

Status of Energy Management and Usage

TSRC refers to the ISO 50001 energy management system structure and adopts the PDCA model to periodically analyze energy use and consumption by major production sites, and conducts checks on process efficiency and system regulations to ensure energy efficiency in all TSRC factories to achieve the goal of energy control and efficiency improvement. Kaohsiung Factory, Nantong Industries and TSRC-UBE have obtained ISO 50001 certification.

TSRC's global operations continue to implement measures to improve energy efficiency and reduce energy consumption. In addition to innovating low-carbon processes and replacing process equipment to achieve carbon reduction targets, major plants and subsidiaries (Kaohsiung Factory, Shen Hua Chemical, Nantong Industries and TSRC-UBE) have set annual energy saving targets. Only Kaohsiung Factory, Shen Hua Chemical and TSRC-UBE failed to meet the target in 2023, while the other plants met the target. The failure to meet the targets was mainly due to the increase in electricity and steam consumption as a result of the change in production volume, additional equipment, and the increase in cooking changeover time and pre-opening heat transfer to meet environmental protection requirements.

	2023 Achievement	2023 Goals	2025 Goals	2030 Goals
 Goals and Achievement	<ul style="list-style-type: none"> TSRC Group's renewable energy accounted for 6.1% of total electricity consumption Kaohsiung Factory increased electricity consumption by 2,795 MWh and steam consumption by 15,529 tons Shen Hua Chemical used 310 kWh/ton of electricity and 1.15 tons/ton of steam per unit product The comprehensive energy consumption of Nantong Industries was 39,423.31 tce (ton of standard coal equivalent), and the comprehensive energy consumption per unit product was 0.591 (tce/ton) The comprehensive energy consumption of TSRC-UBE was 26,519 tce, and the comprehensive energy consumption per unit product was 0.392 (tce/ton) Shanghai Industries' electricity consumption per unit product was 417 kWh/ton in the summer and 403 kWh/ton in the rest of the year TSRC (Vietnam) Co., Ltd.'s electricity consumption per unit product was 865 kWh/ton 	<ul style="list-style-type: none"> TSRC Group's renewable energy accounted for 5% of total electricity consumption Kaohsiung Factory reduced electricity consumption by 750 MWh and steam consumption by 250 tons Shen Hua Chemical's electricity consumption per unit product ≤ 303 kWh/ton, steam consumption per unit product ≤ 1.14 ton/ton Nantong Industries' comprehensive energy consumption in tce $\leq 42,750$, comprehensive energy consumption per unit product ≤ 0.592 (tce/ton) The comprehensive energy consumption of TSRC-UBE was 25,470 tce, and the combined energy consumption per unit product ≤ 0.382 (tce/ton) Shanghai Industries' electricity consumption per unit product < 422 kWh/ton in summer and < 410 kWh/ton in the rest of the year TSRC (Vietnam) Co., Ltd.'s electricity use per unit product $\leq 1,130$ (kWh/ton) 	<p>TSRC Group's renewable energy accounted for 10% of total electricity consumption</p> 	<p>TSRC Group's renewable energy accounted for 30% of total electricity consumption</p>

