5

Green Manufacturing and Operation

5.1 Resources Management

The climate change issue should brook no delay. In order to mitigate the impact on the natural environment, and achieve energy and carbon reduction, TSC is committed to maintaining the spirit of sustainable development and minimizing the environmental impact of operating activities. TSC conducts carbon emissions management according to greenhouse gas inventory results. We also introduced the ISO14001 environmental management system for energy, water resources, waste, wastewater, and air pollution prevention. We continuously implement various environmental management actions.

5.1.1 Carbon Emission Management

TSC plays a vital role in the semiconductor manufacturing chain and also endorses the concept of "Extended Producer Responsibility". The Company is committed to producing and designing environmentally friendly products, reducing product packaging, and researching environmentally friendly materials that are easily biodegradable. To implement various environmentally friendly projects more efficiently, ESG Office has set up an "Environmental and Energy Management Team" functional group to be responsible for annual carbon reduction goals and Implement various greenhouse gas reduction plans, promote renewable energy layout, etc., from the system to reduce greenhouse gas emissions.

Greenhouse Gas Inventory

TSC has implemented a greenhouse gas inventory mechanism in accordance with ISO 14064-1. The Li-Je Site has been conducting inventories for scope 1 and 2 (categories 1 and 2) since 2014, and expanded to include scope 3 (categories 3 to 6) in 2022. The I-lan Site began conducting inventories for categories 1 and 2 in 2022. We plan to further expand its inventory scope in 2024 to include TSC headquarters and overseas business locations, demonstrating its ongoing commitment to Climate Action. In 2022, TSC saw a slight increase in categories 1 and 2 compared to 2021, attributed to increased production capacity. However, the intensity of carbon emissions per unit has been reduced for three consecutive years. We will continue to implement energy-saving and carbon reduction initiatives through various programs in the future.

In 2022, the primary carbon emissions at two sites are attributed to outsourced electricity in category 2. The direct greenhouse gas emissions (category 1) at I-lan Site amount to 0.9059 tCO_2e, while the emissions from outsourced electricity (category 2) total 3,997.2177 tCO_2e, accounting for 99.98% of the site's total emissions. Similarly, at the Li-Je Site, the main source of greenhouse gas emissions is outsourced electricity in category 2, which amounts to 10,341.862 tCO_2e. This is followed by other indirect emissions (categories 3 to 6) totaling 4,672.2161 tCO_2e, and finally, direct greenhouse gas emissions (category 1) of 34.247 t-CO_2e.

Greenhouse Gas Emissions at the I-lan and Li-Je Sites in 2022

Site	Category	Emission Source	GHG Type	Emissions (tCO_2e)	Total (tCO_2e)
I-lan Site	Category 1	Stationary Combustion	CO_2, CH_4 and N_2O	0	0.9059
		Mobile Combustion	CO_2, CH_4 and N_2O	0.2729	
		Process Emission	VOCs	0	
		Fugitive Emission	CH_4	0.6330	
	Category 2	Outsourced Electricity	CO_2	3,997.2177	3,997.2177
Li-Je Site	Category 1	Stationary Combustion	CO_2, CH_4 and N_2O	0.4429	34.2474
		Mobile Combustion	CO_2, CH_4 and N_2O	8.1974	
		Process Emission	VOCs	0	
		Fugitive Emission	CH_4	25.6071	
	Category 2	Outsourced Electricity	CO_2	10,341.862	10,341.862
	Categories 3 to 6	Transport Emission (category 3), Emission from Products Used by Organization (category 4)	CO_2	4,672.2161	4,672.2161

Greenhouse Gas Emissions at Li-Je Site & I-lan Site Each Year

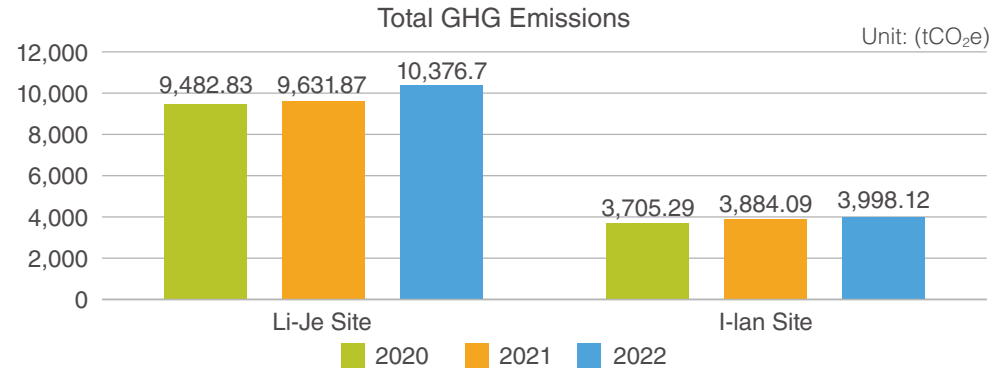
Unit: (tCO_2e)

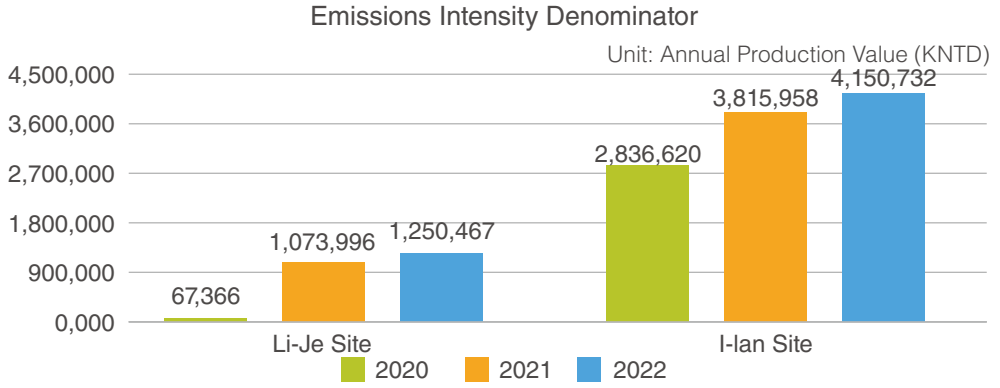
	2020		2021		2022	
	Li-Je Site	I-lan Site	Li-Je Site	I-lan Site	Li-Je Site	I-lan Site
Direct GHG Emissions (Category 1)	46.3758	0.8451	27.8046	0.8214	34.247	0.9059
CO_2 Emissions	1.7285	0.3026	5.498	0.2489	8.5607	0.2809
CH_4 Emissions	18.5175	0.5425	22.2175	0.5725	25.5675	0.6330
N_2O Emissions	0.0298	0	0.0894	0	0.1192	0
PFCs Emissions	0	0	0	0	0	0
HFCs Emissions	26.1	0	0	0	0	0
CO Emissions from the Use of Biofuels	0	0	0	0	0	0
Indirect GHG Emissions (Category 2)	9,436.4528	3,704.8074	9,604.0632	3,883.6527	10,341.862	3,997.2177
CO_2 Emissions	9,436.4528	3,704.8074	9,604.0632	3,883.6527	10,341.862	3,997.2177
CH_4 Emissions	0	0	0	0	0	0
N_2O Emissions	0	0	0	0	0	0
PFCs Emissions	0	0	0	0	0	0
HFCs Emissions	0	0	0	0	0	0

