

# In progress with positive energy

Hyundai Motor Company  
Carbon Neutrality Roadmap



We are in a collision course with nature, draining the Earth of precious resources, and without our attention, it will be too late.

Change starts with an action, not opinions. Hence we stand upon such hope for the sustainable future.

Laying the foundations to improve lives, offering solutions that would build this planet more sustainable.

Hyundai will be the change the world needs, taking the necessary steps to power progress.

This is not a reluctant obligation, but an invitation to the better world, driving positive change for a cleaner future.

**In progress with positive energy.**

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# 01. Hyundai Motor Company carbon neutrality vision and goals

## 1\_1. In progress with positive energy

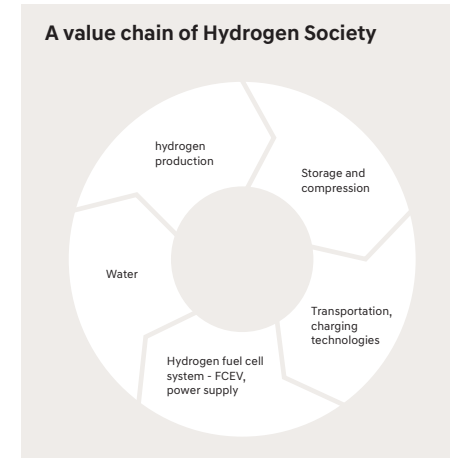
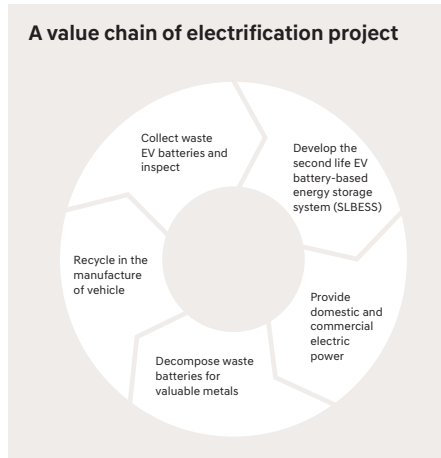
Our vision for achieving what we view as “progress for humanity” is based around our determination to ensure universal mobility without causing harm to our planet. With this vision in mind, Hyundai Motor Company thinks about what is best for humanity, society, and a better future. From transitioning to an electric vehicle (EV) paradigm with the launch of the IONIQ brand to our efforts to build a hydrogen society based on over twenty years of research, we have consistently led the way for change toward greater sustainability. We firmly believe that the automobile industry has the greatest responsibility to take proactive actions against climate change. We promise to continue our journey for humanity and future generations.

The automobile industry has inherent responsibilities with regards to climate change and is undertaking several eco-friendly measures in response. In July of 2021, Hyundai Motor Company announced to become a member of RE100, showing the commitment to attain carbon neutrality in its global operations. At the IAA Mobility held in Munich in September 2021, we presented our strategies to become carbon neutral by 2045, focusing on electrification and hydrogen society.

Hyundai Motor Company has prepared an integrated solution to create a sustainable future not only in terms of mobility but also in terms of energy and entire cities. Our goal is to make our value chains completely carbon neutral. In terms of our electrification project, we are looking for ways to reduce greenhouse gas emissions beyond the stage of manufacturing. One of these methods is recycling waste batteries. For our hydrogen project, we are building a lineup of fuel cell electric vehicles. We also plan to store, transport, charge, and even produce hydrogen energy in the future. In addition, we are developing new mobilities based on environmental energy such as the Urban Air Mobility (UAM) and Purpose-Built Vehicle (PBV) to support clean and urban lifestyles. Based on our advanced technologies, Hyundai Motor Company will implement electrification, build hydrogen society, and help create smart cities. Through this circular economy, we will help our society move closer to carbon neutrality.

# 01. Hyundai Motor Company carbon neutrality vision and goals

1\_1.  
In progress with positive energy



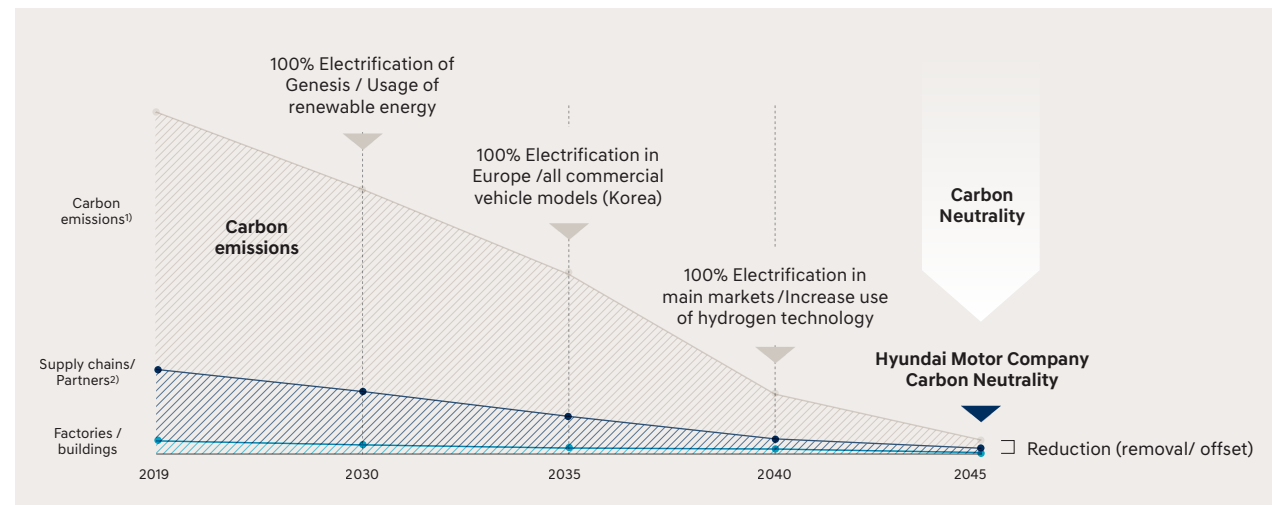
We have a responsibility to pass down breathable air, the beauty of nature, and a sustainable planet to future generations. Progress for humanity will continue to be our greatest interest. Hyundai Motor Company is ready to continuously strive towards carbon neutrality to ensure a brighter future for the next generation.

