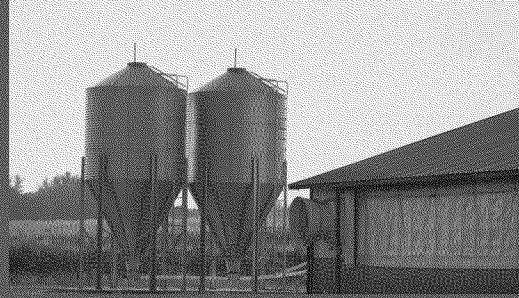


SMITHFIELD SWINE FARM BIOGAS STRATEGY – N.C.



Prepared By Cavanaugh & Associates, P.A. / Smithfield Foods

*An improved Strategy and Plan for Achieving
Additional, Optimal Commercial Value Streams
from Swine Farming Waste*

The Strategy will Accomplish these objectives

- Standardization across all farms
- Standardized / unit manufacturing
- Leveraged Ag Financing / Farmer assets
- General Permitting
- Fixed “farm gate” price for participants
- Vertically Integrated Business Model



Key Market Conditions

- Smithfield commitment to carbon emissions reduction
- Excess carbon reduction credits provided / sold to Smithfield market allies
- RNG has broad & diverse market demands
 - Compliance Market (RINs and RECs)
 - Voluntary Market (other carbon commitments)

The Vision

- Participation by over **90%** of the farms in NC with finishing equivalent capacity of at least 3,672 pigs.
- Each farm will build new in-ground, ambient temperature digesters¹
 - ~10% will cover the existing lagoon(s).
- Biogas will be aggregated and transported to regionalized biogas refineries where upgraded to RNG, injected into the pipelines, and sold to off-takers for premium value.

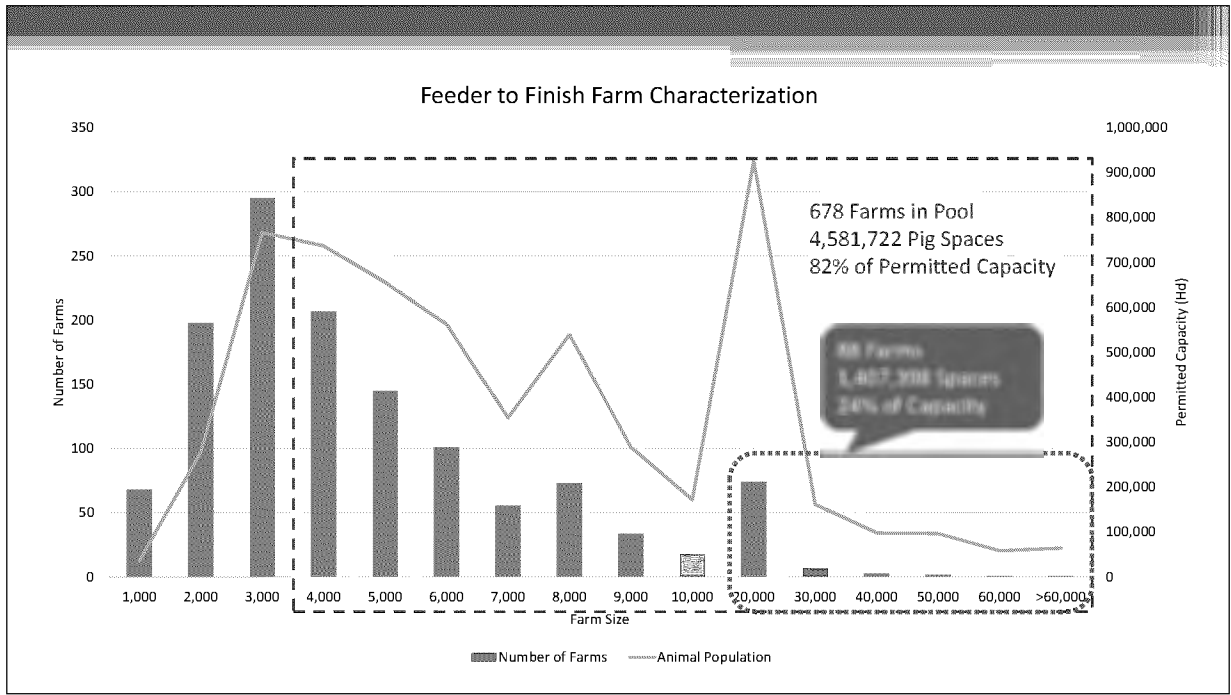
¹ We will not disallow other types of digesters so long as the basic criteria are achieved