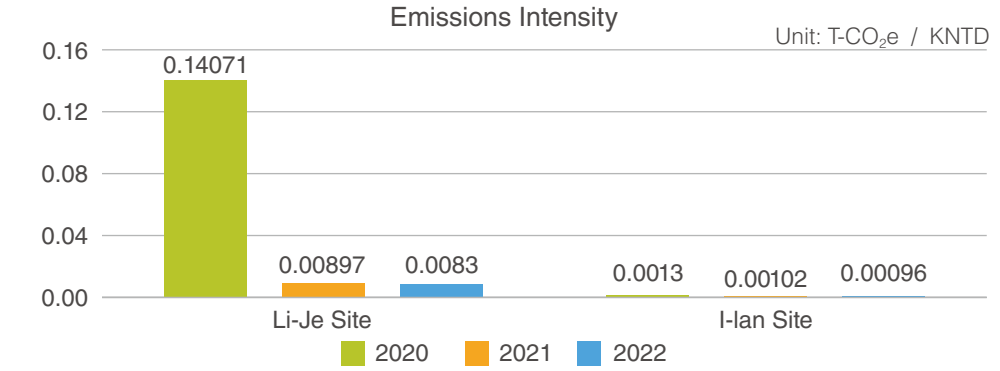
※ Note:

1. The base year for Li-Je Site inventory is 2022 (Li-Je Site added category 3 to 6 GHG inventory, so the base year is updated).
2. The base year for inventory of I-lan Site is 2022.
3. I-lan Site introduced ISO 14064-1 for Category 1 and Category 2 inventory in 2022 and conducted internal verification of the above data in the same year. I-lan Site plans to conduct external verification in 2024.

Greenhouse Gas Emissions Intensity







※ Note: Category 1 and 2 from the greenhouse gas emission table.

Other Indirect GHG Emissions (Categories 3 to 6)

Since 2022, Li-Je Site has conducted an inventory of other indirect GHG emissions. In 2022, the Li-Je Site's Category 3 and Category 4 were the largest suppliers of raw material intake - AUEEC and Taiwan Maxwave materials transportation emissions, as well as for upstream fuel-energy related activities and operational waste treatment, the results were 4,672.2161tCO_2e.

Site	Category	Emission Source	GHG Type	Emissions (tCO_2e)	Total (tCO_2e)
Li-Je Site	Category 3	Transport Emissions	CO_2	2,675.7714	4,672.2161
	Category 4	Product Emissions from Organization Use	CO_2	1,996.4447	

Future Carbon Reduction Program

The carbon reduction programs for both short and medium-term are divided into five categories: equipment replacement, energy-saving projects, clean energy utilization, building management systems, and digital management systems. TSC optimizes energy efficiency through a "source-first" reduction strategy, along with optimizing process conditions and replacing inefficient processing equipment. This helps to reduce both direct and indirect greenhouse gas emissions in our operations and processes.

Five Carbon Reduction Strategies

Strategic Policy	2023	2024-2025
Replace the Old with the New	1. I-lan Site has implemented an improvement plan for the ice water pump and cooling water pump. As part of this plan, frequency converters have been installed for the existing equipment. It is estimated that this installation will result in an annual reduction of electricity consumption by 4.9% by the end of the year. 2. Li-Je Site's performance improvement plan involves incorporating a high-performance magnetic suspension chiller, while retaining the old machines as backups. This strategy results in a 45% reduction in power consumption compared to conventional chillers.	Since 2023, each site has proposed an improvement plan for the following year, including lighting improvement, energy-saving air conditioning, and other initiatives.
Energy Saving Project	1. Apply carbon reduction to energy consumption equipment of each site, employ energy-saving chiller 2. Replace old equipment with new to improve energy efficiency	Conduct regular examinations of facilities to continuously improve carbon reduction
Using Clean Energy	Plans for using renewable energy sources in sites are based on the principles of energy conservation, creation, and storage. 1. I-lan Site has formulated a solar panel assessment plan to achieve the goal of self-sustainability. 2. Solar and energy storage programs assessed by each site. 3. Outsourced green electricity programs assessed by each site.	1. Roof solar panel installation program 2. Using Green Electricity
Establishment of Management System	1. Implement or update ISO 50001 Energy Management System at each site 2. ISO 14064-1:2018 GHG Inventory (categories 1 and 2 with partial categories 3 to 6)	ISO management system of each site is continuously updated and passed third-party certification. 1. Conduct internal inventory and audit annually, and obtain accreditation from a third-party certification authority regularly. 2. Assess and introduce ISO 14067 product carbon footprint, and apply it to the main product line first.
Introducing Digital Management System	Assess smart carbon management programs	Intelligent monitoring and management of energy resources
	Assess data integration at each site and replace manual input with digital technology	Collect real-time data to perform analysis and prediction

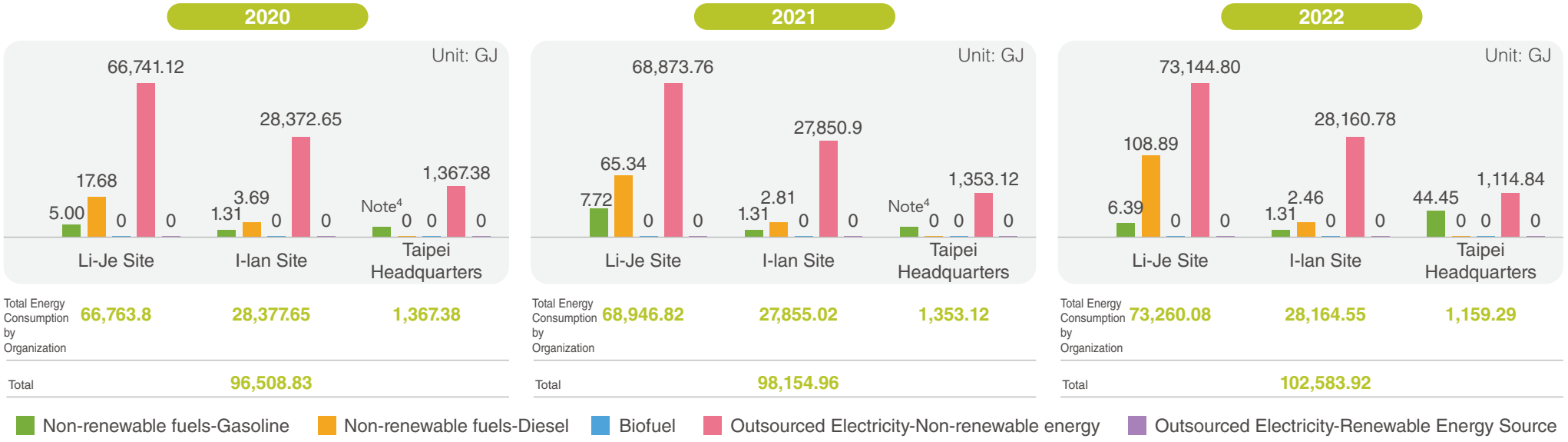
5.1.2 Energy Management

TSC is committed to improving energy efficiency and ensuring that electricity consumption and other energy consumption are reduced by at least 1% annually. Currently, both the Li-Je and I-lan Sites have implemented environmental protection plans that are based on their energy consumption. They conduct inspections on equipment that consumes a significant amount of energy and continuously upgrade to new energy-saving equipment as replacements.

Energy Structure

TSC primarily relies on outsourced electricity as its main energy source. In 2022, electricity accounted for 99.84% of the company's energy consumption. Non-renewable fuel consumption, such as gasoline and diesel, made up less than 1% of the total energy consumption. In terms of energy distribution, the Li-Je site accounted for 71.41% of the company's total energy consumption, followed by the I-lan Site at 27.46%, and the headquarters at approximately 1.13%. Over the past three years, TSC's energy consumption has increased by 50% due to the expansion of production capacity. However, the energy consumption per unit of production value has decreased year by year at both the Li-Je Site and I-lan Site, indicating significant improvements in energy efficiency.