# 01. Hyundai Motor Company carbon neutrality vision and goals

## 1\_2. Hyundai Motor Company carbon neutral goals

The international society is currently building a roadmap to limit the global temperature rise to 1.5°C and achieve carbon neutrality by 2050. We are determined to build a sustainable future and protect the earth's environment for future generations. Thus, we have made it our goal to become carbon neutral across all stages including parts procurement, production, and vehicle operation by 2045. Driving is one of the main sources of carbon emissions. Therefore, our goal is to achieve 100% electrification (through battery electric vehicles and fuel cell electric vehicles) in the European market by 2035 then to 100% electrification in major markets by 2040. We also plan to achieve carbon neutrality by having 100% electrification in emerging global markets by 2045-2050, accordingly to each nation's market condition, infrastructure, and etc. To achieve these goals, Hyundai Motor Company will be implementing carbon neutral strategies based on our advanced environmental technologies for EVs, fuel cell electric vehicles, and hydrogen energy.

Hyundai Motor Company will establish an RE100 roadmap to transition 100% to renewable energy in our overseas factories by 2045. We will also increase the use of green hydrogen in major manufacturing procedures. Furthermore, we will provide carbon neutral guidelines for major partners and demand socially responsible practices from them to reduce greenhouse gas emissions across all stages of manufacturing.



1) Carbon emission in the procedure of Tank of Wheel

2) Suppliers' carbon emission; Aiming to reduce carbon emission through collaboration with partners

## 02. Strategies for vehicle electrification

### 2\_1. Hyundai Motor Company goals for vehicle electrification

According to the International Energy Agency (IEA), carbon emissions produced by transportation account for approx. 20% of the global total, more than 70% of which comes from road traffic that includes automobiles. To limit the global temperature increase to 1.5°C in accordance with the Paris Agreement, we need to aim beyond carbon reduction toward zero carbon emissions. For this goal, our priority is to shift the focus of our products and business structure from internal combustion engine vehicles to electric vehicles. As mentioned above, we plan to achieve 100% electrification (through battery electric vehicles and fuel cell electric vehicles) in the European market by 2035 and to achieve 100% electrification of product vehicles in major markets by 2040. For our luxury brand Genesis, we will implement electrification across all newly launched models starting in 2025 and achieve 100% electrification by 2030. In terms of commercial vehicles (CV) including buses and large trucks, which produce more carbon emissions compared to passenger vehicles, we plan to build a full lineup of fuel cell electric CVs by 2028 and attain 100% electrification in the Korean market by 2035. In the global market, we will gradually expand our business by building hydrogen ecosystems and entering new markets through strategic partnerships. For each region, brand, or model, we are dedicating our best efforts to achieve total electrification as soon as possible.

Furthermore, we plan to replace all company cars used in our domestic/overseas factories with electric vehicles. We will also encourage our partners to switch to electric vehicles and electric transport vessels by 2040-50 to achieve zero carbon emissions across all our factories.



## 02. Strategies for vehicle electrification

### 2\_1. Hyundai Motor Company goals for vehicle electrification

In 2013, Hyundai Motor Company launched TUCSON ix, the world's first fuel cell electric vehicle. In 2018, Hyundai Motor Company launched NEXO, a fuel cell electric vehicle equipped with a next generation fuel cell system comparable to internal combustion engines in terms of performance and durability. As of 2020, NEXO sales reached 6,600 units in the global market, in which it marked #1 in FCEV market. NEXO is currently leading the fuel cell electric vehicle market, accounting for 69% of the market share. Hyundai Motor Company sold 140 units of the XCIENT fuel cell electric truck to Switzerland in 2021 with further plans to increase our exports of fuel cell electric trucks. The number of our fuel cell electric buses operating in Korea will also increase from the current number, 100, to 200 by the end of 2021. Beginning in 2023, we plan to further expand our lineup of fuel cell electric vehicles from one to three. Following the redesigned NEXO scheduled for the second half of 2023, MPV-size FCEV model will be unveiled at the end of 2023, followed by the Large SUV FCEV model after 2025.



Hyundai NEXO  
Fuel cell electric truck XCIENT



## 02. Strategies for vehicle electrification

### 2\_2. Enhancing our technological competitiveness and infrastructure (E-GMP, E-pit, & IONITY investment)

The new EV-exclusive brand IONIQ effectively demonstrates the level of our EV technology. IONIQ 5, launched in April 2021, was designed based on our dedicated BEV platform, the Electric-Global Modular Platform (E-GMP). E-GMP's multi-charger system is compatible with a variety of chargers, allowing users easy access to the nearest charging station. Compared to the existing internal combustion engine renovation platform, E-GMP is equipped with several distinguishing features including flexible product development, EV-optimized designs and structures, a standardized high-capacity battery system (bi-directional power conversion function), longer provision of range (over 500km on a WLTP full charge), futuristic designs, and innovative space. The E-GMP system is a leading technology for future mobilities such as self-driving cars and connected cars which require more energy consumption and precise high-performance control compared to conventional vehicles.

In addition to developing advanced EV technology, Hyundai Motor Company will also help increase EV charging infrastructures and provide customers with easy access to charging. E-pits are ultra-fast EV charging stations built by Hyundai Motor Group to provide convenience to long-distance drivers and expand the distribution of EVs in Korea. They are equipped with 350kW chargers, the most powerful chargers in Korea in terms of output. They can charge an 800V EV from 10% up to 80% in just 18 minutes, which is approx. three times faster than a high-speed charger. Starting in 2021, we plan to expand our charging network by installing 120 chargers at 20 ultra-fast charging infrastructures including 12 major highway rest stops and other areas near 8 urban landmarks in Korea. Moreover, Hyundai Motor Group has signed a strategic investment contract (2019) for IONITY of 75 million euros in Europe. IONITY was co-founded in 2017 by four automakers: BMW, Daimler, Volkswagen, and Ford. This equity investment will help us build partnerships that will accelerate our transition to 'clean mobilities' for our EV customers in Europe.

