Electric Transmission & Distribution Infrastructure

The Role of Electrical Components in the Global Electrical Grid

Q3 2023

Exploring the Power Equipment and Component Market

The North American and European Transmission & Distribution (T&D) industry supplies equipment, services, and systems to help meet the growing need for reliable and affordable energy. The backbone of the modern electrical grid, the T&D network is responsible for delivering electricity from power plants to homes and businesses. For the past several years, the industry has been driven by the need to make significant upgrades, replacements, and expansion to the existing infrastructure in order to increase reliability and capacity. As utilities look ahead to future needs, there will be an increased focus on improving grid resiliency, and support the rapid growth in electrification, the energy transition, and explosive growth in connectivity. To achieve these goals, billions of dollars are being spent annually on power equipment and components, and the industry is well positioned to benefit from future growth.

This report is intended to provide an overview of the U.S. and European market for power equipment and components, highlight the strong tailwinds underpinning the growth in the sector, and provide insight into the key considerations for investors who are exploring ways to play the space.

Introduction to Utility Infrastructure	▪ Overview of utility infrastructure and its role within the electrical grid
Key Growth Drivers	▪ Overview of key drivers supporting long-term demand to maintain and upgrade existing utility infrastructure
Key Components Within T&D Infrastructure	▪ Summary of the key elements that enable and compose the electrical grid
Investment Landscape and Considerations	▪ Current market landscape and product offerings ▪ Core investment themes across power equipment providers

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Electric Transmission & Distribution Overview

T&D Infrastructure and Electric Grid Overview

The term "electric grid" refers to a network of power plants, transmission lines, and distribution lines that provide power to billions of people across the world. Power plants, traditionally located in sparsely populated areas, generate electricity that is transmitted over long distances at high voltages through high-voltage transmission lines. Electricity is subsequently transferred to a distribution substation where power voltage can be modified and routed to end users via a vast network of distribution lines.

Sources of power generation and patterns of consumption are rapidly changing, creating a global need to upgrade and expand existing T&D networks. The integration of renewable energy, growth of energy-intensive sectors such as data centers, and electrification of vehicles are straining the grid and making it less reliable.

There are significant investments underway to increase the reliability and capacity of the grid. Power products manufacturers stand to benefit from strong secular tailwinds driven by a grid failing to keep up with increasing global energy demand, decentralization of power networks, and regulatory requirements to increase energy efficiency and security.

Key Facts & Figures

U.S. Electric Grid

- $155.2B — 2024P U.S. Grid Infrastructure Spend[1]
- 70+ Thousand — Total Wind Turbines[2]
- $73B — Approved for Power & Grid Investments Under the IIJA[3]
- 2+ Thousand — Photovoltaic Generating Facilities[4]
- 7,000+ — Total Power Plants[5]
- 54+ Thousand — EV Charging Stations[5]
- $8,851 — Average Cost per Minute of Data Center Power Outage[6]
- 4.6B+ — Total Kilowatt-Hours 2022 Energy Output[7]
- 63,000+ — Substations[5]
- 6.3M+ — Miles of Distribution Lines[5]

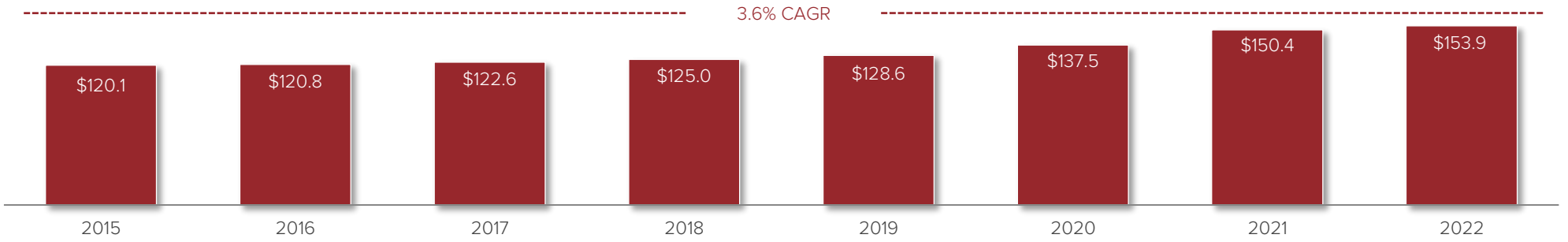
E.U. Electric Grid

- €34-39B — 2024P Grid Infrastructure Spend[8]
- 305,000+ — Kilometers of Distribution Lines[9]
- 2,800+ — Photovoltaic Generating Facilities[9]
- 250+ — Total GW Wind Turbine Capacity[9]
- 1,500+ — Total Power Plants[9]

Continued Spend in the Sector Is Driving Growth

Electricity network investment in North America and Europe[4]
($ in billions)

Grid infrastructure spending has remained resilient through economic cycles

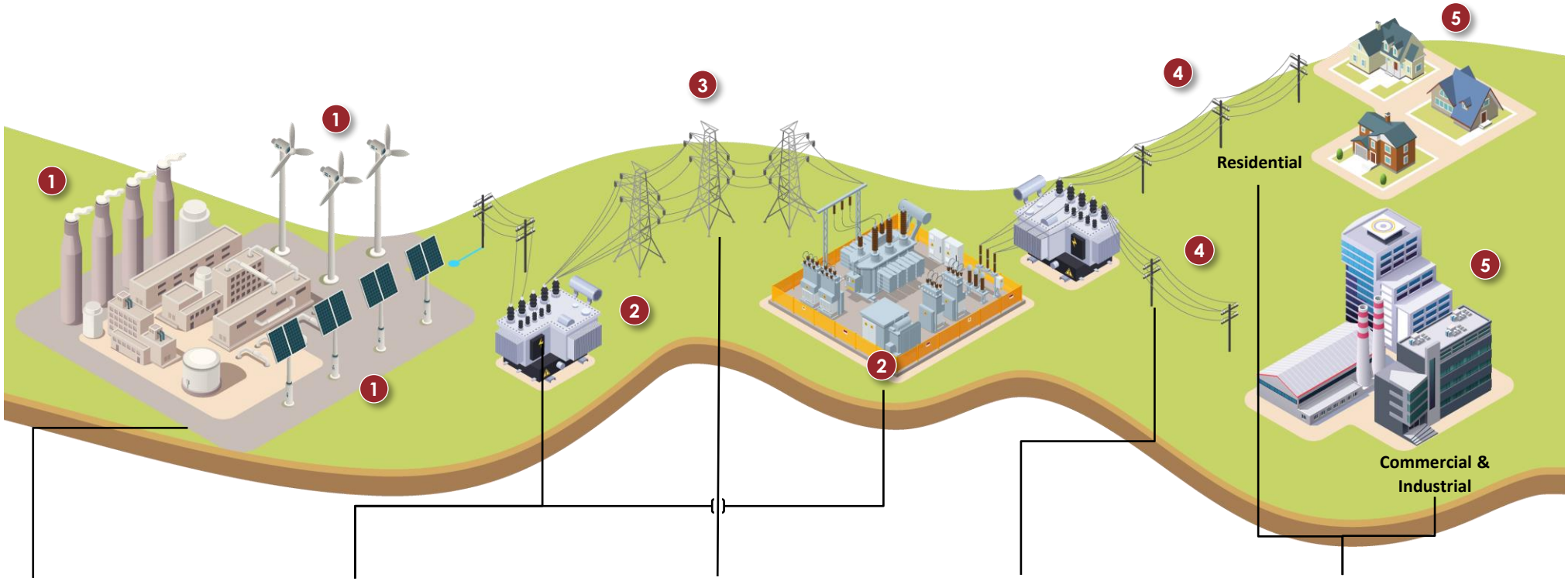


1. Edison Electric Institute; 2. USGS; 3. The White House; 4. EIA; 5. DoE; 6. Vertiv; 7. NERC 8. Eurelectric; 9. Statista

The Electric Grid

From Power Generation to End-User Consumption

The T&D infrastructure that carries electric power from generation to end user depends on millions of components that make up the electric grid. Power, generated from a variety of different sources, has its voltage stepped up by a transmission substation, where it is then transmitted over long distances on high-voltage wires. The transmission lines carry electricity to a distribution substation, where the voltage is stepped down and prepared for end-user consumption. The distribution infrastructure carries the electricity the "last mile" to the residential or commercial and industrial end user. All along the electric grid, a wide range of components play a critical role in delivering safe, reliable power.



