INDUSTRY UPDATE

Taiwan

凱基亞洲 KGI ASIA

Heavy electrical sector

GRSCP & US infrastructure investment to bring growth

Key message

We initiate coverage of the heavy electrical sector, and expect capex of NT$565bn for Taiwan's power grid enhancement and US$464bn in US infrastructure investment to be the main catalysts for heavy electrical equipment manufacturers in 2023-32. Considering share valuations and business structure, our preference of heavy electrical equipment makers is, in descending order, Chung-Hsin Electric, Teco Electric, Shihlin Electric, Fortune Electric, and Allis Electric.

Event

We initiate coverage of the heavy electrical sector, and expect capex of NT$565bn for Taiwan's power grid enhancement and US$464bn in US infrastructure investment to be the main catalysts for heavy electrical equipment manufacturers in 2023-32.

Impact

Due to capex for Taiwan's power grid enhancement, firms with higher tender weighting will experience tailwinds. Taipower has launched a ten-year, NT$565bn Grid Resilience Strengthening Construction Plan (GRSCP), with around 35% of the amount to be executed by 2026 and the remaining 65% to be earmarked during 2026-32. We forecast Taipower's 2023-25 capex CAGR will arrive at 20%, driving a CAGR of 32% for heavy electrical equipment makers' 2023-25 sales to Taipower, with momentum to extend through 2026-32. Therefore, we believe Chung-Hsin Electric (1513 TT, NT$98.7, OP), which has the highest Taipower tender weighting of 50% among heavy electrical equipment makers, will be the largest beneficiary of GRSCP.

On US infrastructure investment, firms with higher transformer export weighting will benefit. The US IIJA and IRA are to allocate US$464bn for energy-related infrastructure investment in 2022-32. We estimate transformer demand of US$4.3bn in 2023-25 will be provided to transformer makers in Taiwan as demand will last through 2026-32. Among heavy electrical equipment makers in Taiwan, we believe Fortune Electric (1519 TT, NT$244.5, N), which has the highest transformer export weighting of 40%, will be the largest beneficiary of US infrastructure investment.

Transformer replacement with amorphous metal still under negotiation; no significant impact before 2027F, indicating overly bullish market expectations. The US is considering replacing electrical steel transformers with amorphous metal transformers from 2027 to reduce energy degradation. Due to insufficient capacity for amorphous metal in the US, the market believes the proposal will benefit transformer exporters in Taiwan. However, as the plan remains unclear, we believe the final result will be a compromised approach for transformer replacement. Hence, there will be no impact on transformer makers before 2025F, with the mid- to long-term impacts yet to be determined.

Stocks for Action

We have revised sector PB of 1.0x and PE of 10x to a respective 1.9x and 18x following the announcement of GRSCP. The sector is currently trading at 12-22x 2024F EPS. We suggest investors keep track of policy developments in Taiwan and the US. We initiate coverage of Chung-Hsin Electric, Fortune Electric, Shihlin Electric (1503 TT, NT$109.5, N), and Allis Electric (1514 TT, NT$50.5, N), and resume coverage of Teco Electric (1504 TT, NT$48.75, N). Considering share valuations and business structure, our preference of heavy electrical equipment makers is, in descending order, Chung-Hsin Electric, Teco Electric, Shihlin Electric, Fortune Electric, and Allis Electric.

Risks

GRSCP tender launch and progress of US infrastructure investment are slower than expected.

Peer valuation

Ticker	Company	Revenue contribution of related products(%)	Market cap (US$mn)	Price (NT$)	Rating	Target price (NT$)	Upside/ downside(%)	EPS (NT$) 2022	2023F	2024F	2024F
1513 TT	Chung-Hsin Electric	Heavy electrical equipment(67), Engineering(14)	1,589	98.70	OP	133	35	5.21	3.83	8.31	9.80
1503 TT	Shihlin Electric	Heavy electrical equipment(52), Engineering(12)	1,826	109.50	N	117	6	3.86	4.87	6.48	8.18
1504 TT	Teco Electric	Heavy electrical equipment(53), Engineering(17)	3,337	48.75	N	57	17	1.64	3.15	3.57	4.03
1514 TT	Allis Electric	Heavy electrical equipment(49), Engineering(19)	399	50.50	N	42	(16)	2.09	2.55	2.82	3.06
1519 TT	Fortune Electric	Heavy electrical equipment(84), Engineering(7)	2,043	244.50	N	244	(0)	3.21	7.81	11.10	13.92

Source: Bloomberg; KGI Research

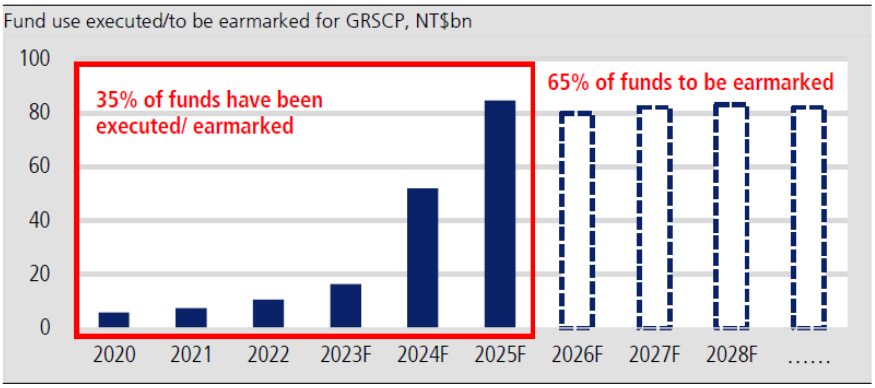
Under GRSCP, plays with higher tender weighting will experience tailwinds; Chung-Hsin Electric to be major beneficiary

Taipower announced a ten-year NT$565bn capex plan for GRSCP, with fund use under the plan earmarked through 2026, with around NT$200bn, or 35%, executed and earmarked, and over NT$300bn, or 65%, to be earmarked in 2026-32. We estimate the first two years (2023-24) of the ten-year GRSCP will see earmarked funds grow gradually, the budget for years three to eight (2025-30) will remain at high levels, while that for the last two years (2031-32) will edge lower as the plan winds up. We believe capex of NT$565bn for Taipower's GRSCP will be the main catalyst for heavy electrical equipment manufacturers in 2023-32.

Taiwanese heavy electrical equipment makers' sales to Taipower and Taipower's capex are highly positively correlated. We forecast 2023-25 Taipower capex CAGR will arrive at 20%, and will sustain at a high level in 2026-32. Driven by the plan, the 2023-25F CAGR for equipment maker sales to Taipower will rise to 32%, while a budget of over NT$350bn will bolster catalysts through 2026-32F.

