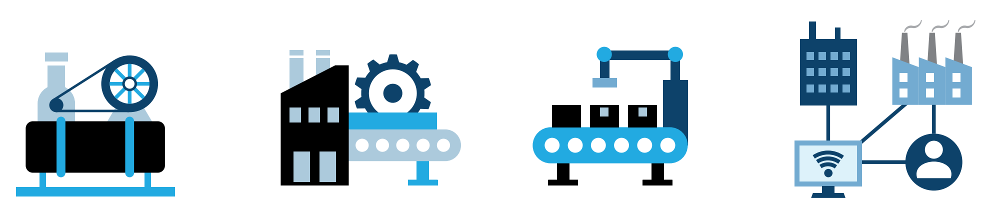
INFOGRAPHIC

NANOPLEX™ POWERS
INDUSTRIAL REVOLUTION 4.0

Industry 4.0—also called the Fourth Industrial Revolution or 4IR—is the next phase in the digitization of the manufacturing sector. This revolution is driven by disruptive trends, including the rise of data and connectivity, analytics, human-machine interaction, and improvements in robotics. Every nation worldwide is experiencing this new "Industry 4.0" age." One of the pillars of this trend, now called "Energy 4.0," is the digitization and use of AI for the power grid.

INDUSTRIAL REVOLUTION 4.0



	1.0 INDUSTRIAL REVOLUTION	2.0 INDUSTRIAL REVOLUTION	3.0 INDUSTRIAL REVOLUTION	4.0 INDUSTRIAL REVOLUTION
Time	1780	1870	1960	2010
Factory	Mechanization	Automation	Robotics	AI Digitization
Transportation	Trains Ships	Trucks Trains Ships	Trucks Trains Ships	Digital EVs Planes Trucks Trains Ships
Economy	Regional	National	Global	Digital
Communications	Telegraph	Phones	Networks	Cloud/Mobile
Power	Steam	Electricity	Power Grid	Smart Grid
Capacitor	None	Paper	BOPP	Metamaterials

As we migrate deeper into Industrial Revolution 4.0, the demand for power will continue to grow. The U.S Energy Information Administration (EIA) predicts that U.S. power demand will grow by 27%, and could be as high as 70% by 2040. This is driving major trends requiring a new age of power management, infrastructure, and storage solutions to meet this demand and support future power generation and distribution models driven by AI-powered smart grids.

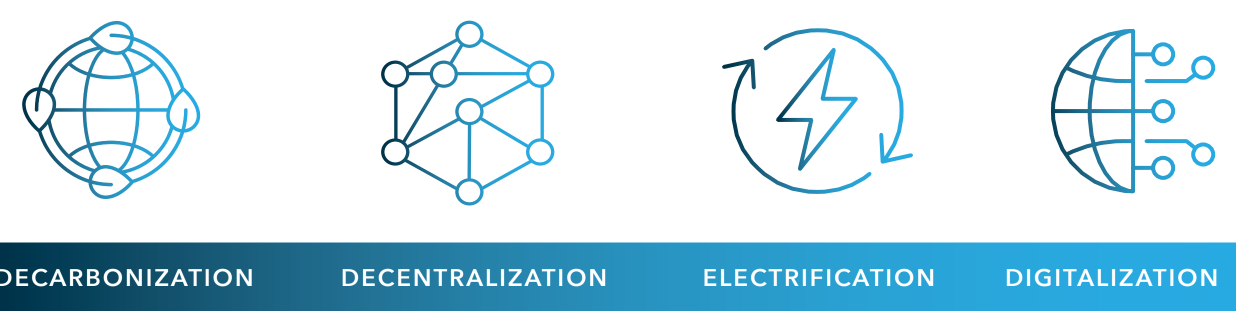
INDUSTRIAL REVOLUTION **4.0** POWER DEMAND

27% INCREASE IN U.S. POWER DEMAND

70% INCREASE IN GLOBAL POWER DEMAND

ENERGY MEGA TRENDS

In "The Future of Electricity" report form Bain & Company released at the most recent World Economic Forum and the article "The Three Biggest Trends and Challenges in the Energy Sector," and the expansion of government funding and regulations decarbonization initiatives through the Infrastructure Investment and Jobs Act (IIJA), which invests $1.2 trillion in the nation's core infrastructure, and the Inflation Reduction Act (IRA), which included $369 billion toward renewable energy production. This has led to four mega-trends trends are emerging as a results of the the changes in industries, policy, regulatory requirements and technology capabilities.



