

Innovative Business Models for Anaerobic Digestion Projects – Part II

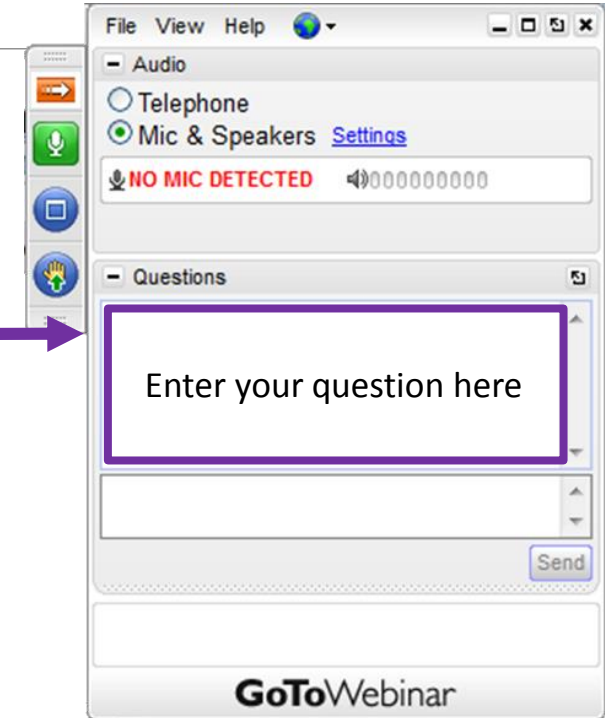
May 24, 2017

NICK ELGER – PROGRAM MANAGER

AGSTAR PROGRAM, US EPA

Reminders

- All participants (except speakers) are in listen-only mode
- Questions submitted during the webinar will be reviewed at the end of the webinar
 - Type a question here
- If you are experiencing technical difficulties, please let us know using the Questions pane on the right side or contact Jay Gallo at 203-687-9432
- A copy of today's presentation will be available on AgSTAR's website



Agenda

- Welcome and Opening Remarks
- USDA Grant and Loan Opportunities for Digesters
 - Fred Petok, US Department of Agriculture Rural Development
- Overview of the U.S. On-farm Digester Industry
 - Nick Elger, US EPA AgSTAR
- Establishing Successful Business Arrangements with Food Waste Producers
 - Chris Noble, Noblehurst Farms and Steve McGlynn, EnviTec Biogas
- Hub-and-Spoke Centralized Digester Model
 - Doug VanOrnum, DVO Inc.
- Questions and Answers

Mention of any company, association, or product in this presentation is for information purposes only and does not constitute a recommendation of any such company, association, or product, either express or implied, by EPA.

AgSTAR Program



- 20+ year collaborative voluntary program of USDA and EPA.
- Promotes the use of anaerobic digestion systems to advance economically and environmentally sound livestock manure management.
- Strong ties to industry, government, NGO and university stakeholders.
- Assist those who enable, purchase or implement anaerobic digesters by identifying project benefits, risks, options and opportunities.



Digester News

- California Department of Food and Agriculture (CDFA) announces \$36 million in funding for dairy digesters in California to reduce GHG emissions
 - Up to \$3 million available per project

<https://www.cdfa.ca.gov/oefi/ddrdp/>

- 3-Day Digester Operator Training Course
June 13-15, 2017 – Oshkosh, WI
 - Hands on training for operators, managers, owners and developers

<http://americanbiogascouncil.org/operatortraining.asp>



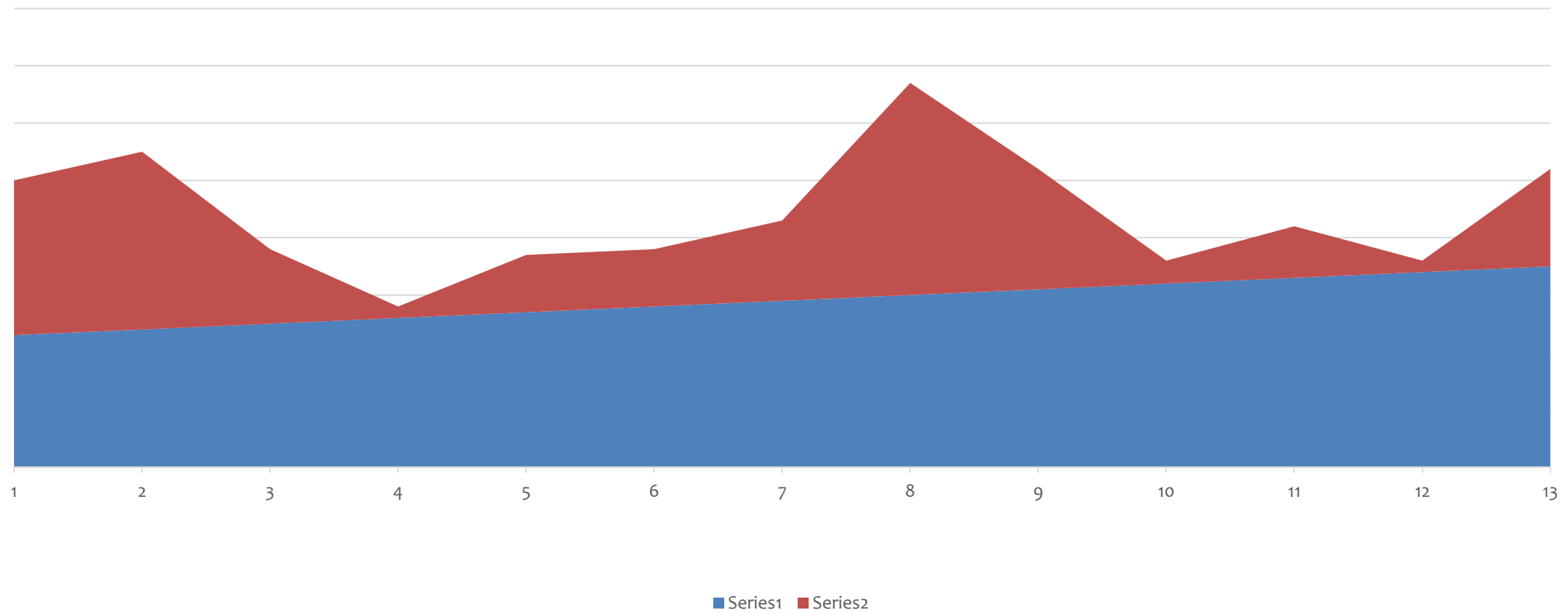


The Ups and Downs of Biogas Building Digesters

A brief presentation from Rural Development by
Fred Petok, C.E.M.



Ups and Downs





REAP is now a permanent program

REAP's mandatory funding authority does not expire with the 2014 farm bill

- Current Status of REAP Grants and Loans
-
- REAP \$20,000 and Less Grants: 333 grants obligated by 49 states and territory totaling \$4,256,916.
- REAP Guaranteed Loans: 23 loans awarded in eight states totaling \$148,860,688.

Energy Programs REAP



REAP Guaranteed Loan Terms

✓ FEES

- One-time guarantee fee of 1%
- ¼% annual renewal fee



BENEFITS FOR THE BANK

- ✓ Mitigate Risk
 - Guarantee is a “loss” guarantee
- ✓ Increase Capital and Improve Bank Liquidity
 - Sale of Loan Note Guarantee on Secondary Market
- ✓ Increase Bank Returns
 - Receive servicing fee from Secondary holder
- ✓ May help satisfy Community Reinvestment Act requirements
- ✓ Provides another tool to expand lender’s portfolio in rural areas

Energy Programs REAP



REAP Grant Assistance

Up to 25%
of Eligible Project Costs

Renewable Energy Systems		Energy Efficiency Improvements	
Minimum Grant Request	\$2,500 Total eligible project costs $\geq$ \$10,000	Minimum Grant Request	\$1,500 Total eligible project costs $\geq$ \$6,000
Maximum Grant Request	\$500,000 Total eligible project costs $\geq$ \$2 million	Maximum Grant Request	\$250,000 Total eligible project costs $\geq$ \$1 million

Energy Programs REAP



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2015 Digesters

CALIFORNIA	7	\$	2,595,968.00
MAINE	1	\$	500,000.00
MASSACHUSETTS	2	\$	729,916.00
MICHIGAN	1	\$	480,251.00
NEW YORK	1	\$	500,000.00
NORTH CAROLINA	2	\$	500,000.00
OHIO	1	\$	311,354.00
Grand Total	15	\$	5,617,489.00