Energy Consumption Over the Years



※ Note:

1. Gasoline is not distinguished by octane number.
2. The conversion coefficients are based on the heating value conversion method by the "Heat Content of Energy Products" published by the "Bureau of Energy, Ministry of Economic Affairs". Gasoline 7,800kcal/L (1 liter of gasoline = 0.0327GJ), diesel 8,400kcal/L (1 liter of diesel = 0.0352GJ), electricity 860kcal/kWh (one degree = 1 degree of electricity = 0.0036GJ).
3. Above numbers are rounded to the second decimal place.
4. The source documents for gasoline in 2020 and 2021 are incomplete at the Taipei headquarters; thus, figures are disclosed from 2022.

Annual Energy Intensity

Item	Year	2020		2021		2022	
	Unit/Site	Li-Je Site	I-lan Site	Li-Je Site	I-lan Site	Li-Je Site	I-lan Site
Total Internal Energy Consumption	GJ	66,763.8	28,507.34	68,946.82	27,855.02	73,260.08	28,164.55
Denominator of Energy Intensity	Annual Production Value (KNTD)	633,766	2,836,620	1,073,996	3,815,958	1,250,467	4,150,732
Energy Intensity	GJ/KNTD	0.105	0.010	0.064	0.007	0.059	0.007

※ Note:

1. The base year for both I-lan Site and Li-Je Site is 2022.
2. The conversion coefficients are based on the heating value conversion method by the "Heat Content of Energy Products" published by the "Bureau of Energy, Ministry of Economic Affairs". Gasoline 7,800kcal/L (1 liter of gasoline = 0.0327GJ), diesel 8,400kcal/L (1 liter of diesel = 0.0352GJ), electricity 860kcal/kWh (one degree = 1 degree of electricity = 0.0036GJ).
3. Above numbers are rounded to the second decimal place.

Continuous Improvement on Energy-saving

Since electricity is the main source of energy consumption at TSC, the energy-saving projects implemented over the past three years have focused on reducing electricity usage at our sites. These initiatives have included enhancing the heat dissipation of cooling towers, optimizing the power of chillers, and updating lighting equipment, among other measures, all aimed at achieving energy savings and reducing carbon emissions. As a result of these efforts, TSC has successfully reduced energy consumption by 5,107.79 GJ from 2020 to 2022.

Li-Je Site's Energy Saving and Carbon Reduction Program and Effectiveness

Year	2020	2021	2022
Site	Li-Je Site		
Energy Saving Item	• Adjust cooling water flow rate to improve cooling tower's dissipation	• Boost chiller's power • Reduce equipment's ventilation • Improve the lighting in the repair area	• Air conditioning system power saving
Energy-saving Quantity (GJ)	526.29	1,195.76	1,291.11
Energy-saving Quantity as a Percentage of Total Electricity Consumption in the Year	0.79%	1.74%	1.76%

I-lan Site's Energy Saving and Carbon Reduction Program and Effectiveness

Year	2020	2021	2022
Site	I-lan Site		
Energy Saving Item	• Improvement measures for process cooling water (PCW) • Replacement of clean room light source	• Improvement measures for outside air handling unit and chiller	• Light source replacement plan for the front TMTT station and molding press station • Replace mercury lamps in the utility apparatus room with LEDs • Exhaust pipeline merger project for site
Energy-saving Quantity (GJ)	323.24	1,329.89	441.50
Energy-saving Quantity as a Percentage of Total Electricity Consumption in the Year	1.14%	4.77%	1.57%

Future Prospects

Li-Je Site will begin implementing the ISO 50001 Energy Management System in 2023. Our objective is to enhance the energy efficiency of the LI-Je Site and elevate its energy performance to the highest level by utilizing PDCA (Plan-Do-Check-Action) mechanisms and relevant management strategies. Through the implementation of greenhouse gas reduction, the Company can attain its goals of sustainable operation and environmental friendliness.

Considering that the air-conditioning system at I-lan Site operates at full capacity throughout the year, there is a risk of wasting energy resources during non-summer seasons. To address this issue, we propose implementing an improvement plan for the ice water and cooling pumps. Specifically, we plan to retrofit 3 cooling water pumps (25HP) and 3 ice water pumps (15HP) with frequency inverters in 2023. These inverters will regulate the frequency based on the equipment temperature requirements, reducing the motor running frequency when the temperature is sufficient and increasing it when insufficient. Based on current on-site data measurements, we have calculated the electricity consumption of the existing ice water pump and cooling water pump equipment for the year 2022. This system accounts for 12.7% of the total plant electricity consumption. After implementing the improvement plan, we anticipate a 4.9% reduction in site electricity consumption. By achieving both energy-saving and cost-saving objectives, this improvement plan will contribute to the company's overall efficiency.

5.1.3 Water Stewardship

In recent years, Taiwan has experienced droughts due to climate change. TSC operates two factories in I-lan, an area without reservoirs. However, the region benefits from abundant rainfall throughout the year and natural groundwater areas in the Lanyang Plain, which prevent water shortage crises in I-lan. As a member of the semiconductor industry, we recognize the significant impact of climate change and water resources on operations. To ensure environmental sustainability and economic efficiency, TSC effectively manages water resources. This includes monitoring and recording water withdrawal and discharge, as well as implementing a grinder and cooling cycle water recycling mechanism to efficiently recycle water.

Water Resource Structure

I-lan Site and Li-Je Site are situated in I-lan County, which is located in the northeastern part of Taiwan. According to the Weather Bureau, I-lan County experiences a monsoon climate, with an average annual precipitation of over 2700mm. In 2022, groundwater constituted approximately 92.6% of the process water used at the I-lan Site, while tap water accounted for 7.4%. Due to the extended rainy seasons in I-lan and the site's proximity to the mountainside, coupled with a daily withdrawal of less than 100 tons of groundwater, there has been no depletion of groundwater, and no water limitation measures have been necessary. On the other hand, the Li-Je Site relies on surface water as its water source. It utilizes the Wulangkeng River as its primary source of pure water, accounting for approximately 87.6%, with tap water making up the remaining 12.4%. As the Wulangkeng River has consistently maintained its water flow over the years, the Li-Je Site currently does not require any water limitation measures.

Types of Water Source and Water Withdrawal at Each Site

Unit: Megaliters

Water Withdrawal by Source	2020			2021			2022		
	I-lan Site	Li-Je Site	Taipei Headquarters	I-lan Site	Li-Je Site	Taipei Headquarters	I-lan Site	Li-Je Site	Taipei Headquarters
Surface Water Withdrawal	0	202.37	0	0	227.97	0	0	249.29	0
Groundwater Withdrawal	32.11	0	0	49.80	0	0	34.82	0	0
Third-party Water Withdrawal [*1]	2.40	26.70	Note[5]	2.50	37.94	Note[5]	2.80	35.22	2.11
Total Water Withdrawal of Each Site	34.51	229.07	0	52.30	265.91	0	37.62	284.51	2.11
Total Water Withdrawal	263.58			318.21			324.24		

※ Note:

1. The third-party water withdrawal is tap water.
2. According to the WRI Aqueduct Tool, the formula for calculating water stress is as follows: annual total water withdrawal divided by annual total available recycled water supply. Areas with water stress ranging from 40% to 80% are classified as high water stress areas, while those exceeding 80% are categorized as extremely high water stress areas. TSC exclusively relies on freshwater sources with a total dissolved solid content of ≤1,000 mg/L. Additionally, all areas under TSC's purview have a water stress index below 40%, and none are designated as water stress areas.
3. The data of seawater and produced water withdrawal, or other water sources for I-lan Site and Li-Je Site is 0.
4. Third party water and surface water withdrawal data are obtained from the water bill, and the groundwater withdrawal data is collected from the water meter reading records of the sites.
5. Due to incomplete information in 2020 and 2021, the Taipei headquarters commenced disclosing using 2022 as the base year.
6. The water withdrawal at the Taipei headquarters is calculated by dividing the office building's water bill among its floors.

