

CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
ENVIRONMENT	SAFETY	PHILANTHROPY	QUALITY	VALUE CHAIN	EMPLOYEES	ECONOMIC CONTRIBUTION	CORPORATE GOVERNANCE & INTERNAL CONTROL

# Working Toward a Sustainable Mobility Society

**Today's world is changing fast. In this era of rapid economic growth and development, countries worldwide face a diverse range of challenges that will have a long-term, direct impact on the ways in which communities function. Against this backdrop, Nissan is identifying and implementing solutions needed to create a sustainable mobility society.**

Urbanization and demographic changes, including rapidly aging populations, are just two of the megatrends that will have a significant global impact. Nissan is responding to these challenges. Our research and development are guided by our long-term goal to eliminate vehicular emissions and end avoidable injuries and deaths on roads and highways. In short, we are guided by a vision of the future where "zero emissions" and "zero fatalities" are a reality.

Larger, urbanized populations need new forms of mobility that result in a smaller carbon footprint. With the number of vehicles on the world's roads projected to reach 2.5 billion by 2050, continuing to rely on current technologies is simply not environmentally sustainable. Increasing the use of electric vehicles (EVs) is just one of the ways in which Nissan is responding to this challenge.

The megatrends also affect the way in which Nissan approaches safety. Although the safety of cars has improved significantly every decade, there are still 6 million accidents annually in the United States alone. Through Autonomous Drive technologies, Nissan seeks to improve the driver's ability to avoid an accident while offering improved mobility for a greater number of people in all age ranges.

In an ever-changing world, Nissan aims to minimize the environmental impact of vehicle transportation and to expand access to safe, sustainable mobility for all.





CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
ENVIRONMENT	SAFETY	PHILANTHROPY	QUALITY	VALUE CHAIN	EMPLOYEES	ECONOMIC CONTRIBUTION	CORPORATE GOVERNANCE & INTERNAL CONTROL

# Leading the Way Toward a Zero-Emission Society



Power-generating wind turbines at Nissan Motor Manufacturing (U.K.).



The Nissan e-NV200.

A growing global population and continuing economic development bring new challenges for society. The increasing pace of industrial activity and resulting increases in CO<sub>2</sub> emissions are among the factors that are contributing to rising average temperatures worldwide. During this century, the rise of megacities is expected to accelerate the impact of global environmental issues, including climate change and atmospheric pollution.

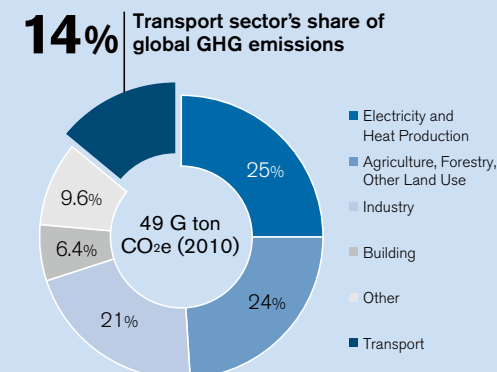
At the same time, there are constraints on the availability of fossil fuels, natural materials and other resources that many nations have traditionally relied upon for economic stability and mobility. Renewable sources are expected to make up an increasing share of the energy mix, a shift that will affect every industry.

The transportation sector currently accounts for approximately 14% of global greenhouse gas emissions. Nissan understands that, as a global automotive manufacturer, our company has to be a part of the solution. Nissan has calculated that "well-to-wheel" CO<sub>2</sub> emissions for new vehicles will need to be reduced by 90% by 2050 compared with levels in 2000 and has also committed to taking a leadership role in promoting the use of zero-emission vehicles.

Nissan aims to continue helping to address global environmental challenges through its advanced vehicle technologies, including our pioneering EVs, the Nissan LEAF and the e-NV200. Nissan's environmental leadership goes beyond cutting-edge vehicles to include how electricity is generated. In our view, greater reliance on renewable energy sources is necessary, and there are many promising solutions in use today or ready to be deployed soon. Recognizing that electricity can be put to use in homes and businesses, as well as on the roads, Nissan is working with various stakeholders on initiatives such as the "LEAF to Home" power supply system, which is creating a new solution for stakeholders worldwide.

