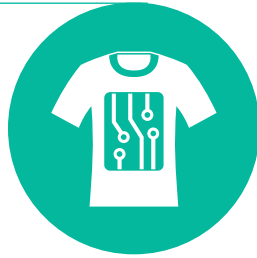


# BUSINESS OVERVIEW

32    Securement of a future growth engine

**525.9** billion KRW

R&D investment



**8.3** %

Investment in R&D against sales

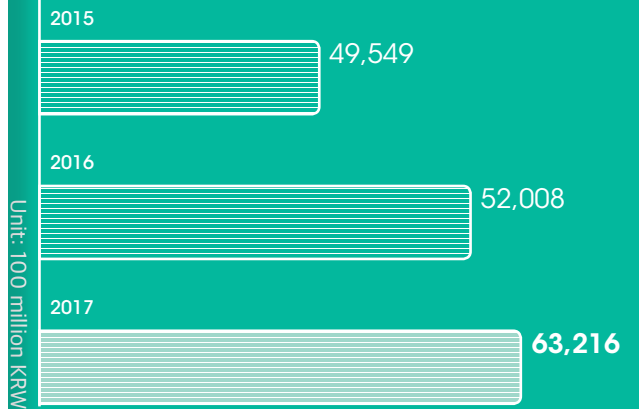


**13,304** cases

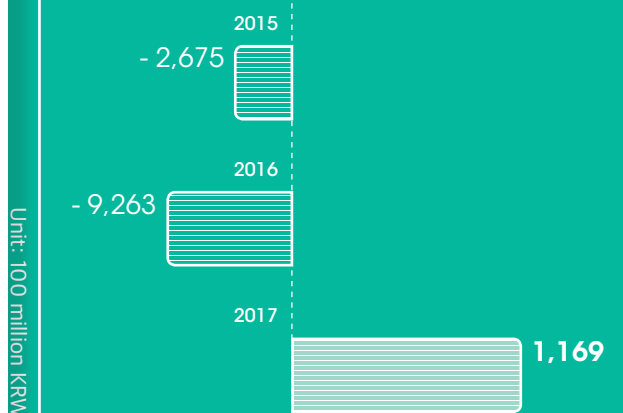
The current state of registration of patents



Revenue



Operating income (Loss)



Net income



24.2%

Portion of research and development staff

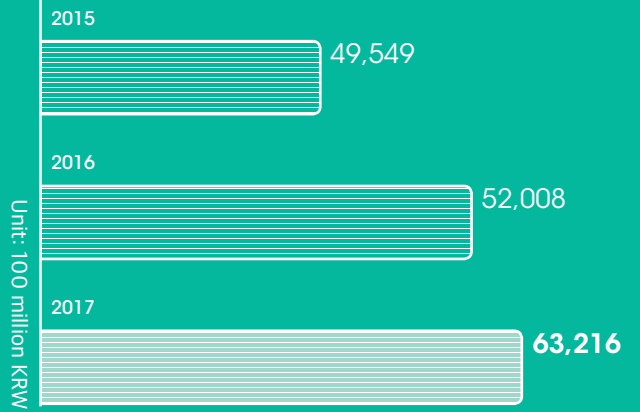


2,215 persons

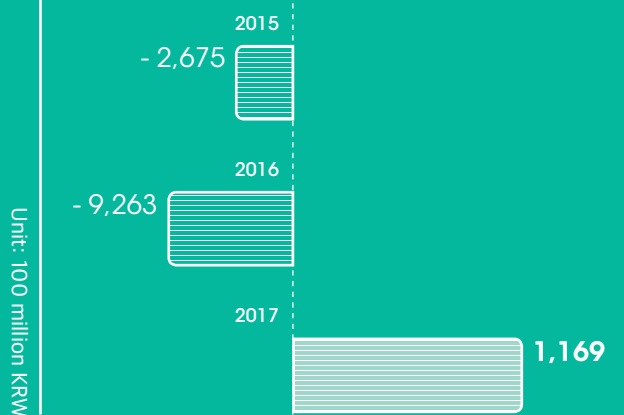
Research and development staff



Revenue



Operating income (Loss)



Net income



Stable managerial achievement through enhanced competitiveness resulting from advanced future technologies



# 01

## Securement of a future growth engine

### What are important issues?

With the intensification of global competition, companies resting on their laurels face difficulties in achieving greater growth and development.

