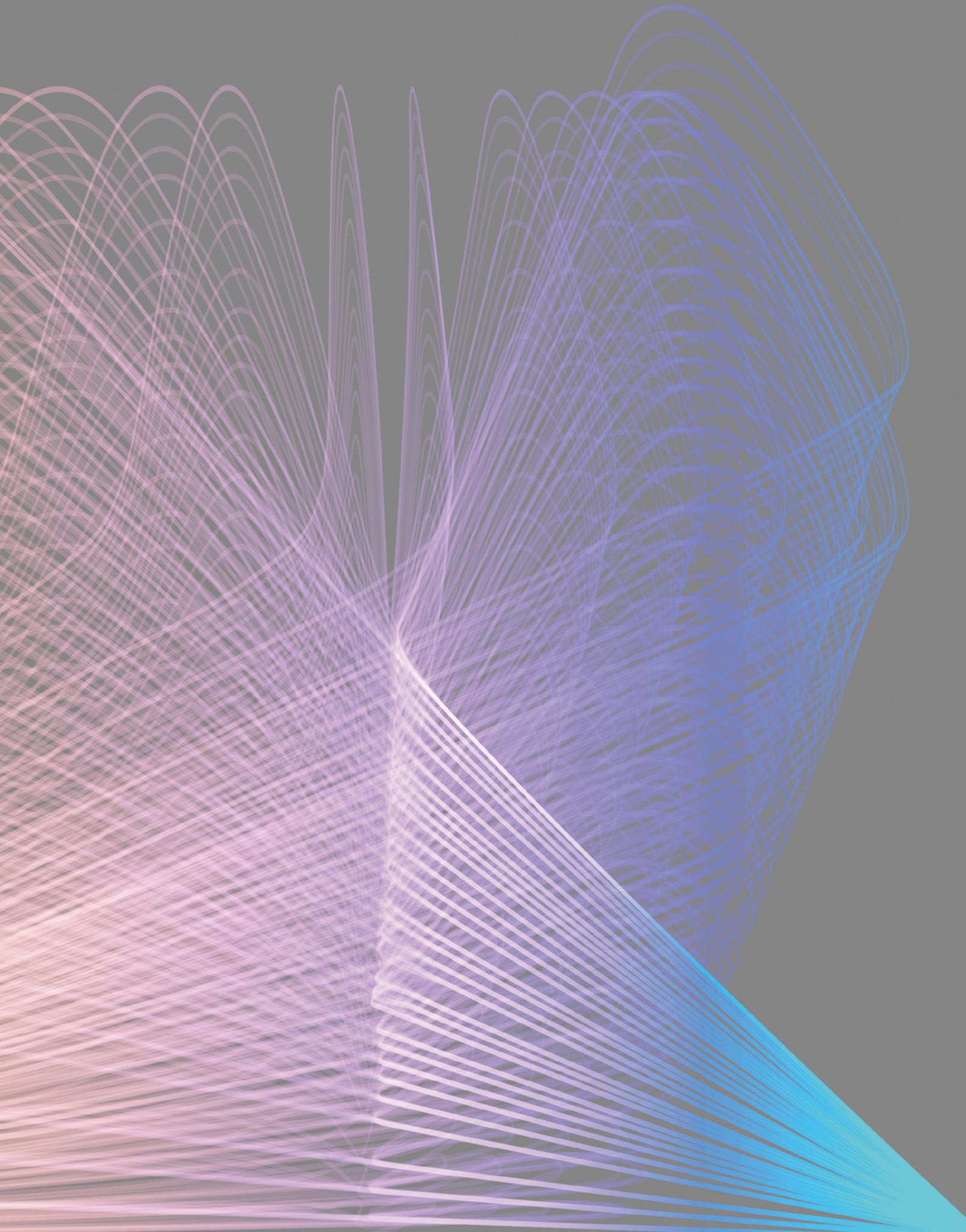


MATERIAL ISSUES IN 2018

# MATERIAL ISSUE IN 2018

- 30 Securing Future Growth Engines
- 38 Securing Product Quality and Safety
- 42 Promotion of a Safe Workplace Culture
- 46 Climate Change Response
- 50 Human Resource Management
- 54 Management of a Sustainable Supply Chain
- 62 Sustainability Data



# 01

## Securing Future Growth Engines



### WHAT ARE THE IMPORTANT ISSUES?

Based on our innovative mindset and strong executive ability, we seek to secure market-leading differentiated technologies and achieve high quality-growth required for sustainable corporate growth.

Innovative technologies change the way we live and work from the unparalleled impact they have on all aspects of the economy and society. Differentiated technologies are necessary to lead the industrial ecosystem in a market dominated by fast-changing technology trends. We strive to strengthen our market leadership by focusing on securing innovative technologies that will lead us to greater growth.

### OUR APPROACH

As a provider of top-rank materials and total energy solutions, Samsung SDI strengthens its technological competitiveness through consistent investment in R&D. We strive to lead the industrial ecosystem by developing innovative products that will pave the way to the future, through tireless work to make improvements in our products and technologies. We make every effort to secure innovative and differentiated technologies in all areas of development, manufacturing and sales so that we can continue to achieve both quantitative and qualitative growth.

### KEY INDICATORS

Revenue by Business Area	Unit	2016	2017	2018
Energy Solutions	KRW 100 million	34,302	43,324	<b>69,542</b>
Electronic Materials	KRW 100 million	17,706	20,142	<b>22,041</b>
Total	KRW 100 million	52,008	63,466	<b>91,583</b>

R&D Investment

604 billion KRW

Domestic R&D staff

2,260 persons

No. of patents

14,384

## STRATEGY AND MANAGEMENT APPROACH

### Small-Sized Li-ion Batteries

#### Prospects for the Global Market

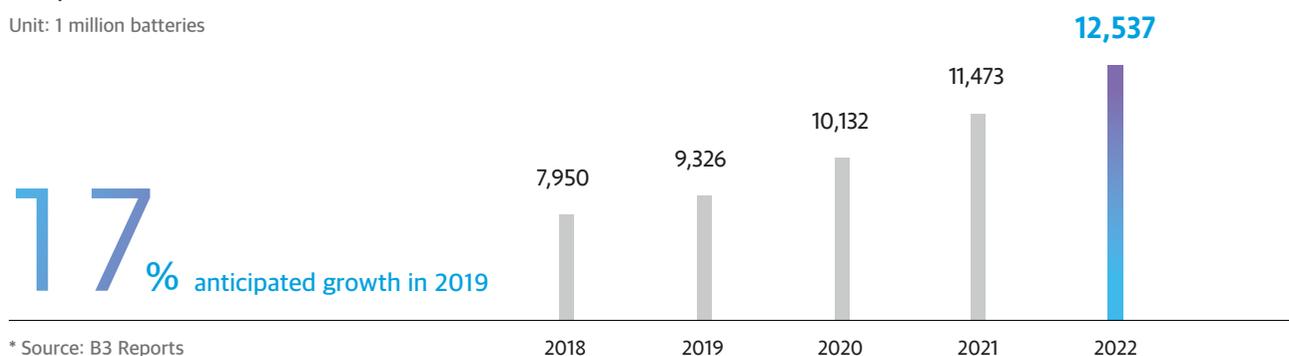
In 2019, demand in the small-sized rechargeable battery market is expected to grow by 17% from the previous year, recording a total of 9.3 billion cells. Most notably, in view of an ever-growing use of Li-ion secondary batteries in non-IT applications such as power tools and vacuum cleaners, demand for these appliances is expected to grow by 20% or more over previous years. In addition, the mobility market for electric vehicles and scooters equipped with cylindrical batteries is dramatically expanding, accelerating the small-sized li-ion battery market. The IT Division forecasts the launch of 5G services along with the full-fledged commercialization of IoT technologies integrated with AI, in addition to the proliferation of new devices such as wearables and Bluetooth headsets. We will strive to further strengthen our market leadership in all IT and non-IT related fields by taking the lead in developing innovative secondary battery technologies.

#### Business Strategy and Plans

We provide optimized solutions to diverse IT device markets, including smartphones, laptop PCs, and wearable devices. In the new small-sized Li-ion battery market that grows fast amid the growing trend of eco-friendliness and high-efficiency, we lead the market and expand our business portfolio based on our differentiated technological capabilities. Following increased profits in 2018, we plan to push for consistent growth in sales and higher profits through stability. As for our polymer product groups, we will strive to further expand our sales based on the increased application of these products to diverse IT products. With respect to cylindrical product groups, we will expand the development and release of differentiated products while maintaining our market dominance.

#### Prospective demand for Small-Sized Li-ion Batteries

Unit: 1 million batteries



#### BUSINESS CASE



#### Achieved the world's highest power and capacity in cylindrical 21700 batteries

Samsung SDI has developed and started mass-producing 4.0Ah batteries in the category of cylindrical 21700 battery cells for the first time in the world. Previously, 18650 batteries were widely used as a common form of cylindrical batteries, but with the advent of new applications, demand for high-capacity batteries has increased and we launched 21700 batteries with higher energy capacity to meet the demand. Through the application of new materials with a high energy density, the capacity of the 21700 4.0 Ah high-power battery increased by more than 33% compared to the existing 18650 product, allowing us to roll out the world's highest-power product through the development of new design technology optimized for high-power batteries. Through this, we expect to strengthen our company's technological leadership and further consolidate our position in the high-power battery application market encompassing power tools, gardening tools and vacuum cleaners.

# Automotive Battery

## Prospects for the Global Market

In 2018, our xEV sales increased in major global markets, including China, Europe, and the Americas, by 25% over the previous year. In 2019, automakers are expected to launch diverse EV models with longer ranges and it is predicted that longer-range autonomous EVs will lead the market. By 2022, the number of EVs sold per annum is expected to surpass 10 million, with the sector accounting for 10% of the entire auto market. Due to strict environmental regulations in Europe (aiming to cut automobile emissions by 37.5% by 2030), the ratio of diesel-fueled cars is declining, with countries like Norway, the Netherlands and Sweden planning to ban the sales and driving of internal combustion engine vehicles. China, the world's largest car market, has announced the introduction of a compulsory quota on electric/plug-in hybrid systems starting in 2019, raising the possibility of a dramatic increase in the EV market in the mid-to-long term.

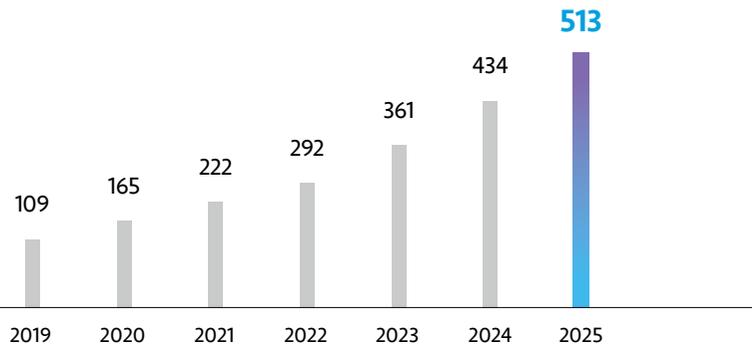
## Business Strategy and Plans

Countries around the world are introducing various environmental regulations to reduce carbon dioxide emissions and other air pollutants that originate from the exhaust of vehicles with internal combustion engines. Automakers are actively proposing alternatives, including electric cars, as an eco-friendly means of transportation. With our accumulated expertise in the mobile device battery sector, we are focusing on the development of high-efficiency, high-energy-density batteries for low-pollution vehicles. Simultaneously, we are promoting diverse investment projects and strategies to expand the launch of our new products equipped with new technologies in energy density and fast charging for Europe, the Americas, and emerging markets expecting consistent growth. Currently, global automakers are racing to develop new electric vehicles to meet the market demand and government policies around the world. For our part, we will strive to not only provide automakers with optimal vehicle battery solutions, but also fulfill our responsibilities as a partner that will lead the upstream and downstream industries in the EV sector.

### Prospective demand for EV batteries

Total demand (GWh)

**29%** CAGR



\* Source: IHS Markit

## BUSINESS CASE



### Fully Charged for the 'Auto 2.0' Era

We participate in domestic and international automotive trade shows to introduce our visions and technological capabilities. In 2018, we participated in various exhibitions related to automobile batteries at home and abroad, including the Detroit Motor Show in January, the Beijing Motor Show in April, EV Trend Korea in April, the International Electric Vehicle Expo in Jeju in May, the Volkswagen International Suppliers' Fair in October, and the Daegu International Future Auto Expo in November. At the Detroit Motor Show in January, we presented our own narratives about the three main subjects of EVs, PHEVs, and low-voltage systems, under the banner of "Charged for Auto 2.0." The automobile industry is shifting from the Auto 1.0 era led by mechanical internal combustion engines to the Auto 2.0 era represented by self-driving, EVs and ridesharing. At the trade show, we shared with our customers and consumers information about how our technological innovations in lithium batteries will power the vehicles of the Auto 2.0 era and shared our preparations for the challenges and opportunities of future changes in transportation.

# ESS

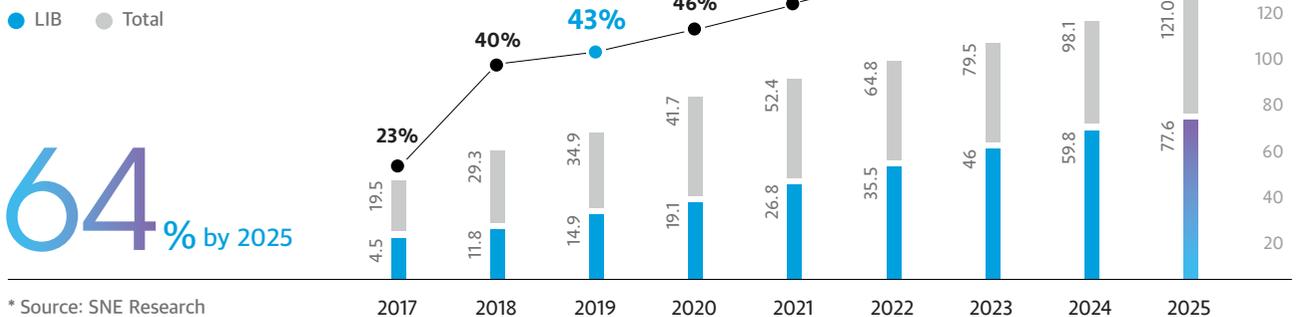
## Prospects for the Global Market

Amid the global trend of phasing out nuclear and coal power, there is an ever-growing interest in renewable energy, which raises the importance of ESS for increasing the efficiency of renewable power generation. The global Li-ion battery ESS market is expected to grow rapidly at a CAGR of 48% yearly from 4.5GWh in 2017 to 77.6GWh by 2025. Advanced countries such as the United States, Europe, Japan, and Australia are carrying out large-scale demonstration projects based on ESS-related government subsidies, with a focus on the stabilization of power systems suffering from the aging of their power grids, as well as on the promotion of renewable power generation, and for securing emergency power supply options. In addition, the installation of ESS is being encouraged systematically through the enactment of mandatory ESS installment bills and the implementation of subsidies for the connection of renewable energy and ESS. Korea is expected to grow steadily in this sector: the government is implementing the REC (Renewable Energy Certificate) policy and is providing support for the development of the ESS industry in accordance with its "Renewable Energy 3020 Implementation Plan." Recently, emerging countries in the Middle East, Southeast Asia and Africa are joining the global ESS expansion trend led by the developed countries. In 2019, further growth is expected in the global ESS market.