1. Energy Saving Targets and Achievements of TSRC

Key factories and subsidiaries	Energy Conservation Targets for 2023	2023 Target Achievement	Description and Improvement Plan	2024 Goals
Kaohsiung Factory	<ul style="list-style-type: none"> Reduce electricity use by 750,000 kWh/year Reduce steam use by 250 tons/year 	<ul style="list-style-type: none"> Increase electricity use by 2,794,910 kWh/year Increase steam use by 15,529 tons/year 	<ul style="list-style-type: none"> Difference in electricity and steam consumption from the estimate due to changes in production and self-generated electricity. Increase in self-generated electricity by 37% in 2023 compared to 2022, resulting in 41% increase in electricity and 42% increase in steam. 	<ul style="list-style-type: none"> Reduce electricity use by 750 MWh/year Reduce steam use by 250 tons/year
Shen Hua Chemical	<ul style="list-style-type: none"> Electricity use per unit product ≤ 303 (kWh/ton) Steam use per unit product ≤ 1.14 (ton/ton) 	<ul style="list-style-type: none"> Electricity use per unit product ≤ 310 (kWh/ton) Steam use per unit product ≤ 1.15 (ton/ton) 	<ul style="list-style-type: none"> Electricity consumption has increased due to the addition of new exhaust gas heat exchanger, exhaust fan, and water-cooled fan. In addition, due to the increase in production volume in 2023, the production line was not refueled for a long period of time, which also led to an increase in electricity consumption. To comply with the environmental protection requirements, the cooking changeover time and pre-opening heat transfer were increased, resulting in an increase in steam consumption. In addition, due to the increase in production volume in 2023, production was conducted without the addition of gel grease for a long period of time, which also resulted in an increase in steam consumption. 	<ul style="list-style-type: none"> Electricity use per unit product ≤ 310 (kWh/ton) Steam use per unit product ≤ 1.14 (ton/ton)
Nantong Industries	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) $\leq 42,750$ Combined energy consumption per unit product ≤ 0.592 (tce/ton) 	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) = 39,423.31 Combined energy consumption per unit product ≤ 0.591 (tce/ton) 	<ul style="list-style-type: none"> Goal achieved. 	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) $\leq 42,900$ Comprehensive energy consumption per unit product ≤ 0.588 (tce/ton)
TSRC-UBE	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) = 25,470 Comprehensive energy consumption per unit product ≤ 0.382 (tce/ton) 	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) = 26,519 Comprehensive energy consumption per unit product ≤ 0.392 (tce/ton) 	<ul style="list-style-type: none"> In 2023, mainly to maintain the stable operation of RTO furnace, there was an increase of steam consumption by 0.20t/t-BR, increase of steam consumption by about 13,500t and increase energy consumption by about 1,230 tce. Prevention and Improvement Measures: Based on the operation of the new RTO furnace, adjust the amount of coalescing and stripping steam added to effectively reduce the use of steam and reduce energy consumption. 	<ul style="list-style-type: none"> Comprehensive energy consumption (tce) $\leq 26,100$ Comprehensive energy consumption per unit product ≤ 0.390 (tce/ton)
Shanghai Industries	<ul style="list-style-type: none"> Summer electricity use per unit product < 422 (kWh/ton) Non-summer electricity use per unit product < 410 (kWh/ton) 	<ul style="list-style-type: none"> Summer electricity use per unit product of 417 (kWh/ton) Non-summer electricity use per unit product of 403 (kWh/ton) 	<ul style="list-style-type: none"> Goal achieved. 	<ul style="list-style-type: none"> Summer electricity use per unit product < 415 (kWh/ton) Non-summer electricity use per unit product < 410 (kWh/ton)
TSRC (Vietnam) Company Limited	<ul style="list-style-type: none"> Electricity use per unit product $\leq 1,130$ (kWh/ton) 	<ul style="list-style-type: none"> Electricity use per unit product = 865 (kWh/ton) 	<ul style="list-style-type: none"> Goal achieved. 	<ul style="list-style-type: none"> Electricity use per unit product $\leq 1,100$ (kWh/ton)

2. TSRC' s Energy Consumption

TSRC Group's total energy consumption in 2023 was 5,042,279.98 gigajoules (GJ), a decrease of 1.93% compared to 2022. In 2023, TSRC's purchased steam decreased by 5.99% compared to 2022, purchased non-renewable electricity decreased by 6.86% compared to 2022, and the use of renewable energy increased, resulting in an energy intensity per metric ton of 9.50 GJ per metric ton of product, a decrease of 0.21% compared to the previous year.

