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| Technology/Service: | quasar energy group - Complete Mix Digester | Date: | October 11, 2018 |
| Information by: | Alan Johnson | | |

COMPANY INFORMATION

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|-----------------|---------------------------|------------------|--|
| Company: | quasar energy group | | |
| Phone: | (216) 986-9999 | Web Site: | www.quasareg.com |
| Address: | 8600 E Pleasant Valley Rd | City: | Independence |
| State: | Ohio | Zip Code: | 44131 |

TECHNICAL CONTACT

DEMONSTRATION SITE CONTACT

| | | | |
|------------------|---------------------------|-------------------|-----------------------|
| Name: | Alan Johnson | Site Name: | Provided upon request |
| Phone: | (216) 644-8817 | Contact: | |
| Email: | ajohnson@quasareg.com | Title: | |
| Address: | 8600 E Pleasant Valley Rd | Phone: | |
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| State: | Ohio | Address: | |
| Zip Code: | 44131 | City: | |
| | | State: | |
| | | Zip Code: | |

INITIAL TECHNOLOGY OVERVIEW

This information is to guide in the development of a more specific and detailed Technology Information Request. Please answer the following questions for each Technology or Service Provided.

What is the name of the technology or service you provide?

Based in Cleveland, Ohio, quasar is a full-service, renewable energy and waste management firm. They specialize in anaerobic digestion as a means of deploying sustainable technology solutions in agricultural, municipal and industrial applications. quasar operates two superior anaerobic digestion laboratory facilities, one at their headquarters in Cleveland, and the second at The Ohio State University Agricultural Research and Development Center (OARDC) campus located in Wooster, Ohio. They design, build, own, operate and retrofit anaerobic digestion facilities using U.S. components to produce renewable energy and a valuable fertilizer product.

Describe how this technology is used in a larger Nutrient Management System. *Please be as detailed as possible.*

quasar designs farm anaerobic digester systems to treat the full manure stream. quasar digesters can also manage food and organic wastes from food manufacturers and municipalities which benefits the project with additional biogas. The full manure stream is processed to produce renewable energy which can be used to produce electricity, CNG vehicle fuel, or pipeline quality biomethane gas, excess heat for farm use from electrical generation, bedding and recovered nutrients from the non-volatile portion of manure or food waste. The digester system reduces odors and greenhouse gas emissions while returning water and natural nutrients for irrigation and crop needs.

How many systems do you have installed on dairy farms or other livestock operations?

| SYSTEMS | NUMBER OF SITES | SIZE OF INSTALLATIONS |
|------------------|---|---|
| Dairy | 3 digesters processing cow manure | Herd sizes range from 300 to 60,000 cows |
| Pork | 2 digesters processing swine manure | 5,000 to 7,000 swine/digester |
| Municipal | 11 digesters installed either at or near WWTP's or Food Processing Plants | Electrical generation ranges from 600KW to over 2.2MW |

What's the smallest and largest farm using your system?

The smallest is a dairy farm with 300 cows. The largest is a digester system which can process the daily manure from up to 60,000 cows.

Does this technology have a 12-month record of reliable performance on at least three dairy farms?

Yes, at least three quasar digesters have 12-month performance records processing cow or swine manure. Multiple other quasar digesters have several years of performance history processing municipal food waste, swine manure and wastewater treatment plant sludge. Within the food waste stream, the plants process various dairy waste streams (spoiled milk, ice cream, yogurt)

Do you have a preferred region or area for the location of projects?

North America

Input and output of your unit/system – do you have a mass balance analysis?

If a mass balance is available, please include below or attach as a separate document.

During project development, a mass balance is prepared with project specific feedstock. This information is considered client confidential.

Input material description and characteristics:

For example: raw manure, digestate, screened digestate, suitable non-farm feedstocks, other.

The input to digester systems is the full manure stream including cleaning water from barns or milking parlors, food waste and other organics are often additional feedstocks to boost methane outputs.

Does the technology treat the full manure stream for a farm or a fraction of the stream?

The digester can be designed to treat the full manure stream for a dairy farm including flush water from the milking parlor.

Do you consider this a mature system or ongoing farm development?

quasar anaerobic digester systems are a mature technology with proven results, qeg makes process and design improvements using feedback from client projects.

Any weather constraints? Yes No *If so, please describe.*

Any bedding constraints? Yes No *If so, please describe.*

Sand is known to have adverse impacts on anaerobic digestion systems. quasar partners with technology providers for separation technologies as necessary.

Output material description and characteristics:

Please include the % of the total stream for each material, i.e. 10% fiber and 90% screened liquid by weight.

quasar digestate streams are approximately 6% -8% total solids, leaving approx and 92%-94% nutrient liquids for beneficial use

Do the Outputs of the process have a resale market identified? Yes No

If so, under what brand name or who is the contract with?

Markets are available to sell energy products (electricity, renewable natural gas and compressed natural gas) and environmental attributes, such as, carbon credits, RINs and RECs. The digestate solids and liquids can be sold as compost or land applied as fertilizer on farm fields.