## Business Strategy and Plans

With ESS as our flagship product we have continued to expand our market share in advanced economies such as Japan, North America and Europe. We now focus our market expansion on emerging markets while increasing the application of our products from power generation and commercial purposes to residential and UPS batteries. In 2019, we expect ESS to further expand their role as key components in improving the efficiency of the power grid. We have established a strategy to meet the demand for ESS solutions in connection with the stabilization of the power grid following increases in solar and wind power generation. In line with the increased virtual power plants (VPPs) and needs for self-consumed PV energy, we will continue to expand our sales to other applications such as commercial and residential ESS. In addition, we will take the lead in the transition to LIB, with our advantages in improved features and competitive prices in the UPS/telecommunication market dominated by lead-acid batteries with more than a 90% market share. In 2018, our ESS battery sales was more than tripled but as an attempt to better our sales record, we will continue to expand our overseas markets into Australia, the Middle East and Southeast Asia, and find new customers around the world throughout 2019.

Prospective demand for Global LiB-ESS



\* Source: SNE Research

## BUSINESS CASE



### Launch of a differentiated household (high-voltage) battery module

Samsung SDI has launched a new ultracompact and lightweight household battery module that utilizes cylindrical 21700 cells (4.1 Ah) of high-energy density. Previously, household ESS generally used an expensive PCS (power conversion system), as they depended on a low-voltage 50V class battery modules whose energy efficiency dropped in the power conversion process to high-voltage (200V, 400V). In 2018, we launched a 100V high-voltage module with cylindrical 21700 cells (3.3 Ah), allowing the system integrator to achieve a high-voltage battery system without the use of an expensive PCS, and providing an opportunity to shift technology trends in the industry to high-voltage systems. In 2019, we have launched another new product, a high-capacity compact product with an increased energy capacity of more than 50%, and an energy density that has almost doubled compared to previous models. In addition to satisfying the needs of household customers who prefer a small-sized ESS, the new 18kg product, with the smallest weight in its class, meets the needs of installers who want to carry and install it themselves (less than 20kg). With the world's top technological competitiveness, we will continue to lead industrial trends and launch battery solutions that can satisfy all stakeholders (consumers, system integrators, installers) in our value chain.

## Electronic Materials

### Prospects for the Global Market

The semiconductor market is said to be leveling off after the memory semiconductor boom that lasted for years. Yet new demand is expected to grow due to the expansion of artificial intelligence and self-driving cars. Competition for the ultra-miniaturization of semiconductors will most likely continue to meet the demand of advanced technologies and various data processing, which requires innovations in technologies and materials in the industry. In the display sector, the LCD market is now dominated by Chinese panel manufacturers on the heels of their aggressive investment, causing previous market leaders to shift their technological focus to OLED.

Most notably, the emergence of new form factor products such as foldable phones in the sluggish smartphone market is driving the development of new innovative materials related to displays.

### Business Strategy and Plans

The electronic materials business is technology-intensive and therefore must accurately forecast the trends of product cycles and technological changes in upstream IT industries, such as semiconductors and displays, and timely launch new products based on differentiated technologies. Samsung SDI maintains its distinctive competitiveness by securing key technologies through close technical cooperation with customers and ongoing R&D investment, in addition to a business structure that can minimize risks stemming from fluctuations in the upstream market through rigorous quality assurance and a robust product portfolio. As fierce competition is anticipated for the semiconductor and display industries in 2019, we plan to expand our profitability by strengthening our existing product portfolio while laying the groundwork for business expansion through rapid product development and solution presentation, largely in high growth markets like China. Most notably, in order to secure new growth engines that will lead the rapidly changing technology trends, we will establish a system in which we can preemptively respond to our customers' needs for pioneering next-generation products such as foldable phones, Quantum dots, and ultra-fine semiconductors, to develop and supply new materials in a timely manner.

Sales of Electronic Materials | Annual sales (Unit: KRW 100 million)



#### BUSINESS CASE

##### Turning a crisis into an opportunity: record-breaking performance by the POL business

LCD prices have fallen rapidly, compounding the difficulties faced by materials suppliers. Our flagship product, the polarizer film, also had a negative outlook due to deteriorating upstream market conditions. In spite of such an unfavorable global market environment, we focused our attention on China. While experiencing a steady increase in supply, we also increased the product proportion for the market, and embarked on the improvement of our manufacturing competitiveness. The development of new mobile products in a timely manner and the restructuring of our product portfolio together enabled us to overcome unfavorable market conditions and achieve the highest business performance yet. Most notably, we have stabilized the POL production lines in Wuxi, China, allowing us to supply products to local customers in a timely manner and to respond to Chinese panel manufacturers that keep increasing their production capacity. We are growing steadily despite worsening business conditions in the upstream market.

## Research and Development

### Enhancement of R&D Capabilities

As a supplier of excellent eco-friendly materials and a total energy solution provider, we continue to secure new technologies and enhance our technological competitiveness through continued investments in R&D. We have expanded our business from cutting-edge materials to components, which enabled us to grow into not only a materials supplier for secondary batteries, IT and auto parts, but also a specialized energy company. Since 2014, when our Battery R&D Center and Electronic Materials Business Division moved to Samsung Electronics Materials Research Complex, we have also created a synergistic effect in our joint R&D projects. We will strive to secure global technology leadership by adding our materials technologies and capabilities to our competitiveness in the future energy business sector.

### Open Innovation

Through enhanced industry-academia cooperation with external specialized institutions and universities, Samsung SDI secures next-generation technologies and nurtures human resources with great potential. Since 2016, we have continuously pursued industry-academia cooperation with leading universities in the battery research field, including partners such as Seoul National University, POSTECH, Hanyang University, Sungkyunkwan University, and UNIST, to secure next-generation battery technologies. Through such cooperation, we are carrying out research on all aspects of batteries ranging from materials needed for better performance of batteries to evaluation methods required for better safety in manufacturing. We maintain ties with the universities to ensure that a systematic research environment is maintained between the staff and us, and that researchers build effective teams with professors and students to carry out joint research projects and train the students to become talented individuals with expertise in the process.

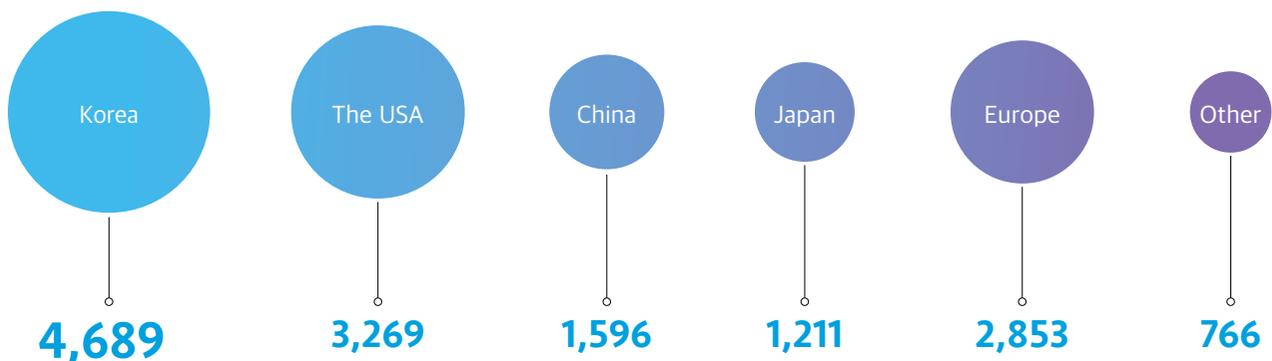
### R&D Organization

We run research and development organizations within the SDI Research Center, the Small-Sized Battery Division, the Mid- and Large-Sized Battery Division, and the Electronic Materials Division, and enhance our global technological leadership through collaborations between the organizations. In addition, we are strengthening our research and development of secondary battery materials and striving for the stabilization of raw material supply. For batteries, materials determine the product characteristics such as energy density, lifetime and output, and their costs account for more than 50% of the battery's price. As a result, the competitiveness of materials is of utmost importance. Samsung SDI runs the SDI Research Center at the Samsung Future Technology Campus which serves as Samsung Electronics Materials Research Complex in Suwon, Korea. The center plays a pivotal role in the development of materials for IT, xEV, ESS batteries. Under the three-pronged strategy of Timing, Differentiation and Collaboration, Samsung SDI Research Center strives to develop new differentiated technologies through collaborations in a timely manner.

### Patent Management

We are developing high-capacity/dense batteries for the next generation, and we are expanding our market share by applying them to battery products used in electrical vehicles and electric storage systems. We are also preventing patent disputes and securing technological competitiveness through efficient management of market leading patent applications and registered patents. Most notably, we enhance our patent competitiveness in material technologies by obtaining patents on the research results of core materials for secondary batteries, semiconductors, and OLED display technologies. As of 2018, we owned 4,689 registered patents in Korea and 9,659 registered patents in major overseas markets including the U.S., Europe, China, and Japan.

Patents Registered | Unit: cases



## Leading Future Markets based on Technological Leadership

In a market that follows fast-changing technology trends, Samsung SDI seeks to lead the industrial ecosystem by focusing on securing differentiated technologies for bigger growth. We strive to secure innovative and differentiated technologies in all areas of development, manufacturing, and sales. We work tirelessly to achieve both quantitative and qualitative growth.

### Development of High Energy Density Automotive Batteries

We are continuously working to develop safe long-range batteries to develop the eco-friendly EV market. In 2018, we developed high-capacity and long-life materials based on the existing cell structure along with high-density electrodes equipped with secured endurance and safety. We consequently improved energy density by more than 20% compared to existing products. In 2019, we plan to begin mass-production. In addition, we are developing new innovative structures and processes that overcome the structural limits of existing products.

### Certified by NFPA (National Fire Protection Association) for ESS Installation

Following the US government's requirement for NFPA certification, we established a cooperation system with the UL, the exam administrator, to expedite the procedure for the mandatory certification program. As a result of thorough preparation for preliminary and main certification evaluations, we were accredited in December 2018 for the first time in Korea. The NFPA accreditation maximized our competitiveness for new orders in the Americas in 2019 and we are looking forward to driving up our market share in the American market with a sharp uptick in sales.

### Development of the Industry's Highest-Capacity Highest-Power Cylindrical Battery for Power Tools

This 35A continuous discharge battery is the world's highest-rated 4.0Ah class and comes in the new standard 21700 size (21mm diameter, 70mm height). We have achieved the highest capacity and ultra-high output through our proprietary technology, the SCN (Si Carbon Nanocomposite) anode material and a low resistance multi-tap design. This enabled us to start mass production ahead of the industry, which contributes greatly to our top market share in the lithium rechargeable battery market for power tools worldwide. As it can also be applied to wireless cleaners, gardening tools and golf carts that require high power and high capacity, the product competitiveness is expected to rise, moving forward.

### Development of the Innovation Module Structure for Automotive Batteries

In order to increase the range of electric vehicles, we are continuing to develop technologies that can improve the energy efficiency of batteries. In 2018, we developed a multi-functional modular platform that has significantly improved our space efficiency, which in turn has increased the energy capacity per module while reducing its weight. We also strived to develop new technologies that use innovative materials and structures with the goal to lighten electric vehicles and improve space efficiency.

### Development of Optically Clear Adhesives for Foldable Smartphones (FOCA)

Having reached maturity, there are great expectations in the smartphone market for new innovative products. The foldable smartphone is anticipated to be a game changer in this stagnant market. Nevertheless, the required innovative materials are completely different from conventional ones because these phones will be required to endure being folded hundreds of thousands of times by users. We have succeeded in securing the FOCA technology that can be applied to foldable displays of various shapes and sizes, and began applying them to our customer's next-generation products.

The technology development has enabled us to gain recognition for our technological capabilities in the next-generation smartphone market that is expected to grow rapidly while laying the groundwork to emerge as a leader of related technologies.

### Timely Development and Supply of SOD, a Process Material for Semiconductor Fine Processes

In order to cope with the rapidly developing semiconductor makers' fine process technology, materials technologies must continue to evolve, too. We have developed and supplied various process materials used in semiconductor processes in a timely manner. For instance, spin-on dielectrics (SOD) which are a coating material used between semiconductor transistors or metal leads, has contributed towards enhancing productivity for customers, and helped reduce capital investment costs in line with their excellent process requirements. In 2018, despite difficult downstream market conditions, we were able to expand our supply not only to the captive market, but also in the external market through product development and supply cycles customized for our customers. In the same year, we won the SK Hynix Best Partner Award as proof of our acclaim in technological excellence at home and abroad.

## Main R&D Performance in 2018

R&D	Expected Effects
Development of the industry's highest capacity and high-power cylindrical lithium secondary batteries for power tools	Contributions to market leadership with a 6-month advantage in mass production over competitors
Development of gap-filling tapes for the protection of electrode assemblies for cylinder-shaped secondary batteries	Improvement of anti-vibration features through the fixation and protection of inner components (jelly rolls) of batteries
Development of cylindrical cases for xEV Li-ion Batteries	Development of a specialized case tailored for EV batteries that have enhanced safety and reliability
Development of FOCA for foldable smartphones	Market leadership expected via the development of the industry's first highly durable FOCA
Development of OLED deposition materials	Advance into new markets through deposition materials resulting in higher efficiency and longer lifecycles
Development of next-generation polarizing films	Portfolio expansion through the timely development of polarizing films applicable to new display products
Development of high-luminance CR	Existing MS retention and new market development through products with enhanced functions such as higher luminance
Development of semiconductor EMC	Differentiation in product performance through next-generation processing materials and higher product quality
Development of SOD for fine semiconductor processes	Securing the captive market and improving external supply through timely development

## Enhancing Executive Abilities through Innovative Leadership

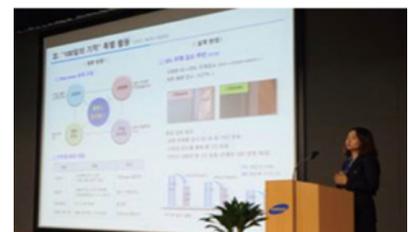
To lead the market amid growing market uncertainties and changing consumer needs, we need to equip ourselves with innovative perspectives and insights into our market. Samsung SDI will continue moving ahead on its path toward becoming the world's top-notch battery and materials company through a corporate culture strong in innovative thinking and executive abilities.

