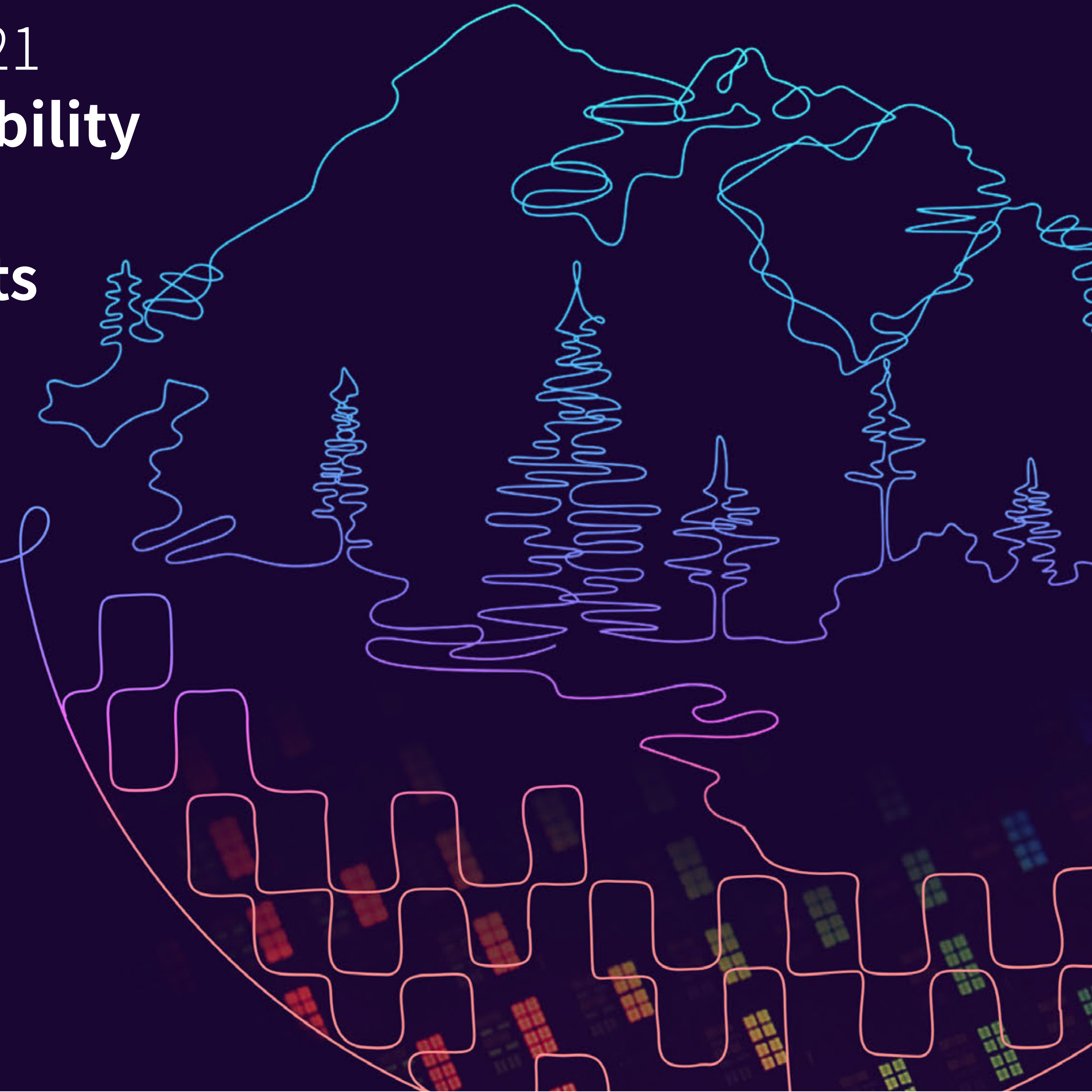


TSMC 2021  
**Sustainability  
Report  
Highlights**



# Connect Sustainability with Innovation

Innovation is the foundation that keeps TSMC growing

High-performance computing propels humanity to a future with AI  
Smartphones breaks the limitation of time and space and bridge us  
with the cloud and to freedom

Advanced automotive electronics carry our imagination to the infinite world  
of mobility

IoT ushers in the era of smart cities and industrial 4.0

ESG is in the DNA of every TSMC employee

TSMC uses concrete action to connect people with people and with  
nature to welcome beautiful change

With an infinite stream of innovative technology solutions,  
TSMC strives to achieve sustainability and connect to a future of  
common good



*Mark Liu*

**Mark Liu**  
Chairman and ESG Steering Committee Chairperson



*Lora Ho*

**Lora Ho**  
Senior Vice President and ESG Committee Chairperson

Over the past two years, COVID-19 has continued to impact our world while the threat of extreme climate conditions has steadily increased. As a key player in the global semiconductor supply chain, TSMC has the responsibility of working with industry partners to take continuous action with regard to ESG (Environmental, Social and Governance) issues.

We work diligently to integrate the ESG ethos into our daily operations with the aim of sustainable development, formulating systematic management strategies, implementing related measures and reviewing action plans. Meanwhile, TSMC looks forward to working with partners and stakeholders from all walks of life to create a sustainable future.

I look forward to strengthening and expanding our sustainable actions to bring about innovative breakthroughs. The Sustainability Report that we compile each year keeps pace with global sustainability trends and has become a guide for organizations to continue advancing their ESG efforts. We expanded our information disclosure and external communications and continued to accumulate our ESG intellectual property. In addition to the existing EP&L Report and TCFD Report, TSMC also released, for the first time, Materiality Analysis Report and the UN SDGs Action Report. Sustainability is a journey without end. As the company continues to grow, we find ourselves with growing responsibilities as well. We will continue to hold true to our ESG vision to uplift society as we strive on forward with steadfast resolve.

# Innovation Value

## Innovations for Sustainability

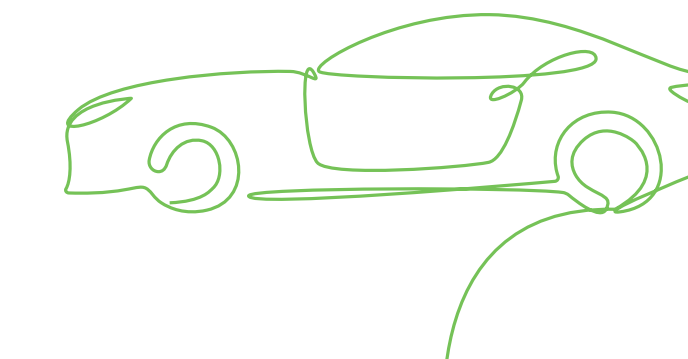
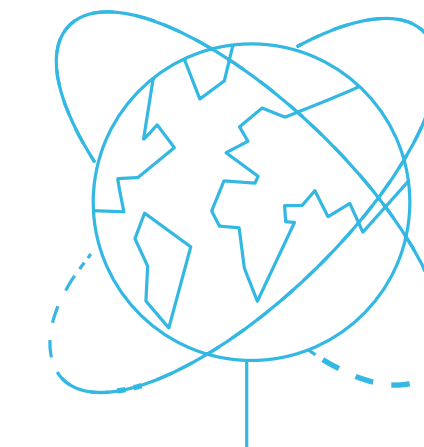
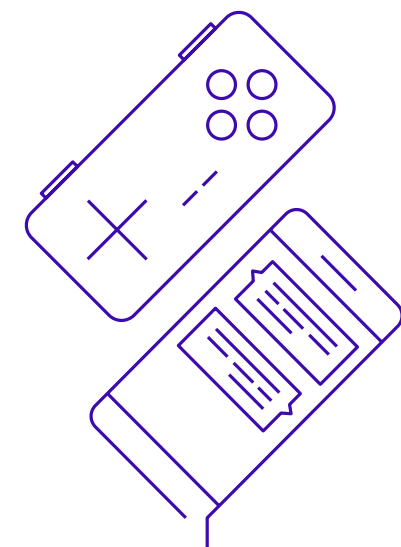
TSMC continues to advance semiconductor manufacturing technologies and services to enable our customers to unleash more than 12,300 chip innovations in 2021. These innovations make products more advanced, capable, intelligent, energy-efficient, and safer, allowing us to greatly increase quality of life and move towards a sustainable well-being society.

## Technology Development Focuses

- Continue to drive semiconductor scaling for both logic and specialty technologies
- Continue to expand specialty technology offerings
- Continue to advance and expand TSMC 3DFabric™ technology offerings

## Benefits to Customer Product Innovation

- Boost product computing power
- Increase product energy efficiency
- Enable smaller form factor
- Provide greater chip design flexibility



Customer Product/  
Applications

### Make communication more effective and work, play, and learn anytime and anywhere

- Application Processors (AP)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensor (CIS)
- Near Field Communication (NFC)
- Bluetooth
- Global Positioning Systems (GPS), etc.

### Enable 5G, Artificial Intelligence (AI), cloud, and data centers for transferring and processing vast amounts of data anywhere and anytime

- Central Processing Unit (CPU)
- Graphics Processor Unit (GPU)
- Field Programmable Gate Array (FPGA)
- Server CPU
- Artificial Intelligence/Machine Learning (AI/ML) Accelerator
- Network Processing Unit (NPU)
- High-speed Networking Chip, etc.

### Empower innovations for artificial intelligence of things (AIoT) and accelerate digital transformation to greener make a more convenient and greener living, and improve health care quality

- Microcontroller Unit (MCU)
- Application Processors (AP)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensors (CIS)
- Near Field Communication (NFC)
- Bluetooth
- Embedded Flash Memory
- Radio Frequency Identification, (RFID) etc.

### Make vehicles, including hybrid/electrical cars, safer, smarter, and greener

- Microcontroller Unit (MCU)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensors (CIS)
- Near Field Communication (NFC)
- Radar
- Ethernet Switches
- Power Management ICs, etc.

### Enable AI-powered smart devices

- Microcontroller Unit (MCU)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensors (CIS)
- Near Field Communication (NFC)
- Bluetooth
- Embedded Flash Memory
- Power Management ICs
- Timing Controllers (T-CON) for Smart 8K/4K Digital TV (DTV)
- 4K Streaming Set-top Box (STB)/Over-the-top (OTT)
- Digital Single-lens Reflex (DSLR) Devices, and so on.