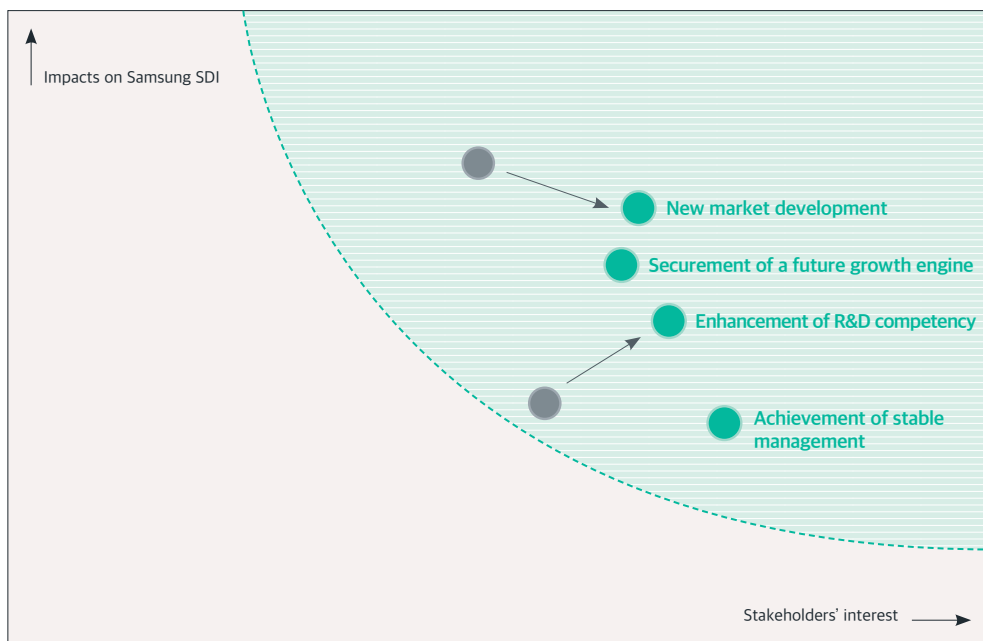
In this context, relevant efforts have been made to secure differentiated research and development competency, as well as to accelerate advancement into new markets based on stable financial performances focused on advanced companies.

### Our status

As a provider of top-rank materials and total energy solutions, Samsung SDI strengthens its technological competitiveness through consistent investments in R&D. Simultaneously, we also endeavor to make inroads into new markets and to conduct solid business management to ensure stable managerial achievement.

### Our evaluation

In addition to 'Enhancement of R&D Competency' and 'New Market Development,' which were selected as high material issues in the financial and economic sectors in 2016, 'Securement of a Future Growth Engine' and 'Achievement of Stable Managerial Performance' were considered new high material issues as a result of a materiality assessment in 2017.



### Our impact boundary

Regarding securement of a future growth engine, 'employees' and 'partners' are defined as areas of major stakeholder interest. Employees and partners fulfill their roles of enhancing productivity and creating new value on the front line of management.

### Our performance & future plan

Samsung SDI plans to increase new orders in existing business areas and to focus on strengthening its global competitiveness. It will also expand investments in R&D in consideration of sales.

### Enhancement of R&D competency

Samsung SDI secures new technologies and furthers technological competitiveness through consistent investments in R&D. In a consistent effort to emerge as an expert company in the energy sector, it seeks to be regarded as an environmentally-friendly top-rank material and total energy solution provider engaged in the next-generation market featuring secondary batteries, semiconductors, and display materials.