DECARBONIZATION

- Renewable Energy Integration
- Hybrid Power Factor
- Fusion Energy
- Consumer Power
- Climate Change Adaption
- Advanced Energy Storage Systems

DECENTRALIZATION

- Disaster Recovery Management
- Microgrids and Local Energy Systems
- Distributed Energy Resources (DER)
- Energy Trading

ELECTRIFICATION

- Electrification of Transport (EV everything)
- AI Data Centers
- IoT
- Smart Homes

DIGITALIZATION

- AI and Analytics
- Digital Twins
- Internet of Things
- Virtual Power Plants
- Grid Modernization and Digitalization
- Cyber Security and Resilience
- Fault location and Isolation and Service Restoration (FLISR)
- Advanced Metering Infrastructure (AMI)

https://www.forbes.com/sites/bernardmarr/2022/02/11/the-3-biggest-future-trends-and-challenges-in-the-energy-sector/?sh=7c3cd86c27b7
https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-industry-4-0-the-fourth-industrial-revolution-and-4ir
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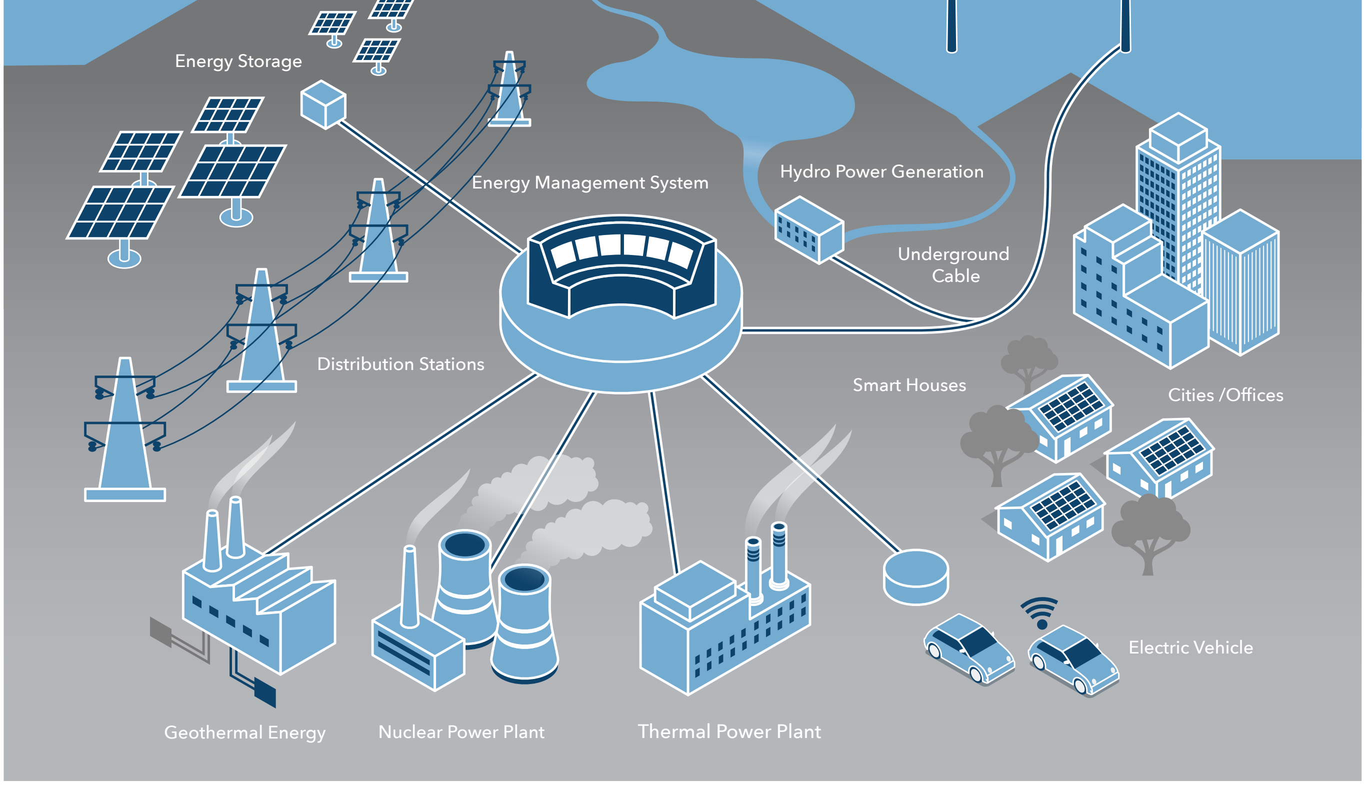
https://go.westmonroe.com/l/166592/2023-12-08/5kzgkr/166592/1702064791ulhEFwdP/West_Monroe_2024_Energy_and_Utilities_Outlook.pdf