### System Integration to Enhance Executive Abilities

Previously, automotive battery and ESS business systems were carried out separately, resulting in unnecessary manual work to link the two. In 2018, we integrated supply chain management (SCM), product lifecycle management (PLM) and cost management systems for both. Now everyone in the business departments can access the system anytime, anywhere to communicate and reach decisions rapidly based on the same information. In 2019, we plan to promote process innovation (PI) and system integration for the entire battery department including the small-sized li-ion battery sector.

### “Tech Forum,” On-Site Improvement Activities through Innovation

Samsung SDI carries out various innovation activities such as “Tech Forum,” which focuses on the improvement of crucial technologies used in the battery manufacturing process, and on-site dialogues concentrated on loss reduction and workflow improvement. “Tech Forum” 2018 was composed of the presentation of outstanding cases by each business site, and “the exchange meeting of 5 major processes” consisting of electrodes, winding, assembly, formation module and packing. Most notably, the forum brought together key personnel in manufacturing and technology from overseas corporations as well as their counterparts in Cheonan and Ulsan in Korea providing an opportunity to upgrade the technological level of all our manufacturing bases by active benchmarking of outstanding cases.



# 02

## Securing Product Quality and Safety



### WHAT ARE THE IMPORTANT ISSUES?

We strive to become a company that contributes to society and humanity by supplying safe and eco-friendly products to our customers in a timely manner.

Product quality and safety are the essential factors required for sustaining continuous growth based on customer confidence. Strict compliance with the standards for product quality is required in the entire process, ranging from the management of supply and demand for raw materials, product design and manufacturing, to disposal. Samsung SDI pursues a close relationship with its customers based on trust and confidence by quickly and accurately responding to customer opinions under the quality management policy of “Creating Value for Customers, and Making the World a Better Place.”

### OUR APPROACH

To supply optimum batteries and electronic materials, we strive to develop products that reflect quality safety in diverse environments where our products are used through an analysis of market demand and consumer need. Most notably, for rapid and accurate quality verification, we have enhanced our leading and accelerated verification processes together with a certification processes - a measure required for us to produce robust designs. We strive to realize uniform quality anywhere in the world through the careful modification management and verification of mass-production feasibility. To that end, we train quality experts to enable them to secure expertise in their respective fields.

### KEY INDICATORS

KPIs	Unit	2018 Targets	2018 Records	Achievements	2019 Targets
Ratio of certified ISO 9001 auditors	%	16	20.2	●	21.3
Ratio of QM certifications (excluding ISO 9001)	%	29	33.1	●	34.8
Certified international quality experts (new)	persons	-	228	-	240

Ratio of ISO 9001 Auditor Qualifications

20.2%

Ratio of Quality Management Qualifications\*

33.1%

\* Excluding ISO 9001

## STRATEGY AND MANAGEMENT APPROACH

### Quality Management Strategy

By placing a top priority on product safety and quality, we roll out products that meet our customers' needs through close co-operations with them. In 2018, we upgraded the quality of our small-sized Li-ion batteries while reviewing the safety risks involved in automotive and ESS batteries. We pay particular attention to the achievement of uniform quality products across the globe through manufacturing standardization and automation. The Electronic Materials Division is enhancing its development QA to improve its warranty capabilities for new products. We are in the process of reviewing and evaluating new raw materials. In 2018, we expanded the scope of quality assurance by setting up CoA and accelerated evaluations for new products.

### Project Initiating System

We run Development (PLM), Production (MES) and Quality (IQMS, LIMS) systems based on global quality management systems such as the ISO 9001 and IATF 16949. We also clearly define procedures and decision criteria for each stage and comply with the 8 Main Quality Processes (development management, reliability, parts management, process quality, modification management, abnormal occurrences, shipping assurance, and VOC management). We continue making improvements to enhance product quality.

### QM Slogan



**Q** | Become a quality expert that can Quickly verify Quality.

**Ace** | Become an Ace in the QA Office through capacity building.

**Pride** | Have Pride in the company, your department, and your work.

**Relationship** | Maintain a good Relationship through close communication.

**Open** | Approach other departments with an Openness for collaboration.

### 8 Major Quality Processes



### Quality Management Policies



## Securing Product Quality and Safety

### Enhanced Quality Assurance

For our automotive and ESS batteries, we conduct quality assurance for the entire process covering raw materials all the way to the delivery. In the event of a customer issue, we review the entire process, focusing on foundational areas such as mass production and product development to come up with basic solutions. In addition, our development organization consists of design, PA (Process Architecture) and PE (Product Engineering) to guarantee the balance needed for the final products through a mutual verification at each work stage. For small Li-ion batteries, we have set up a Q-FMEA (Failure Mode and Effect Analysis) database to expand the relevant evaluation coverage, which has enabled us to improve quality assurance through a shift from passive inspection methods to preemptive inspection methods that include a massive drop in verification analysis and safety verifications under harsh conditions.

As for electronic materials, the Quality Assurance (QA) function is strengthened to ensure quality development procedures. New raw materials are undergo inspection and evaluation and in 2018, we expanded the range of QA by using CoA assessments and setting up evaluation methods to verify the changes in physical properties that may occur during the storage period.

Also, we are carrying out activities to strengthen QA for mass production in order to meet the detailed satisfaction demands of the customers. We have also enhanced our monitoring system with the establishment of the Full Pattern Analysis (FPA) to place our QA system at the highest level.

### UL9540A for ESS



This year, Samsung SDI attracted attention with its further improved safety design technology. The company demonstrated its unrivaled safety design capability by meeting the industry's first ESS fire-resistance test standard from Underwriters Laboratories (UL), a global safety certification company. With this technology, Samsung SDI is set to be a leading company for much safer ESS.

## Quality Management Improvement Efforts

### Support for Partners' Quality Improvement

We support our partners' quality assurance activities by sharing our quality assurance manual with them. We select the inspection criteria from our customers' perspective and have our partners carry out the necessary quality improvements. To prevent any technical issues in advance, we conduct quarterly quality technical reviews on important materials. For automotive and ESS batteries, we placed the focus on the development of their global competitiveness in 2018 through three major shared-growth tasks: support for securing competitiveness, strengthening fair trade processes, and enhancing future technological cooperation. We selected suppliers to produce parts for our plant in Hungary and worked together to improve productivity and quality in response to increasing supply volumes. We also carried out manufacturing innovation activities through the analysis of the partner's defect rate and solutions for chronic problems through QBR (quarterly business review). For electronic materials, demand for the polarizing film is growing for mobile devices. We have organized task forces to provide the technical support required for quality improvement and management of relevant overseas partners.

### Support for Quality Improvement of Overseas Branches

As a way to further enhance our global competitiveness, we provide support to our overseas branches to assist them in their quality improvement efforts so that we can manufacture products with uniform quality, worldwide. For our automotive and ESS batteries, we dispatched quality experts from our mass-production and parts quality departments to our Hungarian production corporation that launched the mass-production of xEV cells/modules in 2018. The experts were sent to train local personnel based on their accumulated experiences and know-how. The efforts resulted in the technological sophistication of a local workforce and an improvement in quality for our global products. The corporation is ready to supply cells/modules to various OEMs in 2019. For electronic materials, we dispatched manufacturing, technology and quality experts from overseas to transfer their polarizing film manufacturing know-how. A forum has been set up to discuss issues and find solutions as soon as possible from among the local workforce, resident employees, and dispatched personnel from the Cheongju production plant.

### Enhancement of a Global Statistical Quality Assurance System

For small-sized Li-ion batteries, we have established a management system for three major control items (Capacity, IR and filling volume) to make improvements in warning rates while running a weekly counseling system to improve the analysis and response capabilities of our overseas corporations. In addition, we have made improvements in facility defect rates through the development of an activating the Tray Map analysis system, which has led to a shorter analysis lead time and lower activating defect costs.

## Product Quality Enhancement from the Customers' Perspectives

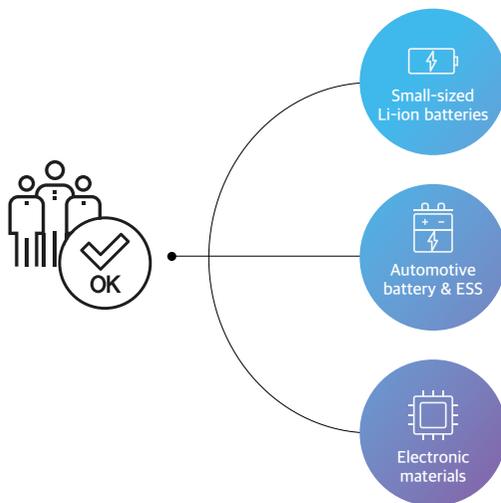
### Product Quality Enhancement through VOC Collection

We have improved our product quality competitiveness by managing customer related items such as voice of the customer (VOC) and defect rates from customers as KPIs in our management activities. In addition to our real-time communication channels with customers, we fielded customer complaints and requests directly through our global response system. As for collected opinions, we analyzed our customers' opinions and made improvements quickly according to the response process so that quality upgrades can be made for customers satisfaction. In 2019, we will prevent quality incidents from happening by managing the trends in process and market defect rates while further consolidating our reputation for product quality by focusing on the prevention of the recurrence of the same defects based on our improvement activities tailored for each customer based on our VOC pattern analysis.

### Raising Customer Satisfaction

Samsung SDI regularly performs detailed customer satisfaction surveys for each business sector. The survey targets product quality and a wide range of other relevant criteria such as R&D competency, services, and deliveries for the purpose of establishing indices and scoring each criterion. The survey results are reflected in the product quality for each business sector and in infrastructure improvements. As for the small-sized Li-ion battery business, a Customer Satisfaction Index (CSI) survey was conducted for 23 major clients in 2018 to analyze customer complaints for categories such as quality characteristics and quality satisfaction progress and to make improvements in those areas.

### Customer Satisfaction for each Business Sector



	Unit	2016	2017	2018
Customer satisfaction score	Points	76.8	81.9	<b>82.0</b>
No. of surveyed companies	Firms	33	21	<b>23</b>
No. of surveyed customers	Persons	35	24	<b>25</b>
Customer satisfaction score	Points	82	86	<b>90</b>
No. of surveyed companies	Firms	2	4	<b>4</b>
No. of surveyed customers	Person	2	4	<b>4</b>
No. of surveyed companies	Firms	28	33	<b>26</b>
No. of surveyed customers	Person	182	190	<b>169</b>

\* As there are various types of products among businesses dealing with electronic materials, there is no overall score for customer satisfaction

### BUSINESS CASE



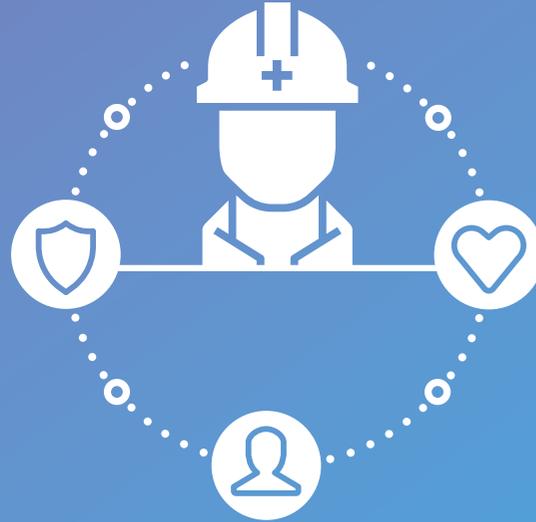
A FIB for Early Analysis of Defects

### Enhancement of the Customer Defect Analysis System

Samsung SDI secures battery safety quality and market safety quality through our high precision and high-resolution analytical power when it comes to dealing with defects reported by customers. Equipped with a high-resolution non-destructive Computed Tomography (CT) system, a Scanning Electron Microscope (SEM) for micro shape analysis, and a Focused Ion Beam (FIB) which is a micro cross-section shape analysis device, we are initiating improvements in the rate of cause identification of defects through mechanism analysis. We strive to detect and improve design problems of newly developed products and mass-produced goods early on in the establishment of the early defect analysis system and reflect on the implications in the guidelines for the development of new models to secure product stability and on-time product delivery.

# 03

## Promotion of a Safe Workplace Culture



Proliferation of a safe culture

3 Cases

### WHAT ARE THE IMPORTANT ISSUES?

We are building a safety management system while enhancing our monitoring efforts to prevent foundational causes of accidents.

SH&E is a top priority in business management. Furthermore, the recent amendment of the Occupational Safety and Health Act has expanded the management scope of SH&E to partner companies while requiring industrial accident prevention systems to operate companywide rather than at the level of each workplace to ensure strict accountability. Meanwhile, safety management is achieved by employees by identifying risks to the processes they are in charge of, and through subsequent activities taken by safety managers to prevent accidents, the significance of our employees' awareness of SH&E is emphasized.

### OUR APPROACH

With the belief that "All accidents are preventable", Samsung SDI implements preemptive risk management to prevent accidents in advance. Our efforts include technical management efforts such as facility pre-inspections and the horizontal implementation of accident recurrence prevention measures and comprehensive prevention efforts that include safety education and a culture of safety. Samsung SDI strives to create a culture of safety, transcending safety systems and regulations. Rather than merely strengthening systems and regulations, we are striving to create culture of safety so that employees can be aware and implement it on a daily basis. Most notably, we have expanded the target of our safety culture to partner companies in order to achieve a zero-accident rate at all our workplaces and those of our partners.

### KEY INDICATORS

KPIs	Unit	2018 Targets	2018 Records	Achievements	2019 Targets
Zero-accidents at workplaces	Case	0	8	●	0
Proliferation of safety culture (seminars, training, etc.)	Case	3	3	●	5

## STRATEGY AND MANAGEMENT APPROACH

### Safety and Health Management Policy

Following the revision of the Occupational Safety and Health Act in January 2019, Samsung SDI prohibits signing of all in-house contracts of partner companies regarding hazardous and dangerous work that involve plating, mercury, lead and cadmium. To promote the health and safety of not only our employees but also our partner companies' employees, we continue to make investments and take improvement measures.