Regional Energy Coordinators

Kevin Boone, Regional Energy Coordinator (Western),
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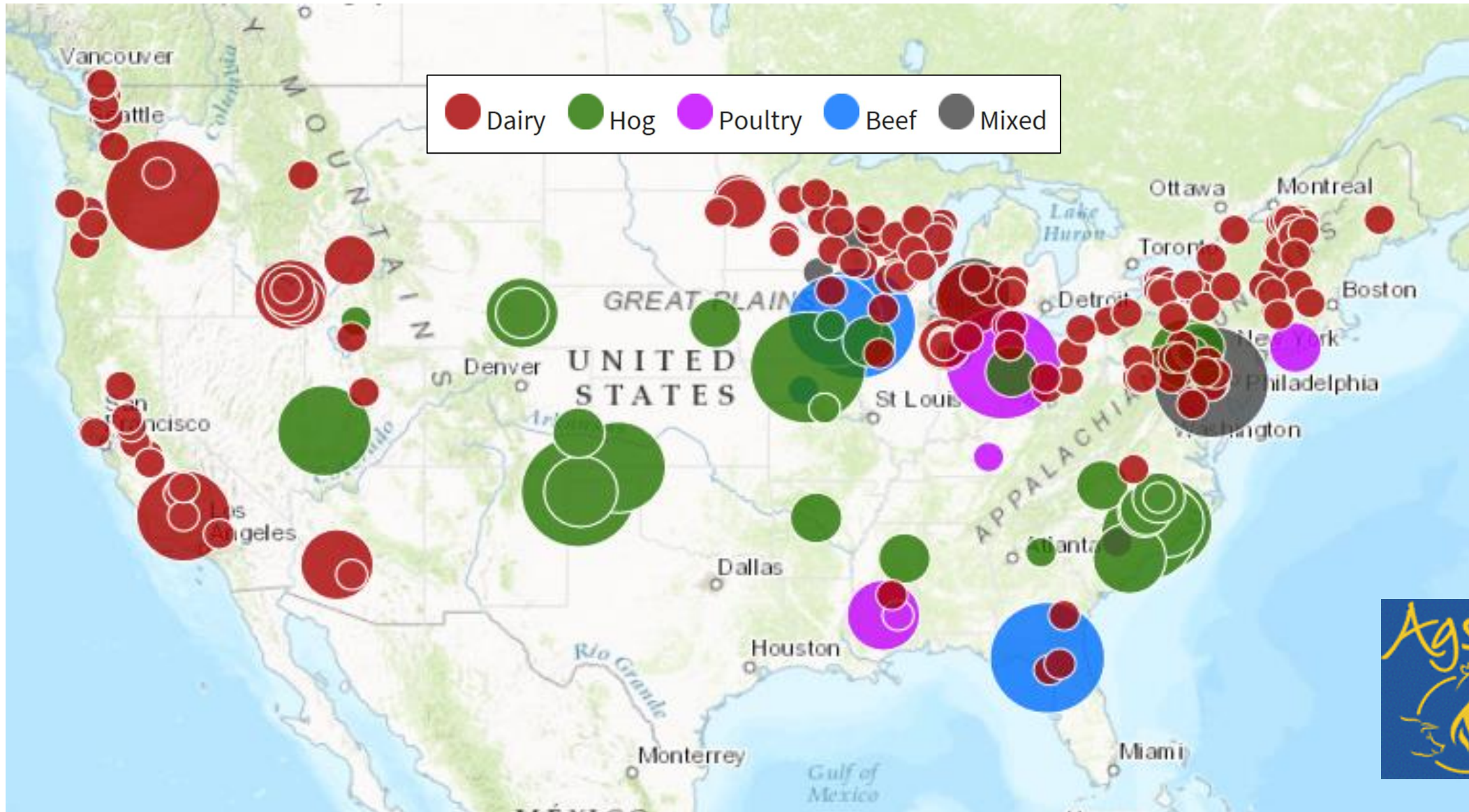
Lisa Noty, Regional Energy Coordinator (Midwestern),
lisa.noty@wdc.usda.gov

Driving the Industry Forward with Innovative Business Models

NICK ELGER, PROGRAM MANAGER
AGSTAR, US EPA



Anaerobic Digester Projects in the U.S.



Livestock Anaerobic Digester Systems in the United States

There is **potential** for about

8,000

additional livestock anaerobic digester systems in the U.S.



If **fully realized**, these digesters could produce

257 billion

cubic feet per year of biogas

That's enough energy to power

1 million American homes

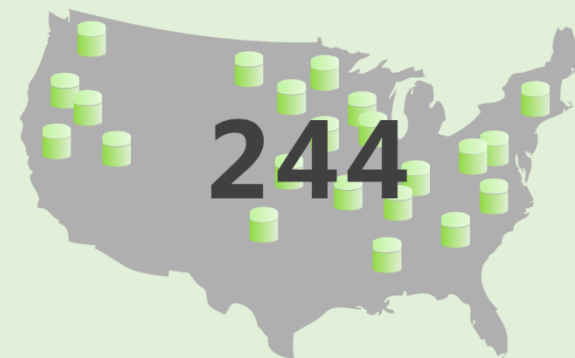
for one year, or provide natural gas to fuel

2 million passenger cars

for one year



There are currently



244

livestock anaerobic digester systems across the U.S.

195 
on dairy farms

32 
on swine farms

17 
on farms with poultry, beef, or a combination of animal types

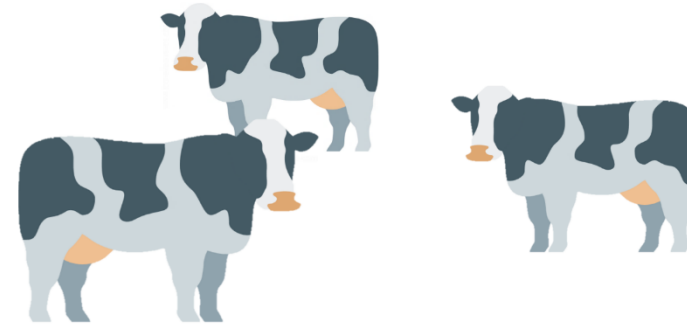


Nutrient Recovery Potential for U.S. Dairies

There is potential for about

2,450

additional dairy anaerobic digester systems in the U.S.