Precede this slide with a brief history of how we got here (from electricity generation to RNG)

North Carolina Swine Farm Statistics

Farm Type	Count	% of Ttl
Swine - Wean to Finish	54	2%
Swine - Feeder to Finish	1,283	56%
Swine - Wean to Feeder	499	
Swine - Gilts	28	
Swine - Farrow to Wean	332	
Swine - Farrow to Finish	33	
Swine - Farrow to Feeder	45	
Swine - Boar/Stud	13	
<i>Total Number of Swine Farm Permits in NC</i>	<i>2,292</i>	

Note data as percentage of animals or percentage of number of farms

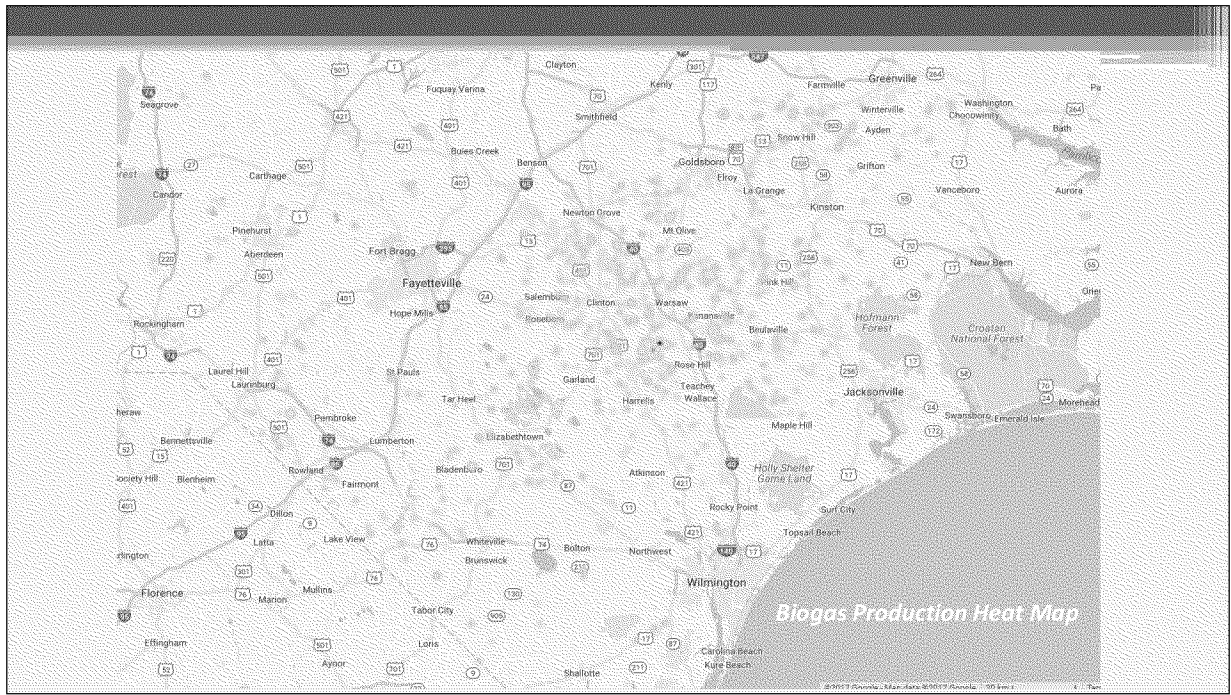


Note data as percentage of animals or percentage of number of farms

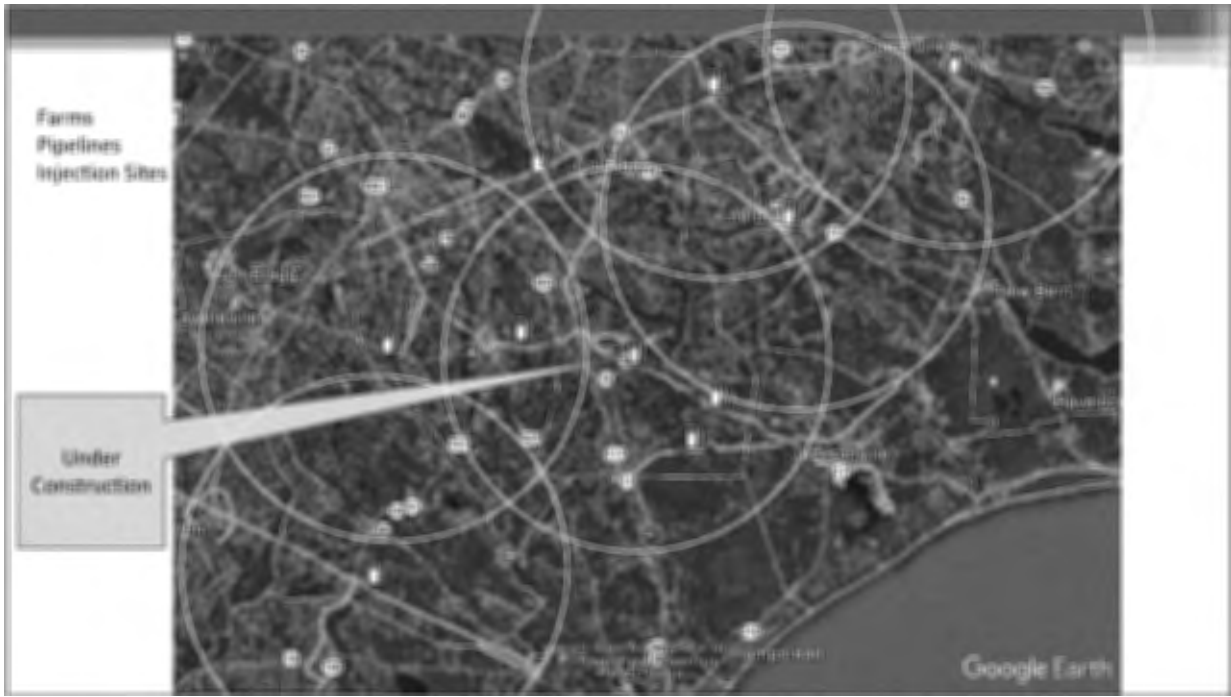
Participant Pool

		Count	Sum Capacity			
	Swine - Feeder to Finish	678	4,581,722			
	Swine - Wean to Finish	43	475,376			