## 02. Strategies for vehicle electrification

2\_2.  
Enhancing our technological competitiveness and infrastructure (E-GMP, E-pit, & IONITY investment)

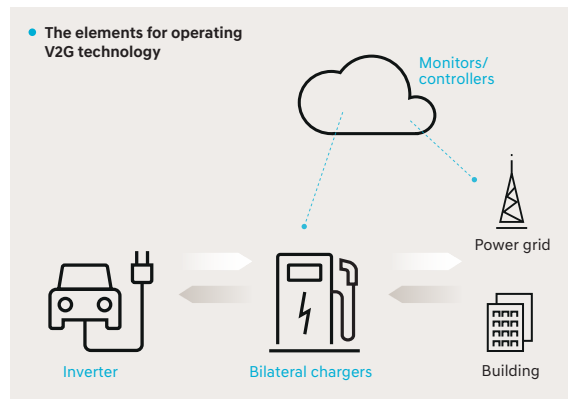


(From the top)  
E-GMP Battery Charging System  
Hyundai Motor Group's EV charging brand E-pit  
IONITY

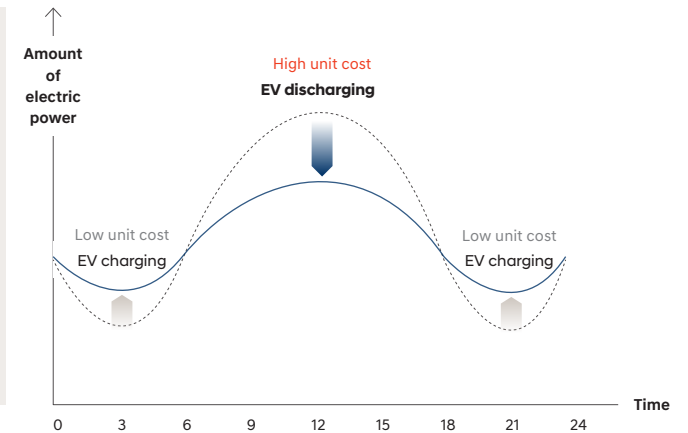
## 02. Strategies for vehicle electrification

### 2\_3. Utilizing electrical energy conversion technologies (V2G & SLBESS)

Hyundai Motor Company will enhance the efficiency of the national power grid and contribute to carbon neutrality in our nation/society through vehicle-to-grid (V2G) technology. We aim to commercialize this next generation charging technology, which allows users to return the power stored in the high-voltage batteries of their EVs to the national grid. With V2G, users can charge their EVs during late hours of the night when power supplies are high and discharge energy during peak hours when they are low, contributing to a stabilized power grid. Applying V2G technology requires the development of DC to AC inverters, bilateral chargers (communication), and management programs (monitors/controllers). Hyundai Motor Group is currently conducting empirical studies for the commercialization of V2G technology at our Seoul headquarters parking tower. In addition to the distribution of new and exceptional EV models, the utilization of V2G technology will further contribute towards building carbon neutral societies by preventing additional constructions of power plants that produce environmentally hazardous materials.



The utilization of V2G technology

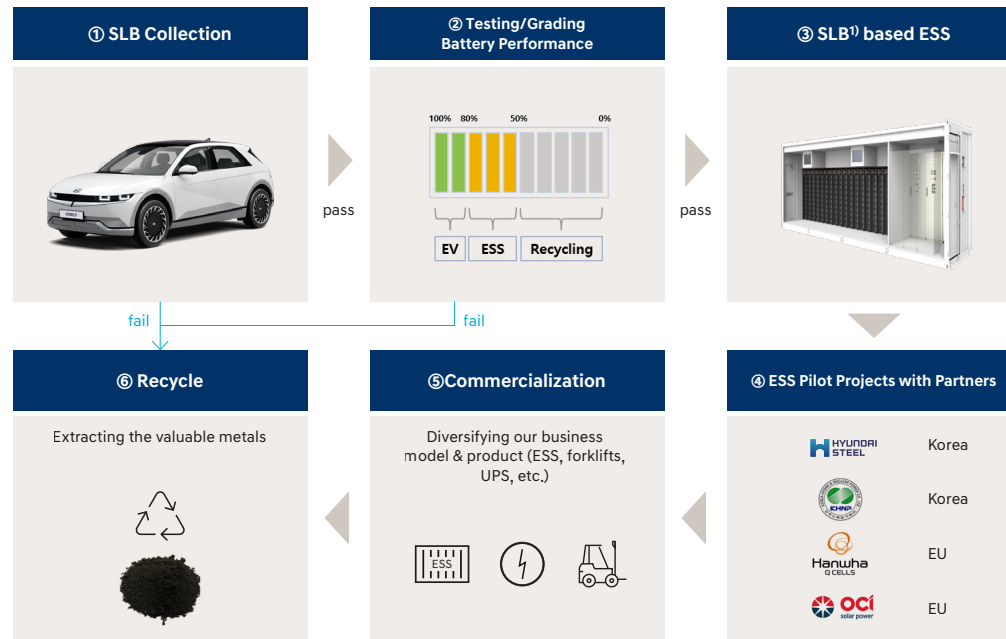


V2G technology concept image

## 02. Strategies for vehicle electrification

### 2\_3. Utilizing electrical energy conversion technologies (V2G & SLBESS)

Waste batteries are expected to increase proportionally to the increase of EV sales in the future, demanding the need for recovery and recycling systems. With the increase of EV distributions, we have arranged to expand our waste battery recovery/recycling network globally across South Korea, Europe, and the United States, and etc. After thorough inspection, recovered batteries will be reused through our currently developing Second Life Battery Energy Storage System (SLBESS). SLBESS has been designed based on EV waste batteries. Hyundai Motor Company is currently conducting an SLBESS/renewable energy demonstration project in collaboration with external companies including Hyundai Steel, Korea Hydro & Nuclear Power, Q-Cells, and OCI. The SLBESS-based resource recycling project will contribute to the reduction of our society's carbon emissions. For waste batteries that are unsuitable for ESS, our company is conducting empirical research with recycling businesses that decompose waste batteries for valuable metals such as lithium, cobalt, and nickel. Hyundai Motor Company will continue to enhance our capacity for reusing these valuable recycled metals.