Water Risk Stewardship

The semiconductor industry is a significant consumer of water during wafer production, and any water shortage could have an immediate impact. Furthermore, the more advanced the process, the greater the water consumption. In Taiwan, the reliance on seasonal rainfall to fill reservoirs, coupled with climate change-induced rainfall instability, has raised concerns about water supply. Although two sites in I-lan are not situated in high water stress areas and do not face strict restrictions on water resource usage, the Company is actively promoting water conservation by implementing a water recycling mechanism at the reproduction site to achieve sustainable development.

Water Withdrawal and Discharge of Each Site

Unit: Megaliters

Item	2020		2021		2022	
	I-lan Site	Li-Je Site	I-lan Site	Li-Je Site	I-lan Site	Li-Je Site
Total Water Withdrawal	34.51	229.07	52.3	265.91	37.62	284.51
Total Water Discharge	11.61	270.71	12.32	270.71	10.84	297.99

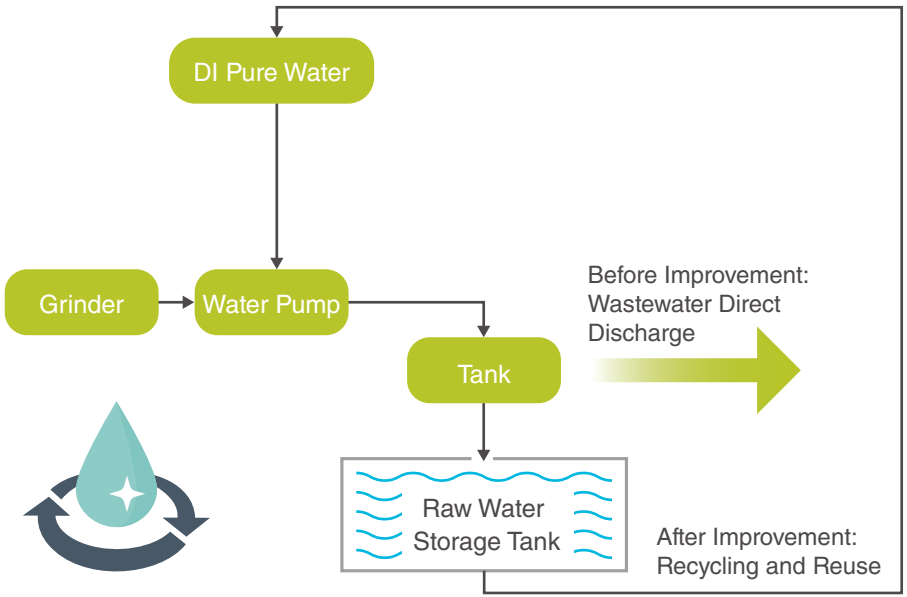
Highlight Story

Recycling and Reuse of Cooling Water from Grinder

Due to the impact of global climate change, the efficient utilization and recycling of water resources have become crucial issues. The Company remains committed to promoting water conservation measures in order to preserve water resources. Since 2015, the I-lan Site has implemented a project to recycle cooling water used in cutting machines, resulting in an annual reduction of over 2,520 tons in water consumption.

In 2022, the Li-Je Site developed a cooling water recycle plan for the grinders, effectively reusing water resources. The annual recycling rate is expected to be approximately 2%, resulting in an efficient recycling of $540,000 and a reduction in wastewater treatment. The Li-Je Site recycles cooling water, collects it through piping to the reservoir, and then transfers it to the raw water tank using a power pump as a source of pure water. Currently, the Li-Je Site drains the recycled water into the raw water tank for use in the plant. After implementation, the actual recycling efficiency in 2022 is 15 tons of water per day. Moving forward, TSC aims to continue maximizing the use of water resources. The implementation of a cooling water recycling system at the Li-Je Site is expected in 2023 to recycle unpolluted and low-pollution water resources, thereby conserving water.

Cooling Water Recycling Mechanism of Grinder



5.2 Waste Management

5.2.1 Waste Management

Waste Management Policy and Goals

TSC is dedicated to reducing environmental impacts, specifically waste pollution, while cutting operating costs by refining waste management and improving resource utilization efficiency. Consequently, both sites have been certified by ISO 14001 environmental management system and conduct regular internal audits based on the system. To implement waste reduction, declaration, and cleaning (removal, treatment and reuse), TSC collects the resource-type waste generated from the site and classifies it based on its nature, and entrusts it to the external clearance. Moreover, for special waste generated during the process, such as chemical solvents, are temporarily stored in specific areas after classification, and are handled by qualified clearance companies approved by the government authorities. On the part of grasping the final flow of waste, we also formulated an audit plan for waste clearance companies, including tracers, GPS tracking, etc., and established a complete contractor management mechanism to actively implement waste management.

Our Commitment to Waste Management:

Waste Output

In 2022, TSC produced a total of 1,219.324 tons of waste, consisting of 285.514 tons of hazardous industrial waste and 933.810 tons of non-hazardous industrial waste, including the largest category of 889.090 tons of calcium fluoride sludge. Thus, TSC established the sludge reduction in 2023. As for the waste liquid, which is the second highest output, is produced during the wafer process in Li-Je Site. The four-inch fab waste liquid is recovered and recycled in collaboration with recycling manufacturers.

Waste Output in 2022

Unit: tons

Category	2022	Category	2022
Hazardous		Non-hazardous	
Waste Liquid	269.530	Sludge	889.090
Empty Bottles of Chemicals	12.627	Spent Mixed Plastics	25.205
Waste Mixed Hardware	3.357	Other	19.515
Subtotal	285.514	Subtotal	933.810
Total	1,219.324		

※ Note:

1. The statistics provided are sourced from Li-Je Site and I-lan Site.
2. Part of the non-hazardous waste produced by TSC, which is not required to be reported, has not been included in the above table due to incomplete information gathering. It is anticipated that it will be disclosed starting in 2023.
3. "Waste electronic components" (included in the category of waste mixed hardware) are classified as non-hazardous waste when stored and handed over to external clearance companies. However, due to the disposal stage is classified as hazardous waste by Ministry of Environment, this table categorizes it under hazardous waste.
4. Waste mixed hardware includes waste solder paste, IC waste, copper waste, waste electronic components, waste products and defective products, etc.
5. Sludge refers to calcium fluoride sludge.
6. Waste mixed plastics include waste rubber strips, general resins, and noble metal ions exchange resins.
7. Others include waste glass, scrap activated carbon, and sandblasting waste.

Waste Clearance and Management

Due to the distinct nature of processes at the I-lan Site and Li-Je Site, the types of waste generated differ to some extent. Consequently, both sites have developed their own "waste clearance process" to enhance waste management. This includes staying updated on Taiwan's laws and regulations, periodically assessing the implementation status, organizing meetings, and conducting regular reviews and corrections to ensure effective waste management.

Waste Clearance Methods

The waste generated by Li-Je Site and I-lan Site is categorized into non-hazardous industrial waste and hazardous industrial waste. TSC outsources the clearance of all waste from both sites. The outsourced process is carried out in accordance with the procedure of the external clearance company and is meticulously documented as follows.

Non-hazardous Industrial Waste

On-site	Contact contract vendor for quotation ➡ Arrange clearance ➡ Issue clearance document ➡ Proceed clearance
Off-site	Follow contract processor by vehicle for weighing and photo-taking

Hazardous Industrial Waste

On-site	Contact contract clearance company to arrange clearance ➡ Issue clearance document ➡ Proceed clearance ➡ Issue clearance triplicate document
Off-site	Modify the actual weight and confirm the document ➡ Download and archive clearance vehicle GPS track map ➡ Archive the triplicate document and other processed documents

Waste Recycling Methods

The clearance company adopts two methods of recycling and reuse, or direct treatment according to the nature of the waste. TSC's recycling percentage of total waste was 87.29%, which was categorized into recycling and reuse for original purpose.