	<i>Total</i>	<i>721</i>	<i>5,057,098</i>			
By County	Swine - Feeder to Finish	Count	Sum Capacity	Rank	% of Total	Cumul %
	Duplin	182	1,356,206	1	27%	27%
	Sampson	164	1,020,829	2	20%	47%
	Wayne	48	358,985	3	7%	54%
	Bladen	39	358,820	4	7%	61%
	Greene	52	296,798	5	6%	67%
	Robeson	23	203,031	6	4%	71%
	Lenoir	29	188,261	7	4%	75%
	Columbus	19	143,960	8	3%	78%
	Pitt	22	142,707	9	3%	80%
	Onslow	22	117,050	10	2%	83%
	Jones	14	98,122	11	2%	85%
	Pender	18	91,519	12	2%	87%
	Northampton	4	68,910	13	1%	88%
	Washington	1	59,000	14	1%	89%
	Johnston	11	56,720	15	1%	90%

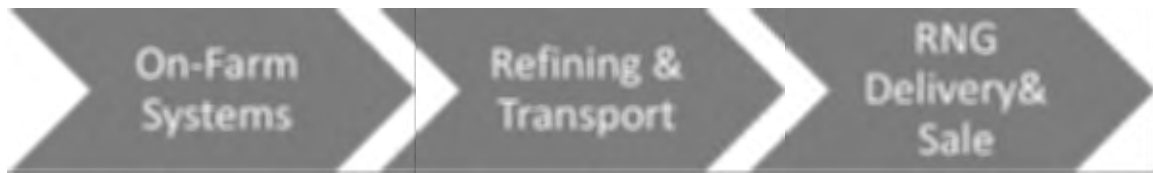
Note data as percentage of animals or percentage of number of farms



Use the typical map of just farm locations, followed by the heat map on biogas production