### R&D strategy

At a research center under the direct supervision of the CEO, Samsung SDI operates Small-sized Li-ion battery business, Automotive and ESS, and the Electronic materials business. More specifically, in 2017, seeking to strengthen the development of new technologies that can lead to momentum for future growth, we expanded and reorganized an R&D center for materials development.

### Open Innovation

In close collaboration with specialized external institutions, experts, and universities, Samsung SDI expands university-industry cooperation to secure next-generation battery technologies while nurturing excellent human resources through facilitated exchanges between the involved universities and corporations.

In 2017, in cooperation with UNIST, we completed the construction of a 'Battery R&D Center' for effective and integrated research on secondary batteries. The research center focuses on the investigation of Small-sized Li-ion batteries for smartphones and IT devices, as well as of automotive & ESS batteries for

electric vehicles and energy storage devices. In an effort to develop 'fast-charged long-lasting safe batteries,' we plan to consistently push research on materials used in lithium secondary batteries for next generation of infrastructure, including an excellent human resource pool, analysis devices, facilities, and production lines.

### Enhancement of cooperation in scientific research on secondary batteries

Samsung SDI takes the lead in expanding the research base of secondary batteries and securing excellent personnel through strengthening networks with universities. Following the establishment of industry-university cooperation in 2016 with Seoul National University, POSTECH, Hanyang University, and UNIST, we signed an agreement with Sungkyunkwan University in February 2018 to expand, sustain, and strengthen cooperation on research in the secondary battery sector. Cooperation with each university features joint research projects, a secondary battery R&D center, and the operation of specialization programs. In order to establish systematic relationships through close interactions with academia, we also match pertinent executives with researchers on a one-on-one basis and provides research grants. Samsung SDI will strengthen the impact of its excellent human resources and expanded recruitment in the secondary battery sector through proactive operation of industry-university programs and push for shared growth in cooperation with academia through consistent exchanges of information, personnel, and materials.



1 A panoramic view of UNIST Li-ion Battery Industry- University Research Center

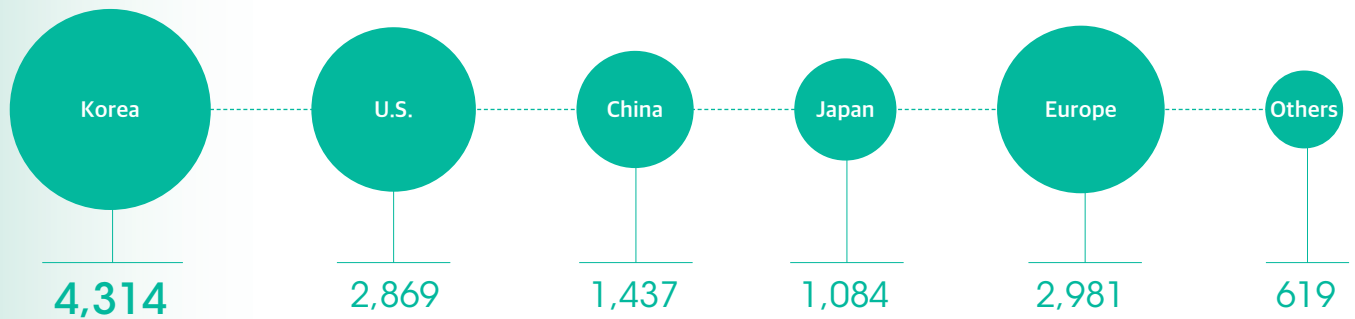
2 Samsung SDI-Sungkyunkwan University Industry- University Cooperation Contract-Signing Ceremony



## Patent management

In order to enhance technological competitiveness in the secondary battery field, Samsung SDI develops core materials of batteries at the SDI Research Center and obtains patents based on the obtained research results. We also strengthen patent competitiveness through effective business support from various sectors and focuses on developing next-generation technologies. As of 2017, we owned 4,314 registered patents in the domestic market and 8,990 registered patents in major overseas markets, including the U.S., Europe, China, and Japan. We also endeavor to be competitive in R&D and prevent disputes on patents through consistent application, registration, and maintenance of them.