Waste battery business/circulation system

1) SLB : the Second Life Battery

## 03. Hydrogen business synergy

### 3\_1. Hyundai Motor Group's 2040 Hydrogen Vision

#### “2040, The Completion of Hydrogen Energy Shift”

Hyundai Motor Group unveiled our visions for our hydrogen business and the world's most advanced hydrogen fuel cell technology with Hydrogen Wave<sup>1)</sup> (September 7, 2021).

Hydrogen Wave represents the group's powerful initiative for shifting the energy paradigm and welcoming in a hydrogen-based society. Our company motto is “2040, The Completion of The Hydrogen Energy Shift.” The three pillars of our hydrogen business are scalability, economic efficiency, and eco-friendliness. Our goal is to popularize hydrogen as a familiar and widely-used energy, not only in transportation but in all aspects of our lives and industry by 2040.

As a global first-mover in hydrogen fuel cells, we are continuously striving to gain competitiveness through technological innovations. To accomplish our visions for the popularization of hydrogen energy by 2040, we will continue to expand our businesses and technologies related to hydrogen energy systems. We will also distribute these systems for competitive prices to help our society transition to hydrogen energy, to achieve carbon neutrality and contribute for the sustainable environment.

1) Hyundai Motor Group 2040 Future Vision for Hydrogen Society Forum (KINTEX, Ilsan)

## 03. Hydrogen business synergy

### 3\_2. Expanding our hydrogen fuel cell business

Hyundai Motor Company launched HTWO, our fuel cell system brand equipped with one of the world's highest level of technology to expand our global business and help build hydrogen ecosystems. HTWO stands for the chemical formula of hydrogen, while also embodying the two pillars of our hydrogen fuel cell project: hydrogen and humanity. The brand name expresses our determination to provide humanity with significant value beyond energy. Based on its merits in terms of energy conversion, storage, and transportation, hydrogen energy has recently been recognized as an optimal solution to combat the limitations of renewable energy that can enhance the quality of life for humanity. Our hydrogen technology is exceptional in terms of its efficiency, durability, and reasonable price. Hyundai Motor Company will leverage these merits to evolve transportation by applying hydrogen energy to all mobilities including passenger/commercial vehicles, public transportation, trams, vessels, and UAMs. We also plan to develop fuel cell systems that can be applied widely across our everyday life and various industries from power generation to heating/cooling and energy storage, thus contributing to building hydrogen society.



Fuel cell electric truck XCIENT  
Fuel cell ship

## 03. Hydrogen business synergy

### 3\_3.

Increasing the competitiveness of our hydrogen fuel cell system

At Hyundai Motor Company, we're striving to stay competitive through technological innovations that significantly enhance the output and durability of our fuel cell system. In terms of our 3rd generation fuel cell system (revealed at Hydrogen Wave), we are working on improving space utilization by reducing the volume of our 100kW fuel cell system by 30% compared to the prior NEXO system. The 200kW fuel cell system will remain the same in terms of volume but will double in output. Currently they are still prototypes, but we can anticipate the launch of highly sophisticated fuel cell systems by the time they are mass produced. We are also releasing a series of next-generation fuel cell systems that are as economically efficient as EV batteries and internal combustion engines. As evidenced by the many collaborations we have going with hydrogen-related companies and government agencies around the world, our fuel cell system is gaining positive results and recognition for its competitiveness.

#### **Hyundai Motor Company exports its first hydrogen fuel cell systems**

On September 2020, Hyundai Motor Company exported four hydrogen fuel cell systems to a European energy solution startup and GRZ Technologies, a hydrogen storage technology company in Switzerland. The exports were performed after the Ministry of Commerce, Industry, and Energy granted approval for the exportation of national core technologies. This was the first time hydrogen fuel cell systems were exported to non-automobile sectors.

#### **Hyundai Motor Company strengthens cooperation with the United States Department of Energy pertaining to hydrogen and hydrogen fuel cell technologies**

Hyundai Motor Company signed a memorandum of understanding (MoU) with the United States Department of Energy to collaborate on innovating and expanding global foundations for hydrogen and hydrogen fuel cell technologies. The main purpose of the MoU is to share empirical/analytical data obtained through operating fuel cell electric vehicles and hydrogen charging stations with academia, government agencies, and companies.

## 03. Hydrogen business synergy

3\_3.

Increasing the competitiveness of our hydrogen fuel cell system

It is also aimed at introducing hydrogen energy to a variety of industries and the general public to innovate hydrogen and hydrogen fuel cell technologies and increase their usage worldwide. Strengthening our cooperation with the US Department of Energy means that the distribution of fuel cell electric vehicles, currently focused mainly in the State of California, may be expanded across the US. It can also lead to increased investments and more jobs across the entire value chain including hydrogen production, storage, and utilization. This in turn can accelerate the dawn of the hydrogen economy and shift energy paradigms.

### **Hyundai Motor Group constructs first hydrogen fuel cell system plant overseas**

To intensify our hydrogen business and expand the ecosystem for hydrogen industries, Hyundai Motor Group signed an MoU with Guangzhou. We also began constructing HTWO Guangzhou, our first hydrogen fuel cell system plant overseas. The construction is scheduled to be completed in 2022. Through HTWO Guangzhou, we will continue to apply our advanced hydrogen fuel cell system as a power source for more mobilities and industries.