### Safe Environment Norms

Under the management principle of "SH&E is the top priority of management," we have announced and implemented the ten commandments for a safe environment as action rules to make our workplace safe. The ten commandments for a safe environment that must be followed by all executives and employees are aimed at raising safety awareness ranging from safety philosophy to action principles and safety standards, and promoting voluntary compliance with safety rules.



### Operation of an Integrated Safe Environment System

We implement the management of safety, environment, health, chemical substances, and disaster prevention as an integrated system. Accidents are prevented through real-time monitoring. We continue making improvements in the system to make it easily accessible by managers and users. When necessary, we also benchmark other Samsung affiliates.

### Regular Evaluations and Monitoring

We regularly evaluate and inspect the safety of our environment and infrastructure to efficiently manage and detect ever-changing risks. We work on areas that are found to be problematic and spread the information horizontally, companywide. In 2018, we carried out an in-depth analysis of 347 weak areas in our domestic and overseas workplaces with the assistance of a professional organization. We continue to make improvements in our weaknesses with specific action plans.

### Safety and Health Risk Management

Samsung SDI conducts accident prevention activities such as monitoring to manage safety and health risks at manufacturing and construction sites. In the event of an accident, we devise solutions through an accident sharing meeting and take measures to reduce similar accident risks through the horizontal proliferation of the relevant information.

### Establishment of the Emergency Response System

Samsung SDI runs the CRO (Chief Risk Officer) system companywide. We have established an emergency response system to deal with emergencies such as safety and environmental accidents and to minimize damage through the systematic management of such situations.

	Normal	Emergency
<b>CRO</b>	<ul style="list-style-type: none"> <li>Hold companywide Crisis Management Committee meetings (semiannual).</li> <li>Facilitate regional S-CRO organizations.</li> <li>Check all accident-prone areas and order adjustments (issue a CRO Guide for each case).</li> </ul>	<ul style="list-style-type: none"> <li>Regular consultation and meetings ► convert to an emergency system</li> <li>Issue an emergency mobilization order for individuals and organizations and resolve situations or grant the authority to do so.</li> <li>Review recurrence prevention countermeasures and approve action results for each case</li> </ul>
<b>S-CRO</b>	<ul style="list-style-type: none"> <li>Host regional Crisis Management Committee meetings (quarterly).</li> <li>Check emergency notices and contact systems for each sector</li> <li>Follow up on activities to raise employee awareness on safety and accident prevention</li> <li>Check all accident-prone areas and order adjustments</li> </ul>	<ul style="list-style-type: none"> <li>Report to the CRO about the results of accident investigation and analysis</li> <li>Issue an emergency mobilization order for the necessary regional manpower and organizations and resolve situations or grant the authority to do so.</li> <li>Verify recurrence prevention countermeasures and perform inspections</li> </ul>

## Workplace Safety Management

### Identification of Potential Risks

Samsung SDI takes measures to identify potential risks to prevent major disasters from occurring. According to Heinrich's Law, to prevent 1 major accident and 29 minor incidents, we make every effort to reduce the number of 300 unreported occurrences through the identification of potential risks companywide and to manage risk by registering such risks in relevant systems.

### Industrial Safety and Health Education

To support safety management for employees, we carry out safety education sessions every quarter, online and offline depending on the job category. In consideration of the practicality of prior safety education and its relevance to actual job performance, we conduct selective safety education according to the employees' preference. For the frequent accidents, we conduct special training based on actual accidents. In addition to such regular training and prevention exercises, we also run the "Environment & Safety Experience Center" that features safety experiences and fire escapes to raise employees' safety awareness and to respond calmly to unexpected accidents through hands-on activities at the center.

### Promotion of a Safe Culture

Samsung SDI conducts an online safety education every quarter to support employee safety management. In consideration of the practicality of existing safety education and its relevance in the workplace, we offer selective safety education in accordance with the preference of our employees. We conduct special training for frequent accidents based on actual cases of accidents at our company. In addition to such regular training and prevention exercises, we also offer safety drills at our Environment and Safety Experience Center together with fire drills in the event of a fire to raise employee awareness for safety and to help them respond calmly to unexpected accidents through hands-on activities at the center.

### 100 Days of Miracle - "0" Accidents

(2018. 09. 01~2018. 12. 09)

1	Awards for potential risk identification (Manufacturing: 1 case/month, Others: 1 case/entire period)	All business sites
2	Established and implemented group ground rules: each group	All business sites
3	Awards for group rule compliance: once a month per group	All business sites
4	Took actions to improve locations where accidents occurred throughout 2018: weekly performance check	All production sites
5	Supervisor safety seminars and meetings : outside lecturers, etc.	All production sites
6	Safety education for shift manufacturing workers (online→offline)	Shift mfg workers
7	Secured safety education venues per business site	All business site
8	Launched a 30-day improvement system for all types of accidents	All business site
9	Launched the pre-project risk factor evaluation system	Production sites

### Spreading Safe Culture to Partners

We define the safety management for partners' as one of our responsibilities. We conduct companywide joint inspections to check their compliance to safety rules at each business site and request that corrective measures be taken when shortfalls have been detected. Most notably, we conducted safety seminars for partners' CEOs twice in 2018 to support their safety performance. At the seminars, we presented our suppliers' best safety practices, shared our safety policy directions and emphasized the importance of workers' safety awareness.

### Battery Safety Management

Samsung SDI recognizes the importance of preventing battery fire accidents and continues to make improvements in this regard. To that end, we have verified the ability of fire extinguishing agents according to battery fire characteristics and streamlined battery handling and storage processes while conducting education on battery risks and battery fire extinguisher exercises.

### BUSINESS CASE



### Seminar on Safety Consciousness for Partners' CEOs

To ensure a safe working environment for all workers at our workplaces, we carry out various activities to proliferate our safety culture. The commitment of the management staff at our partner companies is of utmost importance for all our workers to equip themselves with proper safety awareness and for us to achieve an accident-free workplace. In 2018, we held safety awareness and accident prevention seminars with our partner companies' CEOs. There were two seminars held in the first and second half of the year and 200 people from our partner companies took part. Participants shared the latest trends in industrial occupation legislation and built a consensus on the need to establish a robust safety culture.

## Chemical Substance Management

### Chemical Substance Management System

In July 2016, we established G-EHS system (Global EHS System) and since then, we have checked the legal compliance and conducted preliminary toxicity inspections (preliminary evaluations) for all the chemical substances we handle. In 2018, we upgraded this system. When registering information about new chemical substances an alarm goes off for any in-house restricted materials. To enhance the toxicity verification process, we now run a Substance Approval Committee. Most notably, we have expanded the application of our G-EHS system to our overseas corporations in Malaysia, Vietnam, and Tianjin and Xian in China where efforts are being made to stabilize and implement the system.

### Management of Chemical Substance at Workplaces

When purchasing and receiving chemical substances at our workplaces, we manage them according to our classification of chemicals (A, B, C)\* based on the regulations for substances prohibited by domestic laws and international norms. Class A (Banned Hazardous Chemicals) is not allowed into the business site. Classes B and C (controlled substances) can be used upon obtaining consent of the Substance Approval Committee following its review of the relevant substance replacement and reduction plan as well as potential risk prevention measures. In addition to eliminating the risks of legal violation caused by false information or input mistakes in the MSDS (Material Safety Data Sheet) of chemicals, and improving its reliability, we had an outside professional chemical substance consulting firm carry out a third party conformity verification in 2018 for a total of 576 chemical substances we manufactured including materials and semi-finished goods across the areas of MSDS reliability evaluation and the hazard information and data verification.

\* Class A: prohibited chemicals, Class B & C: controlled chemicals

### Work Environment Monitoring

We conduct work environment measurements every six months for our production and R&D divisions as well as our partner companies that handle chemicals which require legal measurements. We ensure that all our processes are maintained below the legally permitted exposure limits. For a pleasant working environment, we maintain chemical substances at 30% and specially controlled substances at 10% below the exposure limits.

### Management of Local Ventilation Facilities

To create a safe and pleasant working environment free from hazardous factors in manufacturing processes, we installed local ventilation facilities at locations dealing with chemical substances. We have the local ventilation systems inspected and evaluated more than once a year to ensure that the hoods, ducts, fans, etc. operate at the legally required flow velocity or higher. In 2016, we had an external consulting agency conduct a precise diagnosis of the local ventilation systems installed at our domestic workplaces. We made investments in facility upgrades to prevent the generation of hazardous factors and to enhance the air volume efficiency of ventilation facilities. In 2018, we applied the domestic improvement case to our overseas corporations and continued to improve working conditions there.

## Health and Healthcare Management

### Activities to Improve Employee Health

We ensure that employees with suspicious symptoms or health risks (obesity, hyperlipidemia, hypertension, diabetes) as a result of medical checkups will be able to receive sufficient follow-up care for their health. We conduct hazardous factor investigations every three years for those engaged in processes with the legally defined risk of musculoskeletal burdens. For new processes or changes in existing processes, we regularly conduct hazardous factor investigations and join forces with relevant divisions to make improvements where necessary. Our Cheonan and Gumi production sites run the musculoskeletal center to deal with musculoskeletal pain caused by lifestyle habits and work. Most notably, the Cheonan production site runs Total Health Care, a health promotion program that links its in-house clinic and gymnasium with the Medifit program to provide employees with high health risks with various services including physical strength measurement, strength training management and manual therapy to help them regain their health.



Medifit program at the Cheonan production site (manual therapy)

# 04

## Climate Change Response



### WHAT ARE THE IMPORTANT ISSUES?

**We run production sites at major countries that signed the Paris Agreement. We comply with relevant laws in all those countries.**

In order to act against climate changes caused by GHG emissions, the government has implemented the K-ETS in 2015 with a goal to reduce emissions by 30% or more from the Business As Usual (BAU) projected for 2020. Voluntary reduction efforts of companies are in demand for heightened effectiveness of such policies. With the development of battery technologies, the era of IoT (Internet of Things), connecting humans to things and humans to space, is shifting to the age of the BoT (Battery of Things). The importance of batteries continues to grow. They are recognized as key components of various products. Stakeholders' interest in the environmental friendliness of batteries is also rising.

### OUR APPROACH

Samsung SDI complies with the environmental regulations of the countries where its headquarters and overseas business sites are located. In Korea, we continue to reduce and manage GHG and energy according to the Korean Emissions Trading System (K-ETS). Overseas, we set up our own GHG and energy reduction goals and continue to cut down on GHG emissions. Also, we have actively participated in policy meetings in relation to the introduction of green energy. We are reviewing various systems being implemented at the locations of our major business bases.

### KEY INDICATORS

Category	Unit	2016	2017	2018
GHG Reduction	tCO <sub>2</sub> e	53,434	57,510	<b>52,877</b>
Energy Reduction	TJ	1,093	1,176	<b>1,081</b>

GHG Reduction

**52,877** tCO<sub>2</sub>e

Energy Reduction

**1,081** TJ

## STRATEGY AND MANAGEMENT APPROACH

### Climate Change Response Strategies

The Paris Agreement was signed in December 2015 at the COP21 to set up a new climate regime for 2020 and beyond. Compared to the Kyoto Protocol that required advanced countries to reduce GHG emissions, the agreement compels all signatories to reduce GHG emissions. Accordingly, all of them are required to submit their GHG emission goals and verify its implementation. To reduce GHG emissions, the major cause of climate change, Samsung SDI has made a goal of reducing its GHG emissions by BAU 30% for 2020 and have striven to reduce GHG emissions. We joined the K-ETS in 2015. Through the CDP, we also disclose our strategies to combat climate change and information on our efforts to reduce GHG emissions.

### Enhanced GHG Management of Overseas Corporations

We conduct GHG management education for our overseas corporations to improve their GHG management levels. In 2019, we plan to expand the application of our energy management system (s-GEMS) to overseas to help them enhance GHG management.

### Expanded Application of the Energy Management System

We strive to optimize our energy consumption through the expanded application of our energy management system (s-GEMS) to our overseas workplaces. We are implementing tasks designed to cut down on energy consumption. As for the volume of energy consumption, we seek outside monitoring and verification. We have also introduced a utility facility management system whereby we have shifted our focus from facility management centered on controls and oversight to system establishment designed to analyze our operation patterns and efficiency in relation to our plan for integrated data management so that we can carry out operation monitoring from the perspective of optimal efficiency. As we have completed the domestic application of the utility facility management system, we are planning to set up the system in all our overseas workplaces by the end of 2019.

### Management of the Environmental Impact of Products

To efficiently cope with the new global climate regime, we are implementing eco-friendly business management by developing eco-friendly products throughout their entire lifecycles and efficiently using resources and energy.

### GHG Reduction Goals | Unit: tCO<sub>2</sub>e

Description	2020 BAU emissions	Target year (2020)
 GHG Emissions	1,099,587	30% BAU reduction

\* The GHG BAU reduction goal refers only to the energy business sector.

## Climate Change Response Activities

### Participation in the Emissions Trading System (K-ETS)

To actively respond to global climate change related regulations, we have taken part in the country's K-ETS that went into effect in 2015. We are equipped with a carbon management system (MRV/ Monitoring, Reporting & Verification). We systematically manage our goals based on an IT system (s-GEMS). We undertook LED light replacement and waste heat recovery projects for all of our domestic workplaces during phase 1 of the ETS. Based on our monitoring system, we were acknowledged for achievements in our internal GHG emission reduction record (10,587 tons). In 2018, our GHG emissions increased due to the installation of new facilities and increases in production and product sales. We have made every effort to reduce GHG emissions through ongoing voluntary reduction efforts.

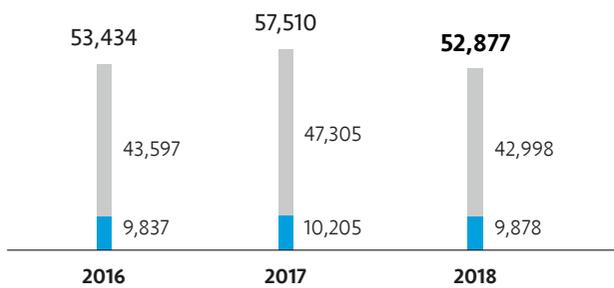
### Response to Carbon Disclosure Project (CDP)

The CDP is a non-profit organization that requests major listed firms in various countries to provide environmental management information on greenhouse gases and energy on behalf of financial institutions all over the world. Through the CDP, we transparently disclose information on our climate change strategies and our GHG reduction activities. There is a growing importance in the economic impact on climate change. We strive to analyze them objectively.