These systems could recover

330,000 tons of Nitrogen

and

110,000 tons of Phosphorus

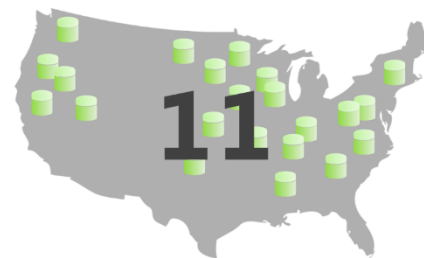
over the course of one year

Valued at

\$467 Million

\$325 Million

Currently, only

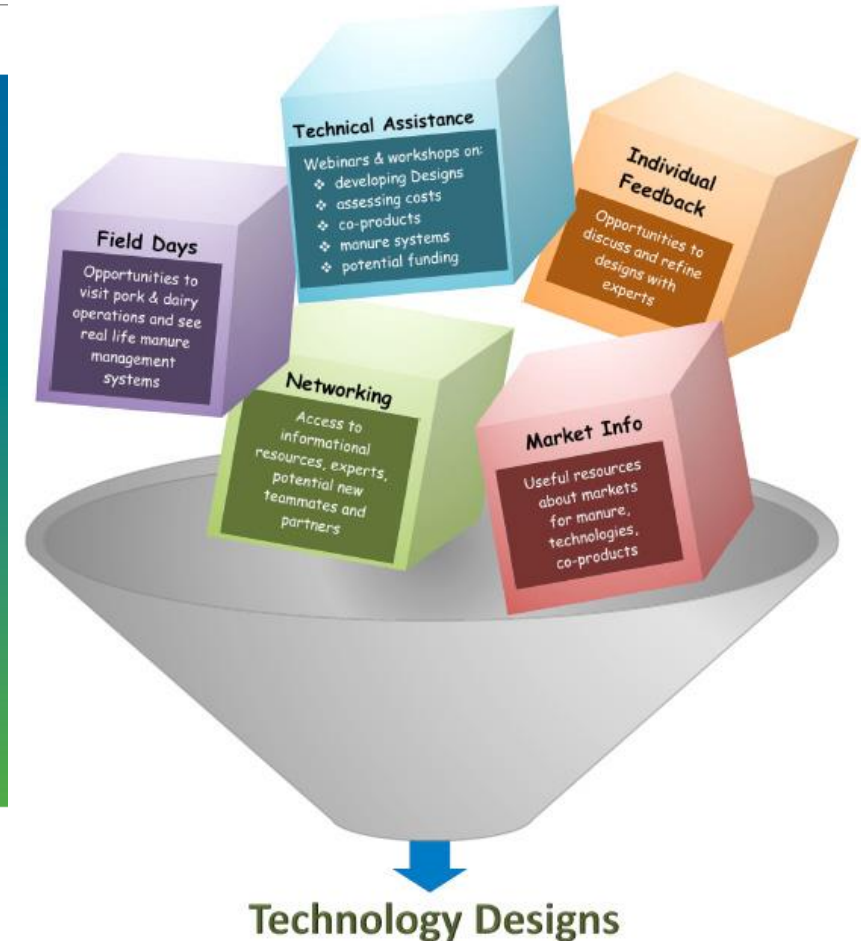


nutrient recovery systems are used on U.S. dairy farms with digesters

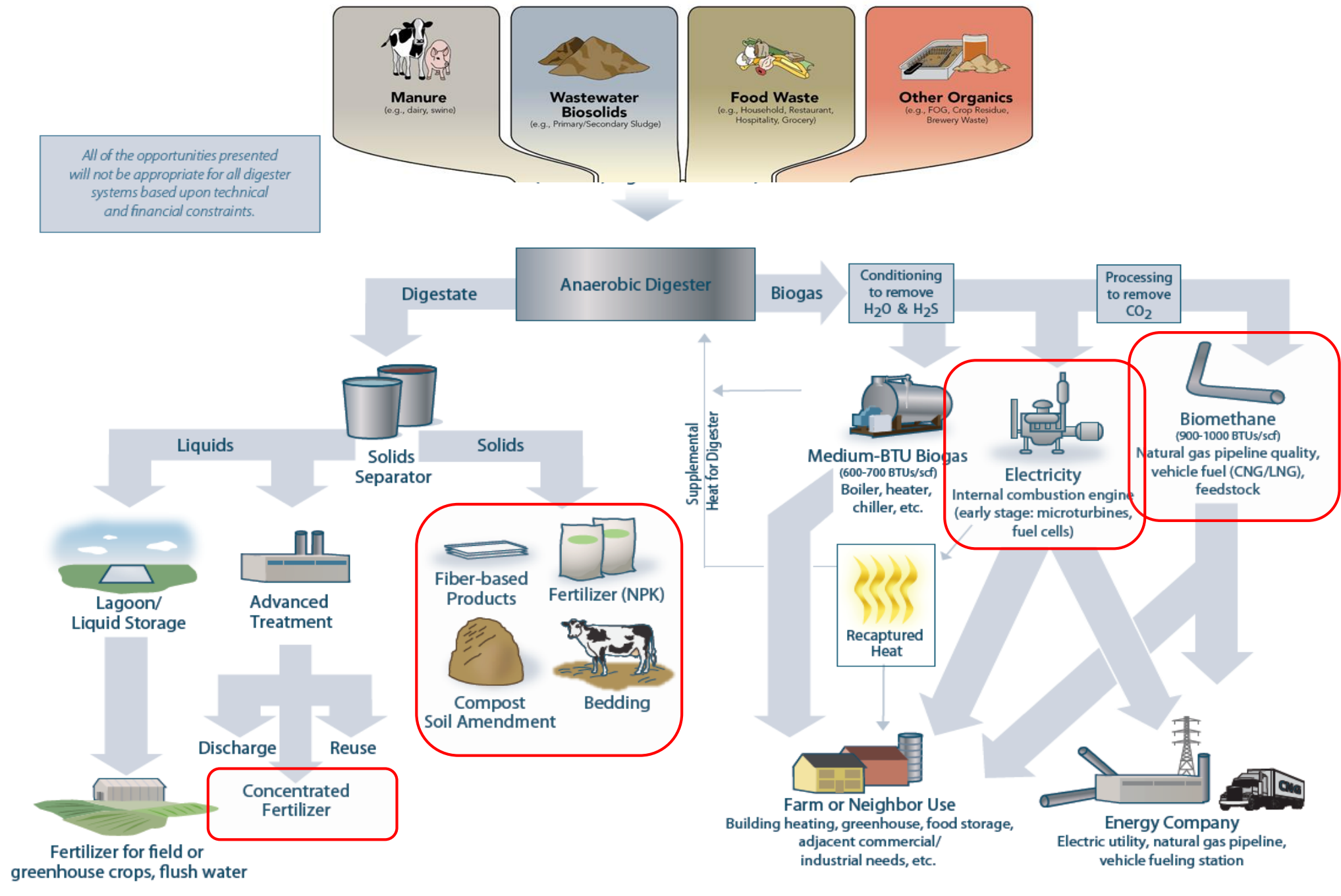
From Informa Economics report on National Market Value of Anaerobic Digester Products



EPA Nutrient Recycling Challenge – Phase II

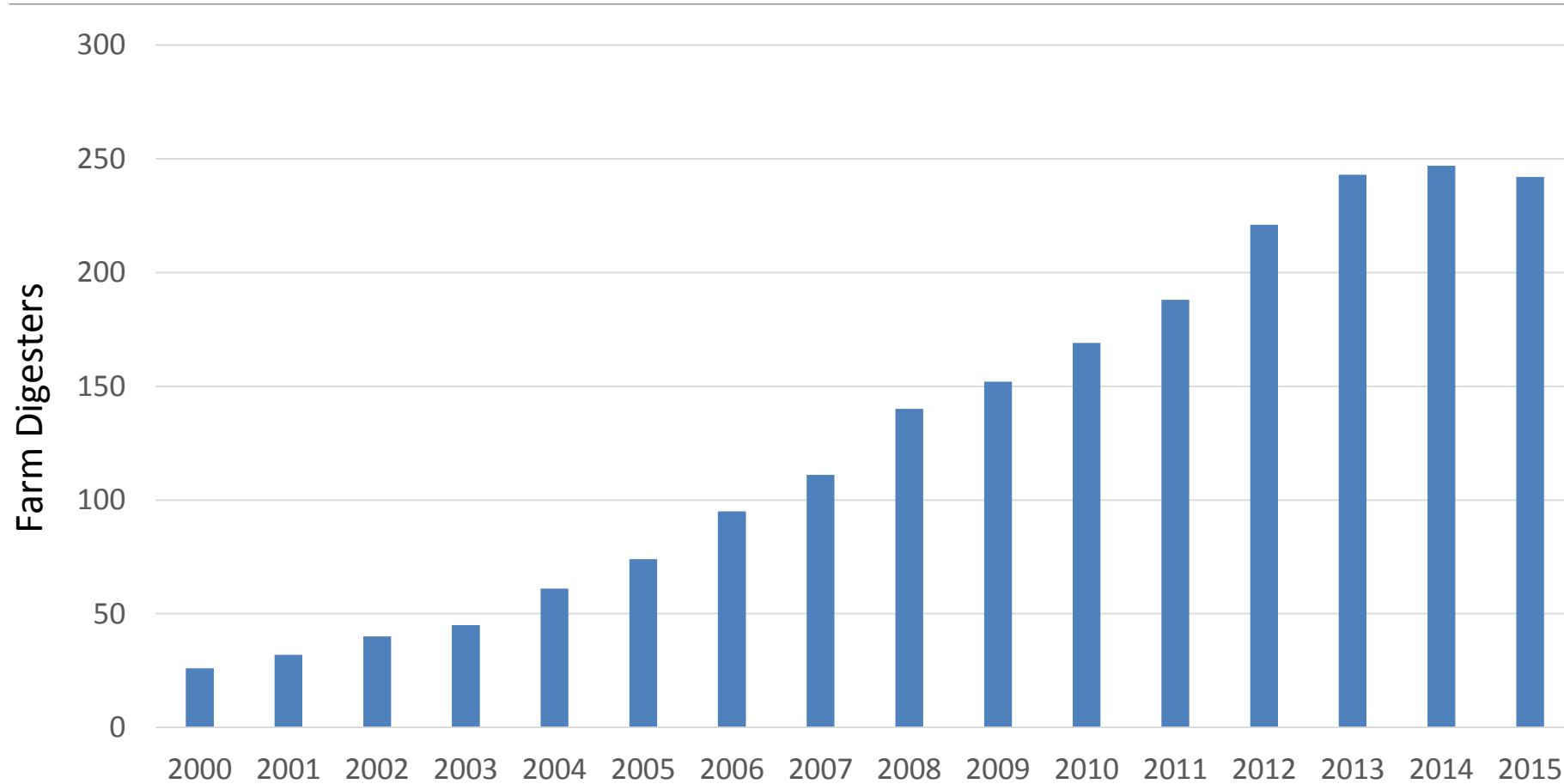


All of the opportunities presented will not be appropriate for all digester systems based upon technical and financial constraints.