Waste Recycling and Reuse Status

Recycling and Reuse Amount in 2022

Unit: tons

Recycling and Reuse Methods	2022	Recycling and Reuse Methods	2022
Hazardous		Non-hazardous	
Recycling	159.849	Recycling	904.425
Subtotal	159.849	Reuse for Original Purpose	0.045
		Subtotal	904.470
Total Amount	1,064.319		

※ Note:

1. The statistics provided are sourced from Li-Je Site and I-lan Site.
2. Hazardous recycling items include empty barrels, waste liquid, and waste electronic components.
3. Non-hazardous recycling items include calcium fluoride sludge, waste activated carbon, and waste glass.
4. Non-hazardous items for reuse for original purpose include ion exchange compounds of noble metals.

Outsourced Waste Treatment Status

Direct treatment by clearance company in 2022

Unit: tons

Category	Clearance Method	Clearance Amount (tons)	Clearance Method Percentage(%)	Category Percentage(%)
Hazardous Waste	Incineration	125.353	80.87%	81.07%
	Other Treatment Operations	0.312	0.20%	
Non-hazardous Waste	Incineration	25.160	16.23%	18.93%
	Landfilling	4.180	2.70%	
Total		155.005	100.00%	100.00%

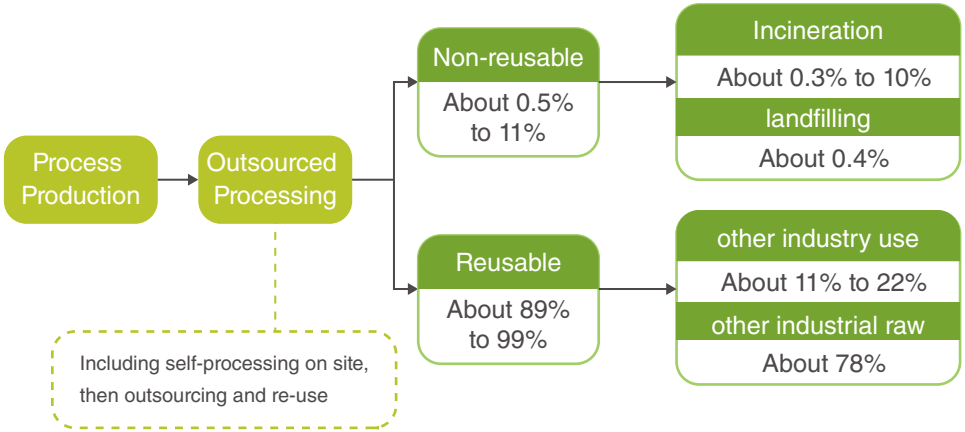
※ Note:

1. The statistics provided are sourced from Li-Je Site and I-lan Site.
2. According to the Ministry of Environment's announcement on "regulated recyclable waste and reuse waste, renewable resource items" and the Ministry of Economic Affairs' "Management Regulations on the Reuse of Industrial Waste," a list of reusable waste items has been provided. However, the hazardous industrial waste that is generated does not include any of the items listed, making it impossible to recycle and reuse. The percentage of hazardous waste that is recycled accounts for 55.99% of the total hazardous waste.
3. Other treatment operations refer to physical processing.

Waste Reduction at Li-Je Site

Li-Je Site actively promotes the utilization of off-site resources, effectively transforming waste from production processes into valuable resources. The reuse percentage for outsourced processing waste reaches an impressive 88.72%, resulting in waste reduction, decreased energy consumption and waste treatment costs, and enhanced efficiency in resource recycling. Our efforts include collaborating with cement manufacturers to recycle calcium fluoride sludge as a raw material in cement production, implementing physical treatment methods to crush and reuse waste glass, and conducting noble metal separation of waste electronic components. Additionally, we partner with recycling manufacturers to recover 94.40% of hazardous waste liquid. Through physical treatment techniques like distillation, this liquid is converted into raw materials such as banana oil, which can be further utilized in various industries, including paint production.

Li-Je Site's waste processing is mainly outsourced. The procedure is as follows:



I-lan Site Waste Reduction Plan

In the past, when our site purchased new equipment and materials, we would often end up with a significant amount of waste packaging materials, such as wooden pallets and crates, which were typically incinerated. In order to actively promote waste reduction, I-lan Site will be collaborating with external clearance companies in 2023. Our goal is to foster resource recycling by partnering with various industries and implementing recycling plans for wood, strip, and plastic waste. We have set a target to reduce total waste by 10% compared to the previous year, as well as decrease waste treatment costs by 20% from the previous year. We anticipate reviewing the results by 2024. The I-lan Site is actively seeking partnerships with manufacturers to achieve our reduction target and will also explore additional opportunities for waste reuse in the future.

Sludge Reduction Plan

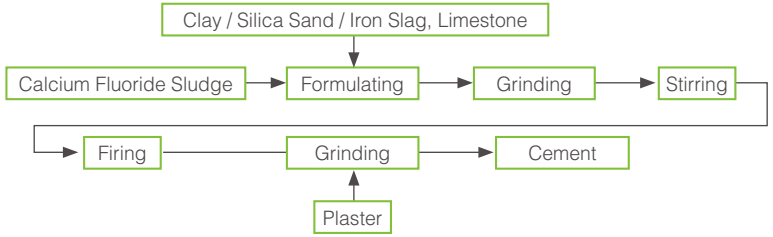
Sludge production at Li-Je Site accounted for 72.92% of the total waste. As outsourcing the removal of high-concentration waste liquid incurred high costs, in the past, the sludge was processed through Site's own wastewater system. We have further reduced sludge output by minimizing the use of chemicals in the wastewater system. With the MVR wastewater treatment mechanism, sludge production will be reduced by 10% monthly compared to the planned.

Highlight Story

We collaborated with the cement factory to recycle 100% of the sludge produced by the Li-Je Site to create a circular economy. During wafer manufacturing process, TSC uses hydrofluoric acid for wafer cleaning and etching. After chemical condensation and precipitation, the resulting hydrofluoric acid waste can be converted into calcium fluoride sludge. This sludge is then ground, stirred, and high-temperature fired in a rotary kiln reaching about 1,450°C . Afterwards, gypsum is added and ground to form cement. TSC then provides the recycled cement to the cement factory as raw material to fully enhance the reuse value of waste liquid.

Circular Economy

- Recycling of calcium fluoride sludge ➡ mineralizer as one of the raw materials for cement manufacturing



- Recycling Photo:

Contractor Waste Management

For contractors' waste treatment, TSC strictly requires manufacturers to regularly update their license. This includes conducting an annual audit of waste clearance and waste handling business activities, as well as noting it in the contract terms and regularly updating the contract. Failure to comply with waste management laws and regulations may result in contract termination. To effectively monitor industrial waste clearance, We utilize the "Global Positioning System (GPS) Real-Time Tracking System" website. This allows us to track the driving routes of the clearance company's vehicles and promptly confirm their movements. We also check and save the GPS track map of the vehicles, and occasionally conduct inspections to strictly monitor the flow direction of the clearance. TSC ensures proper handling of proof documents and produces scrap equipment treatment reports. The Li-Je Site conducts an annual audit of waste removal vendors, while the I-lan Site conducts audits on average once every two months. Vendors are scored based on the details provided in the table, with scores ranging from 0 to 5. A final score of 90 points is considered qualified according to the TSC waste clearance company standard. There have been no substandard contractor assessments for each site in 2022.