Technology  
Platforms

Smartphone

High Performance Computing

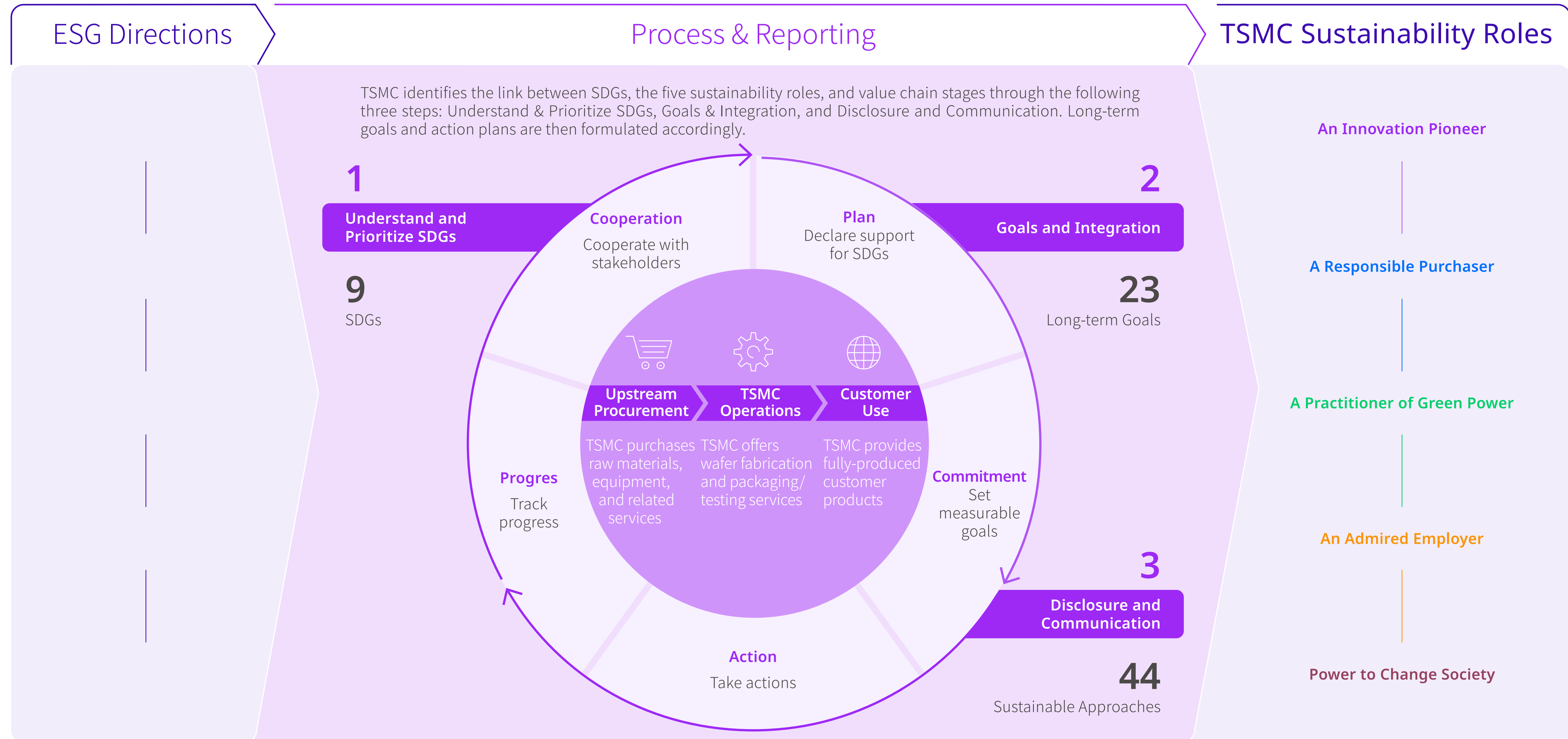
Internet of Things (IoT)

Automotive

Digital Consumer Electronics

# Carry Out the UN Sustainable Development Goals

In 2022, TSMC published the first TSMC UN SDGs Action Report. In line with the reporting framework developed by the GRI, the report details how TSMC supports the 2030 Agenda for Sustainable Development through five principles of disclosure: Plans, Commitments, Actions, Progress, and Collaboration. Under the leadership of ESG Steering Committee Chairman Mark Liu, TSMC continued to spotlight nine SDGs: SDG 3 (Good Health and Wellbeing), SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 17 (Partnership for the Goals). TSMC has also deployed 44 ESG programs and 23 measurable long-term goals for 2030 to effect change through real action.



# TSMC 2030 Sustainability Goals

↑ Trending towards positive impact over past three years  
 ↓ Trending towards negative impact over past three years  
 – Shown signs of instability over the past three years or new/adjusted targets without previous data

## 6 CLEAN WATER AND SANITATION

### Reduce Water Risks

- ↑ Reduce unit water consumption (liter/12-inch equivalent wafer mask layers) by 30% (Base year: 2010)
- ↑ Provide consultation on water reduction for suppliers and reduce water consumption by a cumulative total of 35 million metric tons (Base year: 2020)

### Raise Effluent Standards

- Water pollution composite indicator 50% above effluent standards

### Increase Usage of Reclaimed Water

- Increase more than 60% replacement of water resources with reclaimed water

## 7 AFFORDABLE AND CLEAN ENERGY

### Manufacture with Greater Energy Efficiency

- ↑ Double energy efficiency after five years of mass production for each process technology
- ↑ Save 5,000 GWh cumulatively between 2016 and 2030 through new energy-saving measures

### Use Renewable Energy

- ↑ Starting from 3nm new fabs, renewable energy accounts for more than 20% of energy consumption and the purchasing of renewable energy to increase annually to achieve 40% renewable energy company-wide

### Work with Suppliers Toward Energy Conservation

- ↑ Provide consultation on power reduction for suppliers and reduce energy consumption by a total of 1,500 GWh (Base year: 2018)

## 12 RESPONSIBLE CONSUMPTION AND PRODUCTION

### Reduce Industrial Waste Output

- Outsourced unit waste disposal per wafer ≤ 0.50 (kg/12-inch equivalent wafer mask layer)

### Promote Circular Economy

- Develop multiple types of electronics-grade chemicals for recycling within TSMC
- ↑ Reduce waste production among local major suppliers by 35% (Base year: 2014)

### Improve Environmental Protection

- ↑ Reduce the unit air pollutant emissions by 60% (Base year: 2015)
- ↑ Reduction rate of volatile organic gases > 99

## 13 CLIMATE ACTION

### Implement Adaptation Strategies to Climate Risks

- Reduce unit GHG emissions compared to the base year (metric ton of carbon dioxide equivalent (MTCO<sub>2e</sub>)/12-inch equivalent wafer mask layer) by 30% (Base year: 2020), and restore GHG emissions to the 2020 level

- ↑ Ensure 100% high energy consumption suppliers receive ISO 14064 Greenhouse Gas Emission verification
- ↑ 0 days of production interruption resulted from climate disasters

### Strengthen Supply Chain Climate Resilience

- ↑ Ensure a cumulative total of 300 raw materials suppliers participate in the annual emergency response drill (Base year: 2016)

## 3 GOOD HEALTH AND WELLBEING

### Improve Medical Care to Seniors Living Alone

- ↑ Offer 12,000 services to senior citizens each year through Network of Compassion

## 4 QUALITY EDUCATION

### Promote Filial Piety Among Youth

- ↑ Promote filial piety education in 120 educational institutions

### Youth Education and Talent Empowerment

- ↓ Invest NT\$50 million or more into

### Care for Children in Remote Areas

- ↓ More than 10,000 hours in volunteer storytelling services each year
- ↑ Help over 10,000 children in remote areas

## 12 RESPONSIBLE CONSUMPTION AND PRODUCTION

### Facilitate Health Management

- ↑ 0 cases of occupational disorders caused by exposure to chemicals

## 8 DECENT WORK AND ECONOMIC GROWTH

### Offer Competitive Compensation

- ↑ Maintain position above 75<sup>th</sup> percentile among industry peers in total compensation

### Promote Workplace Safety

- ↑ Disabling Injury Frequency Rate (FR): < 0.3
- ↓ Disabling Severity Rate (SR): < 3
- ↓ Incident Rate per 1,000 Employees: < 0.20

- ↑ All waste treatment vendors shall acquire ISO 14001 or other international EHS Management certification

- ↑ Ensure 100% critical high-risk suppliers complete Safety and Health consultation

- ↑ Assist all high-risk contractors obtain ISO 45001 certification for occupational safety and health management system

- ↑ Ensure a cumulative total of 1,500 suppliers participate in the Environmental Safety and Health (ESH) training program (Base year: 2016)

## 13 CLIMATE ACTION

### Environmental/Energy-saving Volunteers

- ↓ Environment protection volunteers provide services of at least 1,200 times each year

## 8 DECENT WORK AND ECONOMIC GROWTH

### Strengthen Industry Sustainability

- ↑ Ensure 100% Tier 1 suppliers complete the Sustainability Management Self-assessment Questionnaire
- Ensure 100% critical suppliers receive Code of Conduct audits by RBA-certified agencies every 3 years
- ↑ Audit a cumulative total of 30 suppliers (≥ 3 suppliers per year) for due diligence on responsible mineral sourcing
- Ensure 980 critical high-risk suppliers receive audits at a pace of 100 suppliers a year

### Support Local Suppliers

- ↑ Ensure a cumulative total of 145 local raw materials suppliers receive consultation on process advancement and quality improvement (Base year: 2016)
- Encourage 100% of major local raw materials suppliers and 75% of back-end packaging materials suppliers to participate in the Taiwan Continuous Improvement Award with 60% of them to advance to the finals