● Patent registration in 2017 (Unit: Case)



## Main R&D Performance in 2017

Research projects	Research results and envisaged effects
Development of gap-filling tapes for the protection of electrode assembly of cylinder-shaped secondary battery	<ul style="list-style-type: none"> <li>Improvement of anti-vibration feature through fixation and protection of inner components (jelly roll) of the batteries</li> </ul>
Development of cylindrical cases for xEV lithium-ion batteries	<ul style="list-style-type: none"> <li>Development of case befitting batteries for electric vehicles</li> <li>Improvement of safety and reliability</li> </ul>
Development of OLED deposition materials	<ul style="list-style-type: none"> <li>Advancement into new markets through the development of deposition materials that can lead to the development of highly efficient and long-lasting batteries</li> </ul>
Development of next-generation polarizing films	<ul style="list-style-type: none"> <li>Expansion of a product portfolio through the development of polarizing films applicable to new display products</li> </ul>
Development of high-brightness CR	<ul style="list-style-type: none"> <li>Retention of the existing MS through the development of products with a higher brightness than the one afforded by existing products</li> </ul>
Development of semiconductor slurry	<ul style="list-style-type: none"> <li>Expansion of markets through the introduction of new product groups</li> </ul>
Development of semiconductor EMC	<ul style="list-style-type: none"> <li>Expansion of markets through the development of EMC with excellent void properties</li> </ul>
Development of a highly efficient electrode paste	<ul style="list-style-type: none"> <li>Realization of a secure base for increased sales through the development of a highly efficient electrode paste</li> </ul>

1

Samsung SDI develops technologies that can dramatically improve the energy density of batteries to ensure an expanded mileage of electric vehicles.

In 2017, we developed products with battery capacities improved by 25% as compared to existing products of the same size and is currently getting ready for mass production. We are also pushing for the development of technology of innovative materials and structures so as to consistently improve the energy density of batteries.

Development  
of high energy  
density  
automotive  
batteries

### Development of ESS Compact Platform

Seeking to maximize competitiveness of ESS (Energy Storage System), Samsung SDI has reduced the size of platforms from 19" to 17" and has developed a more simplified Compact Platform whose modules are assembled without trays.

This innovation has reduced material costs and improved energy density, thus enabling thus an increase in market share and dramatically increasing sales in the ESS market.

2

3

The capacity of the 21700 battery (21 mm in diameter and 70 mm in height) has improved by 50% as compared to existing products (18650, 18 mm in diameter, 65 mm in height). Therefore the desired capacity can only be achieved with a small number of batteries. The 21700 battery has the optimum size that can maximize not only the lifetime, but also the output. Owing to its cost competitiveness, in the future, it is expected to emerge as the standard of the cylindrical battery market, featuring power tools and electric bikes.

Development of  
cylindrical 21700  
Battery



# 4

Since 2016, when the safety of smartphones was questioned, focused efforts have been invested into strengthening safety in the entire production process of R&D, manufacturing technology, and quality inspection. Accordingly, in order to obtain good feedback from the inspections by external institutions, which led to a full-fledged supply of premium smartphones in the first of half of 2017, Samsung SDI developed products of a greatly strengthened safety. We also conduct continuous research that prioritizes product safety based on pertinent research of all-solid-state batteries that can fundamentally prevent ignition or explosion through the use of solid materials instead of the existing liquid electrolytes.

