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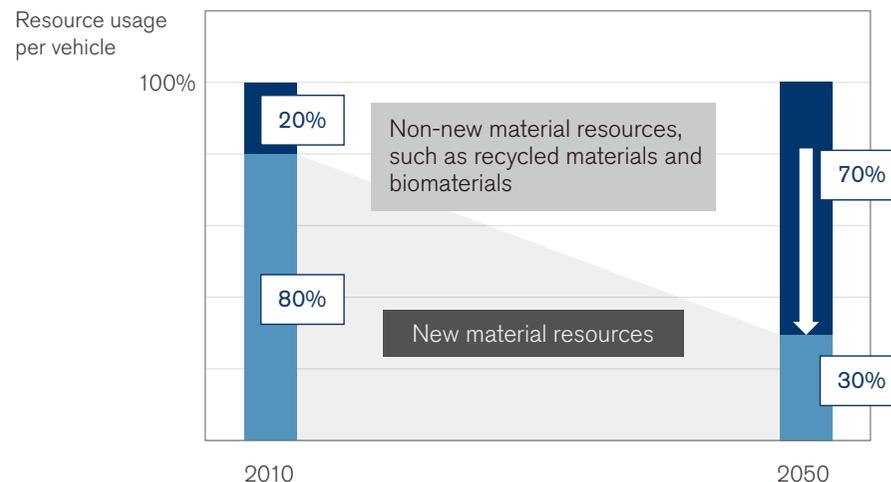
# Resource Dependency

## Resource Dependency Policies and Philosophy

With the world’s population forecast to exceed nine billion by 2050, demand for natural resources such as minerals and fossil fuels is set to rise. This makes it even more important to maximize the value obtained from these resources. The Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 also emphasize the importance of managing resources sustainably and using them efficiently.

Automobiles are made of many components, incorporating a diverse range of resources. The combination of these resources creates new value. Nissan has increased its resource diversification, using more renewable resources and recycled materials. While caring for ecosystems, Nissan became more competitive as we targeted green growth. In working toward the long-term vision of using materials that do not rely on newly mined resources for 70% of the materials used in each vehicle in 2050, we will strive to minimize the use of natural resources and maintain new resource usage at 2010 levels.

## Long-Term Vision for Reducing Resource Dependency



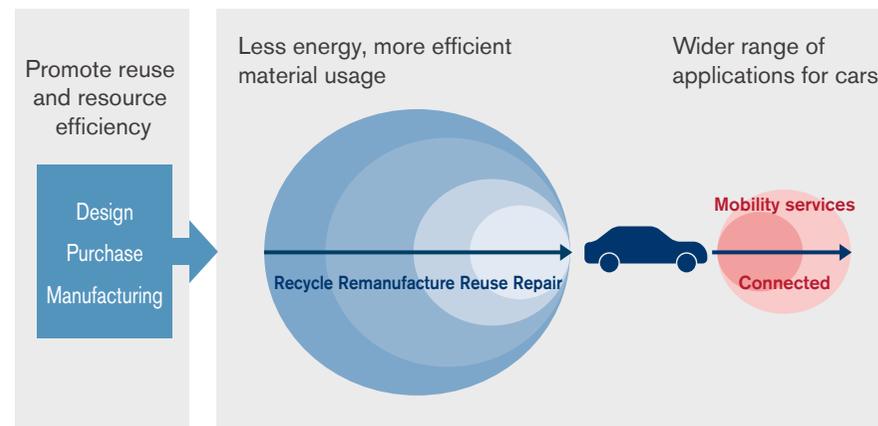
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## Resource Dependency Management

In order to use the earth’s precious and limited resources efficiently, the environmental impact when extracting these resources must be kept to a minimum. At the same time, waste generated during vehicle production and scrap from end-of-life parts must be recycled as extensively as possible without compromising quality, producing materials that can be used in the same types of products. Based on this approach, known as closed-loop recycling, we have focused our efforts on recycling steel, aluminum, and resin —three kinds of material which account for a large proportion of vehicle content yet also have a major impact on the environment.

