



October 3rd, 2011



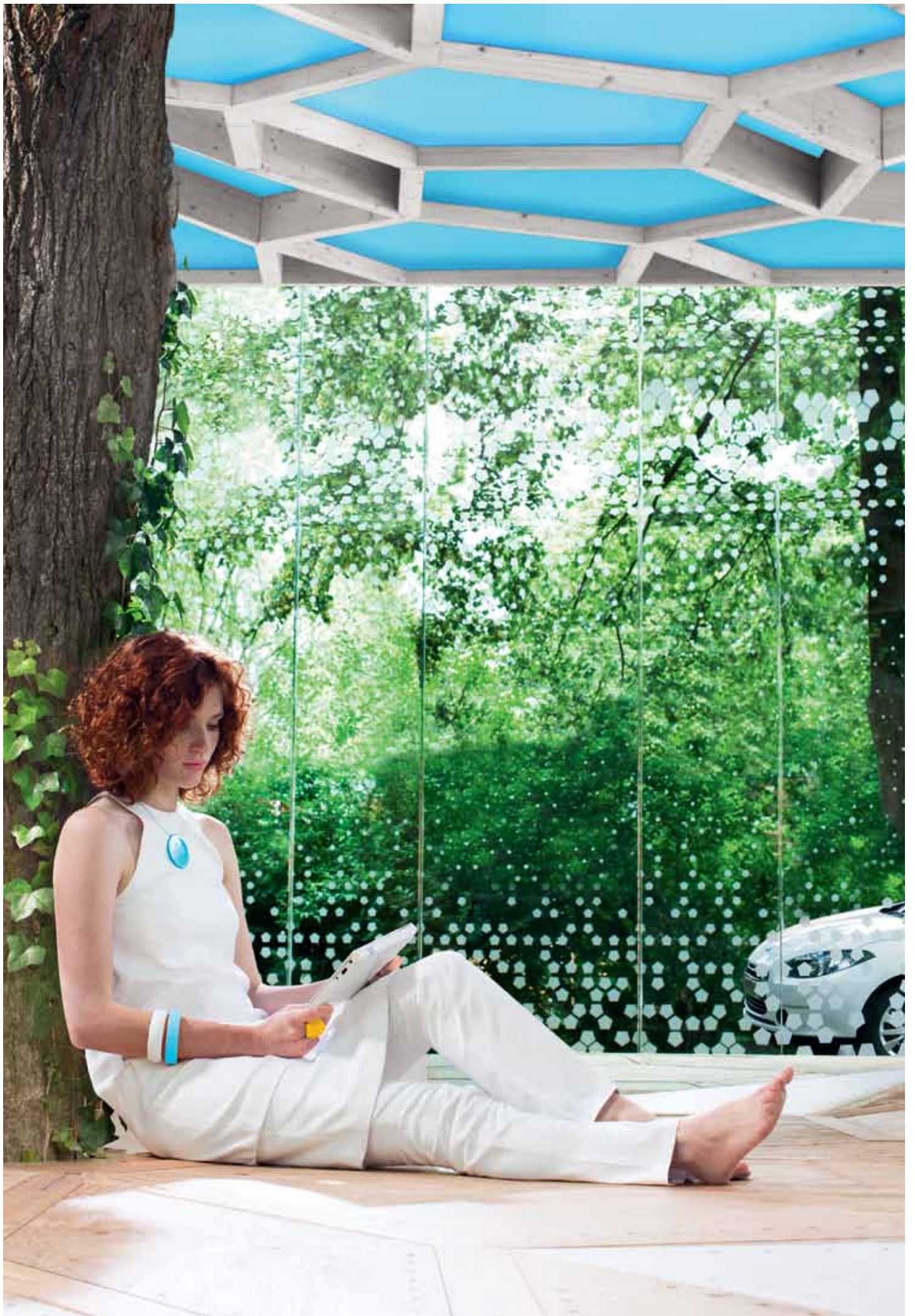
# ALTERNATIVE MOTORING A COMMITMENT BECOMES A REALITY

Renault unveiled four electric concept cars at the 2009 Frankfurt Motor Show with a promise to make them widely available to motorists starting in 2012... Since then, Renault has publicised each milestone in this ambitious and unique project, securing the backing of governments, signing partnership agreements and testing battery safety.

