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From: Jan Allen, P.E. CM Q/OE
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RE: SMALL SCALE ANAEROBIC DIGESTION STATE OF THE ART

IMPACT BIOENERGY is offering Anaerobic Digestion (AD) Systems in the 25 – 11,000 tons per year scale range. We are claiming a niche in the industry in both scale and speed-to-deployment. IMPACT BIOENERGY enjoys a competitive advantage by being cost efficient, deployable quickly, and easy to purchase. We are working to make the process of due diligence, alternative evaluation, and decision to move forward more convenient. The anaerobic digestion market in general is not unproven.

The state of the art for Anaerobic Digestion at any scale can be seen in several commercial sectors in North America. In the United States there are over 1,400 non-landfill AD systems in operation, including 192 farm-based biomethane systems and 1,238 wastewater biomethane systems. In the United States, there are also 594 landfill-based AD systems in operation and an unknown number of experimental food waste/industrial AD systems in operation. In Canada, food waste/industrial digesters are operational at a regional scale. Some of the aforementioned systems are the direct result of engineering/design by IMPACT's Management Team. IMPACT Bioenergy has extrapolated the most successful elements of each model described above and, with the help of our unique supply chain partnerships, re-incorporated these elements into an AD system that is distributed in scale, more affordable than European counterparts to manufacture, and designed to process commercial food waste.

Globally there are over 40 million AD systems in operation today. China, India, and Latin America lead in total number of systems and number of smaller, community-scale systems. There are over 20,000 larger, regional-scale systems in operation within the total. This give some indication of the large number of smaller systems operating today. Germany, there are over 8,000 AD systems in operation, digesting both energy crops and urban organic wastes.

Skeptics of small AD's potential in North America have fallen prey to the assumption that the capital costs for these systems outweigh their ROI and that regional feedstocks are too inconsistent. However, these assumptions are based on the modern attraction to centralized technology, which, like the Canadian model, involves huge, regional systems, high CAPEX, increasing high transportation costs, and complicated grid-interconnection arrangements involving third-party feasibility studies and engineering fees. IMPACT's model addresses these inefficiencies. Decentralization is much simpler and less expensive. "Bigger is not always better."

So why has small AD not been practiced before? The trend is emerging slowly but gradually gaining acceptance, first in the wastewater industry, then the landfill and agricultural sectors. Urban foodwaste diversion is just beginning to gain traction in coastal US cities and in Canada. The main driver in this trend is the scarcity and

high cost of disposal (hauling and tipping). The trend towards micro-grid power and renewables is also a driver and emerging trend.

Small systems are developing in the UK and Germany right now. Small systems are the norm in China, India, and Latin America, but these systems do not have adequate odor control or safety systems to be marketed in North America. Some German systems have offerings in the 1,000 – 5,500 tons per year scale. One UK system has been scaled down to 165 tons per year. Only one domestic system is in this scale range and it is specifically designed for manure digestion (2,900 to 69,000 tons per year). Throughout Europe and Asia small bioenergy systems are converting organic waste into energy and conserving local soil resources while reducing the use of agrichemicals.

Do you have a prototype/reference facility?

We are currently working to get our pilot/reference facility built. Our Management Team (Jan Allen) has over 10MW of bioenergy in his portfolio and has commissioned much larger systems, his most recent being a 30,000 (T/Yr.) facility in Vancouver B.C. Most of these projects are unique in design and our differentiator is in developing prefabricated skid mounted systems that assemble cost-efficiently and quickly. Typically the design of an AD system is analogous to a home builder designing you a home, in that instance the customer would ask to see other homes in their portfolio but not to see the exact same home they are having built. One of our distribution partners has offered to purchase a unit and rent it out for 24-month terms to customers interested in trialing the system.

What is your value proposition?

For Businesses	For Communities	For Government Entities	For Waste Processors
Your business can substantially reduce their cost of waste disposal and energy costs while becoming leaders in sustainability.	Your community can eliminate the third largest source of GHG while reducing the landfill volume, conserving local soil resources, and generating clean renewable energy.	Meet your zero-waste goals and reduce landfill volume while also conserving local soil resources and generating clean renewable energy.	Eliminate the issue caused by food waste and earn additional revenue by increasing your food waste tip revenue and generating renewable energy.

At what stage is your product/technology development?

The standard AD systems we are offering (models 25, 185, 1000 and 5500) are completely specified, with quotations received from our supply chain partners. Many of these partners are long-time associates or vendors we have known since the 1990s. We have developed two complementary composting models and a wood gasification system as well. While we lead with the AD systems, we have, in fact, 8 separate engineered systems

that can be prefabricated and delivered in skids that can be lifted and dropped into place for easy and quick field assembly. These 8 systems have specific synergy with each other (referred to as by-product synergy or biomimicry). Our supply chain is specifically designed to use local vendors we know in Washington, Oregon, or British Columbia as the preferred strategy. The roster we are using shows the vendors we are using, as well as their location (attached).

Our product design and engineering is complete and our supply chain is in place. Our goal is to have each facility up and running 6 months after notice to proceed. We have four financing vehicles in place: Craft3, WA State Housing Finance Commission, McKinstry Capital Lending, and Powerscreen of WA leasing or rental.

Why aren't others applying simple solution to obvious opportunity?

The opportunity is non-obvious and the existing service providers have an incentive to continue with the current practices. Commonly, design and deployment of facilities requires between 2 and 4 years. They are also typically designed as large, centralized facilities due to the presumption that larger facilities are more cost-efficient due to the larger economy of scale. This presumption has proven to be incorrect in most urban situations due to the high cost of hauling and transportation of feedstocks (as inputs) and by-products (as outputs) over increasingly longer distances. Portland is hauling food waste to Everett (200 miles). Seattle is beginning to haul organics to Royal City (155 miles) or Stanwood (60 miles). San Francisco is hauling organics to Vernalis, CA (75 miles). A processor in BC is proposing Vancouver haul to Lytton BC (160 miles).

What's the secret sauce, how do you compete on such lower price point?

Much of this can attributed to product expertise, quick delivery, small footprint, and domestic sourcing. While anaerobic digestion is a very old technology there are few practitioners who understand and can design an efficient system from scratch. Most customers for AD are large waste processors who are served by the German manufacturers at costs that aren't reasonable. The recent project in Vancouver BC ultimately cost nearly twice the budgeted capital cost. This overrun was caused by cultural differences, code differences, currency conversion, perceived risk by local contractors, and shipping costs. Organic waste generators have simply never been approached to do onsite AD.

Is your product sufficiently unique compared to other offerings?

We are unique in

- Domestically sourced equipment – largely from WA State
- Pre-fabricated for quick deployment
- Architecturally exciting
- Exception odor control (competitors don't do this)
- Low risk on technology
- Low capital cost vs. competition
- Low operating cost
- Packaged with CHP or CNG vehicle fueling (competitors don't do this)
- Ability to integrate contaminant removal, composting, drying

Is this the best technology for this application?

This is a very robust and simple AD design. The system is designed for minimal labor and expenses and includes exceptional odor control, small footprint, and architectural flexibility. Anaerobic Digestion is the primary technology, we have several proprietary technologies that make our system more economical better suited for the urban deployment. In the Anaerobic Digestion world our system is best described as a two-stage CSTR (continuously stirred tank reactor) followed by solids dewatering and final digestion of the liquid fraction in an aerobic filter.