## 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

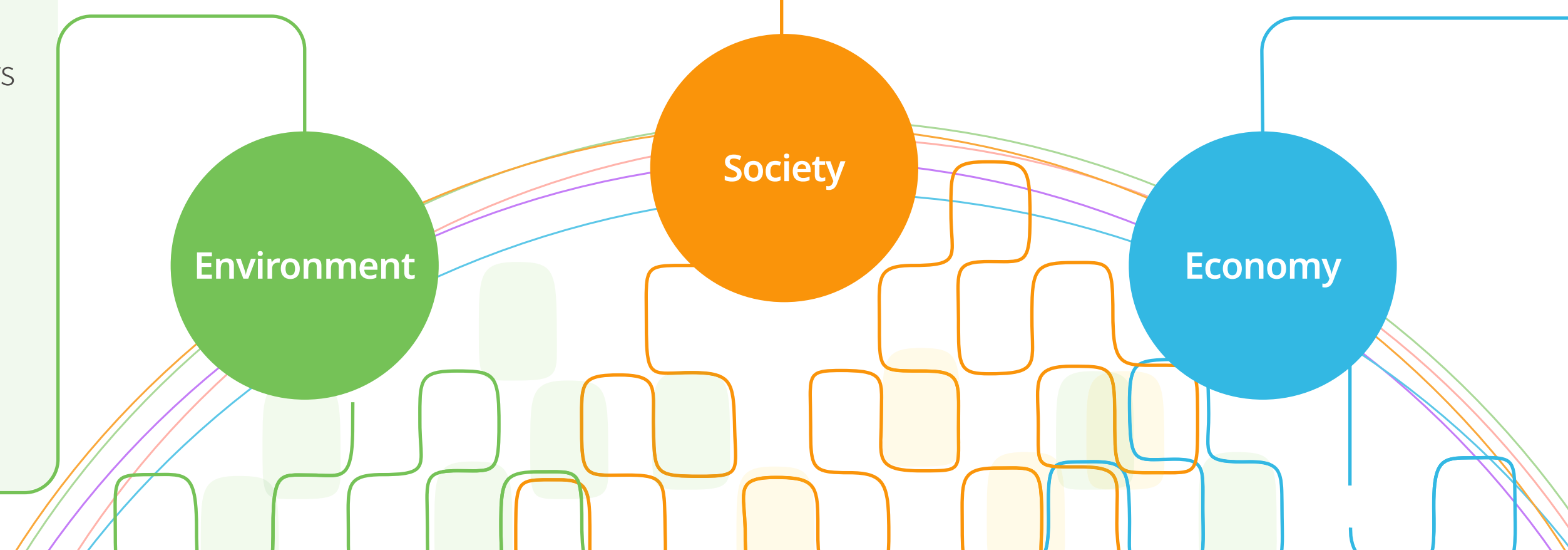
### Encourage Innovation

- ↓ Maintain TSMC's technology leadership and invest 8.5% of revenue R&D expenses annually
- ↑ Over 80,000 global patents granted
- ↑ Over 200,000 trade secret registrations
- ↑ In line with the Company's technology roadmap, TSMC provides customers with over 1,200 types of available wafer manufacturing and process technology, and over 170 types of advanced packaging technology

## 12 RESPONSIBLE CONSUMPTION AND PRODUCTION

### Chemicals Management

- ↑ Develop the ability to analyze 100% of CMR (Carcinogenic, Mutagenic, and Reprotoxic) substances and help the suppliers that supply materials with potential risks develop the same capabilities
- ↓ N-methylpyrrolidone (NMP) 100% replacement (Base year: 2016)
- ↑ No process involves Perfluoroalkyl Substances (PFASs) that have more than four carbons



# An Innovation Pioneer

TSMC remains committed to the core values of Commitment and strives to foster a diverse and inclusive culture as well as an open-style management system to attract and retain talents of different backgrounds and professions. We offer competitive compensation and benefits as well as a safe and fun workplace for growth. It is our mission to become a company that our employees can be proud of.

## 20%

Invested US\$4465,000,000 in R&D to drive innovation, a 20% increase from 2020

## >13M

Total managed capacity reached over 13M 12-inch wafer equivalents

## 100%

Patent approval rate in the U.S., better than any other top 10 patent holder

## 535 customers

With 291 distinct process technologies, 12,302 different products manufactured

## 26%

Accounted for 26% of the worldwide semiconductor market excluding memory, up 2 percentage points from 2020

## 16.2 trillion

Market capitalization (NT\$)

## 12 years

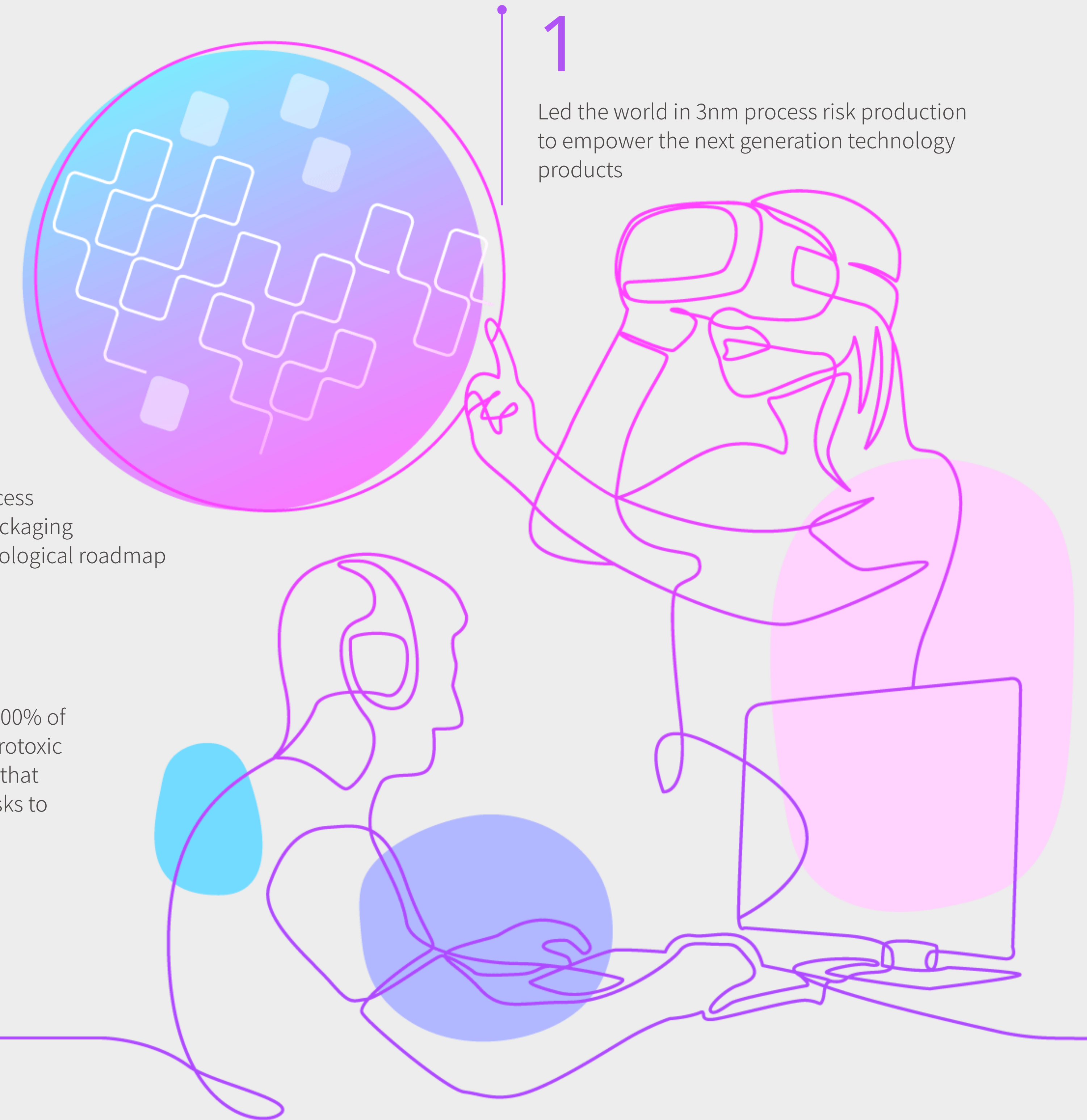
Record high revenues for 12 consecutive years

## 894/98

Provided customers with 894 process technologies and 98 advanced packaging technologies in line with its technological roadmap

## 100%

Developed the ability to analyze 100% of Carcinogenic, Mutagenic and Reprotoxic substances and help all suppliers that supply materials with potential risks to develop the same capabilities



# 1

Led the world in 3nm process risk production to empower the next generation technology products

Case Study

## Collaborate with Customers to Deliver Innovative DNA Sequencing Chips that Help Quickly Identify COVID-19 Variants

TSMC's chips manufactured for customers are widely adopted in a variety of fields. Through consistent advancement in manufacturing technologies, TSMC continues to drive progress for modern society. Thermo Fisher Scientific delivers its Next Generation Sequencing (NGS) System, the Ion Torrent Genexus System by leveraging its innovative and super-fast sequencing technology together with TSMC's industry-leading CMOS MEMS manufacturing technology that greatly reduces signal noise of sensors to offer faster, easier to use, and more flexible Next Generation Sequencing (NGS) solutions.

The Ion Torrent Genexus Integrated Sequencer ("the sequencer") is the industry's first NGS solution that automates the specimen-to-report workflow. Combining its Ion Torrent Genexus Purification System and intelligent design of highly sensitive assays, the whole system takes only two touch points and ten minutes of hands-on time to sequence billions of base pairs in-house with high accuracy, and deliver results within a single day, a significant improvement compared to the weeks previously required. The sequencer can run up to 16 COVID-19 samples simultaneously with its innovative Ion Torrent GX5 chip manufactured by TSMC, greatly reducing the cost and time. All these features enable researchers to quickly turn their focus to interpreting results, thus helping research institutes swiftly identify COVID-19 variants like Omicron and improving the ability of governments and international organizations to predict the virus' evolution and control the pandemic effectively.

<b>Customer Product</b>	<ul style="list-style-type: none"> <li>Thermo Fisher Scientific next-generation DNA sequencer - the Ion Torrent Genexus System</li> </ul>
<b>Product Innovation &amp; Breakthrough</b>	<ul style="list-style-type: none"> <li>The industry's first NGS solution that automates the specimen-to-report workflow</li> <li>Takes only two touch points and ten minutes of hands-on time to complete DNA sequencing with high accuracy and delivers genomic results within a single day</li> <li>Cost-effective as it can run up to 16 samples simultaneously with its innovative Ion Torrent GX5 chip manufactured by TSMC</li> </ul>
<b>Impact on Society</b>	<ul style="list-style-type: none"> <li>Enables researchers to quickly identify variants of the COVID-19 virus variants, contributing enormously to the understanding of the epidemiology and control of the pandemic</li> <li>Plays an important role in the analysis of cancer and inherited disease testing, as well as human reproductive health</li> <li>Accelerates life sciences research, improving patient diagnosis and delivering the promise of precision medicine at the community level</li> </ul>
<b>TSMC's Role</b>	<ul style="list-style-type: none"> <li>Provides industry-leading CMOS MEMS manufacturing technology that greatly reduces signal noises of sensors, contributing significantly to the accuracy of DNA sequencing</li> <li>Dedicates a professional engineering team to help Thermo Fisher Scientific unleash its product innovation</li> </ul>



Thermo Fisher Scientific collaborates with TSMC to deliver its next-generation DNA sequencer, contributing enormously in supporting researchers to quickly understand the COVID-19 epidemiology and controlling the pandemic. (Photo: Courtesy of Thermo Fisher Scientific)

▶ Explore these stories and more in [TSMC 2021 Sustainability Report](#)

Case Study

## Create a Win-Win Situation with Digital Transformation of Customer Audits

To meet the demands of terminal customers, auditing is an essential step before volume production. Due to the impact of COVID-19 pandemic, customers are no longer able to take international business trips. To ensure our customer's products can receive immediate certification, TSMC has overcome the time and space limits of traditional on-site audits. In 2020, the Company capitalized on digital transformation to develop a virtual auditing technology that complies with TSMC safety standards and proprietary information protection and uses different forms of remote conferencing and sharing tools to serve as a customer auditing platform. Even if customers are unable to travel to TSMC in time for audits, our virtual auditing technology can ensure that the audit will be conducted on schedule for volume production.