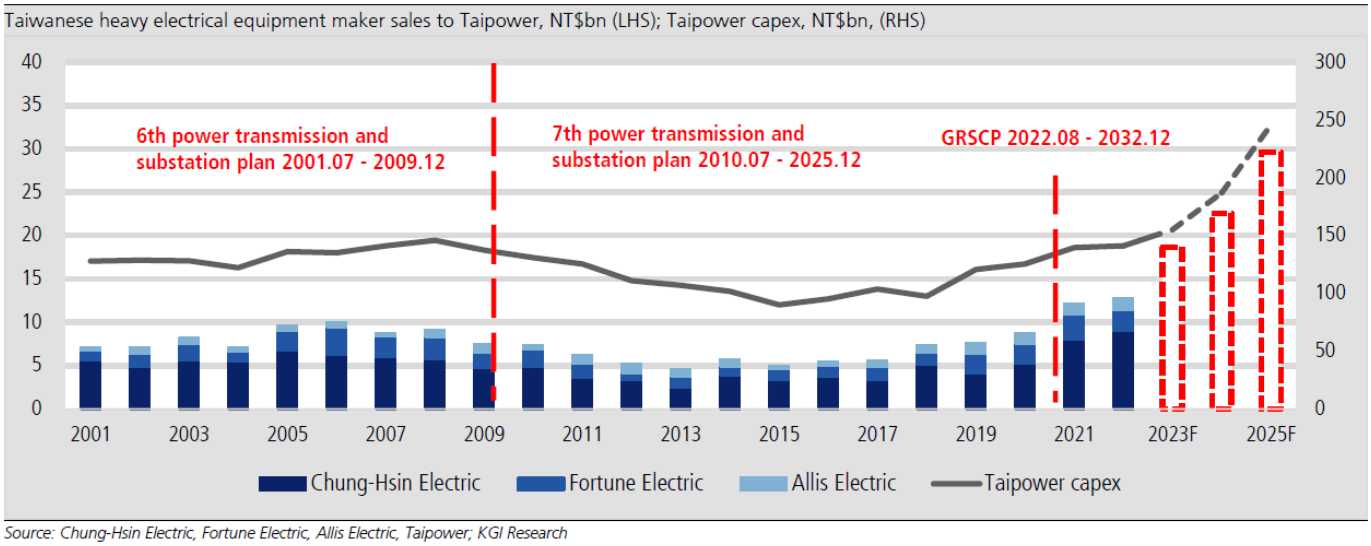
Of Taipower's power transmission and substation tenders in 2019-22, Chung-Hsin Electric, Fortune Electric, Shihlin Electric, Allis Electric, and Teco Electric won a respective 50%, 12%, 10%, 6%, and 2% of projects. As the domestic heavy electrical equipment market is an oligopoly, we estimate heavy electrical equipment makers will see growth in sales to Taipower on par with the above-mentioned ratios. Hence, we believe Chung-Hsin Electric will be the major beneficiary of the plan.

Figure 1: Around NT$200bn, or 35%, of funds for GRSCP have been executed, while over NT$350bn will be earmarked in 2026-32



Source: Taipower; KGI Research

Figure 2: Taipower capex to boost sales for heavy electrical equipment makers

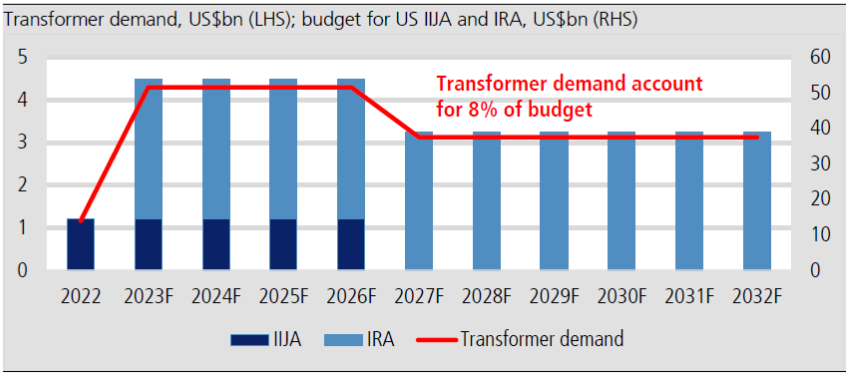


Source: Chung-Hsin Electric, Fortune Electric, Allis Electric, Taipower; KGI Research

Firms with higher export weighting of transformers will benefit from US infrastructure investment; Fortune Electric to be major beneficiary

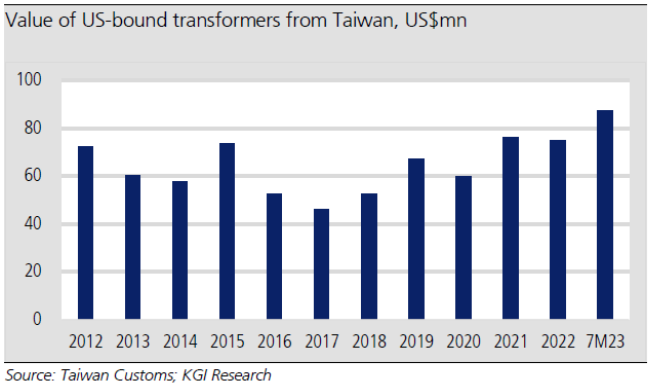
The Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) were approved by the US government in 2021-22. For power grid enhancement, IIJA allocated around US$73bn in 2022-26 for power and grid-related expenditures, while IRA budgeted around US$291bn in 2023-32 for clean energy and climate change initiatives. As a result, IIJA and IRA will allocate US$464bn for energy-related infrastructure investment. Supposing substation equipment will account for 40% of the budget, while power transformers will account for 20% of total equipment, we forecast transformer demand of US$4.3bn per year in 2023-25 for Taiwanese firms, with demand to sustain through 2026-32. Among heavy electrical equipment makers in Taiwan, Fortune Electric, which has the highest transformer export weighting of 40% and the US being its major export destination, will be the largest beneficiary of US infrastructure investment, as its weighting for US-bound transformers exceeds 50%.

Figure 3: We estimate US infrastructure investment will generate transformer demand of US$4.3bn per year in 2023-25F



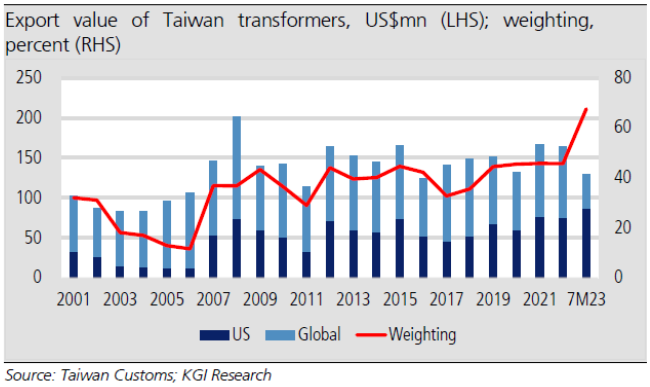
Source: US DOE; KGI Research

Figure 4: Value of US-bound transformers from Taiwan has surpassed 2022 level



Source: Taiwan Customs; KGI Research

Figure 5: Value weighting of US-bound transformers from Taiwan is gradually rising



Source: Taiwan Customs; KGI Research

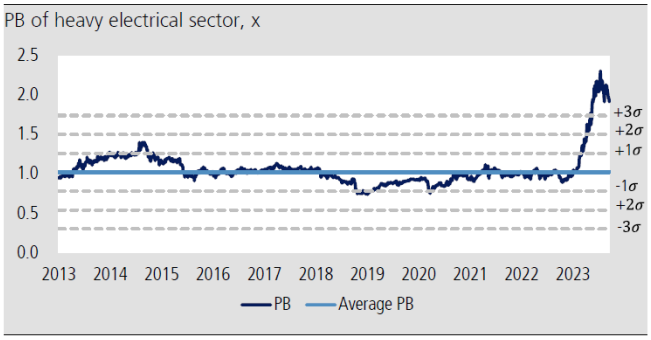
Chung-Hsin Electric is most undemanding heavy electrical equipment maker after heavy electrical sector re-evaluation

We initiate coverage of the heavy electrical sector, and believe capex of NT$565bn for Taiwan's power grid enhancement and US$464bn for US infrastructure investment will be the major catalysts for heavy electrical equipment makers in 2023-32 We have revised sector PB of 1.0x and PE of 10x to a respective 1.9x and 18x following the announcement of GRSCP. The sector is currently trading at 12-22x 2024F EPS. We recommend investors keep track of policy developments in Taiwan and the US.

