Making the connection: meeting the electric T&D supply chain challenge

Executive Summary

September 2025

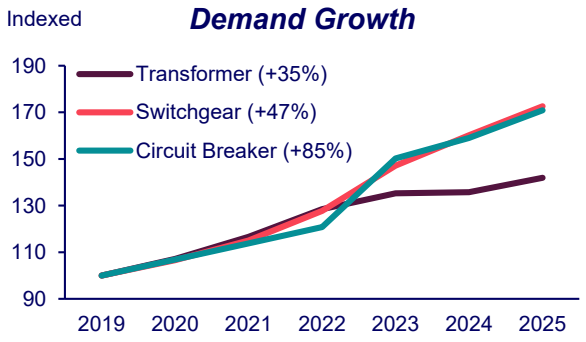
In Partnership with American Clean Power

Key study findings

The study explored numerous key topics in electrical equipment, including rising demand and policy impacts

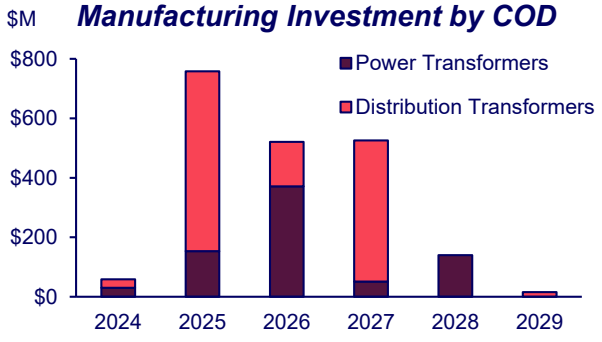
New Demand Drivers

- Growing electricity demand:
  - Data center and manufacturing expansion
  - Electrification (EV Charging, heat pumps)
- Aging T&D infrastructure
- Increasing adoption of clean energy generation.
- Grid hardening and increasing frequency of extreme weather
- Grid modernization efforts



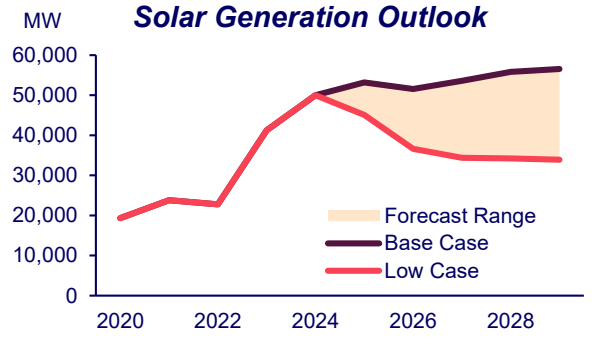
Market Impacts

- Strong demand growth has pushed equipment markets into a deficit
- Equipment lead times and prices for key equipment have surged amid increasing competition for production slots
  - Power transformer and GSUs are seeing sustained lead times of 2 to 3 years.
- Since 2023, nearly $1.8 billion in investments have been announced for transformer production targeting the North American market



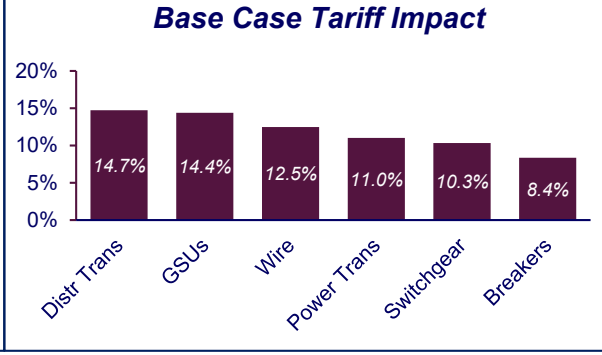
Market Risks

- The combination of new tariffs and evolving policy is exacerbating ongoing market constraints and creating more uncertainty.
- The reduced support for clean energy is dampening the demand outlook for transformers, potentially hindering investment plans.
- The Foreign Entities of Concern (FEOC) provisions of the Big Beautiful Bill will further limit the use of Chinese built transformers and commodities.



Market Outlook

- Evolving trade policy is expected to put additional upward pressure on both imported and domestically produced equipment.
- OEMs have cited raw material constraints and technical labor shortages as bottleneck to capacity expansion.
- Demand is expected to remain strong despite reduced renewable deployments, although growth will stabilize, with the market deficit expected to see improvement over the coming years.



Wood Mackenzie

Sources: Wood Mackenzie Supply Chain

A confluence of demand drivers have contributed to the ongoing shortages

Since 2020, a variety of new demand drivers have emerged resulting in a significant market deficit

Demand Driver	Description	Equipment Impacted
Electrical Load Growth	US electricity demand is estimated to have increased by 7% between 2019 – 2024, reversing from a 1% decline from 2010 to 2020, necessitating increased investment into T&D infrastructure.	Power Transformers, Distribution Transformers, Switchgear & Breakers, Wire
Clean Energy Generation Expansion	The ballooning pipeline for clean energy projects is stimulating demand for equipment, with annual solar deployments increasing by upwards of 400% between 2019 and 2025.	Power Transformers, Switchgear & Breakers,
Aging Infrastructure & Grid Modernization	A recent DOE study found that 55% of in-service distribution transformers (approximately 40 million units) are more than 33 years old, well beyond their expected service life.	Power Transformers, Distribution Transformers
Extreme Weather Events & Grid Hardening	The frequency of billion-dollar weather events in the US has increased from 8 in 2014, to 27 in 2024, resulting in increased damage to utility infrastructure	Power Transformers, Distribution Transformers, Switchgear & Breakers, Wire
Data Center and Manufacturing Investment	Manufacturing construction spending has increased by 96% over the past 3 years, while the data center pipeline reached more than 125 GW in Q1 2025, with monthly additions increasing 226 MW per month over the past two years	Distribution Transformers, Switchgear & Breakers, Wire
Electrification (Heat Pumps and EVs)	The increasing adoption of EVs and heat pumps is further increasing demand electrical equipment.	Distribution Transformers, Switchgear & Breakers, Wire

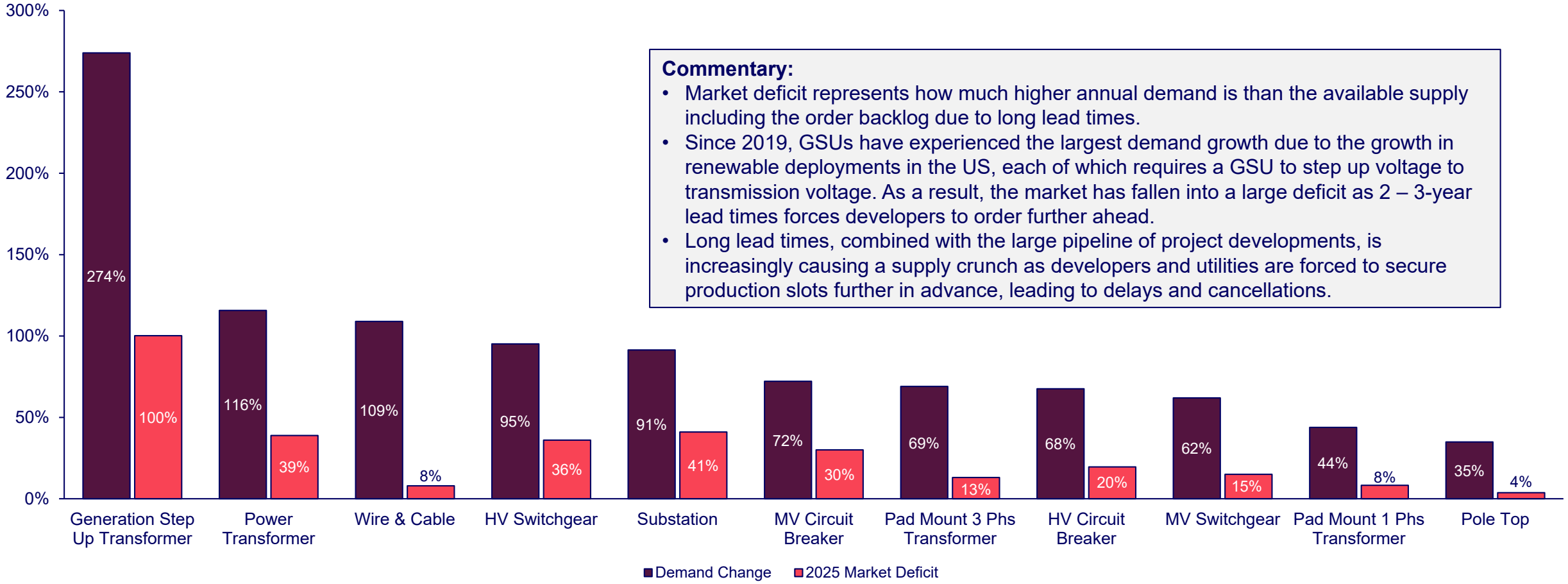
Wood Mackenzie

Sources: Wood Mackenzie Supply Chain

Electrical equipment demand has ballooned in recent years

Demand has increased by 35% to 274% depending on the equipment type, resulting in deficits emerging