What's Happening in the U.S. Market?

Growth in Farm Digester Market is Slowing



Why

Challenges Facing Digester Development

- Low energy prices
- Low milk prices
- Interconnection hurdles
- RFS Uncertainty



What can be done?



Finding the Right Business Model

- Share project risk and reward – not all on farmer
- Involve partners along the value chain – co-ops, customers, suppliers, processors
- Search for common goals – financial, public relations, market expansion
- Draw on strengths – marketing, contracting, permitting, energy, design, operations
- Evaluate third party investment, ownership, operation
- Diversify revenue portfolio– Eco-markets for manure solids and nutrients, alternative uses of energy and fuel, codigestion of food waste
- Be creative and open-minded
 - ...and you're going to hear a lot of that from our speakers today.



Anaerobic Digestion of Cow Manure and Food Wastes



Noblehurst Green Energy



AgSTAR webinar
May 24, 2017

Noblehurst Green Energy

Noblehurst Green Energy owns an anaerobic digester system adjacent to the Noblehurst Farms dairy complex. The complete mix digester was designed, built and commissioned by EnviTec Biogas, a Germany-based provider of on-farm biogas systems. The Noblehurst digester is the second EnviTec installation in the U.S., the first being a system at Lawnhurst Farms in Stanley, New York. EnviTec has over 450 digesters in 17 countries. Noblehurst chose EnviTec based on their experience and proven track record with complete mix digesters co-processing manure with food wastes.



Noblehurst Green Energy

The digester system is designed to receive two different types of substrates; 1) cow manure, and 2) food wastes. It all starts with manure from the Noblehurst dairy cows, which serves as the base volume of material to the tune of approximately 40,000 gallons per day.



Noblehurst Green Energy

Adjacent to the digester is a 42,000 gallon holding tank for liquid food waste. Substrates are conveyed directly from an adjacent dairy processing plant and trucked in from local food manufacturing customers. Also built into the system is a storage pad and conveyor for food scraps and other pre-consumer organics. That material is brought in by Natural Upcycling five days per week.



Noblehurst Green Energy

All of the substrates are received and conveyed into the EnviTec pre-mixing system, which consists of a fully instrumented indoor agitation tank that feeds a specific recipe/mixture into the digester.



Noblehurst Green Energy

The digester is a circular vessel that is sized to continuously stir 1.33 million gallons of material at a mesophilic design temperature of approximately 100-104 degrees. Biogas is produced and then conveyed to combined heat and power (CHP) system. The CHP is capable of producing up to 440 kW. The system is interconnected with the utility provider's (National Grid) power line infrastructure that runs in front of the complex. This power is "net-metered", such that each kWh of electricity produced by the CHP can be offset by each kWh of electricity consumption on-site. By re-investing in the conversion of methane gas to renewable energy, Noblehurst Green Energy is further strengthening Noblehurst Farms' commitment to agricultural resource stewardship.



Recipient of the 2016 Innovation Center for U.S. Dairy
Outstanding Achievement in Community Partnership

Noblehurst Green Energy

Why undertake such an initiative and investment?

Noblehurst Green Energy

- Drivers
 - Business diversification
 - Reducing dairy costs (lower electricity costs over time)
 - Eliminating smell in the manure
 - Providing service to on-site milk processing facility
- Goals
 - Self sufficiency – “standing on its own” financially
 - Income diversification (electricity and food waste)
 - Job creation

Noblehurst Green Energy

- Opportunities – “Challenging” Feedstock



Noblehurst Green Energy

- Challenges
 - Logistics: from customer to disposal site
 - Contamination: wanted control over the feedstock quality
 - Variety: all food waste isn't created equal
 - Episodic: especially on packaged food waste
- Solution



Natural Upcycling

- Created in March 2014 and Founded by
 - Harry Cohen – formerly of Total Organics Recycling of St Louis, MO
 - Christopher Noble – Noblehurst Green Energy of Linwood, NY
- Quickly evolved into Upstate New York's premier food scraps/organics recycling collection company
 - Source-separated organics collection
 - Collecting in Rochester, Buffalo, Syracuse, Ithaca / Tompkins County, Albany / Hudson Valley / western MA and all points in between
 - Food waste depackaging services
 - **Recycling** and/or **upcycling** of packaging & pallets to achieve a zero waste solution in many cases

What Can Be Upcycled?



Organics Pickup Service

- Participating businesses place food waste in color-coded bins located in kitchens or food prep areas.
- Once bins are loaded, they are wheeled to a back dock or other convenient location to be picked up.
- These bins are serviced up to 5 days per week by a specialty vehicle and cleaned by a high pressure system all contained within the truck.
- Sanitized containers limit odor and provide a sterile work environment.



Packaged Food Waste

- Specifically tailored to Food Retailers and Manufacturers
- Heightened food safety standards and product recall costs are increasing amount of packaged food waste disposed of
- Regulation and solidification costs rising at NYS landfills
- Heterogeneous product mix and one-time events makes for challenging disposal solutions – needs to be flexible



What We Do Well

- Align with companies that are leaders in sustainability
- Reduce methane gas emissions & create renewable energy
- Communicate with our partners and customers
- Share the message of keeping food waste out of landfills
- Core value of doing the right thing

Sample Customers



Looking Ahead

- NYS DEC has drafted regulations for large food waste generators to ban food waste from landfills by 2021
- FSMA (Food Safety Modernization Act) implementation will push more food waste out of the animal feed sector
- Consumers more aware of sustainability factors; more willing to purchase from companies that prioritize sustainability
- Those who can address food waste contamination at the source will be at a competitive advantage
- Advances in manure management technology. Nutrient recovery and dewatering as prime drivers.

Looking Ahead

- New York State Governor Andrew Cuomo Methane Reduction Plan:
 - State agencies directed by Governor to develop proposals and policies to inventory methane emissions and identify strategies for methane capture and elimination.
 - The Plan is a framework to reduce emissions from the three sectors responsible for the majority of methane emissions:
 - Oil and gas
 - Landfills
 - Agriculture

“The plan outlines the work that will continue to lower methane emissions in the agricultural sector, including those associated with manure management and livestock.”