We prefer heavy electrical equipment makers with following operating structures: (1) high market share of Taipower's tender, indicating higher potential for acquiring more Taipower tenders, such as Chung-Hsin Electric; and (2) high export weighting of transformers, indicating greater likelihood to benefit from US infrastructure investment, such as Fortune Electric.

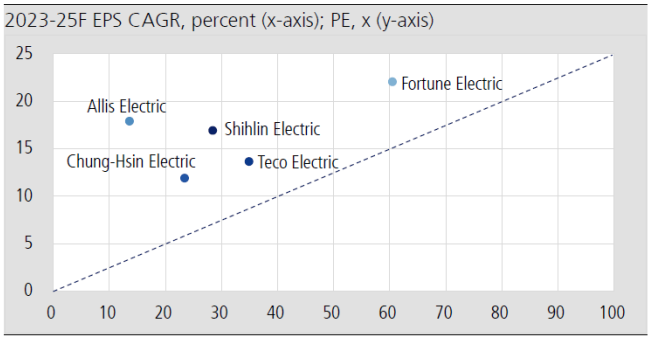
Considering 2023-25F EPS CAGR and operating structures, our valuations for heavy electrical equipment makers are, in descending order: Fortune Electric (growth rate of 60%, PE of 22x), Chung-Hsin Electric (growth rate of 23%, PE of 16x), Shihlin Electric (growth rate of 28%, PE of 18x), Teco Electric (growth rate of 35%, PE of 16x), and Allis Electric (growth rate of 14%, PE of 15x). Having considered their valuations, our preference for heavy electrical equipment makers is, in descending order: Chung-Hsin Electric, Teco Electric, Shihlin Electric, Fortune Electric, and Allis Electric.

Figure 6: Revise up PB of heavy electrical sector from 1.0x to 2.0x



Source: TEJ;; KGI Research

Figure 7: Heavy electrical equipment makers' 2023-25F EPS CAGR to current PE



Source: Bloomberg; KGI Research

Figure 8: Peer comparison – Valuations

Company	Ticker	Market cap	Share price	EPS (LCY)				EPS CAGR (%)	P/E (x)			P/B ratio			GM (%)			OPM (%)		
		(US$mn)	(LCY)	2022	2023F	2024F	2025F	(2022-25F)	2022	2023F	2024F	2022	2023F	2024F	2022	2023F	2024F	2022	2023F	2024F
Chung-Hsin Electric	1513 TT	1,589	98.70	5.21	3.83	8.31	9.80	23.4	18.9	25.8	11.9	3.5	2.9	2.5	25.6	29.6	30.1	15.4	20.6	20.1
Shihlin Electric	1503 TT	1,826	109.50	3.86	4.87	6.48	8.18	28.4	28.4	22.5	16.9	2.0	1.7	1.6	17.0	18.0	19.1	7.3	8.0	9.1
Teco Electric	1504 TT	3,337	48.75	1.64	3.15	3.57	4.03	34.9	29.7	15.5	13.6	1.3	1.2	1.2	22.6	25.0	25.4	8.7	11.5	12.4
Allis Electric	1514 TT	399	50.50	2.09	2.55	2.82	3.06	13.6	24.2	19.8	17.9	3.4	2.8	2.6	16.7	17.3	17.3	6.4	7.3	7.3
Fortune Electric	1519 TT	2,043	244.50	3.21	7.81	11.10	13.27	60.5	76.2	31.3	22.0	15.4	11.5	9.1	20.5	31.1	33.3	5.5	19.7	22.6
Local peer average									**43.4**	**22.2**	**17.9**	**6.7**	**5.2**	**4.3**	**19.9**	**24.5**	**25.4**	**6.9**	**12.8**	**14.1**

Source: Bloomberg; KGI Research

GRSCP has highest budget among power transmission & substation plans in Taipower's history

In September 2022, Taipower announced it would invest NT$565bn to implement the GRSCP over a period of ten years, shifting from a centralized power grid that increased power efficiency to a distributed power grid to boost power resilience, enabling the power grid system to react to accidents, restore stable operations, and rapidly prevent large-scale power outages. Taipower has implemented seven power transmission and substation plans since 1972, when the first such plan was executed. The GRSCP has the highest budget of all plans. It will prompt the development of power line, power cable, transformer, switch, and substation engineering businesses, bringing about robust sales growth for Taiwan's power transmission and substation equipment makers.

The GRSCP is divided into three parts – distributed engineering, solidification engineering, and defensive engineering – with respective budgets of NT$438bn, NT$125bn, and NT$2.0bn. The amount being executed is NT$376bn, spread through Taipower's capex plans. A budget of NT$188bn has been earmarked for specific projects, which will be implemented from 2024. Taipower has divided the GRSCP into short-term (2022-24), medium-term (2022-27), and long-term (2022-32) stages, with respective budgets of NT$87bn, NT$170bn, and NT$307bn for projects, such as power transmission lines to supply power directly to industrial zones and indoor substations.

Figure 9: Taipower power transmission & substation plans

Power transmission and substation plan	Period (years)	Project volume (circuit km/ megavolt amperes)	Budget (NT$bn)
Plan I	1972.07-1976.06 (4)	Transmission line: 2,027 ckm Substation: 10,180 MVA	12
Plan II	1977.07-1982.06 (5)	Transmission line: 3,429 ckm Substation: 19,626 MVA	39
Plan III	1984.07-1988.06 (4)	Transmission line: 3,061 ckm Substation: 14,670 MVA	40
Plan IV	1990.07-1996.06 (6)	Transmission line: 3,206 ckm Substation: 21,577 MVA	71
Plan V	1996.07-2001.06 (5)	Transmission line: 2,459 ckm Substation: 25,955 MVA	123
Plan VI	2001.07-2009.12 (8.5)	Transmission line: 4,587 ckm Substation: 69,235 MVA	327
Plan VII	2010.07-2025.12 (15.5)	Transmission line: 1,966 ckm Substation: 18,554 MVA	237
GRSCP	2022.08-2032.12 (10)	-	565

Source: Taipower; KGI Research

Figure 10: Breakdown of GRSCP budgets

Three major projects of GRSCP	Content	Total budget (NT$bn)	In progress (NT$bn)	Budget balance (NT$bn)
Distributed system - to reduce grid centralization risk	Direct power supply from power plants to science parks; increase of power distribution nodes; improvement of regional dispatch	438	256	182
Reinforcement - to boost equipment stability	Grid expansion and update; increase of energy storage equipment; compartmentalization of substations	125	119	6
Protection - to prevent the spread of power outages	Strengthening protection depth; real-time dynamic protection	2	2	0
Total		**565**	**376**	**188**