HTWO Guangzhou bird's-eye view



## 03. Hydrogen business synergy

### 3\_4. Utilizing green hydrogen and becoming more eco-friendly

To achieve carbon neutrality, we must inevitably transition from fossil fuels to renewable energy. Hydrogen is gaining increasing importance as a future energy source that can make up for the unstable supply and demand of other renewable energies such as solar and wind. In recent years, major countries including the United States, Germany, and Japan have launched long-term projects to build hydrogen ecosystems. As of today, most hydrogen energy consists of gray hydrogen produced from fossil fuels. However, to achieve true carbon neutrality in the future, it is important to transition to green hydrogen based on renewable energy. Hyundai Motor Company plans to procure renewable energy such as solar and wind power through collaborations with RE100 global businesses. We will further expand our collaborations to produce and transition to green hydrogen using renewable energy. Green hydrogen will be used as the main energy source for our fuel cell electric vehicles in the future. It will also be used to generate power in our factories as an alternative to liquefied natural gas (LNG). This will maximize the synergy effect between our hydrogen project and carbon neutrality goals.

## 03. Hydrogen business synergy

### 3\_5. Hydrogen campaigns

For a smooth and effective transition to hydrogen society, Hyundai Motor Company is conducting various campaigns and social activities to communicate the eco-friendliness of hydrogen to our customers. Our plan is to consistently expand our current hydrogen campaign and promotional activities.

#### **H2U (hydrogen to you):**

##### **a global campaign that promotes the benefits of hydrogen**

With the popularization of fuel cell electric vehicles and the construction of hydrogen infrastructures, Hyundai Motor Company believes we have entered a new stage in building hydrogen societies. Alongside various influencers, we launched the campaign helped creating a community of people who believe in the importance of hydrogen societies. We invited professionals in the automobile, eco-friendly mobility, and IT sectors along with lifestyle influencers in the music, fashion, and photography fields to experience our leadership in fuel cell vehicle technology by fuel cell electric vehicle NEXO. We also created content highlighting our hydrogen fuel cell technology, future sustainable mobilities, and the concept of hydrogen societies. Through this content, we were able to engage with millennials who are highly conscious of the environment and society. To enable more customers to experience the hydrogen energy technologies of NEXO, we're planning to expand the H2U campaign to other major cities across Asia and North America starting in 2022.

#### **H2 Economy: a campaign targeted at global opinion leaders**

Partnered with Bloomberg, Hyundai Motor Company is conducting H2 Economy, a campaign aimed at global opinion leaders to consolidate our image as a leading company in building hydrogen economies. The campaign promotes our hydrogen technology and products through educational

## 03. Hydrogen business synergy

### 3\_5. Hydrogen campaigns

videos while also communicating the importance of clean hydrogen energy in developing hydrogen technologies/businesses and building a sustainable future. The ultimate goal of the campaign is to influence how opinion leaders perceive hydrogen. We also rank 15 countries around the world based on their hydrogen adoption, policies, and investment levels to encourage countries to cultivate hydrogen businesses.

#### **“Hyundai Motor Company and BTS promote hydrogen energy”**

To highlight hydrogen as tomorrow’s eco-friendly and sustainable energy, Hyundai Motor Company has teamed up with BTS for the Global Hydrogen Campaign under the slogan “Because of You.” In celebration of Earth Day and Environment Day in 2021, we created a manifesto video and documentary surrounding the theme “For Tomorrow We Won’t Wait.” The videos convey the importance of taking sustainable actions to provide a better future for the next generation. At Hyundai Motor Company, we wish to share our efforts to create a hydrogen society with members of generation Z and millennials, and we hope that, together with BTS, we can make a positive influence on their many fans around the world.



## 04. Achieving carbon neutrality in our factories

### 4\_1. Hyundai Motor Company's direction for attaining carbon neutral factories

Hyundai Motor Company supports the direction and goals of the Paris Agreement and is fully aware of the roles and responsibilities of companies in reducing greenhouse gas emissions on a global level. We intend to increase the development/distribution of eco-friendly vehicles, help create hydrogen society, and implement a variety of activities to reduce greenhouse gas emissions.

At Hyundai Motor Company, we're striving to make our factories carbon neutral by 2045 through the use of hydrogen energy, and etc. We will also be enhancing energy efficiency in our production process by transitioning to renewable energy and adopting high-efficiency motors and inverters. In the short term, we'll be prioritizing transitioning the electricity used in manufacturing to renewable energy by consulting the RE100 roadmap. We're also going to adopt high-efficiency machinery, recycle waste heat, and improve procedures to increase efficiency in our painting process, which currently runs mainly on LNG fuels.

Our long-term goal starting in 2035 is to introduce green hydrogen (in connection with our plans to build hydrogen society) and increase the use of renewable energy to achieve carbon neutrality by 2045. To achieve this goal, we plan to introduce hydrogen combustion machinery such as hydrogen boilers/burners and adopt green LNG that utilizes carbon reduction or carbon capture, utilization, and storage (CCUS) technology.

## 04. Achieving carbon neutrality in our factories

### 4\_2. RE100 initiative and detailed execution plan

Together with our major affiliates—Kia, Hyundai Mobis, Hyundai Wia, and Hyundai Transys—we will reduce carbon emissions by transitioning 100% to renewable energy globally. Our goal is set on 2045, five years earlier than the schedule set by the RE100 (Climate Group) initiative. To transition our overseas factories 100% to renewable energy, we will first start with our Czech Republic plant where renewable energy is easily accessible. We'll then be moving on to factories in other countries such as India and the US by taking into consideration the environment surrounding the supply/demand of renewable energy and government policies/regulations of each country. The gradual transition will be 60% complete (compared to the RE100 (Climate Group) recommendation) by 2030 and 90% complete by 2040. We will carefully consider the circumstances of each plant to come up with the best solutions including installing solar panels on the roofs of our factories, purchasing renewable energy certificates, and signing power purchase agreements (PPA) with external renewable energy companies.