The road to a zero-emission society will be challenging. Nissan is undeterred. We are a leading company in this area with a vision and a commitment to achieving this goal.

## Greenhouse Gas Emissions by Industrial Sector



Source: IPCC, 2014 Summary for Policymakers.  
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CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
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# Leading the Way Toward a Zero-Emission Society: Nissan's Approach



The Nissan New Mobility Concept.

In 2010, the Nissan LEAF was launched as a mass-produced EV. The LEAF is not only a zero-emission car but also an EV with unprecedented quietness, acceleration and handling. Since its launch, this electric car has become the best-selling EV in the world, reaching cumulative sales of 172,000 as of March 2015. Collectively, the LEAF has already traveled more than 2.87 billion kilometers, which is equivalent to saving 422,000 tons of CO<sub>2</sub> emissions<sup>\*1</sup> compared to those of a gas-powered car of the same class.<sup>\*2</sup>

<sup>\*1</sup> Estimate based on: Total distance driven (Global Data Center data) ÷ Number of Carwings registered vehicles x Number of total accumulated sales.

<sup>\*2</sup> Comparison to Nissan Micra: 120 g/km.

Building on the momentum of the LEAF's top market share, Nissan has developed additional models to expand its EV lineup. The e-NV200 also offers entirely new mobility lifestyle options. In 2014, the e-NV200 joined Barcelona's taxi fleet.

Another innovative zero-emission vehicle is the Nissan New Mobility Concept, an ultracompact, highly maneuverable EV that seats two passengers. This new mobility style is advancing Nissan's efforts not only to offer excitement but also to address the growing needs of elderly drivers and single-person households for short-distance mobility.

Nissan uses cutting-edge ICT (information and communication technology) systems to make its



e-NV200 taxis in Barcelona, Spain.



Nissan has installed the 1,000th CHAdeMO quick charger in Europe.

EVs easier to operate, more efficient and better able to communicate with outside surroundings. Furthermore, the ICT systems can collect, with the vehicle owner's consent, static data such as driving history, charging history and battery status from EVs, which may help to improve the design and development of more energy-efficient societies. Nissan is currently conducting joint projects with multiple stakeholders to study possibilities in this area.

Establishing sufficient infrastructure is also essential in order to realize and maximize the benefits of zero-emission mobility. Nissan is working with partners to promote and roll out CHAdeMO-standard networks of chargers, including quick-charge stations to keep EVs moving toward their destinations without delay. It is expected there will be 6 million EVs on roads by 2020, and more than 200,000 fast chargers installed globally.<sup>\*3</sup>

<sup>\*3</sup> Source: CHAdeMO Association.

Beyond vehicles, Nissan is also developing "LEAF to Home" and "Vehicle to Building" solutions. These systems combine an EV and a power control system to charge the car when electricity is inexpensive and to provide electricity to a structure when it is needed. Systems like these will help households and entire communities to use energy more efficiently.

Nissan is creating a future where EVs offer new value, both on the road and off. Zero-emission mobility is foundational to building a sustainable society.



CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
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# Building a Safer Mobility Society



Nissan's Autonomous Drive vehicle.



EPORO robots developed to study collision avoidance.

Mobility will become even more important as populations age and developing economies see greater numbers of people looking to experience the benefits that vehicle ownership brings. Yet we have to address issues that arise with an increase in the number of vehicles on the road. About 1.24 million deaths\* are caused by road accidents every year, with statistics showing that human error is a contributing factor in more than 90% of all accidents. Nissan estimates the global economic losses due to traffic accidents and congestion at ¥104 trillion.

Source: WHO Global Status Report on Road Safety 2013.

Urbanization means that there will be more congestion and greater accident risk due to more cars on the roads.

To address this, Nissan researchers and engineers are guided by a goal of zero fatalities from avoidable traffic accidents. This is leading to the development of world-class Autonomous Drive technologies.