Source: KGI Research

Figure 11: Breakdown of GRSCP short-, medium-, & long-term plans

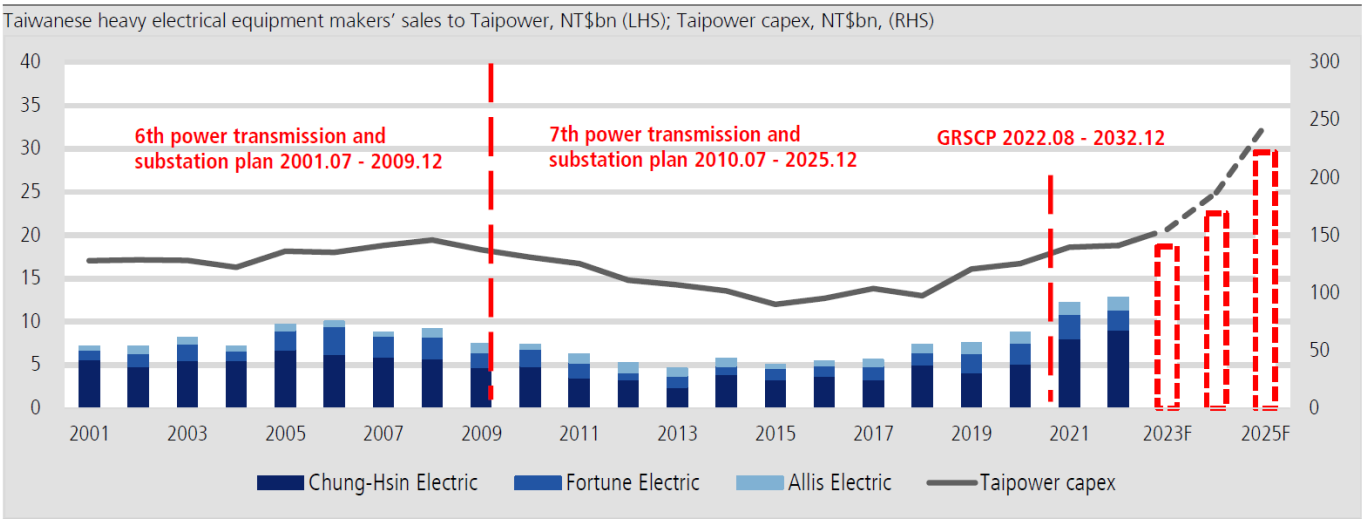
GRSCP timeline	Content	Project	Total budget (NT$bn)
Short-term (2022-24)	Speed up ongoing resilience projects, strengthen system protection and defense capabilities	a) 15 power transmission cables (3.5GW) to directly supply power to five science parks b) 15 new/ updated substations (compartmentalized) c) Transmission line expansion and update for 521 ckm	87
Medium-term (2022-27)	Promotion of distribution grid system and implementation of reinforcement projects	a) Six power transmission cables (1.6GW) to directly supply power to two science parks b) 13 new/ updated substations (compartmentalized) c) Completion of 3 nod groupings	170
Long-term (2022-32)	Completion of three major hubs and related long-term projects	a) 12 power transmission cables (7.4GW) to directly supply power to five science parks b) 20 new/ updated substations (compartmentalized) c) Longtan, Zhongliao and Longqi hub nod risk diversification projects	307

Source: Government e-Procurement System; KGI Research

Funds used under the GRSCP have been earmarked up to 2026, with around NT$200bn, or 35%, executed and earmarked, and over NT$300bn, or 65%, to be earmarked. We estimate the first two years (2023-24) of the ten-year GRSCP will see earmarked funds grow gradually, while the budget for years three to eight (2025-30) will remain at high levels, and that for the last two years (2031-32) will edge lower as the plan winds up.

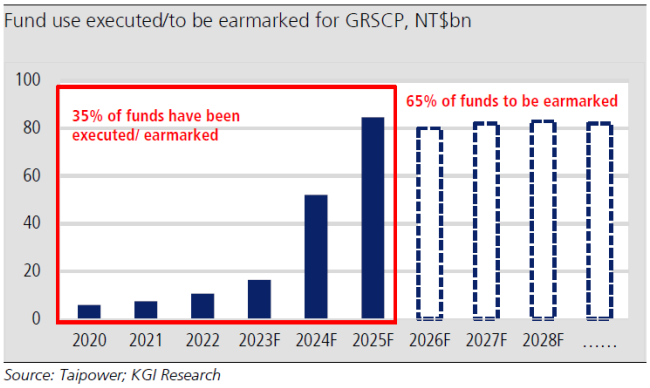
Taiwanese heavy electrical equipment makers' sales to Taipower and Taipower's capex are highly positively correlated. We predict that during the period of the seventh power transmission and substation plan succeeding the GRSCP, Taipower's capex will grow significantly, peak in 2025, and remain lofty in the five years afterwards (2026-30). Driven by the GRSCP, we forecast 2023-25 equipment makers' sales to Taipower will grow by a respective 46%, 21%, and 31% YoY, while a budget of over NT$350bn will bolster catalysts through 2026-32.

Figure 12: Taipower capex to boost sales for heavy electrical equipment makers



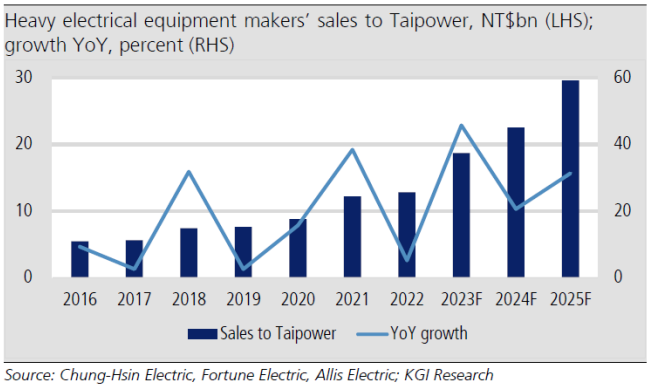
Source: Chung-Hsin Electric, Fortune Electric, Allis Electric, Taipower; KGI Research

Figure 13: Around NT$200bn (35%) of GRSCP funds have been executed, while over NT$350bn will be earmarked in 2026-32F



Source: Taipower; KGI Research

Figure 14: Heavy electrical equipment makers' 2023-25F sales to Taipower to rise 46%, 21%, & 31% YoY



Source: Chung-Hsin Electric, Fortune Electric, Allis Electric; KGI Research

Taipower power transmission, substation & power distribution systems

I. Power transmission systems

Most Taiwanese large power generation plants are located at the seashore or mountainous regions far away from the cities. Power generated by them is transmitted via long power transmission lines to cities, industrial zones, and other regions. Due to varying power demand from region to region, the installation of power transmission lines are in a net-like formation for power dispatch flexibility. In order to minimize power loss during long-distance transmission, transmission voltage is increased to lower transmission current. Currently, Taiwan's power transmission lines are divided into 345kV, 161kV, and 69kV grades.

