

The left side of the slide features a series of vertical lines and circles. From left to right, there is a dotted orange line, a solid orange line, a vertical bar with horizontal lines, and another solid orange line. Below these lines are several orange circles of varying sizes, with the largest one being a large solid circle.

YIELD

renewable energy producers

INS & OUTS OF AD OPERATIONS

**Presented by Tom Ferencevic
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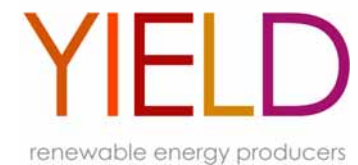
OBJECTIVE

Provide quality information enabling biogas plant owners, investors, operators and waste service companies to ask the right questions

WHO WE ARE & WHAT WE DO



- YIELD Energy is a biogas facility designer, technology supplier and operator in NA
- Our technology partner is FITEC www.fitec.com
- We are experts in the management of all types of contaminated organic waste streams destined for anaerobic digestion
- Our market niche is in the design and integration of equipment to pre-treat and digest physically contaminated feedstock from the urban env.
- Developed Dr. Digester scientific services to perform operational services, feedstock brokering, waste auditing.



CASE STUDIES, REFERENCE SITES & EXPERIENCES



- The following presentation represents both our internal approach when we are designing a turn-key AD system or remediating & optimizing for 3rd party facilities
- We have worked extensively with the waste industry, waste generators and biogas plants
- We have also worked with the compost and organic fertilizer industries

ANALYZING THE IMPACT OF DIFFERENT FEEDSTOCK OPTIONS



- Inadequate understanding of how the physical & chemical composition of the feedstock will impact the biogas generation processes.
- Your goal posts for system stability are retention time and organic loading rate...nothing can change this, meaning you can't trick the bacteria into doing things they aren't capable of doing!
- Do not operate on the edge all the time.

FEEDSTOCK ANALYSIS & AUDITING



➤ Physical Composition:

- Determine the non-digestible fraction and contaminants (egg shells, bones, metal, plastic, wood, glass etc.)
- Process involves:
 - Accurate sampling, shredding and homogenizing
 - Separating contaminants from the organic fraction
 - Drying, weighing and calculating

➤ Chemical Composition:

- Carbohydrates, Fats, Proteins, ash, TS, oTS, oTSv
 - Outputs are Biogas Yield, Methane Yield,

BIOLOGICAL SYSTEM EVALUATION



- Biological System Analysis: Inhibitory factors such as pH and dissolved nitrogen
- BioTip Simulations: modelling of all anaerobic digestion processes simultaneously
- Feedstock Analysis: total solids, carbohydrates, fats, proteins, ash
- In-Situ Digestate Analysis: Ammonia, fatty acid profiles, micronutrient concentration and availability

FULLY UNDERSTAND THE IMPACTS OF CONTAMINANTS



- No pre-treatment system can clean feedstock 100% before it gets into a digester.
- Depending on the technology (s) chosen they can dramatically affect your water balance
- Both a heavy and light fraction of contaminants will get into your digester
- A good pre-treatment solution is a system design not just a piece of equipment added onto your plant
- The good news is that if you are expanding plant capacity you can integrate tank cleaning technology

BUILDING TOO SMALL DIGESTION CAPACITY FOR BIOLOGICAL STABILITY



- We see the decision to save capital result in projects building fewer and/or smaller tanks.
- There is always a trade off...to what extent can you control all of the feedstock coming into your plant for the next 20+ years!
- Projects use a combination of off-farm wastes & manures so understand the proportional revenue contributions and you will realize that the most money and most biologically limiting substrate is the off-farm waste- so the tail wags the dog

BUILDING TOO LARGE DIGESTION CAPACITY



- This is the build and they will come model aka merchant facility ...a very risky biz model!
- Not only are you spending capital that won't generate revenue but you end up being forced to take feedstock you might not have wanted to, such as contaminated feedstock that comes with a tipping fee but your system is not designed to handle.
- You're trading short term gain for long term pain here, your system will have mechanical problems well before you receive any financial benefit from the tipping fees.

BUDGETING FOR SUPPORT SERVICES- YOU CAN'T DO IT ALL YOURSELF



- Look who's operating at 100% day in and day out and ask them how and why.
- Remember what you're good at and stick to it.
- Consider that a poorly operating plant can have an emotional and financial drain on 2 businesses.
- Example: 500 kW plant @ annual program cost @ 18 K
 - @ \$0.16 kWh = 112,500 kWh to payback
 - Equals 18 days of operating at 50%
 - Or approx. 2.7% of revenue
- Our service successes have been in the range of a 30% gas yield improvements not including feedstock changes

SUPPLEMENT FORMULATION & MANUFACTURE



- A wide range of macro and micro nutrients are needed to ensure proper growth and reproduction of your bacterial populations
- The amounts needed vary depending on your feedstock
- In our analysis to date all projects have been either short in absolute concentrations or the availability of trace elements

MONITORING, TRACKING & ONGOING SUPPORT



- In-Situ Digestate Analysis
- Bio-Tip Simulations (Biological Stability)
- In line pH/buffer capacity monitoring
- Customized Formulation of Supplements
- Operational Recommendations
- Addition of other required chemicals (Ferric Chloride dosing)
- Optimized Feeding Schedules
- Feedstock Evaluations and Characterization

HAVE AN ADEQUATE DIGESTATE MANAGEMENT PLAN



- If your plant is on a farm or near a farm then this is relatively straightforward provided your in compliance with your nutrient management plan.
- To date the revenue from digestate business has been all over the map and highly dependent on local market conditions.
- There is a lot of work being done to extract value from the digestate. To date the most value has been derived from the solid fraction being used as animal bedding or as a high OM component to blended growing media.
- Fresh digestate or the separated liquid fraction is generally being valued by the nutrient content plus value added \$ for OM & micros



COMPETITION FOR FEEDSTOCK

- We are currently seeing this unfold in the Ontario marketplace with lots of new biogas plants coming on-line.
- In any market clean feedstock is limited and tipping fees are low or become nil due to trucking costs.
- This is why we are proponents of investing in pre-treatment and contaminant removal technologies OR
 - Partner with a supplier that is investing in an pre-processing so both parties have greater assurances on the supply side.
- Over a 20 year period the capital cost is low and being able to take almost any feedstock gives you the best chance at long term financial success.



FEEDSTOCK SUPPLY MARKETS

- You have to know where the feedstock you hope to get for your plant is going today and what are the associated supply and demand dynamics.
- For example how far it's being trucked and what the trucking costs? If it's clean feedstock how much does it cost to land apply it, can this number go down, what will you do with feedstock if your plant goes down, will your suppliers look for a take-or-pay contract?
- How can you ensure suppliers that your system won't go down?

OVER ESTIMATING THE IMPACT OF CAPEX



- The impact of extra capital for equipment, greater number or larger tanks becomes minimal when long term performance is factored.
- Plan ahead for capital expenditures. You don't have to spend all the money right now, phase it in.
- How do you reach the right balance...
 - Find the right technology partner
 - Find the right feedstock supply partner
 - Make sure both are in it for long haul with you.
- Check reference sites of technology suppliers & look at a companies track record



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Dr. Digester™

THANK YOU

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