Looking Ahead

EnviTec-Biogas commissioning third and fourth digesters in New York



Lamb Lakeshore Dairy, Wilson, NY

Adirondack Dairy, Peru, NY





**“Hub & Spoke” Digestion
Combining Urban Organics
+ Ag Wastes**

Green Cow Power, Goshen IN

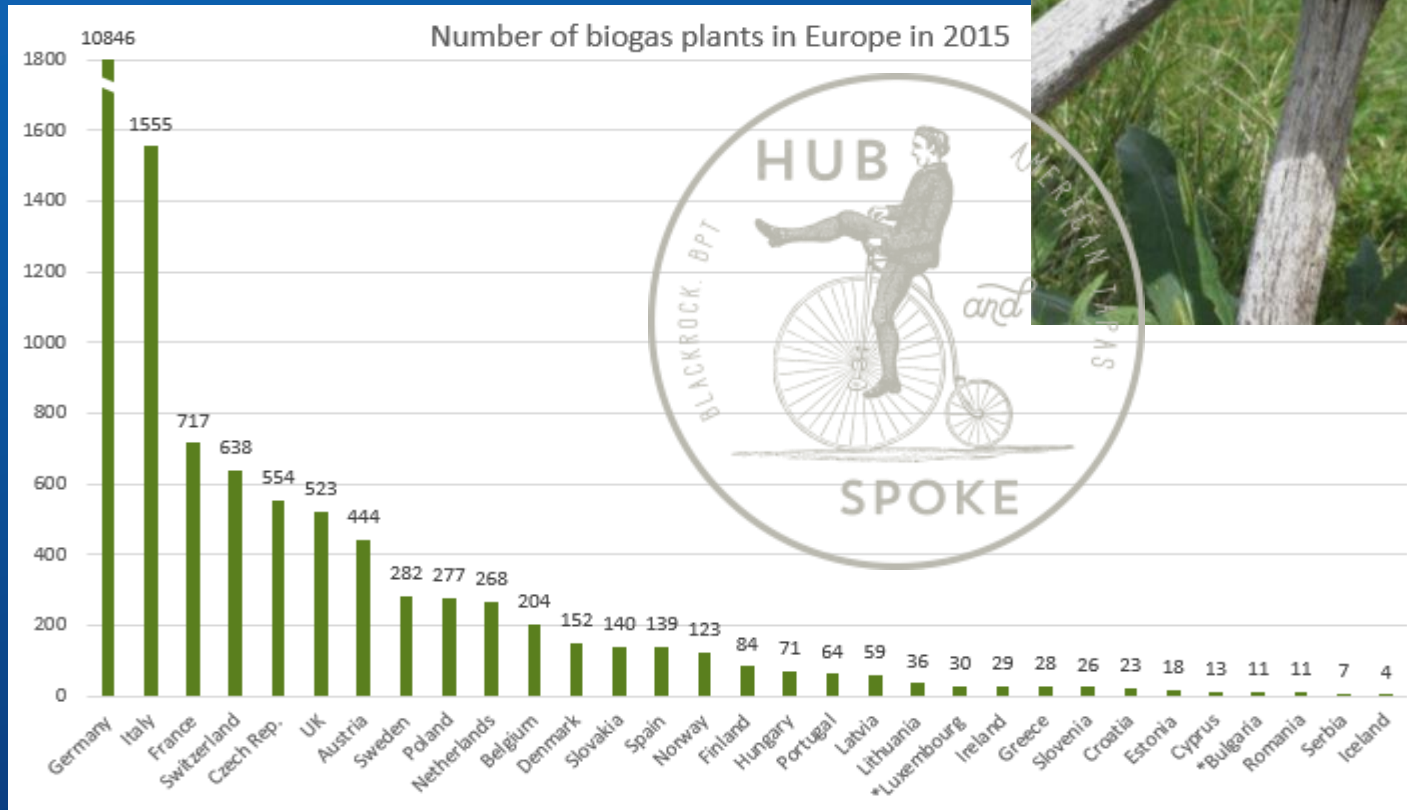


- Based in Wisconsin, USA
- Founded in 1989 by Steve Dvorak, P.E.
 - Packerland (meat processor) digester in 1985 – still operating
- Our first digester (new patented design)
 - Gordondale, WI in September 2001
- DVO is the USA market leader, with 120 vessels operating at 90 sites in 18 U.S. states
- Chile, South Korea, Serbia, Canada, China
- +80 MW combined power generation capacity



HUB & SPOKE MODEL

- Not new!...there are
- Thousands in Europe, but
- Many are quite small and
- Depend on energy crops



WHAT'S CHANGED?

- Lower (or no) tariffs & incentives
- No energy cropping (USA)
- Larger-scale installations
- Newer sources of organics, due in part to:
 - Desire to divert organics from landfills
 - Desire to cease land application of high-strength organics
 - Tighter regulations on composting



MONETIZING DIGESTATE TREATMENT



- When a very significant expense can be turned into another revenue stream... why discharge to a city or waterway?
- We can remove **80-90% of P, and 70% on N** from digestate, *at a profit.*

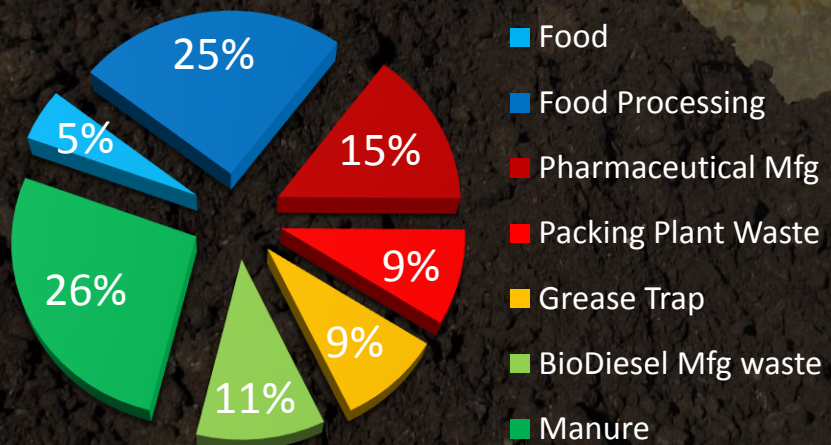
"FREE" BIOGAS PRETREATMENT

Highly efficient H₂S removal,
Low Cap-Ex, & virtually
zero Op-Ex

DRY WASTE PROCESSING...



By recycling treated digestate up to **70% DM** averaged dry inputs can be processed – making a low or even “zero” discharge config. possible.



NEW SOURCES FOR URBAN ORGANICS

A few examples:

- Expired goods
- Food production wastes
- Meat & dairy processors
- Organics from MSW
- Military bases
- Grease traps/FOG
- Industrial organics

NEW BIOGAS MARKETS



Renewable CNG

When used as a transportation fuel to replace diesel or gasoline, renewable CNG earns additional credits – an attractive revenue option.



ENHANCED FERTILIZER SALES



EXAMPLE: "MAGIC DIRT"



Magic Dirt is sold by Walmart stores in NE USA

- Expanding nationwide to +3000 stores in 2017

SITE OPTICS



SITE OPTICS



Example: DVO Mixed-wastes facility in South Korea,
Accepts hog manure and urban food wastes



Commissioned in 2016

Unique features:

- Highly populated area
- Fertilizer plant,
- Odor containment,
- Tight pathogen controls



ODOR CONTROL (CRITICAL)



Odor containment facility for receiving organic wastes (the digester itself destroys odor, it does not produce it)