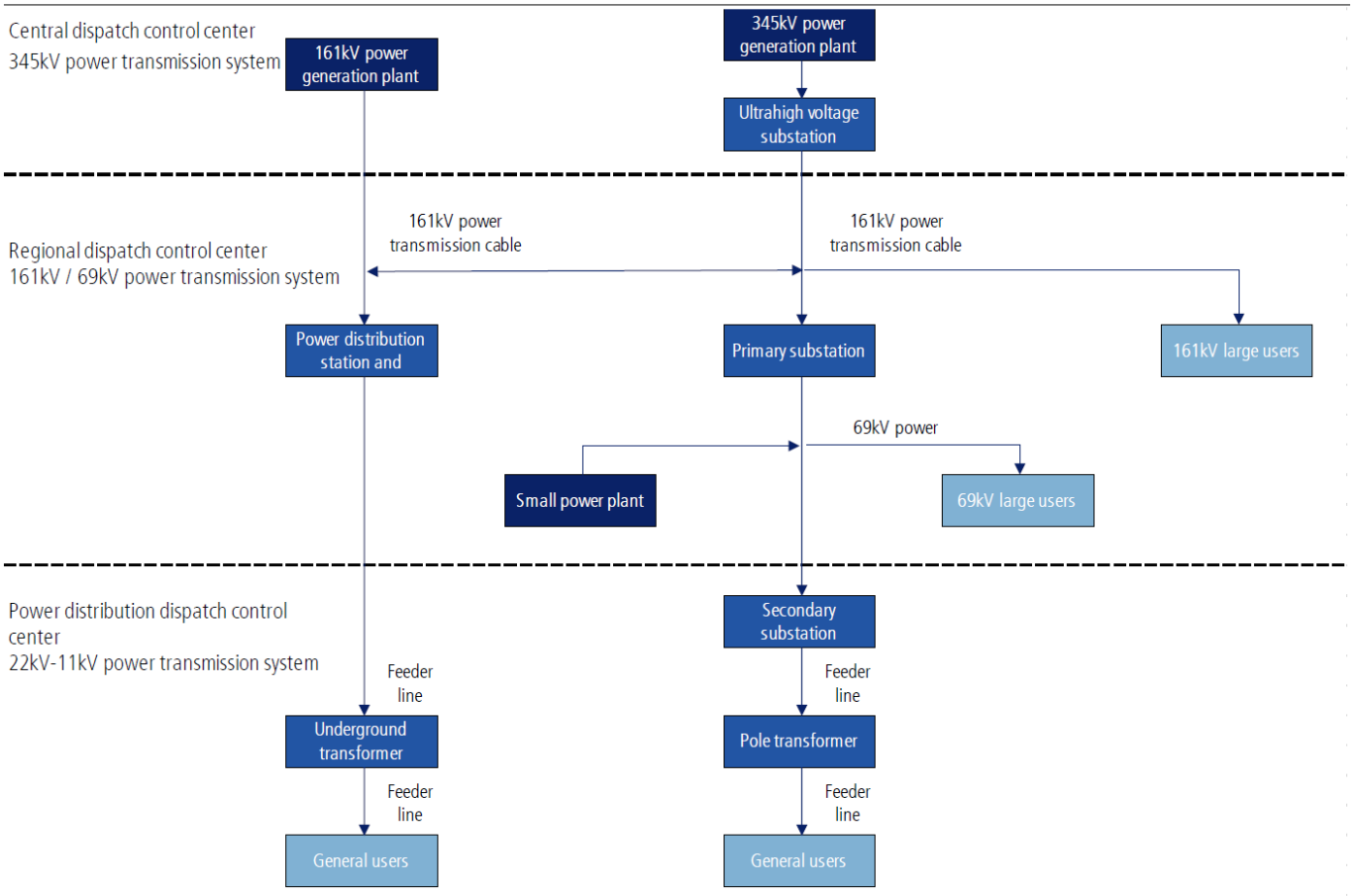
II. Substation systems

Voltage at a power generator's transmission-out end is generally 11-24kV. Before power is delivered to the power transmission system, voltage is increased by booster transformers in the power plant to 345kV, 161kV, or 69kV for transmission. Before power transmission lines reach cities or industrial zones, voltage is first reduced by ultra-high voltage or primary substation to 161kV or 69kV, and then by primary distribution or secondary substation to 11.4kV or 22.8kV to be delivered to the power distribution system.

III. Power distribution systems

Since 11.4kV or 22.8kV is still high and unsuitable for household use, power is first transmitted via overhead or underground power lines to a transformer on electricity poles on streets to reduce voltage to 110V or 220V, and then transmitted to household power meters for use.

Figure 15: Taiwan power system structure



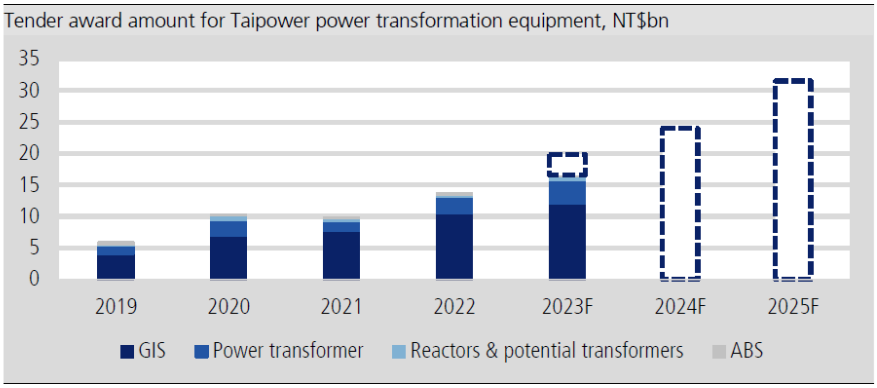
Source: Company data; KGI Research

Power transformation systems – Tender award amount for Taipower's power transformation system-related projects to rise

Major equipment, namely power transformers, reactors and potential transformers, gas insulated switchgear (GIS), and air break switches (ABS), are required when power transformation systems boost. The tender award amount for the aforementioned power transformation equipment rose to NT$14bn in 2022 from NT$6.0bn in 2019, for a CAGR of 32%. We estimate the 2023 tender award amount is near the 2022 level YTD. Among power transformation system-related tenders in 2019-22, the weightings for power transformers, reactors and potential transformers, GIS, and ABS were a respective 20%, 4%, 73%, and 3%. The tender award amount weightings for Chung-Hsin Electric, Fortune Electric, Shihlin Electric, Allis Electric, Teco Electric, and Tatung (2371 TT, NT$43.85, NR) are a respective 50%, 12%, 10%, 6%, 2%, and 10%. The tender award amount for Taipower's power transformation system grew 39% YoY in 2022, and has exceeded the 2022 level as of 2023. We forecast the 2023-25 tender award amount will climb 46%, 21%, and 31% YoY, respectively, boosting heavy electrical equipment makers' sales to Taipower.

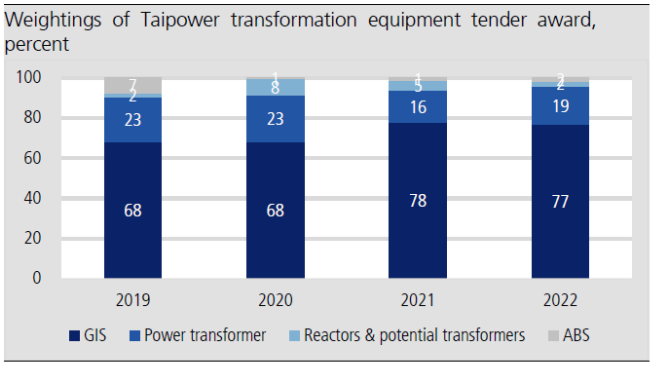
Among Taipower's power transformation system-related public tenders, tender award amount share obtained may vary according to heavy electrical equipment makers' specific manufacturing equipment and product competitiveness, as: (1) power transformers and reactors and potential transformers have been mainly awarded to Shihlin Electric, Fortune Electric, and Tatung; and (2) GIS and ABS have been mainly awarded to Chung-Hsin Electric and Allis Electric.