As part of the Nissan Green Program 2022 (NGP2022), Nissan is developing systems for using resources efficiently and sustainably across their entire life cycle, and has adopted the concept of the “Circular Economy” to maximize the value it provides to customers and society. In an attempt to use resources efficiently with less energy, we will promote the use of recycled materials and recycling end-of-life vehicles, and strive to incorporate reusable resources in our activities at the design, purchasing, and manufacturing stages. We are using fewer resources overall, both through appropriate use of chemical substances and making vehicles more lightweight. We will continue to promote the efficient use of resources with further reduced energy requirements and the expanded use of repaired and remanufactured parts as well as the secondary use of EV batteries in the vehicle use stage, and foster the development of biomaterials and dieless forming technology for practical use. We will also increase the value cars manufactured in this way provide to society and ensure that cars can be put to best use by promoting electrification and autonomous drive in our products, pursuing connectivity and providing mobility services such as ride sharing.

## Nissan’s Circular Economy Concept



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## Resource Dependency: Achievements

### Reducing Dependence on Newly Extracted Resources to 70% by 2022

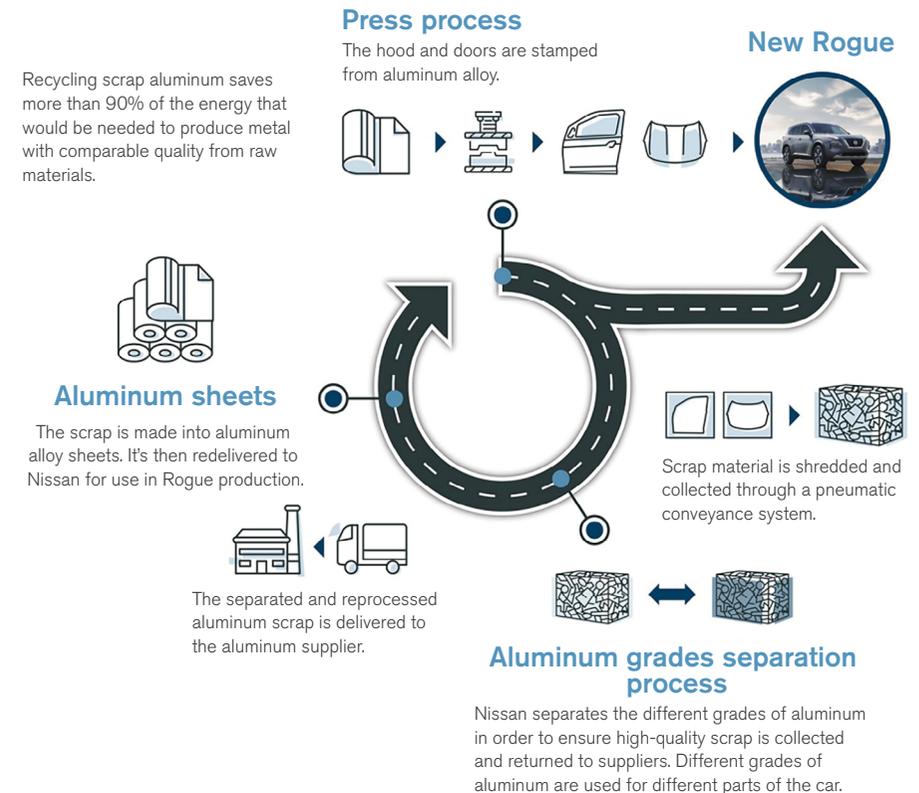
Demand for mineral and fossil resources is rising rapidly with the growth of emerging economies. According to forecasts, if growth in extraction volumes continues, all currently known mineral resources will have been extracted by 2050. There are some existing mining sites and others under exploration that are located in areas with vulnerable local ecosystems, generating concern about the environmental effects of topsoil excavation, deforestation, and wastewater.

To address these issues, Nissan has implemented a policy of minimizing the use of newly extracted natural resources and maximizing the use of recyclable materials from the early development stage while also making structural improvements to facilitate recycling. We are also reducing the use of resources in the manufacturing process and making more efficient use of resources.

