

# Sustainable Wastewater Systems: Using Microorganisms to Treat Wastewater While Generating Biofuel

## Abstract

Sustainable cost/efficient biofuel production is perhaps the simplest solution in reducing the use and dependency on fossil fuels. Achieving efficient biofuel production, while creating a sustainable municipal wastewater system, is possible with the use of Microorganisms. Our current methods for treating wastewater are not cost-efficient or sustainable and will worsen with growing and changing population dynamics. Many wastewater systems are outdated, consume power, uses expensive chemicals, and treatment creates a concentrated sludge that continually needs to be disposed of. In my research I expect to find new approaches that can sufficiently replace existing technologies addressing wastewater, while creating renewable energy sources and improving sustainability. In my research I have found that biogas systems are a great addition to wastewater treatment plants under certain conditions and that they should be pursued to a greater extent. I have also found sufficient evidence that the nutrient rich water that produced after initial treatment can be a quality medium for third and fourth generation biofuels and other valuable products. The interest in alternative wastewater treatment facilities is both for economical and sustainable reasons. Making sure that both are applied is important in future success.

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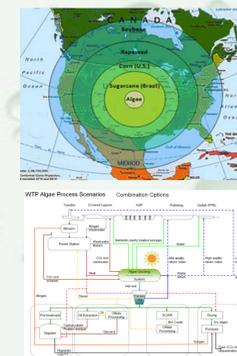
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## Making the Most of Our Wastes

Each year we lose about 600 Mega Watts of Potential energy from not utilizing biogas systems in large Municipal systems alone. Also if we create "Centralized Biofuel processing plants" rural WWTF's can transports biomass e.g. sludge and algal biomass to further increase our renewable energy potential.

## Algae Fuel Potential

Compared with all other biofuel crops algae would by far take the least amount of land along with it not needing arable land and potential for water recycling. Algae is considered the best Biofuel to replace fossil fuels. Algae biofuels can prevent food crops from be sent to biofuel production. And by using recycled water from wastewater treatment we can further increase the sustainability.



## Targeting the WWTF's in Minnesota "Places that show considerable Opportunity"

GIS Map below

## Steps in transforming WWTF's in biofuel producers

1. Understanding the effluent makeup (What is in Your Wastewater)
2. Understanding budget and future projections
3. Understanding regulations and how systems can meet them
4. Matching the biofuel systems to water treatment demands

## Barriers of Implementation

- Inadequate Payback/Economics
- Lack of Available Capital
- Operations/Maintenance
- Complications and Concerns
- Complication with Liquid Stream
- Outside Agents (Non-Regulatory: Utilities, Public)
- We could not work with our power and gas utilities or the public
- Lack of Community/Utility Leadership
- Interest in Green Power
- The environmental benefit provides inadequate Justification
- Difficulties with Air Regulations or Obtaining Air Permit
- Air and GHG regulations make it too difficult
- Plant Too Small Our facility is too small
- Technical Merits/Concerns Technical concerns limit our appetite to implement
- Maintain Status Quo

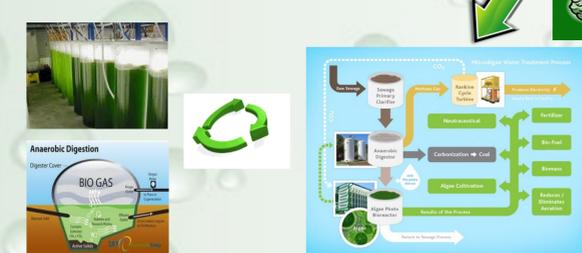
## How organizations have over-came barriers

- Use Alternative Feedstock's to Increase Biogas Production
- Consolidate Solids Handling
- Re-Frame Economics
- Investigate Alternative Sources of Funding
- Simplify Operations and Management
- Highlight Risk of Status Quo to Decision Makers
- Leverage Current Discussions with Third Parties

## Evolution of Wastewater Treatment

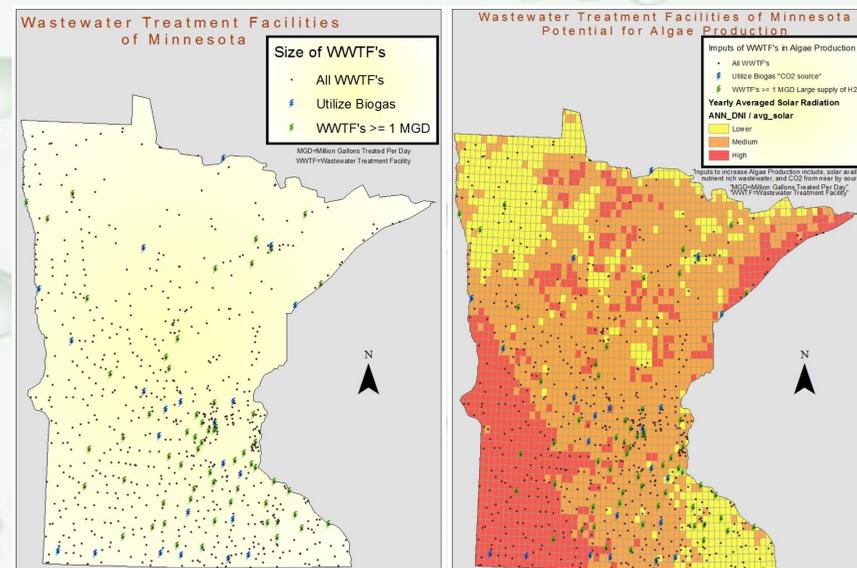


## Future of Wastewater Treatment



## History of Wastewater Treatment

Human activities produce vast amounts of wastewater, what we do with those wastes has changes dramatically over time. As populations have continued to grow our wastes have caused more problems, these problems have been solved by constructing treatment plants and improving infrastructure to move the wastes to plants. Present day we are successfully treating the wastes to remove many of the negative side effects. I see great potential in advancing and developing treatment to treat more effectively and produce sustainable energy.



## Pairing these systems in Wastewater Treatment will bring the greatest benefit

Tapping into the two most important stages of treatment to implement the Biofuel Processes. Why?

- New regulations are calling for more sufficient treatment
- Sludge treatment and nutrient removal can be the most expensive stage in current treatment designs
- Many systems are outdated and need replacement

## Conclusion

Sufficiently treating our wastewater is not only important to the environment its important to human well being. Also concerns of fuel prices and dwindling "easy access" fossil fuels, and grave concerns of climate change have pushed humans to become more creative and efficient regarding energy supplies. There are numerous new renewable energy ideas that potentially can help alleviate our current predicaments. By pairing wastewater treatment with biofuel production we are solving two issues simultaneously.

## Methods

Reviewed numerous scientific papers, articles, contacted officials in the industry and conducted GIS analysis of data.

## References

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