Nissan seeks to take the drudgery out of driving and to support the driver in avoiding potential accidents. Nissan develops technologies that enable vehicles to communicate with one another and with the driving environment, aiming to reduce accidents in urban areas where they are most frequent. Autonomous Drive technology will also improve mobility for the elderly, allowing them to enjoy personal vehicle mobility much later in life.

Nissan today is conducting intensive Autonomous Drive testing in the United States and Japan.

## Global Road Traffic Deaths (2010)

# 1.24 million

**The number has not increased, but remains unacceptably high.**

Source: WHO Global Status Report on Road Safety 2013.

CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
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# Building a Safer Mobility Society: Nissan's Approach



A workshop at the Nissan Research Center in Silicon Valley.

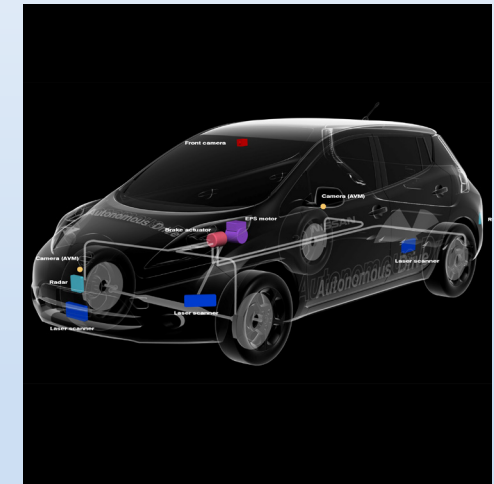
Nissan's extensive autonomous research has already paid off. The Adaptive Cruise Control system, an early building block, debuted at the end of the 1990s, helping to assist drivers in maintaining a safe distance from the vehicle traveling in front of theirs. This work has continued. Nissan was the first automaker in Japan awarded a special license plate to allow street and highway Autonomous Drive testing, enabling researchers to gather valuable real-world data.

Going forward, by leveraging the benefits of the Renault-Nissan Alliance, Nissan is aiming for a 2016 release of its "traffic jam pilot" technology, which will enable cars to drive autonomously and more safely on congested highways. In 2018, Nissan will introduce new technology that allows a car to autonomously negotiate hazards and change lanes. By 2020, the company will be ready to introduce technology that allows a car to navigate on its own in nearly all situations, including complex city driving. Nissan's goal is to be ready to commercialize all of these technologies and to bring vehicles with comprehensive Autonomous Drive capabilities to the market by the start of the next decade.

Nissan is committed to providing its advanced safety technology to as many customers as possible.



Image of Safety Shield technologies.



Nissan's Autonomous Drive system.

By rolling out solutions across all vehicle categories, Nissan is making broad contributions to improve the quality of life for customers seeking enhanced mobility options.

To accelerate research in this area, Nissan maintains engineering bases in Japan, Russia, India and the United States. The latest addition is the Nissan Research Center in California's Silicon Valley, which opened in early 2013 to enhance Nissan's research capabilities through collaborative partnerships with companies and research institutions in this global technology hub. The company has also introduced a Senior Innovation Researcher program as a new incentive for employees in the R&D division, as well as for researchers from outside the company. This program promotes basic research on cutting-edge automotive technologies for batteries and other core elements essential for future mobility. Nissan also collaborates with several premier technical universities, including Stanford, MIT, Oxford and the University of Tokyo.

By forming a global research network, Nissan is able to more effectively draw on cutting-edge thinking and apply it in creating tomorrow's mobility solutions.

CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
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# Expanding Possibilities Through Collaboration



In the drive to achieve the twin goals of zero emissions and zero fatalities, Nissan leads the automotive industry in forging cooperative ties with a broad range of partners, including both national and local governments, electric utilities, corporations and other stakeholders. Nissan is fully committed to providing continued support for promising measures and investing its knowledge and other resources to make mobility safer and more environmentally responsible.

The ceaseless advancement of information technology and the expansion of the Internet have created an increasingly connected world. As demand rises for ubiquitous connectivity, Nissan is ensuring that its vehicles are compatible with this networked society and collaborating with a broad spectrum of partners to enhance connections among people, vehicles and society.

