



Covered Lagoon Digesters (Ambient Temperature)

Mark Moser

RCM International

Oakland, CA

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RCM International LLC

Digester Solutions

- >25 years building digesters on farms
- >85 digesters operating
- Digesters are our only business
- Complete Mix, Plug Flow, Covered Lagoon
- Staff in CA, NY and PA, Projects worldwide

**RCM Plug Flow Digester
Langerwerf Dairy, Durham, CA 1983,
300 cows, 70 kW,**



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contact@rcmdigesters.com
510-834-4568**

RCM Complete Mix Digester Kreider Dairy – Quarryville, PA 700 cows, 225 kW



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RCM 28,000 beef plus stillage complete mix digester w concrete cover



Tollenaar Dairy, CA, 1000 cows, 225 kW Heated Mixed Covered Lagoon



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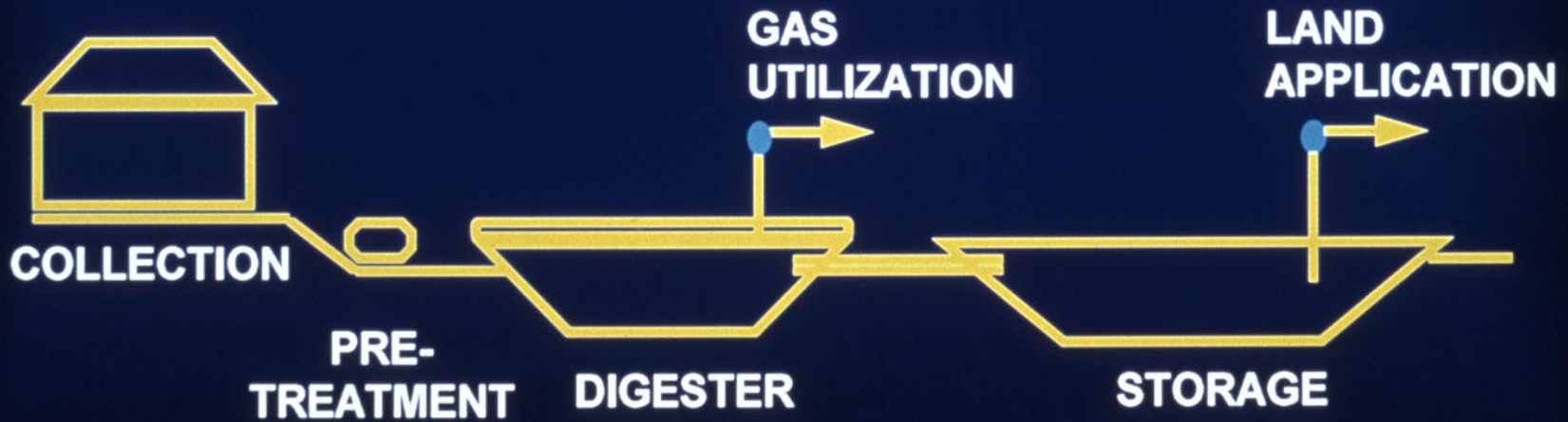
238,000 Finishing Pigs, Heated Covered Lagoon Digester, Chile

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Covered Lagoon Digester

- Aka “Ambient Temperature Digester” or Psychrophillic Digester
- Single Purpose Lagoon with optimized design to produce biogas
- Used for flush or dilute manure
- Not a manure storage facility

Covered Lagoon Digester



Covered Lagoon Digester Castelanelli Brothers, Lodi CA



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Covered Lagoon Digester

- Receives dilute manures with $< 2\%$ solids
- Best used in warm climate
- No supplemental heat required
- HRT > 30 days
- Remove floatable solids and sand before digester

Advantages

- Low Cost to Build/Operate at any size
- Extremely low cost at large sizes
- Very easy to operate
 - Feed the digester the designed amount and it will make gas
 - Nothing to adjust
- Maintenance should be almost zero



600 Cow Covered Lagoon Digester, California

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An aerial photograph of a large-scale covered lagoon digester facility. The facility consists of numerous rectangular basins covered with a translucent, greyish material. A central channel of water runs through the middle of the basins, reflecting the sky. The background shows a clear blue sky with scattered white clouds and some industrial structures in the distance.

