

# Climate Action & Circular Economy

LG Energy Solution operates a department dedicated to cope with climate change such as converting to renewable energy and achieving carbon neutrality. More specifically, all of our global business sites have joined both RE100/EV100 contributing thereby to managing energy efficiency and reducing energy consumption in response to climate change. In addition, we are recycling raw materials by utilizing scraps generated during battery production and reusing batteries as part of the strategy for circular economy. By putting forth such efforts, we are raising the social and environmental value of products and creating new business opportunities.

## Climate Change Response

As a leading company in the battery industry that plays a pivotal role in achieving a carbon-neutral society, LG Energy Solution considers climate change as one of the critical management issues and proactively addresses it. To this end, we are strengthening collaboration and cooperation with our suppliers and relevant partners with a view to reducing GHG emissions and energy consumption in the business sites as well as in the battery industry as a whole.

Furthermore, we are continuously monitoring climate-related policies and regulations worldwide to take adequate measures in a timely manner and thereby minimize business risk. In addition, by proactively responding to customers and investors' demands on climate action, promoting R&D of high-efficiency batteries and renewable energy-linked ESS projects, we minimize adverse impacts of climate change on environment and society and convert them to opportunities to create economic value.

## Setting Carbon Neutrality Goal

RE100  
Renewable Electricity 100%

EV100  
Electric Vehicle 100%

With the goal of achieving carbon neutrality by 2050, LG Energy Solution has introduced various GHG reduction activities. In particular, we joined both RE100 and EV100 initiatives for the first time in the global battery industry in April 2021 with an aim to reduce by making transition to renewable energy and eco-friendly vehicles. Through this, we promised to convert electricity of all business sites, including new sites, to renewable energy by 2030, and convert 100% of corporate-owned and leased vehicles weighing less than 3.5 tons and 50% of vehicles weighing 3.5 to 7.5 tons to eco-friendly vehicles by 2030.

More than approximately 70% of total GHG emissions from our battery manufacturing process comes from the use of electricity, and substantial amount of GHG emissions can be reduced by using renewable energy. Along with making transition to renewable energy, we plan to achieve carbon neutrality by 2050 through improving energy efficiency in battery production process, introducing new technology and highly efficient production facilities, and promoting carbon offset projects in connection with battery business.

## Climate Action Governance Structure

LG Energy Solution is operating a department dedicated to tackling climate change. Our headquarters and business sites are in collaboration to set mid- to long-term targets to reduce GHG emissions and design the implementation plan thereof. The activities include converting to renewable energy across all business sites, managing and reducing energy consumption, participating in emissions trading schemes in Republic Korea and EU, communicating and disclosing relevant information in response to the requests from stakeholders, and continuously monitoring and engaging in domestic and overseas policies, as relevant.

Critical decisions relating to climate action are made at top management meeting participated by C-level and Heads of business sites. The action plans to achieve carbon neutrality, implement RE100, and reduce GHG emissions throughout the supply chain have been established and rolled out.

In addition, LG Energy Solution operates an ESG Committee within the Board of Directors, where ESG-related issues, including climate change, are reported and discussed on a regular basis (biannually or more frequently).

## GHG Reduction Program

### Facilitating Transition to Renewable Energy (RE100)

In line with globally increasing demands for climate action, companies around the world are expanding the use of renewable energy to reduce GHG emissions and thereby cope with climate emergency. Global initiatives such as RE100 are instrumental for companies to align their plans and promote collaboration towards the transition to renewable energy.

LG Energy Solution aims to respond to the needs of customers, investors, and stakeholders and to take the lead in the transition to renewable energy as a leading company in the battery industry, which will be a key driver of a carbon neutral society. As of 2020, we have converted more than 30% of electricity to renewable energy, and plan to complete 100% transition in all domestic and overseas business sites by 2030.

The manufacturing facilities in Poland and the U.S. have completed 100% transition to renewable energy through Green Pricing scheme and purchase of Renewable Energy Certificate (REC). Korean and Chinese business sites are gradually increasing the use of renewable energy, as well. Ochang Plant in Korea is operating 1.2 MW-scale photovoltaic facilities and participating in Korean Green Pricing scheme as part of its efforts to complete the transition to renewable energy. In addition, plans to expand manufacturing facilities are in progress, in response to growing demands for batteries worldwide. Instruments such as Power Purchase Agreement (PPA) are being explored from the facility design phase to ensure the stable supply of renewable energy in the new business sites.