Figure 16: We forecast 2023-25 tender award amount for Taipower power transformation equipment will rise a respective 46%, 21%, and 31% YoY



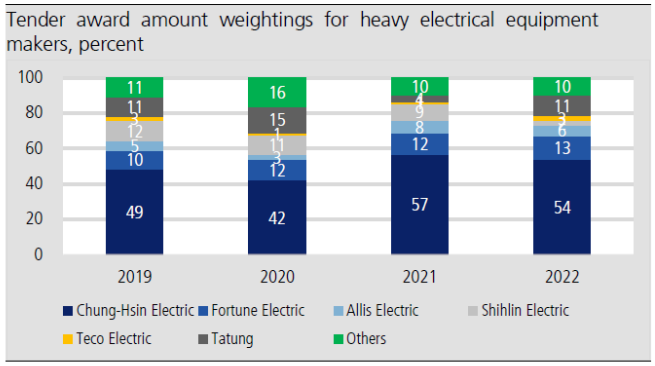
Source: Government e-Procurement System; KGI Research

Figure 17: GIS equipment accounts for 70% of Taipower transformation equipment tender award



Source: Government e-Procurement System; KGI Research

Figure 18: Tender award amount weightings for heavy electrical equipment makers has been largely stable



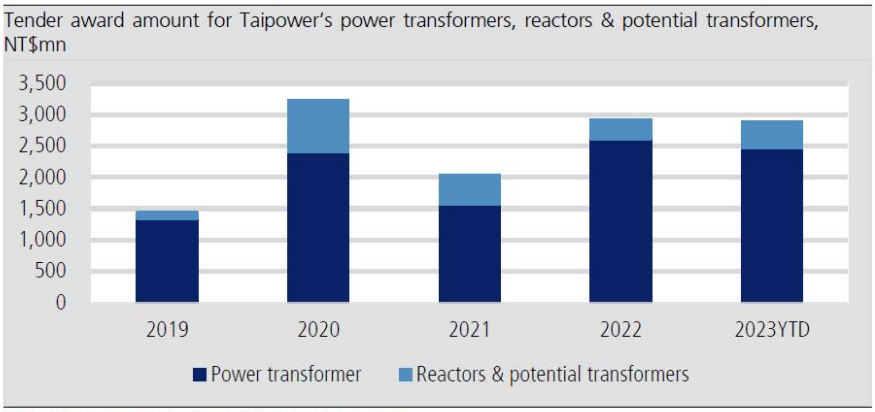
Source: Government e-Procurement System; KGI Research

Major equipment in power transformation systems (Part I) – Power transformers, reactors and potential transformers

A transformer is a device that changes AC voltage by realizing the electromagnetic induction principle. Major components are primary coils, secondary coils, and iron cores, enabling multiple sets of voltage outputs to boost or buck. There are two main types of transformers used in power systems – power transformers and distribution transformers. The former is mainly utilized in power transformation systems, boosting or bucking power generation and transmission voltage, while the latter is mainly adopted in distribution transformers for distribution voltage reduction to low voltage. Power transformers adopted in power transformation systems can be categorized into (by voltage) 345kV, 161kV, and 69kV groups. Shihlin Electric, Fortune Electric, and Tatung all manufacture power transformers. Among 2019-22 Taipower transformer tenders, weightings of award tenders were: Shihlin Electric (33%), Fortune Electric (30%), and Tatung (35%).

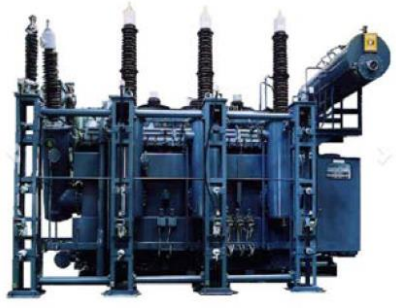
The major component of reactors is aircore coils (without magnetically conductive material), which are used to prevent currents from changing, while maintaining the stability of electrical equipment when a short circuit occurs in a power system. The main component of potential transformers is similar to that of regular transformers and is used to convert high-voltage, which is difficult to be directly measured or controlled by high-voltage meters into voltage required at an appropriate ratio, and can be applied to device analysis and protection. Shihlin Electric, Fortune Electric, and Tatung all manufacture reactors and potential transformers. In Taipower's 2019-22 tenders for reactors and potential transformers, the tender award amount weightings for Shihlin Electric, Fortune Electric, and Tatung were a respective 28%, 32%, and 26%.

Figure 19: Tender award amount for power transformers, reactors & potential transformers were near 2022 levels



Source: Government e-Procurement System; KGI Research

Figure 20: Fortune Electric's 161kV power transformer



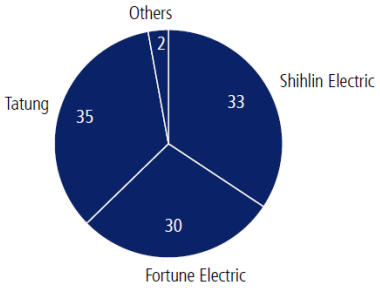
Source: Fortune Electric; KGI Research

Figure 21: Shihlin Electric's series reactor

Source: Shihlin Electric; KGI Research

Figure 22: Power transformer tender weightings for Shihlin Electric, Fortune Electric, & Tatung nearly the same

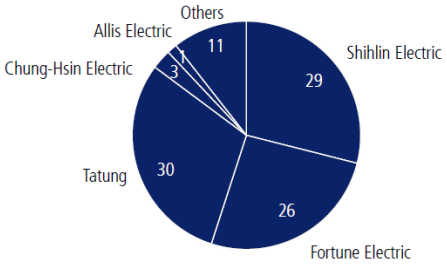
Tender award amount weighting for Taipower power transformers, percent



Source: KGI Research

Figure 23: Reactor & potential transformer tender weightings for Shihlin Electric, Fortune Electric, & Tatung are nearly the same

Tender award amount weightings for Taipower, percent



Source: Company data; KGI Research

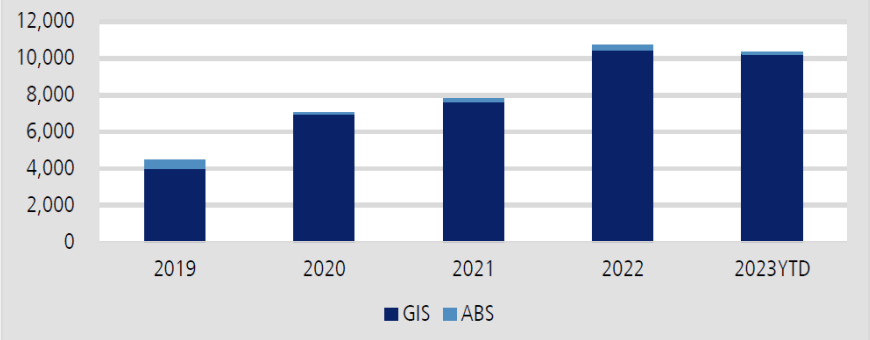
Major equipment in power transformation systems (Part II) – Gas insulated switchgear & air break switch

Gas insulated switchgear (GIS) closely resembles electrical components, such as circuit breakers, grounding switches, busbars, bushings/cable terminal equipment in grounded metal shells, and is filled with high-pressure sulfur hexafluoride (SF6) gas as an insulating medium. It has the advantages of small footprint, high safety, and simple maintenance. GIS can be categorized into (by voltage) 345kV, 161kV, 69kV, and 23kV groups. Chung-Hsin Electric is the only domestic electrical manufacturer that can offer the project as 345kV GIS has higher entry barriers and technological requirements. Hence, only Chung-Hsin Electric possess products ranging from 345kV GIS to 23kV GIS. Among 2019-22 Taipower GIS tenders, the tender award amount weightings for Chung-Hsin Electric, Fortune Electric, Allis Electric, Tatung, and Teco Electric were 69%, 7%, 6%, 2%, and 2%.