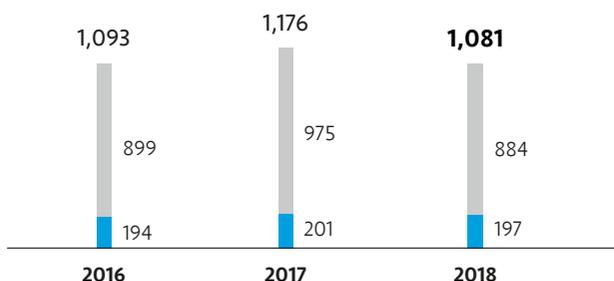
### GHG and Energy Reduction

■ Fuel ■ Power

#### GHG Reduction | Unit: tCO<sub>2</sub>e



#### Energy Reduction | Unit: TJ



## Energy Management

### Energy Conservation Activities

We actively promote energy consumption activities on behalf of energy consumers by setting energy conservation goals for business divisions and running a companywide energy conservation TF. For our major domestic workplaces, we conduct an energy efficiency diagnosis to identify reduction tasks. We make improvements in the operation of facilities that consume a lot of energy. We actively consider applying optimal technologies. We spare no effort in building low energy processes. In 2018, we changed the operation methods of the heating and cooling systems for the Training Center in our Giheung production site and optimized the operation of dehumidifiers installed at our Gumi, Ulsan, and Cheonan production sites as part of efforts to conserve energy.

### Major Energy Conservation Achievements

	Actions	Results
Gumi	<b>Improved React Heat Condensate Traps for Dehumidifiers</b> Our steam traps are designed to recover dehumidifier steam condensates and steam loss in operation which cause energy loss. We replaced them with orifice type steam condensate traps.	Energy Conservation LNG: 153,732 Nm <sup>3</sup> /year Electricity: 882,570 Kwh/year GHG Reduction : 751.61tCO <sub>2</sub> Savings: 190M KRW
Ulsan	<b>Air Volume Adjustment and Heating Temperature Change for Process Dehumidifier React Fans</b> The dehumidification rotors were not able to cope with changes in humidity standards according to seasonal humidity condition changes. There was an excessive amount of dehumidification exhaust. To resolve the situation, we adjusted the processed dehumidification air volume and extra measures determined through energy consulting.	Energy Conservation Power: 327,631 Kwh/year GHG Reduction : 152.758tCO <sub>2</sub> Savings: 33M KRW
Cheonan	<b>Optimization of Recovery Exhaust Air Volume for Dehumidifier Rotors</b> We optimized rotor recovery exhaust air volume through the measurement of the rotor recovery exhaust air volume of each dehumidifier.	Energy Conservation Electricity: 2,663,625kWh/year Savings: 270M KRW/year
Giheung	<b>Changes in Heating and Cooling Methods in Giheung</b> Changed the cold-water supply method from a hot & cold-water system to a refrigeration system for the training center building	Savings: 130M KRW/year

## Management of the Environmental Impact of Products

### Implementation of LCA (Life Cycle Assessment)

According to our customers' demand, we carried out an LCA whereby we analyzed the GHG emitted from the entire process ranging from raw material extraction to product disposal and used the results to improve energy efficiency and minimize the impacts on the environment. In accordance with the LCA Principles as specified in ISO14040/44, we conduct LCA by collecting environmental information on energy and utilities in the manufacturing process and for the components. We use the energy consumption information available on the s-GEMS to work on each process. Also, with the information available on the Bill of Materials (BOM) regarding product components as well as the EHS system, we also carry out an LCA about the period from production to shipping. We establish strategies to minimize environmental impacts based on the results of careful study including that of energy consumption during the production processes. We also seek to develop highly energy-efficient products and to maximize the utilization of renewable energy to improve our performance in energy efficiency.

#### LCA Processes

LCA	<b>Analysis of Product and Manufacturing Processes</b>	<ul style="list-style-type: none"> <li>· Analysis of battery manufacturing processes</li> <li>· Identification of process inputs and outputs</li> </ul>
	<b>Data Collection</b>	<ul style="list-style-type: none"> <li>· Inputs (raw materials, packing materials, power, energy, and industrial water)</li> <li>· Outputs (products, wastes, air, and water contaminants)</li> <li>· Transport information, etc.</li> </ul>
	<b>Data Processing</b>	<ul style="list-style-type: none"> <li>· Validation of collected data (Calculation errors, correlations, etc.)</li> <li>· Data integration by unit process</li> </ul>
	<b>Establishment of Environmental Impacts</b>	<ul style="list-style-type: none"> <li>· Analysis of battery production processes</li> <li>· Identification of process inputs and outputs</li> </ul>
Echo Design		<ul style="list-style-type: none"> <li>· Identification of the major environmental issues of products based on LCA results</li> <li>· Identification of all improvement tasks by stage</li> </ul>

## Green Energy

### Accelerated Introduction of Green Energy

Despite a worldwide trend of businesses using eco-friendly renewables to replace the energy use in their business to reduce environmental impacts, many companies in Korea are having a hard time using renewables simply because of the lack of systems and environments to purchase renewables in the country. In 2018, Samsung SDI actively participated in the government's policy meetings for the introduction of green energy nationwide while reviewing diverse systems being implemented at its major overseas business sites. Samsung SDI in Austria replaced about 81% of its total power consumption with renewables. We plan to urge all our workplaces to join the efforts in using green energy.

### Reduction of GHG Emissions through the EV Charging Infrastructure

To reduce our greenhouse gas emissions, we bought electric cars in 2018 and are waiting for authentication. In 2019, we are planning to use electric buses for employees' commuting purposes and more. We plan to complete the installation of an EV charging infrastructure for our employees at Garage 1 of the Giheung site by March 2019. Ten slow chargers will be installed. We will increase the number after checking the response. We will install five fast chargers in the second half of 2019 at the entrance parking lot used by both customers and employees. Our efforts to promote the use of EVs will enable us to continue to reduce our GHG emissions and make improvements in our environmental protection endeavors.



Samsung SDI Electric Bus

## Human Resource Management



### WHAT ARE THE IMPORTANT ISSUES?

We focus on cultivating global talents equipped with expertise. We create an autonomous and creative organizational culture that motivates our employees to demonstrate their creativity and actively pursue it.

To secure the differentiated technological capabilities required to lead industrial development, hiring and retaining global talents is paramount. Hence, it is becoming more and more critical to cultivate people with global competencies, increase their work immersion and create an autonomous and creative organizational culture in which they can exercise strong executive power.

### OUR APPROACH

Samsung SDI constantly strives to lay the groundwork for our employees' continuous growth. Global competition is intensifying in the battery and electronic materials sectors. We focus on fostering highly skilled personnel. We strive to build an HR management system where employees are evaluated according to their duties and expertise. As such, we try to expand our personnel pool of globally competent talents while continuously improving our HR management system and working environment. In 2018, we upgraded our employee education infrastructure for more efficient education and took significant measures so that our employees can achieve work-life balance through immersion and concentration at work. In addition, we are promoting the introduction of a system to motivate our employees to work with autonomy and responsibility. Starting with the overhaul of our hierarchical corporate title system, we are planning to embark on reforming our HR management system. Over time, we will shift to a task-based HR management system that cherishes our employees' expertise.

### KEY INDICATORS

KPIs	Unit	2018 Targets	2018 Records	Achievements	2019 Targets
Education Hours Per Capita	hours	120	123	●	120

Education Hours  
Per Capita

123 hours

## STRATEGY AND MANAGEMENT APPROACH

### Human Resource Development System

Excellent human resources are an essential element for a company that seeks to enhance its corporate competitiveness and respond flexibly to a rapidly changing business environment.

We conduct consistent capacity building training for our employees to improve their expertise while enhancing the efficiency of employee training through ongoing investments in the area.

Most notably, to cope with the fast pace of technological changes, we seek to secure technological competitiveness through enhanced education in development, process technology and facilities technology. In addition to our own education programs, we also help our employees enhance their job-specific expertise and competencies through industry-academia collaboration training courses and professional exam preparation courses.

#### Human Resource Development Center

In June 2018, Giheung HQ completed construction of the Human Resource Development Center with language test rooms and language classrooms to enable employees to sit for exams and study foreign languages.

In addition to having in-house official language test rooms, the center offers five foreign language courses to help employees enhance their global competitiveness.

In December 2018, more than 120 employees enrolled in various language courses, with more than 300 attending the Global Biz Writing Practice course designed for those who frequently communicate with our overseas corporations and customers.



### Building an Education Infrastructure

To help our employees enhance their capabilities, we continue to make improvements in our educational facilities and systems. In 2018, we built a total of 12 exam rooms and classrooms in the Human Resource Development Center located in Giheung HQ. Most notably, the center is equipped with a private language education and conversation ability test room so that employees' foreign language conversation abilities can be evaluated anytime as part of efforts to help our employees improve their foreign language fluency. In addition, we have upgraded the facilities and equipment at the Human Resources Development Center at the Cheonan plant. We have also built a Facilities Training Center with a floor area of 1,815m<sup>2</sup> to create a foundation for the training of facilities experts. Samsung SDI will continue to make investments in education and training to create a pleasant learning environment.

#### Facilities Training Center

The Facilities Training Center that opened its doors in June 2018 in Cheonan is in charge of overall facilities education from design to operation and maintenance. Equipped with training facilities, the center can offer customized education to anybody when required. With core parts and modules of the equipment used in actual production sites, the center offers theory and practice-based education with one kit per person. The center is responsible for producing experts through improving the quality of education in the field. One difference from outside education is that in addition to regular technical education, the center plays the role of a test bench for engineers who would like to have their ideas verified. The center will continue to identify the technical skills required by the company and develop new education courses accordingly.



## Enhancement of Employees' Expertise

### Strengthening Technological Leadership

Samsung SDI introduced the "Technical Meister" system in 2013 with the purposes of cultivating employees' job expertise and promoting a culture of self-directed learning.

The title Technical Meister is awarded to employees who have obtained three master technician\* certificates or two master technician certificates and one technician certificate. A meister is given a certificate allowance, additional points for promotion, and inducted into the hall of fame with the creation of a copper-plate made in their honor. Starting with the installation of a hall of fame at the Cheongju plant in 2018, Samsung SDI has installed halls of fame at all its domestic production sites (Gumi, Cheongju, Cheonan, Ulsan). The technical meister system was expanded to all our production sites in 2016 and starting in 2017, all the sites began to produce technical meisters. The system has not only improved individuals' job performance and competitiveness but also helped raise the company's overall technological competence. We are planning to devise various programs that will tap into their expertise to generate specific outcomes steadily.

\* master craftsman: the highest level for national technical qualifications



### Training of Job Experts

To enhance our employees' competencies, we offer online and offline education programs related to all aspects of our business such as development, technology, sales and marketing, and management support. Most notably, we have developed sophisticated courses on development, process technologies and facilities technologies that are offered by in-house expert instructors. We promote in-house seminars and learning cell activities while launching in-house courses according to technical need. To cultivate experts in the fields of development and technology, we offer our employees academic training for master's or doctorate degrees as well as non-degree training programs through an industry-academia collaboration. For those engaged in procurement, quality, management, and finance, we help our employees obtain national and international certificates through a professional certificate support program as part of our efforts to cultivate employees into experts in their respective fields.

### Global Capacity-Building Programs

Samsung SDI has launched various foreign language courses to fully support its employees' efforts to improve their foreign language proficiency and engage in self-development, a requirement in the global era. As self-development programs, we run 4- to 10-week residential intensive foreign language courses, in-house foreign language courses, OPIc courses, and global biz writing courses. The residential programs are designed to teach not only language, but also about business practices and culture. Foreign languages taught at the courses as well as global biz writing courses, in-house foreign language courses and special OPIc lectures include English, Chinese, Japanese and strategic languages. We help our employees obtain foreign language certificates. Currently, we run such foreign language courses at all six of our workplaces in Korea. In addition, we run local expert education programs as key global leader training courses including intensive foreign language classes and overseas study classes. In 2018, we dispatched our regional experts to China, Vietnam, Germany, and Hungary. They also helped with the local personnel of our overseas corporations enhance their capabilities.

### Education at Overseas Sales Offices

More than half of SDI personnel working around the globe are foreigners. They work in Asia, Europe, the Americas and elsewhere. Previously, we provided the personnel working at our overseas marketing firms with local education or headquarters education. In 2018, we offered them more field-oriented education in Korea at places such as Suwon, Cheonan, and Ulsan production sites as well as at the headquarters. We invited outstanding personnel from our marketing firms in China, Taiwan, the US, and Germany among others to Korea. During the first week, we shared our company's basic principles through classes such as core DNA, companywide compliance and information security policies. During the second and third weeks, we provided them with technology and manufacturing site education including intensive battery courses at our Cheonan and Ulsan production sites. In 2019, we are planning to expand education to our production plants and offer technology and leadership education for them.



## Hiring and Cultivation of Top Talents

Samsung SDI strives to create quality jobs at home and abroad and continues to secure global top talents. In 2018, we hired a large number of personnel in the fields of technology and manufacturing for our global production bases in Cheonan, Ulsan, Hungary, and Vietnam and worked hard to train them to be technology experts. We also had college career fairs and campus recruiting events in Korea and the United States to recruit global talents in the areas of R&D and technologies.

## Employee Education

Description	2016	2017	2018
<b>Participants</b> * running total	44,045	43,760	<b>49,036</b>
Unit: person			
<b>Education hours per person (Korea)</b>	100	103	<b>123</b>
Unit: hours			
<b>Education hours per person (overseas)</b>	90	86.1	<b>97</b>
Unit: hours			

## Work-Life Balance

### Diverse Support Measures

To create a culture where our employees can work with autonomy and responsibility, we run various programs including flextime. By introducing a particular working-hour system, we have enabled our employees to control their own working hours so that they can increase their work immersion, and find time to achieve work-life balance. To facilitate their quality leisure activities, we pay keen attention to our overall employee vacation planning while encouraging them to use up their allotted holidays. Most notably, in the new system introduction and implementation processes, we consult closely with employee representatives and raise the satisfaction level by making changes through constant communication with all our employees. We also fully support our female employees so that they will not suffer difficulties at work due to pregnancy and childbirth. We offer them a choice of additional 12-month maternity leave on top of a 12-month mandatory maternity leave. We have installed mommy rooms in each of our workplaces. We also run day care centers so that our female workers can work without worrying about their children.