Is this process scalable and to what extent (top and bottom limits)? Yes No *If so, please describe.*

quasar's digester system can be designed for the herd size with no upper limit because the system is modular.

Do you have a known scaling factor? Yes No *If so, please describe.*

quasar's anaerobic digestion systems have a modular design and are scalable, project CAPx on a cost per unit basis goes down as size increases.

Does this technology require any air input? Yes No

What is the preferred air connection? *For example: psi, fitting size, air quality.*

If not distributed by the system, please list each connected device.

Does this technology require any water input? Yes No *If so, please describe.*

What is the preferred water connection? *For example: psi, fitting size, water quality, gpm.*

If not distributed by the system, please list each connected device.

Does this technology require any electrical input? Yes No *If so, please describe.*

Standard commercial electricity supply for pumps, mixers, and process control

What is the preferred electrical connection? *For example: phase #, voltage, full load amps.*

If not distributed by the system, please list each connected device.

480 volt three-phase power required.

Does this technology require any mechanical input? Yes No *If so, please describe.*

What is the preferred mechanical connection? *For example: horsepower, connection, rpms.*

If not distributed by the system, please list each connected device.

Does this system require any special plumbing? Yes No *If so, please describe what is required.*

Does this system require any special foundations or pads? Yes No *If so, please describe.*

The digester tanks have standard concrete ring-wall foundations at typical sites.

Do you consider this technology part of a larger system that you provide? Yes No *If so, please describe.*

The digester can be designed as a stand-alone system or can incorporate solids separation, heat recovery and a variety of bedding recovery and nutrient extraction systems.

Does your system require any other components that you do not provide or are not included in your proposal? Yes No
If so, please describe.

Each proposal is generated with the client's specific needs in mind. quasar has a history of providing turnkey projects, however, we welcome the opportunity to partner with outside suppliers and engineers when it offers clients the best value option.

How is the system delivered to the site? *For example: skid mounted, assembled on site, constructed on site.*

quasar digesters are assembled on-site with additional on-site construction

Is this system portable or configured in such a way that it could be easily transported for use in several locations?

Yes No *If so, please describe.*

Has your technology been accepted by the NRCS and is it included into a practice standard? Yes No

If so, please describe if necessary.

Digesters are an approved NRCS standard practice

Are there any unusable or hazardous byproducts of this process? Yes No

If so, please describe the product and recommended means of disposal.

What spare parts and redundant components are included with the system?

Spare parts are commercially available and meet all applicable industry standards. quasar provides customers with O&M plans and spare parts lists during project development.

How is the system controlled and what are the components and capabilities of the control system?

The system is automated for 24/7 operation using on-line SCADA and PLC systems.

What is the usable life of the system?

With proper O/M the system have a service life of 20-30 years

What is the salvage value at the end of the usable life?

Main mechanical components such as the gen-set, blowers, valves, meters, etc. have salvage value

What is the educational and technical level of competence for the operation of the system?

Local qualified labor can be trained to operate the system

What level of maintenance is required for the system?

Please indicate if rebuilds or major components must be replaced and what the frequency is for these components.

Component parts require maintenance and replacement per maintenance schedule. Daily walk through inspections and periodic response to system upsets are required

Are consumables used in the process? Yes No

Please provide the nature and purchase relationship for these consumables. For example: proprietary, special contract, generally available.

Which of these NRCS codes would your technology be classified under? Check all that apply. Add if necessary.

| CODE | NRCS DESCRIPTION | CHECK ALL THAT APPLY |
|------|--|-------------------------------------|
| 472 | Access Control | <input type="checkbox"/> |
| 560 | Access Road | <input type="checkbox"/> |
| 309 | Agrichemical Handling | <input type="checkbox"/> |
| 371 | Air Filtration and Scrubbing | <input checked="" type="checkbox"/> |
| 591 | Amendments for the Treatment of Agricultural Waste | <input checked="" type="checkbox"/> |
| 366 | Anaerobic Digester | <input checked="" type="checkbox"/> |
| 672 | Building Envelope Improvement | <input type="checkbox"/> |
| 372 | Combustion System Improvement | <input checked="" type="checkbox"/> |
| 317 | Composting Facility | <input type="checkbox"/> |
| 554 | Drainage Water Management | <input type="checkbox"/> |
| 375 | Dust Control from Animal Activity on Open Lot Surfaces | <input type="checkbox"/> |
| 373 | Dust Control on Unpaved Roads and Surfaces | <input type="checkbox"/> |
| 374 | Farmstead Energy Improvement | <input checked="" type="checkbox"/> |
| 512 | Forage and Biomass Planting | <input type="checkbox"/> |
| 561 | Heavy Use Area Protection | <input type="checkbox"/> |
| 516 | Livestock Pipeline | <input type="checkbox"/> |
| 590 | Nutrient Management | <input checked="" type="checkbox"/> |
| 521A | Pond Sealing or Lining, Flexible Membrane | <input type="checkbox"/> |
| 533 | Pumping Plant | <input type="checkbox"/> |
| 588 | Roof Runoff Structure | <input type="checkbox"/> |
| 367 | Roofs and Covers | <input checked="" type="checkbox"/> |
| 318 | Short-Term Storage of Animal Waste and By-Products | <input type="checkbox"/> |
| 570 | Stormwater Runoff Control | <input type="checkbox"/> |
| 606 | Subsurface Drain | <input type="checkbox"/> |
| 635 | Vegetated Treatment Area | <input type="checkbox"/> |
| 601 | Vegetative Barrier | <input type="checkbox"/> |
| 360 | Waste Facility Closure | <input type="checkbox"/> |
| 632 | Waste Separation Facility | <input type="checkbox"/> |
| 313 | Waste Storage Facility | <input type="checkbox"/> |
| 634 | Waste Transfer | <input type="checkbox"/> |
| 629 | Waste Treatment | <input checked="" type="checkbox"/> |
| 359 | Waste Treatment Lagoon | <input type="checkbox"/> |