In 2021, TSMC further introduced a "mixed reality" technology to enhance virtual auditing technologies. In addition to the existing remote information sharing, customers can also use a head-mounted wearable device that will display the insides of TSMC fabs for "real-time production line audits," achieving the same effects as traditional on-site audits but saving our customers the energy and time consumed by long-distance travels. This can further effectively reduce time to volume production and help us earn our customers' trust. As of the end of 2021, TSMC and customers have successfully completed 30 remote audits, accelerating time-to-market of new products and creating a win-win partnership.



▶ "Virtual Audit" to enable real time audit of production fab remotely

▶ Explore these stories and more in [TSMC 2021 Sustainability Report](#)

# A Responsible Purchaser

TSMC strives for sustainable management and responsible purchases. We ask our suppliers to make advancements in the following areas: technology, quality, delivery, environmental protection, human rights, safety, and health. We also take climate risks into consideration, actively trying to strengthen our climate resilience so that we can develop a low-carbon, sustainable semiconductor supply chain.

51%

High energy consumption suppliers received ISO 14064 Greenhouse Gas Emission verification

340 GWh

Cumulative energy conserved by suppliers with TSMC's support

100%

Critical high-risk suppliers completed Safety and Health Consultation

31%

Waste production per unit among local major suppliers reduced

100%

Responsible mineral sourcing

19.71 million metric tons

Supplier water consumption reduced

86

Critical suppliers Completed S.H.A.R.P. (Supplier Healthiness Assessment Rectification Program) Audits

109

Multi-source supply solutions developed

>200,000

Certificates awarded for completing the annual TSMC Supplier Sustainability Academy program

1.3 trillion

Output value and 2.24 million jobs generated in Taiwan (NT\$)





Case Study

## Launch Supplier Fire Protection Personnel Project to Improve Supply Chain Resilience

TSMC strives to improve supply chain resilience. To reduce the risk of supply chain interruption caused by fires, TSMC has created the Supplier Fire Protection Sustainability Management Mechanism, which advises and inspects supplier fire protection systems by standards exceeding local codes. In 2021, TSMC further activated the Supplier Fire Protection Personnel Project for critical suppliers and suppliers that have shown room for improvement in fire protection audits conducted in previous years. Each supplier plant has one staff dedicated to fire protection management. TSMC offers resources and technologies to all fire protection dedicated personnel, who will receive a capability grading, training, and training result evaluation.

In 2021, 48 dedicated staffs of suppliers that didn't meet the criteria for Grade 3 in the professional all completed training. The percentage of trainees in Grade 3 and Grade 4 has increased from 58% to 82%. In 2022, TSMC plans to collaborate with academic partners. By offering teaching materials applicable to all industries, professional instructors, and teaching equipment that supports practical training, the Company will continue to improve supply

### 2021 Supplier Fire Protection Personnel Project Implementation Results

chain resilience as a globally trusted provider of technologies and manufacturing capacity.



I appreciate that TSMC offers counseling and assistance through its expert teams. In addition to sharing risk management experience in high-tech semiconductor foundries, TSMC also held practical training sessions for supplier fire protection dedicated personnel. It helps enhance the overall fire protection of the plant and disaster prevention self-management capabilities and reduces fire risks for the company.

**Chao Kuan-Chun** President of Wonik Quartz Taiwan Co., Ltd.

91



Suppliers took part in the project



▲ TSMC enhances supply chain resilience by sharing its experience in fire protection management through the "Supplier Fire Protection Sustainability Management Mechanism."

Case Study

## TSMC Supplier Sustainability Academy Systematically Shares Experiences to Drive Supply Chain Excellence

TSMC supply chains have a global reach. Therefore, TSMC set up the TSMC Supplier Sustainability Academy on the Supply Online 360 platform to improve supplier capabilities. As a pioneering open-source educational platform for industry peers in Taiwan, the Academy produces and puts out educational animation videos on the cloud platform, systematically sharing TSMC manufacturing and operational experiences with suppliers. TSMC designates mandatory courses for the suppliers to ensure effective learning. Furthermore, the Academy is available for the general public to register and access, promoting the common good in society. In 2021, TSMC Supplier Sustainability Academy was connected to the construction management system for internal contractors, moving the contractor badge application process online and imposing stricter qualification requirements for high-risk operations to reduce potential construction safety risks. Please refer to the section [Digitizing Contractor Training Programs at a 100% Completion Rate](#) for further information.

92%

Completion rate of Tier 1 suppliers on TSMC Supplier Code of Conduct training program

210

Tier 1 suppliers have adopted the TSMC Supplier Sustainability Academy as the training program for 210 of their suppliers

200,000 People

Completed the training program, with a satisfaction rating of 4.8 (highest score: 5)

# A Practitioner of Green Power

Striving to realize our belief in co-existence and shared prosperity with the environment, TSMC is actively developing and applying innovative green technologies to climate and energy, water stewardship, circular resources, and air pollution control to roll out a comprehensive action plan for sustainability so that TSMC can become the global benchmark for green corporations.

# 0

Announced to reach Net Zero Emissions by 2050

# 1

Leading company in semiconductor industry as well as in Taiwan with the largest LEED-certified building area

# 1

Received the highest UL 2799 platinum rating for zero waste to landfill

# 98.4%

Reduction rate of volatile organic gases

# 14.9%

Unit water consumption reduced (Base year: 2010)

# 499

Energy saving measures across 8 major categories, saving an additional 700 GWh

# 94%

Reduction in F-GHGs, taking lead in the global semiconductor industry

# 95%

Waste recycling rate for 7 consecutive years and a burial rate of less than 1% for 12 consecutive years

# A rating

Highest rating in CDP Water Security Program for 2 consecutive years

# 54%

Unit air pollutant emissions reduced (Base year: 2015)



Case Study

## First Semiconductor Company to Adopt Energy-Efficient Measures in Advanced Manufacturing Equipment Worldwide

TSMC is committed to creating a sustainable semiconductor supply chain. Since the power consumption of the process manufacturing equipment accounts for over 50% of the Company's energy use, and the number of advanced manufacturing equipment increases every year, TSMC launched 365 action plans under the Energy Conservation Action Project for Next-generation Fab Tools in 2021. 159 action plans have been verified and applied to 119 advanced manufacturing tool models for 5 nm process manufacturing and 3nm process manufacturing in the future. Moreover, the program introduced high-efficiency parts and energy-saving designs in 17 energy-intensive components and successfully saved 400 GWh of electricity in a year.

The New Generation Equipment Energy Conservation Program holds over 100 meetings every year in search of opportunities and innovative mindsets for equipment energy conservation. TSMC is engaged in-depth with the design of energy-conserving modules for advanced manufacturing equipment with the top six power-consuming equipment suppliers and provides implementation guidelines. Also, through regular technical review meetings, TSMC repeatedly validates the green benefits of the solutions. The energy-saving specifications are incorporated in the standards for new equipment purchases as well. As the first semiconductor company to drive the adoption of energy conservation measures in advanced manufacturing equipment among equipment suppliers, we strive towards the sustainability goal of saving energy by 20% on average for each machine by 2030.

“

TSMC is committed to practicing green manufacturing. We will continue to develop innovative energy-conserving designs in partnership with our equipment suppliers and adopt them in new manufacturing equipment in the future to optimize energy efficiency.