For the phased RE100 conversion by 2030, LG Energy Solution will continue to make efforts to secure various renewable energy portfolios, including PPA, Green Pricing scheme, and REC, and take the lead in producing eco-friendly batteries.

**Risks and Opportunities for Carbon Reduction**

**GHG Emissions Reduction in Transportation (EV100)**

LG Energy Solution promised to convert 100% of the owned and leased vehicles weighing less than 3.5 tons and 50% of those weighing over 3.5 to 7.5 tons into eco-friendly vehicles by 2030.

The transportation sector accounts for more than 20% of global GHG emissions, and the transition to eco-friendly vehicles is an important means to reduce GHG emissions. As a manufacturer of batteries, a key component of EVs, LG Energy Solution is dedicated to taking the lead in transition to eco-friendly vehicles and contributing to GHG reduction.

We are gradually converting the vehicles used in domestic and overseas business sites to eco-friendly vehicles, and EV charging stations are being installed across all domestic sites. Taking the diversification of EV models in the coming years into consideration, we plan to convert vehicles at all business sites into EVs in a phased manner by 2030.

**Climate Action Communication**

LG Energy Solution provides information on product carbon footprint, including carbon labeling and information on associated GHG reduction activities, upon the request of stakeholders. We will continue to actively support decision-making of shareholders and investors by disclosing and communicating in a transparent manner climate-related information, including energy and GHG, through regular business reports, ESG Reports, CDP annual reports, etc.

Climate change is a global issue of great importance that transcends national and business boundaries. It is widely recognized as an essential part, not an option, of sustainable business growth. It is therefore critical to keep a keen eye on climate ambition and policy instruments set out by other countries—particularly, EU, the U.S. and China—including carbon neutral goals, carbon border tax, reinforced emissions standards for vehicles, and on an increasing number of countries joining global initiatives such as RE100.

Furthermore, the financial sector increasingly requests companies to take climate action and disclose climate-related information in a transparent manner, using global sustainability standards, such as Taskforce on Climate-Related Financial Disclosures (TCFD) and Value Reporting Foundation Sustainability Accounting Standards Board (VRFASB).

To this end, LG Energy Solution classifies climate risks by government/customer, supply chain, and stakeholders, and sets action plans for each issue to manage opportunities and threats.

**Threats and Opportunities of Climate Change**

Category	Risk factor	Activity	Expected outcome
<b>Government / customer</b>	Emissions trading scheme (ETS)	Establishing and operating ETS management system	Lowering costs incurred by purchasing carbon allowance
	Demand for renewable energy	Transition to 100% renewable energy by 2030 (Joining RE100)	Reinforcing the position as a global leader in tackling climate change Creating opportunities for renewable energy-linked ESS projects
	Carbon border adjustment mechanism / EU battery regulations, etc.	Strengthening management of product carbon footprint Increasing recycling & reuse of materials	Strengthening product competitiveness from a perspective of LCA Expanding business opportunities of battery recycling & reuse
	Energy efficiency management	Establishing an integrated energy efficiency management system and promoting energy saving activities	Lowering operating costs by reducing energy consumption
<b>Supply chain</b>	Reducing GHG emissions from supply chain	Developing and implementing a plan to support the transition to renewable energy in supply chain	Strengthening product competitiveness from a perspective of LCA
	Battery recycling	Increasing recycling & reuse of raw materials	Expanding business opportunities of battery recycling & reuse
<b>Shareholders / investors</b>	Stakeholder communication	Strengthening disclosure of climate-related information, including via TCFD, CDP	Reinforcing the position as a global leader in tackling climate change
	Response to emerging domestic and overseas policy and regulation	Establishing and continuously enhancing a strategic framework for climate action	

## GHG Reduction Performance

LG Energy Solution is participating in the emissions trading schemes in Korea and Europe, respectively, and devising cost-effective measures to reduce GHG emissions.