Development of technology to enhance safety of batteries

Development of a low-voltage, long-lasting OLED emitting material

In 2014, in an effort to help realize environmentally friendly/low-voltage smartphones, we successfully developed G-Host (Phosphorescence Green Host), a low-voltage, long-lasting OLED emitting material. In 2017, we succeeded in developing improved products with longer lifetimes and lower operating voltages to secure differentiated competitiveness. Consequently, it was selected by major smartphone providers for their new products.

# 5

# 6

OLED panels require polarized films with a new structure that would differ from the existing LCD products due to the strong surface-reflection characteristics. In this respect, Samsung SDI started developing OLED polarized films based on the phase difference in thin films and succeeded in securing this technology in 2017 before supplying it to client companies.

This achievement led Samsung SDI to secure product technology that can respond to new processes and own diversified polarized film product portfolios needed on the rapidly growing OLED market.

Development of Polarized Films for OLED

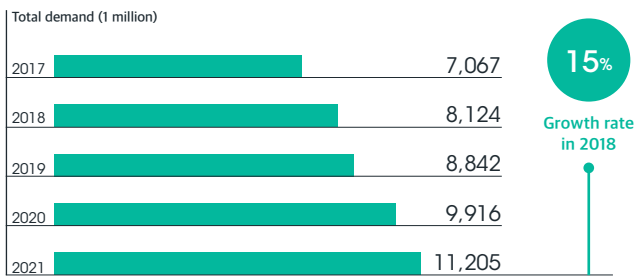


## Small-sized Li-Ion Battery

### BUSINESS STRATEGY

Samsung SDI provides optimized solutions to diverse IT device markets featuring smartphones and wearable devices. It also expands the business and leads the new fast-growing Small-sized Li-ion battery market, thereby expanding environmentally friendly, highly efficient trends based on the effective use of differentiated technologies.

#### Demand prospects for Small-sized Li-ion Battery



### PROSPECTS FOR GLOBAL MARKET

In 2018, demand in the Small-sized Li-ion battery market is expected to grow by 15% from the previous year, to post a total of 8.1 billion cells. In particular, in view of an ever-growing use of lithium ion secondary batteries in various power applications, such as electric devices and vacuum cleaners, demand for these appliances is expected to grow by 26% or more from previous years.

In addition, the market for electric vehicles with cylindrical batteries is dramatically expanding. IT Division forecasts that AI and IoT (Internet of Things) technologies will soon be genuinely commercialized, leading to the proliferation of new wearable and VR/AR devices. In this context, Samsung SDI plans to further strengthen its leadership in various markets, ranging from electric power to IT.

### BUSINESS CASE

#### Participation in EURO BIKE 2017

Samsung SDI participated in 'EURO BIKE 2017' held in Friedrichshafen in Germany to unveil the lithium-ion battery technology for various electric bikes. We displayed 6 types of standardized battery packs for electric bikes. In addition, we also showed 12 types of battery packs and cells of various specifications. It also introduced added Bluetooth functions to the battery pack that enables users to check remaining battery power and Distance to Empty (DTE) with a smartphone while riding a bike.

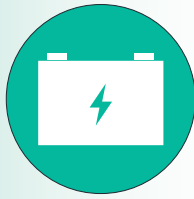
#### A 25% increase in capacity based on free-form batteries with a smaller gap

As 250mAh Free Verse Battery developed by Samsung SDI was installed in Samsung Electronics Gear S2, it was unveiled in the market for the first time. In order to increase battery capacity by approximately 25% and to best fit the cylindrical design, the newly developed free verse battery will be improved in terms of spatial use.

### BUSINESS PLAN FOR 2018

Following the success of a surplus in 2017, Samsung SDI plans to push for consistent growth in sales and higher profits through stability.

With regard to polymer product groups, we plan to continuously expand our sales of such high-safety, high-energy-density products to major global clients. Concerning cylindrical product groups, we plan to maintain our currently dominating market share and to expand the development and release of differentiated products.