1 Power Generation

Thermal, hydro-electric, nuclear, solar, and wind power generation facilities

2 Substation

Steps voltage up or down from generating sources to voltages appropriate for transmission over long distances

3 Transmission

Carries electricity to transmission substations for voltage conversion

4 Distribution

Steps down voltage prior to consumption to service commercial and residential power usage

5 End User

Electricity arrives to end users at their homes and businesses

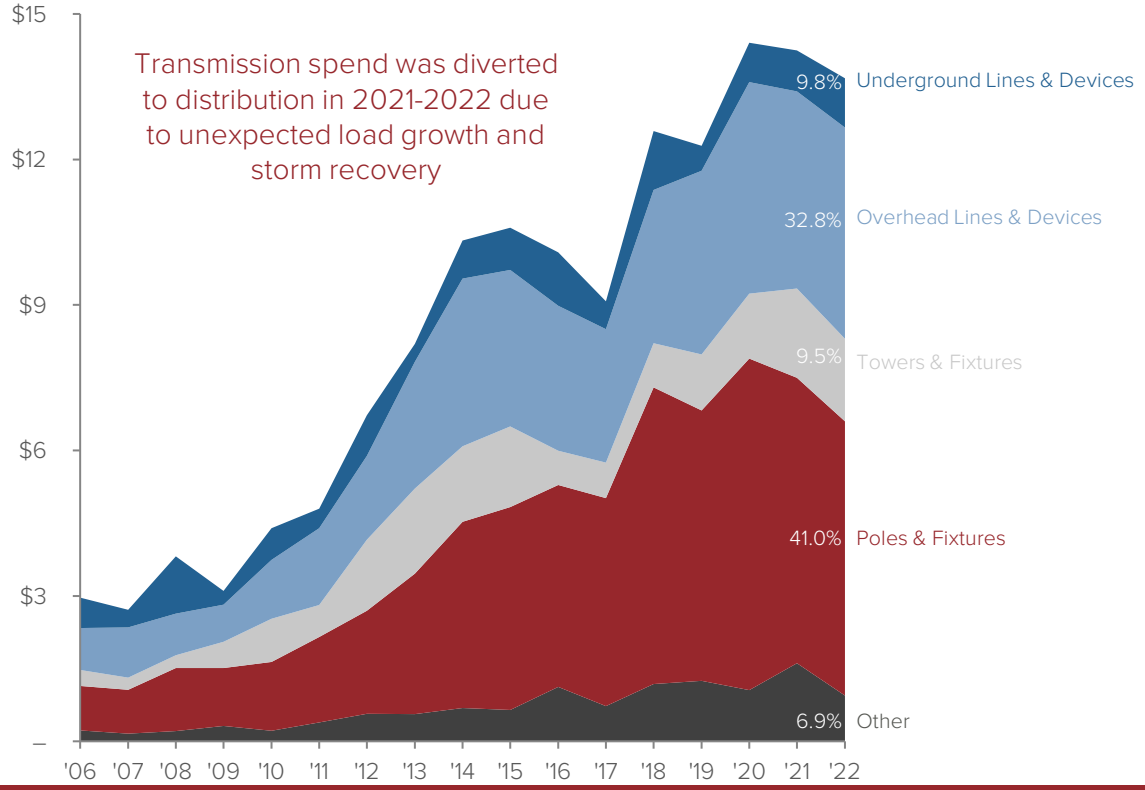
Electric Transmission Market and Capital Requirements

Traditionally, power generation resources are located outside the cities and areas they service, which is enabled by the electrical transmission infrastructure. High-voltage transmission systems carry electricity over long distances, from power generation to end user. Due to the age of infrastructure and the need for additional capacity, there are significant capital requirements. From 2021-2022, spend on transmission grew to 20% of total T&D infrastructure spend, with ~$30 billion spent on transmission in 2022. The electric transmission market is poised for another round of measurable growth driven by renewable energy capacity needs. The transition to clean energy and the U.S and Europe's net zero goals will be largely dependent on new and upgraded transmission lines.

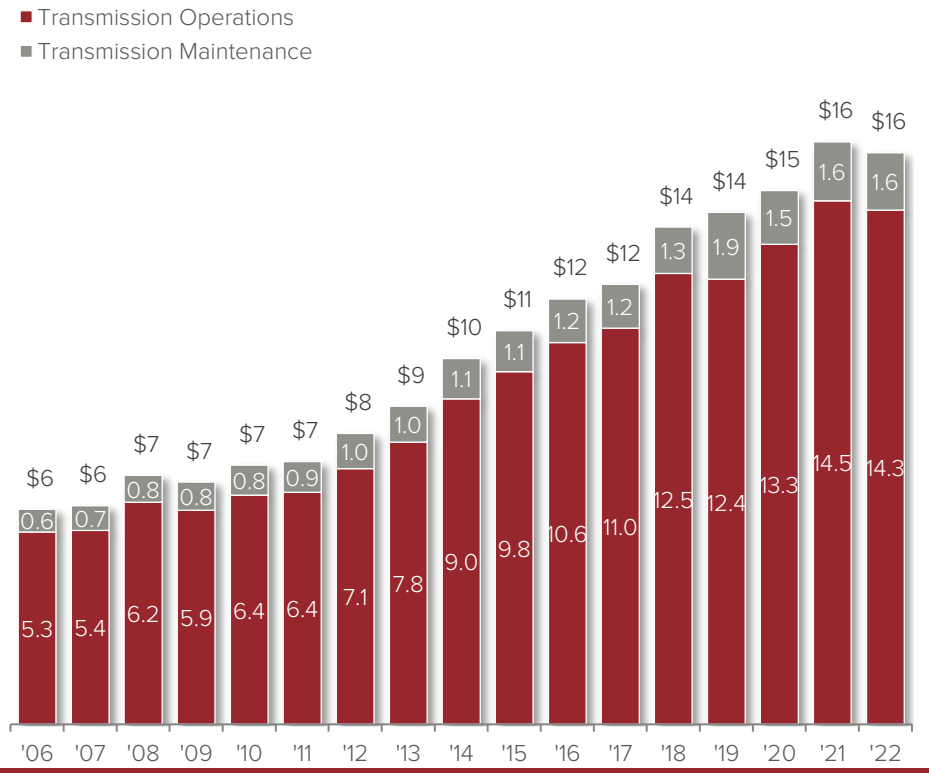
The energy mix in the U.S and Europe is rapidly changing, and with the increasingly complex electric transmission grid comes an increase in overall spend and the requirement for extensive investments in renewable energy. Utilities spend a notable amount on transmission infrastructure, especially as new technologies and advancements are rolled out. From 2022 to 2026, top investor-owned utility holding companies are forecasting spend of $152 billion for new or upgraded transmission assets. The U.S. Department of Energy (DOE) Electricity Office estimates that electricity transmission systems will need to expand by 60% by 2030 and may need to triple by 2050.

Stable, Through-Cycle Spending Across Both Capex and Maintenance Budgets for Electric Transmission Infrastructure

Major U.S. Utility Annual Electric Transmission Investment[1]
($ in billions)



Major U.S. Utility Annual Electric Transmission Operations & Maintenance Expenses[1]
($ in billions)



1. Federal Energy Regulatory Commission (FERC)

Electric Substation Market and Capital Requirements

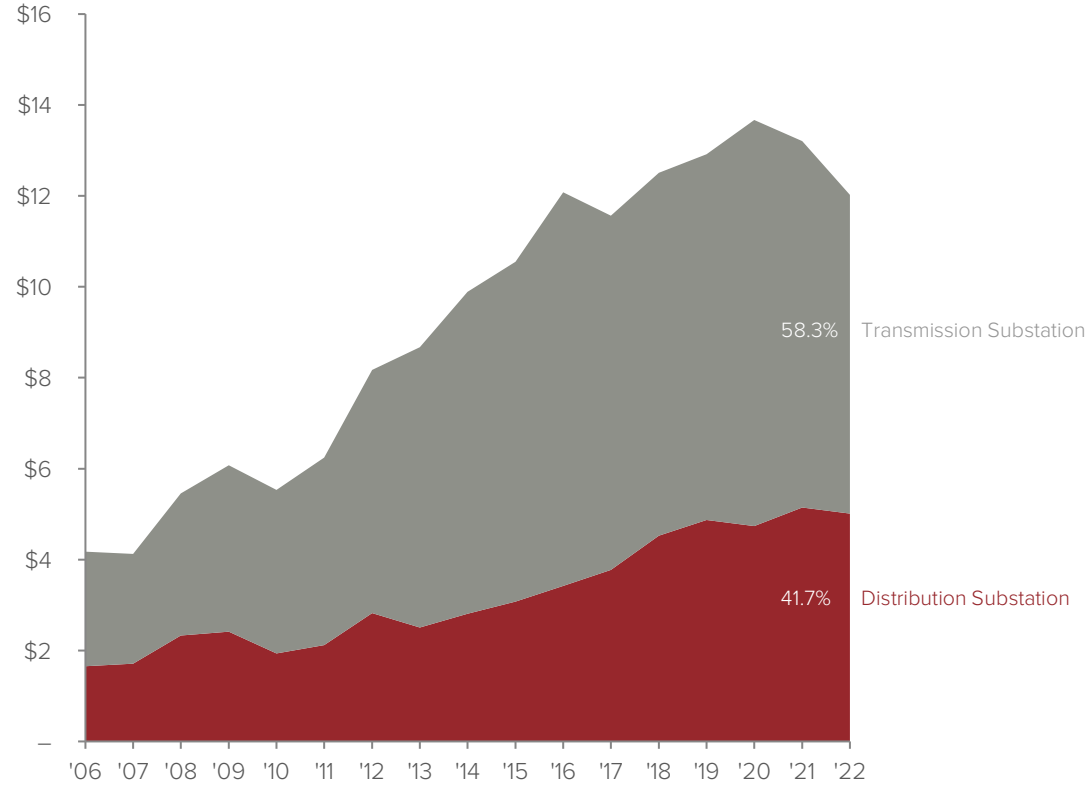
Substations serve as the central nervous system of the electrical grid, interlinking the key components of the transmission and distribution infrastructure. Transmission substations assume the role of connecting multiple transmission lines via high-voltage switches, enabling the connection or isolating the lines for maintenance, while distribution substations connect the transmission infrastructure to the distribution infrastructure by reducing the voltage through transformers.

Given the critical nature of substations within the grid, the U.S. and European governments have implemented legislation mandating reliability standards to prevent blackouts and to promote investment in the grid. Substation CapEx for large U.S. utilities has grown by over $3.8B in the past decade, while operations and maintenance costs have grown to over $1.5B per year.