Renault has focused on training its network, sales staff, technicians and repairers with the aim of offering customers seamless service. Electric vehicles were first tested in The Sims virtual community before being put through real-world trials involving more than 400 EVs and a panel of users.

Today, Renault is honouring the commitment it made at the 2009 Frankfurt Motor Show with the release of its first electric vehicles. Renault is demonstrating its drive for innovation, clearly investing in a future with mankind at its core. Electric cars are no longer a dream out of reach for many, but a reality accessible to all.

RENAULT  
**ZE.**



# **ELECTRIC VEHICLES**

## **ARE A CLEAN BREAK SOLUTION OFFERING MOBILITY FOR ALL WITH ZERO CO<sub>2</sub> EMISSIONS DURING ROAD USE**

Electric vehicles are the flagships of Renault's eco<sup>2</sup> drive, a position which is centred squarely on the availability of a range of more ecologically-aware and readily affordable products and services. In its 'Renault 2016 – Drive the Change' plan, the Renault group committed to reducing its global carbon footprint by 10 percent between now and 2013, and by a further 10 percent between 2013 and 2016. It will achieve this by:

- introducing new technologies for internal combustion engines and transmissions, and
- making an unprecedented commitment to all-electric vehicles.

Renault estimates that electric vehicles will account for 10 percent of the world market by 2020. The Renault-Nissan Alliance aims to be a key player in this new form of mobility with 1.5 million Renault and Nissan electric vehicles on the roads by 2016. The Alliance is investing €4 billion in this Zero Emission programme and deploying a 2,000-strong team (1,000 at Renault and 1,000 at Nissan) to work on electric vehicles.





# ARE YOU SWITCHED ON TO THE ELECTRIC REVOLUTION?

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# 01

## WHY ELECTRIC VEHICLES?

«The automobile industry contributes to the problem of climate change. It generates 12 percent of the CO<sub>2</sub> emissions that result from human activity and accounts for 25 percent of the world's oil consumption. At Renault, therefore, we have decided to be part of the solution. The stakes relating to the introduction of widely affordable electric vehicles call for far-reaching changes to our industry so that the automobile is once more perceived as a means of progress, both for mankind and for the planet. The aim is to integrate the automobile more fully in its environment and make our towns and villages greener, quieter and more pleasant to live in.»

**Carlos Ghosn,**  
Chairman and Chief Executive Officer  
of the Renault Group



After 18 years of research, lithium-ion battery technology has come of age and provides a satisfactory response in terms of both range – which has doubled compared with the technology developed in the 1980s – and safety.

Although Renault engines stand out as examples as far as their CO<sub>2</sub> emissions are concerned, using oil as a source of energy will always result in the emission of CO<sub>2</sub>. Electric vehicles are consequently the only real clean-break solution, since they do not emit any CO<sub>2</sub> during their use on the road.

However, the environmental impact of electricity generation must also be addressed. That said, as things stand, electric vehicles are much cleaner than their internal combustion-engined counterparts in terms of their 'well-to-wheel' energy balance, even when the generation of the electricity they use is taken into account.

And if electricity is one day produced entirely by the sun, wind or water, or by nuclear power, they will become emission-free. With an all-electric car and clean energy, the lifecycle of our vehicles – from manufacturing through to recycling – will be that much more attractive.

# 02

## IN THE BEGINNING...

**“In 2011, the utopian idea of driving electric cars will at last become a reality thanks to Renault, 169 years after an electric vehicle first turned a wheel. That historic occasion was back in 1842 when a certain Andrew Davidson could be seen in the streets of Edinburgh travelling in a bizarre machine equipped with two electromagnetically-driven axles. This year, it will be possible to spot no fewer than two electric vehicles in our towns and countryside: Kangoo Z.E. and Fluence Z.E., these models will cost the same price as an equivalent diesel-engined model. Soon, Twizy (at the price of a three wheeled scooter) and ZOE (at a Clio’s price) will complete the electric range. With Renault, not only are electric vehicles about to take to the streets, but they are also readily affordable.”**

**Thierry Koskas,  
Electric Vehicle Programme Director**



One car stood out on the Tuileries Esplanade at the second Paris Motor Show in June 1899: The ‘Jamais Contente’, designed by Belgian Camille Jenatzy. This electric car was powered by two electric motors each producing 50kW. It had broken the land speed record not far from Achères, near Paris, on April 28, 1899, reaching a phenomenal 106kph. In 1904, there were some 30 electric carriages on the streets of Paris. They had to return to the depot every 60 kilometres to be fitted with a freshly charged battery. At the time, there were only 10 or so petrol-driven carriages around...