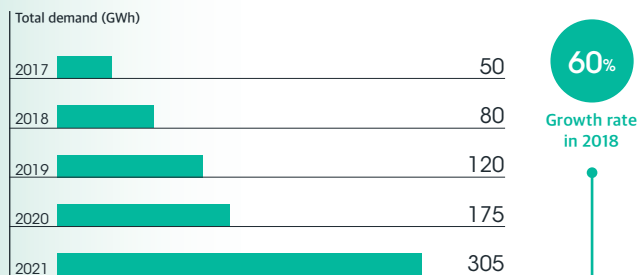


## Automotive battery

### BUSINESS STRATEGY

Seeking to minimize CO<sub>2</sub> and various air contaminants emitted from the existing internal-combustion engines, global auto producers suggest environmentally friendly alternatives, including electric vehicles. In this respect, Samsung SDI focuses on high-efficiency, high-energy-density batteries for low-pollution vehicles with the accumulated expertise in the mobile device battery sector.

#### Demand prospects for Electric Vehicles Battery



### PROSPECTS FOR THE GLOBAL MARKET

In 2017, Samsung SDI's sales of electric vehicles (xEV) increased in major global markets, including China, Europe, and the Americas, to record a 25% growth rate from the previous year.

At the moment, we plan to start releasing a new model with a greater mileage in 2018, and automakers are expected to start launching models equipped with long-distance driving systems and self-driving systems, giving further momentum to the market in 2020.

By 2022, the number of electric vehicles sold per annum is expected to record over 10 million, accounting thus for 10% of the entire auto market. In addition, due to strict environmental regulations in Europe, the number of diesel-fueled cars is currently decreasing; moreover, countries like Norway and the Netherlands are planning to stop selling and operating vehicles with internal combustion engines. As to China, the world's largest car market, it is expected to introduce a compulsory quota on electric/plug-in hybrid systems from 2019. Accordingly, the mid-to-long-term electric car market is likely to dramatically surpass market expectations.

### BUSINESS CASE

#### Samsung SDI, 'The Future of an Electric Vehicles Begin Today'

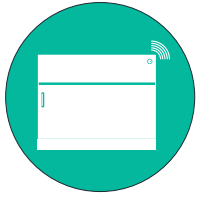
The '2018 Detroit Auto Show' held in Cobo Center in Detroit, Michigan, demonstrated high-capacity, rapid-charging innovative materials, as well as advanced products that are expected to play an essential role in inducing popularization of electric vehicles en masse. At this event, we displayed differentiated product competitiveness through a diversified battery cell line-up for the next generation that can be applied to high-energy-density battery cells for battery electric or plug-in hybrid vehicles that can run up to 600km by integrating 20-minute fast charge technology. Samsung SDI is also determined to further develop innovative technologies by introducing graphene balls (improved by 45% in terms of capacity and five times faster in terms of speed) and an all-solid-state battery (improved in terms of material, capacity, and safety). This achievement has been reported in a publication in Nature, a world-renowned science journal.

#### Completion of construction of a factory manufacturing batteries for electric vehicles in Hungary

We completed the construction of a factory that can produce batteries for 50,000 electric vehicles in an area covering about 330,000 m<sup>2</sup> in Goed city, near Budapest in Hungary. The factory in Hungary plans to start mass production of the vehicles from the second quarter of 2018. The factory will contribute to reducing logistical costs and further enhance services offered to clients in Europe. Due to strict environmental regulations, Europe is a gigantic potential market in the electric car sector, and the completion of the plant in Hungary has led Samsung SDI to establish, in cooperation with Ulsan and Xian in China, a triangular production system for global electric car batteries.

### BUSINESS PLAN IN 2018

In Europe and other emerging markets where Samsung SDI is expected to achieve consistent growth, we plan to continuously increase the release of new products whose production will employ the use of new technologies, such as an energy-density fast-charging system. Currently, in an effort to meet the market demand for environmentally safe cars, global automakers are focused on developing electric vehicles. In this context, shifting the focus from the sale of components, Samsung SDI plans to play the role of a reliable partner that can offer the optimum automotive battery solution to automakers while leading the upstream and the downstream industries in the electric vehicles sector.