MIXED WASTES – A BASIC INSTALLATION

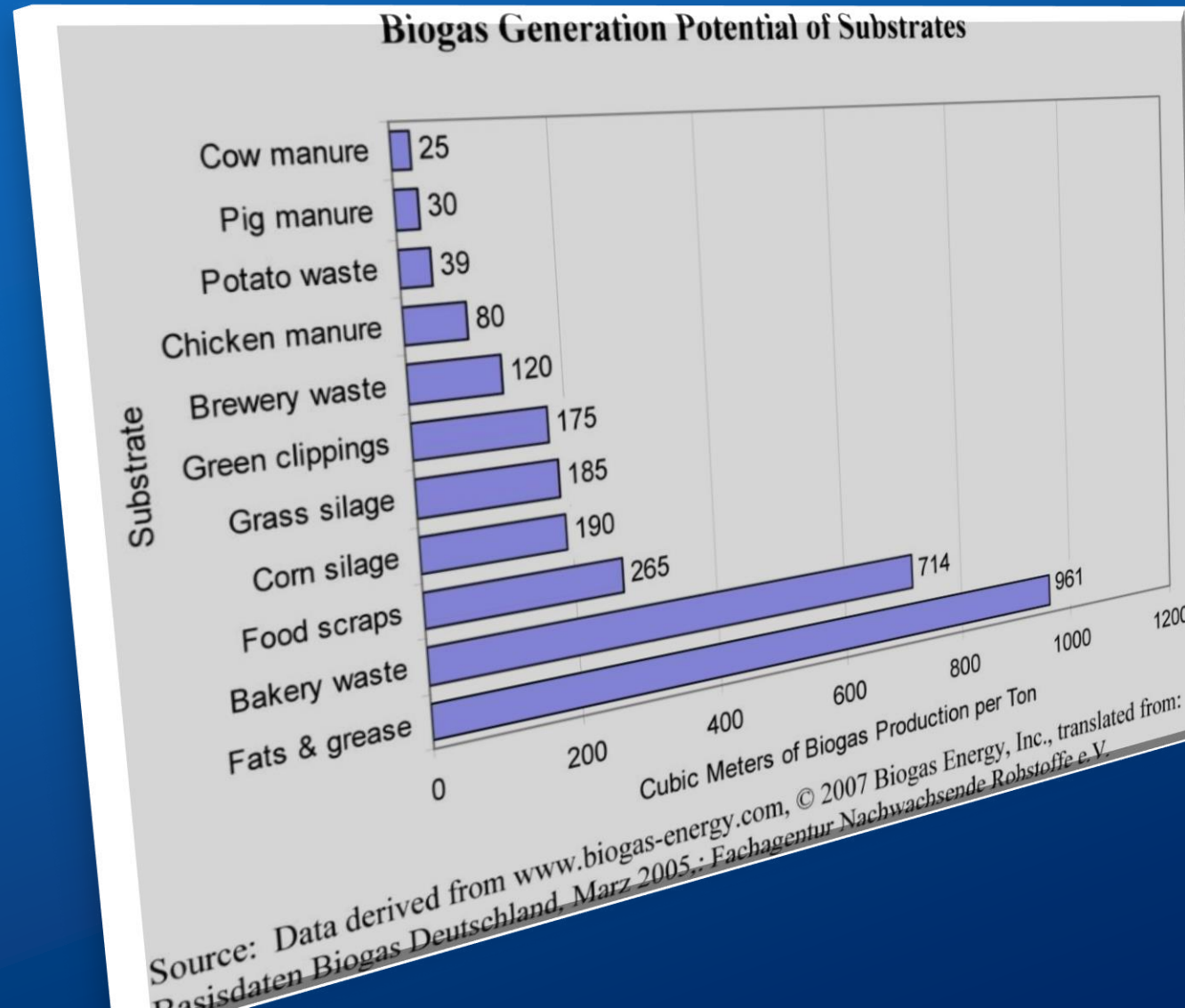
green
COW
POWER

24130 County Road 40
Goshen, IN 46526

COMBINES DAIRY WASTE + URBAN ORGANICS

**Urban organics
accounts for 80% of
the power generated**

FEEDSTOCK ENERGY VALUES



65 TONS DELIVERED DAILY



**Food production
wastes, cheese whey
& ethanol production
products**

EXCAVATION, FALL 2013



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POUR IN-PLACE CONSTRUCTION



CONCRETE COVER



FULLY COMMISSIONED, SPRING 2015

High-Strength AD Challenges:

- Startup
- Equalization
- Sanitizers
- Inorganics

FULLY COMMISSIONED, SPRING 2015



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SOLIDS AUGERED TO MIXING PIT



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MANURE FROM 2,000 DAIRY CATTLE ADDED