Despite these promising first steps, internal combustion engines took precedence over electric motors because they were a faster solution to get up and running and to amortise. One hundred years later, electricity is an integral part of our lives and we use electrical appliances, cameras and camcorders, mobile phones and even trains, underground systems and trams on a daily basis. Personal transport and aeronautics are the last two industries consuming oil as their direct source of energy.



# 03

## HOW AN ELECTRIC MOTOR WORKS

### MOTOR-REDUCER UNIT

Electric motors comprise a stator which creates a rotating magnetic field, which in turn causes a rotor to rotate around the motor's shaft. The motor itself is coupled to a reducer with a single output ratio that transmits torque to the wheels. This assembly is known as the motor-reducer and ensures smooth, linear acceleration. It can never stall, since there is no clutch. Reverse is obtained by simply making the motor rotate in the opposite direction. Electric motors boast outstanding energy efficiency (90 percent) which is far superior to 25 to 40 percent of internal combustion engines.

### POWER ELECTRONICS UNIT

Electrical energy is transmitted to the motor-reducer unit via a power electronics unit which incorporates a controller. This transforms the 400V direct current into three-phase alternating current to power the stator. Situated in the same housing as the controller, the transformer converts the 400V DC stored in the traction battery into 12V DC to supply the vehicle's conventional onboard electrics and auxiliary functions (interior and exterior lighting, audio system, electric windows, etc.).

### JUNCTION BOX

It is the junction box which distributes the power current to the motor, battery, climate control and heating systems. It also houses the charger which converts the electricity supply's 220V AC into 400V DC for battery charging when decelerating.

For its launch, Fluence Z.E. will be powered by electric motors made and assembled by Continental. From early 2013, Renault will manufacture its own electric motors at its Cléon plant in France.

Discover the video "electric engine works" by clicking the image or by flashing the QR code with your Smartphone.





# 04

## SAFE, HIGH-PERFORMANCE BATTERIES

Fluence Z.E. and Kangoo Z.E.'s battery comprises 48 power modules, each of which incorporates four elementary cells. It is inside these cells that the electrochemical reactions take place, enabling electrical current to be produced or energy to be stored. Individual modules are similar in size to a laptop computer and are positioned in three superimposed layers. Each module delivers 8.3V, making a combined total of 400V for the 48 modules. These compact, innovative lithium-ion batteries are supplied by AESC (Automotive Electric Supply Corporation), a Nissan-NEC joint venture.

Renault has chosen lithium-ion technology. The performance of these batteries compared with former-generation nickel metal hydride batteries is superior in every domain, from range and battery life, to reliability, safety and price. They do not suffer from the so-called memory effect resulting from incomplete charge cycles which can ultimately lead to a fall-off in capacity in the case of conventional batteries. The battery requires no maintenance and can be charged for short cycles with no adverse effect on capacity.

To put the demand for lithium supplies into perspective, a 250kg battery contains 3kg of lithium. According to mining companies Chemetall and SQM, worldwide lithium reserves are currently estimated to be between 14 and 17 million tonnes. At our current state of research, this represents more than six billion electric vehicles, taking into account the different types of battery used.

Renault is establishing a system to collect damaged or end-of-life batteries in all the countries where its electric vehicles are marketed. The recycling process itself involves stripping batteries into sub-assemblies ( housings, electronics, modules, etc.). All the components, with the exception of the modules and cells, are recycled in keeping with conventional processes or else re-employed. Battery modules are dealt with by specialist recycling companies. Renault has entered into an initial partnership with Umicore, a company with a global presence and the number one lithium-ion battery recycling specialist.

From the very beginning of the project, Renault, monitored by the public authorities, committed to making its electric vehicles as safe as its internal combustion-engined vehicles. Battery safety is ensured thanks to the following:

- The stable properties of manganese.
- The electronic system which monitors the battery's cells.



- The robust housing of the modules. The specification of this housing has been selected to optimise passive safety in a collision. The vehicle structure itself is also reinforced in order to protect the battery.

Meanwhile, Renault has been working actively with emergency services ahead of the launch of its electric vehicles. For example, an Emergency Response Guide (ERG) has been drawn up in association with fire fighting services for the latter's own training purposes.

