Heavy electrical sector

US power grid construction to pick up pace from 1Q25F

Key message

1. US power grid construction will accelerate from 1Q25F.
2. US needs to expand transmission capacity by 114% by 2035F.
3. US market will drive sales growth for Taiwanese power transformer manufacturers.

Event

On October 30, the US Department of Energy (DOE) announced the first round of selection of subsidy recipients for the country's power transmission system, and released a report entitled "National Transmission Needs Study". We believe the US will speed up power grid construction from 1Q25F.

Impact

US to accelerate power grid construction from 1Q25F. The US government will allocate a total of US$464bn for energy infrastructure investment in 2022-32F, which will drive transformer demand. The US DOE announced subsidies for three transmission projects under its Transmission Facilitation Program (TFP) on October 30. Two of the three transmission projects will begin construction in 1Q25F, and one in 2H26F, to respectively account for 14%, 14%, and 79% of the estimated 2030 transmission capacity needs of those regions where the projects are located. As such, we expect US power grid construction to pick up pace from 1Q25F in order to achieve the Biden administration's goal of a 100% clean electricity grid by 2035F.

US needs to expand transmission capacity by 114% by 2035F. According to the National Transmission Needs Study report, the US needs to increase intraregional power transmission circuit miles by 64% and cross-region transmission capacity by 114% by 2035, under the aegis of government support, such as the Inflation Reduction Act (IRA), in order to meet power consumption demand. To that end, we estimate the US will spend US$1.3-1.6tn on expansion of the existing transmission system, including US$80-100bn on the import of power transformers, for a 2024-35F expenditure CAGR of 6%.

US market to drive sales growth for Taiwanese power transformer manufacturers. In dollar terms, US imports of power transformers in January-October reached 123% of the full-year 2022 level. In the meantime, Taiwan's transformer exports to the US were also reached 172% of the full-year 2022 level. While the majority of global transformer vendors have prolonged lead times to over two years, Taiwanese suppliers boast a much shorter lead time of eighteen months, and have thus received more orders. We believe US investment in power grid infrastructure will create solid growth momentum for transformer suppliers in Taiwan. Specifically, we estimate Shihlin Electric (1503 TT, NT$114.5, OP) and Fortune Electric (1519 TT, NT$316.5, OP) will see US sales grow at a respective 89% and 41% CAGR in 2023-25F, with the US market contributing 5% and 41% of 2025F sales, respectively.

Stocks for Action

Taiwan's heavy electrical sector shares have seen rerating on the back of state-run Taipower's (unlisted) grid enhancement plan and US infrastructure investment, with shares now trading at 2024F PE of 14-26x. We believe Shihlin Electric and Fortune Electric will secure transformer orders from US clients, with earnings growth outstripping that of local peers. As such, we value the two companies at respective PE of 25x and 35x. We prefer Fortune Electric over Shilin Electric on a more attractive valuation and a better business portfolio.

Risks

Slow US power infrastructure investment.

Peer comparison - 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
1503 TT	Shihlin Electric	Heavy electrical equipment(52)	1,932	114.50	OP	163	42	3.86	4.60	6.52	8.29
1519 TT	Fortune Electric	Heavy electrical equipment(84)	2,676	316.50	OP	500	58	3.21	8.40	14.25	19.13

Source: Bloomberg; KGI Research

TFP to drive faster grid construction from 1Q25F

In our September 21 report, "GRSCP & US infrastructure investment to bring growth", we noted that the US government will allocate a total of US$464bn to energy infrastructure investment in 2022-32F, based on the Infrastructure Investment & Jobs Act (IIJA) and IRA. The first round of selection of subsidy recipients under TFP, which is directly related to power transmission and transformation systems, is underway, and the DOE's National Transmission Needs Study report released on October 30 reiterates the Biden administration's goal of a 100% clean electricity grid by 2035F. We believe the subsidies to be granted and the power transmission needs report pave a clearer way ahead for US grid construction and upgrades in 2025-35F, which will very likely accelerate US power grid construction.

(1) Contract negotiations underway for first round of TFP subsidies

According to North American Electric Reliability Corporation (NERC), the expansion and upgrades of US power transmission networks, spanning permit application, site selection and completion of construction work, could take 7-10 years. A long construction period and relatively low returns compared to other investment opportunities make it more difficult to attract investors for such projects, consequently capping the investment scale. The TFP is put in place to address this issue, namely that the federal government provides subsidies to encourage installation of new power transmission lines on a large scale, upgrading of existing networks, and the connection of microgrids across all states.