**Chen-Bin Lin** Director of Intelligent Engineering Center at TSMC

400 GWh

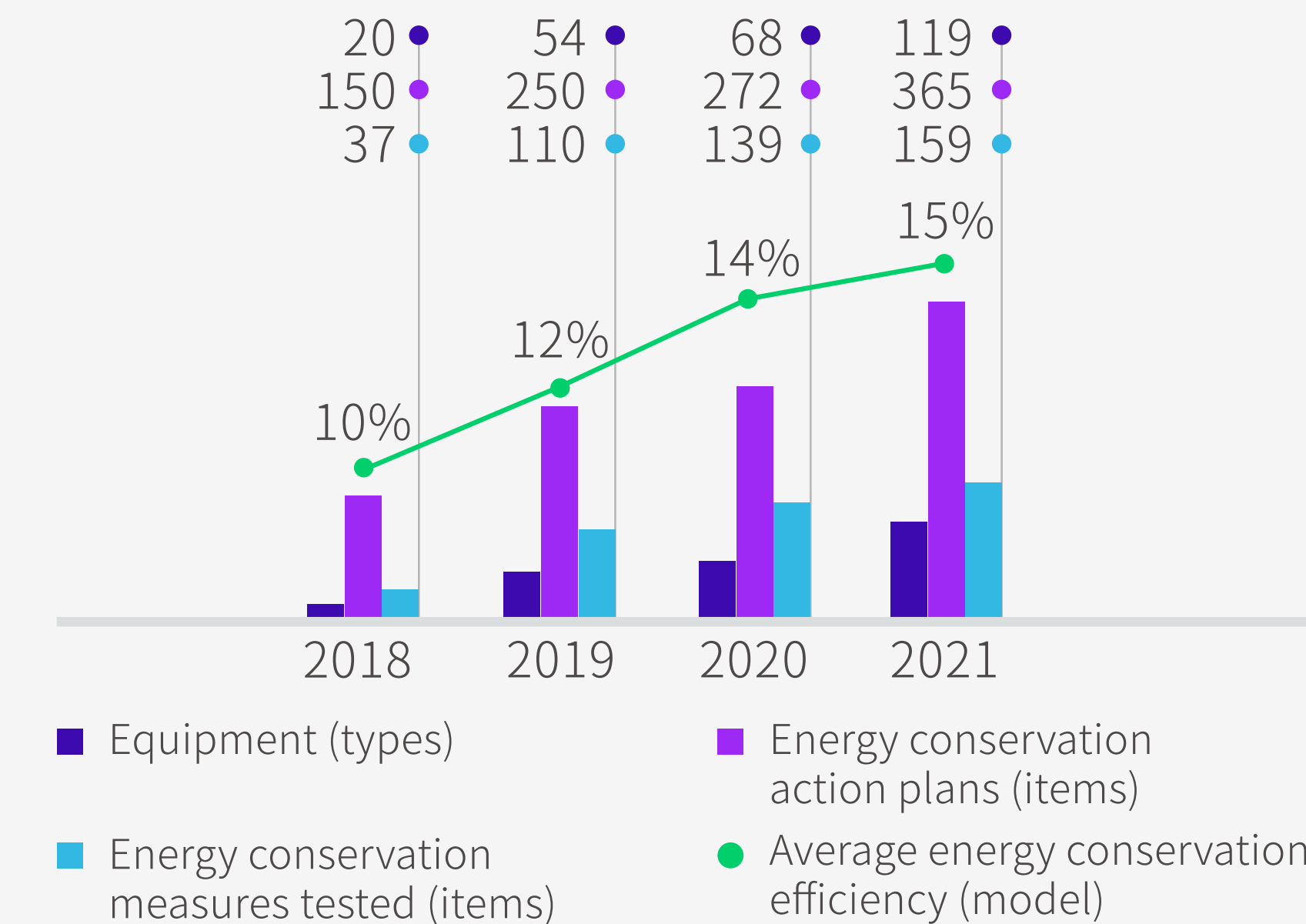
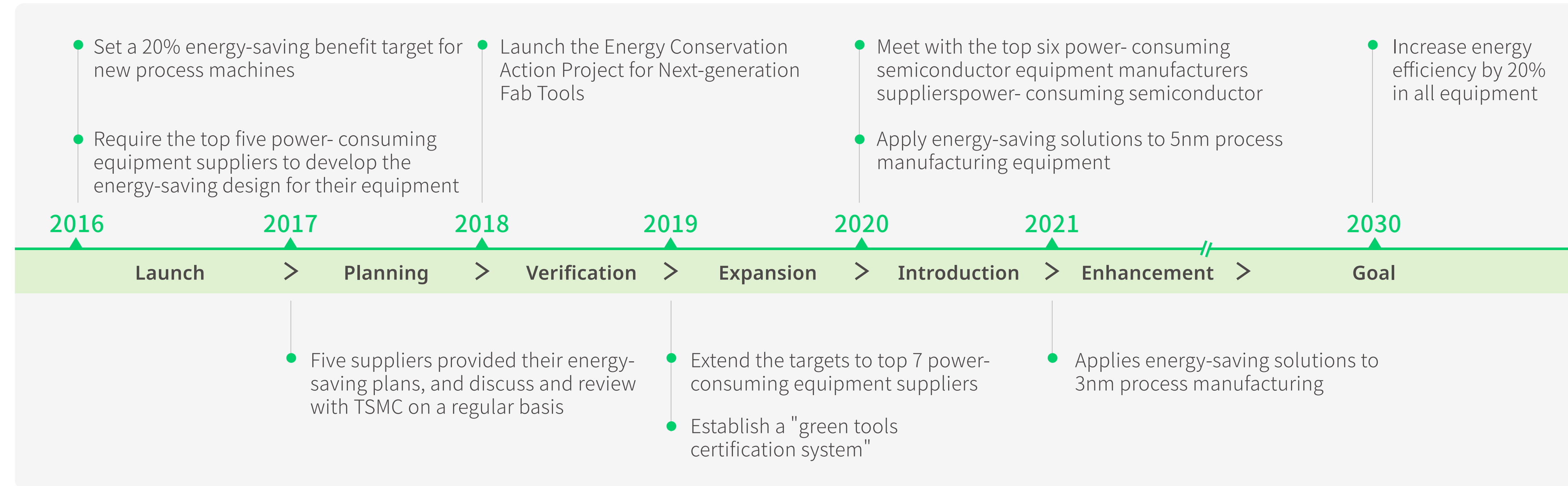


Electricity is saved



▲ TSMC collaborates with equipment suppliers in the continuous development of green semiconductor manufacturing equipment and the production of sustainable products under high energy efficiency.

### Milestones and Results of the Energy Conservation Action Project for Next-generation Fab Tools



# An Admired Employer

TSMC remains committed to the core values of Commitment and strives to foster a diverse and inclusive culture as well as an open-style management system to attract and retain talents of different backgrounds and professions. We offer competitive compensation and benefits as well as a safe and fun workplace for growth. It is our mission to become a company that our employees can be proud of.

4x

Average total compensation for direct employee is four times the minimum monthly wage in Taiwan

1

Named by Fortune as the 2021 World's Most Admired Companies

8,536

New high-quality jobs around the world

1

Ranked by Cheers as Number One in Top 10 Most Admired Companies to Young Generations for five consecutive years

100%

Employees and contractors passed safety and health training programs for operational qualifications

224 million

Number of certificates awarded to employees for completing TSMC training programs

>82.5%

Manager positions filled through internal promotions

65%

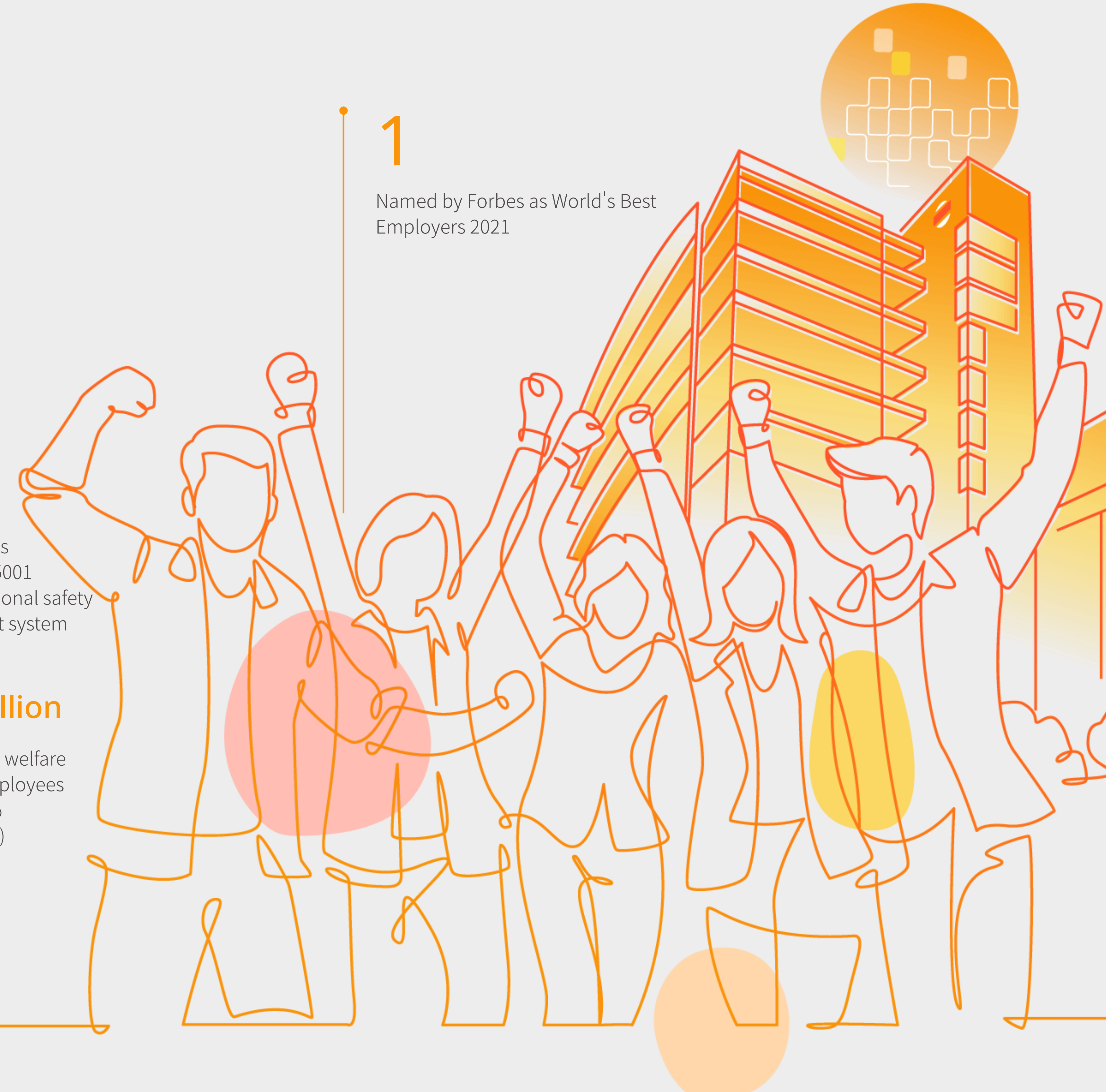
High-risk contractors was assisted to obtain ISO 45001 certification for occupational safety and health management system

164.9 billion

Total compensation and welfare handed out to TSMC employees around the world, a 17% increase from 2020 (NT\$)