US Demand Growth (2019 – 2025) Vs. Current Market Deficit (2025)



Commentary:

- Market deficit represents how much higher annual demand is than the available supply including the order backlog due to long lead times.
- Since 2019, GSUs have experienced the largest demand growth due to the growth in renewable deployments in the US, each of which requires a GSU to step up voltage to transmission voltage. As a result, the market has fallen into a large deficit as 2 – 3-year lead times forces developers to order further ahead.
- Long lead times, combined with the large pipeline of project developments, is increasingly causing a supply crunch as developers and utilities are forced to secure production slots further in advance, leading to delays and cancellations.

Wood Mackenzie

Sources: Wood Mackenzie Supply Chain

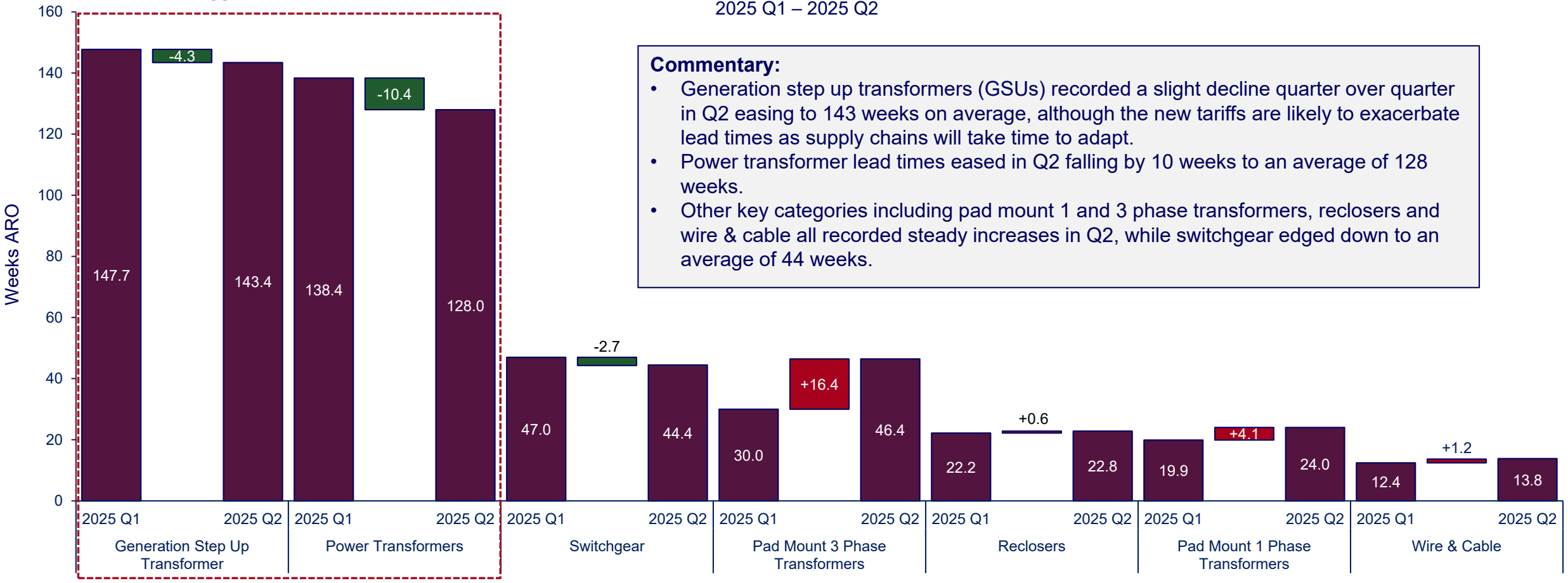
Equipment lead times remain volatile, but signs of improvement emerge

GSU and power transformer lead times show signs of improvement but remain between 2 – 3 years.

Biggest areas of concern

Quarterly lead time change

2025 Q1 – 2025 Q2



Commentary:

- Generation step up transformers (GSUs) recorded a slight decline quarter over quarter in Q2 easing to 143 weeks on average, although the new tariffs are likely to exacerbate lead times as supply chains will take time to adapt.
- Power transformer lead times eased in Q2 falling by 10 weeks to an average of 128 weeks.
- Other key categories including pad mount 1 and 3 phase transformers, reclosers and wire & cable all recorded steady increases in Q2, while switchgear edged down to an average of 44 weeks.

Wood Mackenzie

Source: Wood Mackenzie Supply Chain's Lead Time Benchmarking Product

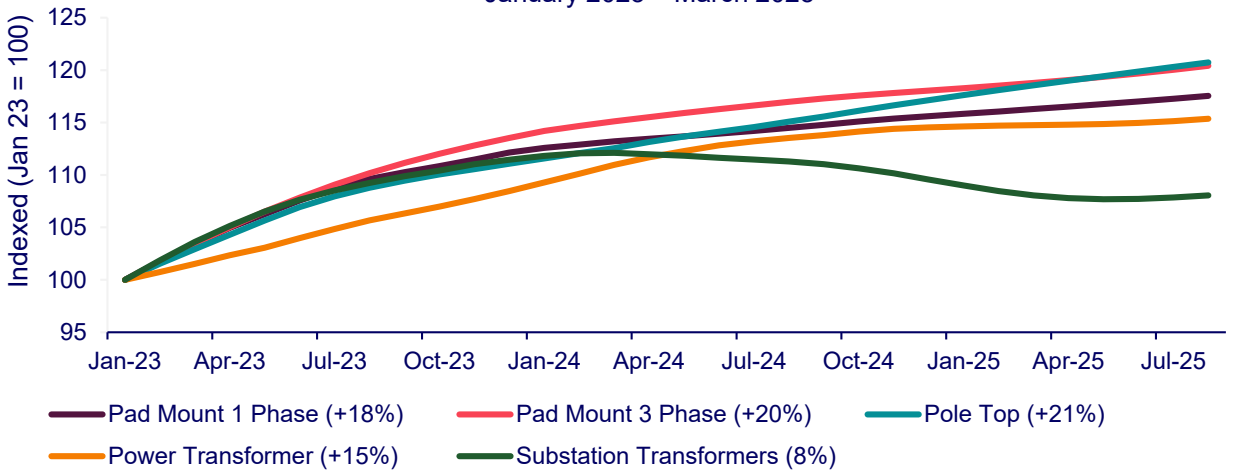
Lead times are classified based on transformer type rather than voltage or other specifications.

Transformer prices remain elevated amid ongoing market shortage

Strong demand for transformers has prompted increased investment although industry challenges remain

Transformer Price Change by Specification

January 2023 – March 2025

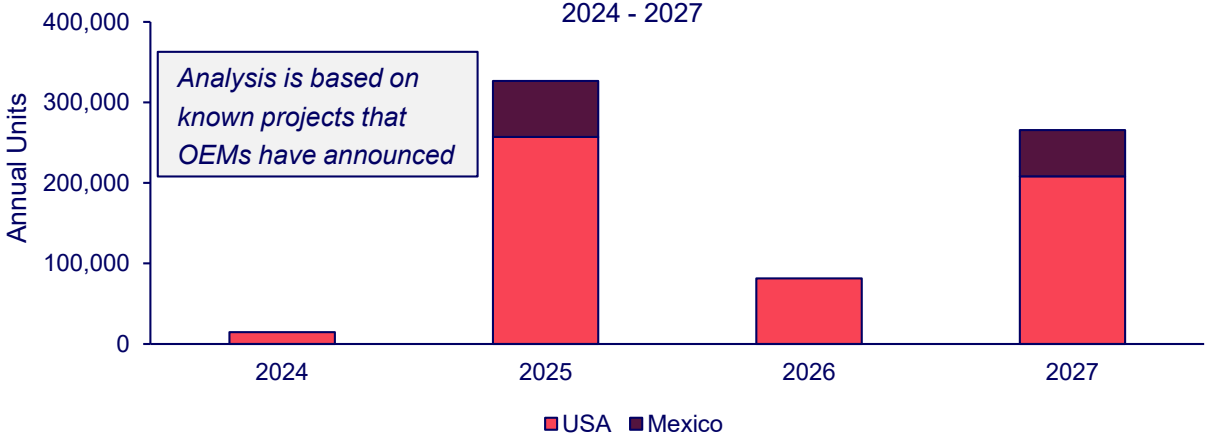


Market Risks:

- Electrical steel prices remain volatile with prices increasing by upwards of 20% over the last couple of months, resulting in price shifts in contracts if linked with an adjustment formula.
- Copper wire used in transformer windings has been cited as a bottleneck in transformer production due to limited supply for the specifications required.
- US tariffs will make imported units less price competitive, resulting in increased competition for domestic production slots.
- While production capacity is ramping up, additional investment is still required to help address the market shortage.