In NGP2022, our goal is to cut the use of newly extracted resources to 70% per vehicle in fiscal 2022. We intend to increase the use of recycled materials in our vehicles on a global scale, including Japan, Europe, and North America, in cooperation with our suppliers.

## Initiatives to Expand Use of Recycled Materials (Ferrous and Nonferrous Metals)

In fiscal 2021, ferrous metals accounted for 60% of the materials used in our automobiles by weight. Nonferrous metals made up another 14% and resins 15%, with miscellaneous materials making up the final 12%. To further reduce our use of natural resources, we are advancing initiatives to expand the use of recycled materials in each of these categories.



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We are taking steps to reduce the steel and aluminum scrap left over in the manufacturing process, and working globally with business partners to collect and reuse this scrap as material for new vehicles through closed-loop recycling initiatives.

Currently, at Nissan Motor Kyushu and plants in North America and Europe, where new X-Trail, Rogue and Qashqai are manufactured, we are collaborating with aluminum manufacturers to adopt a closed-loop recycling process that recycles aluminum scraps generated during manufacturing into aluminum alloy sheets for automobiles. The sorting and collecting of scrap in this process control impurities, realizing horizontal recycling without quality deterioration, which contributes to reductions in the amount of new mined resources (aluminum ingots) used.

## Initiatives to Expand Use of Recycled Materials (Resins)

In addition to our initiatives to expand the use of recycled steel and aluminum, Nissan also strives to use more recycled resins.

As a closed-loop recycling initiative, we are collecting finished bumper scrap generated at our plants and sending it to our Oppama Plant, where we process it by removing the paint film and recycling it. These recycled resins have been given new life as bumpers in the Nissan LEAF and many other new vehicles. This initiative was expanded to Dongfeng Motor Co. (DFL), our joint venture in China, where they have been used to produce replacement bumpers since 2014.

Additionally, exchanged bumpers collected from dealerships are being recycled as materials used in under covers and for other components. We collected and recycled approximately 93,000 bumpers in fiscal 2021, representing 63.0% of bumpers removed at Japanese dealerships.

Furthermore, 30% of the automotive shredder residue (ASR) processed at dedicated processing plants is made from resins. In order to use these resins in automobiles, we are running a number of R&D projects on topics such as like optimizing the recycling process for resins recovered from

ASR, and conversion of auto waste plastic into oil. \*



Research on optimization of ASR recovered resin recycling process. Left photo is ASR and right photo is resin recovered from ASR.

\* These R&D projects are undertaken as part of our recycling optimization support business using surplus money from recycling fees deposited for three specified components (refrigerant, airbags, ASR) based on Japan's End-of-Life Vehicle Recycling Law. Click here for more information on the implementation of Nissan's project to advance recycling (in Japanese only). [https://www.nissan-global.com/JP/SUSTAINABILITY/ENVIRONMENT/A\\_RECYCLE/R\\_FEE/SAISHIGEN](https://www.nissan-global.com/JP/SUSTAINABILITY/ENVIRONMENT/A_RECYCLE/R_FEE/SAISHIGEN)

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## End-of-Life Vehicle Recycling

Nissan considers the three Rs —reduce, reuse, and recycle —from the design stage for new vehicles. Since fiscal 2005, all new models launched in the Japanese and European markets have achieved a 95% or greater recyclability rate.\*1

We have also joined forces with other automotive companies to promote the recycling of end-of-life vehicles (ELVs) through dismantling and shredding. Based on Japan’s End-of-Life Vehicle Recycling Law, Nissan has achieved at least 95% effective recycling rate of ELVs in Japan since fiscal 2005. In fiscal 2021, we achieved a final recovery ratio for ELVs of 99.4%\*2 in Japan, greatly exceeding the target effective recycling rate of 95% set by the Japanese government.