1

Named by Forbes as World's Best Employers 2021



Case Study

## TSMC Newcomer Training Center

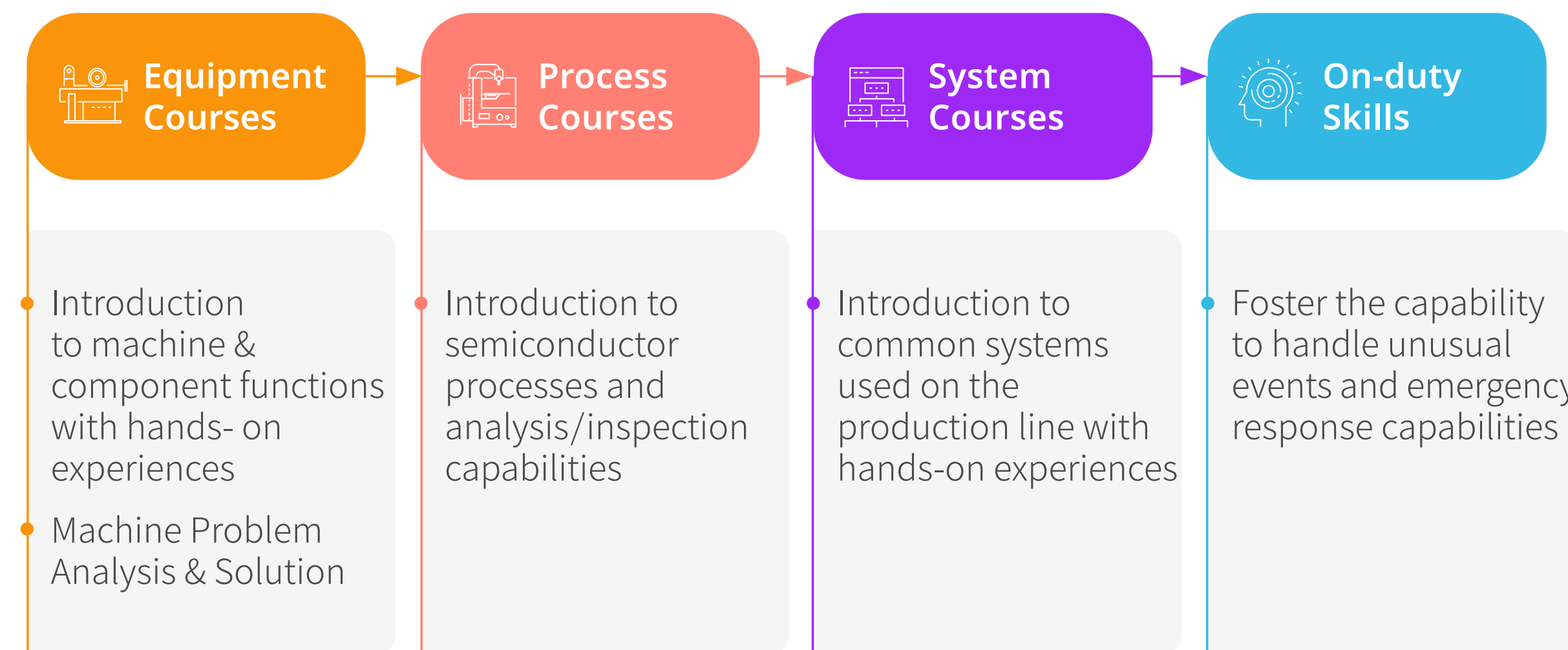
To cultivate the next generation of young semiconductor professionals, in 2021, TSMC opened the Newcomer Training Center at TC-Site so that new employees can quickly learn about fundamental semiconductor knowledge, and familiarize them with the Company's core values so that they can better assimilate into the corporate culture.



► The Newcomer Training Center helps new TSMC employees understand their work in a safer and more efficient way

In 2021, the Newcomer Training Center trained over 2,000 TSMC employees with shortening the time for independent work by about 10%.

### Four Main Courses at Newcomer Training Center



Case Study

## Digitalized Learning Map with 111 Professional Courses for Occupational Safety and Health

To raise awareness for occupational safety and health, TSMC is actively cultivating occupational safety and health professionals to lead TSMC employees in fostering a friendly and healthy workplace. In 2021, TSMC created a digitalized learning map for occupational safety and health personnel and drafted three-stage tracks for both theory and practices according to job responsibilities. The learning map contained 111 required courses on safety and health, environmental protection, and emergency response. With systematic learning as well as the sharing of know-how and experiences, TSMC aims to quickly familiarize new employees with their job responsibilities, advance their professional know-how, and improve the organization's safety performance. In 2021, 189 occupational safety and health personnel with three years of experience or less completed the learning map.



### Responsibilities & Professional Skillset of Occupational Safety and Health Personnel

Case Study

## Virtual Walking Challenge - 14,550 Employees Walked 1,029,825 kilometers

TSMC cares about employee health and promotes a lifestyle where 'every day is sports day.' As such, we decided to host a one-month virtual walking challenge. In 2021, the virtual walking challenge attracted 1,455 teams comprised of 14,550 employees. They completed a total of 1,029,825km, which is around 1,373,100,000 steps and the equivalent of 26 laps around Earth and 2,004 laps around Taiwan. The total number of walking hours was 205,965 hours and participants burned a total of 64,014kcal.

“ The challenge motivated me to get active and encouraged me to run my heart out after work. The best incentive is health itself.

**Chu Yih-Chin** TSMC Employee



► Members from the TSMC Jogging Club assembled their own team: 99% - Mr. Guan No.1 to participate in the Virtual Walking Challenge

# Power to Change Society

With a sustainable vision to "better society," the TSMC Education and Culture Foundation and the TSMC Charity Foundation have galvanized internal and external resources to spotlight the following areas: cultivate our youth, rural education, and support arts, culture, and the environment. We also care for the disadvantaged as well as seniors living alone to build a strong foundation for society through common good.

891,962

Beneficiaries of social engagement programs

572 million

Annual expenditure dedicated to talent cultivation (NT\$)

14,083

Services provided to seniors through the Network of Compassion Program by collaborating with 15 medical and Care centers

25,082

Participants of Arts and Culture Promotion

58,862

Beneficiaries from 122 organizations supporting the disadvantaged benefited from the Cherish Food Program

203,814

Beneficiaries of the Youth Cultivation Program

>6,500

Students from top universities and graduate institutes around the world participated in TSMC's diverse industry-academia cooperation programs

42.6 billion

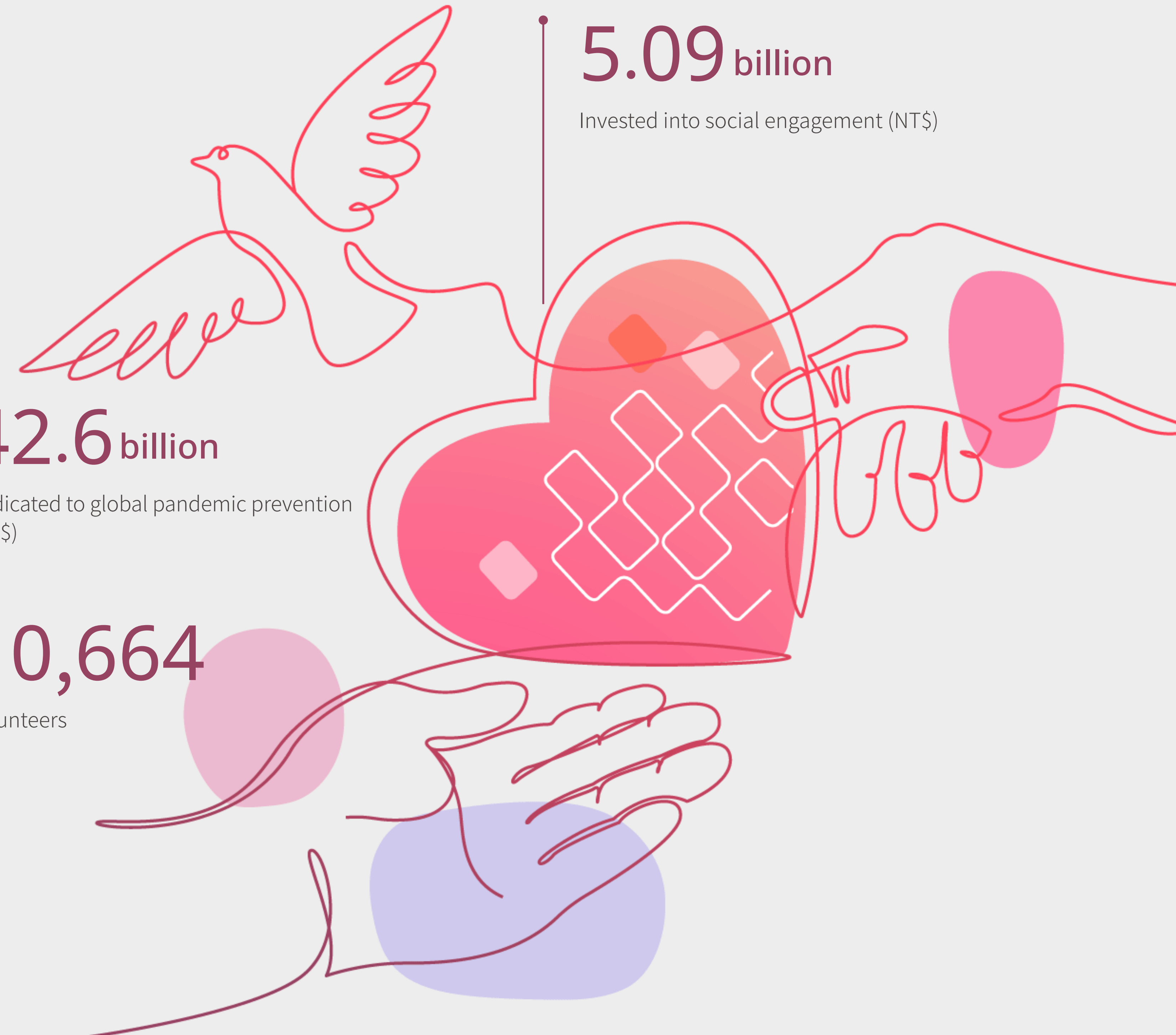
Dedicated to global pandemic prevention (NT\$)

10,664

Volunteers

5.09 billion

Invested into social engagement (NT\$)



Case Study

## Relief Efforts for Global Pandemic Prevention against COVID-19

In 2021, TSMC allocated NT\$ 4.26 billion to support global efforts against COVID-19 pandemic. Our endeavors include vaccine donations, sponsoring university medical research on pandemic prevention and control, and providing relief through TSMC Charity Foundation in healthcare, rural education, and care for the disadvantaged.

“

Adequate testing capacity is the key to COVID-19 pandemic control and prevention. We're grateful for TSMC Charity Foundation's timely donation of contactless testing stations to the NTUH medical team when most needed.

**Ming-Shiang Wu**

Superintendent of National Taiwan University Hospital



▲ TSMC Charity Foundation donated contactless testing stations to protect medical staff and enhance testing capacity.

Comprehensive Medical Resources	Undisrupted Education in Rural Areas	Caring for the Disadvantaged
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Case Study

## Cultivate New-Generation STEAM Talent

To enhance the quality of talent in Taiwan, TSMC is dedicated to youth incubation, the potential realization of diversified education, and caring for the disadvantaged communities lacking educational resources. The Company strives to achieve SDG4 of ensuring quality education by providing students in all educational stages development opportunities within and outside the scope of formal education, as well as learning resources linked to industry practices.