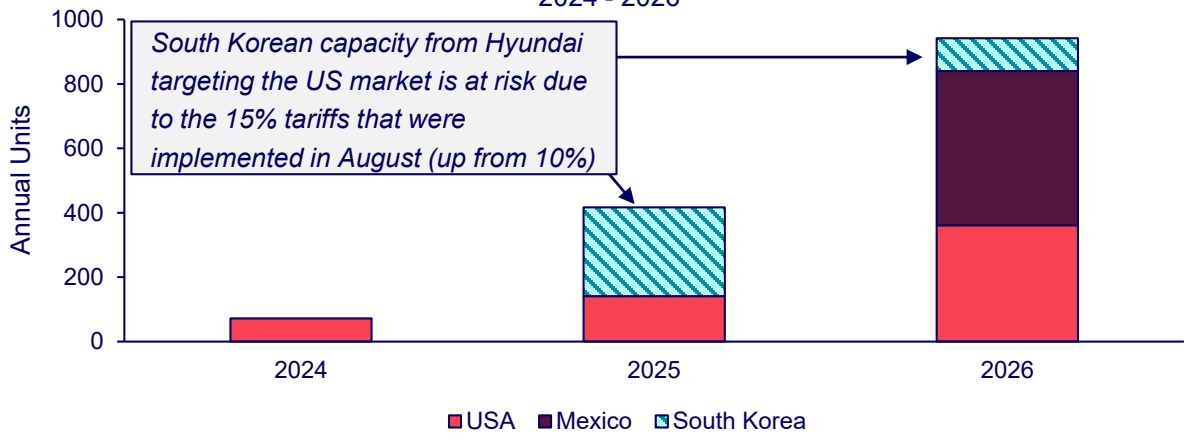
Distribution Transformer Expected Annual Capacity Expansion

2024 - 2027



Power Transformer Expected Annual Capacity Expansion

2024 - 2026



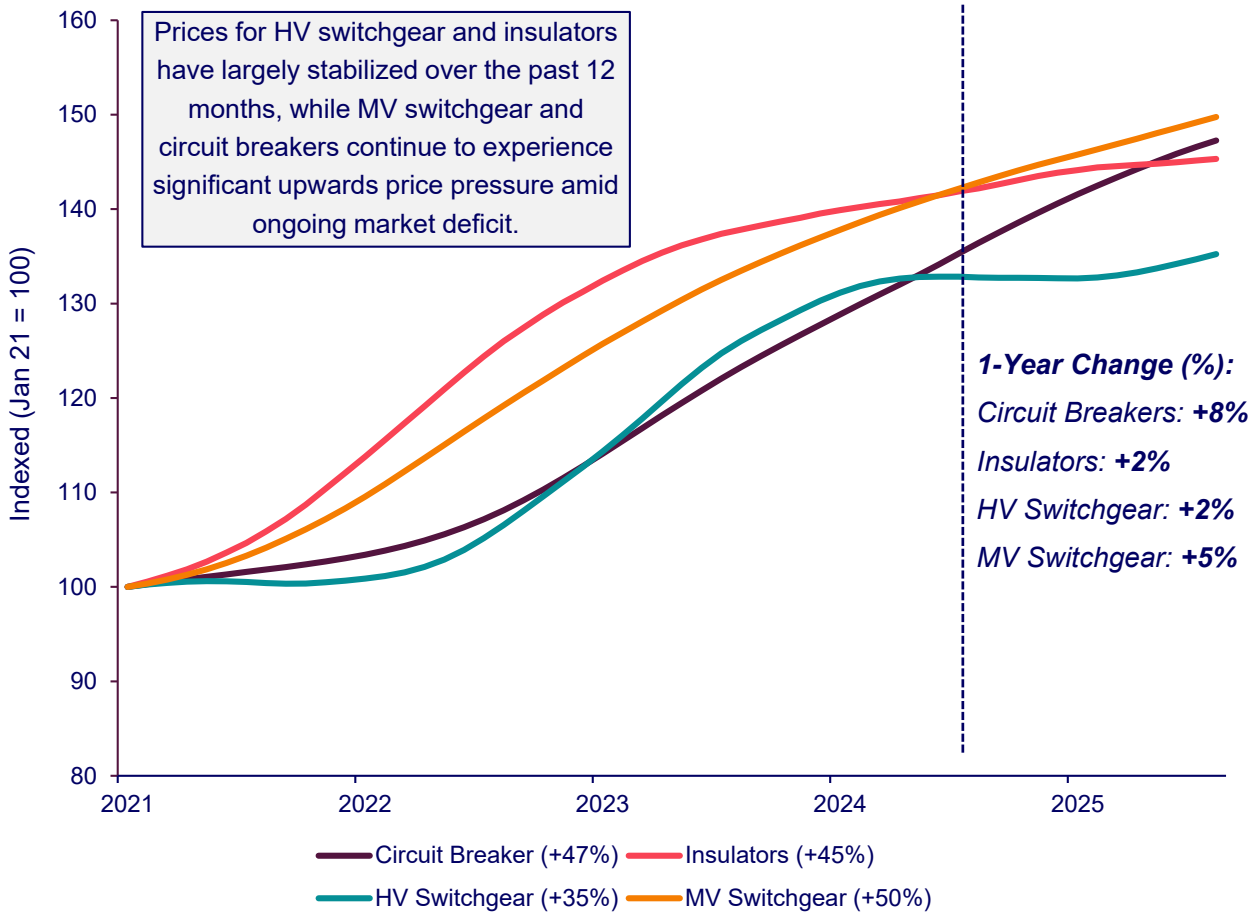
Source: Wood Mackenzie Supply Chain

Electrical equipment prices remain volatile amid strong demand

Despite breakers and switchgear being in a significant market surplus, capacity investment remains limited

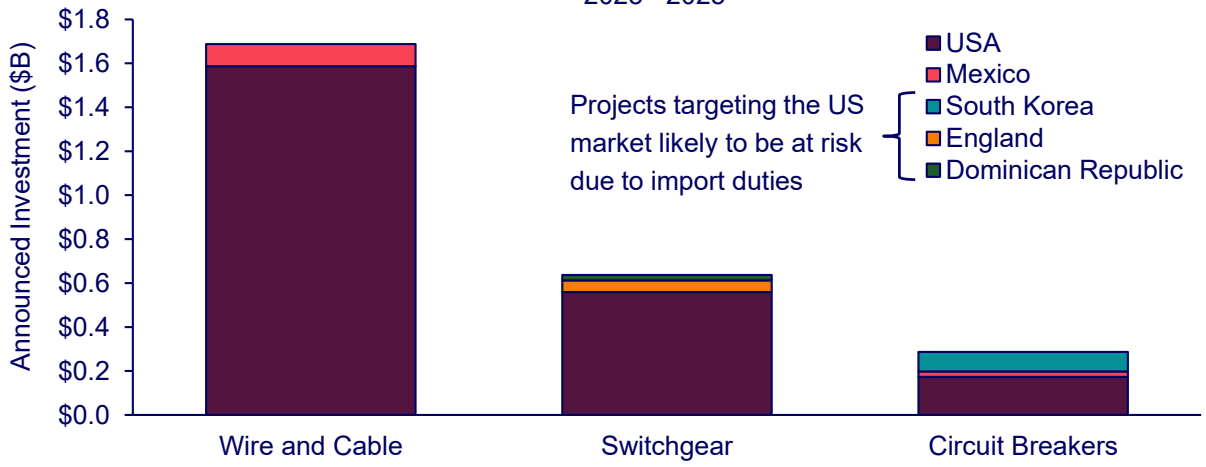
Electrical Equipment Price Trends by Type

January 2021 – March 2025



Manufacturing Investment Pipeline by Type

2023 - 2025



Market Risks:

- Electrical equipment of all types, from circuit breakers and switchgear to insulators, have seen significant price pressure over the past 4 years as investment in energy intensive industries continues to ramp up.
- Over $2.6B of investment has been announced to expand capacity of key electrical equipment, with wire capacity being the largest driver with almost $1.7B worth of investment announced over the past couple of years.
- Capacity outside of the US, Mexico, and Canada (assuming USMCA compliant) is at risk due to the new import duties as it will make the costs less competitive.