Extensive testing has been carried out to ensure that Z.E. vehicles are risk-free. An in-house so-called 'barbecue test' saw Renault light a fire underneath a vehicle to measure how long it took for the vehicle to catch fire. The result showed that electric vehicles are even more fire-resistant than internal combustion-engined vehicles because they do not have a fuel tank. The battery catches fire after a period of 10 minutes, compared to between one and two minutes in the case of a petrol tank. And there is no explosion.

Discover the video "Thierry Koskas" by clicking the image or by flashing the QR code with your Smartphone.





# 05

## FULL-SCALE TRIALS: 400 VEHICLES IN NINE COUNTRIES

Between December 2010 and the launch of Renault's electric vehicle range, more than 400 Zero Emission cars have been and will be put into the hands of customers. To date, such trials are running in nine countries: France, Germany, Italy, Denmark, Israel, Russia, Korea, Singapore and Australia.

Initial reactions from those involved in the SAVE trials in France have been extremely positive. According to participants, Z.E. vehicles deliver the same performance as an internal combustion-engined vehicle: "I always thought electric vehicles were for fuddy-duddies, but they aren't at all," noted one lady user who works for Carrefour Property. Battery charging was found to be simple: "The charging station is tactile and easy to operate," remarked another user. Z.E. vehicles are reassuring to drive: "You see other drivers waiting at traffic lights revving their engine, clearly in a hurry. It's a bit silly really, and quite a strange antic when you think about it," observed another Carrefour Property employee.

Feedback from trials indicates that the vehicles were used intensively – proof that they meet customers' needs for transportation. By way of example, the company Colizen used its Kangoo Z.E. an average 90 kilometres per day. And passenger transport company 2ATP MR drove their Fluence Z.E. an average 107 kilometres per day.

**Z.E. Tour:** Renault's entire Z.E. range toured 11 European countries over seven months. Test-drive centres opened their doors to all those keen to experience the driving pleasure of an electric car.

Discover the video "Save" by clicking the image or by flashing the QR code with your Smartphone.





# 06

## AWARD-WINNING TECHNOLOGY

Renault Fluence Z.E. took first place on the podium in the 300-kilometre inter-city 2011 Challenge Bibendum rally. Despite entering a category not normally suited to electric vehicles, it took the trophy not only from high-performance electric roadsters, but also from hydrogen and fuel-cell vehicles.

Renault Fluence Z.E. has also notched up several other awards:

- Renault Fluence Z.E. came first in the manoeuvrability test on the ADAC circuit. In the hands of Gregory Fargier, a test driver for Renault Sport Technologies, the car achieved a record time of 2 minutes, which is five seconds faster than the most powerful electric roadster.
- Renault Fluence Z.E. won the award for best energy efficiency. It succeeded in covering the 300 kilometres of the Challenge Bibendum with a consumption of only 37.44kWh. This represents a total range of 215 kilometres (including performance tests).
- Fluence Z.E.'s entire well-to-wheel CO<sub>2</sub> output was also recognised with an award. As calculated by the Michelin team of experts, the figure of 57g/km was lower than that of hybrid and fuel-cell vehicles. It demonstrates that Renault's electric technology is the cleanest and

best-performing alternative energy solution.

- Renault also received a design award for the best integration of battery charging solutions in the vehicle.

Fluence Z.E. needed one battery swap halfway through the race to complete 300-kilometre route, taking six minutes to do the job. This was carried out under rally conditions by simply altering the battery mountings so that the battery could be changed using just hand tools. The final battery mounting system available as standard equipment will be designed for automated battery swaps only.

Discover the video "Bibendum's challenge" by clicking the image or by flashing the QR code with your Smartphone.





# 07

## NETWORK GEARED UP FOR ARRIVAL OF Z.E. RANGE

Renault has structured its sales and after-sales network for optimum customer service. Customers will be able to buy and have their Z.E. serviced anywhere in the Renault network (agents, dealerships and subsidiaries). Among these, some outlets will offer additional E.V. services under two banners:

- **Renault Z.E. Centres:** These centres will introduce customers to a whole new world of motoring enjoyment. The emphasis here will be on test drives in order to get a thorough understanding of what life with an electric vehicle is all about.
- **Renault Z.E. Expert establishments:** These outlets will be equipped with a specific Z.E. workshop capable of repairing the vehicle on-site.

