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OVERCOMING CHALLENGES

IN RENEWABLE NATURAL GAS PRODUCTION

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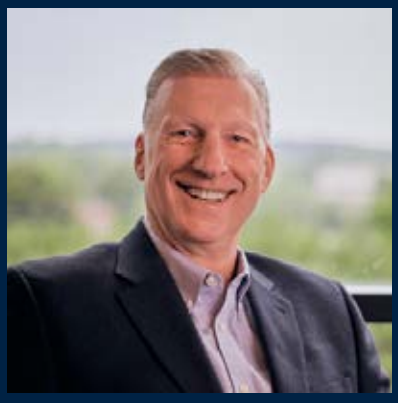
PEOPLE, PROCESS, AND TECHNOLOGY FOR INCREASED SAFETY AND EFFICIENCY

Renewable Natural Gas (RNG) is a key component of the U.S. clean energy transition. Derived from organic waste, RNG offers a sustainable alternative to conventional fossil fuels while helping to reduce greenhouse gas emissions. Its widespread adoption faces several challenges, however, including production costs, regulatory hurdles, and infrastructure limitations.

This e-book explores these challenges and highlights the technologies that can help producers operate safely and efficiently.

KEVIN HANNIGAN
CEO



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OVERVIEW

What is RNG?

RNG is a pipeline-quality gas derived from biogas, which is produced through the decomposition of organic matter. It is chemically similar to fossil-based natural gas but has the advantage of being carbon-neutral or even carbon-negative, depending on production methods.

How is RNG Produced?

RNG production typically involves one of two processes:

- Anaerobic Digestion: Organic waste (e.g., manure, food waste, wastewater sludge) is broken down by microorganisms in an oxygen-free environment to produce biogas.
- Gasification: Biomass is heated at high temperatures to produce syngas, which is then converted into methane.

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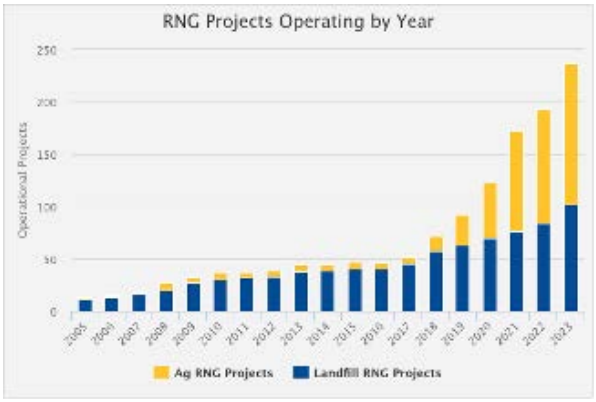
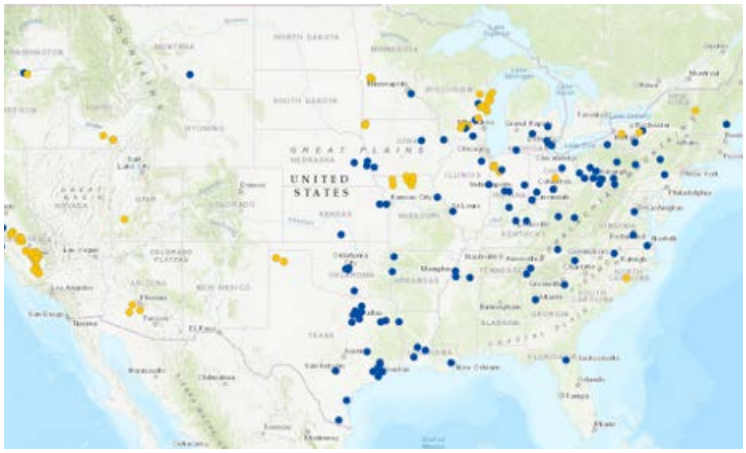
KEY PLAYERS AND INDUSTRY TRENDS

Major energy companies, agricultural producers, and waste management firms are investing in RNG projects. The sector is growing due to sustainability initiatives and government incentives promoting renewable energy adoption.

- American Biogas Council estimates 8,600 farms have potential for RNG operations, up from 400 today
- EPA AgSTAR database has 400 Anaerobic Digester facilities listed (updated June 2024):



POLICY INCENTIVES AND REGULATORY COMPLIANCE



Federal and state policies, such as the Renewable Fuel Standard (RFS) and Low Carbon Fuel Standard (LCFS), support RNG production. However, compliance with regulations remains a significant challenge for producers.

Key market drivers include:

- Credit generation from clean fuel programs
- Rise in voluntary purchasing
- Corporate decarbonization goals
- Expansion of investment tax credits to include biodigester projects

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KEY CHALLENGES IN RNG PRODUCTION IN THE US

FEEDSTOCK LIMITATIONS AND VARIABILITY	RNG production depends on organic waste, which varies in availability and quality. Seasonal fluctuations and contamination risks affect consistency and output.
REGULATORY AND COMPLIANCE BARRIERS	Producers face federal, state, and local permitting challenges. Strict environmental and emissions regulations, along with complex safety standards, require continuous monitoring and compliance efforts.
INFRASTRUCTURE AND DISTRIBUTION HURDLES	A limited RNG pipeline network and high transportation costs hinder widespread adoption. Interconnection constraints further complicate distribution.
GAS QUALITY AND UPGRADING COMPLEXITIES	Biogas impurities like CO2, H2S, and siloxanes must be removed to meet stringent pipeline and vehicle fuel standards. Advanced purification methods are needed to ensure compliance.
ECONOMIC AND MARKET UNCERTAINTY	High capital investment and operational costs, fluctuating energy prices, and competition with conventional natural gas make market entry challenging. Incentive structures help offset costs but are subject to policy changes.