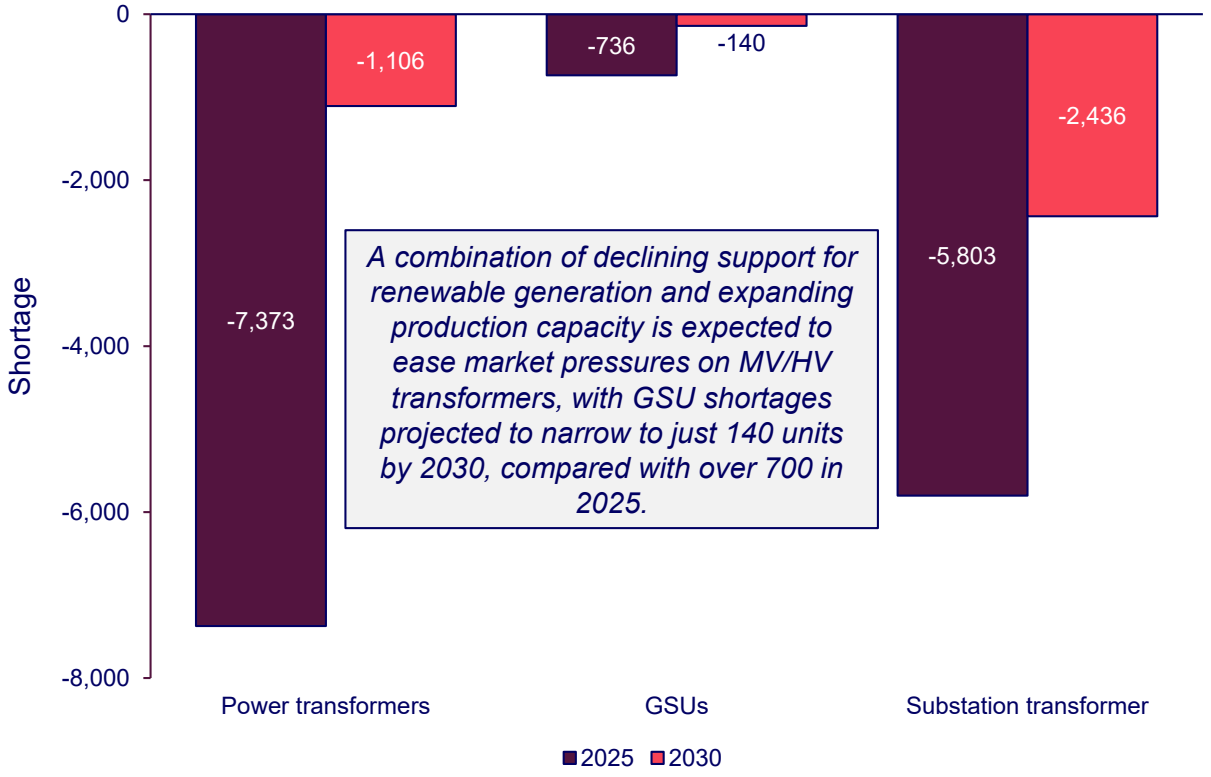
Source: Wood Mackenzie Supply Chain

Transformer market deficit to persist although some improvements will emerge

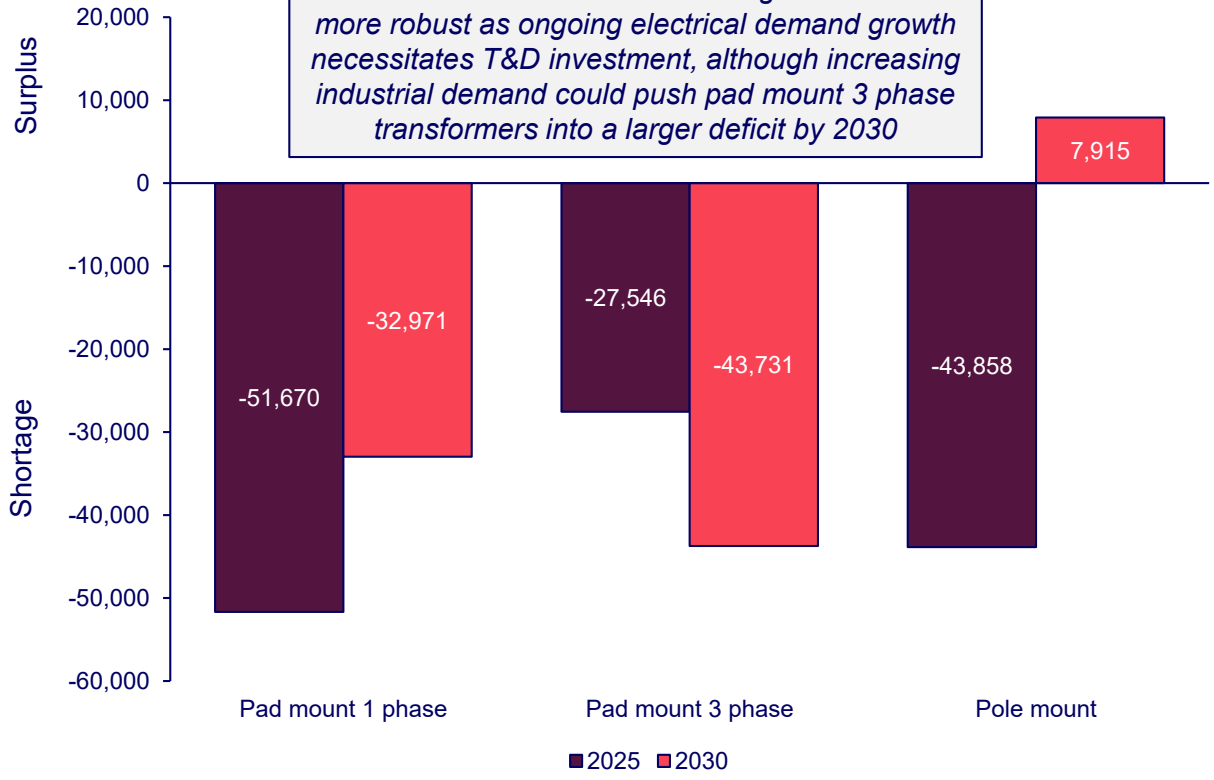
Demand associated with generation assets will ease, while T&D investment will continue to spur demand

Market Balance by Transformer Type

2025 - 2030



A combination of declining support for renewable generation and expanding production capacity is expected to ease market pressures on MV/HV transformers, with GSU shortages projected to narrow to just 140 units by 2030, compared with over 700 in 2025.



Distribution transformer demand growth will be more robust as ongoing electrical demand growth necessitates T&D investment, although increasing industrial demand could push pad mount 3 phase transformers into a larger deficit by 2030

Source: Wood Mackenzie Supply Chain

Tariff impact remains uncertain amid evolving trade policy

Based on our tariff outlook, equipment cost impacts could range from just 1% to upwards of 20%.