By the time the first Z.E. vehicles reach the marketplace, some 750 Z.E. Centres and Z.E. Expert establishments will be operational across Europe. They will all also be equipped with battery charging facilities.

At each Renault site, customers will be able to count on the services of specialists who have undergone specific training in electric vehicles. The entire network has received both sales and technical training.

# 08

## PARTNERSHIP AGREEMENTS

To date, more than 100 partnership agreements have been signed worldwide by the Renault-Nissan Alliance in order to promote electric vehicles and introduce charging facility networks:

Geographical coverage	Partners
<b>Europe</b>	<p><b>Denmark:</b> Better Place.  <b>Europe-wide:</b> Europcar, IBIL, AXA Assistance.  <b>France:</b> La CREA, E.Leclerc, EDF, Carbox, Monaco, SAVE, Colizen, Vinci Autoroutes, Nord-Pas de Calais region, Unibail-Rodamco.  <b>France (Ile de la Réunion):</b> EDF, GBH, Total Réunion, GE Money and GERRI Agency.  <b>GB:</b> Elektromotive, Greentomatocars, Milton Keynes, One North East. <b>Georgia:</b> government.  <b>Germany:</b> RWE, Pilot Project (NRW, FKA and IFHT).  <b>Italy:</b> A2A, Enel.  <b>Ireland:</b> Irish government and Electricity Supply Board, Northern Ireland.  <b>Portugal:</b> MOBI.E Tech, government.  <b>Spain:</b> Unibail-Rodamco, Acciona Emo, Andalusia, Barcelona, Castilla y Leon, Endesa, Madrid.  <b>Switzerland:</b> EWZ.  <b>Netherlands:</b> Amsterdam, Lease Plan, government, Athlon, E-Laad, TNT.</p>
<b>America</b>	<p><b>Argentina :</b> Cordoba.  <b>Arizona :</b> Ecotality / ETEC &amp; PAG (Tuscon area), MAG.  <b>Brazil :</b> Sao Paulo.  <b>Canada :</b> British Columbia, Vancouver et BC Hydro, Toronto, Toronto Hydro.  <b>Chile:</b> government.  <b>California :</b> San Diego Gas &amp; Electric, San Francisco, Sonoma County.  <b>North Carolina :</b> Raleigh, Advanced Energy, Progress Energy, Charlotte city Partners, Duke Energy.  <b>Connecticut :</b> Northeast Utilities, L'Etat du Connecticut et CL&amp;P. Gouvernement federal : Department of Energy.  <b>Florida :</b> Orlando and Orlando Utilities Commission.  <b>Georgia :</b> Atlanta, Georgia Power.  <b>Hawaiï :</b> Hawaiï State. <b>Massachusetts :</b> Massachusetts Dept of Energy Resources. <b>Mexico :</b> Mexico city.  <b>Oregon :</b> Oregon State and PGE. <b>Quebec :</b> Communauto, Quebec Province, Quebec city, Quebec hydro, Montreal.  <b>Tennessee :</b> Oak Ridge National Laboratory, Tennessee State and TVA, Houston and Reliant Energy.  <b>Washington :</b> Seattle.</p>
<b>Japan</b>	<p>Aomiri, ChaDeMo Association, Daikyo, Horiba, Kanagawa Prefecture, Kita Kyushu City, Kyoto, Mitsubishi Motor, Miyazaki Prefecture, Niigata, Okinawa, Ryokan Association, Saitama City, Yakushima, Yokohama city.</p>
<b>Other regions</b>	<p><b>Australia :</b> ACT CAnderra, New South Wales, L'Etat de Victoria, Better Place.  <b>China :</b> Guangdong Province, Guangzhou City, Ministère de l'industrie, Dongfeng, Wuhan City, Hong Kong.  <b>India :</b> Chennai.  <b>Israël :</b> Better Place.  <b>Jordania, New Zealand :</b> EECA, Wellington.  <b>Singapore :</b> EMA, LTA, EDB.  <b>South Africa :</b> Gauteng.  <b>Taiwan :</b> Taichung.  <b>Turkey :</b> Istanbul, Gaziantep &amp; Gaski Enerji, Ankara.</p>
<b>Worldwide</b>	<p>AVIS, DHL, GE Global Research, Schindler.</p>



# 09

## EIGHT MISCONCEPTIONS ABOUT ELECTRIC MOTORING

### “NO CHARGING SOCKET WILL BE THE SAME”

The cable included with Fluence Z.E. complies with the standards in force in the country of launch.