ELV processing consists of four phases. First, Nissan ELVs entering the dismantling process are recycled, including flat steel, cast aluminum, bumpers, interior plastic parts, wire harnesses, and precious rare earth metals. Second, specific items such as lithium-ion batteries are collected individually and directed to a dedicated recycling process. Third, residues from the dismantling process are crushed and the metallic portions recovered. Fourth, the resulting ASR is turned into recycled materials. Since 2004, Nissan and 12 other Japanese auto manufacturers have supported ASR recycling facilities, as called for in Japan’s End-of-Life Vehicle Recycling Law, as an integral part of a system to recycle ASR effectively, smoothly, and efficiently. Nissan is taking an important role in this joint undertaking.

We have also established a take-back system for ELVs in Europe. This network of Authorized Treatment Facilities was developed for individual countries in collaboration with contracted dismantlers, contracted service providers, and governments in alignment with a European ELV directive. Additionally, Japan Automobile Manufacturers Association, Inc. (JAMA) established a common scheme for recovering used lithium-ion batteries along with a system for processing these batteries appropriately, and put both into operation in fiscal 2018.

\*1 Calculated based on 1998 JAMA definition and calculation guidelines (in Japan) and ISO 22628 (in Europe).

\*2 Based on Nissan research

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## Developing Biomaterials

Nissan is promoting technical research to replace plastics and other resin materials used in automobiles with biomaterials derived from plants. NGP2022 contains concrete goals for biomaterials development, and these materials are already being used in cars. For example, the coverings on the seats in the Nissan LEAF are made using biomaterials.



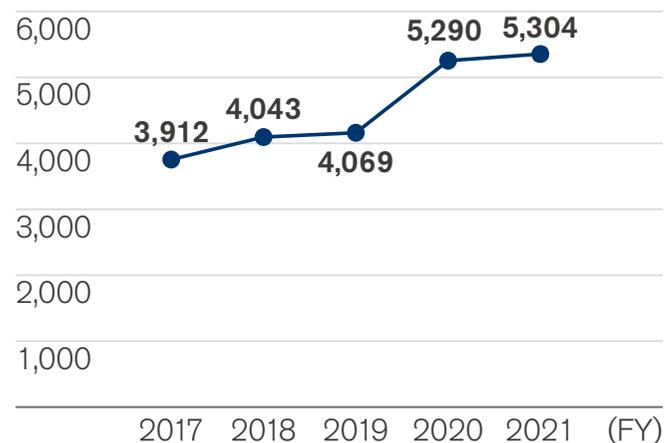
Seat coverings made from biomaterials in Nissan LEAF

## Proper Use of Regulated Chemical Substances

Nissan revised its standard for the assessment of hazards and risks in the Renault-Nissan Alliance, actively applying restrictions to substances more stringent than existing regulations in areas of growing concern around the world. As a result, the number of substances covered by the Nissan Engineering Standard in fiscal 2021 rose to 5,304. These steps are thought to be necessary for future efforts in the repair, reuse, remanufacture, and recycle loop for resources.

\* Click here for more information related to our governance system for chemical substances. [>>> P085](#)

Defined Chemical Substances (Substances)



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## Expansion of Remanufactured Parts

Parts with the potential for recycling include those reclaimed from ELVs, as well as those replaced during repairs. In Japan, we collect and thoroughly check the quality of these secondhand parts. Those that receive a passing grade are sold through our retail outlets as Nissan Green Parts. We sell these parts in two categories: remanufactured parts, which are disassembled and have components replaced as needed, and reusable parts, which are cleaned and tested for quality before sale. In NGP2022, we are enhancing the deployment of Nissan Green Parts in Japan, and are also strengthening management to deploy similar kinds of activities in Europe and North America, aiming for twice the parts coverage in 2022 compared to 2016. This initiative provides customers who seek to use cars for a long period of time with the new option of using remanufactured parts.