Tariff Impact by Equipment Type and Scenario

2025

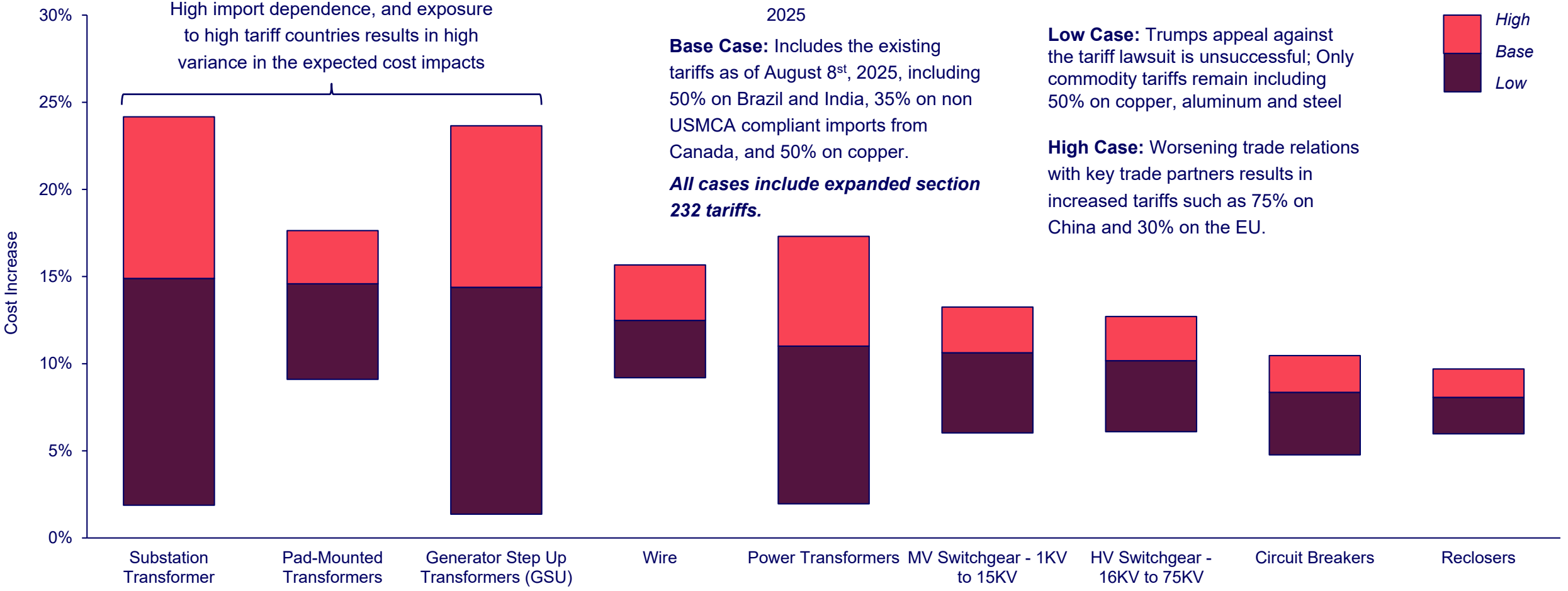
High import dependence, and exposure to high tariff countries results in high variance in the expected cost impacts

Base Case: Includes the existing tariffs as of August 8st, 2025, including 50% on Brazil and India, 35% on non USMCA compliant imports from Canada, and 50% on copper.

All cases include expanded section 232 tariffs.

Low Case: Trumps appeal against the tariff lawsuit is unsuccessful; Only commodity tariffs remain including 50% on copper, aluminum and steel

High Case: Worsening trade relations with key trade partners results in increased tariffs such as 75% on China and 30% on the EU.



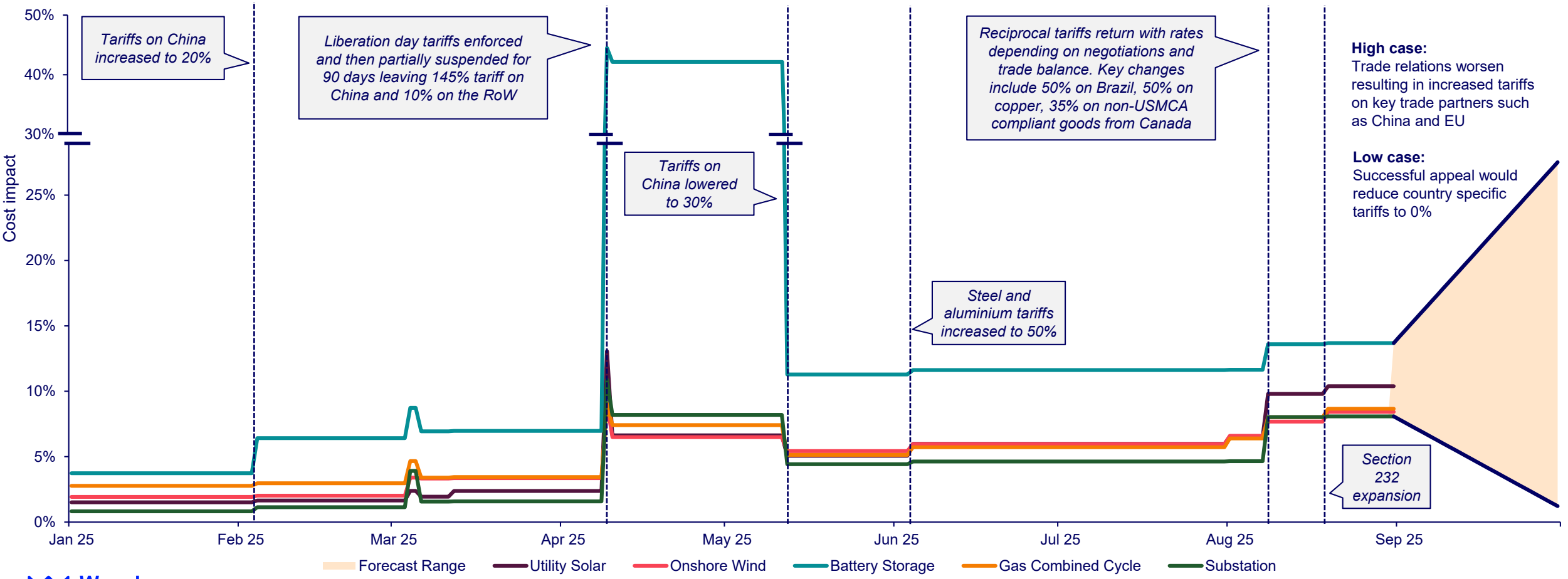
Source: Wood Mackenzie Supply Chain

Evolving trade policies are resulting in a rollercoaster for project planning

US projects across the board will experience price increases of different magnitudes due to new tariffs

Cost increase evolution for US projects based on tariff changes

January 2025 – September 2025



Source: Wood Mackenzie Tariff Cost Calculator, The White House

New tariffs represent another setback for utility project costs

Increased tariffs on key trade partners like Canada, Brazil and the EU with further inflate equipment costs

Tariff impacts by asset and scenario

Low: unsuccessful tariff appeal

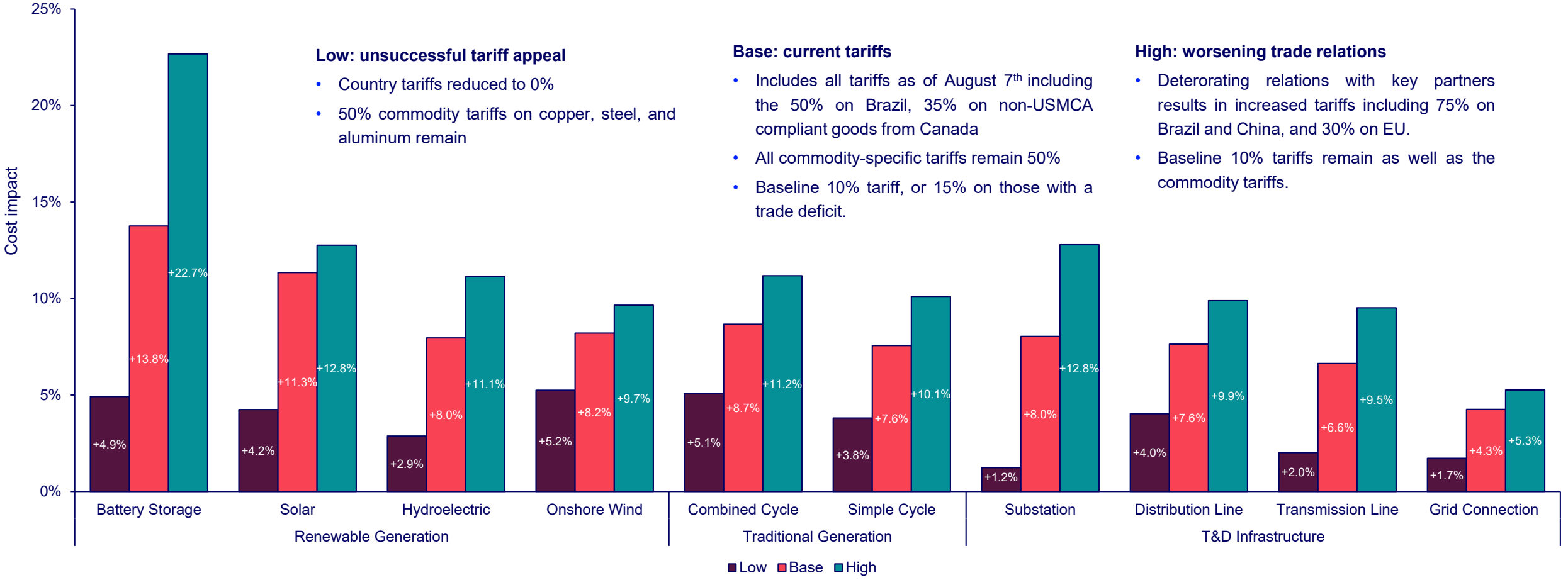
- Country tariffs reduced to 0%
- 50% commodity tariffs on copper, steel, and aluminum remain

Base: current tariffs

- Includes all tariffs as of August 7th including the 50% on Brazil, 35% on non-USMCA compliant goods from Canada
- All commodity-specific tariffs remain 50%
- Baseline 10% tariff, or 15% on those with a trade deficit.

High: worsening trade relations

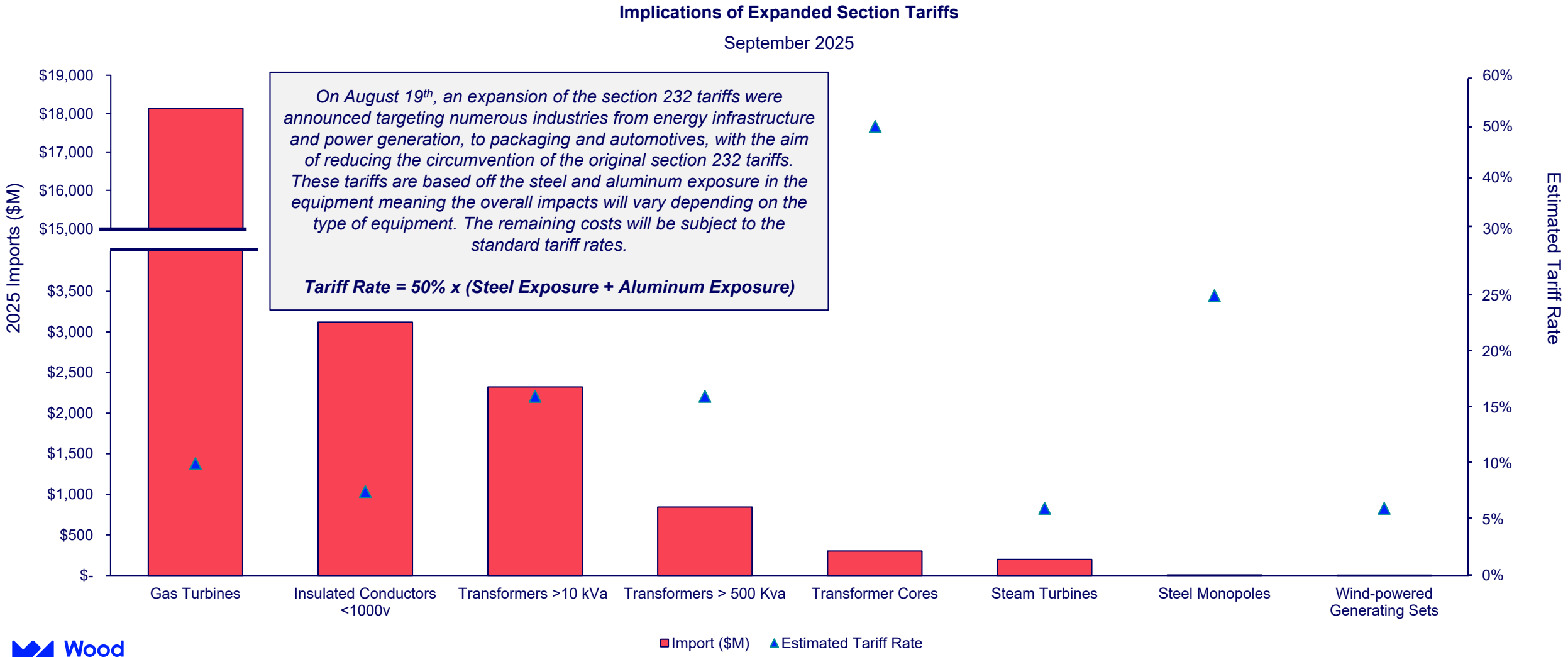
- Deterorating relations with key partners results in increased tariffs including 75% on Brazil and China, and 30% on EU.
- Baseline 10% tariffs remain as well as the commodity tariffs.



Source: Wood Mackenzie Supply Chain, US Trade Census

Section 232 Tariffs Expanded to Capture Energy Infrastructure

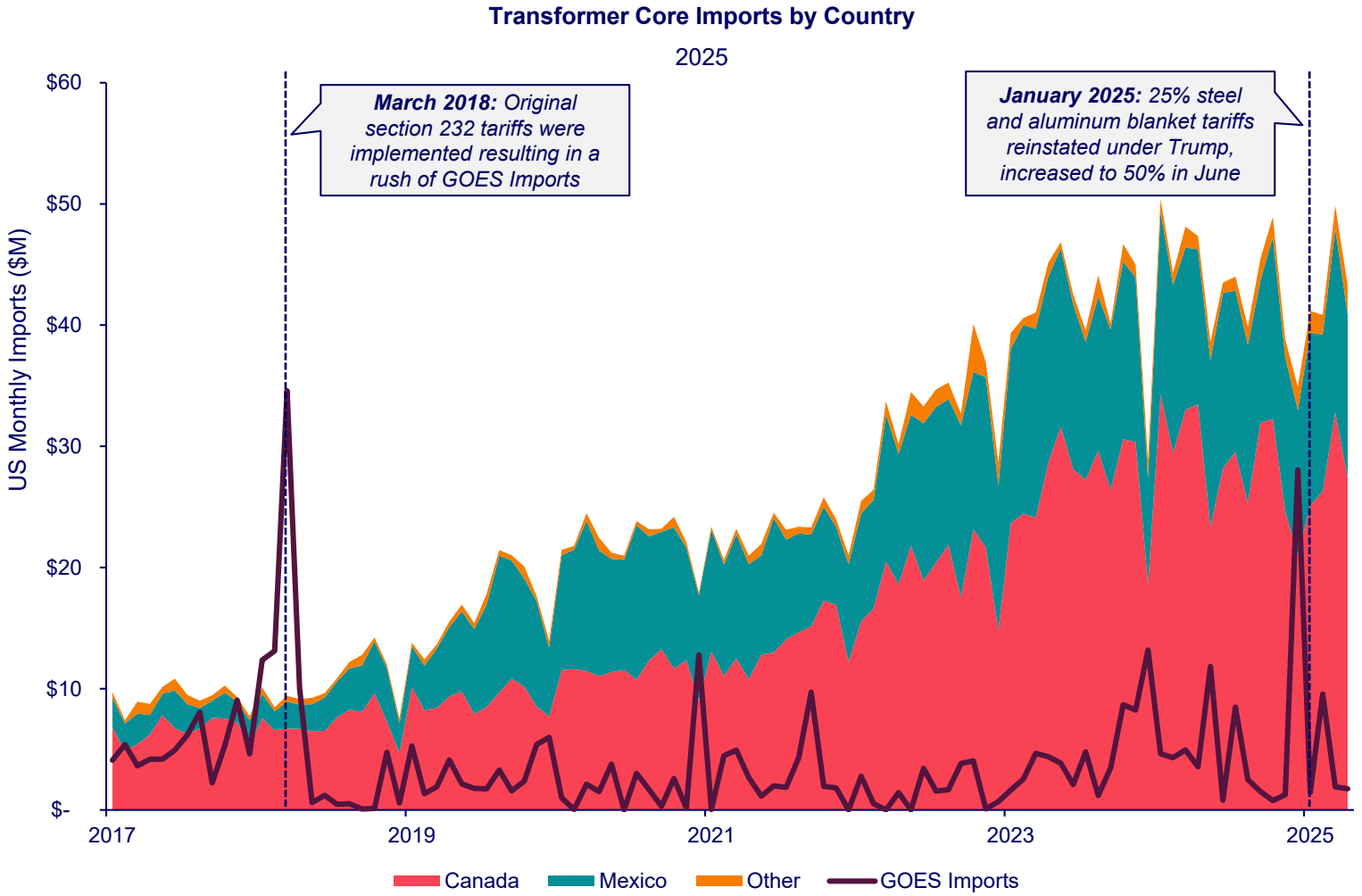
Section 232 tariffs now include upwards of 400 additional HS codes, further compounding tariff implications



Source: Wood Mackenzie Supply Chain, US Trade Census

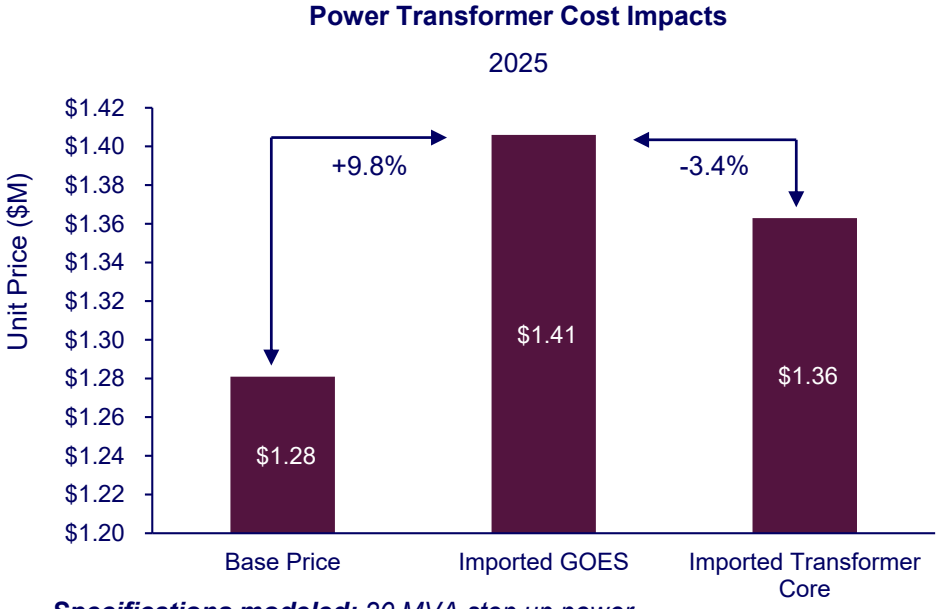
Tariff impacts on transformer costs can be mitigated by importing transformer cores

Imports of finished cores well exceed that of electrical steel due to section 232 tariffs



Commentary:

- *Since the implementation of the section 232 tariffs under Trump in 2018, GOES imports to the US have tumbled despite limited domestic supply as OEMs import the finished transformer cores from Mexico and Canada to avoid paying the 25% import duties.*
- *With the new 50% tariffs on steel imports, this trend is likely to be exacerbated further as transformer cores are exempt from the Canadian and Mexican tariffs under USMCA compliance.*
- *Cost impact of tariffs falls to just 2.4% (versus 5.9%) using imported transformer cores.*



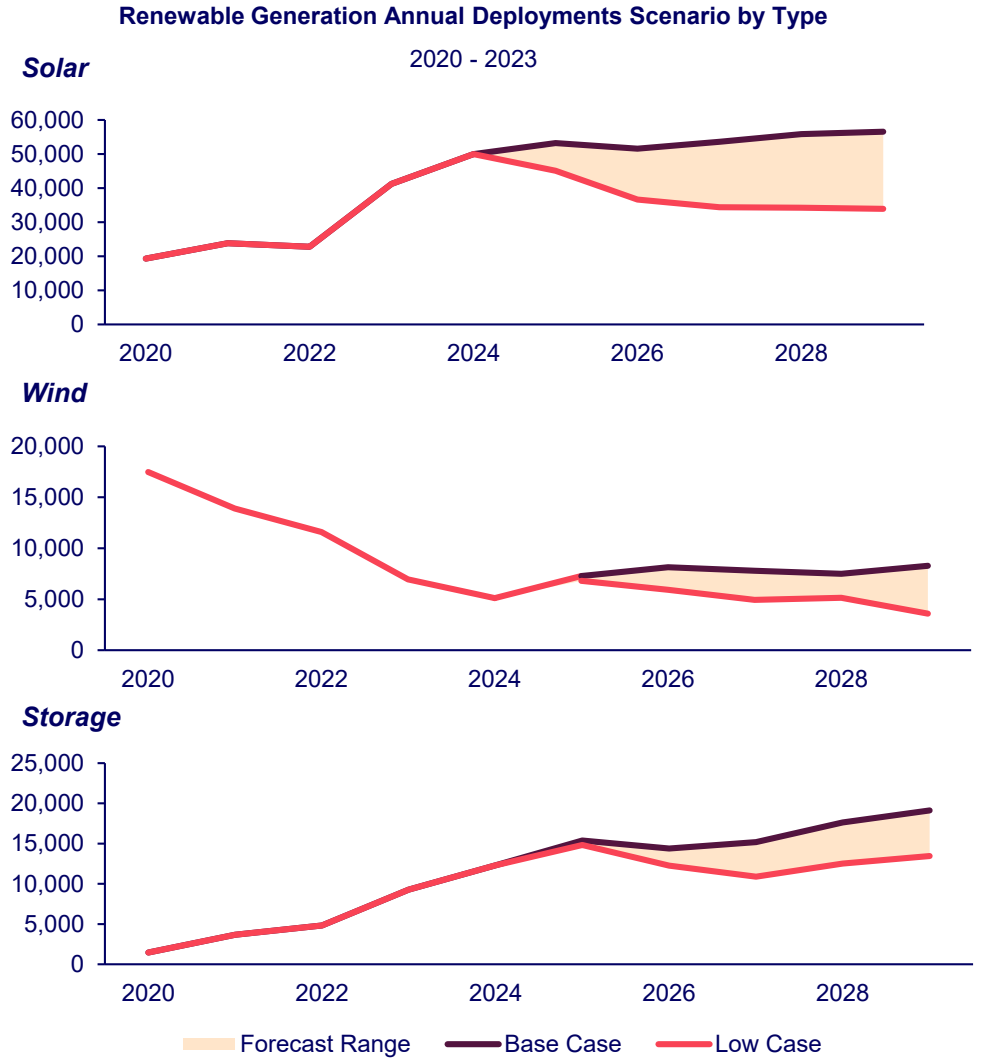
Specifications modeled: *20 MVA step up power transformer (Produced in the USA)*
Tariffs: *Current conditions as of August 8th including 50% on copper imports and 50% on India*

Source: Wood Mackenzie Supply Chain, US Trade Census

New budget reconciliation bill further clouds US renewable outlook

A phase out of IRA tax credits and a variety of other changes will reduce the long-term renewable outlook

Budget Bill Element	Implications for Renewable Energy
ITC/PTC phaseout	To be phased out by year end 2027; hinders solar, wind, storage growth. projects beginning construction within 12 months of enactment (by July 2026) remain eligible under prior rules
Section 25D elimination	Ends residential solar/storage credits by year end 2025; raises costs for homeowners, slows adoption in residential clean energy markets
Stricter FEOC restrictions	Addition of strict "foreign entity of concern" (FEOC) provisions to the ITC, PTC and manufacturing credits, restricting the use of Chinese equipment and underlying materials sourced from China
Wind component credit termination	Terminates manufacturing credits by year end 2027. Negatively impacts wind supply chain and project pipeline
EV tax credit elimination	Repeals EV purchase credits by 2025, resulting in a potential slowdown in EV adoption and related clean energy infrastructure
Hydrogen credit termination	Facilities starting construction after 2027 won't qualify. Threatens to derail US clean hydrogen ambitions with 95% of announced green hydrogen capacity is at risk
Nuclear credit phaseout	Expires 2031, Reducing investment incentives for nuclear power, although federal support continues
45Q carbon credit retention	CCUS remains largely unaffected, emerging as a relative winner in the proposal