PRETREATMENT



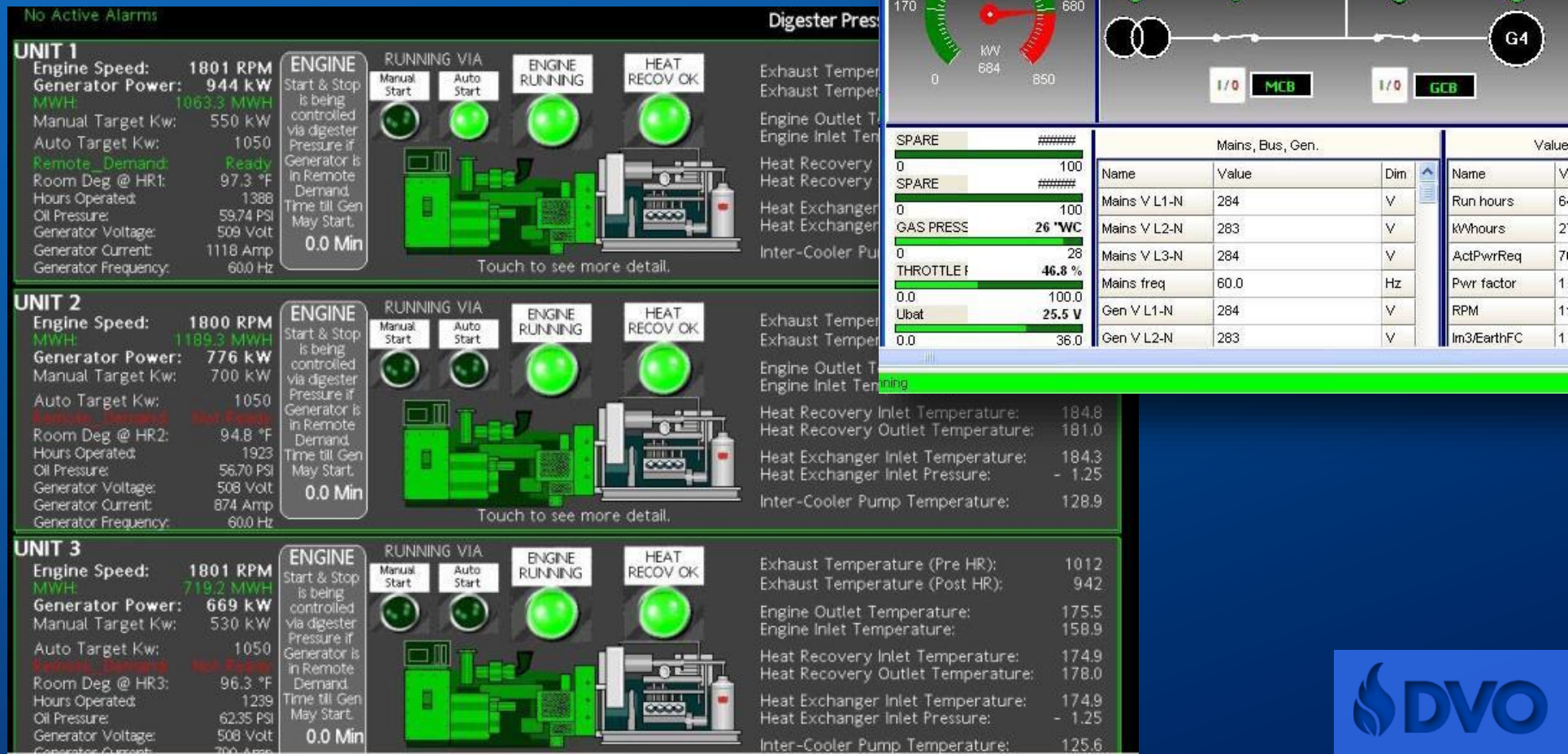
SINGLE OPERATOR DESIGN

Activities

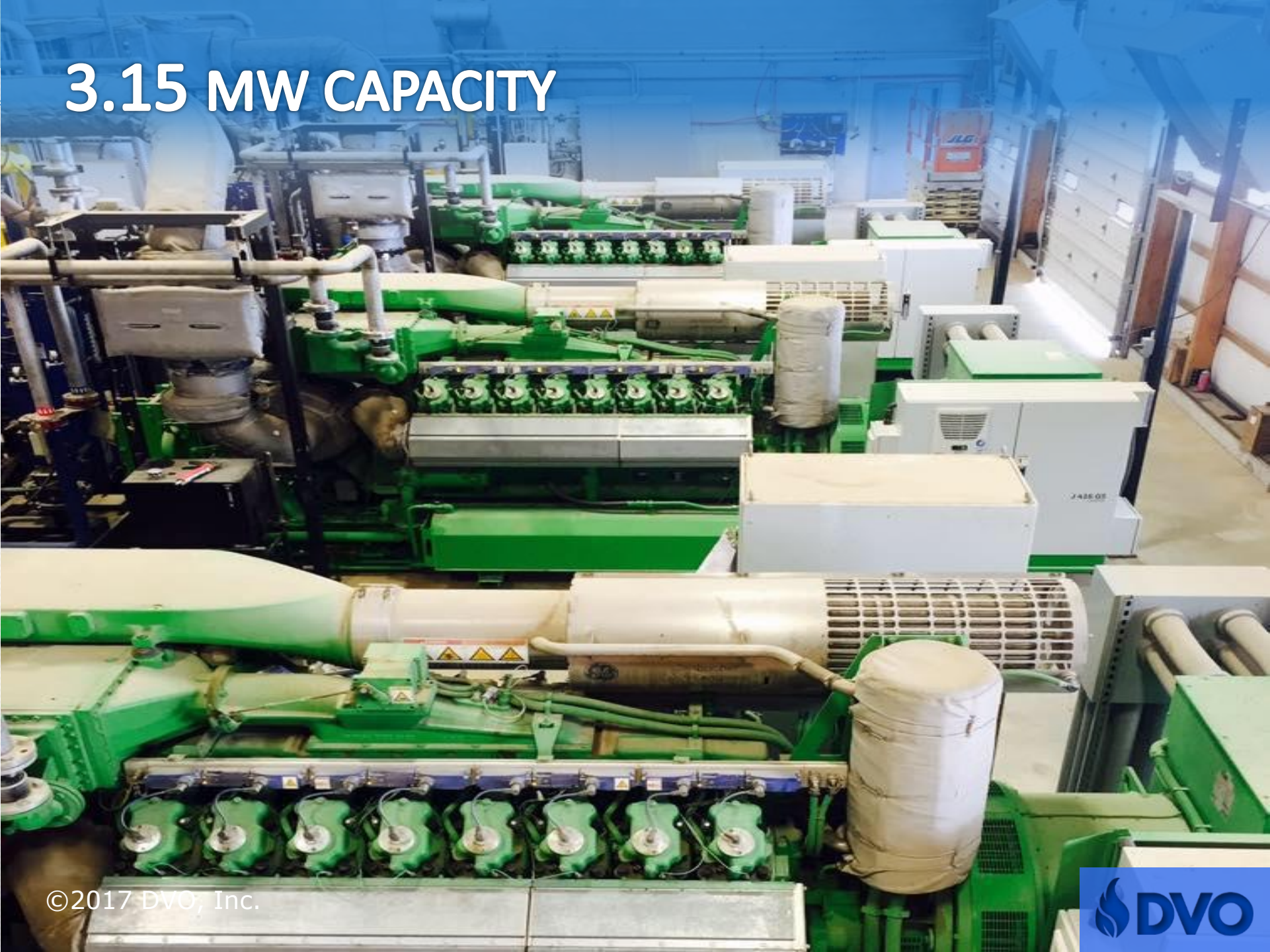
- Truck traffic
- AD inputs
- AD O&M
- “Light” genset O&M

REMOTE MONITORING

- Generation equipment can be monitored and controlled remotely...



3.15 MW CAPACITY



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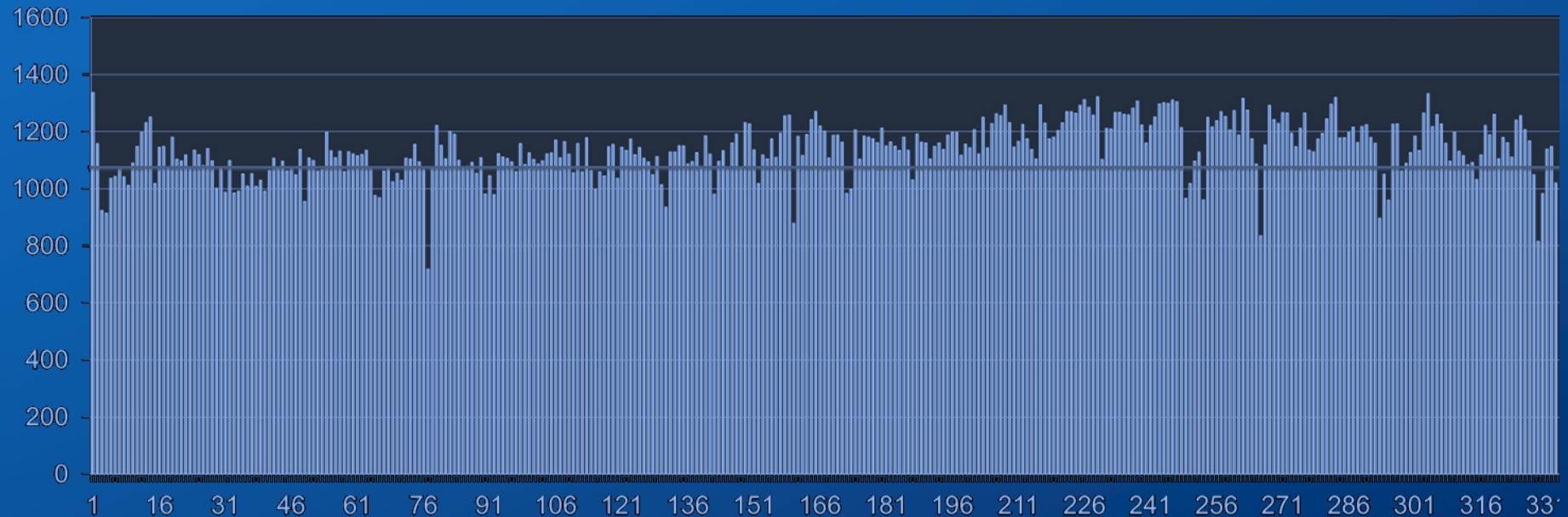
DVO'S LARGEST: 6.3MW TOTAL



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BUFFERING, FOR CONTINUOUS POWER



- High-strength wastes are buffered & fed to the digester over time
- Power production is not dependent upon the sun, or wind...

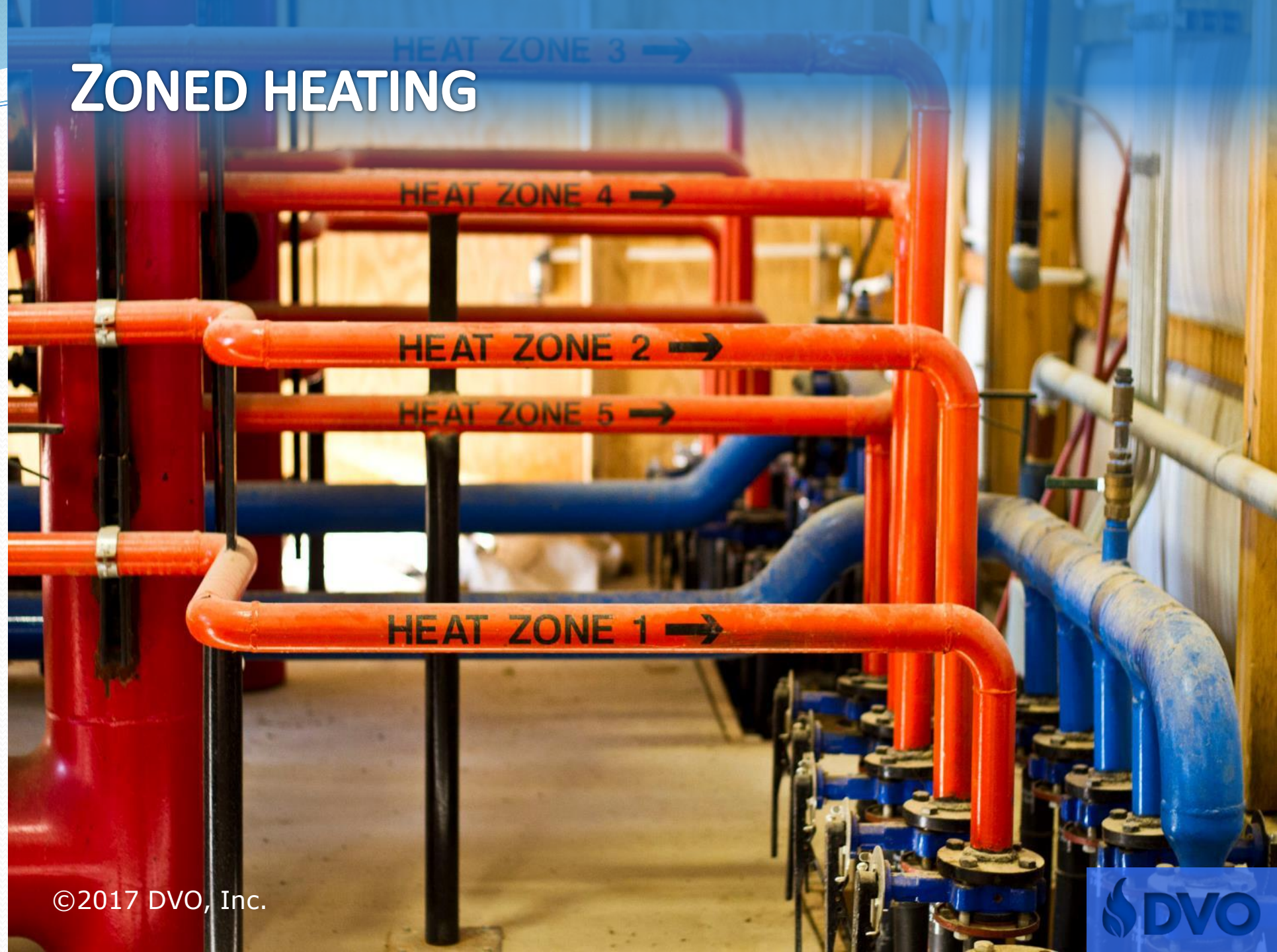
HEAT RESERVOIR



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ZONED HEATING



ZONED MIXING SYSTEM

©2017 DVO, Inc.