### Innovations in Work Culture



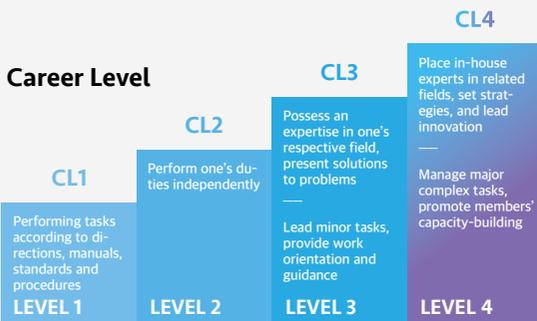
Work Immersion Campaign

Samsung SDI complies with the laws governing wage policies and working hours in the countries where it operates.

In Korea, the Labor Standards Act was amended in July 2018 so that the maximum weekly working hours should not exceed 52 hours. We embarked on the improvement of our work culture so that our employees could break from common practices and increase their work immersion and concentration systematically to achieve a work-life balance. In 2018, we launched the “Work Efficient Up” campaign to minimize the number of meetings and simplify the hierarchical reporting system.

We have produced an educational video series that has dramatized our key workplace issues such as meetings, reports, immersion and task management and posted it on the in-house online bulletin board. We conduct a good manners campaign as well.

## BUSINESS CASE



Stages of Job Expertise Development

## Change the Job Hierarchy Structure to a Career Level System

As global competition heats up in the battery and electronic materials industries, securing human resources has become crucial. This determines industry leadership moving forward. To help our employees reach their fullest potential, we strive to create an organizational culture where they do not fear making mistakes and instead become enterprising and creative. We changed our traditional job hierarchy structure into a grade level system with the goals of building a horizontal organizational culture and improving our employees' expertise. According to the new systems, our employees are recognized for their performance and expertise. The career levels consist of four levels: CL1, CL2, CL3, and CL4. As our employees' expertise improves, for instance, they can expect their career levels to rise. The new system requires all our employees, except those in managerial positions, to functions as experts in their respective fields.

# 06

## Management of a Sustainable Supply Chain



### WHAT ARE THE IMPORTANT ISSUES?

Under the slogan of “Grow as global leaders through win-win collaborations,” we promote CSR in our supply chain to grow with our partners.

Following industrial convergence and diversification, it is critical to secure a competitive supply chain through collaboration in order to obtain global competitiveness. Stakeholders demand that businesses fulfill their social responsibilities toward their supply chains. Businesses can secure the sustainability of their business models by joining forces with their respective supply chains to faithfully implement their social and environmental responsibilities.

### OUR APPROACH

With the conviction that competent partner companies are a driving force behind corporate growth, we assisted our partners with an aim of creating virtuous cycles of corporate ecosystems instead of the one-way dispensation of favors. In 2018, with a focus on our partner companies’ innovations in manufacturing and quality, we strove to enhance their innovation capabilities through assistance in training and hiring as well as the implementation of collaborative tasks. Also, as a global corporation, we carry out technology protection and payment risk prevention activities. In this regard, we continuously monitor our partners’ risks in labor, safety and health, the environment, ethical management, and management systems and ensure that they comply with sustainability standards through cooperations with us. We pay particular attention to continuous monitoring for responsible mineral sourcing and to ensure that we fulfill our corporate social responsibilities (CSR) starting at the raw materials acquisition stage for the production of batteries and electronic materials. We are planning to expand a win-win cooperation system to our second- and third-tier partner companies so that our first-tier partners can establish a fair transaction culture with our second- and third-tier companies and so that we can expand the scope of our CSR activities.

### KEY INDICATORS

KPIs	Unit	2018 Targets	2018 Records	Achievements	2019 Targets
Financial assistance	KRW 100 million	Ongoing Expansion	489	●	Ongoing Expansion
Manpower training support	Persons	1,100	1,102	●	1,120
S-Partner Certification	Case	100	91	◐	90

Financial assistance

48.9 billion KRW

Training and Hiring Assistance

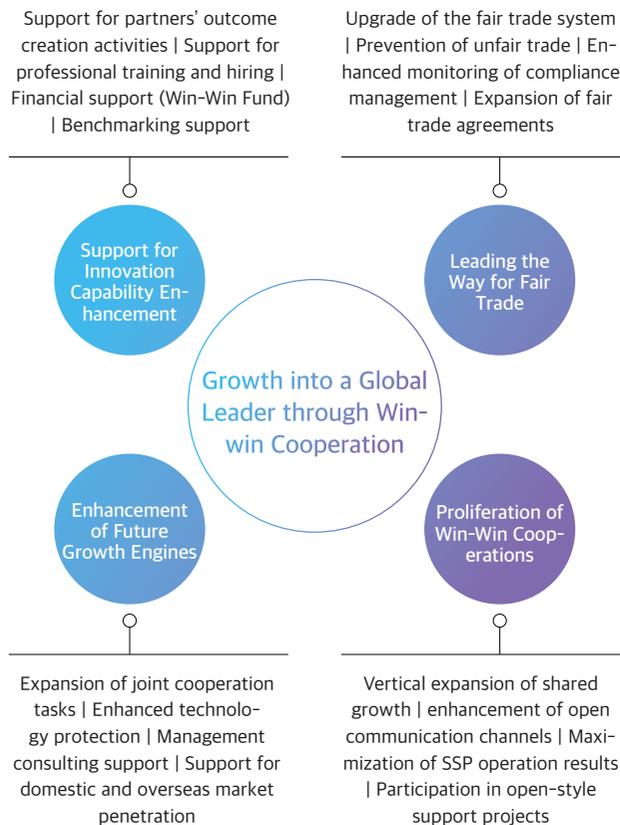
1,102 persons

## STRATEGY AND MANAGEMENT APPROACH

### Win-Win Cooperation Promotion System

Samsung SDI manages the suppliers of raw materials used for the production of batteries and electronic materials as its major supply chain. Our supply chain is composed of the first-tier partners that supply raw materials and parts for the components and products that we produce and the second- and third-tier partners who supply raw and subsidiary materials to our first-tier partners. To ensure that systematic support is provided to the supply chain, the Win-Win Cooperation Bureau at the Purchase Team promotes compliance with fair trade legislation and partner companies' capacity-building. In 2018, we helped our partners in the areas of innovations in manufacturing and quality, training and hiring, and collaborative tasks. We continued to work with them on technology protection and payment risk reduction as a global corporation. On the basis of our corporate principles such as fair trade, safety, and ethics, we are planning to promote the establishment of a fair-trade culture between our first-tier partners and second- and third-tier partners.

#### Win-Win Cooperation Promotion Plan (2019)



### Supply Chain Risk Management

For suppliers' social and environmental risk management, we have established a code of conduct for our suppliers, which must be obeyed by all our suppliers. All new partners are required to sign and submit the "CSR Compliance Agreement" as part of our efforts to minimize supply chain risks. For any violations, we recommend corrective measures. Should the violation continue, we place restrictions on future transactions. To secure transparency and fairness in our partner selection and management process, we carry out application reviews and conduct due diligence by checking not only financial status, production capabilities, and quality levels, but also production site safety, environment, and human rights protection as nonfinancial risks. Most notably, through the S-Partner certification system, we monitor our partners' risks in labor, ethics, environment and safety and health for their continuous improvement in the fields as part of our efforts to fulfill our duties to promote their social responsibilities and secure their sustainability.

### Fair Trade Policies

To establish a reasonable and fair trade order, we use a standard agreement in transactions with our partners. We proceed with purchase agreements with our partners under the following four principles: "Execution of desirable agreements," "Selection and registration of partners," "Establishment and operation of an In-House Deliberation Committee," and "Issuance and retention of written agreements." The Subcontract Deliberation Committee convenes every month to review fairness in contract execution processes including pricing as well as compliance with relevant laws for a subcontract worth a certain amount of money. The committee asks for corrective actions or imposes sanctions as required.

Total Purchase Amount | Unit: KRW 100 million **70,896**

Description	2016	2017	2018
Raw materials	28,590	37,512	<b>55,921</b>
Facilities	4,402	5,191	<b>12,729</b>
MRO*	1,091	1,384	<b>2,035</b>
Outsourcing	286	215	<b>211</b>

\* MRO(Maintenance, Repair & Operation): Including packing costs

## Support for Win-Win Cooperation

### Support for Shared Growth

Samsung SDI has concluded fair trade and shared growth agreements with its suppliers to support various win-win cooperation programs. Some programs include not just first-tier partners with whom it is in a direct contractual relationship, but also third-tier partners as its support beneficiaries. To achieve joint growth, we plan to expand our support for second- and third-tier partners.

#### Shared Growth Agreement | Unit: No. of companies

Description	2016	2017	2018
1 <sup>st</sup> -tier partners	112	110	<b>111</b>
2 <sup>nd</sup> tier partners	140	120	<b>129</b>

### Support for Securing Competitiveness

To enhance our partners' innovative capabilities, we help them in various areas such as financial support, professional personnel training, and hiring, overseas benchmarking and customized specialized consulting. For partners having a hard time with finance operations, we have upgraded our payment criteria and created a Win-Win Fund to support our first-, second- and third-tier partners. We take part in the Industrial Innovation Movement being promoted by the Ministry of Trade, Industry, and Energy and the Korea Chamber of Commerce and Industry to contribute to efforts to improve the country's industrial productivity and support innovation activities in manufacturing sites. In 2018, we provided offline education to 910 people from 137 partner companies and online education to 111 people from 11 partner companies.

#### Financial Support | Unit: KRW 100 million

Description	2016	2017	2018
Direct support (Molding fee support, etc.)	156	97.1	<b>160</b>
Hybrid support (Win-Win Fund contributions*)	270	270	<b>325</b>
Special support (Education, etc.)	12	11.8	<b>4</b>

\* Eligible for first-, second- and third-tier partners

#### Education Support | Unit: person/No. of companies

Description	2016	2017	2018
Offline education	727/86	759/75	<b>910/137</b>
Online education	138/9	146/14	<b>111/11</b>

### Support for Win-Win Cooperation between 1<sup>st</sup> and 2<sup>nd</sup> Partners

We have our first- and second-tier partners execute agreements to spread the win-win cooperation culture through financial and technological support. Through a win-win payment system, we monitor the payment status between our second-tier and third-tier partners and encourage them to improve their payment schemes.

### Enhancement of Technological Protection for Future Growth

Besides various win-win cooperation programs, we help our partner companies enhance their overall competitiveness through collaborations including joint research and development. As we increase our global business network, we promote shared growth with our partners by enhancing their global competitiveness. To technologically support our partners, we implement a conditional procurement system and results sharing system. To protect their technologies, we run "the Trade Secret Original Certification System" and support full expenses incurred with information registration.

In addition, we implement "the Technology Depot System" to deposit relevant technologies into a Large and Small Enterprise Cooperation Fund (KESCROW) so that our partners' interests can be protected in the event of technology leakage.

## BUSINESS CASE Securing Transparency and Reliability in Contract Procedures

For domestic workplaces, we undertake purchase agreement execution and management using a public certification method. For overseas corporations there have been various issues such as document loss or work inefficiency in manual labor due to the lack of the public certification method. Hence, we have established an e-contract system for our overseas corporation through blockchain technology for the first time in the Korean manufacturing industry. We have secured the transparency and reliability of contract-related work by managing signature and seal images and user passwords through blockchain. In 2018, we applied the system to all our corporations in China, Malaysia, and Hungary. When the relevant law goes into effect, we will apply the blockchain method in domestic e-contract management and expand blockchain applications to other areas as well. Also, overseas corporations depend on employees' manual work for their construction management ranging from contract management to final payment while construction management in Korea is being implemented through the G-SRM system. Thus, in order to prevent accidents caused by inadequate construction and carry out purchasing fairly, we standardized construction processes at our overseas corporation in 2018 including proposal, estimations, bidding, contractor selection, contract execution, and supervision.

## Enhancement of Cooperation through Communication

### Shared Growth through Information Sharing

We run a partner portal website (SRM) on which we not only manage new partners' registration and management, but also share information on diverse issues such as producing environmental restrictions and conflict minerals. We also run the Samsung SDI Partners' Association (SSP) and make a firm commitment toward win-win prosperity with partners. As of 2018, the association had 38 partners and held top management seminars and carried out overseas benchmarking tours for their representatives to grasp the global economic and industrial trends and cope with ongoing industrial changes worldwide.



Partner Consulting Channels

### Partner Communication Channels

To manage partners' grievances, we run "Partner Sinmungo" on our website to collect complaints and diverse opinions about unreasonable systems among others. We keep all the submitted information confidential and take corrective actions according to the relevant procedures. In 2018, we reflected "Partner VOS Operation Process" on our in-house rules "Partner Company Management Regulations" to set up our opinion gathering (dispute adjustment etc.) procedure and reporting system (CEO) among others.



## ASUNG PLATECH Won Outstanding Innovation Award on "2018 Shared Growth Day"

We celebrate Shared Growth Day annually to share our partners' innovation cases and recognize our outstanding partners.



ASUNG PLATECH is a supplier of plastic parts for automotive battery modules. They initially faced difficulty meeting requirements in terms of productivity and quality as it had specialized in automotive interior and exterior materials. In addition to quality improvements, process innovations were required as product order quantities increased. We joined forces with the company to find solutions.

### Securing Quality

To solve the burr defect problem of ASUNG PLATECH, we manufactured new molds. The existing molds were still usable, but to reduce burr occurrence due to mold erosion and to secure mold repair periods within the delivery periods, we fabricated additional molds. In the new mold fabrication and approval process, all relevant divisions of Samsung SDI and ASUNG PLATECH closely cooperated and obtained approval for the mass production of new molds.

### Productivity Improvement

Samsung SDI dispatched a professional consultant to ASUNG PLATECH for manufacturing innovation consulting. Following the analysis of operators' movements and processes, we improved the operating rate of the injection molding machine through a real-time accumulated management of injection production time. In the case of holder busbars, ASUNG PLATECH was able to improve productivity per person by 94% from 71 to 138 per hour following the minimization of non-operating losses. Previously, product inspection and packaging was done on the same floor. Following innovation consulting, the two jobs were assigned to different floors, logistical problems were resolved, and shipping efficiency was improved.