### Type of Nissan Green Parts in Japan



Alternator



Air conditioning compressor



Starter motor

## Joint Venture to Promote Second-Life Use for Batteries

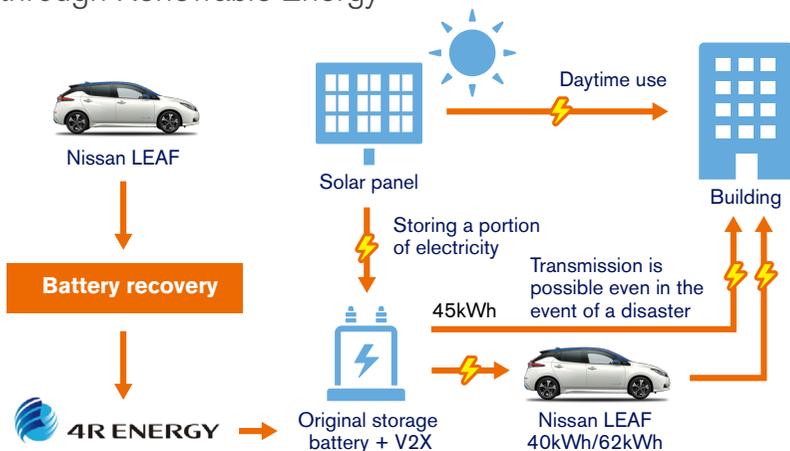
Lithium-ion batteries used in Nissan’s EVs retain capacity well beyond the useful life of the vehicles themselves. The “4R” business models —which reuses, refabricates, resells, and recycles lithium-ion batteries —allows for their effective use as energy storage solutions in a range of applications, thus creating a much more efficient energy cycle of battery use.

As the EV market expands, we anticipate a need to utilize reusable lithium-ion batteries more effectively. In 2010, we launched 4R Energy Corporation, a joint venture with Sumitomo Corporation that is engaged in establishing EV battery reuse and refabrication technologies. With the establishment of these technologies and an increase in the number of used batteries collected, in March 2018, operations commenced at Japan’s first base and plant for the reuse and refabrication of used lithium-ion batteries located in the town of Namie, Fukushima Prefecture.

4R Energy is actively engaged in the development and production of various battery storage systems built with used Nissan LEAF batteries at the Namie facility. One example of these efforts is the development of stationary power storage systems that reuse 40 kWh batteries used in the Nissan LEAF for the purpose of enhancing resiliency. Since September 2019, this reuse stationary power storage system has been used in trials for procuring electricity using renewable energy at ten 7-Eleven convenience stores in Kanagawa Prefecture. Additionally, in conjunction with IKS Japan Co., Ltd., we are developing new models with Vehicle to Everything (V2X) functions that can also utilize electric power from EVs, sales of which launched in fiscal 2020 and are proceeding apace.

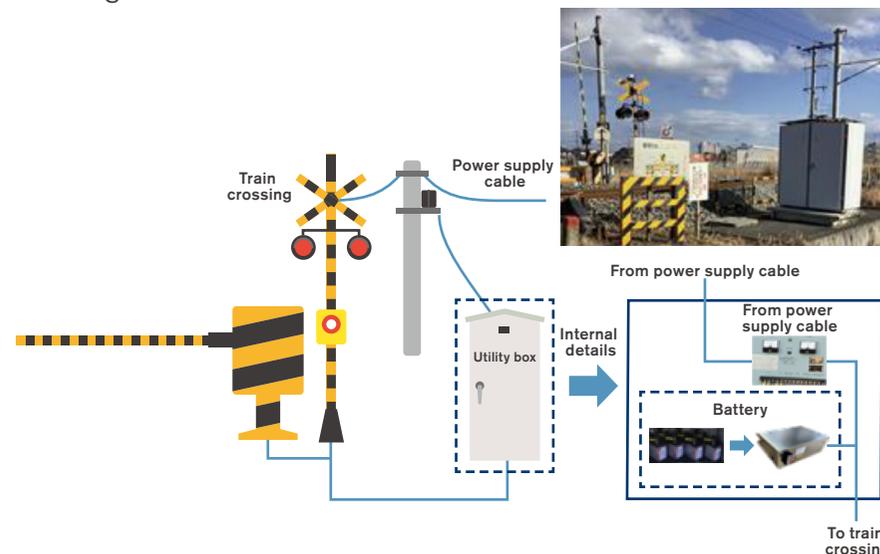
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### Overview of Proof of Concept for Procuring Electricity through Renewable Energy