The battery technology in EVs and the renewable energy that can be used to power them promises deeper applications in society than in mobility alone. By tackling a comprehensive range of issues, including the use of renewables and the reuse of lithium-ion battery cells, Nissan seeks to provide value by encouraging greater standardization of electrical systems.

Creating a zero-emission society will also require the construction and further development of infrastructure around the world to allow for recharging of EVs. With its partners supporting the CHAdeMO charging standard, Nissan is cooperating with governments and private-sector stakeholders to ensure the installation of charging station networks that give EV owners the geographic coverage they need to make their cars convenient as well as eco-friendly.

The pursuit of a zero-fatality mobility society, meanwhile, will also require advanced intelligent transport systems (ITS) and other infrastructure linking vehicles with the society around them. Here, Nissan is leading the way through partnerships with local governments and corporations aimed at creating systems that can communicate with vehicles on the road, thereby sharing vital safety and congestion information in real time.

## Nissan collaborates with a range of partners to advance its sustainable mobility goals.



CONTENTS	INTRODUCTION	CEO MESSAGE	WORKING TOWARD A SUSTAINABLE MOBILITY SOCIETY	BLUE CITIZENSHIP: NISSAN'S CSR	RENAULT-NISSAN ALLIANCE	CSR DATA	THIRD-PARTY ASSURANCE
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# Collaborating with Stakeholders Beyond Our Industry to Create a Sustainable Future



## Creating Advanced Energy Systems in Maui

Nissan is proud to be part of the JUMP Smart Maui project, which was launched in Maui, Hawaii, in 2011. This project incorporates technologies related to renewable energy, smart grids and electric vehicles (EVs) to develop more efficient, cleaner electric systems and transportation options.

Japanese companies, including Hitachi, are leading the project with funding from Japan's New Energy and Industrial Technology Development Organization. The Nissan LEAF was chosen as the initial EV to be used in the experiment.

In the first phase of the project, over 200 Nissan LEAFs were utilized to store excess electricity generated by renewable energy sources such as wind. During the second phase of the project, which started in March 2015, the vehicles were utilized in a LEAF to Home-style arrangement and fed electricity back into the grid when needed.

Through the project, the Nissan LEAF has become an integral part of the Maui community. Over 250 community members, including Maui county government officials, private business leaders and individual citizens, became either owners or lessees of the LEAF vehicles in the first phase, and the number is planned to expand to 500 during the second phase.

The Nissan LEAF has not only contributed to the success of the experiment but also enabled volunteer participants to drive without emitting any CO<sub>2</sub>. This has allowed participants to significantly reduce their fuel expenses by avoiding the costs related to using gas-powered vehicles. Furthermore, the Nissan LEAF is demonstrating its uniqueness as a supply source for mobile energy. Nissan believes this is promoting a greater understanding of the positive impact that a single individual can have in advancing community-wide sustainability goals, just by utilizing the Nissan LEAF for day-to-day transportation needs.



## NASA-Nissan Research Partnership

In the United States, the NASA Ames Research Center and the Nissan Research Center Silicon Valley are working together to advance Autonomous Drive technologies. Nissan is providing component technology while NASA is sharing its experience in operating planetary rovers, accelerating Nissan's development of Autonomous Drive solutions to be rolled out to consumers progressively through 2020.



## World-Leading Car-Sharing Scheme

In October 2014, Terschelling, one of the Dutch Frisian Islands, became home to the world's largest island-based car-sharing scheme. A pool of 65 Nissan LEAF EVs is now in place, with plans to expand to 100 vehicles. These EVs are expected to handle 10% or more of the islanders' driving needs, producing zero emissions in the process.

### Vehicle-to-Grid (V2G) project at Los Angeles Air Force Base

» website

Click here for more information on the V2G project.

### Establishment of the Nissan Zero Emission Fund

» website

Click here for more information on the Zero Emission Fund.

### Practical testing of Autonomous Drive tech

» website

Click here for more information on Autonomous Drive.