# Management of a Sustainable Supply Chain

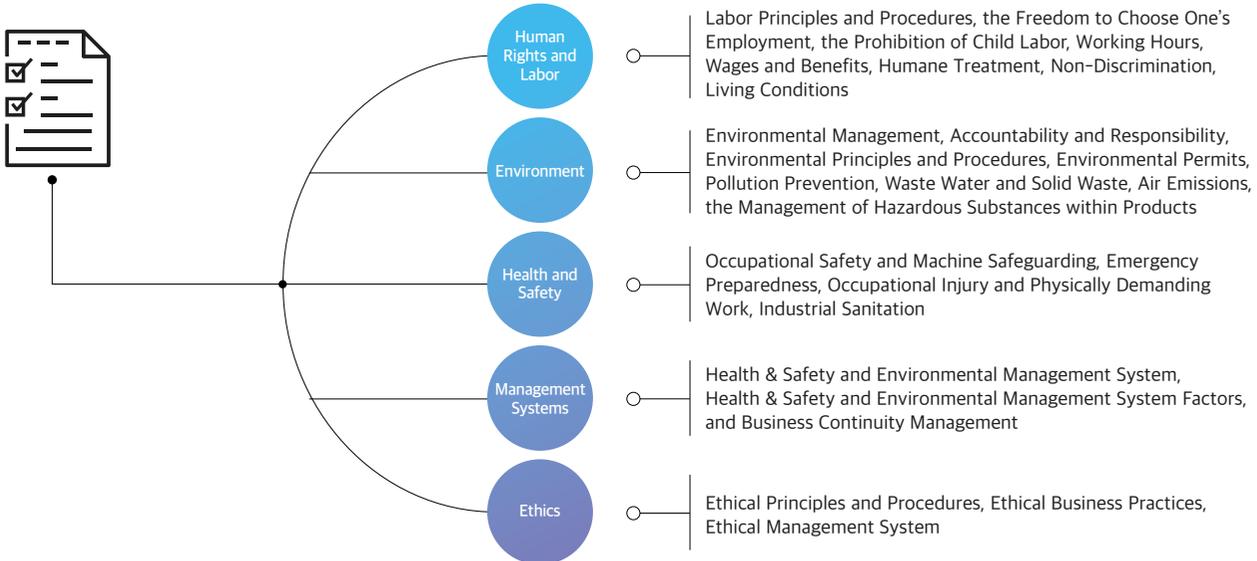
## S-Partner Certification System

We operate the S-Partner System as part of pre-emptive steps to improve our partners' working environment and eliminate potential risks related to human rights, labor, environment, safety, health and ethics. In 2017, we established the Samsung SDI Partner Code of Conduct based on the RBA Code of Conduct. We have since conducted education on the code among our partners every year to raise their awareness. We run the S-Partner certification system to ensure their compliance with the code, whereby their self-analysis and our on-site audits are carried out over their systems governing human rights, labor, environment, safety, health, ethics and business practices. We request their thorough compliance under the principles of intolerance regarding key provisions related to child labor, forced labor, pollutant discharge and environmental permits and licenses.

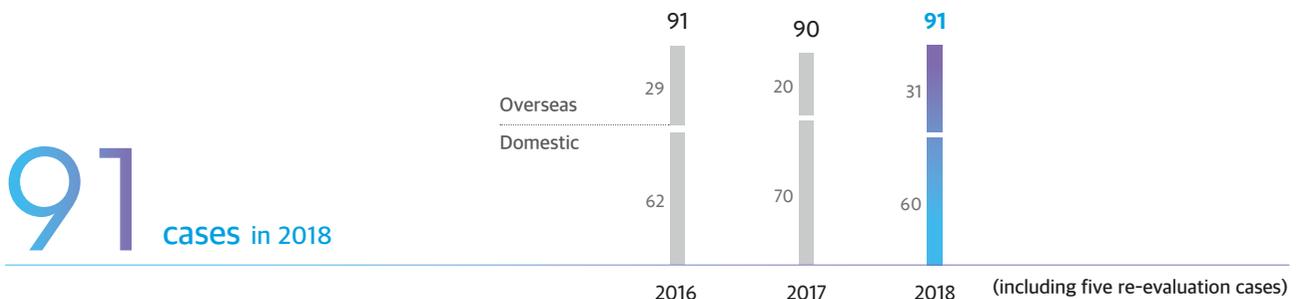
## S-Partner Evaluation Process

Every two years, we carry out the S-Partner certification evaluation for all our raw material suppliers including new partners. The evaluation consists of a self-diagnosis by our partners and on-site inspections by professional consultants commissioned by Samsung SDI. Re-evaluations are conducted for partners found to have violated key compliance items or to have fallen short of the stipulated overall scores (80 for existing partners and 70 for new partners). Also, regarding items found inappropriate by independent consultants, we ask relevant partners to submit improvement plans within one month. In 2018, we conducted evaluations for a total of 91 partners including 60 in Korea and 31 overseas, including re-evaluations for five companies at the bottom of our 2017 evaluation. The 2018 evaluation results indicated that none of them violated rules related to child labor or forced labor. Regarding some major violations detected in the areas of labor, environment, health and safety, we have asked relevant partners to submit improvement plans and to implement them.

### Evaluation Criteria



### S-Partner Certification Performance | Unit: cases



## Responsible Mineral Sourcing

### Cobalt

Cobalt is a critical metal in the production of batteries for the automotive and electronics industries. The world's largest known reserves of this raw material are located in the Democratic Republic of the Congo. Large scale, industrial mining accounts for roughly 80-85% of Congolese cobalt production, with artisanal mining operations producing the remaining 15-20%. At present, companies are facing challenges in the areas of environment, health and safety, and human rights when cobalt is extracted through artisanal mining.

### Policy and Management System

For the past 3 years Samsung SDI has been striving at improving its due diligence policies and practices towards human rights, with an explicit mention for cobalt, in accordance to OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. Starting from 2017 we have been very transparent about our policy and we publicly disclosed our policy through our website and a fully detailed progress report.

We communicate regularly our policy through training sessions to all our stakeholders, including our investors, suppliers, our purchasing department and our executive management

### Risk Assessment

We map regularly, on a yearly basis, the circumstances of our cobalt supply chain. Starting from 2018 we have been requiring our suppliers utilizing Cobalt to submit an industry-wide standard Cobalt Reporting Template ("CRT"). In 2018 we requested 19 suppliers to fill the CRT, and collected and processed data provided by 15 suppliers through their completion of the CRTs and other sources of information to map our supply chain to the smelter and refiner level and to the mine-site level, to the extent available. The response rate to the CRT request in 2018 was 79%. It is our responsibility to strive to increase the response rate for the years to come.

Based on our risk assessment, we have identified at least 4 major risks related to the cobalt value chain: (1) Child Labour and Human Rights Abuses, (2) Health & Safety Protection, (3) Environmental Pollution, (4) Bribery, although there is still a gap to fill in linking particular value chains to the related specific risks, given the lack of cooperation of few suppliers.

### Risk Response

In the year 2018 we have decided to partner with likeminded companies and try to address the risks associated with extraction, trade, handling and export of cobalt straight to the root, right in DRC. For more information please have a look at the call-out below "GIZ Project. Cobalt for Development"

## Cobalt for Development



Samsung SDI, together with Samsung Electronics, BMW Group, and BASF SE has commissioned a fully privately financed pilot project, named Cobalt for Development, to the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The project aims to scrutinize, over a period of three years, how the living and working conditions in artisanal and small-scale mining and surrounding communities in the Democratic Republic of the Congo can be developed.

GIZ started to implement the project in D.R. Congo in February 2019 with an initial focus on one artisanal pilot mine site.

The aim is to contribute in developing better working standards for artisanal cobalt mines. Provided this pilot project is successful, these might be scaled up to other artisanal mines in D.R. Congo. Measures include workshops and training on health and safety standards (e.g. usage of adequate protective equipment), environmental management (e.g. reduction in air and water pollution) and management systems (e.g. legal compliance and effective access controls). Local stakeholders, such as mining cooperatives, are participating from the very beginning in implementing learned measures, strengthening their capacities and skills.

At the same time, the project seeks to improve living conditions in neighbouring communities by facilitating access to education, improving household budget management skills and strengthening alternative livelihoods. Cobalt for Development builds on a feasibility study conducted by GIZ, and funded by BMW Group. Insights gained from visits to several artisanal mines, stakeholder interviews and surveys of miners and community members were instrumental in shaping the approach for the project.

The findings from the project will flow into the work of other initiatives that promote sustainable battery supply chains, such as the Global Battery Alliance.

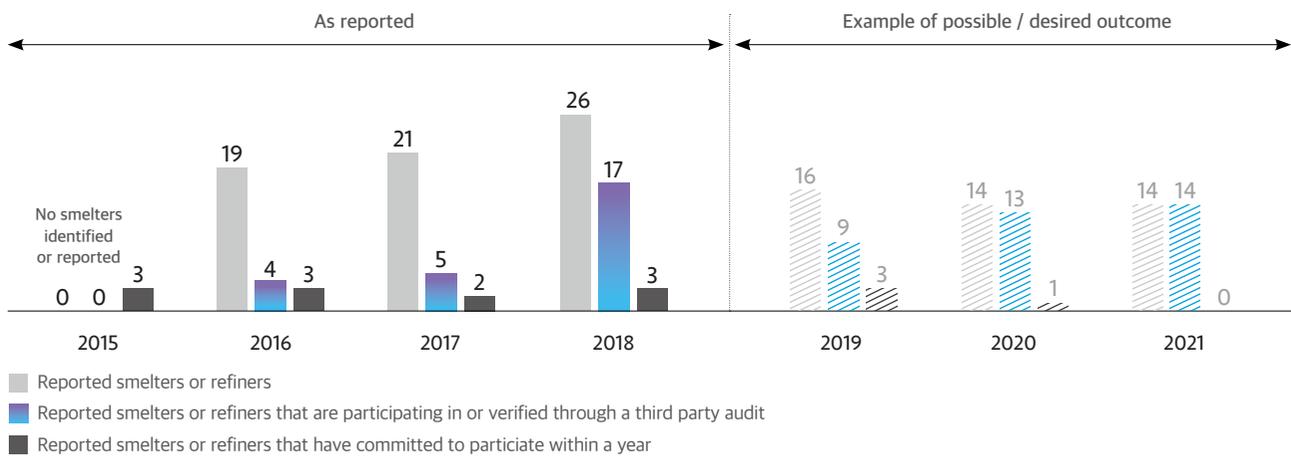
## Third Party Audits

Our goal is to see the pace of third party audits to accelerate. Since 2015, we have seen tangible improvements in the amount of cobalt refiners/smelters in our supply chain that decided to voluntarily undertake a third party audit, and we are hoping to see more by the end of 2019.

## Public Reporting

We keep on reporting publicly about our progresses in our cobalt supply chain through our sustainability report and a dedicated webpage on our website. We also publicly report, since 2017 our smelters list and the countries of origin.

### Year over Year progress towards participating cobalt smelters and refiners in the Samsung SDI cobalt supply chain.



## Reported Smelters and Refiners

	Smelters and Refiners	Plant
1	Chambishi Metals Plc	Zambia
2	CTT Guemassa	Morocco
3	Etoile	DRC
4	Freeport Kokkola	Finland
5	Gangzhou Yi Hao Umicore Industry Co., Ltd.	China
6	Gangzhou Tengyuan Cobalt New Material Co., Ltd.	China
7	Gem (Jiangsu) Cobalt Industrial Co., Ltd.	China
8	Guangdong Jiana Energy Technology Co., Ltd.	China
9	Guangxi Yinyi Advanced Material Co., Ltd.	China
10	Jiangsu Xiongfeng Technology Co., Ltd.	China
11	Jiangxi Jiangwu Cobalt Industry Co., Ltd	China
12	Jingmen GEM Co., Ltd.	China
13	JSC Kolskaya Mining and Metallurgical Company (Kola MMC)	Russia
14	Kamoto Copper Company	DRC
15	Lanzhou Jinchuan Advanced Materials Technology Co., Ltd.	China
16	Nantong Xinwei Nickel Cobalt Technology Development Co., Ltd.	China
17	New Era Group Zhejiang Zhongneng Cycle Technology Co., Ltd.	China

	Smelters and Refiners	Plant
18	Norilsk Nickel Harjavalta Oy	Finland
19	Quzhou Huayou Cobalt New Material Co., Ltd.	China
20	SungEel HiTech Co.,Ltd.	Korea
21	Tianjin Maolian Science & Technology Co., Ltd.	China
22	Umicore Olen	Belgium
23	Usoke	DRC
24	Vale	New Caledonia
25	XTC New Energy Materials (Xiamen) Ltd.	China
26	Zhejiang Huayou Cobalt Co.,Ltd.	China

## Reported Countries of Origin

	The origin of cobalt
1	Australia
2	Democratic Republic of Congo (DRC)
3	New Caledonia
4	Madagascar
5	Russia
6	Finland

## Graphite

Natural graphite is widely used as a key material in battery cathodes. Recent environmental pollution issues in the area includes fugitive dust generated during the extraction and processing stages in graphite mines in China.

In 2018, we established our own evaluation criteria for graphite suppliers in China and conducted on-site inspections for major graphite mines and suppliers in the country related to our products. For graphite mines and suppliers that are not involved in direct transaction relations with us, we asked our first-tier partners to carry out a self-diagnosis and to make the necessary improvements.

The findings at our on-site inspections indicate that Chinese graphite mines and processing plants related to our products are not involved with any environmental issues and that they have little negative impact on their neighboring communities.

We plan to carry out regular on-site inspections for the graphite mines and processing companies and make sure that the necessary improvements are made promptly.

### Major Evaluation Results from an Environmental Aspect

Description	Major Content	Grade
Mines	<ul style="list-style-type: none"> <li>Cleanness of the mines (generation of fugitive dust in mining operations)</li> <li>Recycling of leachate from extraction instead of disposal as wastewater</li> <li>Compliance with environmental laws and annual implementation of environmental impact assessment</li> </ul>	●
Processing	<ul style="list-style-type: none"> <li>Air pollutants are released after having been first treated at air treatment facilities</li> <li>Wastewater treatment at the neighboring complex</li> <li>Compliance with legal requirements regarding the environment</li> </ul>	●
Community Impacts	<ul style="list-style-type: none"> <li>Impacts on the local environment including the neighboring arable land and streams</li> </ul>	●
Others	<ul style="list-style-type: none"> <li>Safety and health: Noise needs to be reduced</li> <li>Labor: Worker penalty rules need to be improved</li> </ul>	▲

Good ● Average ▲ Bad ×

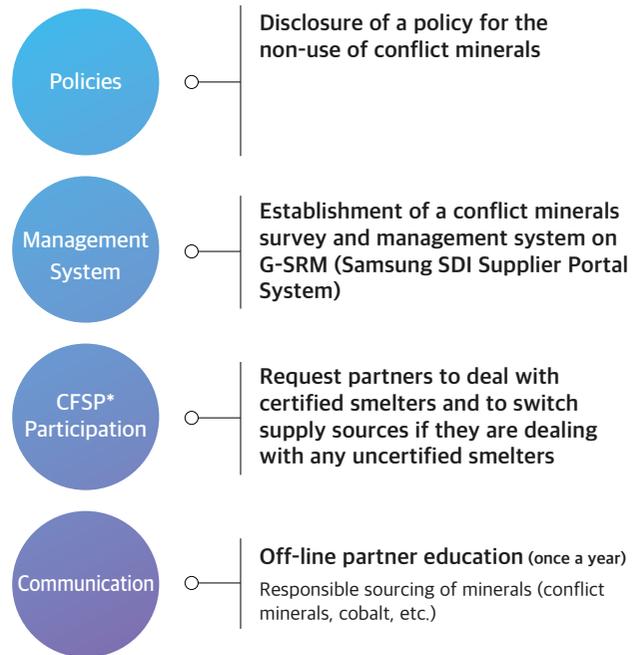
## Conflict Minerals

Conflict minerals refer to the raw materials: tantalum, tin, tungsten and gold that are extracted in African conflict zones, benefited by armed groups, and often involve human rights violations and child labor among other social issues. We actively participate in efforts to eliminate the concerns of the international community regarding conflict minerals extracted from the Democratic Republic of the Congo and neighboring regions.

We have established conflict minerals management policies and management processes. We conduct relevant education for our partners at least once a year to distribute our policies. Also, through a conflict minerals management system, we check the performance of our supply chain and if we find a smelter that does not possess a conflict-free smelter certification, we strongly ask the relevant partner to deal only with certified smelters.

In the results of our 2018 survey regarding the use of conflict minerals, the smelters of the four minerals (tantalum, tin, tungsten and gold) used in Samsung SDI products have all acquired the certification that show that “they do not provide benefits to armed groups.”

### Conflict Minerals Improvement System



\* CFSP: Conflict-Free Smelter Program

# SUSTAINABILITY DATA

## 01. Securing Future Growth Engines

### Financial Performance

Description	Unit	2016	2017	2018	
Revenue	Energy solutions	KRW 100 million	34,302	43,324	69,542
	Electronic materials	KRW 100 million	17,706	20,142	22,041
	Total	KRW 100 million	52,008	63,466	91,583
Operating income	KRW 100 million	-9,263	1,169	7,150	
Net income	KRW 100 million	2,111	6,432	7,450	
Total assets	Stockholders' equity	KRW 100 million	109,641	114,520	122,252
	Liabilities	KRW 100 million	39,362	42,897	71,245
	Total assets	KRW 100 million	149,003	157,417	193,497

### Output

Description	Unit	2016	2017	2018	
Energy solutions	Small-sized Li-ion batteries, etc.	Millions	1,053	1,158	1,514
Electronic materials	EMC	Tons	6,218	6,236	6,341
	Polarizing film	1,000m <sup>2</sup>	45,023	66,046	84,874

### Market Share

Description	Unit	2016	2017	2018	
Energy solutions	Small-sized Li-ion battery	%	24	21	19
	- Cylindrical	%	26	24	23
	- Prismatic	%	25	25	20
	- Polymer	%	14	14	13
	Automotive battery	%	7	7	5
* Source: Reports by market research firm B3					
Electronic materials	ESS	%	21	35	46
	EMC	%	7	7	6
* Source: criteria of SNE Research					

### Enhancement of R&D Capabilities

R&D Investment	Unit	2016	2017	2018
R&D costs	KRW 100 million	5,525	5,259	6,040
Investment/revenue	%	10.6	8.3	6.6

Training R&D Staff	Unit	2018	
		Korea	Overseas
R&D staff	Persons	2,260	375
Companywide ratio of R&D staff	%	22.2	2.6

Patent Registration	Unit	2016	2017	2018
Korea	Cases	4,273	4,314	4,689
U.S.	Cases	2,702	2,869	3,269
China	Cases	1,392	1,437	1,596
Japan	Cases	1,127	1,084	1,211
Europe	Cases	1,812	2,981	2,853
Others	Cases	580	619	766
Total	Cases	11,886	13,304	14,384

### Tax Risk Management (2018 Tax Payments by Country)

We comply with the tax laws of the countries where we run our business by faithfully filing and paying taxes. We assess our tax risks from various aspects. We prevent tax risks in advance through carefully checking global business sites and transaction partners. To comply with the regulations designed to prevent tax avoidance and evasion across the globe, we keep monitoring not only tax laws at home and abroad, but also the policies of tax authorities in different countries and regions for them to be reflected in our corporate tax policies.

(Unit: KRW)

Korea	141,334,370,420	South-East Asia	4,334,737,927
Japan	296,685,442	China	34,033,969,857
America	6,414,004,815	South America	4,338,053,536
Europe	22,453,601,167	Hong Kong	2,059,600,327

## 02. Securing Product Quality and Safety

### QM Staff Training

Description	Unit	2016	2017	2018
Quality experts	Persons	140	74	43
QM training hours	Hours	1,398	1,346	704

### QA Staff Training

Description	Unit	2016	2017	2018
Ratio of qualified ISO 9001 auditors	%	18	15	20.2
Ratio of qualified QM staff (excluding ISO 9001)	%	29	26	33.1

### Customer Satisfaction

Description	Unit	2018
Small-sized Li-ion battery	Score	Points 82
	No. of companies	Company 23
	No. of customers	Persons 25
Automotive battery & ESS	Score	Points 90
	No. of companies	Company 4
	No. of customers	Persons 4
Electronic materials*	No. of companies	Company 26
	No. of customers	Persons 169

\* We do not present scores for electronic materials due to too diverse kinds of products.

## 03. Workplace Safety and Health

### Safe Environment Inspections and Audits

Description	Unit	2016	2017	2018
CEO-led meetings	Cases	4	4	4
Safe environment audits	Korea	Cases 1,314	188	81
	Overseas	Cases 793	168	266

### Ratio of National Technical Certificates

Description	Unit	2016	2017	2018
Industrial engineers or higher	%	73	83	68
Master craftsmen or higher	%	17	37	21

## Industrial Accidents

Description		Unit	2016	2017	2018
Employees	No. of accidents	Cases	55	7	8
	Accident rate		0.3000	0.0334	0.0377
	- Korea		0.2943	0.0327	0.0763
	- Overseas		0.3109	0.0339	0.0000
	Illness rate		0	0	0.0054
	Fatalities	Persons	0	0	0
In-house partners	No. of accidents	Cases	1	0	1
	Accident rate		0.0910	0.0000	0.0459

Description		Employees			In-house partners			Total		
		Korea	Overseas	Total	Korea	Overseas	Total	Korea	Overseas	Total
Injury rate	On a 300-day basis	0.3472	0	<b>0.1794</b>	0.3157	0	<b>0.1911</b>	0.3434	0	<b>0.1807</b>
Loss rate		33,1163	0	<b>17,1181</b>	21,4647	0	<b>12,9969</b>	29,1133	0	<b>16,6851</b>
Incidence rate*		0.0833	0	<b>0.0431</b>	0.0758	0	<b>0.0459</b>	0.0858	0	<b>0.0434</b>

\* Accident and Illness

## 04. Climate Change Response

### GHG Emissions

Description		Unit	2016	2017	2018
Direct/indirect emissions	Total	tCO <sub>2</sub> e	747,926	919,382	1,129,564
	Domestic	tCO <sub>2</sub> e	379,701	438,399	511,379
	Overseas	tCO <sub>2</sub> e	368,225	480,983	618,185
	Direct emissions	tCO <sub>2</sub> e	99,847	143,581	154,704
	Indirect emissions	tCO <sub>2</sub> e	648,080	775,801	974,860
	Direct emissions intensity	tCO <sub>2</sub> e/KRW 100 million	14.38	14.49	12.33
Other emissions	Employee trips	tCO <sub>2</sub> e	2,184	4,331	4,385
	Product transport	tCO <sub>2</sub> e	768	516	562
Emissions by product	Small-sized Li-ion batteries	tCO <sub>2</sub> e	427,735	467,140	566,356
	Automotive & ESS batteries	tCO <sub>2</sub> e	178,479	221,133	331,027
	Electronic materials	tCO <sub>2</sub> e	110,924	197,008	189,661
	R&D and others	tCO <sub>2</sub> e	30,788	34,101	42,520

### Energy Consumption

Description	Unit	2016	2017	2018
Total	TJ	12,876	14,988	18,947
Domestic	TJ	8,033	8,609	10,509
Overseas	TJ	4,843	6,379	8,438
Intensity	TJ/KRW 100 million	0.25	0.24	0.21

## Energy Conservation Investments/Activities & Effects

Description	Unit	2016	2017	2018	
Total investments	KRW 1 million	2,312	3,522	1,840	
Fuel conservation activities	Cases	129	71	78	
Power conservation activities	Cases	513	390	634	
Conservation Effects	Total conservation	TJ	1,093	1,176	1,081
	Fuel conservation	TJ	194	201	197
	Power conservation	TJ	899	975	884
	Total conservation effects	KRW 100 million	137	102	89
	Fuel conservation effects	KRW 100 million	28	11	10
	Power conservation effects	KRW 100 million	109	91	79

- Scope of data collection: all domestic and overseas production corporations, headquarters, and research centers except sales corporations and offices (only production corporations with production records in 2018 are included).
- Sales used in calculating the amounts in KRW are based on consolidated financial statements.

## 05. Human Resource Management

### Employees

Description	Unit	2016	2017	2018
Total	Persons	19,353	22,142	24,718
By gender	Males	14,489	16,211	18,307
	Females	4,864	5,931	6,411
By region	Korea	9,200	9,258	10,268
	Asia	9,378	11,858	12,242
	Europe	694	895	2,037
	America	81	131	171
By age	Under 30	9,253	4,595	12,185
	30-50	9,258	16,553	11,384
	Over 50	842	994	1,149
By employment type	Full-time	17,631	20,078	22,410
	Contract	1,326	1,364	1,387
	Dispatched*	396	700	921

\* Domestic dispatched employees include executive secretaries, administrative assistants, interpreters, and drivers whereas overseas dispatched employees include those engaged in manufacturing and packaging inspection tasks.

### Employment

Description	Unit	2016	2017	2018
By gender	Males	3,201	4,999	6,046
	Females	1,496	3,007	2,142
By region	Domestic	755	684	1,128
	Overseas	3,942	7,322	7,060
Total	Persons	4,697	8,006	8,188

## Training

Description	Unit	2016	2017	2018
Hours per person - Korea	Hour	100	103	123
Costs per person - Korea	KRW	1,097,022	990,632	984,151
Hours per person - Overseas corporations*	Hour	90	86.1	97
Total costs	KRW 100 million	82	83	97
Total persons	Persons	44,045	43,760	49,036

\* excluding newly incorporated or acquired overseas corporations in 2019

## Training of Sales/Marketing Personnel

Description	Unit	2016	2017	2018
Total sales/marketing personnel (domestic/overseas)	Persons	289/160	314/160	328/185
Ratio of sales/marketing personnel (domestic/overseas)	%	3.2/1.6	3.4/1.2	3.2/1.3
Sales/marketing training costs	KRW 1 million	-	12	9

## Turnover

Description	Unit	2016	2017	2018	
Turnover Rate	Total	%	22.3	27.4	22.2
	Domestic	%	13.6	2.4	2.5
	Overseas	%	30.2	45.6	35.9
By gender	Males	%	19.3	23.9	21.1
	Females	%	30.8	36.6	25.4
By region	Asia	%	31.5	48.1	37.2
	Europe	%	10.0	13.9	26.4
	America	%	24.1	11.5	28.7
By age	Under 30	%	31.0	45.2	35.2
	30-50	%	10.5	12.0	11.3
	Over 50	%	67.7	5.4	6.6

\* From 2017, the calculation of the turnover rate is the number of staff leaving during the year divided by the average number of staff.

## 06. Management of a Sustainable Supply Chain

### Purchasing Amounts

Description	Unit	2016	2017	2018
Total purchasing amounts	KRW 100 million	34,369	44,302	70,896
Raw/subsidiary materials	KRW 100 million	28,590	37,512	55,921
Facilities	KRW 100 million	4,402	5,191	12,729
MRO purchasing (incl. packaging materials)	KRW 100 million	1,091	1,384	2,035
Outsourcing costs	KRW 100 million	286	215	211
Ratio of partners' local purchasing (Battery Division)	%	40.0	40.6	39.0

\* MRO(Maintenance, Repair & Operation)

## Shared Growth Agreement

Description	Unit	2016	2017	2018
First-tier partners	Companies	112	110	111
Second-tier partners	Companies	140	120	129

## Shared Growth Support Activities

Description	Unit	2016	2017	2018
<b>Financial support activities</b>				
- Direct support (mold cost support, etc.)	KRW 100 million	156	97.1	160
- Mixed support (contributions to win-win fund)*	KRW 100 million	270	270	325
- Special support (education, etc.)*	KRW 100 million	12	11.8	4

\* available to first, second, and third-tier partners

### Direct/Indirect Management Support

- Group training (partners)	Persons (companies)	727(86)	759(75)	910(137)
- Online training (partners)	Persons (companies)	138(9)	146(14)	111(11)
- Recruitment support*	Persons	53	65	81
	Companies	6	7	4
- Innovation guidance	Companies	10	12	12

\* support for youth job creation (between the ages of 15-30)

## Achievements in Shared Growth Support

Description	Unit	2016	2017	2018
<b>Achievements in Skill Support and Protection</b>				
- Public-private joint investment development projects	Cases	1	2	0
- Conditional purchases (localization tasks)	Cases	1	5	0
- Original trade secret certification system	Cases	5	19	47
- Technical escrow system	Cases	15	8	8
<b>Achievements in New Market Penetration Support</b>				
- Support for partners' buyer meetings	Cases	7	6	6
- Support for partners' trade fair exhibitions	Cases	1	1	1
- Support for partners' overseas benchmarking	Cases	2	2	2
- Participation in overseas corporations' info sessions with the Investment Authority	Cases	1	-	1
- Support for participation in overseas tech expositions	Cases	2	1	1

## Achievements in S-Partner Certification

Description	Unit	2016	2017	2018
Domestic	Cases	62	70	60
Overseas	Cases	29	20	31
Total	Cases	91	90	91
Partners that failed to meet certification criteria	Companies	-	-	-