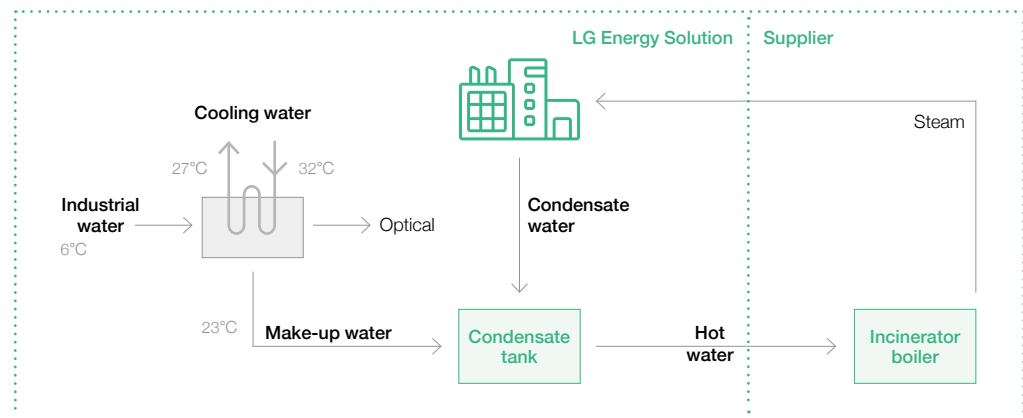
Based on our analysis on energy use, more than 70% of our GHG emissions comes from the use of electricity (Scope 2). By joining RE100 initiative in early 2021, we declared to make transition to 100% renewable energy by 2030, by which it is expected to reduce significant amount of GHG emissions. In addition, with a view to reducing GHG emissions from direct sources (Scope 1), including from the use of LNG, we will continue to explore measures to improve energy efficiency, such as improving the production process and introducing highly efficient production facilities. On the long term, we aim to achieve carbon neutrality by 2050.

### Energy Saving / GHG Reduction Activities

LG Energy Solution sets annually an energy saving plan, aiming at saving about 5% of the total energy consumption estimated for the year. In particular, Ochang Plant in Korea won Top Energy Management Leadership Award at 2016 Clean Energy Ministerial (CEM), which convened 24 countries, including the U.S., EU and China, and 3 international organizations including IEA. It continues to explore and carry out activities to reduce energy consumption.

Key energy saving activities include establishing an eco-friendly key energy saving activities related to the improvement of the production process, including circular resource system that generates steam reusing the heat from solid waste incineration, an exhaust heat recovery system. Furthermore, we keep exploring and devising various measures to save energy consumption and thereby reduce GHG emissions at business sites, including optimizing the heating, ventilation and air conditioning system, improving the efficiency of chiller and cooling tower, and introducing Factory Energy Management System (FEMS). In addition, we developed and distributed a technical manual compiling technologies and good practices of saving energy consumption over the past decade, as well as relevant theories and methodologies to support the mainstreaming of energy saving and GHG reduction into the daily work of our staff.

Incineration Heat Circular System



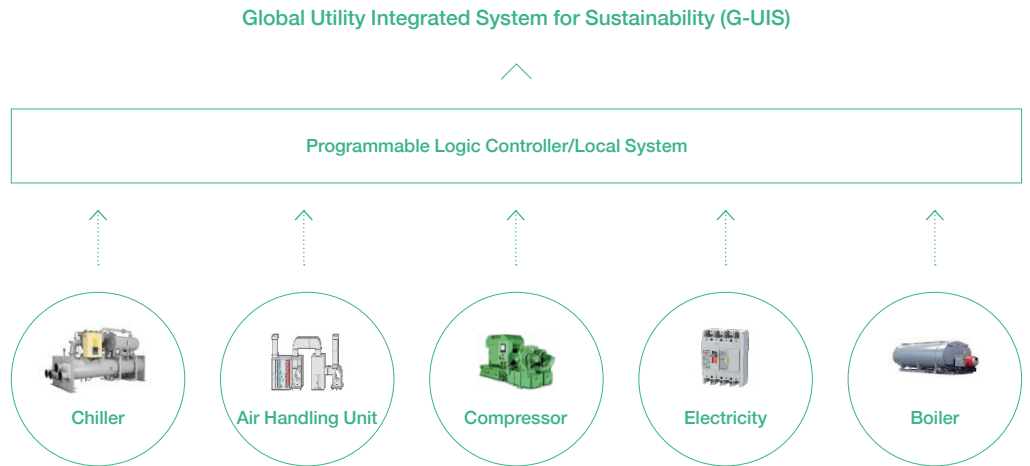
### Energy Management System

In 2020, LG Energy Solution established the Global Utility Integrated System for Sustainability (G-UIS) that integrates the energy consumption management across all business sites and manufacturing facilities. G-UIS applies the standardized monitoring package (gauge, operating system display, etc.), and at Ochang Plant, it collects the real-time data on energy use from approximately 60,000 measuring points.