The DOE announced on October 30 that three transmission projects across six states are undergoing contract negotiations. Through the TFP, the US government intends to provide US$1.3bn in subsidies to expand 3.5GW of grid capacity. The contracts will hold the DOE accountable for purchasing a certain percentage of the capacity. This will help strengthen investors' confidence in the projects, and reduce the overall risk faced by project developers. The three transmission projects to receive the first round of TFP subsidies are:

(a) Cross-Tie 500kV Transmission Line Project (Nevada, Utah)

(b) Southline Transmission Project (Arizona, New Mexico)

(c) Twin States Clean Energy Link (New Hampshire, Vermont)

The Cross-Tie 500kV Transmission Line Project and Southline Transmission Project are both intraregional expansion projects and will begin construction in 1Q25F, and will account for 14% of the transmission capacity needed by 2030F. The Twin States Clean Energy Link is a cross-state expansion project, and will begin construction in 2H26F, accounting for 79% of cross-region transmission capacity needs by 2030F. The first round of TFP subsidies represent a milestone of US transmission network build-out on a contracted capacity basis, driven by the federal government. We believe the US will speed up grid construction from 1Q25F so that the Biden administration can achieve its goal of having a 100% clean electricity grid by 2035F.

Figure 1: Recipients of first round of TFP subsidies

Selected projects	Planned project location	Region	Construction start	Project size	Contribution of need by 2030
Cross-Tie 500kV Transmission Line	Utah to Nevada	Mountain	1Q25	1,500 MW 214 miles	14% of regional need
Southline Transmission	New Mexico to Arizona	Southwest	1Q25	1,000 MW 175 miles	14% of regional need
Twin States Clean Energy Link	Vermont to New Hampshire (linking Canada & New England's grid)	Northeast	2H26	1,200 MW HVDC 75 miles	79% of interregional need

Source: US DOE; KGI Research

(2) National Transmission Needs Study suggests US transmission circuit miles & capacity need to increase by 64% & 114%, respectively, by 2035F

The DOE's National Transmission Needs Study report examines the power transmission needs across thirteen regions in the US mainland by 2030, 2035 and 2040, based on three scenarios of grid loading and clean energy penetration, namely (a) medium loading and medium penetration; (b) medium loading and high penetration; and (c) high loading and high penetration. The medium loading and high penetration scenario is more in line with the outlook for the electric power industry that the IIJA and IRA aim to achieve.

In the medium loading and high penetration scenario pursuant to IIJA and IRA, the US mainland needs to add (by 2035F) high-voltage power transmission lines of a total of 54,500GW-miles, an increase of 64% over the 85,600GW-miles of line in place as of 2020, and 124.6GW of capacity, an increase of 114% over the 109GW in place in 2019, in order to fulfill potential demand (this is according to the median forecasts of the transmission needs study).

According to UT-Austin Energy Institute, the total cost of replacing the US power grid is about US$4.8tn, of which transmission lines account for 33%, or US$1.6tn. Having considered intraregional and cross-region demand for electric power transmission in a scenario of medium grid loading and high penetration of clean energy, the US will need to add 54,500GW-miles of intraregional transmission lines to carry an additional capacity of 124.6GW by 2035F. This means the overall capacity of the US power grid system will need to expand by 80-100%, requiring an investment in grid infrastructure amounting to US$1.3-1.6tn.

Figure 2: Overview of power transmission networks by region in National Transmission Needs Study — 13 regions in US mainland plus Hawaii & Alaska

Source: National Renewable Energy Laboratory

Figure 3: US requirements for intraregional transmission circuit miles by region, according to National Transmission Needs Study