Contractor Waste Assessment Items

Clearance

- Regular maintenance on clearance machines
- Pollution prevention and safety equipment for clearance machines
- Clearance machines' grade of fit and clearance ability assessment
- Personnel driver's license management, dangerous goods delivery personnel certificate
- Emergency response equipment, methods, manuals

Other

- Organization/Competence
- Online reporting and proper handling of documents' accuracy and completeness
- Relevant performance and experience
- Accuracy of written information
- Establish ISO 14000 system or operating standard

Storage

- Whether storage capacity in the clearance site meets processing capacity
- Chemical compatibility/regional classification
- Groundwater/rainwater infiltration prevention facility
- Abnormal spills in storage area
- Preservation of hazardous and non-hazardous clearance documents

Industrial safety and fire protection

- Safe protection apparatus documents
- Feasibility of wearing and operation of protective equipment
- Inspection of fire safety facilities, audit records
- Establish security measures and fire protection equipment
- Other industrial safety management systems

5.2.2 Wastewater Management

Effective wastewater management is a crucial aspect of our sustainable development. The discharge of wastewater can have a direct impact on the local ecology and can also lead to the indirect pollution of the global environment through the spread of pollutants via runoff. TSC has established a stringent objective of "cleanliness improvement" for wastewater management, ensuring that waste liquid from each site is properly treated to prevent contamination of the surrounding soil.

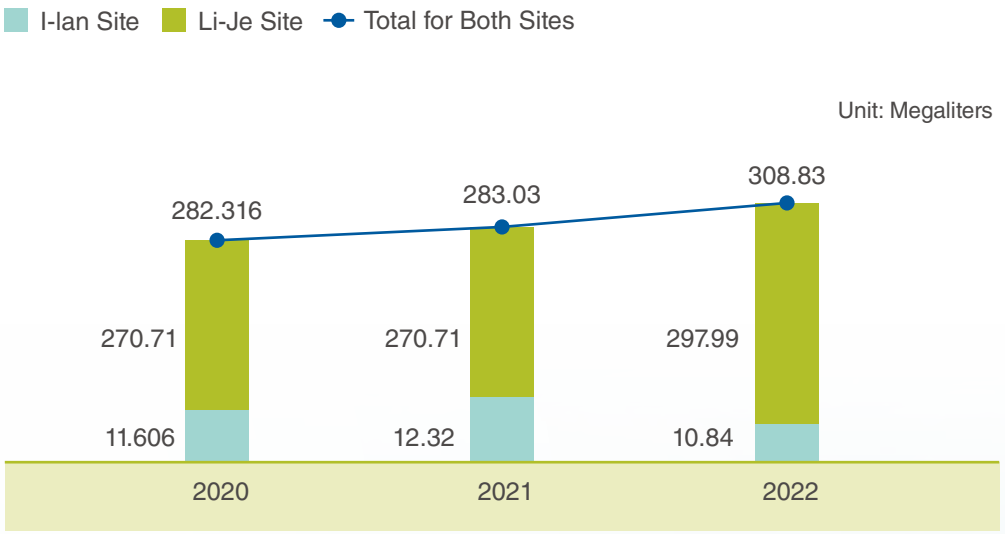
Wastewater Management Policy and Goals

In order to minimize the environmental impact of wastewater, TSC operates its wastewater facility in accordance with the discharge license and complies with the "Effluent Standards" for semiconductor manufacturing. We have implemented a comprehensive wastewater management process, which includes daily water quality analysis and regular engagement of third-party verification units to test the quality of effluent water. Additionally, we plan to introduce Mechanical Vapor Recompression (MVR) in 2023 to ensure consistent wastewater effluent and meet regulatory standards.

Annual Wastewater Discharge Trend in Each Site

Due to differences in production activities and scale, the amount of wastewater discharged at the Li-Je Site and I-lan Site varies. To address the specific needs and circumstances of each site, we have implemented appropriate project management methods and a water quality monitoring mechanism. The Li-Je Site specializes in semiconductor front-end wafer manufacturing and consumes a larger volume of water compared to I-lan. Consequently, the majority of wastewater discharged in 2022 originated from the Li-Je Site. In total, both sites processed 308.83 megaliters of wastewater in 2022. The increase can be primarily attributed to the expanded production capacity at the Li-Je Site. Conversely, wastewater at the I-lan Site decreased from 2021, primarily due to reduced cutting water consumption resulting from adjustments in the product mix.

Annual Wastewater Discharge in Each Site



※ Note: All drainage terminals in TSC are fresh water (≤1,000 mg/L total dissolved solids), and the water pressure index in the area is lower than 40%, no discharge of wastewater to areas with water pressure.

Wastewater Monitoring Mechanism

Two sites have implemented the "Wastewater Management Operating Procedure" to effectively control and process wastewater discharged during the production process. This procedure clearly regulates wastewater collection, monitoring, recording, testing, and reporting. By strengthening wastewater quality control, we can prevent abnormal effluent quality that negatively impacts the environment. The two sites diligently document the discharge and dosage on a daily basis, ensuring compliance with the effluent quality standards set by the Ministry of Environment. Additionally, they conduct 24-hour monitoring of the wastewater treatment system. The duty staff records the daily wastewater system operation data and water quality analysis values, which are then approved by the system engineer. The unit supervisor reviews these records, and the monthly reports are compiled into charts and submitted to the top supervisor of the site for review.

Water Quality Monitoring Mechanism of I-lan Site

The wastewater from the I-lan Site is discharged into the I-lan River under the supervision of the Site Affairs Department. The department conducts daily pH value examinations, weekly observations of suspended solids, and prepares semi-annual water quality reports. Additionally, the department undergoes annual ISO 14001 inspections conducted by external third-party certification units. In 2022, an inspection was conducted on the wastewater discharge from the I-lan Site. The inspection revealed that the discharge contained only a small amount of suspended solids (<5mg/L) and the pH level was determined to be neutral without requiring any adjustments (pH 7 ± 1). Based on these findings, TSC concluded that all wastewater discharged from the I-lan Site in 2022 met the effluent standard and did not cause any water pollution.

Due to the high purity and low pollution levels of the wastewater at the I-lan Site, as well as its low volume, the environmental impact is minimal. In 2022, the Environmental Protection Bureau of I-lan County advised TSC to apply for a modification to the wastewater discharge permit in accordance with legal requirements. As a result, the Wastewater Site Simplification Project was established at I-lan Site, aiming to reduce daily wastewater discharge from 100 tons to 64 tons. Additionally, the I-lan Site has developed a comprehensive plan for managing wastewater, which includes relocating the groundwater treatment unit tanks to the ground floor. This measure ensures that unprocessed wastewater will not spill and contaminate the soil. The completion of this plan is expected between 2023 and 2024.

Water Quality Monitoring Mechanism of Li-Je Site

Li-Je Site discharges wastewater into the Xincheng River. The wastewater treatment system is continuously monitored, and water quality is analyzed twice daily. Environmental Safety and Site Affairs staff collect the data, which is then submitted to the system engineer for approval. The unit supervisor verifies and analyzes the data, which is then compiled into monthly charts and reports for review by the highest-level supervisor at the site. Li-Je Site closely monitors any changes in water quality and promptly initiates an analysis and improvement process if the plant's limits are exceeded. Any violations are documented, and improvement plans are proposed. In terms of external audits, Li-Je Site's management performance is evaluated and certified by a third-party organization annually. This organization examines the operations and records of ISO 14001. Additionally, the quality of Li-Je Site's effluent is tested quarterly by a third-party certification unit, which reports the results to the Ministry of Environment using production data.

