kg) versus specific energy (Wh/kg) Source: Axeon Power (Ford, CTI Symposium, May 2011)
Figure 35: Cycles by chemistry (deep discharge) Source: Knibb Gormezano & Partners
Figure 36: Application cycle requirements Source: Knibb Gormezano & Partners
Figure 37: Lithium-ion battery cell costs breakdown Source: Yano Research
Figure 38: Lithium-ion battery pack cost breakdown Source: Yano Research/ Axeon Technologies
Figure 39: Battery costs to OEMs at low volumes Source: Boston Consulting Group
Figure 40: Lithium-ion and nanotechnology roadmap
Figure 41: Cathode (and anode in the case of LTO) performance Source: BCG
Figure 42: Voltage versus capacity for some electrode materials Source: Department of energy and materials science. Saga University
Figure 43: Anode energy density for various anode technologies Source: Nexeon
Figure 44 : Lithium-ion prismatic battery design Source: Batscap
Figure 45: Lithium-ion battery construction Source: EnerDel
Figure 46: Zinc-Air battery systems Source: ReVolt
Figure 47: Theoretical maximum energy density for different cell chemistries Source: Axeon
Figure 49: Energy density versus power density for various energy-storage devices
Figure 48: Redox battery technology Source: Green car congress
Figure 50: Ultracapacitor within a stop-start system Source: Maxwell
Figure 51: Ultracapacitor used to overcome temperature sensitivity to temperature of li-ion battery pack Source:
Figure 52: Ultracapacitor versus lithium-ion energy efficiency
Figure 53: Ultra-capacitor components Source: SupplierBusiness
Figure 54: Typical torque and power comparisons Source: Edrive
Figure 55: Switched reluctance motors Source: Ricardo
Figure 56: Axial Flux PM motors Source: Evo Electric
Figure 57: Technology roadmap for electric traction motors Source: US DOE
Figure 58: Mitsubishi MIEV Source: Mitsubishi
Figure 59: Honda in-wheel motor Source: Honda
Figure 60: Michelin ActiveWheel Source: Michelin
Figure 61: Continental eCorner Source: Continental
Figure 62: Optimum EV transmission ratios for each performance criterion Source: IAV, Chemnitz and Gifhorn; CTI Symposium, Michigan, May 2011
Figure 63: Antonov three-speed EV transmission Source: Antonov
Figure 64: BorgWarner 31-03 eGearDrive single-speed transmission Source: BorgWarner
Figure 65: IAV DrivePacEV80 Source: IAV
Figure 66: Oelikon Graziano-Vocis two-speed EV transmission Source: Vocis
Figure 67: Wrightspeed GTD Source: Wrightspeed
Figure 68: Xtrac transmission for the Rolls-Royce 102EX Source: Xtrac
Figure 69: Chevrolet Volt Source: GM
Figure 70: Fisker Karma Source: Fisker
Figure 71: Lotus range-extender system Source: Lotus
Figure 72: Honda FCX Clarity Source: Honda
Figure 73: Continental regenerative braking unit Source: Continental
Figure 74: Continental spindle-actuated electromechanical brake Source: Continental
Figure 76: EV/ PHEV electricity demand by time of day Source: US EPA
Figure 75: EV/ PHEV electricity demand in the US to 2030 Source: US EPA
Figure 77: A utility vision of a smart grid installation Source: EPRI
Figure 78: Changes in utility customer relationships Source: Southern California Edison
Figure 79: A schematic showing smart grid connectivity elements Source: AC Propulsion
Figure 80: Electric vehicles and smart grids - cars as appliances Source: Curtin University of Technology
Figure 81: Different options for grid connection Source: Pacific Gas and Electricity Company
Figure 82: GE s WattStation electric vehicle charging station Source: GE
Figure 83: Better Place battery exchange system Source: Better Place
Table 1: Battery cost evolution

Table 2: Lithium-ion battery cost breakdown

Table 3: Four main types of cathode technology in use today (2010) Source: Deutsche Bank

Ordering: Order Online - <http://www.researchandmarkets.com/reports/2060313/>

Order by Fax - using the form below

Order by Post - print the order form below and send to

Research and Markets,
Guinness Centre,
Taylors Lane,
Dublin 8,
Ireland.

Fax Order Form

To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit

<http://www.researchandmarkets.com/contact/>

Order Information

Please verify that the product information is correct.

Product Name: Electric and Range Extended Electric Light-Vehicle Report
Web Address: <http://www.researchandmarkets.com/reports/2060313/>
Office Code: OC8DIRRQPVNRY

Product Format

Please select the product format and quantity you require:

Quantity
Electronic (PDF) - €1,690
Single User:

Contact Information

Please enter all the information below in **BLOCK CAPITALS**

Title: Mr Mrs Dr Miss Ms Prof

First Name: _____ Last Name: _____

Email Address: * _____

Job Title: _____

Organisation: _____

Address: _____

City: _____

Postal / Zip Code: _____

Country: _____

Phone Number: _____

Fax Number: _____

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)

Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

- Pay by credit card:
 - American Express
 - Diners Club
 - Master Card
 - Visa

Cardholder's Name _____

Cardholder's Signature _____

Expiry Date _____ | _____

Card Number _____

CVV Number _____

Issue Date _____ | _____

(for Diners Club only)

- Pay by check:

Please post the check, accompanied by this form, to:

Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

- Pay by wire transfer:

Please transfer funds to:

Account number	833 130 83
Sort code	98-53-30
Swift code	ULSBIE2D
IBAN number	IE78ULSB98533083313083
Bank Address	Ulster Bank, 27-35 Main Street, Blackrock, Co. Dublin, Ireland.

If you have a Marketing Code please enter it below:

Marketing Code: _____

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at <http://www.researchandmarkets.com/info/terms.asp>

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World