Region	2020	New in 2030		New in 2035		New in 2040	
	TW-mi	TW-mi	Growth (%)	TW-mi	Growth (%)	TW-mi	Growth (%)
California	4.29	0.09	2	0.12	3	0.12	3
Mountain	3.48	2.28	66	3.14	90	2.88	83
Northwest	15.24	0.07	0	0.54	4	0.00	0
Southwest	5.66	0.93	16	1.87	33	0.81	14
Texas	6.43	6.04	94	9.00	140	9.60	149
Delta	3.36	0.39	12	1.65	49	1.37	41
Florida	2.97	0.06	2	0.81	27	1.04	35
Mid-Atlantic	14.60	1.09	7	3.28	22	3.61	25
Midwest	11.92	3.71	31	13.34	112	16.22	136
New England	1.94	0.05	3	0.10	5	2.72	140
New York	0.82	0.00	0	0.00	0	0.06	7
Plains	6.97	3.52	51	8.32	119	6.31	91
Southeast	8.90	2.83	32	6.82	77	6.04	68
Total US	**85.60**	**23.4**	**27**	**54.50**	**64**	**42.20**	**49**

Source: US DOE; KGI Research

Figure 4: US requirements for cross-region transmission capacity, according to National Transmission Needs Study

Region	2020	New in 2030		New in 2035		New in 2040	
	GW	GW	Growth (%)	GW	Growth (%)	GW	Growth (%)
California - Mountain	2.12	0.58	27	1.87	88	4.97	234
California - Northwest	5.15	0.00	0	0.13	3	0.00	0
California - Southwest	5.23	0.05	1	0.31	6	5.09	97
Mountain - Northwest	12.70	1.08	9	3.30	26	0.00	0
Mountain - Southwest	4.06	0.37	9	1.65	41	1.70	42
Mountain - Plains	0.92	0.79	86	2.64	287	11.90	1293
Plains - Southwest	0.40	2.53	633	3.66	915	13.10	3275
Plains - Texas	0.82	1.15	140	9.84	1200	14.60	1780
Delta - Midwest	3.00	0.00	0	0.00	0	0.00	0
Delta - Plains	4.76	4.89	103	19.70	414	0.00	0
Delta - Southeast	5.92	0.92	16	5.10	86	10.70	181
Florida - Southeast	3.60	0.00	0	1.14	32	7.20	200
Mid-Atlantic - Midwest	21.70	9.87	45	33.80	156	21.90	101
Mid-Atlantic - New York	2.00	0.00	0	2.43	122	14.80	740
Mid-Atlantic - Southeast	7.07	2.78	39	6.86	97	12.50	177
Midwest - Plains	12.10	7.99	66	21.10	174	23.00	190
Midwest - Southeast	8.27	1.28	15	4.46	54	6.23	75
New England - New York	2.03	1.53	75	5.19	256	11.40	562
Total US	**109.00**	**33.20**	**30**	**124.60**	**114**	**239.40**	**220**

Source: US DOE; KGI Research

Overview – US power grid systems

I. Eastern, Western & Texas Interconnection are the three major power grids

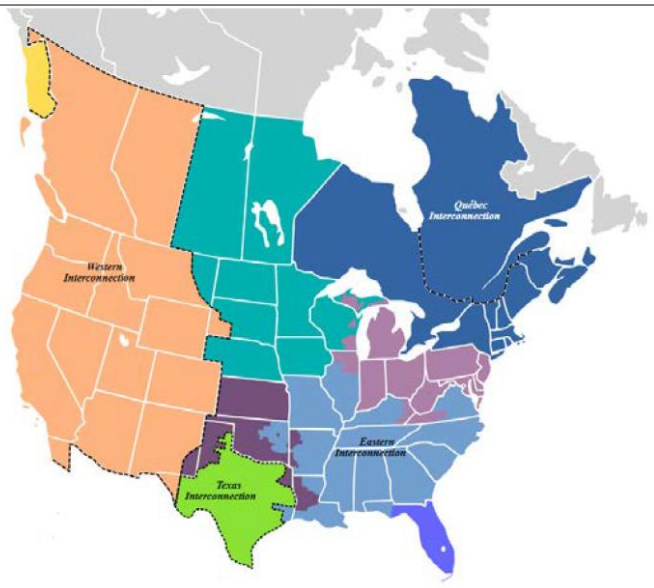
The US electric power sector started out as a free market, with power generation and transmission rights highly fragmented as each state independently designed and built its own power market. As a result, the power market scale differs from state to state, making effective market synchronization impossible. Due to geographical conditions and system characteristics, cross-region power grid construction has proven difficult. As such, electricity plants across the country developed into multiple isolated power grids, and then later grouped together to form three major power grids - the Eastern Interconnection, the Western Interconnection and the Texas Interconnection.