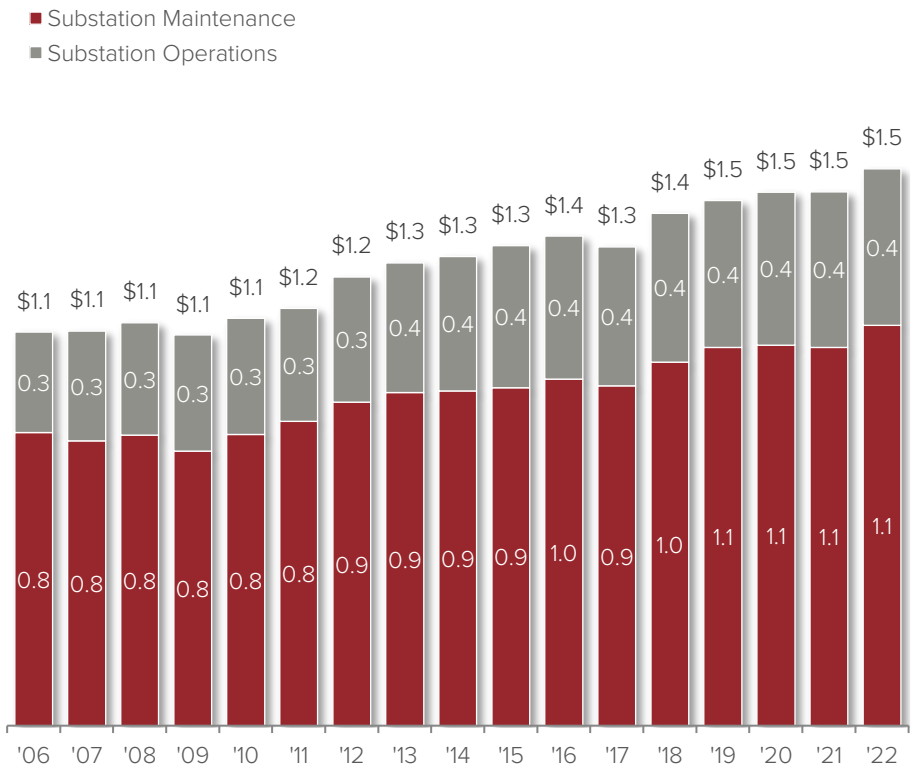
Substation investment is expected to continue to increase significantly as more renewable sources of power generation are brought online, and they are upgraded with advanced materials and technology in order to better withstand extreme weather events, and to allow for greater voltage control during emergencies.

Stable, Through-Cycle Spending Across Both Capex and Maintenance Budgets for Electric Substation Infrastructure

Major U.S. Utility Annual Electric Substation Investment[1]
($ in billions)



Major U.S. Utility Annual Electric Substation Operating & Maintenance Expenses[1]
($ in billions)



1. Federal Energy Regulatory Commission (FERC)

Electric Distribution Market and Capital Requirements

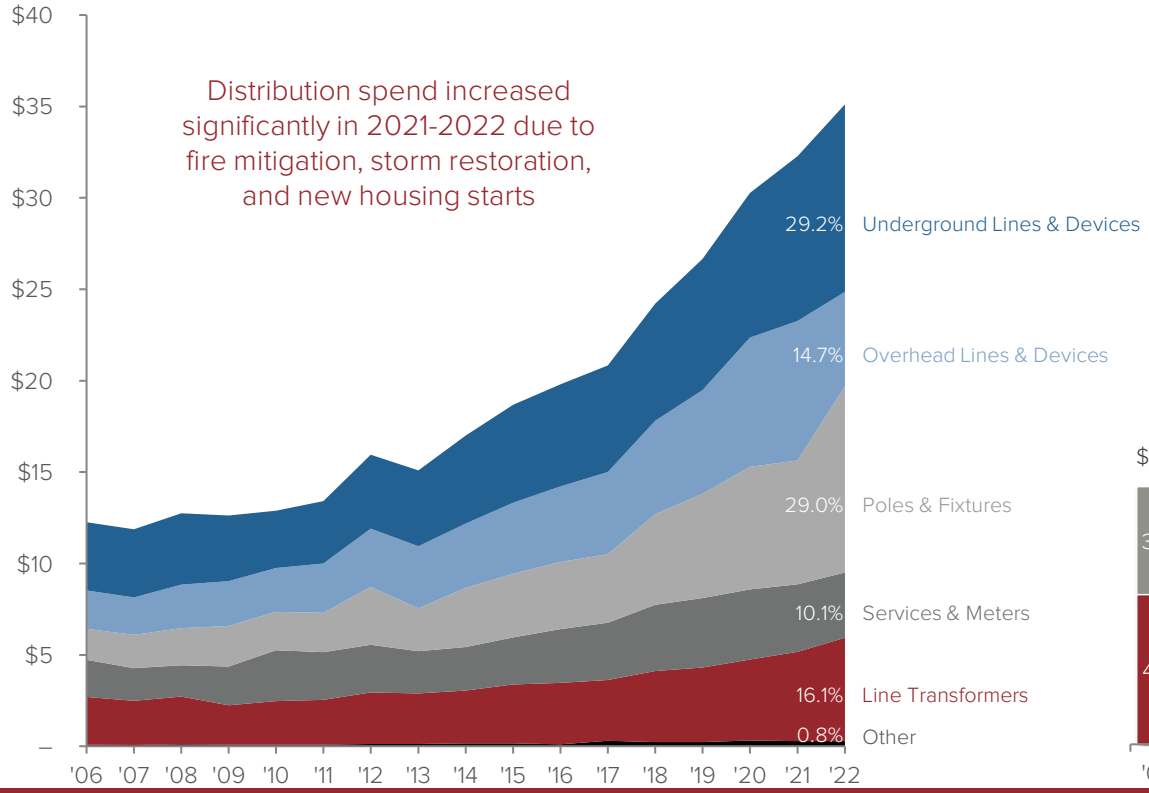
Electric distribution systems in the U.S. and Europe are responsible for carrying electricity directly to customers. Over the past two decades, spending on electrical distribution systems has risen 54%, from $31 billion to $51 billion per year. In 2022, North America's electric distribution spend made up 33% of total T&D infrastructure spend, with over $51 billion spent in 2022.

As utilities continue to invest in complex distribution system upgrades and enhancements, and demand for electric power grows, there has been a shift in focus toward resiliency and reliability. Electrical disturbances are increasingly caused by extreme weather events coupled with aging infrastructure. As a result, utilities have increased their spend on grid resiliency programs, leading to an increase in maintenance expenses. Power equipment manufacturers have developed new technologies and equipment better capable of withstanding extreme weather events than the legacy equipment, resulting in expanded capital requirements for replacement.

The increased capital expenditure on distribution is urging companies in the U.S. and Europe to spark the growth of new communication networks and database systems that will further develop electrical systems to advance toward creating a smarter grid.

Stable Spending Across the Electric Distribution Infrastructure

Major U.S. Utility Annual Electric Distribution Investment[1]
($ in billions)



Major U.S. Utility Annual Electric Distribution Operating & Maintenance Expenses[1]
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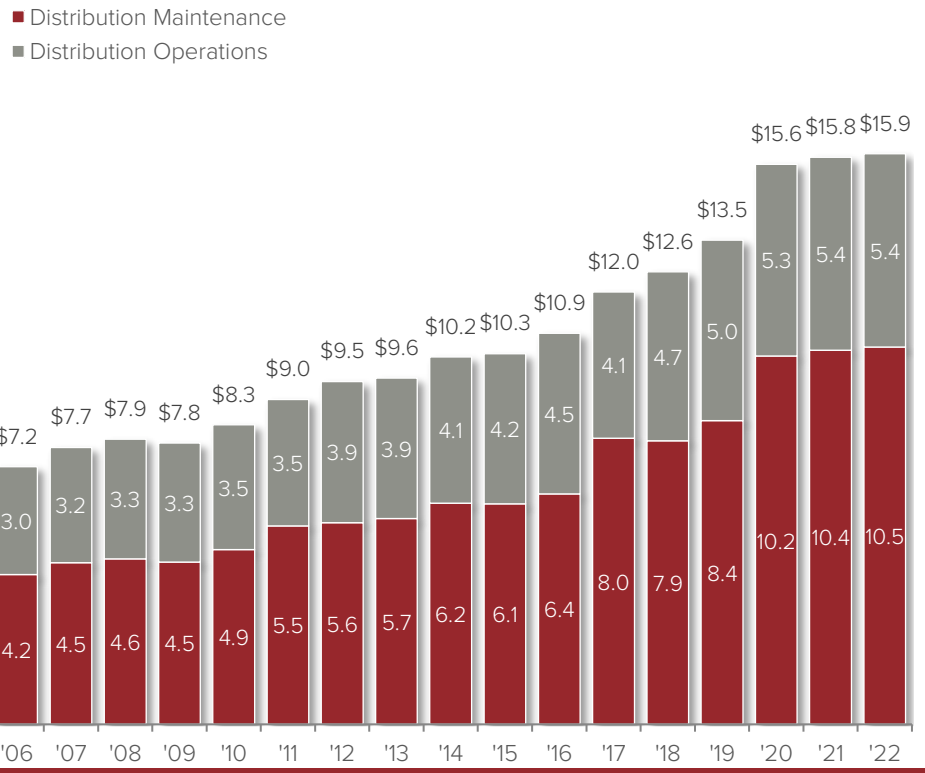