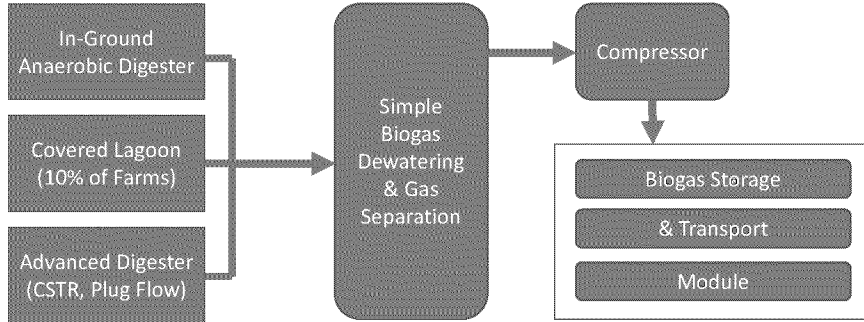


Process Description



Process Description

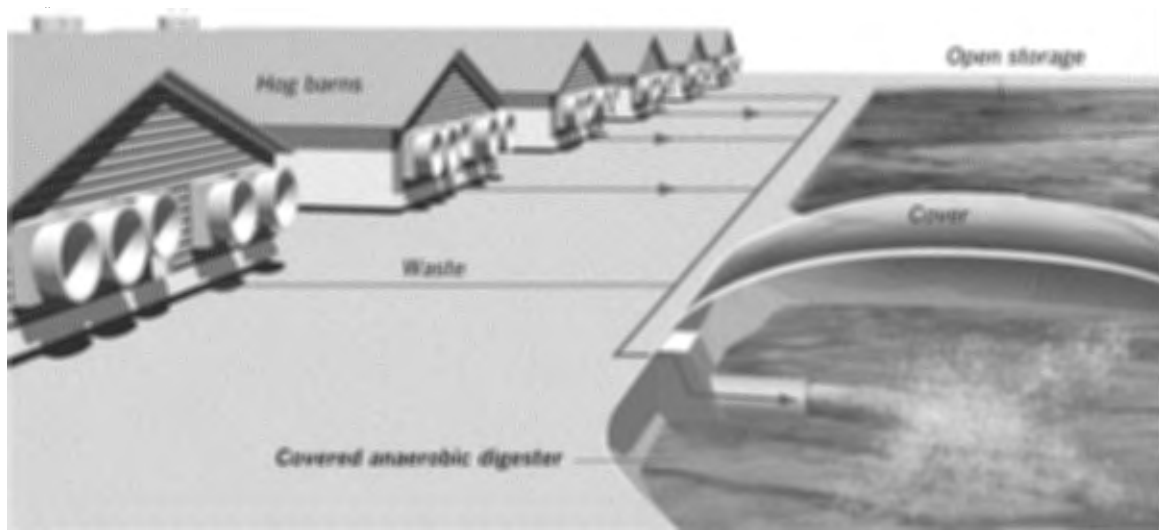
On-Farm Systems



On-Farm Systems

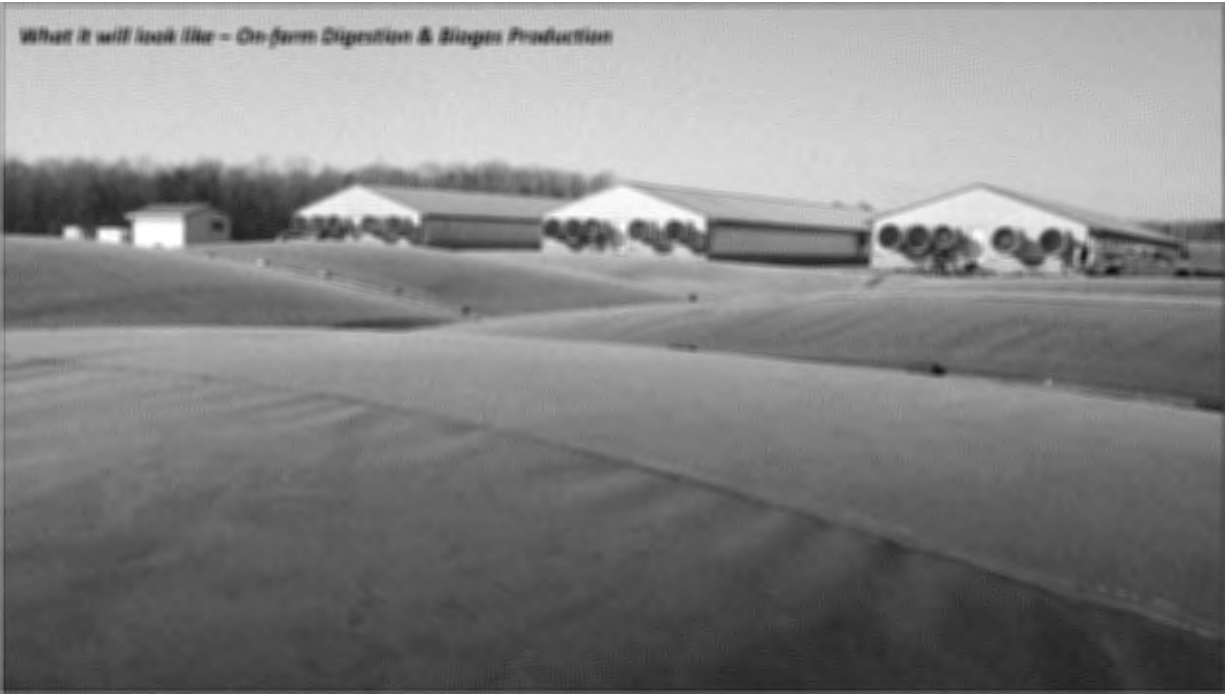
- Standard Farm Gate Price for biogas
- Collateralize existing farm assets
- In Ground digester (or other design)
- Incentives improved manure management
- Economics of scale

Visualization





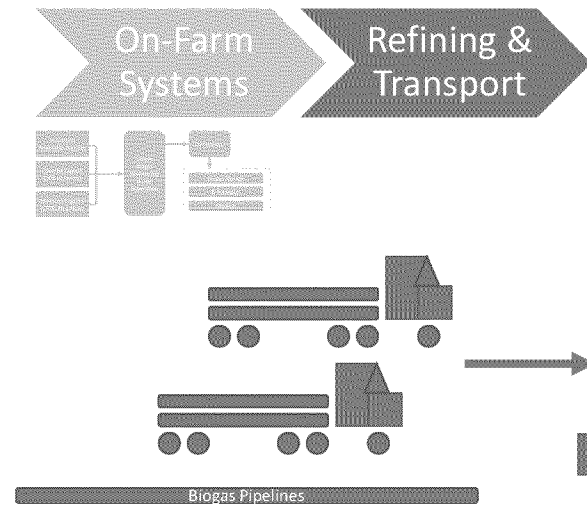
What it will look like - On-farm Digestion & Biogas Production



Additional Farm Benefits

- Increases effluent storage and treatment capacity on farms (by volume of digester)
- Postpones sludge removal costs for existing lagoon (by added volume)
- Fixed asset investment eligible for 5-year accelerated depreciation
- Improved public perception
- Production Contract Terms?