TREND	DESCRIPTION	THE NANOPLEX PLAY
Fusion Energy	Fusion is the next big power generation option for the future. It solves the 24/7 challenges for wind and solar, mitigates the climate change concerns for hydro, and does not have the radioactivity issues of nuclear.	NanoPlex-based capacitors provide the high-powered pulsed energy and extended duty cycles required to ignite the fusion process up to 5x longer than industry standard BOPP.
Internet of Things (IoT)	Power companies are adding IoT for real-time monitoring. Energy utility companies are integrating smart meters, sensors, and automation systems into power distribution networks to enable proactive maintenance.	NanoPlex-based capacitors can store up to 4X more energy to support peak demand and enable IoT devices to optimize power efficiency.
Renewable Energy Integration	The shift towards renewable energy sources like wind, solar, and hydro to reduce carbon emissions will continue to be a major trend. This includes efforts to decarbonize not just electricity generation but the entire energy system.	NanoPlex-based capacitors improve power factor correction across hybrid (wind, hydro, solar) and conventional energy creation sources to optimize step-up and step-down transmission. NanoPlex enhances energy transfer efficiency by mitigating the phase difference between voltage and current.
Advanced Energy Storage	As renewable energy sources, which are intermittent by nature, become more prevalent, advanced energy storage technologies like battery storage and pumped hydro storage will become critical for balancing supply and demand.	Capacitors have long been used provide a buffer to support extra energy storage. Nano-Plex-based capacitors can store up to 4x more energy and can offer even greater storage because more capacitor film can be deployed in the same space.
Grid Modernization and Digitalization	The power grid will become smarter and more flexible, incorporating advanced digital technologies, including the Internet of Things (IoT), artificial intelligence (AI), and machine learning (ML), to optimize energy flow and improve grid management.	As power grids become more automated, capacitors will be called upon to provide greater durability duty cycles. Peak's NanoPlex films will enable the flexibility required with extended-life, lower maintenance cost, and more stable/predictable services.
Electrification of Transport	The growth in electric vehicles (EVs) will significantly increase electricity demand and introduce new challenges and opportunities for grid management, including vehicle-to-grid (V2G) technologies.	Electrification of cars, trucks, and busses will lead to spikes in demand around shift changes and people returning home to charge. NanoPlex-based capacitors are ideal for supporting without negatively impacting the stability of the power grid.
Virtual Power Plants	Virtual power plants (VPPs) leverage AI-based software and control systems to aggregate and orchestrate a network of diverse energy resources (industrial, consumer power, and cooperatives). This can include solar panels, battery storage, EVs, and more. VPPs provide a framework for flexible demand response to mitigate the issue of intermittency in power grids.	NanoPlex-based capacitors are ideal for virtual power plants because of the diverse sources of power to enable more optimal hybrid power factoring.
Smart Assessment Maintenance	Energy companies are leveraging predictive analytics, ML, and IoT sensors to monitor equipment health and performance in real-time for proactive asset management systems to make data-driven decisions that optimize resource allocation and maintenance programs.	The cost and impact maintenance are primarily driven by the duty cycle of the equipment deployed - NanoPlex-based capacitors can often operate for up to 5x longer that traditional BOPP based capacitors.
Increased Consumer Participation	Consumers will play a more active role in the energy ecosystem through distributed energy resources (DERs) like rooftop solar panels, home batteries, and smart home technologies, transitioning from passive consumers to active prosumers.	Like hybrid power factoring for renewals, consumer participation in the power grid will require more flexibility and capacities of the equipment in the grid. NanoPlex-based capacitors will help manage spikes, fill gaps, and enable AI-based grids.
Disaster Recovery Management	Natural disasters pose a major threat to power infrastructure, causing prolonged outages and disruptions. Advanced technologies, including predictive analytics and real-time monitoring systems enable early detection and rapid response to such issues.	Mobile power solutions are often deployed to help power grids impacted by outages from spikes in demand or loss of service due to natural disasters. NanoPlex-based capacitors can scale the power of mobile power systems from 4-8x depending on the deployment model.
Microgrids and Local Energy Systems	The development of microgrids and local energy systems will provide communities with more control over their energy sources, enhancing resilience.	Microgrids demand highly optimized hybrid power factoring. NanoPlex-based capacitors are ideal for this task because they can hold more energy with lower costs and smaller footprints.
Climate Change Adaptation	The power grid will need to adapt to the impacts of climate change, including increased frequency and severity of extreme weather events, to ensure reliability and prevent outages.	One of the key benefits of the NanoPlex is the ability to operate at higher temperatures without impacting power performance when deployed in high-temperature environments like Arizona or the Middle East.

ENERGY 4.0 AI-BASED SMART GRID
POWERED BY NANOPLEX



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