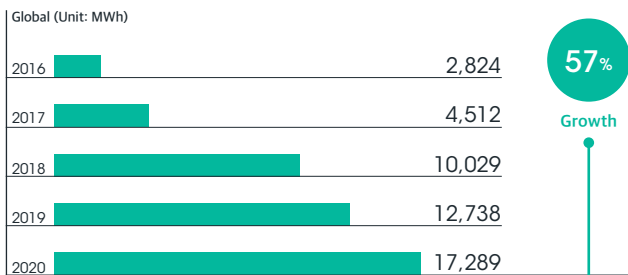


## ESS

### BUSINESS STRATEGY

By promoting the ESS battery, the main product of Samsung SDI, its market share is not only increasing in the domestic market, but also in advanced economies such as Japan, the Americas, and Europe. The strategy also focuses on advancing into emerging markets, and intensifying our presence in various areas in battery domain, ranging from common household batteries to large-sized power batteries, commercial batteries, and UPS batteries.

#### Scale of global ESS lithium-ion battery market



### PROSPECTS FOR THE GLOBAL MARKET

Advanced countries, including the U.S., Japan, and Europe, conduct large-scale empirical projects with ESS-related government grants and secure price competitiveness through mass production of lithium-ion secondary batteries. In addition, by legislating the mandatory introduction of ESS and by providing subsidies in the event of linkage between new renewable energy and ESS, these economies provide systematic support to the installation of ESS. Accordingly, in addition to the U.S., the world's largest ESS market, the demand for ESS is expected to constantly grow also in Japan and Europe, centering around Germany. The Korean government nurtures the ESS industry through the 'ESS promotion fee system,' the 'REC weight value policy in case of linkage between new and renewable power generators and ESS,' and the 'Renewable Energy 3020 Action Plan.' All these initiatives are expected to expand the domestic ESS market.

### BUSINESS CASE

#### Additional supply of Samsung SDI batteries at 5,000 meters above sea level in the high reaches of Tibet

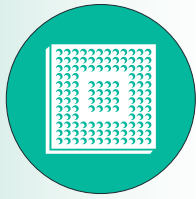
In 2016, aiming to supply power to residents of the high reaches of Tibet, Samsung SDI, in cooperation with Sungrow, the largest PCS (Power Conditioning System) provider in China, conducted an environmentally friendly self-sufficiency system project with a 14MWh ESS and a 13MW photovoltaic generator system. Shuanghu in Tibet, the world's highest-altitude site among global ESS installation sites, has extremely cold (range: -5°C to -40°C) weather conditions. Amid these difficulties, Samsung SDI supplied highly competitive batteries developed based on optimum solutions. On top of these achievements, aiming to prove that our batteries can provide the optimum solution in harsh weather conditions, we also installed PV and ESS on the same scale as Sungrow.

#### Samsung SDI supplies batteries to the world's largest industrial ESS

Using Samsung SDI batteries in its HQ in Ulsan, Hyundai Heavy Industries Co., Ltd. established a 51.5MWh industrial ESS center. This is recognized as the world's largest industrial ESS and can save power used by 15,000 persons a day, which accounts for 1/5 of the target of an ESS proliferation project that the government pursues as part of a new energy program. Operating the ESS is expected to decrease energy use at peak times recorded by HHI and to increase energy efficiency to save above 10 billion KRW in annual expenses.