Starting with our plant in the Czech Republic, Hyundai Motor Company plans to transition 100% to renewable energies by obtaining guarantee of origin (GO) certificates in 2022. Starting in 2035, we're also planning to install solar panels on the roofs of our factories and parking lots. Our India plant is already purchasing approx. 85% of its power (wind power 20%, solar power 8%, waste incineration cogeneration 56%<sup>1)</sup> from external power companies through PPA. We are also installing 10MW solar panels on our roofs, which will be ready by 2021. In addition, we have already constructed 3.2MW solar panels at our plant in Indonesia (built in 2021). These panels have been in operation since April 2021.

In Korea, we have made joint investments with large power companies and leased the roofs of our factories for solar panels. These panels supply electricity to external grids. The 10MW solar panels installed in 2013 at our Asan plant are producing 13,000Mwh electricity per year. In 2021, we constructed a 9MW solar energy facility at the parking lot of our Ulsan plant. We are also conducting a demonstration project that combines solar power with energy storage systems (ESS) made from reused waste batteries.

1) Waste incineration cogeneration will gradually be replaced by renewable energy in the future.

## 04. Achieving carbon neutrality in our factories

In addition to transitioning to renewable energy, we are continually adopting new high-efficiency machinery such as high efficiency motors, inverters, and LED lights. We are also using energy usage monitoring systems to minimize energy waste and reduce carbon emissions. In the future, we plan to upgrade digital technologies based on AI and big data to optimize energy usage in our production process and reduce carbon emissions in our factories.

4\_2.  
RE100 initiative and  
detailed execution plan



(From the top)  
Photovoltaic power generation in Hyundai's  
plant in India  
2MWh ESS at Ulsan plant  
A solar energy facility in the Ulsan factory  
parking lot

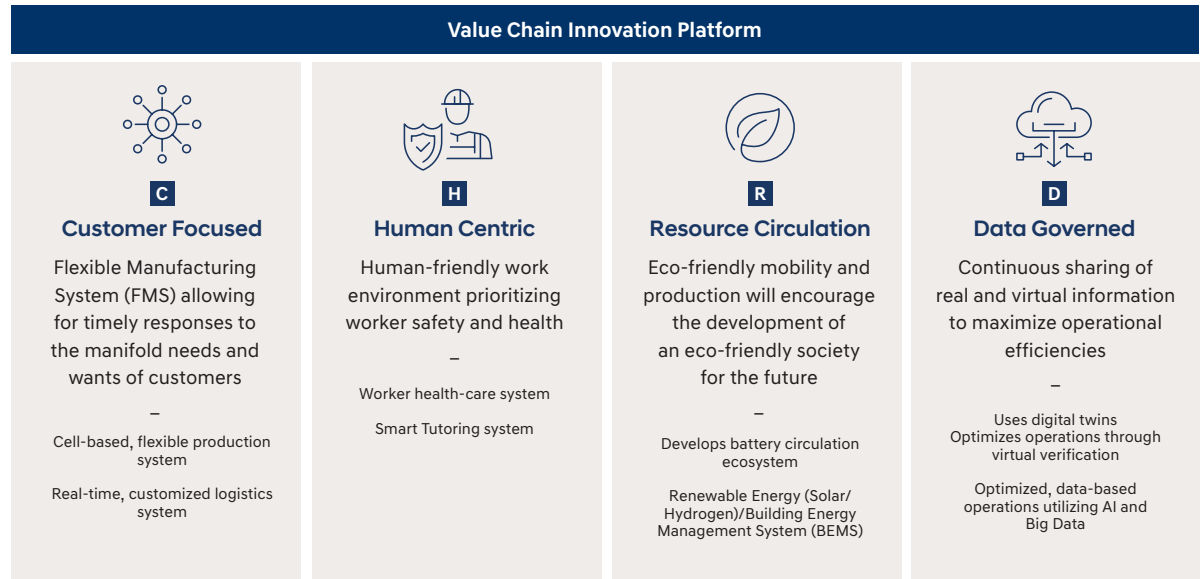
## 04. Achieving carbon neutrality in our factories

### 4\_3. Eco-friendly smart factory

Together with our affiliates, we are currently constructing the Hyundai Motor Group Innovation Center in Singapore (HMGICS, scheduled for completion in November 2022) at the Jurong Innovation District. This is based on our attempts to create an entire ecosystem for green mobilities that goes beyond eco-friendly factories through advanced manufacturing technologies and platform innovations. The HMGICS is an open research base for building innovative mobility ecosystems. It will conduct research and empirical studies on mobility-related value chains, which includes receiving new orders, manufacturing, delivering, test-driving, and servicing. In the future, we'll also be utilizing solar power and hydrogen power to create carbon neutral manufacturing hubs and help local communities achieve sustainable growth. In addition, the center will conduct empirical studies on emerging businesses such as Battery-as-a-Service (BaaS) and implement our visions for future mobilities such as smart cities, UAMs, and robotics to shift our society to environmental mobilities. Moreover, we are also building an intelligent manufacturing platform named M-CHoRD, a flexible production system for multiple car models that can easily adapt to market changes and demand. Moving away from traditional methods of manufacturing based on conveyor belts (optimized for mass producing single models), M-CHoRD is designed to produce a variety of models in cell unit assemblies with greater efficiency and adjustability. In addition to developing innovative manufacturing platforms that incorporate the technologies of the fourth industrial revolution, the center will also serve as a testbed for these platforms. Furthermore, we plan to create human-friendly environments through cooperation systems between humans and robots, technologies for preventing musculoskeletal disorders, and tutoring systems for work guidance.