(1) The Eastern Interconnection. This power grid covers most US eastern regions, including the East Coast and certain areas of the Midwest, and is a vast power transmission network connecting to certain Canadian provinces and some areas in Mexico, making it a transnational power transmission network. The Eastern Interconnection is composed of regional power companies and power generation plants, which generate electricity mainly using coal and natural gas.

(2) The Western Interconnection. This power grid covers most US western regions, including the area west of the Rocky Mountains (i.e. the West Coast and cities like Los Angeles and San Francisco). It is composed of regional power companies and generation plants. Since the area is geographically diverse, including vast mountainous terrains and deserts, and is less densely populated, independent power grid systems have formed to meet power demand there. Hydropower is the main source of electricity in the Western Interconnection due to the steep terrains of the Rockies, which hinder links to other regions.

(3) The Texas Interconnection. Covering the state of Texas in its entirety, this power grid is independent due to the history and policy of the state's power market development. Texas started developing its own power system early in the 20th century and has yet to join the nationwide power grid, allowing the Texas Interconnection to enjoy an independent status. This power grid is operated and managed by Electric Reliability Council of Texas (ERCOT). Based in an area where a shale gas basin is located, the Texas Interconnection is a small, monopolistic, independent power grid producing natural gas-fueled electricity.

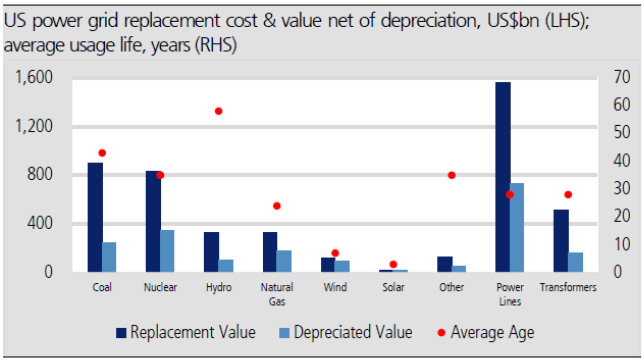
Figure 5: US power grid systems



Source: North American Reliability Corporations

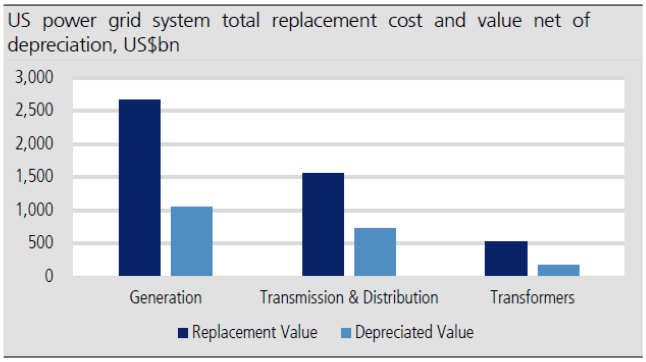
The infrastructure of the US power grid systems includes over 7,000 power generation plants, 6.3mn miles of power distribution lines, 640k miles of high-voltage power transmission lines and 50mn substation transformers. According to UT-Austin, the US power grid is valued at around US$2.0tn net of depreciation, of which 54% is power generation facilities, 37% is power transmission and distribution lines and 8% is transformers. The total replacement cost is US$4.8tn, of which 56% is power generation facilities, 33% is power transmission and distribution lines and 11% is transformers. These statistics mean that transformers account for 8-11% of US total power grid system spending. For reference, in our September 21 report, "GRSCP & US infrastructure investment to bring growth", we estimate that transformers account for 8% of Taiwan total power grid system spending, based on the fact that Taiwan's substation-related equipment accounts for 40% of the total power grid budget and transformers account for 20% of Taipower's substation equipment tenders.