| | | |
|--|--|--------------------------|
| | | <input type="checkbox"/> |
| | | <input type="checkbox"/> |
| | | <input type="checkbox"/> |

Can you provide an estimate of the capital required for the installation of this technology?

Please include all components and designate if provided by you or others.

The capital requirements to install a digester will vary widely depending on digester design, size, and choice of equipment for utilization of the biogas and/or for separating out manure fiber. If the renewable energy portion of the project is not included (i.e., gen-set or gas upgrade); the the estimated digester CapEx range is \$0.0015 per 1000 gallons of capacity for a larger system and \$0.0065 per 1000 gallons of capacity for a smaller system. A larger system is typically greater than 1 million gallons of capacity.

quasar considers financial modeling to be an essential step in project development. quasar can provide financing options and assistance with grants and available tax credits to ensure competitive pricing.

Can you provide an estimate of the operational costs required for this technology?

Please include all costs and designate if provided by you or others.

Annualized operations and maintenance cost of a dairy anaerobic digester and genset are estimated to be approximately 3 to 5 percent of the total capital cost of the system on a project by project basis.

https://www.epa.gov/sites/production/files/2014-12/documents/quasar_energy_agstar_site_profile_508_022614.pdf

Is there financing available for this system? Yes No *If so, what are the conditions for this financing?*

quasar is prepared to invest resources and capital to develop projects and commercial arrangements that are practical and financeable. Additionally, quasar has a network of investors and financial institutions that may provide all or a portion of the project equity and debt requirements.

Is the system available for lease? Yes No *If so, please describe.*

What sort of warrantee or guarantee do you provide with this technology?

Do you provide any performance guarantees or strictly defects in parts and materials?

quasar offers a standard warranty on every project and passes along any equipment warranty to the Owner. quasar is willing to offer performance guarantees on deployed technology. quasar agrees to process a given amount of material and generate a given amount of renewable energy. Performance guarantees are contingent upon feedstock testing and agreed upon during the EPC process.

Explain how this system is unique or transformative and how does it improve upon or go beyond other technologies that are currently available.

quasar’s Anaerobic Digestion Technology sets us apart from our competitors. Our in-house staff supports each project through the full project cycle, providing the expertise to make each project a success. With all necessary services under one roof quasar can be the single point of contact for any project.

- Design: In-house engineering consistently developing next generation AD technology.
- Quality Components: key components designed by quasar; 100% US supply chain.
- High Efficiency: ability to achieve >70% volatile solids reduction and process up to 12% total solids blended feedstock

Would you be willing to provide a location for a site visit by Newtrient? Yes No *If so, please provide location.*

quasar offers facility tours by appointment only.

TECHNOLOGY REFERENCES

Please provide customers with whom we can discuss this technology and its performance.
Include a company name, location, contact name and contact information.

Reference 1

| | |
|-----------------------------|---|
| Company Name: | AGreen Energy LLC |
| Company Location: | Rutland, Massachusetts |
| Contact Name: | Bill Jorgenson |
| Contact Information: | (E) wjorgenson@agreenenergyllc.com ; (P) (617)-510-5245 |

Reference 2

| | |
|-----------------------------|---|
| Company Name: | Haviland Drainage |
| Company Location: | Haviland, Ohio |
| Contact Name: | Craig Stoller |
| Contact Information: | (E) cstoller@haviland-drainage.com ; (P) (419) 622-4611 |

Reference 3

| | |
|-----------------------------|---|
| Company Name: | City of Wooster, Ohio |
| Company Location: | Wooster, Ohio |
| Contact Name: | Kevin Givins |
| Contact Information: | (E) kgivins@woosteroh.com ; (P) (614) 801-6408 |

Reference 4

| | |
|-----------------------------|---|
| Company Name: | Eastern Ohio Regional Wastewater Authority |
| Company Location: | Bellaire, Ohio |
| Contact Name: | Valerie Moore |
| Contact Information: | (E) vmoore@eoraw.org ; (P) (740) 676-5911 |

Are there any other facts about this technology that you feel should be included in this document?

quasar is able to support the entire dairy industry by digesting other organic material and not just utilizing manure management technology.