Air break switches (ABS) is used for isolating and switching circuits, as electric arc extinction is conducted through compressing air. ABS is usually adopted by outdoor switch gear factories. Among 2019-22 Taipower ABS tenders, the tender award amount weightings for Allis Electric and Shihlin Electric was a respective 51% and 24%.

Figure 24: Tender award amount for GIS & ABS near 2022 levels

Tender award amount for Taipower GIS and ABS, NT$mn

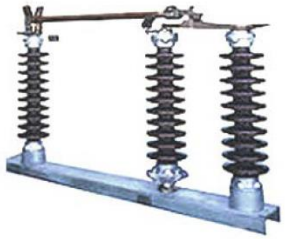


Source: Government e-Procurement System; KGI Research

Figure 25: Teco Electric's 161kV GIS

Source: Teco Electric; KGI Research

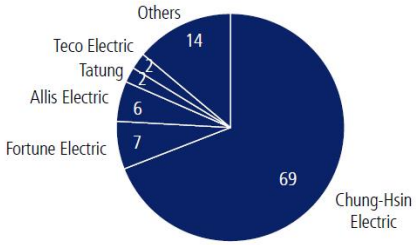
Figure 26: Allis Electric's ABS



Source: Allis Electric; KGI Research

Figure 27: Chung-Hsin Electric is 70% of GIS tender

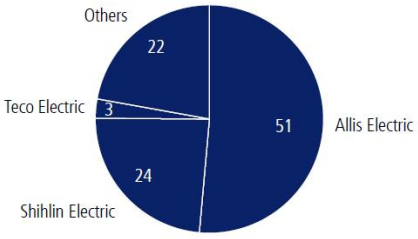
Tender award amount weighting for Taipower GIS tender, percent



Source: KGI Research

Figure 28: Allis Electric accounts for 50% of ABS tender

Tender award amount weighting for Taipower ABS tender, percent



Source: Company data; KGI Research

Figure 29: Overview of Taiwan's major heavy electrical equipment manufacturers

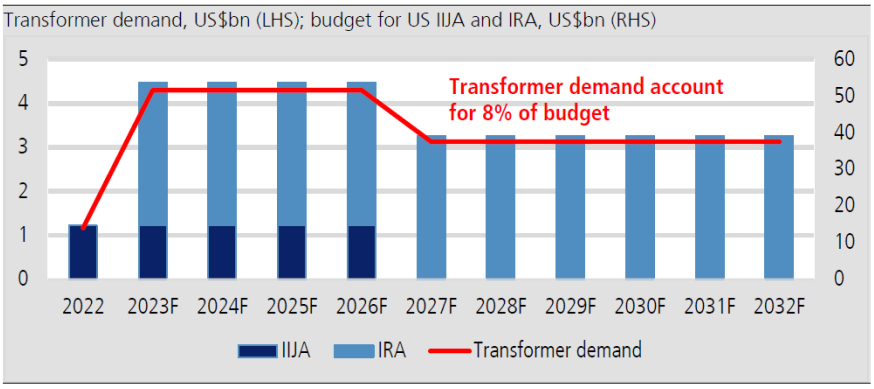
Company	Chung-Hsin (1513 TT)	Fortune Electric (1519 TT)	Shihlin Electric (1503 TT)	Teco Electric & Machinery (1504 TT)	Allis Electric (1514 TT)	Tatung (2371 TT)
Market cap (US$mn)	1,589	2,043	1,826	3,337	399	3,193
2022 sales (NT$mn)	18,547	7,751	30,758	58,315	7,709	34,539
2022 sales by department (%)	Electrical-mechanical energy (67) Services (19) Engineering and other (14)	Electromechanical department (93) Turnkey department (7)	Power distribution (61) Vehicle components (20) Automation equipment and components (16)	Electromechanical system (53) Smart energy (17) Smart living (24)	Distributing board (25) Transformer (13) Electrical-mechanical supplies (11) Electronics (23) Engineering (19)	New energy (54) Consumer electronics (35) Real estate (7)
2022 gross margin (%)	25.6	20.5	17.0	22.6	16.7	21.1
2022 operating margin (%)	10.2	5.5	7.3	13.9	6.4	0.9
Taipower substation equipment tender						
Gas insulated switch equipment	345kV/161kV/69kV	23kV	X	161kV/69kV	69kV/23kV	161kV/23kV
Power transformer	X	345kV/161kV/69kV 69kV-23.9kV/11.95kV	345kV/161kV/69kV 69kV-23.9kV/11.95kV	X	X	345kV/161kV/69kV 69kV-23.9kV/11.95kV
Reactor & potential transformer	X	161kV/33kV parallel reactor 69kV series reactor	161kV/33kV parallel reactor 69kV series reactor 69kV potential transformer	X	25.5kV Series reactor	345kV/161kV/33kV parallel 69kV Series reactor 69kV potential transformer
Air break switch	X	X	69kV	X	161kV/69kV/23kV	X
Taipower substation equipment tender weighting (%)						
Power transformer	-	28	34	-	-	34
Reactor & potential transformer	-	26	29	-	1	30
Gas insulated switch equipment	69	7	-	2	6	2
Air break switch	-	-	24	-	51	-

Source: Company data; KGI Research

Infrastructure investment for US IIJA & IRA to boost transformer export growth

According to statistics from the US Department of Energy (DOE), 75% of power transmission and transformation lines and transformers in the US power grid have been operating for more than 25 years, of which 90% of large power transformers in the US have been operating for over 40 years, resulting in energy waste due to equipment efficiency degradation within the US power grid, which is prone to failure during extreme weather. Total infrastructure assets of the current US power grid exceeds US$1.0tn, encompassing 7,000 power plants, 6.3mn miles power distribution lines, 640k miles of high-voltage transmission lines, and 50mn distribution transformers. According to the DOE, losses of US$70bn are registered in the US per year due to power outages. Therefore, the IIJA and IRA were approved by the US government in 2021-22 for power grid enhancement budgets, of which the IIJA allocated around US$73bn for power and grid-related expenditures in 2022-26, while the IRA budgeted around US$391bn in 2023-32 for clean energy and climate change initiatives. Supposing power transformer equipment accounts for 40% of the budget, and power transformers account for 20% of equipment, we forecast transformer demand of US$4.3bn per year in 2023-25 for Taiwanese firms, as demand will continue through 2026-32.