Figure 6: US power grid value; US$2.0tn net of depreciation; total replacement cost of US$4.8tn



Source: UT-Austin Energy Institute

Figure 7: US power grid value; 55% power generation facilities; 33% power transmission & distribution lines; 10% transformers



Source: UT-Austin Energy Institute; KGI Research

III. US power transmission & substation lines by region

The highest voltage of power transmission and substation lines in Taiwan is just 345kV due to its small land area, while in the US the voltage can be as high as 735kV, in order to reduce waste caused by long-distance transmission. The high voltage power transmission and substation lines can be divided into 735kV, 500kV, 245kV and 230kV systems, deployed in the following regions:

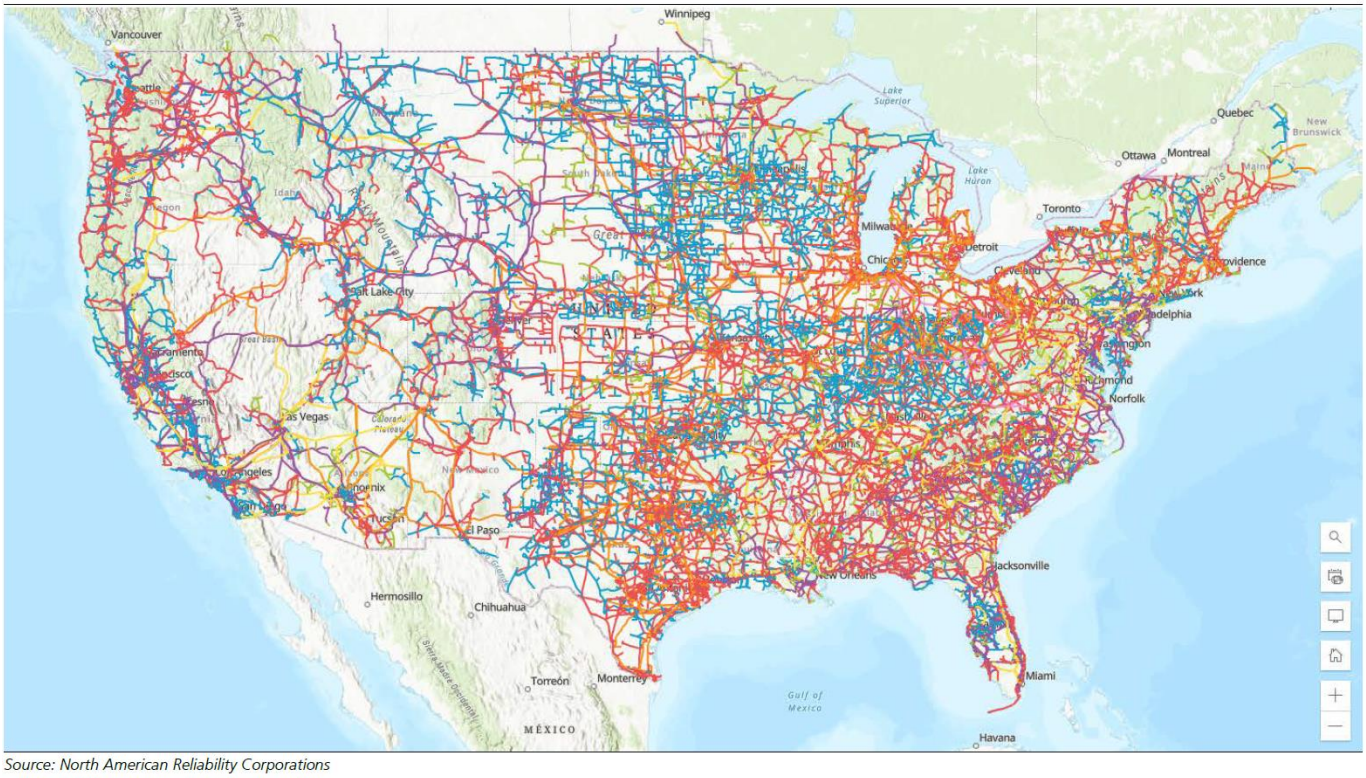
(1) 735kV – Lines between the Eastern Interconnection and Canada's Quebec Interconnection, responsible for transmitting power generated in the James Bay and Churchill Falls hydroelectric projects.

(2) 500kV – The highest main voltage in the Eastern Interconnection and the Western Interconnection. The voltage is first reduced to 230kV for transmission, and then to below 100kV for consumption.

(3) 345kV – The highest voltage in the intersection of the Eastern Interconnection and the Western Interconnection, as well as the Texas Interconnection. The voltage is first reduced to 130-161kV for transmission, and then to below 100kV for consumption.