G-UIS helps to manage facilities in a stable and efficient manner by processing information relevant to analyzing energy consumption status and providing real-time information on any issue emerging from major facilities. In addition, it offers various data analysis tools to identify areas of improvement, estimate the level of energy consumption, improve efficiency of facility management, and carry out predictive maintenance.

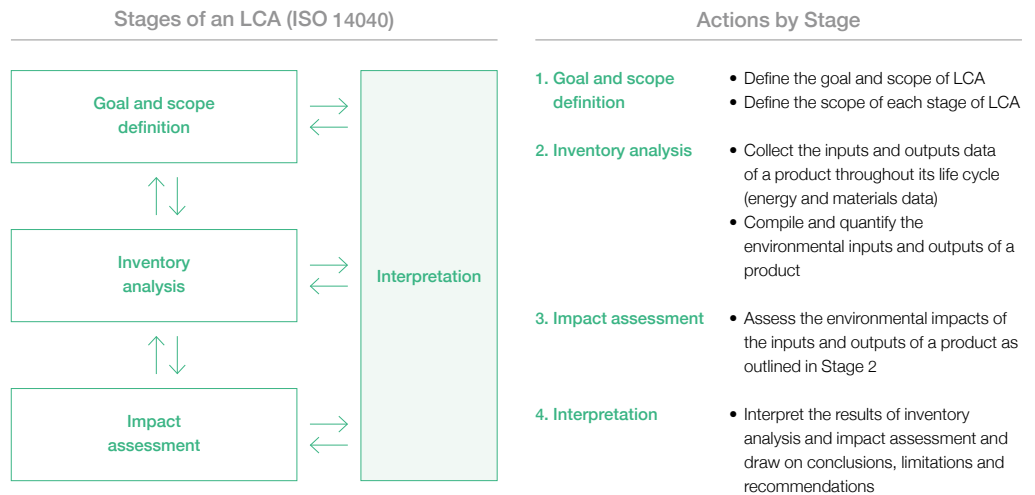
Currently, we are expanding the application of G-UIS system in the business sites in China and Poland and plan to introduce the system in the U.S. in 2022, thereafter to integrate the energy management system across all global business sites. Furthermore, we have established an “energy efficiency indicator system” in conjunction with the production management system to manage energy intensity of and GHG emissions from each site and line product.

G-UIS Structure



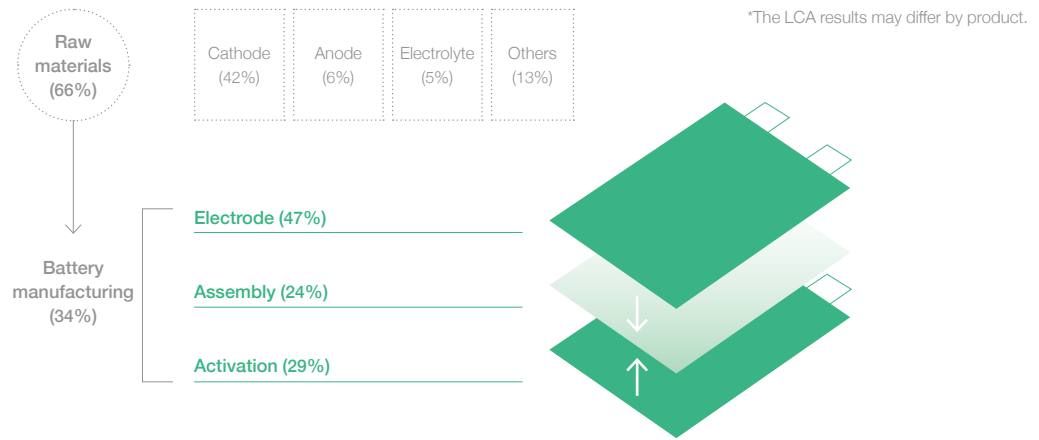
**Product LCA Management**

Life Cycle Assessment (LCA) is a methodology framework for assessing the environmental impacts of a product life cycle, from cradle to grave. LG Energy Solution undertakes LCA of key products and communicates thereof with relevant stakeholders, including its customers.



