# Low-Cost Solution for Wastewater Treatment Plant Denitrification

## Make methanol you can reuse with the RTI Microreformer™

### Value Proposition

**Economically competitive and efficient use of flared biogas** by converting to methanol

**Closing the loop on Denitrification** by using methanol to reduce cost per gallon and per pound of nitrate removed

**Reducing greenhouse gas emissions**

**Expansion to other value added products**

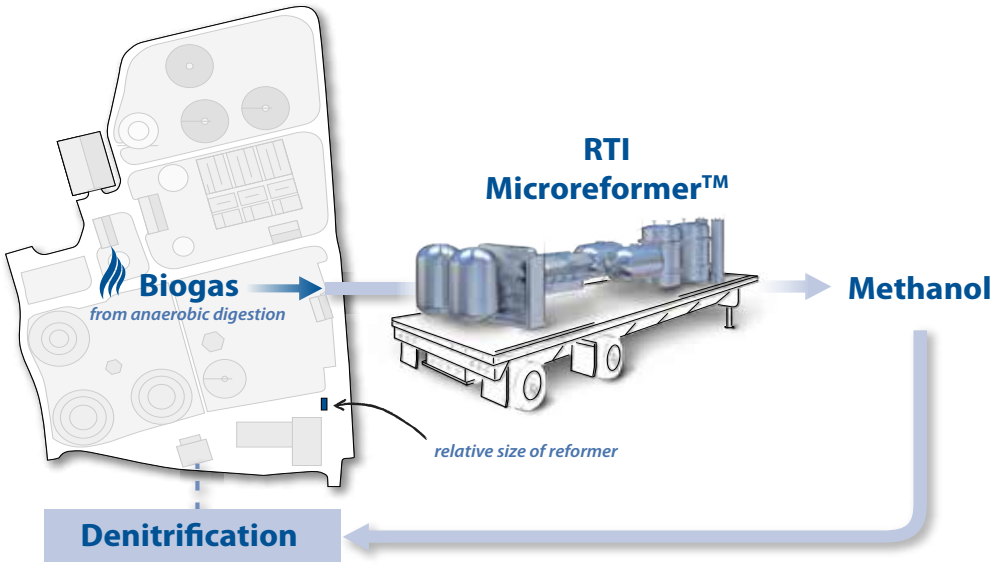
- Ammonia
- Dimethyl Ether
- Fischer-Tropsch Liquids

### Problem: Costly Denitrification

In North America, over 23,000 wastewater treatment plants must find a cost saving and energy-effective solution for denitrification. Excess nitrogen causes an overgrowth of algae, leading to less oxygen and sunlight penetration to deep water, hence disturbing the ecosystem. The use of methanol as an additional carbon source is the most cost effective solution for denitrification, costing nearly 50% lower than glycerol-based alternatives per gallon and per pound of nitrate removed.

### Solution: Closing the Loop of Wastewater Treatment with Methanol Production

RTI's Microreformer technology can assist wastewater treatment plants "close the loop" on denitrification. Instead of flaring biogas, RTI's Microreformer can capture and convert it into methanol. The methanol can then be used as a carbon source for bacteria in wastewater sludge for denitrification.



## Wastewater Treatment Plant Application

The RTI Microreformer technology can enable an economically competitive, efficient use of the flared biogas that occurs during wastewater treatment. RTI has developed and is currently testing an internal combustion engine based syngas generation system that can convert 50,000 standard cubic feet per day (scfd) of natural gas to 10 barrels per day of over 99% methanol. An average wastewater treatment plant emits around 100,000 scfd of biogas per day, so two RTI Microreformers could satisfy the amount of biogas flared each day.

The engine reformer is composed of a standard, mass manufactured 8.8L engine, run on natural gas, that has been coupled with a generator. The engine produces syngas for methanol synthesis, or synthesis of other value added products, and power. In the current pilot system, the power is dissipated to an electrical load bank. In a commercial unit, that power will be integrated into the system operation.

One challenge in small-scale gas conversion is competing with the economics derived from the economies of scale in traditional chemicals processing. Utilizing mass manufactured internal combustion engines exemplifies substituting economies of scale with economies of mass production, advancing the concept of viable distributed fuel production.

*Current pilot of RTI Microreformer located in Research Triangle Park, NC.*

**We are presently seeking co-development and partnership opportunities for the RTI Microreformer, the solution to small-scale modular gas conversion.**

## More Information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### Presentations and Conferences


Carpenter, J. (2017) "Compact Microreformers for Distributed GTL." Presentation presented at Energy Frontiers International: Gas Flare Monetization Forum, Denver, Colorado.

Carpenter, J. (2015-2017) "Compact Microreformers for Distributed GTL." Poster session presented at ARPA-E Technology Innovation Showcase, Washington, DC.

Carpenter, J. (2016) "Compact RTI Microreformer™ for Distributed GTL." Presentation presented at Gasification Syngas Technologies Conference, Vancouver, Canada.

Carpenter, J., Lesemann, M. (2016) "Compact Inexpensive Reformers for Natural Gas." Paper presented at Industrial Energy Technologies Conference, New Orleans, Louisiana.





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