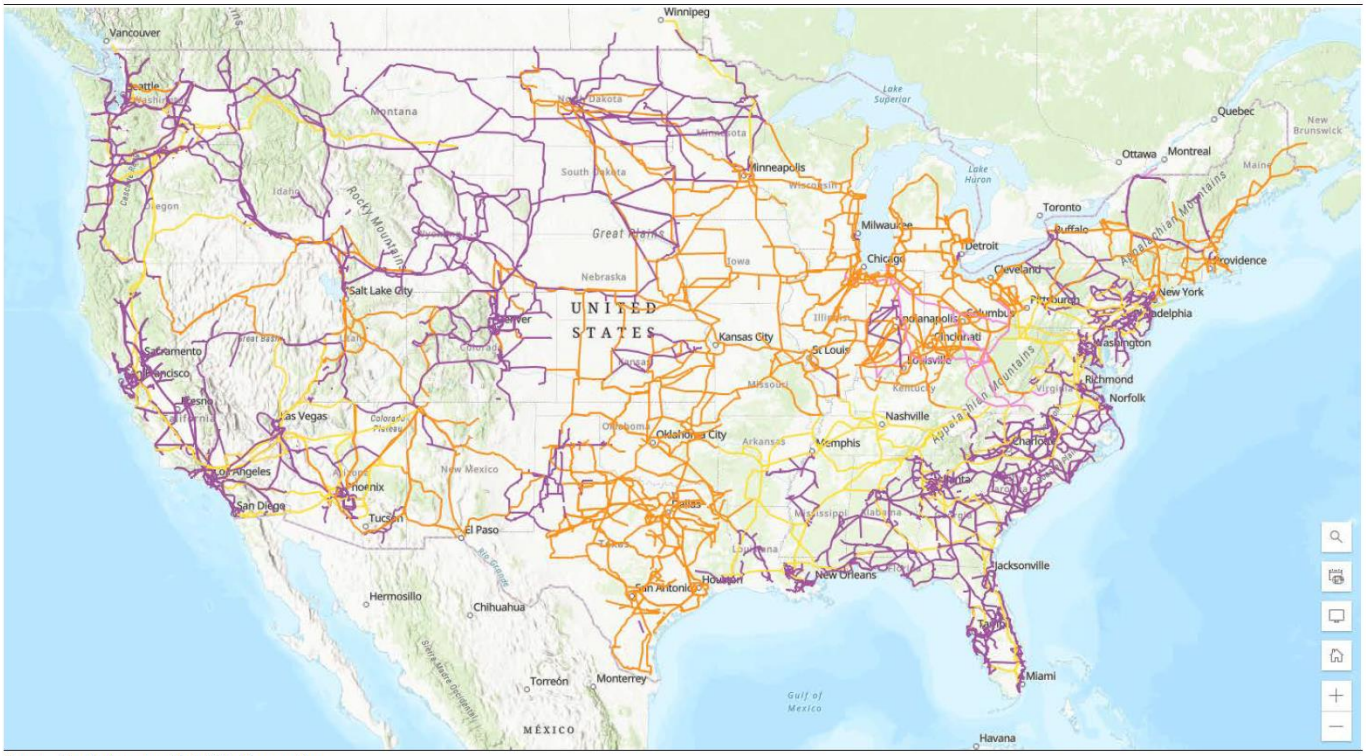
(4) 230kV – Used in the coastal regions of the Eastern Interconnection and the Western Interconnection. The voltage of long-distance 500kV transmission lines is reduced to 230kV, and then to below 100kV for consumption.

Figure 8: US power transmission lines by region (blue – below 100kV; red - 100-161kV; purple - 230kV; orange - 345kV; yellow - 500kV; pink - 735kV)



Source: North American Reliability Corporations

Figure 9: US over-230kV transmission lines by region (purple - 230kV; orange - 345kV; yellow - 500kV; pink - 735kV)



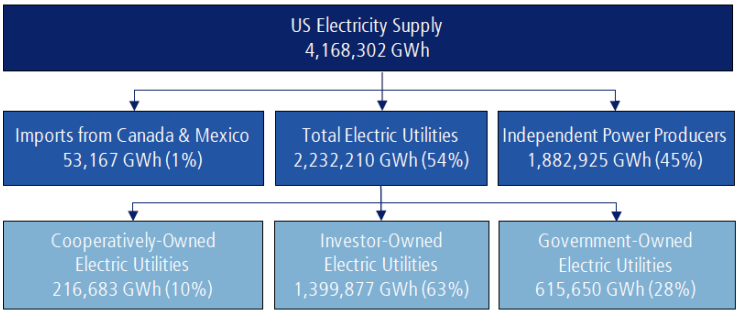
Source: North American Reliability Corporations