In line with more and stronger policies and regulations regarding GHG emissions and recycling of batteries in EU and other countries, it has become critical to minimize the environmental impacts of a product. LG Energy Solution aims to reinforce its competitiveness as leading a low carbon industry worldwide, by calculating product carbon footprint by battery model and acquiring eco-labeling. In addition, we are developing an LCA methodology based on the analysis of relevant methodologies (including ISO 14040/44 and K-ecolabeling), with a view to undertaking LCA in a reliable and accountable manner that meets global standards. We have been also engaging in global initiatives and relevant consultation process to represent the industry in the design of LCA methodology for batteries as part of EU directive.

An LCA of a battery involves inventory analysis of the product, including raw materials and production systems, collection and analysis of data covering the life cycle, and assessment of environmental impacts of the given product. Our LCA of products show that significant level of environmental impacts results from raw materials, such as cathode, which means GHG emissions reduction in raw materials supply chain, as well as in the production process, is important to enhance the product sustainability.



### Facilitating engagement and cooperation of suppliers for GHG reduction

More than 60% of the GHG generated from the battery production attributes to raw material production, in particular, cathodes and anodes. As a result, suppliers' engagement and cooperation is key to reducing GHG emissions throughout the entire value chain. LG Energy Solution compiles energy/GHG data provided by raw materials suppliers and utilizes it to quantify inputs and outputs of a product in LCA. Further, we support the transition to renewable energy and the establishment of highly efficient facilities in supply chain and develop a long-term plan to reduce GHG emissions in the entire value chain.

### Developing an LCA Calculation System for Product Sustainability Management

The requests from key stakeholders, including governments and customers, are increasing to manage and reduce environmental impacts of a product through its life cycle. In particular, partners from EU call for various measures to reduce product carbon footprint as a means to addressing climate change.

LG Energy Solution is developing an LCA calculation system to assess the environmental impacts of the products. In doing so, we are developing an LCA methodology taking relevant regulations and guidelines into account and plan to link it with the in-house portal system to facilitate LCA process. Given that third-party LCA verification is expected to become mandatory in near future, we plan to utilize the methodology and results of LCA to acquire eco-labeling, including EU Product Environmental Footprint and Korean eco-labeling.

# Circular Economy

## Background

The rapidly growing EV market and increasing demand for rechargeable batteries has now drawn attention to the treatment of used batteries given its environmental and economic impacts.

In general, EV battery is considered to have completed its life cycle when it has degraded to 70-80% of its initial capacity. Although the residual capacity may be insufficient for automotive use, it could be re-purposed in other applications. It could be reused for different purposes and dismantled thereafter to extract and recycle critical materials such as Lithium, Cobalt, Nickel and Manganese. By doing so, environmental loads can be reduced and residual value of batteries can be maximized. As a result, building a circular economy for batteries has become an important ESG business model in battery manufacturing industry.

LG Energy Solution is striving to build a closed-loop throughout the value chain ranging from raw materials to production, consumption and disposal of batteries. With a view to meeting global environmental standards, we are collaborating with local partners to reuse batteries as well as recycle the scraps generated during the production process. In particular, we have established a closed-loop in the respective business site in China, by which the used batteries and/or the scraps generated during the battery production are purchased by local recycling companies and the extracted Nickel, Cobalt and Lithium are recycled to produce cathode. LG Energy Solution will capitalize the closed-loop to secure the used batteries.

## Strategy/Policy Toward Circular Economy

Based on the wealth of experience and technologies, LG Energy Solution has come up with various means of reuse and recycling of batteries—for example, reuse in ESS, recycling of scraps generated during the production process by applying the optimal recycling technology.

- ① **Reuse:** Used EV batteries could be reused depending on their residual capacity and state of health. We continue to research and develop technology to create various business models, such as battery reuse in ESS and pioneer the establishment of battery circular (second use) ecosystem in collaboration with key OEM partners. We plan to start demonstration of relevant business models across global business sites [starting next year] and strengthen the circular economy by linking with recycling thereafter.
- ② **Recycle:** Batteries that have completed the lifespan or cannot be reused anymore, and scraps generated during the production process could be recycled. A closed-loop entails dismantling waste batteries and scraps, dissolving them, extracting raw materials such as Nickel, Cobalt and Lithium, and using them to produce cathode. The closed-loop, once built, can facilitate recycling of batteries. To this end, our business sites in Europe and the U.S. are strengthening strategic partnership with companies that can offer an integrated management of closed-loop, ranging from extracting metals from used batteries and scraps to production of cathode.

Battery Circular Ecosystem