### “FINDING A BATTERY CHARGING STATION WILL BE MISSION IMPOSSIBLE”

The Carminat TomTom® Z.E. Live smart navigation system – standard equipment on Fluence Z.E. – finds the nearest battery charging stations for you. Simply follow the instructions to locate one!

### “THE BATTERY LOSES POTENTIAL IF IT IS CHARGED INCORRECTLY”

Lithium-ion technology means that when you do not use your vehicle, the battery does not lose its potential at all.

### “EVS AREN'T FOR BIG ROAD USERS”

If you drive an average of 150 kilometres per day, that is equivalent to 45,000 kilometres per year. The technology can more than go the distance.

### “ELECTRIC VEHICLES JUST AREN'T PRACTICAL”

You need never change your route again to ‘fill up’. Charging stations are positioned exactly where you usually park your vehicle. And forget about scheduling an oil change...

### “AT NIGHT, THE LIGHTS DRAIN THE BATTERY”

The lights are extremely economical in the power they use – you’ll find they can go on just as long as you do.

### “THE BATTERIES ARE TOUGH TO RECYCLE”

The batteries can be dismantled entirely and fully recycled. Lithium-ion is not a heavy metal, so it is easy to reuse – you even find it in some medications.

### “THE POWER GRID WON'T BE ABLE TO HANDLE IT”

A significant proportion of electricity generated at night is not used. The majority of electric vehicles will be charged at night in order to take advantage of off-peak electricity rates.

Discover the video “electric range” by clicking the image or by flashing the QR code with your Smartphone.





# 10

## THE RENAULT Z.E. RANGE

Renault will be the first volume automobile manufacturer to offer a comprehensive range of all-electric vehicles in 2012. Today you will be test-driving the first two readily affordable models. The two vehicles due out next are full of surprises. Renault's Z.E. range will soon be boosted by the arrival of Twizy and ZOE – two models designed as EVs from the ground up.

### Twizy, an unprecedented urban mobility solution

Twizy is an unprecedented solution for city motoring. Its nimble handling prompts parallels with the world of scooters and motorbikes, yet the standard of safety and comfort it delivers is close to that of a four-wheeled vehicle. Twizy stands out as a symbol of the 'Renault 2016 – Drive the Change' plan and is available in a choice of two versions:

- In certain countries, Twizy 45 will not require a driving licence.
- A driving licence will be required to drive Twizy.

### ZOE, the compact saloon that ensures everyday wellbeing for all

ZOE is an all-electric compact saloon. From mid-2012, ZOE – a true mass-market vehicle – is poised to become the flagship of Renault's "innovation for all" drive and concern for the environment, as well as being an ambassador for the brand's new design strategy.



# FOR 111 YEARS, RENAULT HAS ALWAYS COMMUNICATED THE VIEW THAT FOR A VEHICLE TO BE IN TUNE WITH THE TIMES, IT HAS TO BE INNOVATIVE, MAKE A RESPONSIBLE COMMITMENT, AND INSPIRE PASSION WHILE OFFERING SUSTAINABLE MOBILITY FOR ALL.

Our relationship with drivers and their passengers is founded on one simple idea: for a car to be popular, it has to be practical, reliable and suited to the lifestyle and expectations of each individual. This is why Renault offers general models, - cars for living -, accessible for everyone. From the first standardised models in the beginning of the 20th century, to the upcoming launch of the first range of electric vehicles, our aim has always been to make the motor car and mobility available to as many people as possible.

Today, we are convinced **that another world is possible**; a world where the automobile is no longer a threat to the environment but instead combines **mobility, safety and quality - for everyone**.

We assert this vision every day, never losing sight of the fact **that passion for motoring** is, and will always be, what drives us forward. We want to bring new meaning to the automobile, so that it can take a different, more appropriate position with regard to social issues and so that it will always remain a sign of progress for Mankind.

The Renault vehicles for today and for the future are the founding stones of our **ambition to offer sustainable mobility to all**.

RENAULT. DRIVE THE CHANGE.



Full technical specifications can be downloaded from:  
[www.media.renault.com](http://www.media.renault.com) > Products and Brands > Renault > Electric Vehicles

Renault high-resolution images can be downloaded from:  
[www.media.renault.com](http://www.media.renault.com) > Photo Library > Renault Range > Electric vehicles

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