6,000 Cow Covered Lagoon Digester, Chihuahua, Mexico

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4,000 nursery pigs – Ecuador

Covered lagoon digester



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103,000 Finishing Pigs, Covered Lagoon Digester Chile

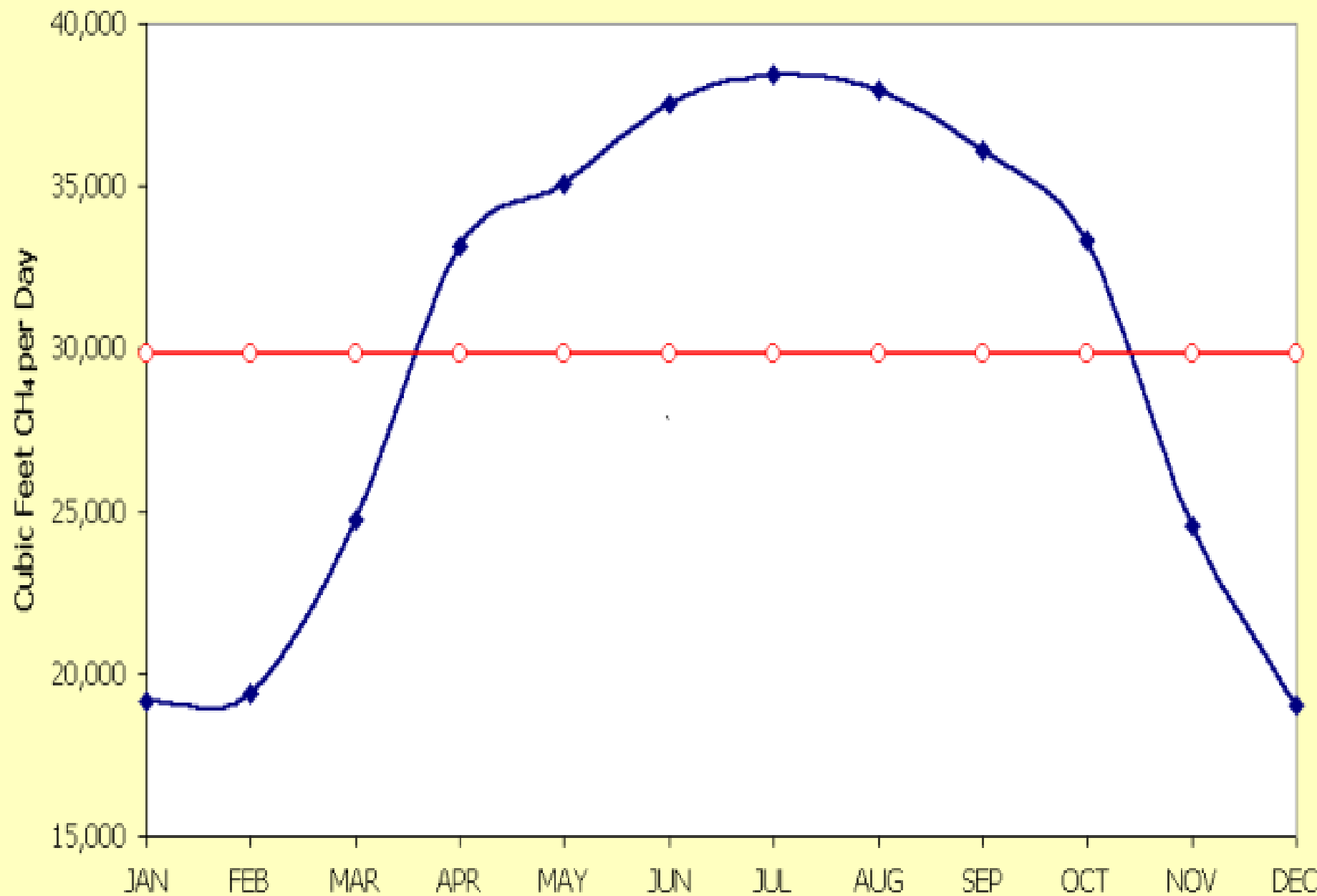


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Limitations

- Biogas production varies seasonally
- Difficult to build in high ground water area
- Manure pre screening/settling required

Illustration of Monthly Mean v. Annual Mean

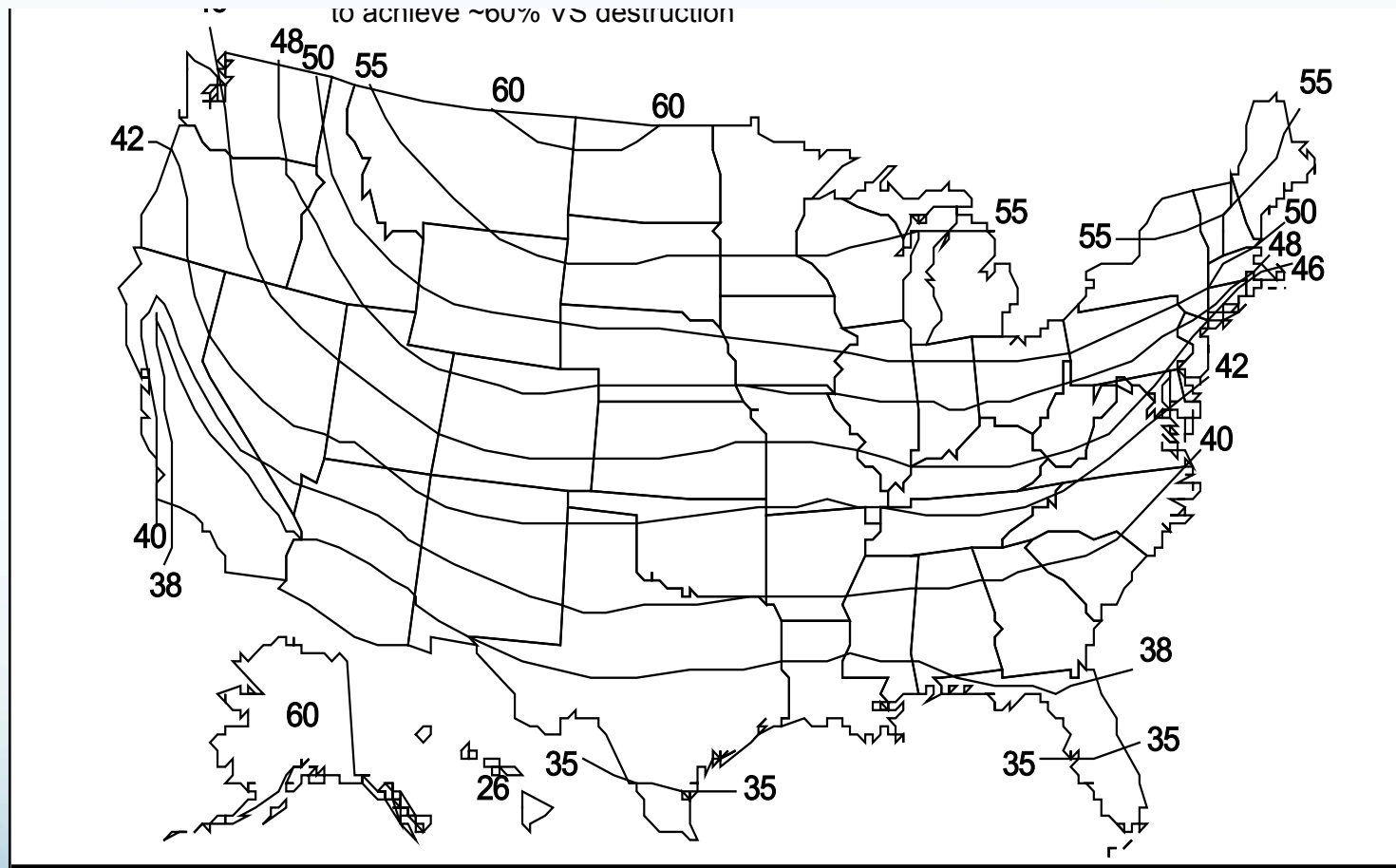


Digester Design

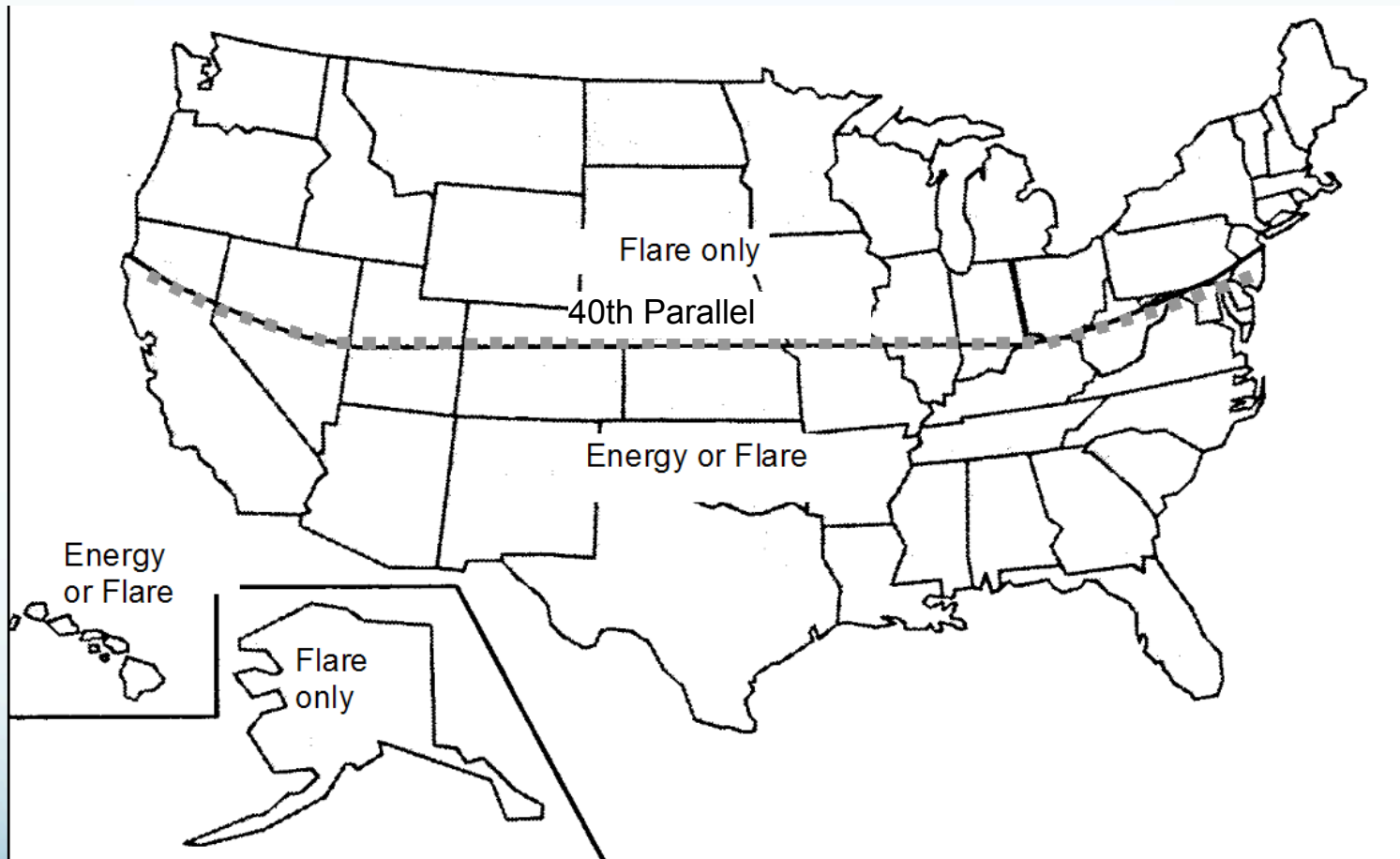
- NRCS Practice Standard 366
- Design based on waste strength or Hydraulic Retention Time (HRT)
- Consider Soil Type
- Liner may be needed
- Gas seal critical
- Inlet/Outlet location recommendation

Sizing a Covered Lagoon

NRCS Practice Standard 366



USDA NRCS Guidance – Use of Biogas



Baldwin Dairy, Baldwin, WI

Odor control, rainfall exclusion cover

Built 1999

Gas flaring 5 –6 months per year

Lagoon by NRCS, Cover by EFI

Gas handling by RCM Digesters

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**Castelanelli Brothers Dairy Lodi, CA
Covered Lagoon Digester 2,000
cows, Sand Bedding, Flush**

300 kW Generator

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RCM Digesters

La Ramirana 30,000 pigs Covered lagoon digester



Covered Lagoon Digester Components

1. Digester
2. Solids/Sand Recovery
3. Digester
4. Gas Management and use
Compression, cleanup, use, safety

Components Lagoon Digester



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Components – Cover

**5000 cows, Covered Lagoon Digester,
California**

**Cover Collects and Directs Gas
and Manages Rainwater**

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**Component
Solids Separator
before
Covered Lagoon
Digester**

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Component – H₂S Gas Scrubber



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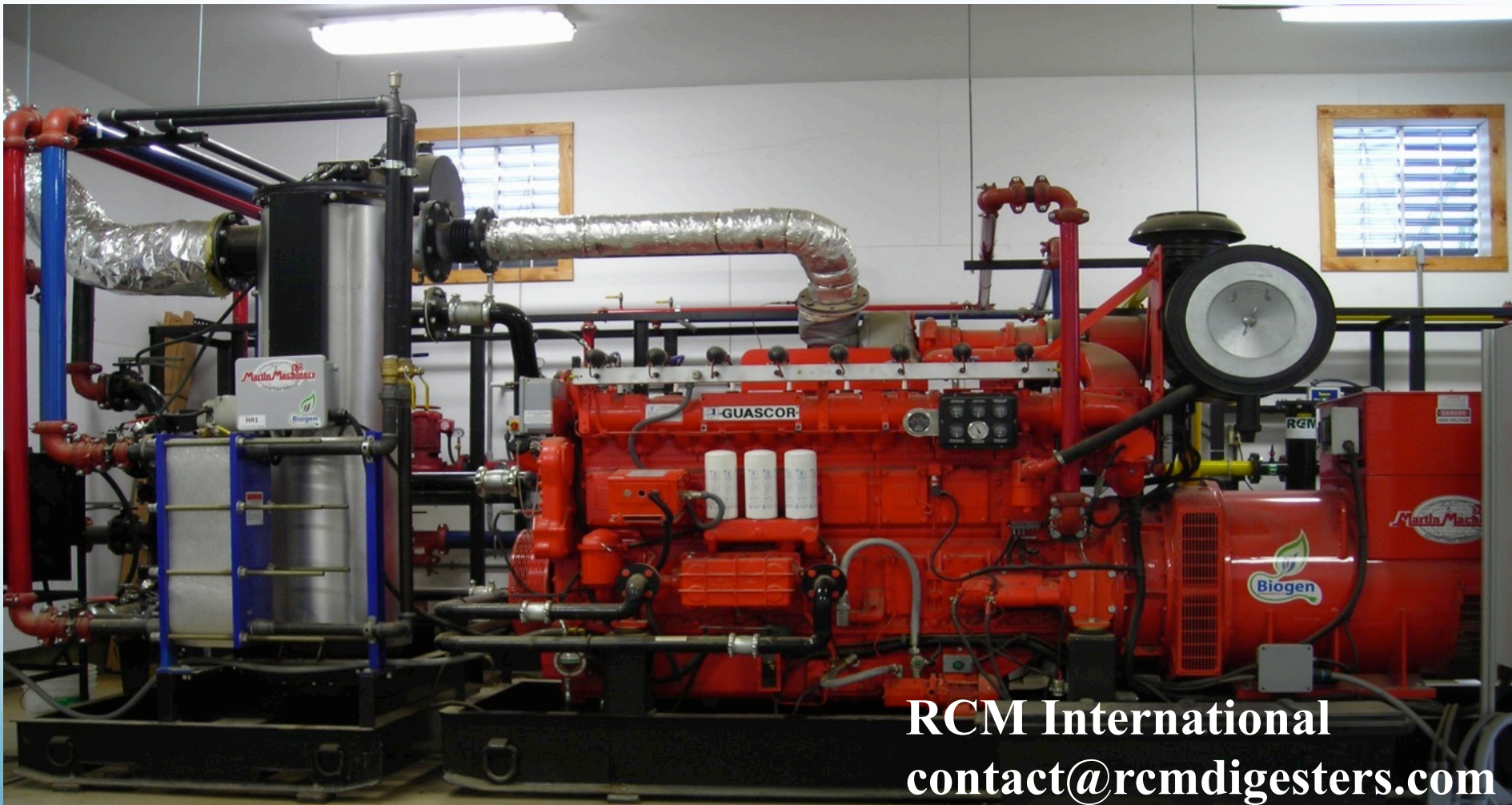


Gas Handling
Castelanelli, Lodi,
Ca

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Component Gas Use: 300 kW



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800 kW Generator

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400 hp Biogas Boiler and Gas Skid, Chile



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Component -Safety Flare



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Can you add Food waste to a covered lagoon? Plan for it



Can you heat a covered lagoon digester?

- The answer: Maybe
- Lagoon temperature can be raised depending on the climate
- Results of heating a covered lagoon are better gas production in colder months
- Typically there is not enough gas or waste heat to raise a digester into mesophilic temperatures in the winter.

Nitrogen removal after Covered Lagoon Digesters



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RCM International – What we do:

RCM Digesters:

Plug Flow, Complete Mix, and
Covered Lagoon digesters

RCM Services

1. Cost Estimates
2. Detailed Feasibility Studies
3. Design and equipment supply
4. Equipment Manufacturing
5. Turnkey construction



Manure Odors

Sample	TON*	Odor Impact
Undigested Influent	247	--
3-day Storage	437	77% Increase
Digested Effluent	7	97% Reduction

*Total Odor Number