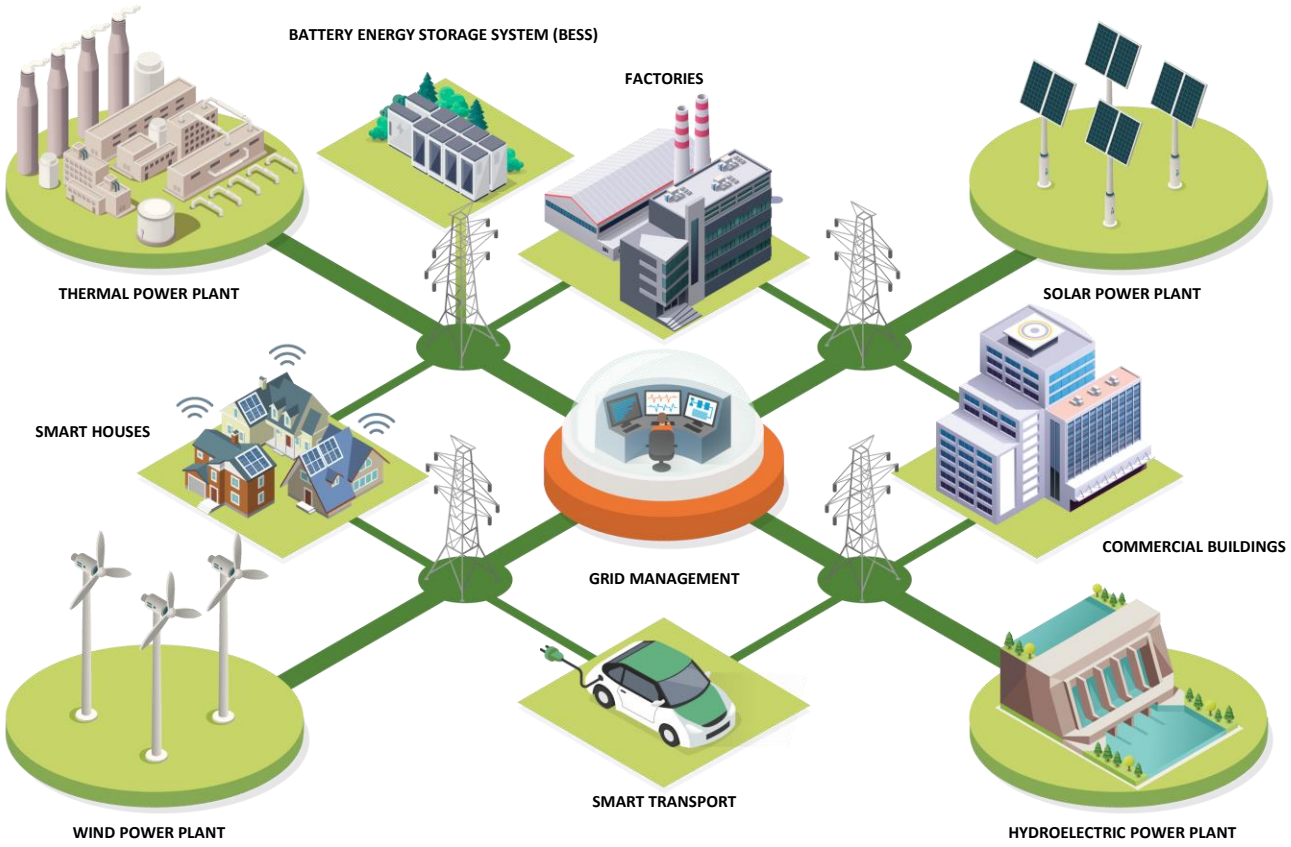
1. Federal Energy Regulatory Commission (FERC)

Increasingly Complex Grid

The Rise of Distributed Power Generation Has Complicated a Linearly Designed System

T&D infrastructure, originally designed to operate linearly from power generation to transmission to distribution to end consumer, is becoming increasingly complex as new power sources come online and the built environment becomes increasingly electrified. Distributed power generation, from small-scale residential renewables to centralized utility-scale solar and wind farms, have complicated the job of grid operators, as the grid requires infrastructure upgrades in order to bring these new power sources online. This transition is not limited to the United States, making the need for infrastructure upgrades a global priority. Once online, these power sources must be carefully monitored by grid operators as they balance the supply and demand of electricity. As the grid evolves and grid management becomes increasing complicated, the components, sensors, and tools that enable balancing the supply and demand of electricity are becoming increasingly important.

Distributed Power Network



Drivers of Increased Grid Complexity

Decentralization

As the grid becomes more decentralized, the boundaries between power generation, transmission, and distribution are blurring, and the need for interconnection infrastructure grows.

Bidirection Power

Distributed power generation is disrupting the traditional linear model and increasingly introducing bidirectional flows onto the grid.

Power Generation Variability

Integration of variable, imperfectly predictable power from renewable sources will require new ways to store energy and deploy power when needed.

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T&D Infrastructure Spend is Growing and Non-Cyclical

Drivers of Increased T&D Infrastructure Spend		U.S. Impact	Global Impact
1	**Aging Infrastructure**	Aging U.S. and E.U. transmission and distribution infrastructure is expected to undergo replacement and revitalization to mitigate failure rates and costly outages.		
2	**Grid Resiliency / Hardening**	Investment in grid resiliency and durability is urgently needed in the face of extreme weather, natural disasters, and decreased tolerance for outages.		
3	**Increasing Regulation / Public Funding**	Increasing focus on aging infrastructure, grid resiliency, and climate impact have inspired sweeping legislation expected to drive both near- and long-term spending.		
4	**Growth of Renewable Assets**	Intermittent energy sources such as wind and solar require investment in grid infrastructure to safely bring renewable generation sources online.		
5	**Smart Grid Technology Initiatives**	Digital technologies, sensors and software are being designed to better match the supply and demand of electricity in real time.		
6	**Electrification of Everything**	Energy-intensive sectors such as data centers and electric vehicles are increasing demand on grid capacity and resilience.		

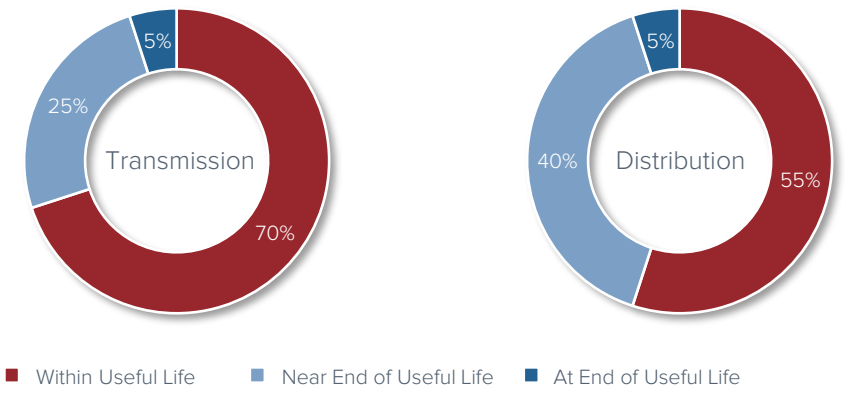
1 Aging Grid Infrastructure

Aging Global Grid Requires Transformative Renovation

A significant portion of the U.S. and E.U. power grid infrastructure is beyond its useful life or is rapidly becoming obsolete due to decades of underinvestment, changing patterns in the use of electrical power, and a greater reliance on renewable energy sources. Coupled with a heightened degree of safety and regulatory requirements, utilities are facing increased pressure to invest in infrastructure upgrades, overhaul existing infrastructure, and perform ongoing maintenance in order to prevent large-scale electrical disturbances.

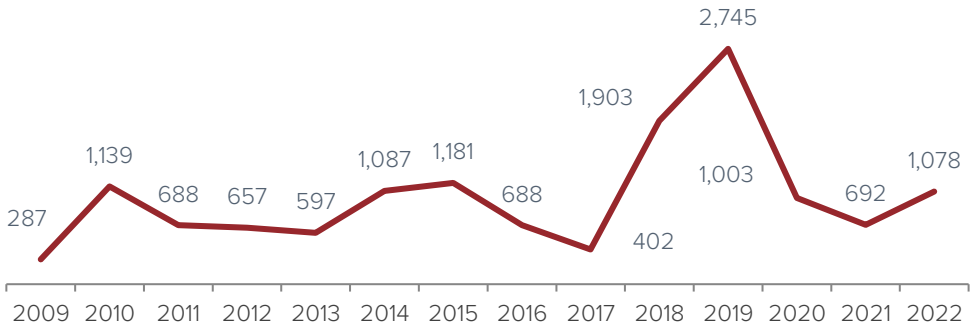
Aging U.S. T&D Infrastructure Base

Existing T&D Infrastructure Age[1]
(% of Total Existing Infrastructure)



U.S. Electrical Disturbance Losses

Average Electrical Disturbance Losses[2]
(MW)

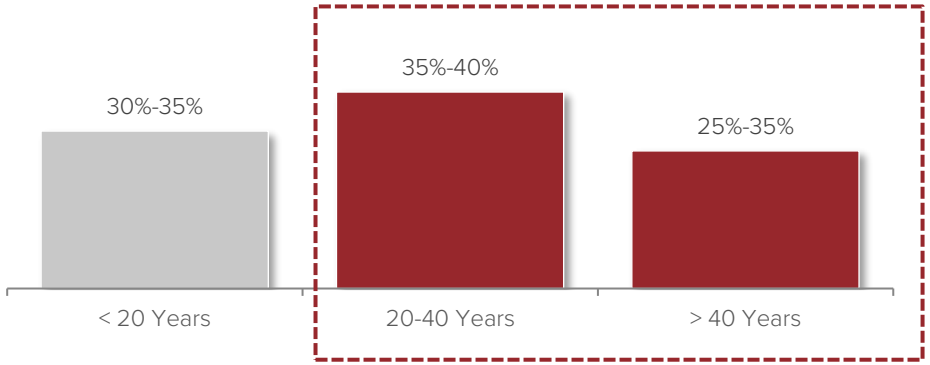


Aging EU T&D Infrastructure Base

The European grid infrastructure is facing similar infrastructure shortfalls to those in the United States. In particular, Europe's distribution grid is at risk of becoming obsolete. As of 2020, 25%-35% of Europe's distribution infrastructure is over 40 years old, and that number is likely to increase to 40%-55% if assets are not replaced at the end of their useful life[3].

These dynamics underscore the pressure that aging infrastructure puts on a grid and the associated need for transformative investment in the E.U. as well as in the U.S.

Average Age of Low-Voltage Power Lines in 2020[3]
(% of power lines)



1. EY Parthenon; 2. U.S. DOE; 3. Monitor Deloitte

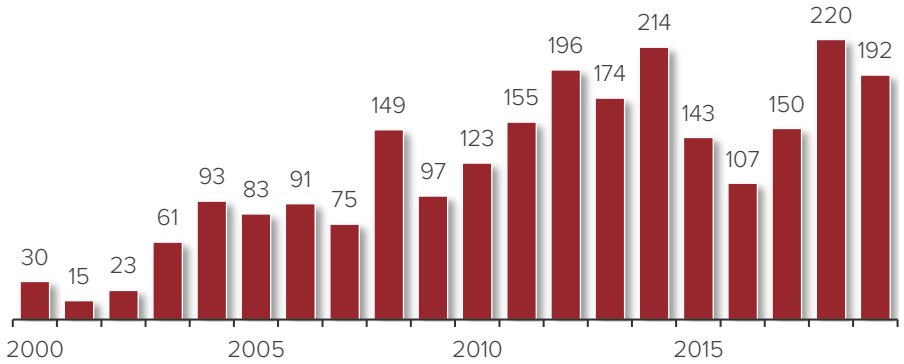
2 Grid Resiliency / Hardening

Rising Costs and Risks Drive International Focus on Grid Resilience

Utilities and corporations across the U.S. and E.U. are investing heavily in resources to harden and modernize the electric grid in an effort to combat costly outages and equipment downtime. Increased levels of storms and natural disasters require a much higher level of grid resiliency to ensure power is safely delivered from source to consumer. The costs of electrical systems outages / failures are extremely high for commercial and industrial customers, especially those critically dependent on electrical power. In the U.S. alone, power outages are estimated to cost businesses over $150B a year[2].

U.S. Power Outages

Annual Power Outages[3]



Regulator-Approved Grid Resiliency Programs[4]

Storm Hardening

Focus is on hardening networks to withstand increasing frequency and severity of storms, including wind and floods

Fire Mitigation

Focus is on preventing utility-owned-equipment-caused fires

Grid Modernization / Transformation

Focus is on replacing aging equipment with hardening a secondary objective

U.S. Utility[1]	Capital Spending Plans
exelon	Exelon increased their four-year capital spending plan to $31.3B starting in 2023
DUKE ENERGY	Duke expects to spend $65B from 2023 – 2027 on capital projects
Southern Company	Southern Company is expected to reach nearly $40.5B of capital spend by 2027
PG&E	PG&E plans to spend $52B on capital projects through 2027 and another $67B from 2028 – 2032
NEXTera ENERGY	NextEra will maintain an average of over $20B in annual capital spend through 2024
AMERICAN ELECTRIC POWER	AEP plans to invest $38B in capital from 2022 through 2026, with an emphasis on T&D and renewable energy
DTE	DTE Electric plans to spend $13B by 2027 specifically on base and distribution infrastructure
EDISON INTERNATIONAL	Edison has outlined a capital spending plan of $38B to $43B for 2023 through 2028
Dominion Energy	Dominion is progressing through their 15-year $72B capital spend plan implemented in 2020
conEdison	Con Ed expects to reach nearly $15B in capital spend from 2023 to 2025

1. Utilities ranked by annual revenue; 2. U.S. Department of Energy; 3. U.S. Energy Information Administration Note: includes power outages impacting at least 50% customers or causing unplanned firm load loss of at least 300MW 4. Proprietary Source

3 Increased Regulation and Public Funding

The U.S. Has Passed Billions in Federal Spending Supporting Energy Infrastructure and the Shift to Renewable Energy

IIJA

- The IIJA, passed in 2021, represents a historic investment in the nation's core infrastructure systems.
  - The IIJA authorizes $1.2T in spending, with approximately $550B allocated to new programs and investments and $79B earmarked for power and grid spending.
  - Power and grid spending will be allocated to grid reliability and resiliency; critical minerals and supply chains for clean energy technology, including carbon capture, direct air capture, hydrogen, and energy efficiency.
  - To date, over $220B has funded 32,000 projects and awards across all 50 states, D.C., and U.S. territories.[1]

IRA

- The IRA, passed in 2022, represents the largest investment to address climate change in U.S. history.
  - In total, the IRA will raise $738B, allocating roughly $391B in spending to address a variety of clean energy and climate change initiatives.
  - It is estimated that 70% of the grid's transmission lines are over 25 years old and, to accommodate these new initiatives, the IRA includes a historic investment in new and updated transmission lines.[1]
  - The IRA also invests nearly $3B in the U.S. transmission system to help overcome the financial and permitting challenges that could hinder investments in new high-capacity lines.[1]

Government Plans Around the World Will Have a Strong Positive Impact on T&D Investments Through the Foreseeable Future

Country	Planned Annual Investment		Type	Time Frame
	Power & Grid Investment	T&D Related Investment		
Germany	N/A	$7.0B	Gov-agreed plan from private cos.	2022-35
France	N/A	$7.8B	Direct from state-owned entities	2019-32
UK	$16B	$6.6B	Private sector investment	2023-30
Italy	N/A	$2.2B	Direct from part-state-owned entity	2021-25
Spain	N/A	$1.3B	Direct from part-state-owned entity	2021-26

Country	Planned Annual Investment		Type	Time Frame
	Power & Grid Investment	T&D Related Investment		
China	$88B	N/A	Direct from state-owned entity	2021-2025
Saudi Arabia	$5B	$4B	Direct from state-owned entity	2023
Brazil	N/A	$9.5B	Direct investment from the state	2023-24
India	$16B	$6.6B	Private sector investment	2023-30
Oman	N/A	$1.6B	Direct from state-owned entities	2022-2026

1. EY Parthenon

4 Growth of Renewable Assets

Energy Transition Depends on Grid Upgrades and Expansion

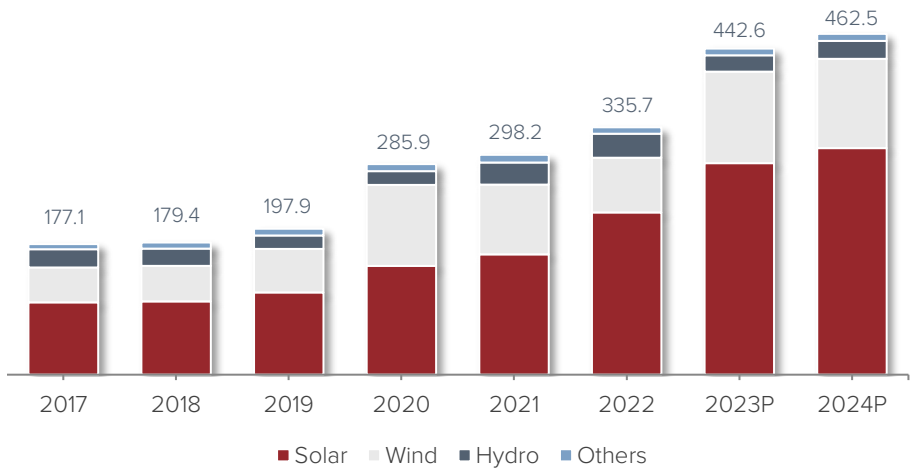
Growing demand for clean energy has led to a wave of new renewable asset projects across the U.S. and E.U. As renewable generation assets come online, utilities will need to invest in T&D infrastructure to link these assets to the grid and to accommodate a more dynamic, intermittent generation fleet.

In the US alone, there were over 5,000 projects waiting to be connected to the power grid as of the end of 2020[1]. As renewable energy generation and distributed energy infrastructure is built out, utilities must invest in new power lines, transformers, substations, and other critical components to reconfigure the power grid and to connect these new sources of power generation.

The share of electricity generation from renewable sources in the United States is projected to increase from 21% in 2021 to 44% in 2050[2]. In Europe, renewable energy is projected to grow in line with other sources and compose 34% of supply by 2028[3].

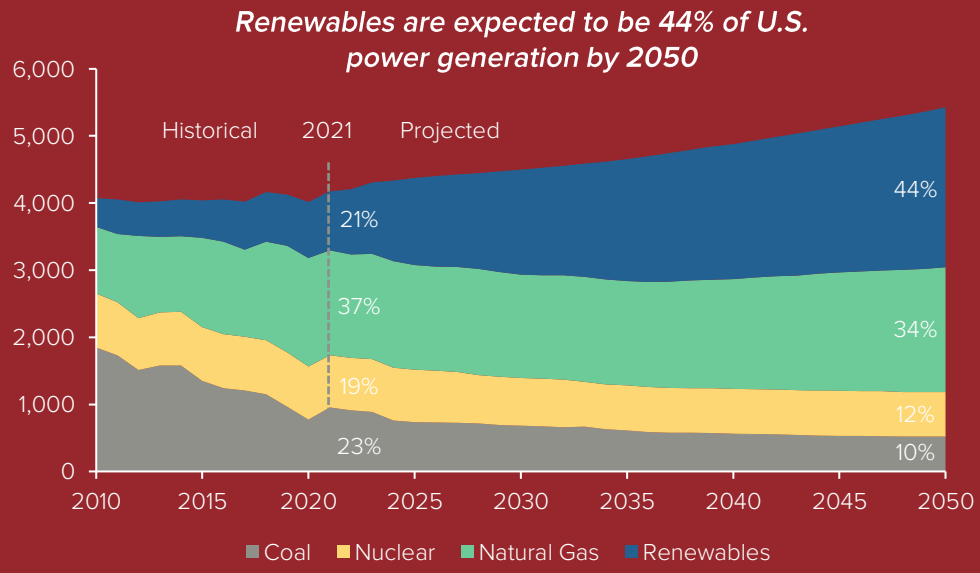
Renewable Energy Additions Continue to Accelerate Globally

Global Net Renewable Electricity Capacity Additions
(GW)



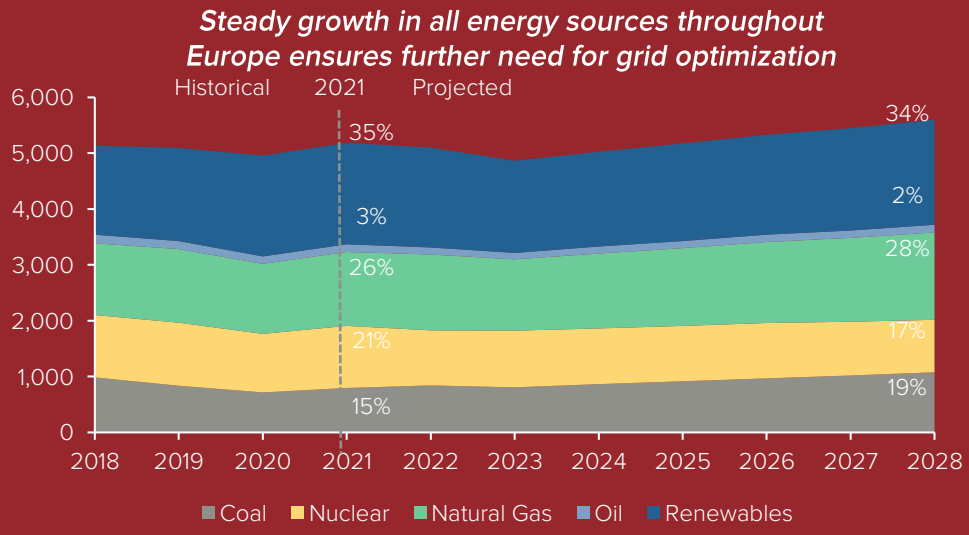
U.S. Electricity Generation by Source[2]

(Billion kW Hours)



Europe Electricity Generation by Source[3]

(Billion kW Hours)



1. McKinsey; 2. U.S. EIA; 3. Statista

5 Smart Grid Technology Initiatives

Impacts of Digital and Advanced Technologies on Grid Infrastructure

The term "smart grid" encompasses technologies that allow for two-way communication between the utility and its customers. Two-way communication gives both parties the ability to more closely monitor and control the flow and usage of electricity. This technology allows utilities to manage the grid more efficiently, leading to more reliable power delivery. The data gathered through smart grid technologies enables real-time monitoring of supply and demand conditions, making it possible to predict failures and carry out preventative maintenance to avoid a failure.

These new technologies require upgrades and enhancements to existing infrastructure, driving investment in transmission lines, transformers, substations, and control centers. Additional investments are required to incorporate new components such as smart meters, smart sensors, smart load control switches, and smart distribution boards.

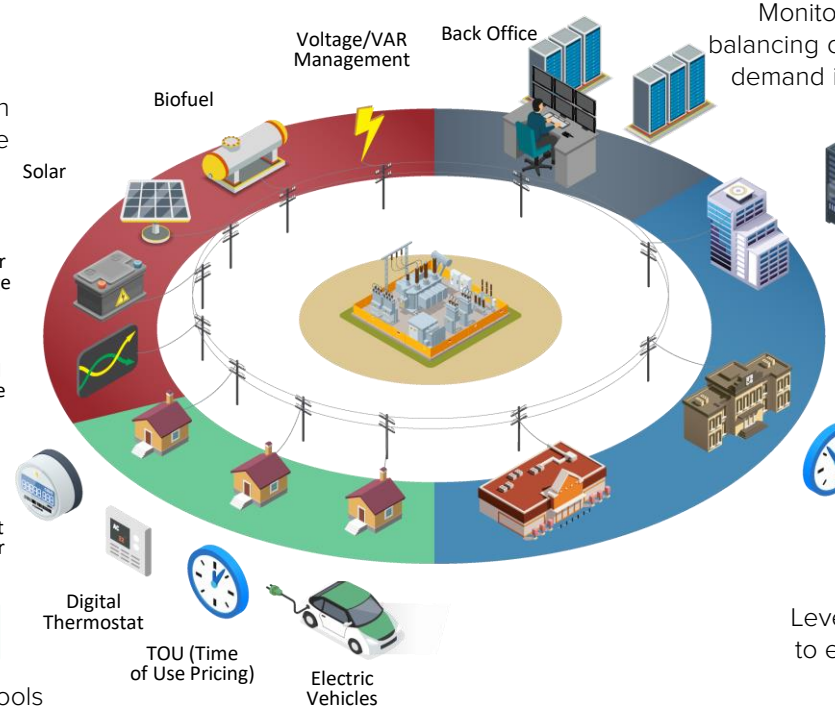
Smart Grid Technology

Smart Generation

Integration of modern power plants that use renewable sources

Grid Management

Monitoring and balancing of supply and demand in real time



Smart Building

Leveraging of technology to enable efficient use of resources

Smart End Use

Adoption of digital tools to monitor and manage power consumption

Smart Grid Infrastructure

Type	Description
Advanced Metering Infrastructure ("AMI")	▪ These meters, often referred to as smart meters, operate digitally in place of mechanical meters, allowing for automated transfers of information between the home and energy provider, and facilitating two-way energy metering
Smart Appliances	▪ When integrated into an energy management system, utilities are able to send signals to smart appliances to reduce energy consumption during peak hours, flatting the energy consumption curve (i.e., "duck" curve)
Electric Vehicles	▪ Increasing electric vehicle adoption will compel utilities to invest in smarter distribution infrastructure to support the increased voltage offtake

6 Electrification of Everything

Factors Supporting Electricity Demand Growth

EVs and EV Infrastructure

Electric Vehicles

- Transportation electrification and efforts to transition away from fossil fuels are expected to have an enormous impact on electric demand
- EVs may drive significant changes in peak demand and may require power generation capacity increases, new renewable-enabling transmission lines, and increased energy storage

EV Chargers

- In addition to the increasing role of electric vehicles, the growth of home and public charging stations will drive additional T&D infrastructure investments
- As the percentage of EVs on the road increases, clustering will occur (multiple cars per home, neighborhoods, etc.) and could require upgrades to the distribution infrastructure

Transition Away from Fossil Fuels

Appliances

- State initiatives in New York and California have begun to limit the use of gas appliances in new home construction, following similar guidelines to those in Europe
- In the U.S., the residential tax benefits in the IRA also offer incentives for homeowners to switch to electric heat pumps or electric stoves

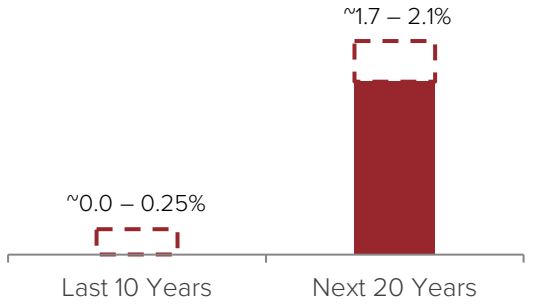
Other Potential Influencers

Data Centers

- Over 250 co-location and hyperscale data centers are currently under construction or in development in North America[2]
- The rise of smartphones and other smart devices, along with the buildout of 5G networks, compounds the need for additional data center buildout to support increased demand for data and connectivity

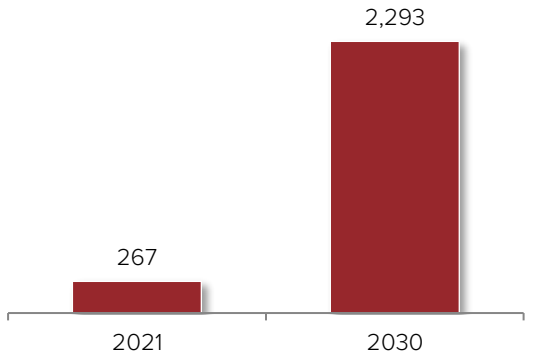
U.S. Electricity Consumption Growth Rate

Electricity consumption in the U.S. is expected to grow over the next few decades[1]



Projected EV Charger Installation Growth

Expected 27% CAGR growth in the number of EV chargers installed outside the home in the U.S.[3]



1. Joint Center for Housing Studies, EY Parthenon 2. EY Parthenon 3. McKinsey Industry Report

Power Equipment and Component Industry Impacts

Industry Impacts Have Driven Recent Growth

Evolving constraints on the electrical grid from both utility and C&I customers, coupled with recent supply chain disruptions dramatically reducing the inventory of readily available components, have led to a step change in growth in the industry. As increased demand is driving shortages and longer lead times across the industry, long-term industry demand drivers are already facing outsized impact.

Manufacturing Capacity Constraints	▪ Demand far exceeds current production capacity for components and equipment critical to maintaining and building out the grid across both C&I and utility customers ▪ The problem is exacerbated by the difficulty and time it takes to bring additional capacity online given corresponding labor requirements
Increasing Pricing	▪ With elevated demand, manufacturers across the sector have implemented pricing initiatives to reflect the value delivered to their customers, as well as increasing input costs
Growing Volume	▪ Demand for power equipment increases as capacity is added to the grid, aging infrastructure is replaced, and new renewable technology is introduced
Margin Improvement	▪ With increasing pricing power, volume, and economies of scale, equipment providers can continue to drive margin expansion
Uptick in M&A Activity	▪ Favorable tailwinds enhance appetite for investment activity in the sector from strategic and financial acquirers alike

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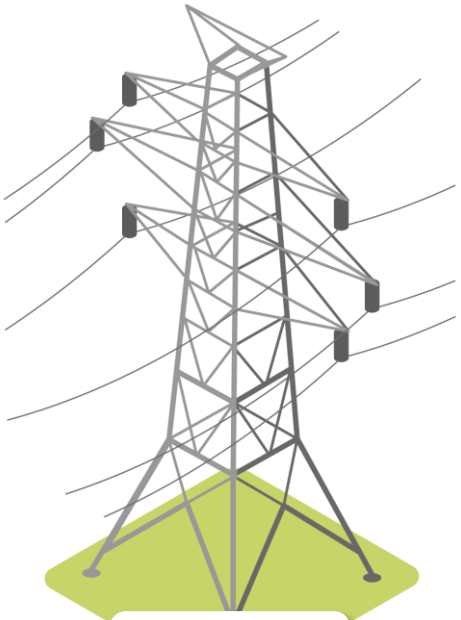
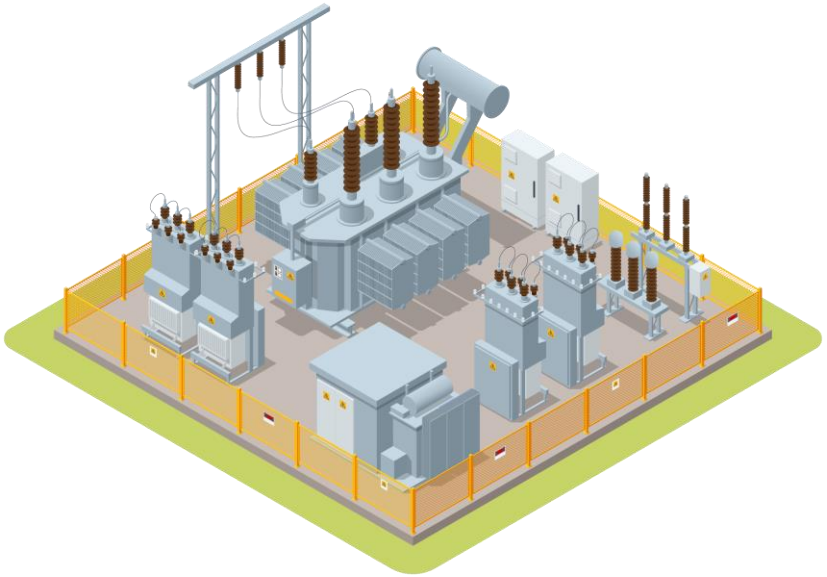
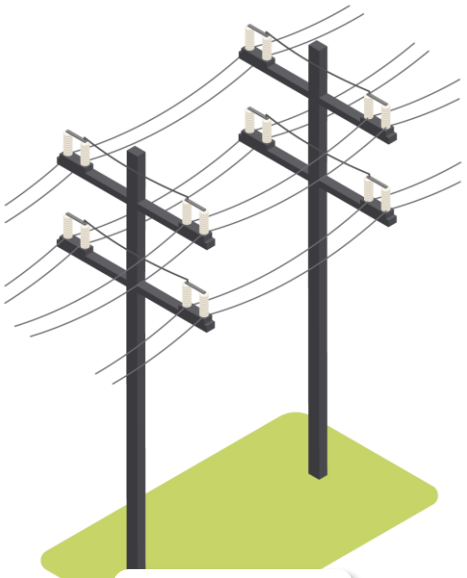
Key Components Categories Within Utility Infrastructure

Millions of products and components work together to make up the modern electrical grid



69 – 765 kV





2.4 – 33 kV

Transmission

Transmission products play a critical role within the electrical grid by facilitating the efficient and reliable transfer of electricity over long distances. Transmission lines are interconnected sets of conductors (wire), supported by a series of associated equipment including poles, transformers, connectors insulators, etc.

These products, including transmission lines, transformers, and associated equipment, enable the transmission of high-voltage power from generation sources to distribution networks.

Substation

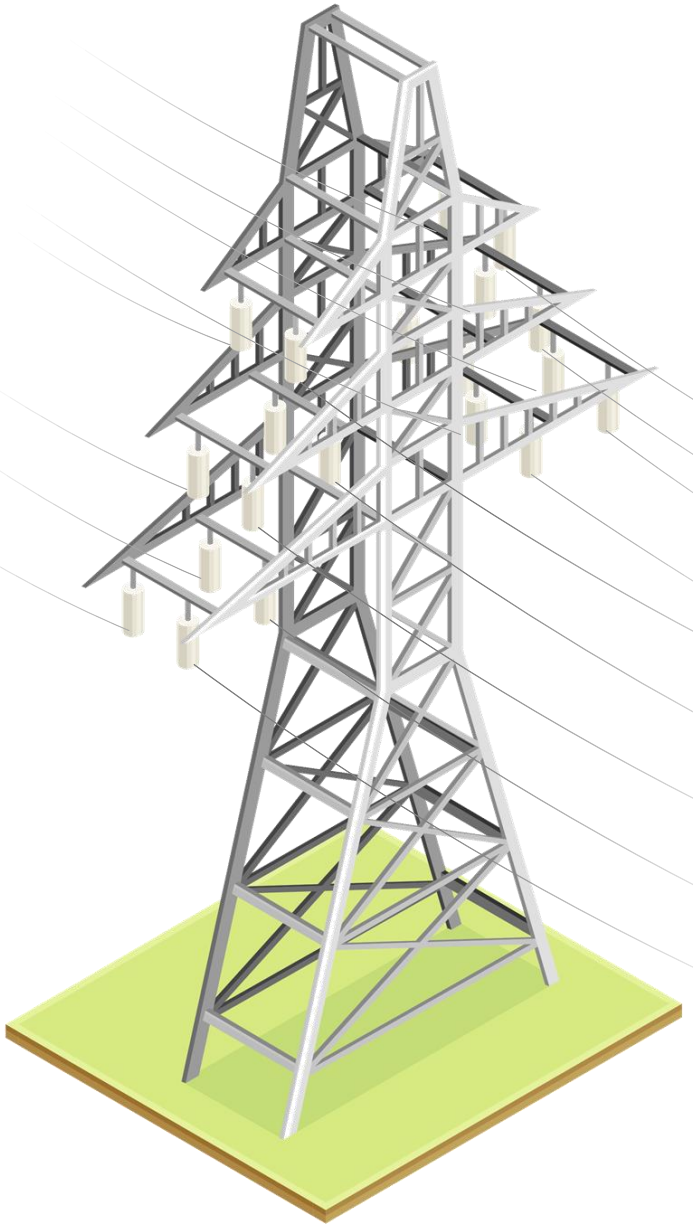
Substation products support the stepping up and stepping down of voltages within the electrical grid by being the intermediate connection point between the transmission and distribution infrastructure. These products combine to become the brain of the electric grid and encompass transformers, circuit breakers, switchgear, and control systems that ensure a safe and reliable energy source.

Distribution

The distribution grid is final phase of the electrical grid, which distributes energy from the substation to end consumers. Distribution products further reduce voltages to safe, customer-useable levels. The distribution grid is made up of lines, poles, transformers, and switching and protection units that ensure safe electrical power for customers.

TRANSMISSION

Transmission Components are Designed to Carry Electricity Over Long Distances Through High Voltage Transmission



Poles / Structures

Transmission poles / structures are engineered structures designed to elevate and support high-voltage transmission lines. They provide the necessary support and clearances for high-voltage wires to prevent anyone or anything getting close enough to interfere with electricity transfer.

Long Rod Insulators

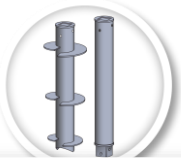
Long rod insulators support high-voltage transmission lines on steel towers, isolating the power lines from the tower. They are often made of porcelain materials and are designed to withstand mechanical and environmental stressors such as thermal resistance and pollution.

High-Voltage Wires

High-voltage wires act as a conduit for the efficient and long-distance transmission of electricity through elevated power levels. By effectively carrying large amount of electricity over significant distances, high-voltage wires facilitate the reliable and cost-effective delivery of electricity.

Connectors

Connectors provide secure and efficient connections between various components and connectors. They ensure reliable electrical continuity, enable the efficient transfer of power, and facilitate the flexibility and scalability of the grid.

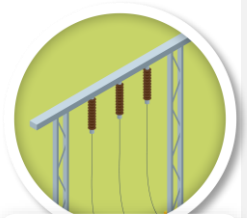


Anchors

Anchors provide transmission networks with additional stability needed to withstand storms and disasters. The anchor rod is fixed at one end to a guy wire (a tensioned cable fixed to the tower) and at the other end to the earth anchor buried under the ground.

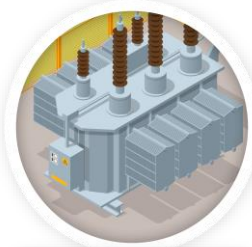
SUBSTATION

Substation Components are the Intermediate Point Between the Transmission and Distribution Infrastructure



Busbar

Busbars are a kind of electrical junction that has outgoing and incoming current paths. Whenever a fault occurs in the busbar, entire components connected to that specific section are instantly switched off to avoid danger stemming from the conductor's heat.

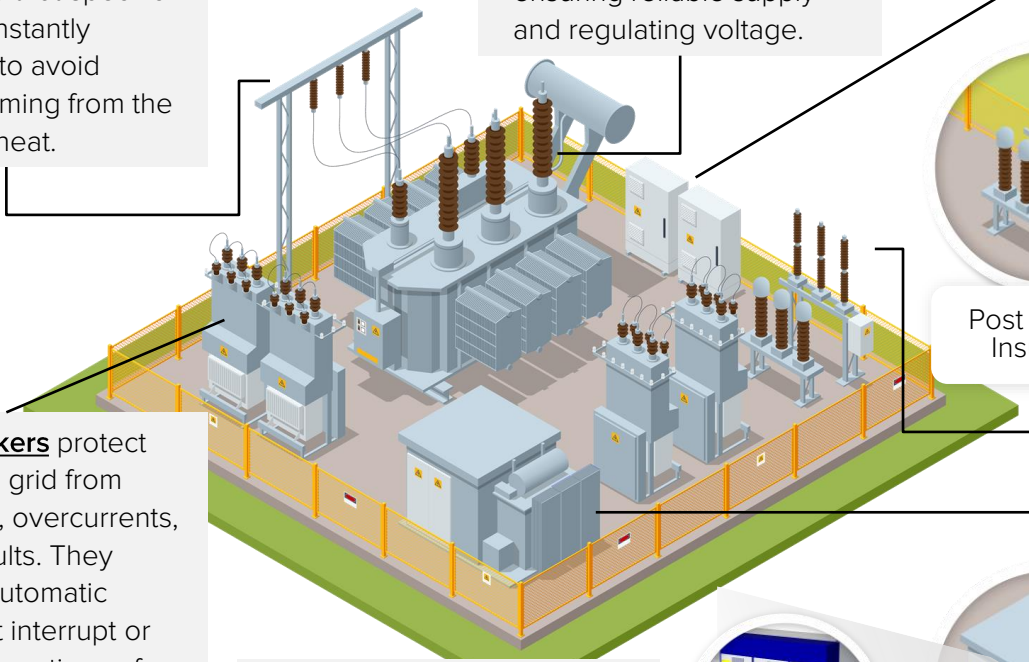


Power Transformer

Power Transformers convert high-voltage-transmission electricity to lower voltage levels suitable for distribution to consumers. They ensure the safe and efficient transfer of electrical power within the substation, ensuring reliable supply and regulating voltage.

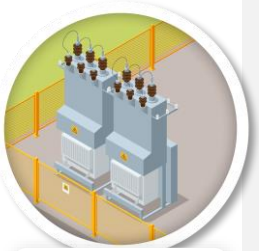
Switchgear / Circuit Breaker

Switchgear is an engineered collection of circuit breakers, fuses, and switches that function to protect, control, and isolate electrical equipment. In the event of a fault or abnormal condition, switchgear detects the issue and the initiates appropriate actions.



Post / Hollow Insulators

Post & Hollow Insulators isolate and support energized electrical equipment to minimize the risk of electrical leakage or flashovers. Often made of porcelain or composite materials, they're designed to withstand mechanical and environmental stressors such as vibration and pollution.

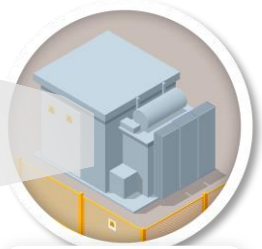


Circuit Breaker

Circuit Breakers protect the electrical grid from short circuits, overcurrents, and other faults. They function as automatic switches that interrupt or isolate faulty sections of the circuit, preventing damage to equipment, minimizing downtime.

Control & Relay Panels manage and regulate the flow of electricity by monitoring signals and conditions, allowing them to control various equipment.

Control / Relay Panels

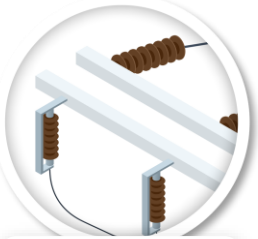


Enclosures

Enclosures provide robust protection and housing for sensitive electrical equipment such as relay and circuit panels by shielding components from external elements and unauthorized access.

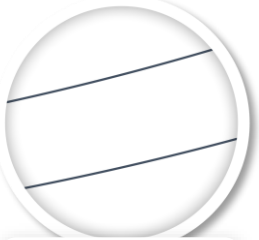
DISTRIBUTION

Distribution Components Facilitate the Safe Transfer of Electricity to End Users at Residential Homes and Commercial Properties



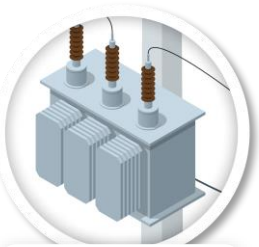
Line Post Insulators

T&D insulators support overhead power lines through suspensions, supports, spacers, and dampers. These insulators are typically made of porcelain or composite and isolate the energized conductors from the support structures, preventing electrical leakage and maintaining operation integrity.



Medium-Voltage Wires

Medium-voltage wires are the backbone of electrical distribution infrastructure. These power lines operate at 1 kV to 69 and Kv enable the distribution of electricity over medium distances. Designed with extra protection in mind these cable typically include insulation and external jacket shields.

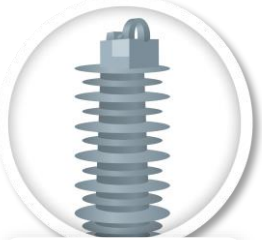


Transformers

Pole-mounted transformers step down voltage from medium voltage to 220 / 120 V, lower voltage levels suitable for consumption by households and businesses. They are Common in households and low-volume business installations in rural areas.

Meters

Meters accurately measure the amount of electricity consumed by residential, commercial and industrial customers. Meters provide valuable data for billing purposes, and enable accurate and fair assessment of energy usage.



Sensors

Sensors monitor the flow of electricity through the grid, allowing utilities to track useful statistics like power usage and load management, as well as monitor potential disruptions and faults that might affect their ability to deliver power to their customers.

Pad-Mount Switchgear

Pad-mount switchgear incorporates key protective equipment such as circuit breakers, fuses, and relays to control and safeguard circuits in a convenient location for underground distribution infrastructure.

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Power Product Landscape Today[1]

Select Private Power Equipment and Components Participants

Manufacturer	HQ	Ownership	Business Description and Primary Product Offering
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]

For the full market taxonomy, please reach out to EPIInsights@harriswilliams.com

1. For more information regarding the transformer landscape, please contact Harris Williams for our Transformer Primer

Power Product Landscape Today[1] (Cont.)

Select Private Power Equipment and Components Participants

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OEM / Multinationals				

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Key Investment Considerations

What Should Investors Be Looking For?

Mission-Critical Product Offering

Market Leadership

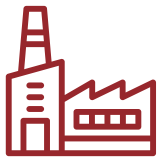
Go-to-Market Strategy With Multiple Established Sales Channels

Differentiated Product

Technical Expertise and Proven Management Team

Optimized Lead Times

Proven Execution Excellence



Strategic Footprint

Additional Value Drivers

M&A Capabilities

Vertical Integration

Deep Customer Relationships

Stringent Regulatory and Product Certification Requirements

Harris Williams / ENERGY, POWER & INFRASTRUCTURE GROUP

Innovative energy, power, and infrastructure services companies benefit from some of the world's most powerful trends, including ESG, grid upgrades and maintenance, 5G expansion, energy transition, and infrastructure investment. Senior professionals in our Energy, Power & Infrastructure Group work with investors and company leaders to make the most of these opportunities. Clients worldwide turn to us to keep a pulse on the energy, power, and infrastructure market and to help unlock value in their businesses through M&A.

We have a robust track record across industry sectors such as environmental services; utility and telecom; environmental services; engineering and construction; energy management; energy technology; renewables and distributed energy; and testing, inspection, certification, and compliance.

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DMC POWER a portfolio company of Bridgepoint has been acquired by Golden Gate Capital

ENERCON a portfolio company of ae Industrial Partners has been acquired by OAKTREE

USIC a portfolio company of Partners Group has received an investment from Kohlberg Company / Neuberger Berman

BHI energy a portfolio company of ae Industrial Partners has been acquired by Westinghouse a portfolio company of Brookfield

Southwire has acquired Novinium Underground

a portfolio company of funds managed by OAKTREE has been acquired by CENTURI a wholly-owned subsidiary of Southwest GRS

QUALUS Power Services a portfolio company of Mason Wells has been acquired by NMC New Mountain Capital LLC

ESG Operations, Inc. has merged with INFRAMARK a portfolio company of NMC New Mountain Capital LLC

INVESTCORP has acquired RESA POWER a portfolio company of BLUE SEA CAPITAL

ARCLINE Investment Management has acquired NASS EPS portfolio companies of Industrial Growth Partners

FRANKLIN ENERGY a portfolio company of Kohlberg Company has been acquired by abry partners

Solomon Corporation a portfolio company of OAKTREE has been acquired by SUNBELT Transformer a portfolio company of TRILANTIC North America

ONICON Flow and Energy Measurement a portfolio company of Harbour Group has been acquired by TASI Group BERWIND

Osmose a portfolio company of KOHLBERG & COMPANY has been acquired by EQT

Si Shermco Industries a portfolio company of OAKTREE has been acquired by Gryphon Investors

PEAK Utility Services Group a portfolio company of CIVC Partners has been acquired by ORIX

Harris Williams / GLOBAL INVESTMENT BANK

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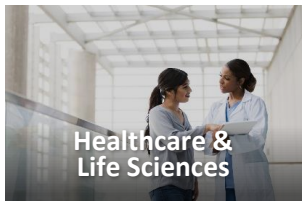
Deep Industry Experience



Proven Expertise

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PRIMARY FUND PLACEMENT

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75% Revenue from repeat clients

87% Managing Directors promoted from within

30+ Year history

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