# 04. Achieving carbon neutrality in our factories

## 4\_3. Eco-friendly smart factory



M-CHoRD, the Vision of HMGICS



Bird's-eye view of HMGICS



## **05. Encouraging and supporting our auto-part supply chains (partners) in achieving carbon neutrality**

5\_1.

Hyundai Motor Company's supply chain (partner) management direction

The excellence of our finished vehicles is dependent on the auto parts of our partners. Their quality and technology in turn are directly related to consumer trust. Under this belief, Hyundai Motor Company supports our partners by providing customized education and quality management/technology courses that are designed to help boost their competitiveness and productivity. In addition, we help our partners improve the quality of their auto parts, develop technologies, and cultivate management skills through a variety of activities including our five-star partner system, free patents, and technological guidance.

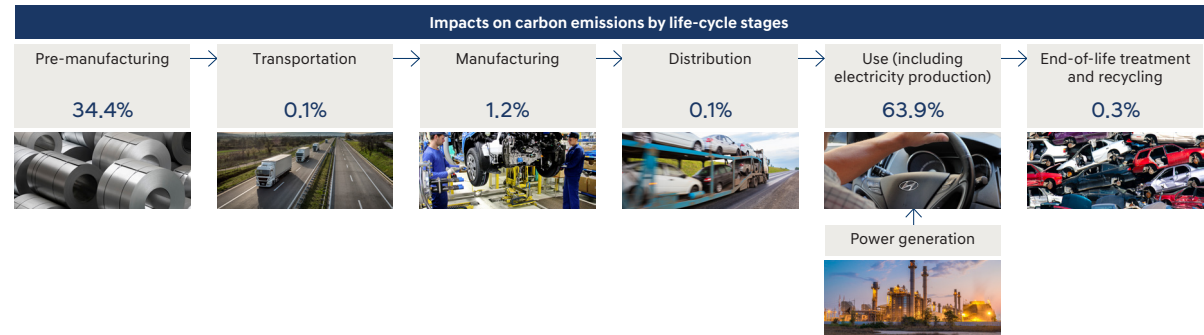
In the future, we will also encourage our partners to practice carbon neutrality and implement environmental, social, and governance (ESG) management. We're then going to investigate the carbon emission levels of approx. 400 of our major partners. Following that, we'll be selecting core partners for managing carbon neutrality goals, providing guidelines, and encouraging them to adopt environmental and socially responsible practices. By next year, we will identify the characteristics of each partner, categorize them into groups, and develop cooperation programs for our supply chain. The programs will include activities for reducing carbon emissions based on each group, education on carbon neutrality, and awareness raising activities. Furthermore, since raw material companies tend to produce the most carbon emissions, we plan to devise joint solutions in connection with automobile design technologies, which will increase the use of recycled or advanced materials.

## 05. Encouraging and supporting our auto-part supply chains (partners) in achieving carbon neutrality

### 5\_2.

Encouraging partners to go carbon neutral through LCA management

To achieve carbon neutrality, we believe it is important to analyze the environmental impact of a vehicle throughout its entire life-cycle from the acquisition of raw materials to its operation, disposal, and recycling. Thus, we plan to conduct life-cycle assessments (LCA<sup>1)</sup>) on our vehicles to try to minimize their effect on nature across all procedures. We have already conducted complete LCAs on Kona EVs according to the 2020 criteria and will gradually expand our analysis to include other EVs that will be launched in the future.



According to the LCA, Kona EVs have the largest effect on global warming in the operation stage (approx. 64%) followed by pre-manufacturing (approx. 34%) and manufacturing/distribution/disposal (approx. 2%). These results suggest that in addition to reducing carbon emissions in the operation stage, we must help our partners manage their carbon emissions to decrease environmental impacts produced at the pre-manufacturing, part-procurement stage. Thus, we plan to develop ways for our partners to utilize recycled materials and provide technological support for low carbon practices. We will also use digital technologies (for example, our carbon neutral support computer system for partners) to enhance the credibility of our pre-manufacturing carbon emissions data and LCA analysis. These activities and technologies will help us further enhance the climate-friendliness of our new vehicle models.

1) LCA: Life Cycle Assessments

## **06. Social activities to reduce carbon emissions: carbon reduction and recycling**

### **6\_1.**

#### **Carbon capture utilization and storage (CCUS)**

To achieve carbon neutrality, we must stop using fossil fuels to manufacture vehicles. However, there are many obstacles to reaching our decarbonization goals, and the process requires an extended period of time. Thus, CCUS technology may serve as useful and practical carbon neutral measures during the transitional period. LNG fuels produce 22.12 tons of carbon emissions per 10,000 Nm<sup>3</sup>. With this in mind, Hyundai Motor Company started developing CCUS technology since 2012 for our manufacturing process. The technology is currently being used in our factories in Korea. CCUS technology can also be used in other industries beyond automotive manufacturing. To prepare for its commercialization, we are conducting empirical studies at our lab in Korea and will be performing consistent market monitoring and technology development.

## **06. Social activities to reduce carbon emissions: carbon reduction and recycling**

### **6\_2.**

Designs that consider recycling possibilities

In addition to energy storage systems (ESS), which allow us to reuse waste batteries from electric vehicles, Hyundai Motor Company will also use post-industrial recycled (PIR) materials in our main auto parts and create designs that consider recycling possibilities for disposed vehicles. We are using recycled plastic in our auto parts by utilizing waste resources recovered from disposed cars. In 2020, we increased the scope even further by inventing recycled materials for cowl top covers. In our newly launched Genesis G80 and IONIQ 5, we used additional recycled materials and biomaterials for the interiors. The paints used in the IONIQ 5 are made from plant-based bio-oil ingredients, and the leather seats were pretreated using plant oils.

In Europe, we are increasing the use of recycled plastic in the models produced at our Czech Republic plant to comply with European Green Deal policies and environmental regulations. For this, we are seeking local recycling companies in Europe and developing ways to manufacture parts from locally recycled materials.