(Unit: GJ)		2020	2021	2022	2023
Non-renewable energy	Bituminous coal	1,179,625.25	0.00	0.00	0.00
	Fuel oil	22,762.09	0.00	0.00	0.00
	Plant diesel	14,775.47	5,283.02	12,126.96	9,936.36
	Natural gas	1,621,896.17	1,822,886.21	1,763,823.66	1,815,902.91
	Liquefied petroleum gas (LPG)	4,161.60	1,824.44	769.22	239.91
	Gasoline	1,070.08	1,415.94	1,241.03	1,530.97
	Recycled butadiene	53,400.51	59,917.15	66,979.31	76,259.51
	Purchased electricity	921,085.20	975,172.68	929,941.41	866,128.46
	Purchased steam	1,402,533.40	2,290,025.73	2,366,576.76	2,234,203.88
	Subtotal	5,221,309.77	5,156,525.17	5,141,458.35	5,004,202.00
Renewable energy	Purchased electricity	0.00	0.00	0.00	36,000.60
	Self-generated electricity	0.00	0.00	0.00	2,077.38
	Subtotal	0.00	0.00	0.00	38,077.98
Total energy consumption		5,221,309.77	5,156,525.17	5,141,458.35	5,042,279.98
Self-generated electricity (non-renewable energy)		0.00	22,952.62	60,071.87	82,148.90
Percentage of electricity used from the power grid (%)		100.00%	97.70%	93.96%	87.81%
Percentage of renewable energy (%)		0.00%	0.00%	0.00%	0.76%
Percentage of electricity from the grid out of total energy consumption (%)		17.64%	18.91%	19.33%	17.18%

Note:

- The 2020-2021 data covers the Global Business Headquarters within the reporting boundary, two factories (Kaohsiung and Gangshan), and 6 subsidiaries that engage in manufacturing activities. It excludes 2 holding companies, Polybus and TSRC (Lux.), which mainly engage in trading activities.
- The 2022-2023 data covers the Global Business Headquarters within the reporting boundary, two factories (Kaohsiung and Gangshan), 6 subsidiaries and 2 holding companies, Polybus and TSRC (Lux.), which mainly engaged in trading activities.
- The TSRC (Lux.) data is based on the sum of the electricity used on the LEO online inquiry platform (launched on October 16, 2023) and the annual settlement payment notice, which is the annual electricity consumption. However, the data from April 19, 2023 to before the launch of the inquiry platform is based on the average value from January to April 2023, and the actual data will be available at the end of April 2024.
- The energy conversion factors are based on the "GHG Emission Inventory Guideline (non-official translation)" published by the Environmental Protection Administration of Taiwan. The data is calculated based on the Lower Heating Values (LHV) of the fuels. The results are rounded to the second decimal place using rounding rules.
- Organization Total energy consumption= the internal energy consumption= non-renewable energy + renewable energy.
- Percentage of electricity used from the power grid (%) = (Purchased electricity (non-renewable energy)) / (Purchased electricity (non-renewable energy) + Purchased electricity (renewable energy) + self-generated electricity (renewable energy) + self-generated electricity (Non-renewable energy)).
- Percentage of renewable energy (%) = (Purchased electricity (Renewable energy) + Self-generated electricity (renewable energy)) / Total energy consumption.
- Percentage of electricity from the grid out of total energy consumption (%) = Purchased electricity (non-renewable energy) / Total energy consumption.
- Heating value conversion factor of each energy use refers to version 6.0.4 of the Greenhouse Gas Emission Factor Management Table of the Environmental Protection Agency of Taiwan. Among them, the recycled butadiene reference petroleum heating value, is calculated based on 7,800 kcal/L calculation. For steam, except for Shenhua Chemical and Nantong Industries, a standard conversion factor of 2.26 GJ for the heat required to vaporize one ton of water at one atmosphere pressure is used. Shen Hua Chemical and Nantong Industries use a conversion factor provided by their supplier, which is 2.96626 GJ for one ton of water.
- Except for Shen Hua Chemical and Nantong Industries, the other factories use the standard 1 atmosphere that the amount of heat required to vaporize one ton of water = 2.26 GJ calculation. Shen Hua Chemical and Nantong Industries have heating value conversion factor provided by suppliers, and it is calculated based on a ton of water 2.96626GJ.
- Starting from 2021, all manufacturing factories of TSRC no longer use bituminous coal and fuel oil as energy sources.
- Restatements of information: TSRC Group's direct energy consumption data in 2022 is revised based on verification, and the indirect energy consumption value is changed due to the change of the unit conversion factor of TSRC purchased steam.