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"The future of Renewable Natural Gas in the U.S. hinges on smarter, more connected operations. As technology advances, automation and real-time monitoring will be key to scaling production efficiently while ensuring sustainability and compliance."

-Chris Monchinski, CTO
InflexionPoint

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TECHNOLOGIES FOR SAFE AND EFFICIENT RNG OPERATIONS

Advanced Anaerobic Digestion Systems

New generation digesters with improved efficiency enhance methane yields. Co-digestion techniques optimize feedstock utilization and improve economic viability.

Gas Upgrading, Purification, and Carbon Capture

Membrane separation, pressure swing adsorption, and water scrubbing improve gas quality while cutting energy use and costs. Integrating RNG production with carbon capture boosts sustainability, repurposing CO2 for industrial use and extra revenue.

Automation and Artificial Intelligence

IIoT sensors collect operational data, from equipment performance to environment. AI optimizes feedstock, maintenance, and gas monitoring, boosting efficiency and reducing risk.

Safety Technologies and Best Practices

Advanced leak detection, real-time monitoring, and cybersecurity enhance safety and reliability. Regular audits, testing, and updates guard against evolving threats.

Remote Monitoring and Management

RNG sites are often remote, making full-time staffing costly. Use secure web-based systems for remote monitoring, ensuring OT system performance and uptime anywhere.

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DELIVERING ON THE PROMISE OF CLEAN ENERGY

We help a major utility ensure reliable and efficient RNG production through a combination of software, services, and support.

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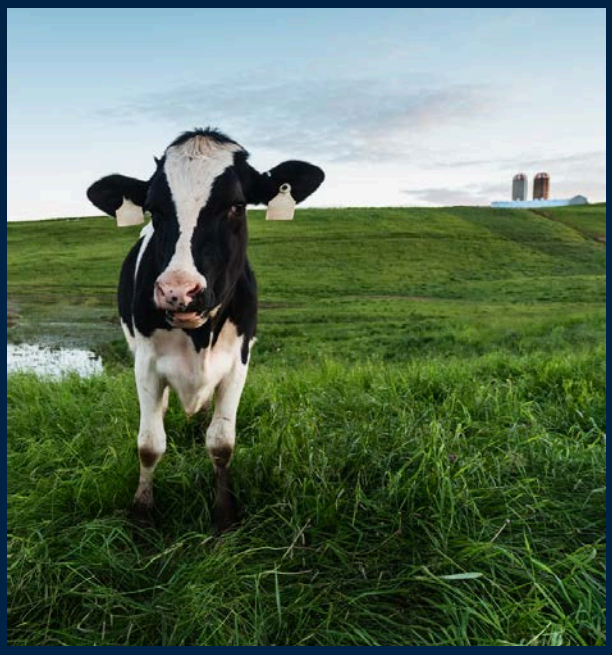
STREAMLINING RNG OPERATIONS: SMARTER SYSTEMS FOR EFFICIENCY

A 100-year-old power generator that serves over 700,000 families and businesses has committed to producing clean energy through the capture and conversion of renewable natural gas (RNG) at dozens of dairy farms.

Each farm is a miniature natural gas facility, with the same risks and requirements as a larger facility, but without the production throughput to support dedicated resources. Operating these renewable energy production facilities safely and productively requires tight control over costs and resources.



At InflexionPoint we know that effective technology systems act as a seamless extension of the people and processes they are meant to serve. With secure remote access at the heart of the operational plans we designed a system that puts everything operators need — equipment controls, SCADA, cybersecurity — into a secure web interface accessible from anywhere. Each facility received a self-contained integrated data center (IDC) that was pre-configured and tested, ready to run. We also updated and patched all operating systems and assets at each facility and implemented Ignition SCADA for easier monitoring and management of processes. Last, but certainly not least, as an operating partner we provide 24/7 support. All software, services and support are included in one monthly fee per facility.

The system has already provided tremendous value, identified critical vulnerabilities and exposures (CVEs) and we were able to quickly develop a remediation strategy. We manage 250 support tickets on average per month across 15+ sites providing triage, incident command, routing, remediation and root cause analysis providing valuable insight.

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PROJECT INSIGHTS

Challenges

- Collects natural gas from dairy farms
- Operations spread across multiple operating states
- Data gaps result in lost revenue
- Full-time staff cost prohibitive

Solution

- Unified dashboard to manage all systems
- One common IDC; drop into each facility
- Ability to monitor and manage remotely, no personnel on site
- Patching, asset management of all systems
- Added Ignition SCADA
- 24x7 Remote Management and Monitoring
- 24x7 Critical Operations Support

Results

- See all OT equipment in real time
- No breaches; identified a couple CVEs; offered remediation strategy
- 250+ tickets per month
- System pays for itself

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UNLOCKING RNG POTENTIAL

Despite significant challenges, RNG production offers significant benefits to producers that do it right. By leveraging emerging technologies, producers can enhance safety, efficiency, and profitability, ensuring a cleaner and more resilient energy future.

LOOKING FOR AN OPERATIONAL EXCELLENCE PARTNER?

LOOK NO FURTHER.

For over forty years we have helped companies in life sciences, critical infrastructure, and food and beverage use technology — including automation, analytics, and AI — to operate more safely and effectively. Learn more about our services and how we can help you achieve Operational Excellence. Visit our website or call us today.

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