For university and graduate students and teachers, TSMC collaborates with schools in Taiwan and overseas to launch university programs. Through the support of teacher recruitment, mentoring programs, lectures, competitions, scholarships, groundbreaking industry-academia collaborative research programs, and production capacity for worldwide top university students and teachers to turn their IC designs into actual chips, TSMC is committed to the cultivation of next-generation semiconductor talent.

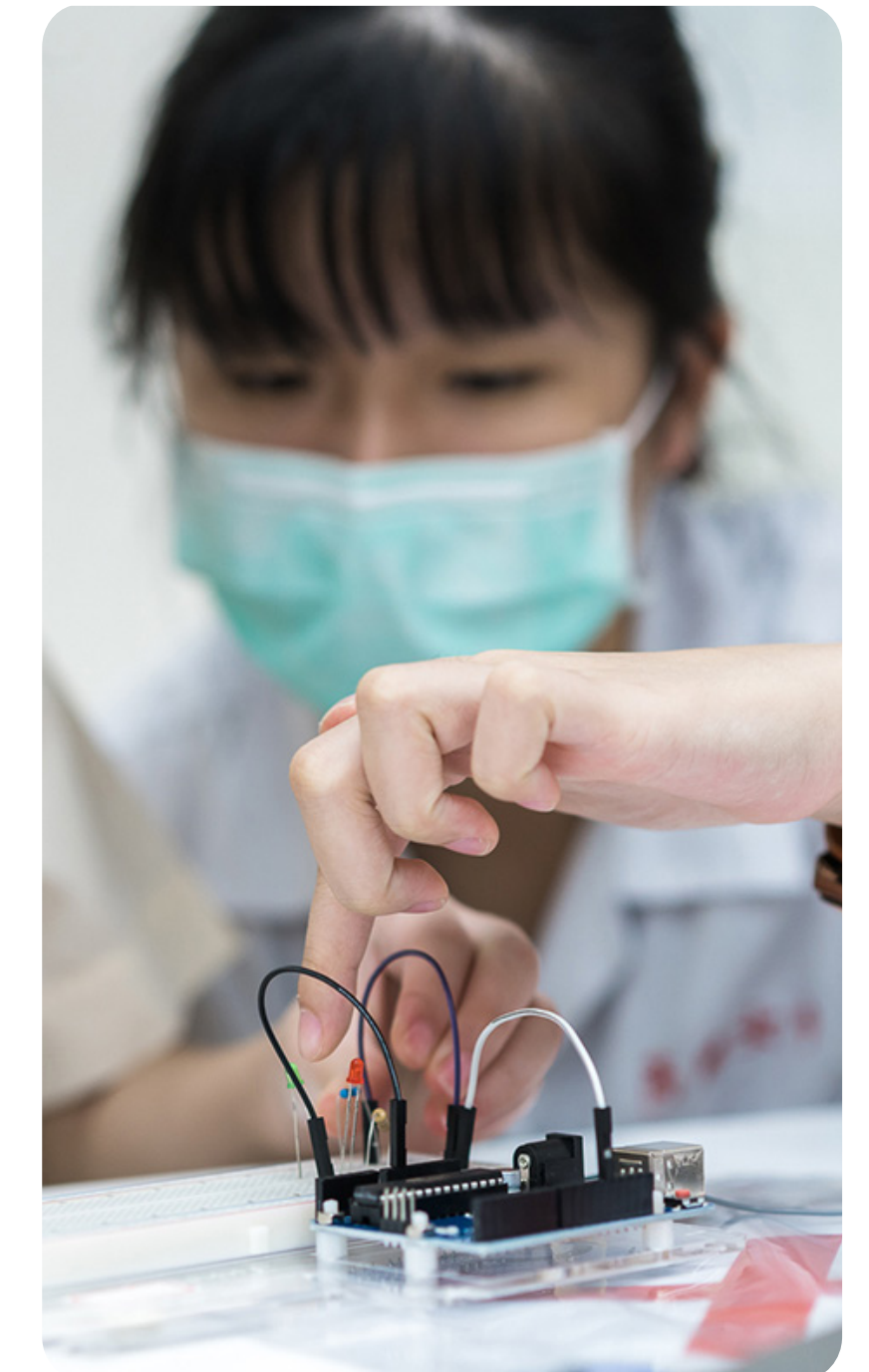
For students currently in the nine-year compulsory education system, TSMC Education and Culture Foundation and TSMC Charity Foundation jointly allocate educational resources to achieve equal access to education and empower children with STEAM capabilities.

“

In addition to training students to exert creativity and complete IC designs independently, the University Shuttle Program effectively bridges students with the industry and further introduces our efforts to the world.

**Shen-luan Liu**

Distinguished Professor at the Department of Electrical Engineering, National Taiwan University



▲ TSMC doubles down on holding Journeys of Female Scientist Lectures, offering female students diverse learning opportunities in technology.

Junior High School and Elementary Schools	High Schools	University Students	Graduate Students	Academic Research
<ul style="list-style-type: none"> <li>• Volunteer Services</li> <li>• Teach and Learn Program — Teachers Training in Reading</li> <li>• Sponsor the Exhibition Hall "The World of Semiconductors" to the National Museum of Natural Science</li> <li>• Support the Teach for Taiwan organization through regular employee donations</li> <li>• TSMC Little Baseball Hero Support Program</li> <li>• Sponsor Emei Junior High School KIST Education</li> <li>• TSMC Science and Aesthetics Tours</li> </ul>	<ul style="list-style-type: none"> <li>• TSMC Youth Theater Project</li> <li>• TSMC Journeys of Female Scientist Lectures</li> <li>• Vocational Training Program</li> <li>• Support the Junyi Academy through regular employee donations<sup>Note</sup></li> <li>• SMC Cup- Competition of Scientific Short Talk</li> <li>• Sponsorship of Science Camps</li> <li>• TSMC Youth Calligraphy and Literature Competitions</li> </ul>	<ul style="list-style-type: none"> <li>• Scholarships for outstanding yet economically disadvantaged students</li> <li>• TSMC Semiconductor Programs</li> <li>• Hsien-Yung Pai Literature Lectures</li> <li>• Big Data and Cloud Technology</li> <li>• TSMC X Microsoft Careerhack Competition</li> <li>• TSMC Youth Dream Building Project</li> </ul>	<ul style="list-style-type: none"> <li>• TSMC Ph.D. Scholarship</li> <li>• University Research Center</li> <li>• National Academy for Key Fields of Research</li> </ul>	<ul style="list-style-type: none"> <li>• Industry-Academia Joint Development Project</li> <li>• University Shuttle Program</li> </ul>

Note : Junyi Academy Foundation offers free online learning materials for elementary school, junior high school, and high school students.

# ESG Performance Summary

	Key Indicators	2019	2020	2021
<b>Operational &amp; Economics</b>	Revenue (NT\$ billion)	1,070	1,339	1,587
	Net income attributable to shareholders of the parent company (NT\$ billion)	345	518	597
	Income tax expense (NT\$ billion)	45	67	66
	Cash dividend (NT\$ billion)	259	259	266
	R&D expenditures (NT\$ billion)	91	109	125
	Capital expenditures (NT\$ billion)	460	507	83
<b>An Innovation Pioneer</b>	R&D expenses to revenue (%)	8.5	8.2	7.9
	Global patents granted	39,118	45,162	50,506
	Registered trade secrets	88,000	100,000	120,000
	Value generated from improvement projects (NT\$/ billion)	15	15	12
	Encourage all major local raw materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)	100	79	64
	Encourage back-end packaging materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)	-	46	67
	Local and back-end packaging materials suppliers that advanced to the finals of the Taiwan Continuous Improvement Award (%)	-	-	16
	New innovative testing methods for product quality and reliability	-	-	254
	Complete quality and reliability certification during the design stage for advanced processes, specialty processes, and wafer-level packaging processes in compliance with the TSMC technological roadmap	Completed	Completed	Completed
	Develop analytical abilities for carcinogenic, mutagenic, and reprotoxic substances and assist the suppliers that supply materials with potential risks in developing such abilities (%)	83	100	100
	NMP replacement rate (%) (Base year: 2016)	38	59	75
	Ensure that manufacturing processes are free from PFASs with more than 4 carbon atoms	Replaced 86% of PFOA-related matters	Ensured that all 3nm process and beyond are free from PFASs with more than 4 carbon atoms	Selected PFHxA substitutes and launched production line testing
	Diversify facilities and assess new suppliers in compliance with the multi-source program (Base year: 2018)	56	70	109

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	Key Indicators	2019	2020	2021
<b>A Responsible Purchaser</b>	Tier 1 suppliers' completion rate of the Sustainability Management Self-Assessment Questionnaire (%)	100	100	100
	Critical suppliers' completion rate for receiving third-party audits (by RBA-certified auditing institutions) every three years (%)	102	40	60
	Total number of critical high-risk suppliers that have received audits for the S.H.A.R.P. Program	-	-	86
	Requires suppliers to conduct due diligence for responsible mining; % of legally compliant mines	100	100	100
	Audit at least three suppliers for due diligence in responsible mining each year	-	-	3
	Total number of suppliers audited for due diligence in responsible mining	-	-	3
	Raw materials suppliers invited to observe the annual emergency response drill (Base year: 2016)	90	111	132
	Total number of suppliers that participated in the ESH training program (Base year: 2016)	411	558	759
	Critical high-risk suppliers that received safety and health support (%)	100	100	100
	Increase local sourcing of indirect raw materials (%)	59	60	60.4
	Increase local sourcing of parts and components (%)	50	45	46.4
	Total energy conserved by helping suppliers (GWh) (Base year: 2018)	0.97	2.1	3.4
	Total water conserved by helping suppliers (metric tons) (Base year: 2020)	-	2,130,000	19,710,000
	High-energy-consumption suppliers that have received ISO14064 certification for GHG emissions (%)	-	-	51
Waste reduction in major waste-generating suppliers (%) (Base year: 2014)	28.5	29.4	31	