### BUSINESS PLAN IN 2018

Amid global nuclear-and-coal-phase-out trends, there is an ever-growing interest in new renewable energy. Following 2017, we started expanding investments in electric ESS solutions and deemed it necessary to establish a strategy that would enhance the supply to meet the demands for ESS in consideration of the facilitated photovoltaic industry in 2018. In addition, considering the globally rising self-consumption of photovoltaic systems for households, we plan to expand a supply channel of household ESS solutions and to steady increase our market share in this segment. We also plan to expand ESS solution businesses and to solidify our status as a market leader in the ESS sector in the North American and European markets, where the business is gradually growing as a result of increased electric charges and improved economic efficiency. In the domestic market, this will be achieved by launching the products based on innovative technology, which will lead to the constant expansion of sales and let us gain great success in the industry.

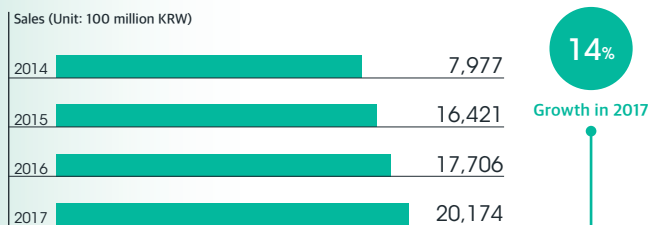


## Electronic materials

### BUSINESS STRATEGY

The Electronic Materials Business Division of Samsung SDI develops and sells materials used in semiconductors, displays, and next-generation energy. As these products are characterized by a short life-cycle and speedy technological changes, we strive to be equipped with advanced R&D capability in order to meet diverse customer demands and vigorously push forward the enhancement of business competitiveness through use of differentiated technology and strict quality management.

#### Sales performance of electronic materials



### PROSPECTS FOR THE GLOBAL MARKET

With a recent slowdown of the growth rate in the TV and smartphone markets, demand for such main products as semiconductors and displays has stagnated. However, the global economy is expected to record the greatest growth in 2018 after the financial crises, and demand for our business is expected to grow as well. In particular, the semiconductor market, where the memory sector yields good results, is expected to boom on the strength of the development of fine process technology and the expansion of a three-dimensional structure. Accordingly, diverse applications are likely to continue adopting OLED, thereby creating a new demand in the display market. However, due to generalization of technology, the LCD market is expected to face intensified competition. Accordingly, the use of differentiated technology, cost savings, and further efforts to diversify responses to customers will become key concerns in the future.

### BUSINESS CASE

#### Electronic materials business makes continuing efforts to realize self-innovation

Starting with the development of EMC, a process material for semiconductors, in 1994, we entered the electronic materials sector. Since then, due to constant self-innovation and ceaseless technological development, we have successfully advanced into new sectors. Currently, with its advanced technology and specialized competency in various sectors, ranging from semiconductors, displays, and secondary batteries to materials for photovoltaic cells, we lead global technology trends.

#### A path for a new growth engine found in OLED

Industrial leaders with strong market dominance in the smartphone market have already applied OLED in their main products. Samsung SDI takes the lead in advancing development in an effort to respond to shifting customer needs in the rapidly changing market where even latecomers try to get ahead of others by expanding investments in related sectors. Phosphorescence Green Host (G-Host), an OLED material developed by Samsung SDI in 2014, continues to rank 1st in global market share, and we were successful in developing improved products with longer lifetimes and lower operating voltages so that these products were selected by major smartphone providers for their new products in 2017. In 2016, on opening a factory in Wuxi, China, we successfully developed polarizing films for OLED characterized by a completely different structure and enhanced productivity.

### BUSINESS PLAN IN 2018

Samsung SDI aims to maintain its global market leadership by launching differentiated products on the strength of advanced technology in 2018. Furthermore, through proactive investments in products expected to lead technology trends in the future we also plan to provide the solutions most desired by customers. In order to secure dominance in the existing market and to focus on developing and supplying products that can respond to the high demand for high-efficiency products in fast growing photovoltaic energy material markets, we will offer semiconductor and display materials that excel beyond those of competitors. At the same time, we will develop flexible display and semiconductor materials for the future, thereby leading the next-generation IT device market in order to secure a growth base while establishing a production system to provide products desired by customers.