

Electrification of Steam Crackers in the Petrochemical Industry

Innovative Reduction of Carbon Emissions and Enhancement of Energy Efficiencies

INDUSTRY

Oil and Gas
(Petrochemical)

SOLUTION

Steam Crackers

APPLICATION

Thyro-PX SCR and
dASM cards

CHALLENGE

The oil and gas sector, particularly the petrochemical industry, faces increasing pressure to reduce carbon emissions. Traditional steam crackers, which rely on fossil fuels for heating, are significant contributors to CO₂ emissions. Steam crackers are large industrial furnaces used in the petrochemical industry to break down (or "crack") hydrocarbons, such as naphtha or ethane, into smaller molecules like ethylene, propylene, and other valuable chemicals. This case study explores the implementation of electrically heated steam cracker technology, marking a pivotal shift towards sustainable industrial processes. The challenges when producing solutions for these issues include:

- **High Carbon Emissions:** Conventional steam crackers generate substantial CO₂ emissions due to fossil fuel combustion, prompting the need for a cleaner alternative.
- **Technical and Operational Feasibility:** Developing and validating a new electrically heated steam cracker required overcoming significant technical and operational hurdles, including demonstrating efficiency and reliability in real-world conditions.
- **Energy Efficiency:** Traditional fired furnaces offer only 40 to 45% efficiency in transferring energy to the process coils, resulting in considerable energy losses.

SOLUTION

To address these challenges, Advanced Energy proposed a comprehensive solution featuring six Thyro-PX SCR power controller systems and six custom dASM (digital advanced signal management) cards, pioneering the first industrial-scale demonstration of an electrically heated steam cracker.

The Thyro-PX systems are advanced, high-performance silicon-controlled rectifiers (SCRs) designed for precise, reliable control of high-power electrical loads. These SCRs enable fine-tuned power management, ensuring that the heating elements within the

steam cracker receive stable and optimal electrical input. The custom dASM cards are engineered to provide enhanced signal processing and integration capabilities, allowing seamless communication between the power control systems and the broader plant automation infrastructure.

The project introduced the first-ever large-scale electrically heated steam cracker, showcasing the feasibility of electrification in high-temperature industrial processes. The use of Advanced Energy's SCRs enabled precise power management, essential for maintaining optimal heating conditions and maximizing energy efficiency.



RESULTS AND BENEFITS

Partnering with Advanced Energy provided the customer with:

- **Reduced Carbon Footprint:** The electrically heated furnace dramatically lowers CO₂ emissions, supporting global sustainability initiatives and helping the industry meet regulatory demands.
- **Enhanced Energy Efficiency:** The new system achieves over 95% efficiency in utilizing electrical power for the cracking process, far surpassing the traditional efficiency rates.
- **Operational Versatility:** The solution is adaptable to a variety of feedstocks, from ethane to pyrolysis oil, providing greater flexibility and resilience in operations.
- **Precise Process Control:** Advanced Energy's SCRs deliver accurate power regulation, crucial for optimizing the cracking process and further reducing emissions.



For international contact information, visit advancedenergy.com.

powersales@aei.com
productsupport.ep@aei.com
+1 888 412 7832

PRECISION | POWER | PERFORMANCE | TRUST

Specifications are subject to change without notice. Not responsible for errors or omissions.
©2025 Advanced Energy Industries, Inc. All rights reserved. Advanced Energy and AE are U.S. trademarks of Advanced Energy Industries, Inc.