Figure 30: We estimate US infrastructure investment will generate transformer demand of US$4.3bn per year in 2023-25F



Source: US DOE; KGI Research

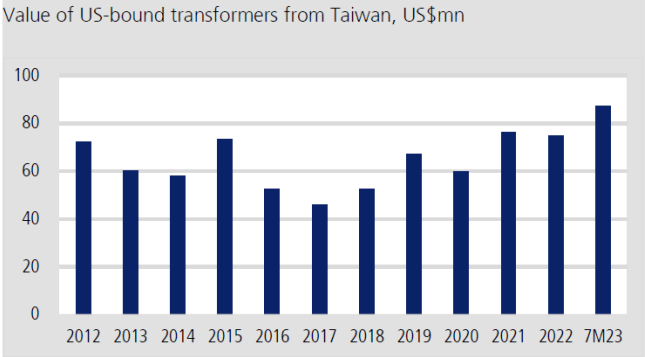
Based on the framework of the abovementioned acts, the US DOE announced it would promote the Grid Resilience Innovative Partnership (GRIP) in August 2022, aiming to enhance US power grid flexibility and strengthen the resilience of the grid to cope with extreme weather. The plan is part of the Bipartisan Infrastructure Law (BIL), with a projected US$10.5bn of investment in 2022-26. The plan is divided into three stages: (1) grid resilience grants (US$2.5bn) – Subsidize grid operators, power companies, power and distribution companies' development of new power transmission and distribution solutions to mitigate the impact of extreme weather on regional power supply; (2) smart grid grants (US$3bn) – Expand smart grid technology and expedite market application for better power grid flexibility, efficiency, and reliability, while simultaneously increasing the capacity of the power transmission system to utilize more renewable energy interconnection; and (3) grid innovation program (US$5bn) – fund state governments' cooperation with power grid operators, power companies, and power distribution companies to promote projects such as, regional power grid interconnection, clean energy grid interconnection, and decentralized energy integration in innovative ways.

In January 2023, the US DOE further announced a budget of US$2.86bn in the Inflation Reduction Act (IRA) for power grid improvement, fulfilling the Biden administration's target of net-zero emissions from the power segment by 2035 through power grid enhancement, upgrading power grid efficiency, and adoption of cleaner energy. The enhancement plan aims to realize US power grid modernization and expedite long-distance power transmission line construction, with related budgets including: (1) US$2.0bn in financing for power transmission and transformation facilities, aiding the US DOE in implementing a direct loan program for the construction or renovation of power transmission and transformation facilities; (2) US$760mn for power transmission line construction and research on the potential impact of power transmission lines and alternative locations in a bid to speed up power transmission line extension and power transmission; and (3) NT$100mn for offshore wind power research and planning.

For power transmission and substation systems in the US, transformers are mainly imported from overseas multinational enterprises, such as Hitachi Energy (CH), Hyundai Electric (KR), and Mitsubishi Electric (JP). On the other hand, given freight rates, installation labor costs, and customization, distribution transformers are mainly provided by US manufacturers, namely Eaton and Ermco. However, according to the American Public Power Association (APPA), average lead time for distribution transformers rose 429% in 2020-22 to 12 months in 2022 from 2-3 months before 2021, while delivery time for some transformers has exceeded three years. As transformers can't be acquired in time due to prolonged delivery, US utility companies are to defer or cancel part of infrastructure projects, with 20% of items impacted, according to analysis. Due to prolonged delivery, we think some distribution transformer demand will be fulfilled through overseas imports, instead of being fully acquired from US manufacturers. Hence, besides rising exports of power transformers, Taiwanese heavy electrical manufacturers could see increasing distribution transformer exports.

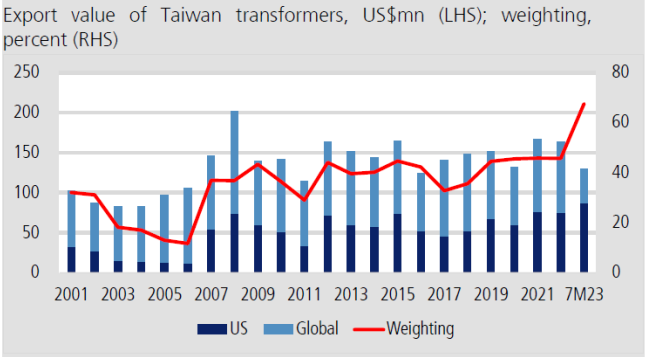
Among heavy electrical equipment makers in Taiwan, Fortune Electric, which has the highest transformer export weighting of 40% and the US being its major export destination, will be the largest beneficiary of US infrastructure investment, as its weighting for US-bound transformers exceeds 50%.

Figure 31: Value of US-bound transformers from Taiwan has surpassed 2022 level



Source: Taiwan Customs; KGI Research

Figure 32: Value weighting of US-bound transformers from Taiwan is gradually rising



Source: Taiwan Customs; KGI Research

Transformer replacement with amorphous material still under negotiation; no significant impact before 2027F, indicating overly bullish market expectations

In addition, the US DOE is discussing enhancing the energy performance standard of certain types of distribution transformers, and may switch the current mainstream silicon lamination (from electrical steel) transformer core material to amorphous metal. There are two major types of losses when a transformer operates – copper loss (load loss) and iron loss (no load loss). The former hinges on the load fluctuation, while the latter is registering losses at all times. Copper loss is induced by the resistance of the coil itself, and can be reduced by increasing the cross-sectional area of the wire and reducing the number of coil turns, while iron loss is registered on the material of the iron core. The iron loss of a transformer with an amorphous iron core is only 20-30% that of traditional silicon in a silicon lamination core, thus the power consumption efficiency can be significantly improved when amorphous transformers are adopted. Take Shihlin Electric's 1,000kVA distribution transformer as an example, in terms of no-load losses, that of an amorphous oil-immersed transformer is 380W, while that of a high efficiency oil-immersed distribution transformer is 1,590W. No-load losses of amorphous metal transformers are 24% that of conventional transformers.

Figure 33: Specs & features of amorphous metal & silicon lamination transformers

Transformer type	Capacity (kVA)	Rated voltage (primary)	Rated voltage (secondary)	No-load loss (W)
Amorphous energy-saving oil-immersed transformer	1,000	22.8/11.4kV	380/220V	380
Amorphous energy-saving oil-immersed transformer	2,000	22.8/11.4kV	380/220V	650
High efficiency oil-immensed transformer	1,000	22.8/11.4kV	380/220V	1,590
High efficiency oil-immensed transformer	2,000	22.8/11.4kV	380/220V	2,570

Source: US DOE; KGI Research

If the US DOE's current proposal is approved, almost all distribution transformers have to adopt amorphous metal cores from 2027. At present, Metglas (US) is the only domestic amorphous metal core manufacturer with market share below 5%. Hence, the amorphous metal core supply crunch may slow the pace of infrastructure construction, while higher cost of amorphous metal cores and the redesign of distribution transformers will weigh on small US manufacturers. Therefore, an opportunity to expand into the US market is possible for non-US transformer manufacturers. Among Taiwanese heavy electrical equipment makers, Fortune Electric, Shihlin Electric, Allis Electric, and Tatung all produce amorphous metal transformers. The market is positive the proposal will benefit transformer exporters in Taiwan. However, as the plan remains unclear, we believe the final result will be a compromised approach for transformer replacement. Hence, there will be no impact on transformer makers before 2025F, with the mid- to long-term impacts yet to be determined.

Figure 34: Shihlin Electric's amorphous metal core transformer

Source: Shihlin Electric; KGI Research

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