3. TSRC Purchased Energy

Year	Purchased Energy	TSRC Corporation	Shen Hua Chemical	Nantong Industries	TSRC-UBE	Shanghai Industries	TSRC (Vietnam) Company Limited	TSRC Speciality Materials LLC	Polybus	TSRC (Lux.)	TSRC Group in total	
2020	Amount of electricity purchased from external sources (MWh)	105,790	53,467	49,993	21,868	4,576	0	20,163	n/a	n/a	255,857	
	The steam purchased from external sources (metric ton)	49,068	192,784	176,435	22,935	0	0	179,368	n/a	n/a	620,590	
	The energy consumption of external purchases (GJ)	Electricity	380,844	192,481	179,975	78,725	16,474	72,587	n/a	n/a	n/a	921,085
		Steam	110,894	435,692	398,743	51,833	0	405,372	n/a	n/a	n/a	1,402,533
		Electricity & Steam	491,738	628,173	578,718	130,558	16,474	477,958	n/a	n/a	n/a	2,323,619
	Production volume (metric tons)	173,773	170,426	55,560	63,036	12,214	0	46,521	n/a	n/a	n/a	
	Indirect energy intensity per unit product (GJ/metric tons)	2.83	3.69	10.42	2.07	1.35	0	10.27	n/a	n/a	4.46	
2021	Amount of electricity purchased from external sources (MWh)	108,106	54,051	60,513	21,338	4,170	2,290	20,413	n/a	n/a	270,881	
	The steam purchased from external sources (metric ton)	59,025	192,407	392,510	230,190	0	0	139,154	n/a	n/a	1,013,286	
	The energy consumption of external purchases (GJ)	Electricity	389,182	194,584	217,847	76,817	15,012	73,487	n/a	n/a	n/a	975,173
		Steam	133,397	434,839	887,073	520,229	0	314,488	n/a	n/a	n/a	2,290,026
		Electricity & Steam	522,578	629,423	1,104,919	597,046	15,012	387,975	n/a	n/a	n/a	3,265,197
	Production volume (metric tons)	194,194	170,988	73,815	65,285	9,934	0	47,921	n/a	n/a	562,138	
	Indirect energy intensity per unit product (GJ/metric tons)	2.69	3.68	14.97	9.15	1.51	0	8.10	n/a	n/a	5.81	

(Continued)

Year	Purchased Energy	TSRC Corporation	Shen Hua Chemical	Nantong Industries	TSRC-UBE	Shanghai Industries	TSRC (Vietnam) Company Limited	TSRC Specialty Materials LLC	Polybus	TSRC (Lux.)	TSRC Group in total	
2022	Amount of electricity purchased from external sources (MWh)	92,803	53,899	65,727	21,165	2,703	1,164	20,850	4	2	258,317	
	The steam purchased from external sources (metric ton)	27,993	177,090	320,918	215,399	0	0	138,157	0	0	879,556	
	The energy consumption of external purchases (GJ)	Electricity	334,091	194,038	236,616	76,195	9,730	4,190	75,060	14	9	929,941
		Steam	63,263	400,222	951,927	638,929	0	0	312,235	0	0	2,366,577
		Electricity & Steam	397,355	594,260	1,188,543	715,123	9,730	4,190	387,295	14	9	3,296,518
	Production volume (metric tons)	178,484	170,522	72,822	67,217	5,494	577	44,910	0	0	540,026	
	Indirect energy intensity per unit product (GJ/metric tons)	2.22	3.48	16.32	10.64	1.77	7.26	8.62	n/a	n/a	6.10	
2023	Amount of electricity purchased from external sources (MWh)	89,225	56,633	51,395	20,831	2,440	1,379	18,683	3	3	240,591	
	The steam purchased from external sources (metric ton)	223	183,646	291,595	225,965	0	0	125,417	0	0	826,846	
	The energy consumption of external purchases (GJ)	Electricity (non-renewable energy)	321,212	203,880	185,020	74,992	8,782	4,964	67,257	10	11	866,128
		Electricity (renewable energy)	0	0	36,001	0	0	0	0	0	0	36,001
		Steam	504	415,040	864,947	670,271	0	0	283,442	0	0	2,234,204
		Electricity & Steam	321,716	618,920	1,085,968	745,263	8,782	4,964	350,700	10	11	3,136,333
	Production volume (metric tons)	178,370	171,221	66,747	67,622	6,094	1,101	39,846	0	0	531,001	
Indirect energy intensity per unit product (GJ/metric tons)	1.80	3.61	16.27	11.02	1.44	4.51	8.80	n/a	n/a	5.91		