In addition, recycled lithium-ion storage batteries “EneHand Green (the trading name of 4R Energy)” were developed for East Japan Railway Company (JR East) as a power source for railroad crossing security equipment by reusing modules from the used 24kWh batteries recovered from the Nissan LEAF. The system features longer service life and lower operating costs compared to conventional lead-acid battery power supplies. Field trials began in January 2021 on the Joban Line, followed by trial installations (5 units) at train crossings on the Joban and Mito Lines, and advanced installations (10 units) of the production version. Plans are underway to install approximately 1,600 units of the production version in 24 railway line sections in JR East’s service area from fiscal 2022 onward.

### Reused Nissan LEAF batteries be utilized at JR East train crossings



At the same time, 4R Energy acquired the world’s first UL1974\*1 certification in June 2019, which is an international evaluation standard for evaluating repurposing batteries, and has been certified by a third-party organization for reusage and refabricating processes and product manufacturing with an emphasis on safety. Furthermore, in recognition of these activities, in October 2019 4R Energy was presented with the Frost & Sullivan\*2 “2019 Strategy Innovation and Leadership Award,” and in March 2020, in conjunction with Nissan, 4R Energy and Nissan won the “Sixth Annual Japan Resilience Award 2020,” sponsored by the Association for Resilience Japan.\*3

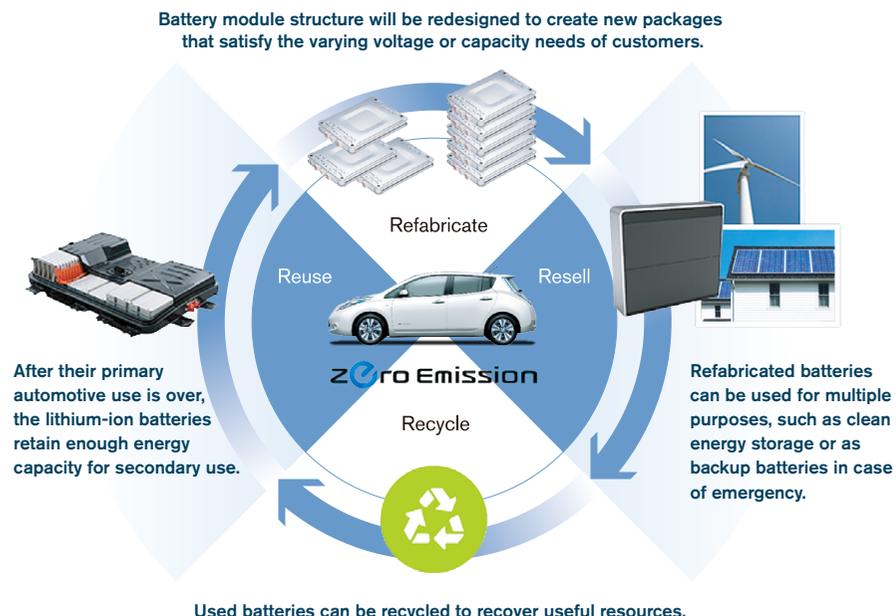
Furthermore, in December 2021, 4R Energy and Nissan received the 2021 Minister of the Environment’s Award for Climate Action in the development and commercialization category in recognition of their initiatives to reduce CO<sub>2</sub> emissions.

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We are extensively involved with 4R business model activities globally as well.

- \*1 The UL1974 Standard for Evaluation for Repurposing Batteries defines the process for determining and classifying the suitability of usage when battery packs, modules, or cells used to drive EVs have finished their intended period of use. Evaluating reused batteries in accordance with this process enables the provision of reused batteries that are safe and give a clear understanding of remaining capacity to meet a variety of demands.
- \*2 Frost & Sullivan provides research and consulting services in 80 countries and over 300 major markets through a global network of more than 40 locations.
- \*3 In light of the results of the National Resilience Minister's Private Advisory Committee National Resilience Roundtable, to ensure the Fundamental Plan for National Resilience is executed smoothly, the Council aims to build a resilient nation with cooperation among industry, academia, government, and the private sector.

### 4R Concept



### Reducing Use of Scarce Resources

Rare earth elements are scarce resources that are necessary for electrification. Reducing their usage is important because rare earth elements are unevenly distributed around the globe, and the shifting balance of supply and demand leads to price fluctuations. Since their adoption in the Nissan LEAF, we have continuously reduced heavy rare earth elements in motors for hybrid vehicles. In 2020, the Note e-POWER adopted magnets with 85% less heavy rare earth elements compared to 2010. Furthermore, the 2022 Nissan ARIYA has a magnet-free EV motor. As a new initiative, Nissan is also promoting the development of rare earth metal recovery technologies from drive motor magnets. Up to now, in order to recycle magnets used in motors, multiple processes including manual disassembly and removal of the magnets have been required, making economic efficiency an issue. Nissan and Waseda University collaborated to establish technologies for recovering rare earth metals in highly pure states through direct dissolution using borate as a flux, eliminating the need to dismantle the motor rotors. Going forward, we will conduct trial testing aimed at practical implementation. In these ways, with respect to motors, which are a key technology, Nissan is engaged in developments corresponding to the circular economy concept, from reducing the amount of rare earth metals used to reuse that utilize resources efficiently and sustainably.

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## Resource Dependency: Achievements in Waste Reduction

### Thorough Measures for Waste Materials

Nissan actively promotes measures based on the 3R (Reduce, Reuse, Recycle) approach in its production processes whenever possible, striving to minimize the waste generated and maximize recycling efficiency by thoroughly waste sorting. At the end of fiscal 2010, we achieved a 100% Recycling rate at all of our production sites in Japan, including five manufacturing plants, two operation centers, and five affiliates. Overseas, we have reached 100% Recycling rates at plants in Mexico, Brazil, and elsewhere. We are striving to bring Recycling rates to industry-leading levels in each global region.

We have been making great efforts to reduce the number of wooden pallets and cardboard used in import and export parts shipping.

Foldable plastic and steel containers are used as returnable containers\*1 for the distribution of parts between overseas bases for repeated use. We have also been working with Renault to expand use of globally standardized returnable containers. We contribute to reduce packaging material wastage by optimizing the package volume during transportation.

To accomplish it, we have also optimized parts shape at parts design stage which called logistics simultaneous activities. In addition, we contribute to waste reduction by selecting recyclable materials at the packaging material selection stage.

Nissan is also actively engaged in the development of recycling technologies for CFRP\*2, which contributes to the weight reduction of automobiles. Through such efforts, we plan to reduce waste from our production factories by 2% annually in Japan and by 1% annually worldwide as compared to business as usual (BAU\*3), that is, waste levels expected if no special steps had been taken.

\*1 Returnable containers: Containers for packing parts that can be returned to the sender after parts delivery and used repeatedly. Nissan has adopted a folding structure in consideration of transportation efficiency at the time of return.

\*2 Carbon Fiber Reinforced Plastics

\*3 BAU (Business As Usual)

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## Waste

Waste generated globally in fiscal 2021 amounted to 158,199 tons, an increase from 153,160 tons in fiscal 2020. Waste generated globally from production sites in fiscal 2021 was 150,945 tons★.

★ This figure is subject to assurance by KPMG AZSA Sustainability Co., Ltd. For details, please see here.

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(FY)

	Unit	2020	2021
Total	ton	153,160	158,199

By region			
Japan	ton	48,921	52,386
North America	ton	48,043	51,062
Europe	ton	31,868	33,895
Other	ton	24,328	20,857

By treatment method			
Waste for disposal	ton	6,539	7,208
Recycled	ton	146,621	150,991

\* Click here for more information on Resource Dependency (Facility Waste).

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