US transformer import demand

The product life of ANSI/ IEEE standard power transformers, under ideal circumstances, is 20 years. However, according to the US Department of Energy, 75% of power transmission and substation lines, as well as transformers, in the US have been used for over 25 years. The average age of large transformers, which handle 90% of US power, exceeds 40 years, leading to energy waste, falling efficiency and malfunctions in the face of extreme weather. US power transformers are mainly imported. According to the US Department of Commerce, 750 transformers were purchased and deployed in 2019, of which 137 were made domestically, 617 were imported and 4 exported, for a self-sufficiency rate of just 18%.

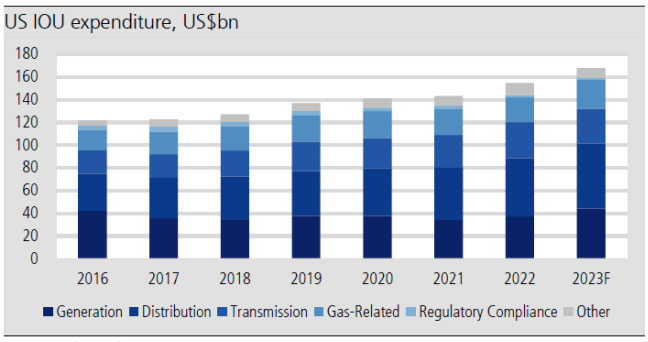
In the US, electricity is supplied from three sources: (1) electric utilities (54%); (2) independent electricity producers (45%); and (3) imports from Canada and Mexico (1%). Electric utilities can be divided into investor-owned electric utilities (IOU), government-owned electric utilities and cooperatively-owned electric utilities, accounting for a respective 63%, 28% and 10% of utility power generation. Edison Electric Institute forecasts IOUs will spend US$167.8bn on US power grid infrastructure in 2023 – up 8% from US$154.7bn in 2022 – of which US$44.2bn will be for power generation, US$30.7bn for power transmission and US$57.1bn for power distribution. Based on the power transmission and distribution expenditures of IOUs, transformers accounting for around 8% of power grid spending, and the US importing around 80% of transformers deployed, we calculate that transformer import demand from the US will hold a value of US$5.6bn in 2023F ((US$30.7bn + US$57.1bn) x 8% x 80% = US$5.6bn).

Figure 10: US electricity supply structure by ownership in 2021



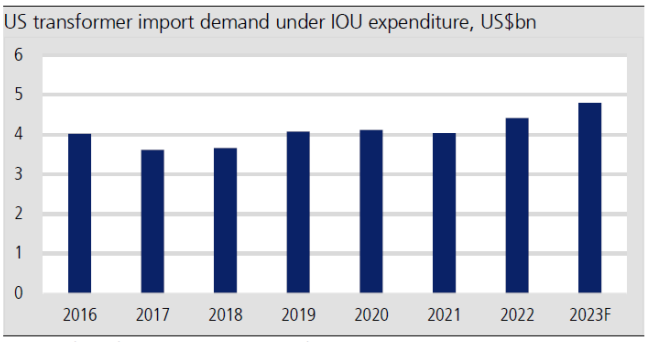
Source: Edison Electric Institute

Figure 11: US IOUs will spend US$167.8bn on power grid infrastructure expenditures in 2023F



Source: Edison Electric Institute

Figure 12: US transformer import demand will hold a value of US$5.6bn in 2023F under IOUs' expenditure