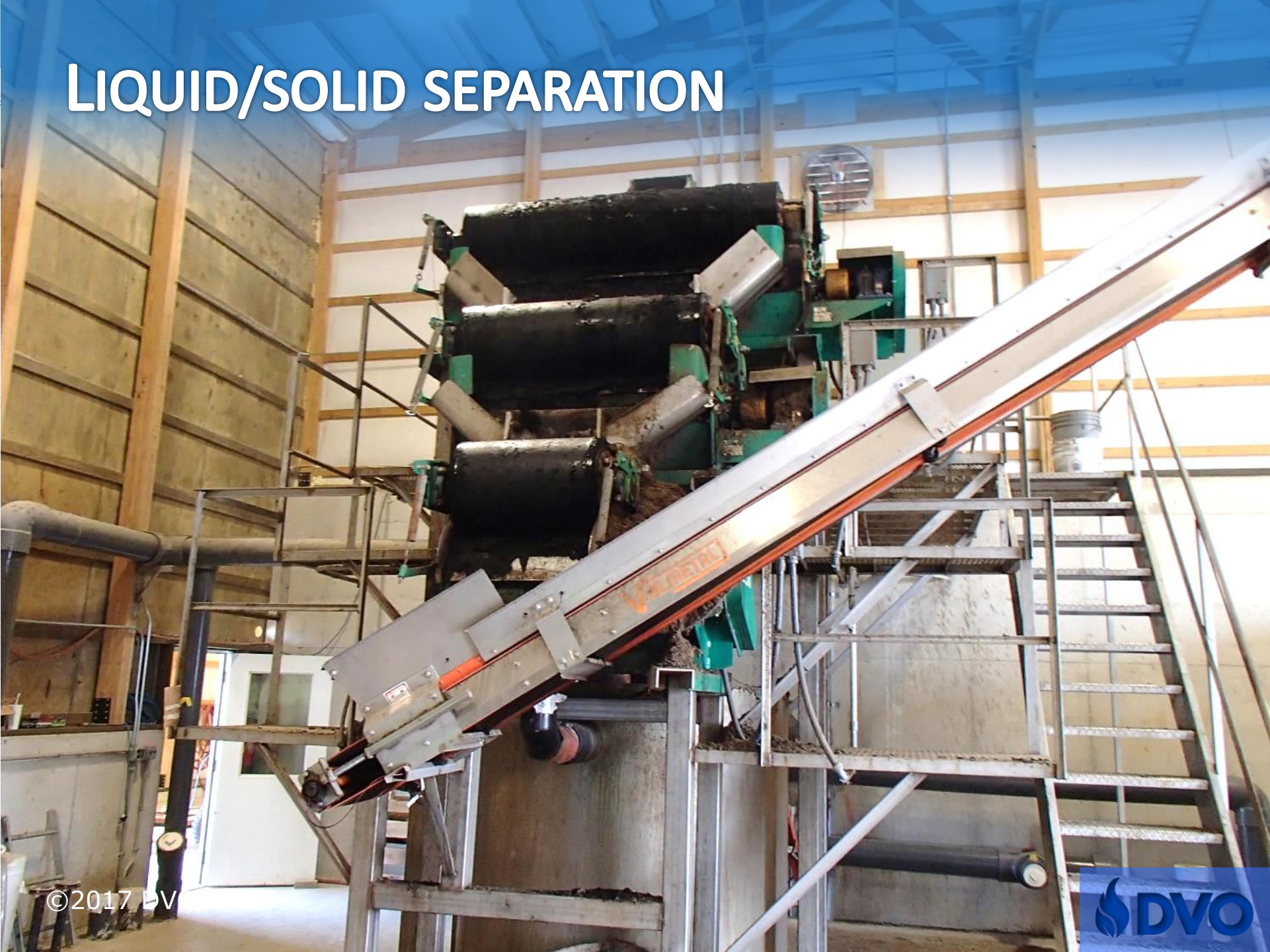
MOSTLY STAINLESS PIPING



©2017 DVO, Inc.



LIQUID/SOLID SEPARATION



FIBER SOLIDS

Often sold for use as:

- Animal bedding
- Landscaping
- Peat moss replacement
- Fertilizers

DIGESTATE STORAGE



LIQUID FERTILIZERS





**"One-third the operating
cost of centrifuges.
Better performance.
You need this.
- George DeRuyter,
Owner**



**ANAEROBIC
DIGESTION**



**AMMONIA
RECOVERY**



**PHOSPHORUS
RECOVERY**



**NITROGEN
REMOVAL**



**STREAM
DISCHARGE**

Tell Your Phosphorus Where To Go.

DVO's advanced Phosphorus Recovery system provides for a more efficient and cost-effective nutrient recycling solution for municipalities, farmers & agribusinesses.

Revolutionary results.

Treating wastes using DVO's patented *Two-Stage Mixed Plug Flow™* anaerobic digester and proven, automated Phosphorus Recovery (PR) system removes 80-95% of phosphorus from digested wastes.

The ability to economically remove phosphorus, and greatly reduce the "pollution potential" of farm wastes in particular, is a breakthrough for the industry.

Keeping our waterways clean.

Farm and commercial bio-wastes can introduce excess phosphorus to the environment. Phosphorus is a valuable fertilizer for agriculture, but too much of it in waterways can cause damage to sensitive aquatic ecosystems.

New, marketable byproduct.

The extracted phosphorus is a condensed solid that is stackable, storable, spreadable and profitable. This new byproduct can be easily transported and marketed as a soil amendment, fertilizer or potting soil/peat moss replacement.

Very low operating costs.

Operating costs for DVO's PR system are dramatically lower than the cost of transporting nutrient-rich liquid long distances to the land that needs it. Typically, < \$0.002 /gallon processed.





INFO@DVOINC.COM CHILTON, WI USA 920 . 849 . 9797

Questions

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Wrap Up

- Today's presentation will be posted to AgSTAR's website on the Events page
- To learn more about EPA's AgSTAR program and the benefits of biogas recovery projects, visit AgSTAR's website at www.epa.gov/AgSTAR
- Please fill out the online webinar evaluation form
– your feedback is much appreciated!

 United States Environmental Protection Agency

Environmental Topics Laws & Regulations About EPA

AgSTAR: Biogas Recovery in the Agriculture Sector Share Contact Us

Anaerobic Digestion at Work on Livestock Farms

Check out our [Stories from the Farm](#) for a first-hand account of project operations, lessons learned, benefits and challenges.



1 2

- [Learn About Biogas Recovery](#)
- [Browse the AgSTAR Library](#)
- [Project Database](#)
- [How AgSTAR Works](#)
- [Market Data and Trends](#)
- [Codigestion Guidelines](#)
- [Frequent Questions](#)
- [Events](#)

AgSTAR promotes the use of biogas recovery systems to reduce methane emissions from livestock waste. In addition to producing biogas, anaerobic digestion systems can also help achieve other social, environmental, agricultural and economic benefits.



Learn about Biogas Recovery

- [How does anaerobic digestion \(AD\) work?](#)
- [Explore stories from the farm](#)
- [Realize the benefits of biogas](#)
- [AgSTAR National Mapping Tool](#)



Implement AD Projects

- [Is AD right for you?](#)
- [Determine financing options](#)
- [Review guidelines for AD systems](#)
- [View the vendor directory](#)
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