Regulatory Compliance and Improvement Measures

The Company's production process results in wastewater discharge that contains small amounts of heavy metal nickel and fluorine ion pollutants. The wastewater discharge from both sites complies with the "Effluent Standards" established for the semiconductor manufacturing industry. On May 21, 2022, the Environmental Protection Bureau of I-lan County conducted an audit of Li-Je Site. The audit revealed that TSC violated one paragraph of Article 7 of the Water Pollution Control Act. Specifically, the water sample taken from discharge port D01 did not meet the effluent standards (nickel: 2.39mg/L, exceeding the maximum value of 1.0 mg/L). As a result, TSC was fined NT$561,000 and required to attend 2 hours of environmental lectures conducted by the Environmental Protection Bureau, I-lan County. TSC made improvements by July 24, 2022, and developed short-term and long-term plans to enhance management and provide education and training to personnel, ensuring the achievement of each stage's goals. Following this incident, Li-Je Site included the higher hazardous pollutants present in the discharged water as part of the key items.

2022 Wastewater Discharge Violation

Site	Violation Incident	Fines
Li-Je Site	The water sampling quality test results for the discharge port (D01) do not meet the effluent standards.	NT$561,000

Water Quality Improvement Program

In order to achieve the goal of improving water quality management, we conducted a thorough investigation into the incident of wastewater discharge violation in 2022. Following the investigation and review, we developed the Li-Je Site water quality improvement plan to ensure compliance with sampling standards. Moving forward, we have devised short-term monitoring measures and long-term improvement efforts. The following methods are employed to monitor water quality and prevent the recurrence of illegal activities.

Implementation Methods Li-Je Site

Short-term Monitoring

- Increase and confirm dosing quantity, alter the safety stock of chemicals to ensure consistent dosage.
- Assign personnel to perform nickel quick sieving of the WM05 high fluorine system rapid sedimentation basin daily to ensure effective dosing *1, by adjusting dosage amount and dispensing concentration to ensure that heavy metal nickel in boiling water can be effectively removed. (figure below)

Undosed

After dosing

Medium-term Monitoring

- The new MVR system is scheduled for completion in 2023. It aims to decompose pollutants in wastewater to stabilize the quality of discharged water, reduce the dosage of the wastewater treatment system, and evaluate the inclusion of nickel ion detection equipment for real-time monitoring of water quality to ensure its normalcy.
- Utilizing innovative treatment technology to reuse sludge derived from wastewater treatment, forming a circular economy (please refer to 5.2.1 Waste Recycling - Sludge Recycle and Reuse)

Long-term Improvement

- Transform wet processes into dry processes to minimize the discharge of high-concentration waste liquids and decrease the presence of pollutants in wastewater.
- To enhance the efficiency of sludge treatment and minimize the potential for sludge spillage, it is recommended to procure and install a new sludge hydro extractor.

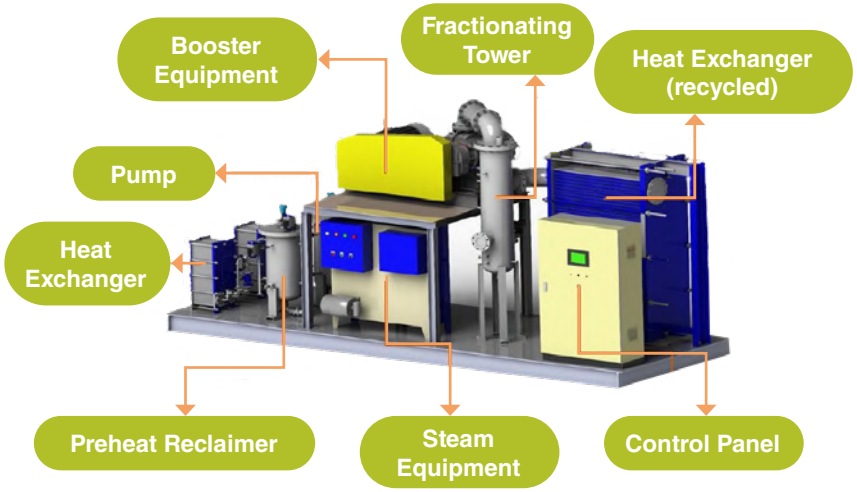
*1 : The heavy metal collecting reagent is utilized to conduct a rapid screening test for nickel. This test is performed on heavy metal wastewater in a quick sedimentation basin. The purpose of this test is to confirm the dosing status and ensure that the concentration of heavy metals in the water meets emission standards.

Highlight Story

Addition of Distillation Processing System

Li-Je Site is situated in I-lan. In order to address the expensive outsourcing costs associated with removing highly concentrated waste liquid produced at the site, it was decided to process it through the site's wastewater system. In light of the "Effluent Standards" regulation implemented in 2021, which imposes stricter controls on ammonia nitrogen and nitrate nitrogen management, the Company conducted an assessment of the potential risks to the effluent water quality at the site. In 2022, Li-Je Site carried out water sample testing and developed plans to incorporate it into the wastewater treatment facilities. By the end of 2022, TSC had installed the Mechanical Vapor Recompression (MVR) system, which is scheduled to be completed by the end of 2023. The first phase has already begun, converting high-concentration waste liquid into clarified liquid discharge for the low fluorine wastewater treatment system after undergoing MVR treatment. So far, the actual performance has resulted in a reduction of the monthly treatment volume of concentrated waste liquid to 12,300 tons, while increasing the capacity for treating high acid waste liquid to 214 tons per month. It is anticipated that in the future, these figures will further expand to 24,600 tons per month and 450 tons per month, respectively, leading to a significant reduction in various chemical substances in the wastewater and effectively minimizing the production of sludge used in the wastewater systems.

MVR System



For future utilization of MVR systems, TSC anticipates that the second phase of the plan will involve wastewater management. The Li-Je Wastewater Site will be utilized to treat low-concentration wastewater, thereby mitigating environmental impact and minimizing the potential for non-compliance with environmental laws and regulations at the site. In the third phase, the objective is to recycle and reuse the wastewater, thereby reducing water consumption and promoting sustainable operations.

Stage 1:

High concentration waste liquid discharging to the low fluorine wastewater treatment system through MVR system

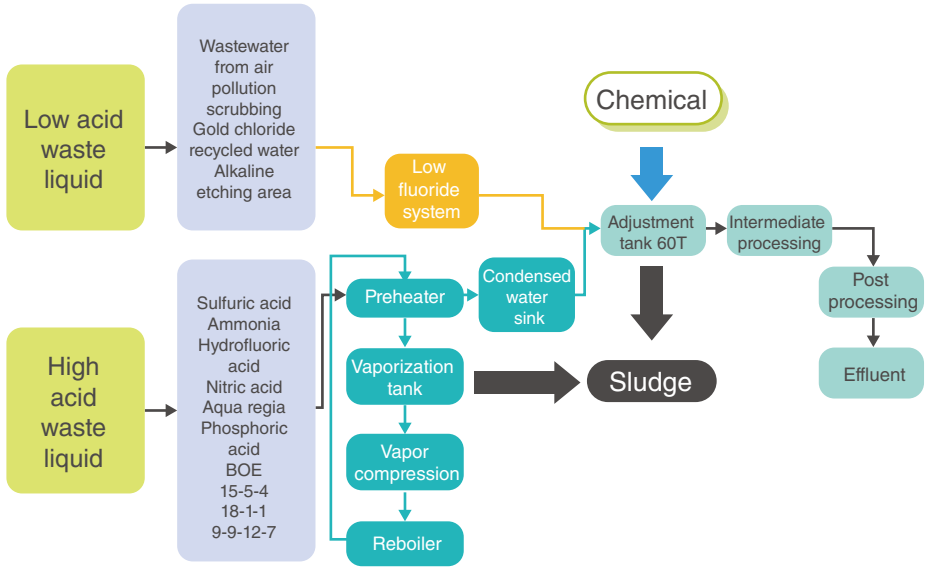
Stage 2:

Wastewater management

Stage 3:

Wastewater recycling and reuse

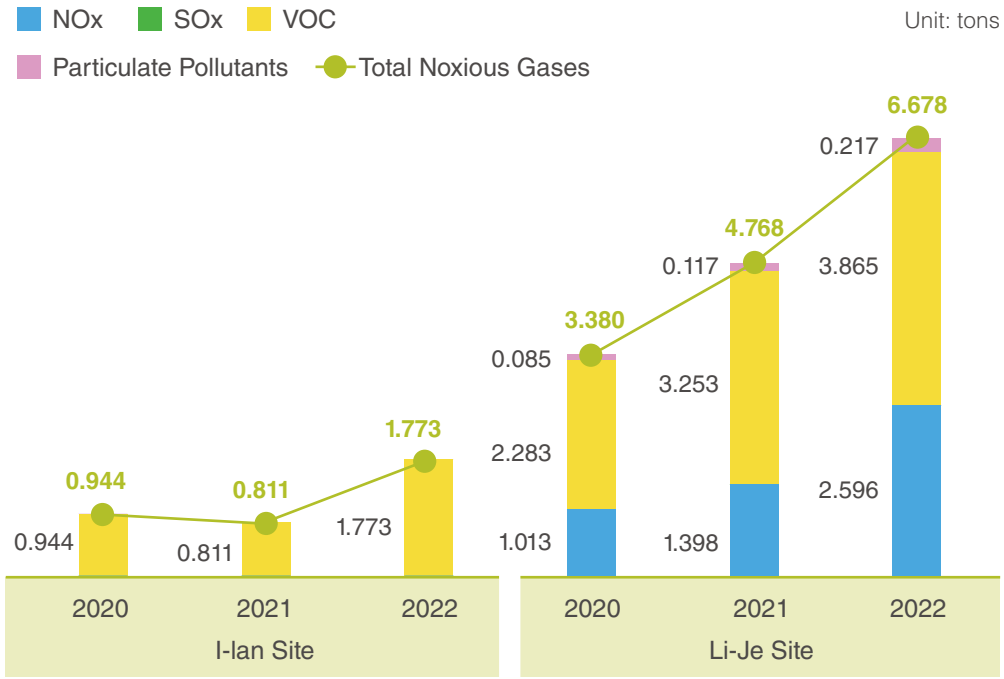
Reduce water consumption



5.2.3 Air Pollution Control

TSC is dedicated to preventing air pollution and implementing environmental protection measures. The company's air pollutant emissions, which include acid and alkaline waste gas, as well as volatile organic waste gas (VOCs), are effectively managed through various control equipment. These include acid and alkaline scrubbing towers and zeolite rotor incineration systems. Continuous monitoring is conducted using flame ionization detector (GC-FID systems) to ensure that the control equipment operates efficiently and meets regulatory standards. In 2022, due to the expansion of production capacity, there was a slight increase in actual VOC emissions compared to 2021.

Annual Noxious Gas Discharge in Each Site



Note:
1. Li-Je Site and I-lan Site have no emissions of ozone-depleting substance (ODS), persistent organic pollutants (POPs), and particulate matter (PM) in the past three years
2. Measurement method: Real-time site monitoring data
3. I-lan Site did not detect any NOx, SOx, or particulate pollutants in the past three years.
4. Li-Je Site did not detect any SOx in the past three years.

Air Pollution Control Monitoring

TSC complies with the "Air Pollution Control and Emissions Standards for the Semiconductor Industry" to manage emissions and conducts regular audits, both internally and externally, to monitor air pollution prevention equipment. In 2022, I-lan and Li-Je sites had average VOC emissions of 0.202kg/hr and 0.33kg/hr, respectively, surpassing the emission standards set by the Ministry of Environment.

Waste Gas Treatment

TSC emits primary air pollutants that can be classified as acid and alkali waste gas, as well as volatile organic waste gas. TSC utilizes specialized treatment equipment and processes that are tailored to the characteristics of each type of waste gas.

Treatment of Each Air Pollutant

Air Pollutant Type	Treatment Method
Acid/alkaline Exhaust Gas	Acid and alkali wastes are collected in an acid/waste scrubbing tower for appropriate treatment, ensuring that the resulting wastes comply with emission standards.
Volatile Organic Waste Gas	Li-Je Site: Volatile organic compounds (VOCs) are adsorbed and concentrated using a zeolite rotor. This is followed by a continuous high-temperature desorption process and catalytic incineration. As a result, the treated waste gas meets emission standards, achieving a reduction rate of over 90% for volatile organic waste gas. I-lan Site: VOCs are treated using scrubbing towers to remove VOCs from the waste gas. The resulting waste liquid is then discharged into the wastewater system. Since the concentration of VOCs is lower at the I-lan Site compared to the Li-Je Site, scrubbing is the preferred treatment method. This eliminates the need for concentrated purification using zeolite rotor adsorption.

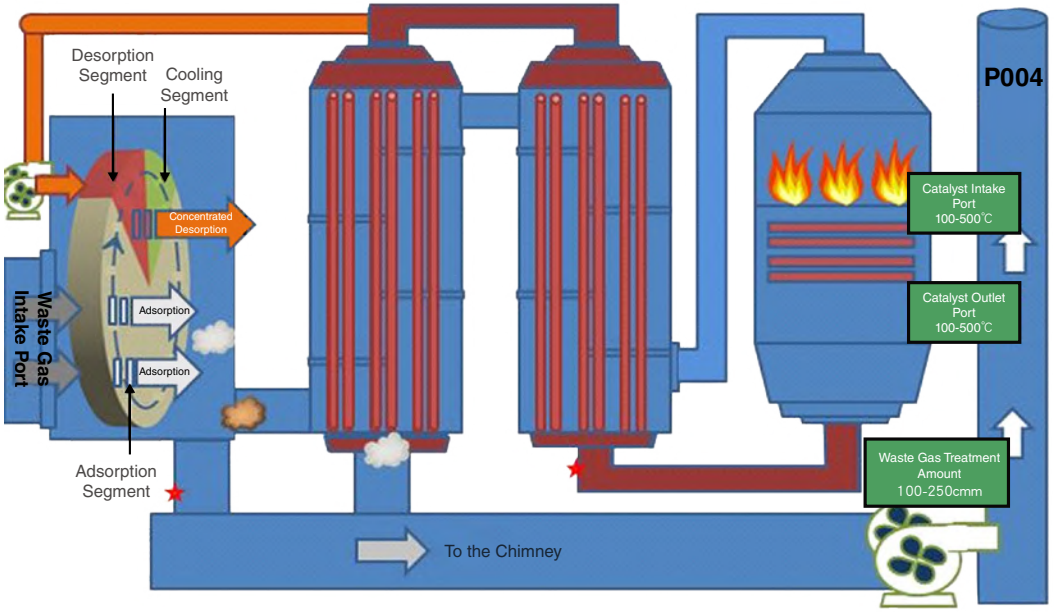
The scrubber tower at Li-Je Site utilizes a parallel method to process both acidic and alkaline waste gases. In the event of an emergency, the remaining equipment can be adjusted to handle the target exhaust treatment, while also coordinating with the production line to prevent air pollution. Furthermore, the zeolite rotor continuous incineration (RCO) system, which is employed to treat volatile organic exhaust gases, can be switched to the activated carbon tower in parallel during emergencies. This allows for simultaneous coordination with the production line to minimize environmental impact.

Waste Gas Treatment Flow Chart

Emission Management

Volatile Organic Waste Gas → Zeolite Rotor Adsorption Purification → High Temperature Desorption → Catalytic Combustion

Zeolite Rotor Concentration System	Heat Exchanger A	Heat Exchanger B	Heater Catalyst Bed	Chimney



On-site Photos: