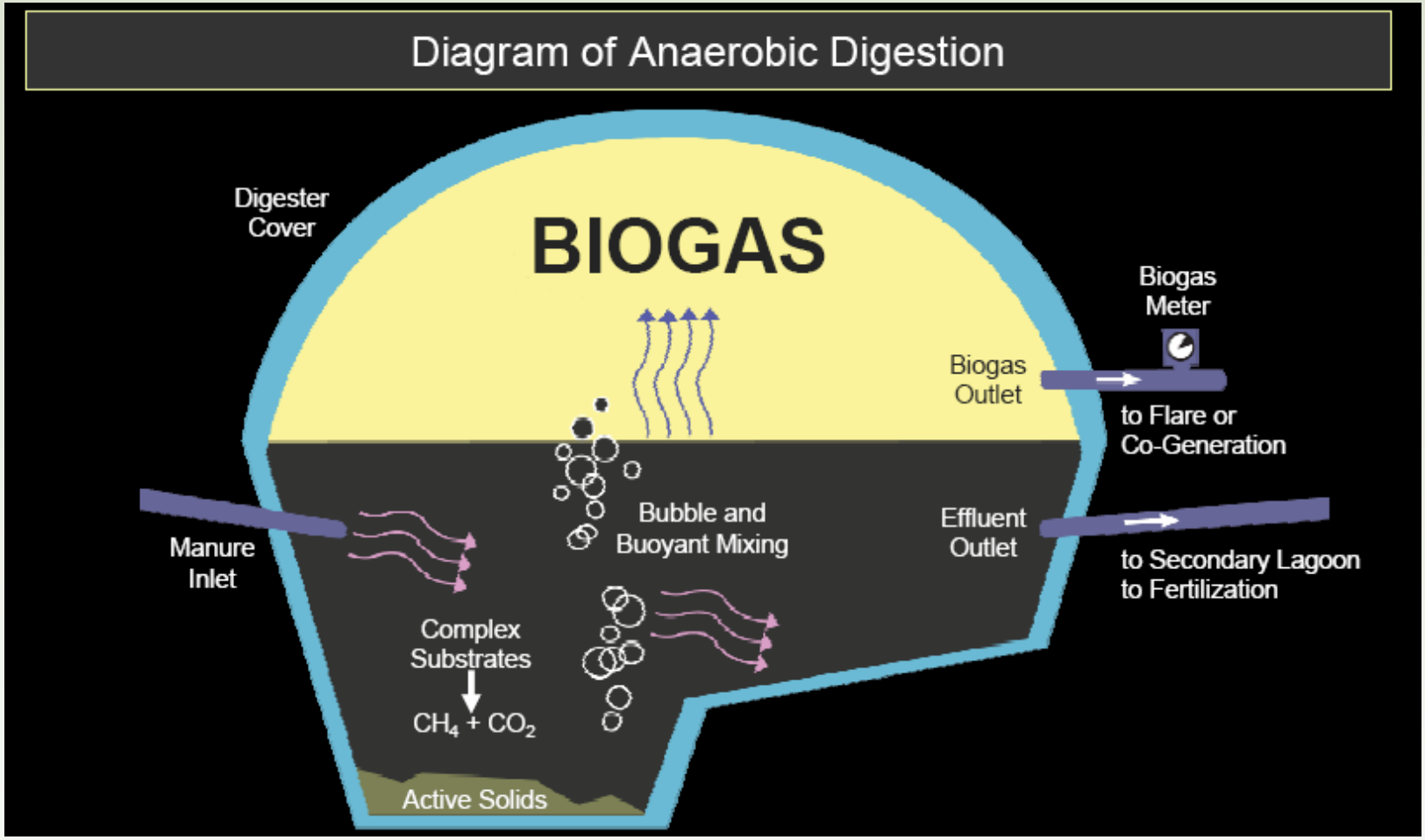
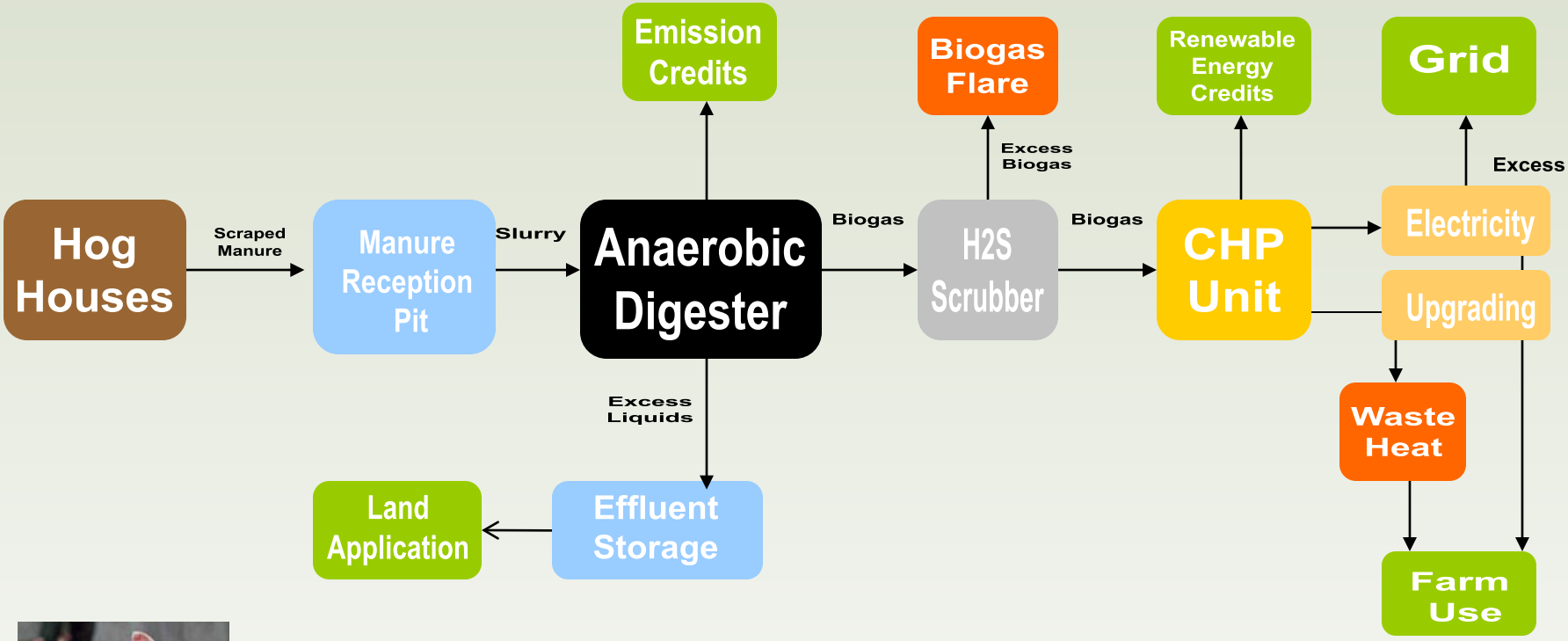
Lagoon Cover Anaerobic Digesters.
A Cost Effective Solution for Energy Recovery

Floating Digester Cover

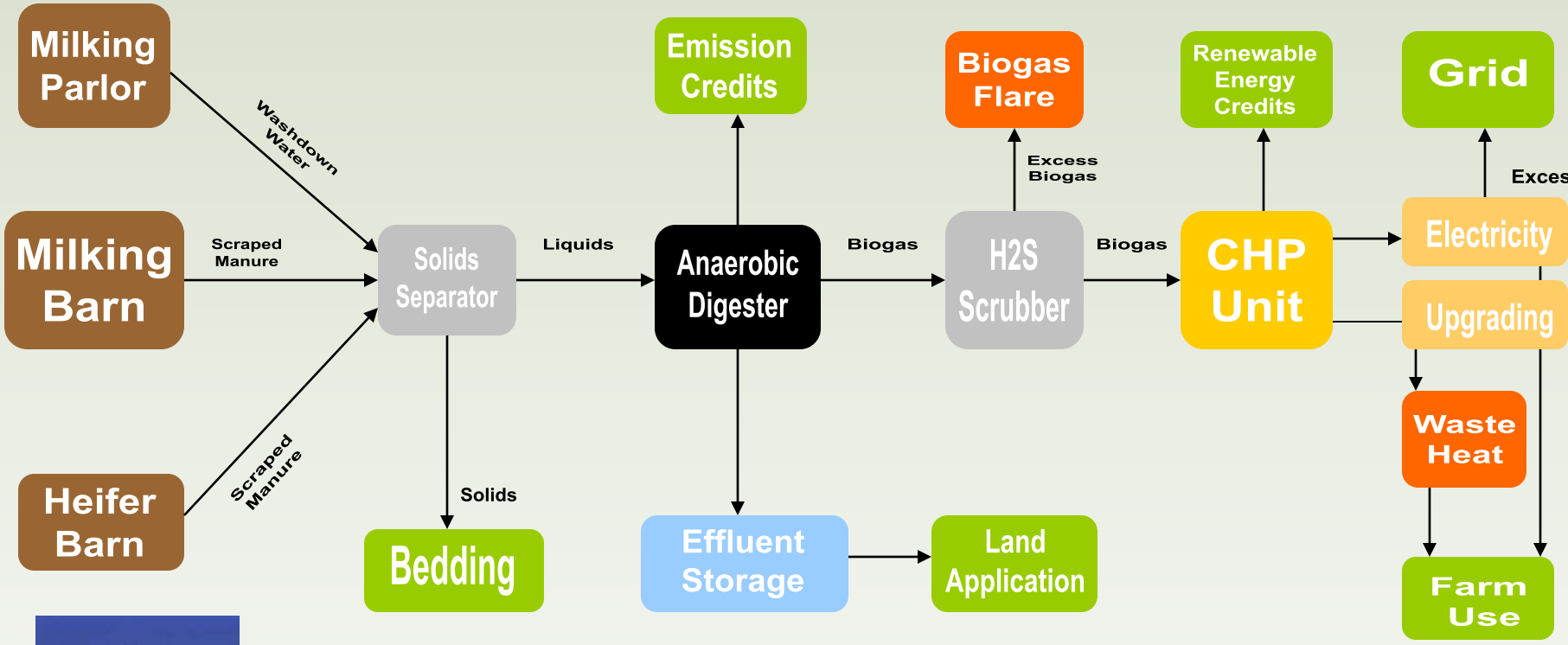
Biodigester



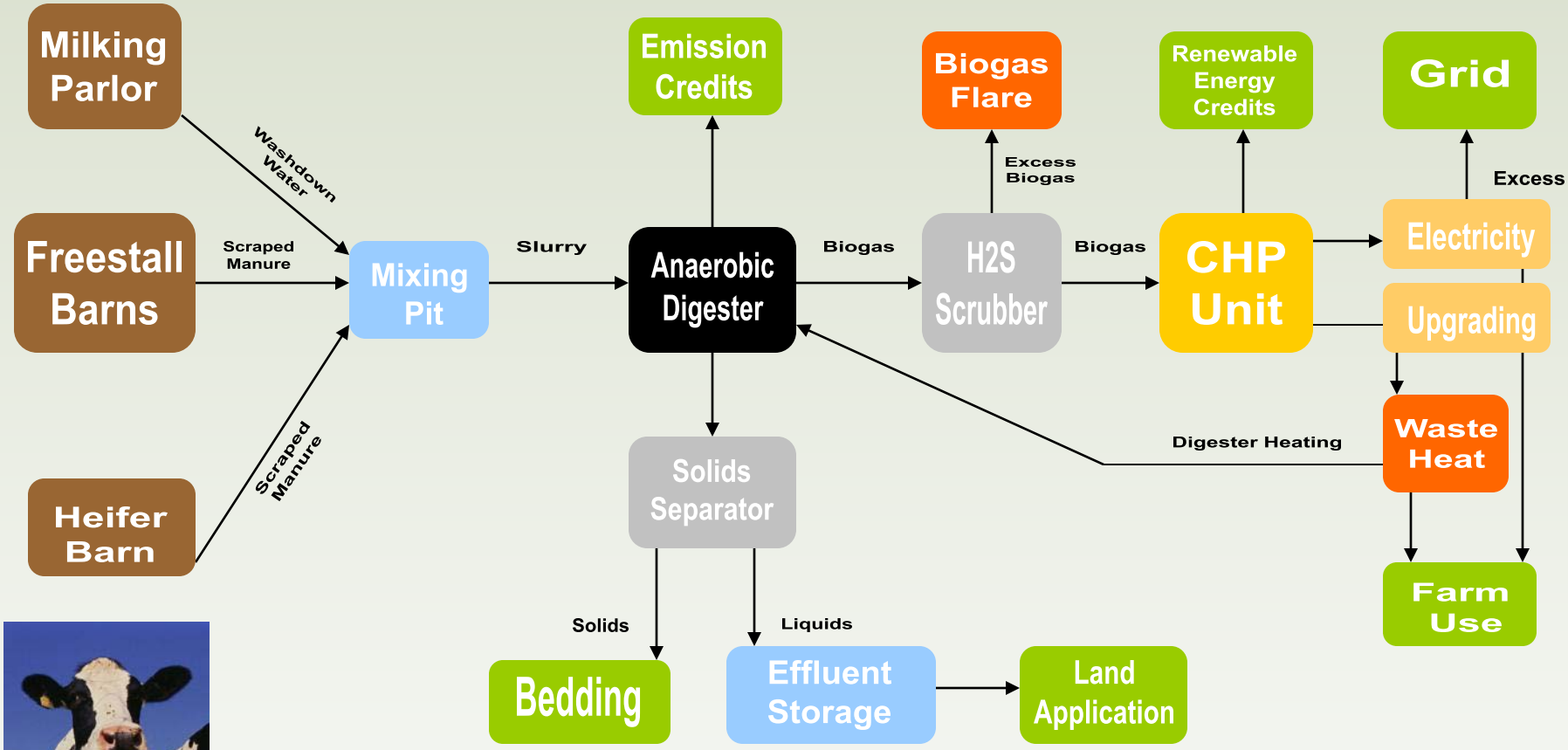
Swine Anaerobic Digestion System Flowchart



Ambient Dairy Anaerobic Digestion System Flowchart



Heated Mixed Dairy Anaerobic Digestion System Flowchart



Simple Remote Monitoring.

- EFI's flare and monitoring equipment complies with the latest regulations in methodologies such as AMS IIID v14
- The destruction and creation of CO2e tons is monitored remotely via internet by a cell phone modem.

File View tools Help

Data Logger Name

Fessenden_NY

Start Time

09:30:55 Apr 6, 2010

End Time

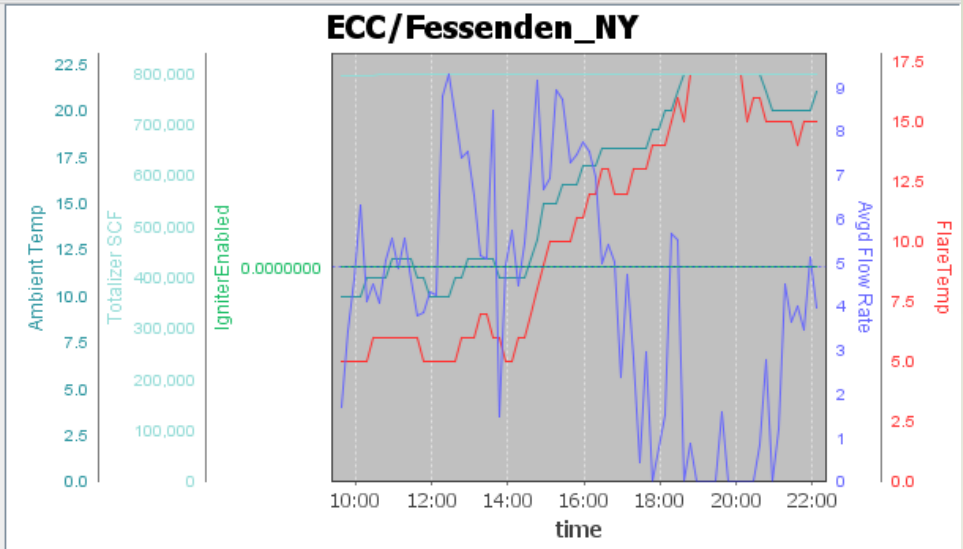
09:30:55 Apr 7, 2010

Data Types

- [ ] Fan Ctrl
- [x] IgniterEnabled
- [ ] Door Status
- [ ] Fan RPM
- [x] Avgd Flow Rate
- [x] Totalizer SCF
- [x] FlareTemp
- [ ] Supply Voltage
- [ ] FM Pwr
- [ ] Igniter Status
- [ ] Modem Pwr
- [x] Ambient Temp
- [ ] Charge Current

Select All | Select None

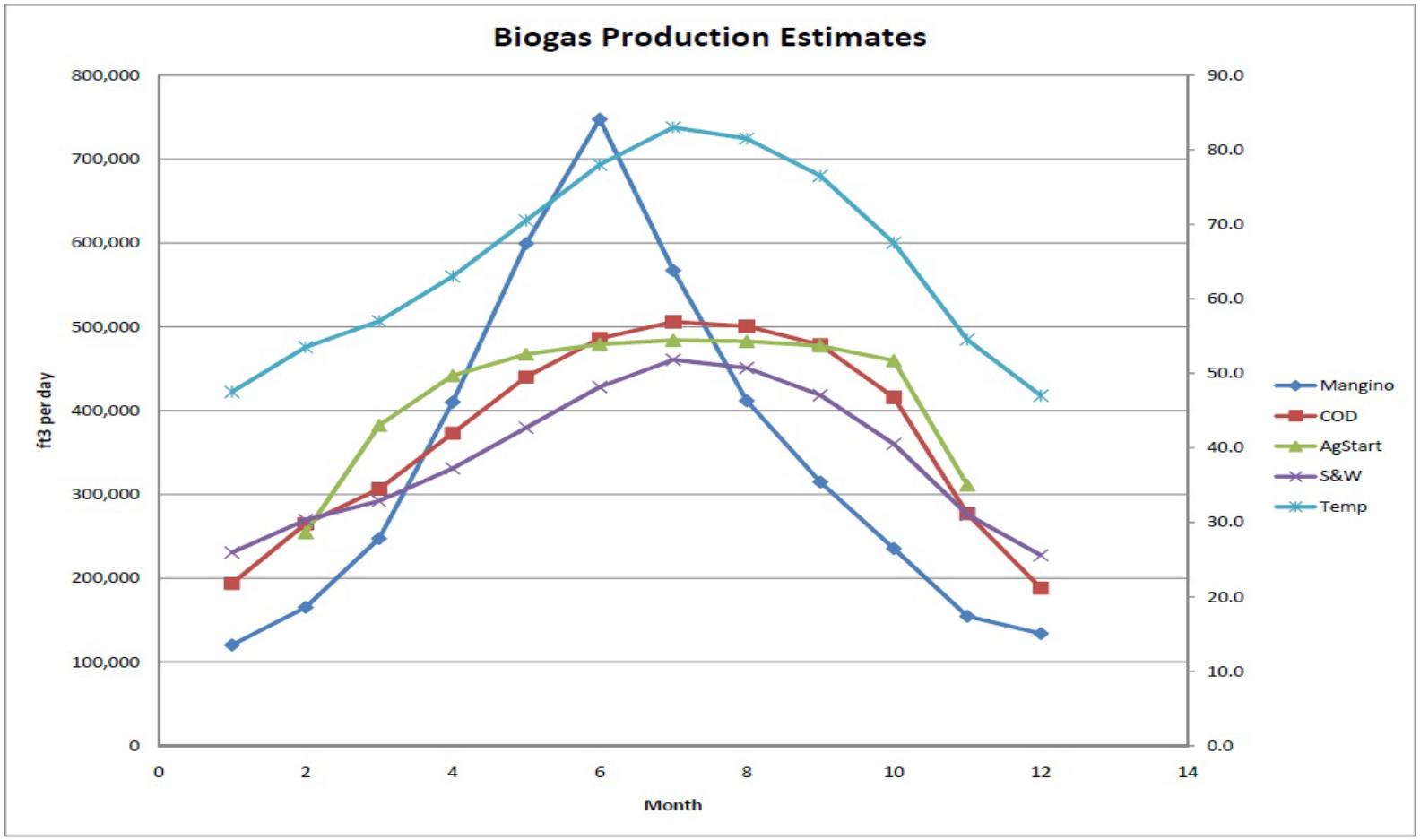
Update



Time	IgniterEnab...	Avgd Flow ...	Totalizer SCF	FlareTemp	Ambient Te...
2010-04-0...	false	1.70682	796484	5	10
2010-04-0...	false	3.4328	796504	5	10
2010-04-0...	false	4.62994	796541	5	10
2010-04-0...	false	6.32513	796592	5	10
2010-04-0...	false	4.11056	796640	5	11
2010-04-0...	false	4.50327	796682	6	11
2010-04-0...	false	4.08074	796724	6	11
2010-04-0...	false	5.04159	796778	6	11
2010-04-0...	false	5.55576	796833	6	12
2010-04-0...	false	4.86696	796879	6	12
2010-04-0...	false	5.53759	796931	6	12
2010-04-0...	false	4.60321	796970	6	12
2010-04-0...	false	3.79496	796970	6	11
2010-04-0...	false	3.79496	797020	6	11
2010-04-0...	false	3.85983	797063	5	11
2010-04-0...	false	4.33842	797101	5	10
2010-04-0...	false	4.26341	797145	5	10
2010-04-0	false	8.78972	797213	5	10

EN 9:35 AM 4/7/2010

Ambient vs Heated: Seasonality



Biodigester Construction

Project Area

Existing
Manure
Storage

Biodigester Construction

Earthworks

Anchor Trench and Piping

Biodigester Construction

Liner
Installation

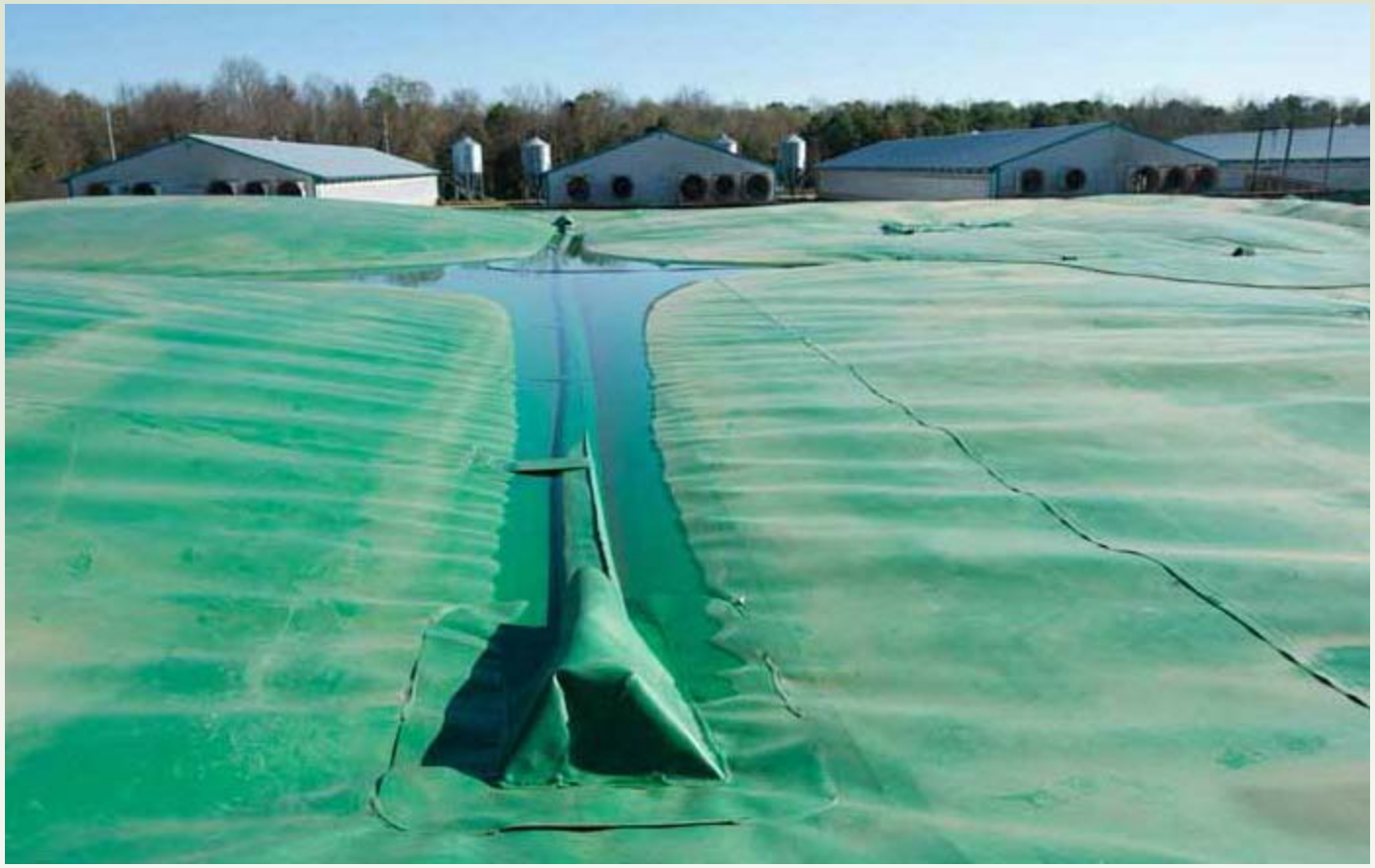
Sludge Removal
System Installation

Biodigester Construction

Filling
process

Filling
process

Biodigester Construction



Biodigester Construction

Biodigester Construction

Developing Projects In the US

Project Overview

- South Carolina's first farm-based animal waste to energy project located in Williamsburg County, SC.
- **9600** Gilt replacement farm
- EFI will install a Heated Complete Mix Anaerobic Digester with a CHP unit.
- The engine has rated capacity of **180** kilowatts
- Will provide enough electricity for about **90** average South Carolina homes
- Part of Santee Cooper's renewable energy portfolio
- Removes approx **5200 tons of CO2e** per year.

Unique Characteristics

- Project employs two innovative elements to make digester/generator technology possible for family farms:

1. **Cost-efficient** geo-membrane digester vessel to reduce capital costs;
2. A **business model** that overcomes the obstacles **small farms** face in getting access to capital, developing operational expertise, and manpower.

- EFI will **own** and **operate** the project for 10 years, at which time the upfront capital will be repaid. Then, EFI and the farm owner will negotiate a new lease agreement.
- Requires **no investment** from farm owners.

Project Collaborators

The project was an all-South Carolina effort to develop this renewable source of energy for the state.

- **Duffy Connolly** - owner of Burrows Hall Farm
- **Santee Cooper** - power purchaser
- **Clemson's South Carolina Institute for Energy Studies** (SCIES) - project definition and implementation
- **EFI** - providing project engineering, construction and operation of the anaerobic digester and energy facility
- **South Carolina Energy Office** - administered competitive grant program
- **South Carolina Department of Agriculture** - provided initial grant support
- **Santee Electric Cooperative** - providing interconnection to electric grid

Project Funding

- **Environmental Fabrics, Inc.** (EFI) has executed a *Power Purchase Agreement* with the **South Carolina Public Service Authority** (**Santee Cooper**).
- EFI will apply for a **US Treasury tax credit** (under Section **1603** of ARRA). The funds from this will not be available until well after construction is completed.
- The **SC Energy Office** granted $199,995 for the initial feasibility study by **Clemson's South Carolina Institute for Energy Studies**
- **No Cash Investment made by Duffy Connolly**. Farm provides land and manure.
- **EFI** is funding ALL construction and operation costs.

Developing Projects In MEXICO

Why Mexico?

Target Markets

- *Animal Waste*
  - **Dairy**
    - » Potential per state/cluster
    - » Existing CDM projects
  - **Swine**
    - » Potential per state/cluster
    - » Existing CDM projects
- *Food Processors*
  - **Slaughterhouses**
    - » Potential per state/cluster

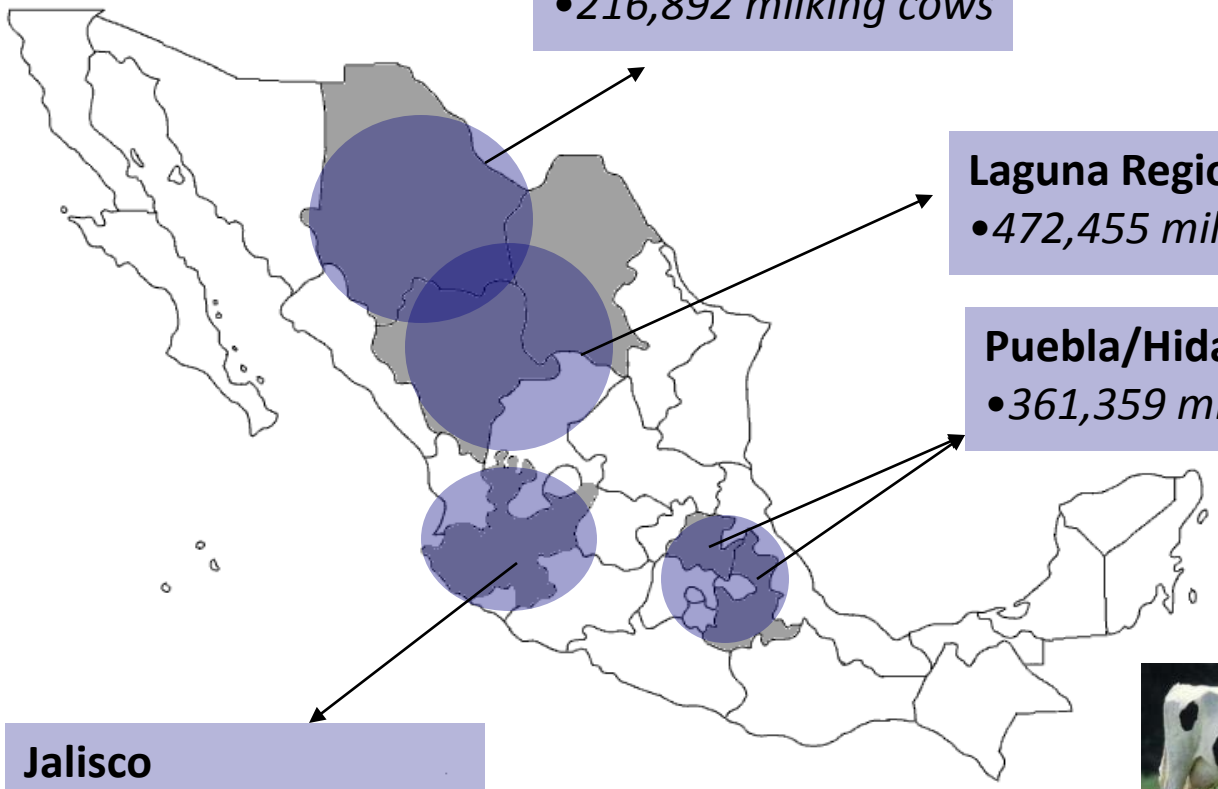
Dairy

- According to the Ministry of Agriculture of Mexico (SAGARPA, 2007) there are approximately **2.2 million milking cows** in Mexico. The US Department of Agriculture places Mexico 7th on the list of Number of Living Milking Cows after the European Union, India, Brazil, Russia, the US, and China. It ranks **2nd** after Brazil in Latin America.
- We identified the following clusters as the largest dairy regions in the country: (Sagarpa, 2005)*
  - **Laguna Region** – 472,455 milking cows
  - **Chihuahua** – 216,892 milking cows
  - **Jalisco** – 216,254 milking cows
  - **Hidalgo** – 186,725 milking cows
  - **Puebla** – 174,634 milking cows

**Based on Holstein only*

Dairy Clusters

Figure 1.1



Chihuahua
•*216,892 milking cows*

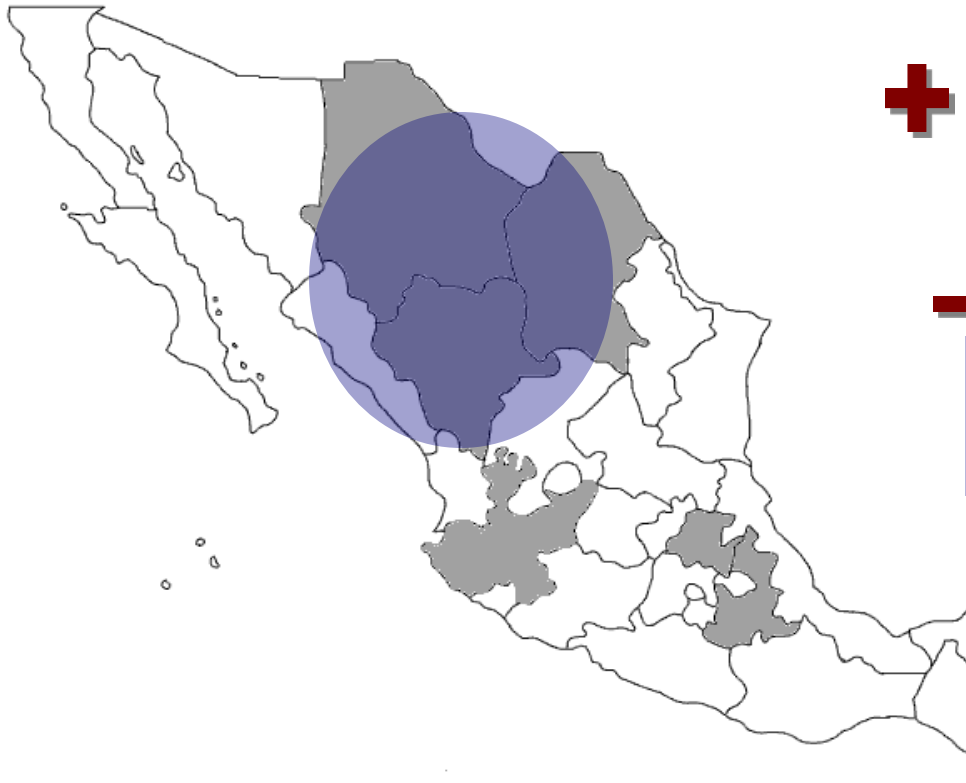
Laguna Region
•*472,455 milking cows*

Puebla/Hidalgo
•*361,359 milking cows*

Jalisco
•*216,254 milking cows*

Dairy Clusters

Figure 1.2



Chihuahua
- *216,892 milking cows*

Laguna Region
- *472,455 milking cows*

North Central Region
- *689,284 milking cows*

Dairy

Table 1.1

Region	*Number of Milking Cows*	*Number of Farms²*	*Number of Farms built*	*Potential CDM Projects*	*Potential in 100 kW CHP**
Laguna	472,455	236	34	202	404
Chihuahua	216,832	108	3	105	210
Jalisco	216,254	108	1	104	208
Hidalgo	186,725	93	0	93	186
Puebla	174,634	87	0	87	174
Total	***1,266,960***	***632***	***41***	***591***	***1182***

²Based on average farm size of 2000 milking cows

**Based on the assumption that a 1900 cow dairy will produce around 2975 m³ of biogas which will produce 262kW.*

Swine

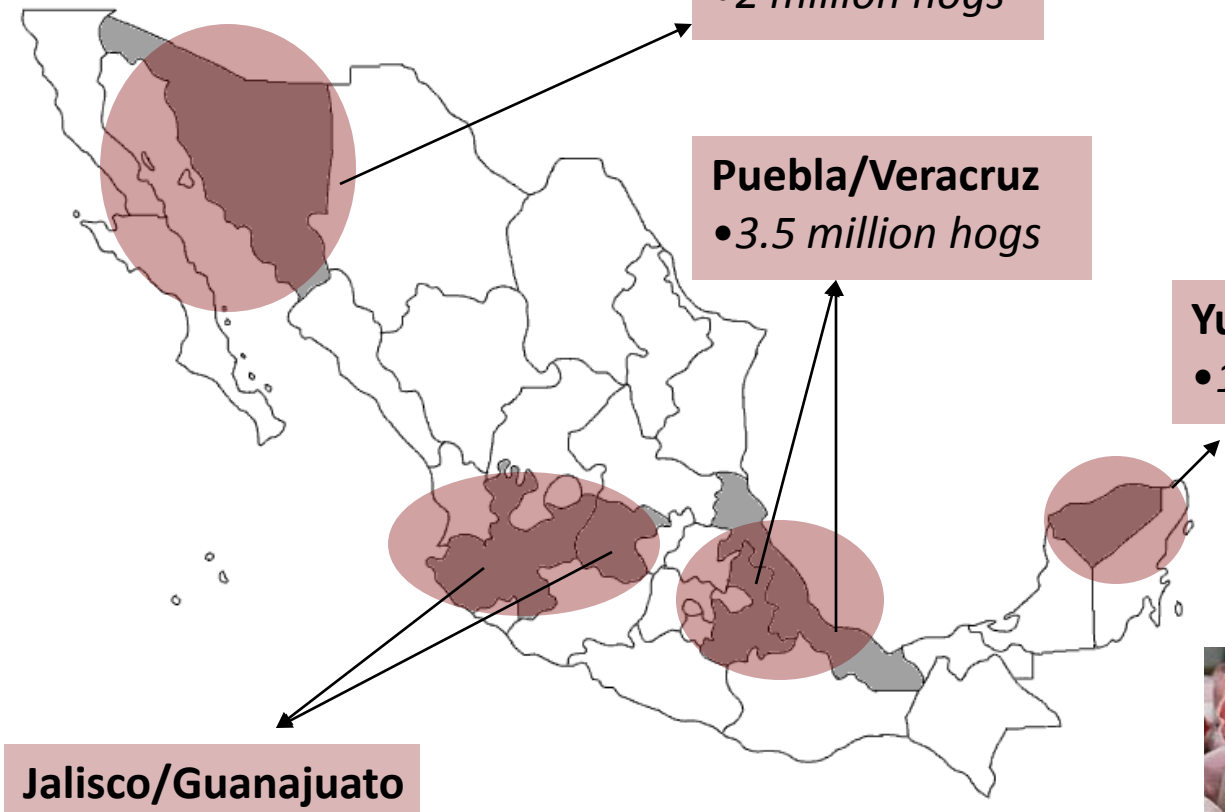
- According to the USDA (US Dept of Agriculture, 2007) Mexico produces **15.8 million hogs** annually, placing it **7th** in the world after China, the European Union, the US, Russia, Brazil, Canada, and Japan. It ranks **2nd** after Brazil in Latin America.

- We identified the following clusters as the biggest pork regions in the country: (Sagarpa, 2005)*
  - **Jalisco** – 3.5 million hogs
  - **Sonora** – 2 million hogs
  - **Puebla** – 1.82 million hogs
  - **Veracruz** – 1.7 million hogs
  - **Guanajuato** – 1.5 million hogs
  - **Yucatán** – 1.5 million hogs

**Based on Estimations from Sagarpa's Annual Inventory*

Swine Clusters

Figure 2.1



Sonora
•*2 million hogs*

Puebla/Veracruz
•*3.5 million hogs*

Yucatán
•*1.5 million hogs*

Jalisco/Guanajuato
•*5.0 million hogs*

Swine

Table 2.1

Region	Anual Swine Production	Number of Farms[2]		Number of Farms built	Potential		100Kw CHP*
		5,000	8,000		5,000	8,000	8,000
Jalisco	3.5	700	438	83	617	355	355
Sonora	2	400	250	117	283	133	133
Puebla	1.82	364	228	16	348	212	212
Veracruz	1.7	340	213	3	337	210	210
Guanajuato	1.5	300	188	10	290	178	178
Yucatán	1.5	300	188	3	297	185	185
Total	***12.02***	***2404***	***1505***	***232***	***2172***	***1273***	***1273***

[2]Based on an average farm size of 5,000 and 8,000 per farm.

**Based on the assumption that 8,000 hogs produce enough gas for a 100kW engine.*

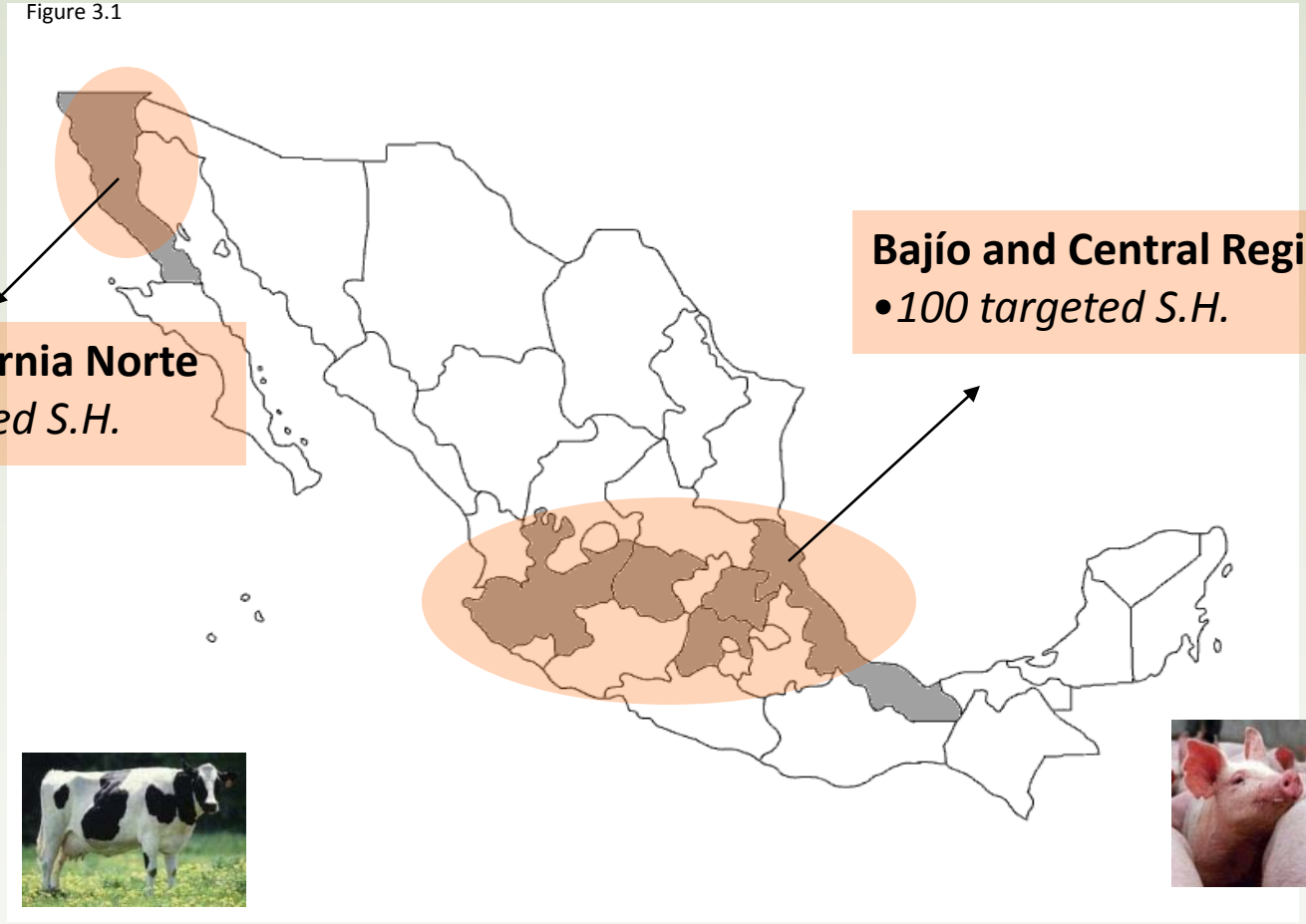
Slaughterhouses

- According to the USDA (US Dept of Agriculture, 2007) Mexico ranks **8th** and **7th** on the slaughter of pork and beef in the world meat market. In 2007, 2,200 tons of beef and 1,200 tons of pork meat were produced in Mexican Slaughterhouses.
  - Although, most of the slaughterhouses are municipal, our main focus is TIF's (*Tipo Inspección Federal*) and Private Slaughterhouses.

- We identified the following clusters as the regions with the most targeted slaughterhouses in the country: (Sagarpa, 2005)*
  - **Edo. De México –** 23 Targeted Slaughterhouses
  - **Veracruz –** 23 Targeted Slaughterhouses
  - **Jalisco –** 19 Targeted Slaughterhouses
  - **Guanajuato –** 17 Targeted Slaughterhouses
  - **Baja California Norte –** 15 Targeted Slaughterhouses
  - **Hidalgo –** 17 Targeted Slaughterhouses

Slaughterhouse Clusters

Figure 3.1



Baja California Norte
- *15 targeted S.H.*

Bajío and Central Region
- *100 targeted S.H.*

San Felipe (Mexico)

- Proteína Animal SA de CV
- Location: San Juan de los Lagos, Jalisco
- 2,300 milking cows and 18,000 finshing pigs
- Size: 165 x 55 x 5 m
- Volume: 34,800 m^3
- Biogas Production: from 172 to 283 m^3/h (4,140 to 6,790 m^3/day)
- Energy Production: 200 to 520 KWh
- Construction Completed: January of 2011

Santo Domingo. (Mexico)

- Proteína Animal SA de CV
- Encarnación de Díaz, Jalisco
- 2,400 milking cows and 6,500 heifers
- Size of Digester 95 x 90 x 8 m
- Volume: 45,500 m^3
- Biogas Production: 260 m^3/h (6,240 m^3/day)
- Electricity Production: 400 KWh
- October 2010

Establo Porvenir

- Establo El Porvenir SA de CV
- Torreon Mexico
- 1600 miking up to 2,400 future.
- Size of Digester 135 x 50 x 8 m
- Volume: 22,200 m^3
- Biogas Production: 104 m^3/h (2505 m^3/day)
- Electricity Production: 270 KWh
- October 2010
- Cost 200,000 USD

Bunge-Olmeca Palm Oil Mill

- Location: Guatemala
- Project: Palm Oil Mill Waste to Energy Project (2 Digesters)
- Production: 720 Ton of fruit/day. 1,000 m3/day of wastewater.
- Biogas production: 22,500 m3/day
- 2 MW of electircity will be generated.
- Cost 2 million USD

Lujan Dairy

- Site: Lujan Dairy
- Chihuahua, Mexico
- Size: 5,000 cows
  - 1 lined and covered biodigesters
    - Eliminate odor and groundwater problems
    - Capture Methane
  - Generation of Electricity
    - One 700kw generator sets to convert the gas to electricity

Project Funding in Mexico

- **FIRA Development Bank.** Offered low cost loans with Green Loan Guarantees.
- **Agricultural Ministry** had a shared risk grant of $80,000 per project.
- **Energy Utility** offers great incentives for power. (Net metering, banking, wheeling)
- **Minimal Cash Investment made by Farmers**. Farm provides land and manure.
- **Proteina Animal** decided to invest in the project direct without assistance and they payback was 24 months.

Why don’t we have more of these?

Let’s look at the numbers

9600 Finisher Farm in SC with Carbon Credits

Project Cost			$ 655,000.00				
FINANCIALS							
Commercial Loan			$(458,500.00)		Average NOI	90,479	/yr
Interest	10 yr period	4%	$(98,550.75)		Princip + Interest	55,705	
Total Revenue Electrical			$1,257,498.00		DSCR	1.62	
Total Revenue Carbon Credits			$343,916.38		IRR	15%	
Total Income			$904,789.91				
Electrical OPEX Against Income			47%				
Carbon OPEX Against Income			35%				
Overall OPEX Against Income			73%				
Total Profit			**$ 347,739.16**				
Profit Margin			22%				

Let’s look at the numbers

9600 Finisher Farm in NC without Carbon

Project Cost			$ 665,000.00				
FINANCIALS							
Commercial Loan			$55,180.00		Average NOI	112,026	/
Interest	10 yr period	4%	$(11,860.48)		Princip + Interest	6,704	
Total Income			$1,120,261.53		DSCR	16.71	
OPEX Against Revenue			39%		IRR	214%	
Total Profit			**$ 1,053,221.05**				
Profit Margin			61%				

Let’s look at the numbers

3MW Organic Waste Facility in SC

Project Cost			$ 9,583,165.93				
FINANCIALS							
Commercial Loan			$(9,583,165.93)		Average NOI	1,271,944	/y
Interest	10 yr period	4%	$(2,059,821.57)		Princip + Interest	1,164,299	
Total Revenue			$12,719,436.07		DSCR	1.09	
OPEX against Income			85%		IRR	6%	
Total Profit			**$ 1,076,448.57**				
Profit Margin			5%				

Let's look at the numbers

3MW Organic Waste Facility in NC

Project Cost			$ 9,583,165.93			
FINANCIALS						
Commercial Loan			$(9,583,165.93)		Average NOI	2,270,924
Interest	10 yr period	4%	$(2,059,821.57)		Princip + Interest	1,164,299
Total Income			$22,709,236.07		DSCR	1.95
OPEX Against Revenue			58%		IRR	22%
Total Profit			**$ 11,066,248.57**			
Profit Margin			35%			

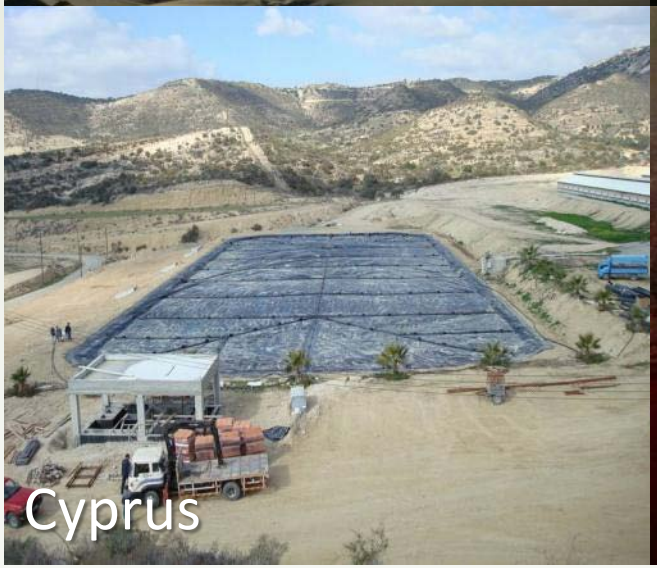
The Solution

- Little changes in Policy make a BIG difference.
- There are cost effective solutions to access to biogas.
- It helps reduce carbon emissions.
- An RPS brings jobs and makes countries competitive It typically does not dramatically affect rates.
- A balanced portfolio with nuclear, hydro and renewables should be the future if we want those jobs.
- If we don’t act NOW. Jobs and other opportunities will go to more business friendly countries.

Environmental Fabrics Inc (EFI)

- **Environmental Fabrics, Inc.,** is a manufacturing and general contracting firm founded in 1993 by Zeb Fuchsluger, Dennis Shanklin, and Ray Pickel.
- The diverse backgrounds of the founders provided the firm knowledge to design, fabricate and install geosynthetic products.
- The firm specializes in the application of Floating Cover Anaerobic Digesters for the generation of Biogas, with projects throughout the world.
- EFI is a recognized Voluntary Emission Reduction and Clean Development Mechanism technology provider in the US and Kyoto allied countries.
- The Principals have the combined experience of over 50 years in the field of civil/environmental manufacturing and construction.

Global Installation Capacity



International Operations

Thank you for your attention!

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dshanklin@environmentalfabrics.com or visit www.environmentalfabrics.com

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SAGARPA
SECRETARÍA DE AGRICULTURA, GANADERÍA, DESARROLLO RURAL, PESCA Y ALIMENTACIÓN

USDA