We are also creating economic value by procuring resources from various wastes produced during consumption, thus reducing environmental pollution. We are currently working on developing ways to recycle discarded fishing nets to reduce marine pollution. These fishing nets will be reused for exterior auto parts such as cowl top covers, engine covers, and wheel covers. We are also conducting pilot studies in preparation of tomorrow's hydrogen economy on recycling carbon fibers obtained from the hydrogen tanks of discarded hydrogen vehicles.

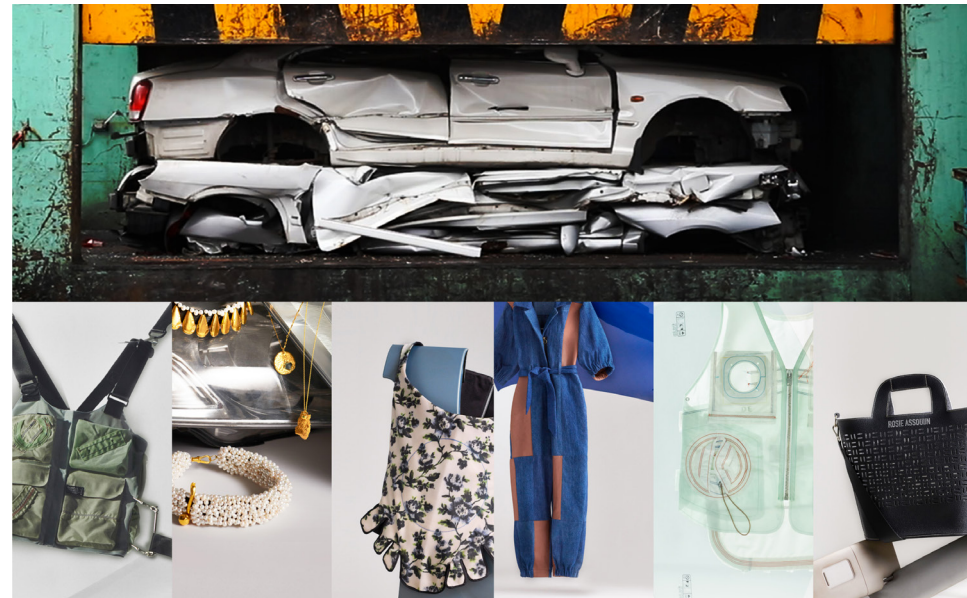
## 06. Social activities to reduce carbon emissions: carbon reduction and recycling

6\_3.

Re:Style, creating shared value through upcycling

### Re:Style, Hyundai Motor Company upcycling project

Sustainability is becoming increasingly important in today's society. To promote upcycling trends worldwide by combining mobility with fashion, Hyundai Motor Company launched Re:Style, our new sustainability project. Automobile materials such as leather, glass, and air bag material have low recycling rates and are mostly discarded. We reused these materials to create accessories, effectively redefining automobile waste as valuable materials for fashion items. The project will continue to promote sustainability across the automobile and fashion industries.



Re:Style, Hyundai Motor Company upcycling project

## 06. Social activities to reduce carbon emissions: carbon reduction and recycling

6\_3.

Re:Style, creating shared value through upcycling

### IONIQ Forest

From 2016 to 2020, Hyundai Motor Company conducted the IONIQ Forest project in partnership with Sudokwon(capital area) Landfill Site Management Corporation and Tree Planet to plant fine-dust-reducing trees at landfills in Incheon's metropolitan area. Together with forest experts, customers who purchased IONIQ, and participants in the IONIQ Longest Run, we planted 23,000 trees by 2020 and created a fine dust prevention forest.

In 2021, we will be planting native camellia trees, azaleas, hydrangeas, etc. at the National Sinsido Natural Recreation Forest to create forest paths.

We will also be providing eco-friendly mobility experiences with IONIQ 5 and participating in community volunteer work.



### Hyundai Green Zone

The Hyundai Green Zone is a global ecological restoration project that has been conducted by Hyundai Motor Company since 2008. The first Hyundai Green Zone project was carried out from 2008 to 2013 across 50 million square meters in Chakanor, Apakachi, Inner Mongolia-one of the main sources of yellow dust in China. The project has successfully transformed an alkaline salt desert into grassland. From 2014 to 2020, we conducted a second project aimed at restoring the Baoshadainao Nur, Zhenglan Qi and

## 06. Social activities to reduce carbon emissions: carbon reduction and recycling

6\_3.

Re:Style, creating shared value through upcycling

Haginor regions into grasslands. In 2021, we will be transferring the seeding perennial plant techniques we have gathered from these regions to the Inner Mongolian government and we will also be launching our third project in Chayojungqi, Ulanqab, Inner Mongolia. The Hyundai Green Zone project brings together volunteers from various backgrounds including Hyundai Motor Company employees and college students from Beijing and Tianjin to prevent the spread of desertification. In recognition of these contributions, Hyundai Motor Company was ranked No.1 among automakers operating in China for five consecutive years in a corporate social responsibility development index published by the CSR Research Center at the Chinese Academy of Social Sciences. In the overall ranking including all companies in China, Hyundai Motor Company was ranked No.4.



Hyundai Green Zone project

### Restoring marine ecosystems & upcycling

Partnered with Healthy Seas, Hyundai Motor Company is restoring marine ecosystems through cleanup activities. The objective of the activities is to remove discarded fishing nets and rubbish from our sea and beaches. The fishing nets are made into econyls, biodegradable nylon made from up-cycled fishing nets or cloth. These materials are then used to create new products such as bracelets or possibly even automobile parts for our

## 06. Social activities to reduce carbon emissions: carbon reduction and recycling

6\_3.  
Re:Style, creating shared value through upcycling

vehicles. In addition, we will be using IONIQ 5 for transportation in six major European countries to reduce our carbon footprint and continue to implement creating shared value (CSV) activities to protect the environment.



Marine Ecosystem Restoration and Upcycling Project (Europe)