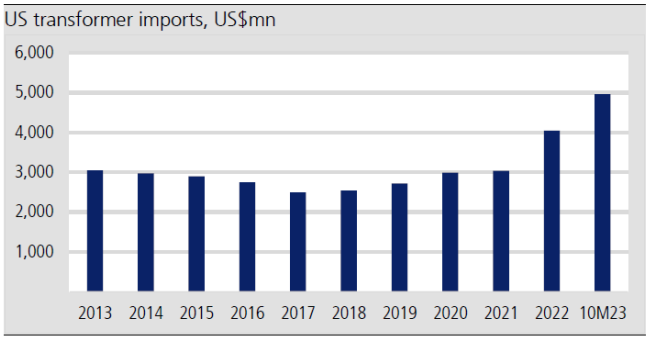


Source: Edison Electric Institute; KGI Research

We estimate US power grid systems need to spend US$1.3-1.6tn on power transmission systems by 2035. Our estimation is based on a national power transmission study released by the US Department of Energy, in which 54,500GW-mile (64%) of regional power transmission lines and 124.6GW (114%) of cumulative power transmission capacity will need to be added to achieve the medium load/ high clean energy scenario by 2035. On our abovementioned assumptions, we forecast US transformer imports will be worth US$80-100bn by 2035. According to US Customs data, 2023 US transformer imports were worth US$5.0bn through to October, up 23% over total 2022 imports. We forecast US transformer imports will be US$5.6bn in 2023, and will grow at a CAGR rate of 6% in 2024-35F, towards achieving the Biden administration's clean energy goals for 2035.

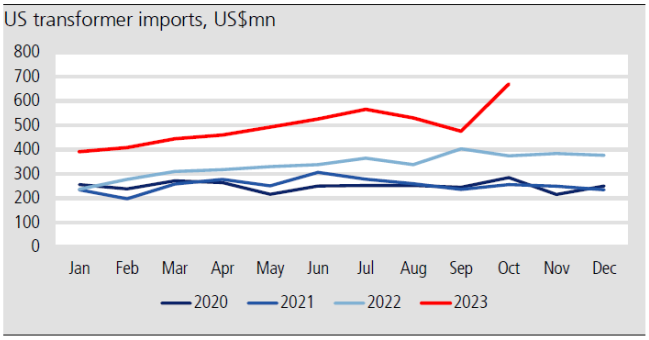
Among Taiwanese transformer manufacturers, Shihlin Electric and Fortune Electric obtain transformer export orders from the US. In January-October, Taiwan exported nearly US$130mn of transformers to the US, up 72% over full-year 2022, with the US accounting for 66% of total transformer exports, up from 46% in 2022. As demand for transformers has grown, global transformer giants' lead time has lengthened to over two years, while Taiwanese makers' is just 18 months, allowing them to secure more export orders. We believe US power-grid infrastructure spending will be a strong source of growth for Taiwanese transformer makers. We forecast Shihlin Electric's and Fortune Electric's US sales will grow at a respective CAGR of 89% and 47% in 2023-25F, and contribute 5% and 41% of respective 2025F sales.

Figure 13: US transformer imports have reached 123% of 2022 level



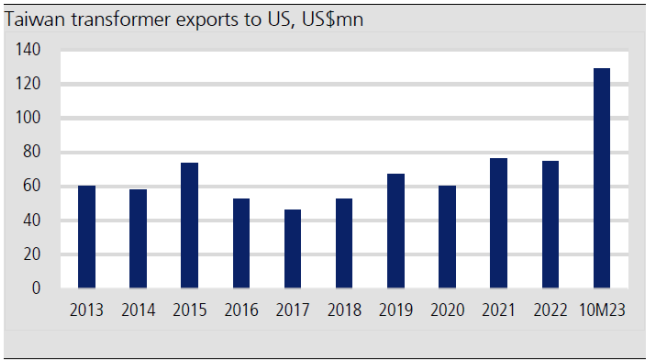
Source: US Census Bureau; KGI Research

Figure 14: US transformer imports up YoY



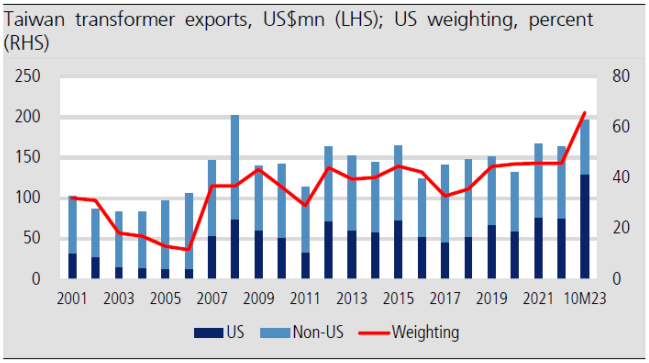
Source: US Census Bureau; KGI Research

Figure 15: Taiwan transformer exports to the US have reached 172% of 2022 level



Source: ROC Customs Administration; KGI Research

Figure 16: Weighting of Taiwan transformer exports to US has risen to 66%



Source: ROC Customs Administration; KGI Research

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