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Key Indicators	2019	2020	2021
Greenhouse gas emission (metric ton - CO <sub>2</sub> equivalent) (scope 1 and scope 2 market-based)	8,769,614	9,464,696	10,304,344
Scope 1 (metric ton - CO <sub>2</sub> equivalent) <sup>Note 1</sup>	2,071,743	2,004,841	2,151,937
Taiwan sites	1,678,754	1,710,677	1,808,427
Subsidiaries <sup>Note 2</sup>	392,989	294,164	343,510
Scope 2 (metric ton - CO <sub>2</sub> equivalent) (market-based)	6,697,872	7,459,856	8,152,497
Taiwan sites	6,673,235	7,429,951	8,116,440
Subsidiaries <sup>Note 2</sup>	24,637	29,905	36,057
Scope 2 (metric ton - CO <sub>2</sub> equivalent) (location-based)	7,350,195	8,282,509	9,196,964
Scope 3 (metric ton - CO <sub>2</sub> equivalent) <sup>Note 3</sup>	5,307,028	5,511,486	6,049,256
Carbon offset (metric ton - CO <sub>2</sub> equivalent)	15,376	4,125	241,577
Fluorinated greenhouse gas emission (metric ton - CO <sub>2</sub> equivalent)	1,081,212	1,311,530	1,369,478
Reduction rate of GHG emissions per unit product compared to the base year (metric ton - CO <sub>2</sub> equivalent - 12-inch equivalent wafer mask layer) (%)	17	23	27
Energy consumption (GWh) (including electricity, natural gas and diesel)	14,323	16,919	19,192
Direct energy consumption (GWh) (including natural gas and diesel)	747	861	1,112
Indirect energy consumption (GWh) (non-renewable energy)	12,658	14,828	16,409
Indirect energy consumption (GWh) (renewable energy)	918	1,230	1,671
Renewable energy used at all TSMC fab operation sites (%)	6.7	7.6	9.2
Renewable energy used at overseas subsidiaries (%)	100	100	100

**A Practitioner of Green Power**

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Key Indicators	2019	2020	2021
Total energy conserved from new energy saving measures since 2016 (GWh/y)	12	17	24
Energy efficiency after volume production - 16nm technology	1.4 (5 <sup>th</sup> year)	-	-
Energy efficiency after volume production - 10nm & 7nm technology	0.7 (3 <sup>rd</sup> year)	1.4 (4 <sup>th</sup> year)	1.5 (5 <sup>th</sup> year)
Energy efficiency after volume production - 5nm technology	-	-	0.2 (2 <sup>nd</sup> year)
Days of production interrupted due to climate disasters	0	0	0
NO <sub>x</sub> emissions (metric tons)	116.67	170.36	205.57
SO <sub>x</sub> emissions (metric tons)	32.18	38.13	39.48
VOC emissions (metric tons)	102.1	106.8	107.7
Reduction in air pollutant emissions per unit of production (%)	30	45	54
Reduction rate of volatile organic gases (%)	97.8	98.3	98.4
Number of unusual events reported in air pollution prevention equipment	0	0	0
ISO 14001 certified sites number	22	23	24
ISO 14001 certified sites percentage (%)	100	100	100
Water consumption (million metric tons)	64.3	77.3	82.8
Taiwan sites	58	70.6	76.1
Subsidiaries <sup>Note 2</sup>	6.3	6.7	6.7
Process water recycling rate (%) <sup>Note 3</sup>	86.7	86.4	85.4
Total water saving (million metric tons) <sup>Note 3</sup>	133.6	173	186.3

**A Practitioner of Green Power**

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Key Indicators	2019	2020	2021
Ultra-pure water usage (million metric tons)	90.1	102.4	109.5
Tetramethylammonium hydroxide (TMAH)	7.9	6.3	5.5
Copper ion (Cu <sup>2+</sup> )	0.09	0.07	0.07
Reduction % in unit water consumption (liter/12-inch equivalent wafer mask layer) (Base year: 2010)	5.2	8.9	14.9
% of water pollution composite indicator above effluent standards	43.8	42.4	42.5
Waste generated (metric tons)	416,715	575,740	674,703
General waste generated (metric tons)	219,584	277,340	335,080
Taiwan sites	212,465	269,640	326,069
Subsidiaries <sup>Note 2</sup>	7,119	7,700	9,011
Hazardous waste generated	197,131	298,400	339,623
Taiwan sites	183,015	280,635	319,763
Subsidiaries <sup>Note 2</sup>	14,116	17,765	19,860
Waste recycling rate (%)	96	95	95
Taiwan sites	96	95	95
Subsidiaries <sup>Note 2</sup>	74	77	85
Outsourced unit waste disposal per wafer (kg/12-inch equivalent wafer mask layer)	0.89	1.01	0.99
Develop multiple types of electronic-grade chemicals for resource recycling within TSMC - % of resource recycling within facilities	22	22	22
Waste treatment vendors that have obtained ISO 14001 or other international EHS Management certifications (%)	70	80	82

A Practitioner of Green Power

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	2019	2020	2021
<b>Key Indicators</b>			
Numbers of employee	51,297	56,831	65,152
Employee training hours	74,178	926,379	3,185,784
Females in all employees (%)	37.8	37.1	35.4
Females in management (%)	12.7	12.5	13
Females in junior management (%)	13.6	13	13.4
Females in top management (%)	11.1	10	8.3
Females in newly hired technical professionals (%)	-	-	21.3
Turnover rate (%)	4.9	5.3	6.8
New hire (< 1 year) turnover rate (%)	13.4	15.7	17.6
<b>An Admired Employer</b>			
Voluntary turnover rate (%)	4.8	5.1	6.7
Total compensation amongst industry peers	Top 25%	Top 25%	Top 25%
Management positions filled through internal promotions (%)	-	79.3	82.5
Positions are filled through internal transfers (%)	50.8	45.2	57.6
Employees are fully committed to their work (%)	-	96	-
Employees are willing to continue working for TSMC in the next five years (%)	-	95	-
Goals for the issue of sustainably engaged from the Engagement Survey in comparison to the WTW Global High Performance Norm	-	-	Top 25%
Injury frequency rate <sup>Note 4</sup>	0.52	0.42	0.38
Injury severity rate <sup>Note 5</sup>	9	4	7
Occupational fatalities - employees	0	0	0

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	Key Indicators	2019	2020	2021
<b>An Admired Employer</b>	Occupational fatalities - contractors	0	0	0
	Incident rate per 1,000 employees	0.425	0.311	0.252
	Cases of occupational disorders caused by exposure to chemicals	0	0	0
	Contractors that have obtained ISO 45001 certification for occupational safety and health management system with help from TSMC (%)	50	60	65
<b>Power to Change Society</b>	Total participants in youth competitions	-	1,551	1,614
	Promotional events on semiconductor sciences	-	5	6
	Sponsor outstanding local artists or groups	7	Suspended due to COVID-19	12
	Hours in reading services	8,400	5,060	4,910
	Annual cash donations to the disadvantaged (NT\$ million)	1,321	1,210	2,263
	Children in remote areas that have benefited from TSMC programs	1,400	3,279	5,287
	Service visits to seniors living alone by Network of Compassion	9,527	10,855	15,719
	Meals delivered by Network of Compassion	-	-	304,477
	Promote filial piety education	37	57	64
	Annual beneficiaries of the Cherish Food Program	21,791	37,071	58,862
Volunteer service from environmental protection volunteers	770	1,044	794	

Note: Figures from all Taiwan fabs and subsidiaries of TSMC

Note 1: To ensure consistent data in GHG inventory and reduction goals after 2020, inventory data for Scope 1 will comply with the 2019 Refinement to the 200 IPCC Guidelines for National Greenhouse Gases Inventories starting from 2020 and the base year also change from 2010 to 2020

Note 2: The scope of subsidiaries in Environmental parts includes WaferTech, TSMC China Company Limited, TSMC Nanjing Company Limited and VisEra

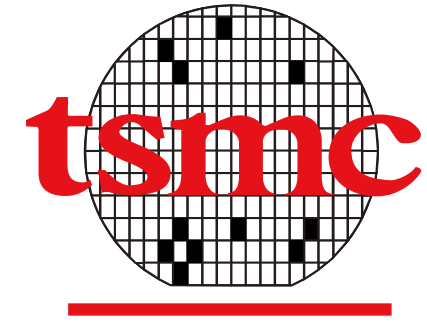
Note 3: Figures from all Taiwan fabs of TSMC

Note 4: Safety –Injury Frequency Rate=Injury Number x 1,000,000/Total hours worked

According to the Occupational Safety and Health Act, Disabling Injury Frequency Rate (FR)/Disabling Severity Rate (SR) are defined as any diseases, injuries, disabilities, or deaths of workers caused by buildings, machinery, equipment, raw materials, materials, chemicals, gases, vapors, dusts, etc., at the place of duty, or as a result of work activities, or due to other occupational causes. Other unrelated injuries in the workplace such as falling in the cafeteria or parking lot due to various reasons are not considered as work injuries. Target has been amended according to new definition. See Statistical Analysis of Disabling Injuries for detailed information

Note 5: Safety –Injury Severity Rate=Lost Work Days x 1,000,000/Total hours worked

According to the Occupational Safety and Health Act, Disabling Injury Frequency Rate (FR)/Disabling Severity Rate (SR) are defined as any diseases, injuries, disabilities, or deaths of workers caused by buildings, machinery, equipment, raw materials, materials, chemicals, gases, vapors, dusts, etc., at the place of duty, or as a result of work activities, or due to other occupational causes. Other unrelated injuries in the workplace such as falling in the cafeteria or parking lot due to various reasons are not considered as work injuries. Target has been amended according to new definition. See Statistical Analysis of Disabling Injuries for detailed information



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- The Sustainable Markets Initiative



**FTSE4Good**

**FTSE4Good Index**

- FTSE4Good Emerging Index component
- FTSE4Good All-World Index component
- FTSE4Good TIP Taiwan ESG Index component



**World Benchmarking Alliance (WBA)**

- SDG 2000 – The 2,000 Most Influential Companies



**CommonWealth Magazine**

- Excellence in Corporate Social Responsibility Award – Large cap – First Place



**Carbon Disclosure Project (CDP)**

- 2021 CDP Supplier Engagement Leaderboard
- Water Security A Ratings
- Climate Change B Ratings



**Alliance for Water Stewardship**

- Platinum certifications, the highest level, from AWS for three consecutive years

▶ For more information about TSMC's latest sustainability practices, please refer to [TSMC 2021 Sustainability Report](#), [ESG Website](#), and [LinkedIn](#)

If you have any suggestions, please contact us through [ESG@tsmc.com](mailto:ESG@tsmc.com)