

NANOPLEX™



SOLUTION SHEET



**NANOPLEX™ FILMS FOR HYBRID
POWER FACTOR CORRECTION**



HIGH TEMP CAPACITORS FOR OPTIMIZED POWER FACTOR CORRECTION

NANOPLEX FOR HIGH FREQUENCY SWITCHING

- NanoPlex based capacitors provide temperate tolerance up to 135°C
- NanoPlex based capacitors are predicted to have 3-5X longer lifetimes than BOPP based capacitors
- NanoPlex based capacitors enable faster discharge with lower impedance, making power factoring more efficient.
- Over 20 global patents for NanoPlex film technology.
- NanoPlex is 100% US-engineered and manufactured – no reliance on China.



NANOPLEX™ FILMS FOR HYBRID POWER FACTOR CORRECTION

Hybrid Power Correction

Hybrid power factoring (HPF) is the process of integrating multiple energy sources into the modern power grid. As power grids increasingly incorporate a mix of traditional and renewable energy sources, such as wind, solar, and hydro, hybrid power factoring helps optimize the transmission and distribution of electricity. New technologies such as high frequency switching are modernizing this process to provide better controls and support AI-driven power exchanges.

NanoPlex-based capacitors will play a key role in this process by improving power factor correction across these varied energy sources. They enhance energy transfer efficiency by mitigating the phase difference between voltage and current, which is especially important when dealing with the variable nature of renewable energy inputs. By employing hybrid power factoring, grid operators can maintain a more stable and reliable power supply, even as the energy mix becomes increasingly complex and diverse.

Hybrid Power Factoring Applications:

Capacitors, as the backbone for reactive power compensation, are not just fundamental components in hybrid power factoring systems, but they also uniquely combine the strengths of traditional passive power factor correction methods with advanced active compensation technologies. Hybrid power factoring systems are used for several compelling reasons:



- **Renewable Integration** - Hybrid systems help manage the variability introduced by renewable energy sources, supporting their integration into the grid.



- **Improved Power Quality** - Hybrid power factoring systems help maintain a high-power factor, reducing voltage fluctuations and improving overall power quality.



- **Energy Efficiency** - These systems help minimize energy losses in the distribution system by reducing reactive power flow.



- **Cost Reduction** - Improved power factoring reduces electricity bills and can help avoid utility penalties.



- **Increased System Capacity** - Reducing reactive power flow increases the capacity available for active power transmission.



- **Equipment Protection** - Proper power factor correction helps protect electrical equipment from damage due to voltage fluctuations and harmonics.



- **Regulatory Compliance** - Many utilities and grid operators require consumers to maintain a minimum power factor, which these systems help achieve.



The Role of NanoPlex Based Capacitors in Hybrid Power Factoring

In hybrid power grids, which combine traditional and renewable energy sources, capacitors act as energy storage devices that can rapidly charge and discharge to balance fluctuations in power supply and demand. They optimize the relationship between real and reactive power in the system. By storing and releasing electrical energy as needed, capacitors help reduce the phase difference between voltage and current, thereby improving overall power factor and minimizing energy losses during transmission.

Advanced capacitor technologies, such as those based on NanoPlex films, offer higher energy density and improved thermal performance, allowing for more efficient and compact power factor correction solutions. These capacitors also contribute to voltage regulation, harmonic filtering, and transient suppression, all of which are critical for maintaining grid stability and reliability in hybrid power systems. As the energy landscape continues to evolve with increasing integration of renewable sources, the role of high-performance capacitors in hybrid power factoring becomes even more significant, enabling smoother integration of diverse energy sources and enhancing overall grid efficiency. NanoPlex-based capacitors enhance energy transfer efficiency in hybrid power systems through several key mechanisms:

- Improved Power Factor Correction:** NanoPlex-based capacitors optimize power factor correction and mitigate the phase difference between voltage and current, which is crucial when dealing with the variable nature of renewable energy inputs.
- Enhanced Energy Storage and Discharge:** NanoPlex based capacitors can store up to 4X more energy more efficiently than traditional capacitors. This capability allows them to manage energy fluctuations effectively, stabilizing voltage levels throughout the grid.
- Improved Thermal Performance:** NanoPlex-based capacitors can operate at temperatures up to 135°C. This enhanced thermal stability allows for more efficient operation in high-temperature environments.
- By incorporating these advanced capabilities, NanoPlex-based capacitors significantly enhance the overall efficiency and reliability of hybrid power systems, enabling better integration of diverse energy sources and improving grid stability.

Hybrid Power Factoring