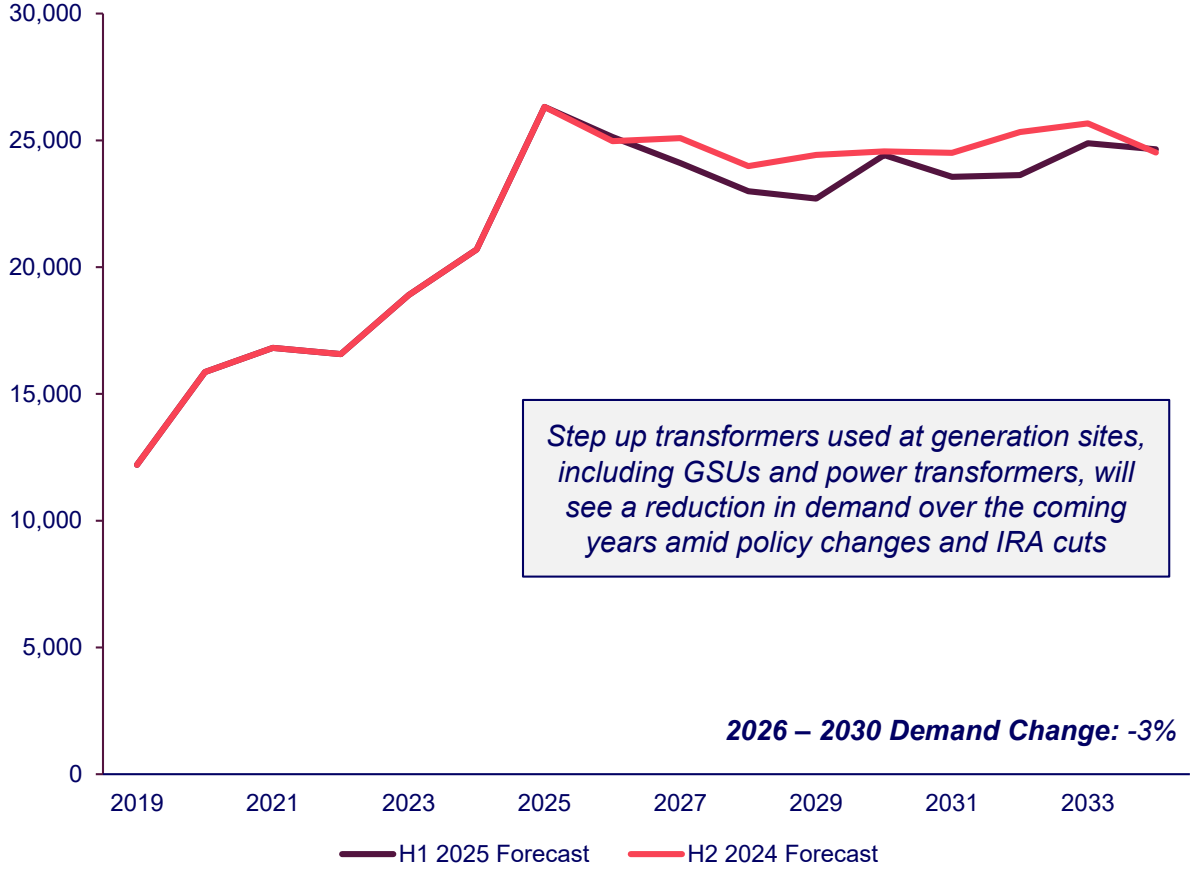
Source: Wood Mackenzie P&R Publication "A sledgehammer disguised as a scalpel"

Reduced policy support for renewables will push equipment demand lower

Despite the weakening outlook for renewables, demand will remain well above pre-pandemic levels

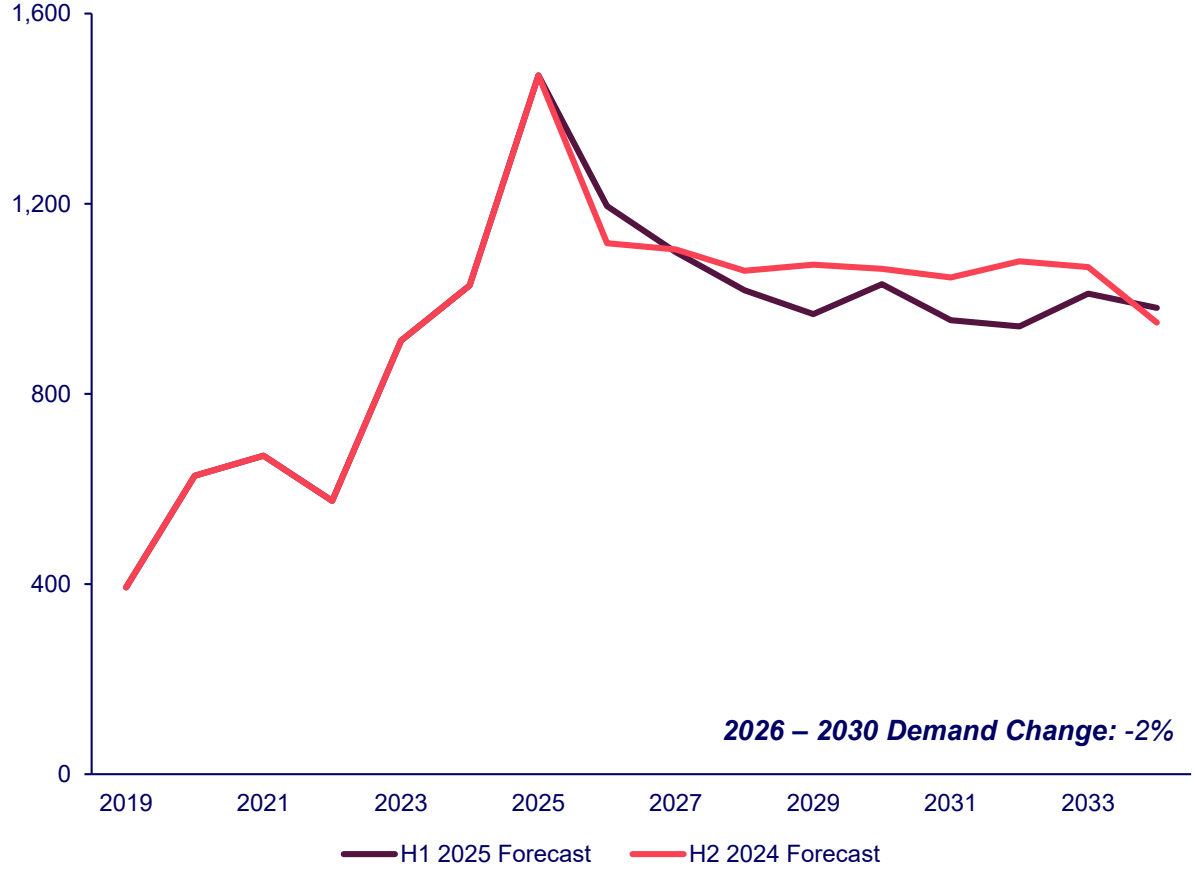
Power Transformer Demand

2019 - 2034



Generation Step-Up Transformer Demand

2019 - 2034



Source: Wood Mackenzie Supply Chain

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Market Reports

Quarterly Research

Commentary & analysis on the geopolitical & macroeconomic impacts on the Power & Renewables industry with an emphasis on supply chain risks & opportunities

Ad hoc Reports

On hot topics as they occur (e.g. tariffs)

Analysis Tools

Tariff Cost Impacts

Quantify the cost impact of any scenario for 10+ Power & Renewable asset types

Equipment Supply & Demand

For 10+ critical electrical equipment items in 35+ countries forecasted out to 2034

Data Dashboard

Industry Price Benchmarks

For hundreds of detailed specifications covering critical equipment & service items

Industry Lead Time Benchmarks

For 9 critical electrical equipment categories including transformers & circuit breakers

5-yr Forecasted Cost Trends

For critical equipment & service categories with granular input cost breakdowns

Dollar-based Time Series

For 8,000+ input costs across labor, metals, chemicals, manufacturing etc.

Location, Risk, & Diversity Data

For tens of thousands of equipment and service vendors across the world

Use it to:

Validate proposed pricing to uncover cost-saving opportunities in negotiations and obtain fair market rates

Improve project planning by identifying bottlenecks due to long lead times and expected supply constraints

Quantify your exposure to volatility in commodity & labor markets with monthly-updated forecast data

Understand the industry impacts of changing policy decisions and geopolitical tensions as they occur

Improve budgeting accuracy with cost-trend forecasts and expected cost increases due to tariffs

Qualify vendors' risk profiles and identify new vendors to de-risk and expand your source of supply

Identify forecasted electrical equipment supply imbalances and how OEM's are investing in new production capacity

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