Process Description



Biogas Refining/ Transport

- Two transport options; trucking biogas and piping biogas

Trucking

- Requires overcoming hurdles of compressing raw biogas & DOT permits (CO₂, H₂S)
- Bridge to pipeline installation

Pipeline

- Longest position – requires no trucks, drivers

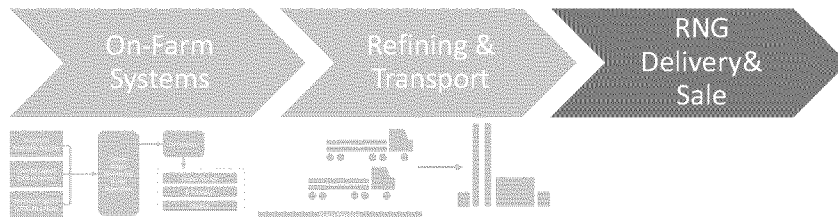




*Compressed Natural Gas / Biogas
Transport Modules*



Process Description



RNG Delivery and Sale

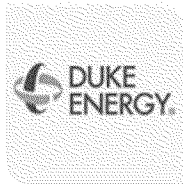
- Stable off-take with transparent pricing
- Market diversity (RINs, RECs, Electricity Generation, Heat, Petrochemical Manufacturing, etc.)
- Long-term competitive pricing with conventional fuels



What it will look like - Pipeline Injection



But Who Buys Renewable Natural Gas?



UPS to purchase RNG from Clean Energy

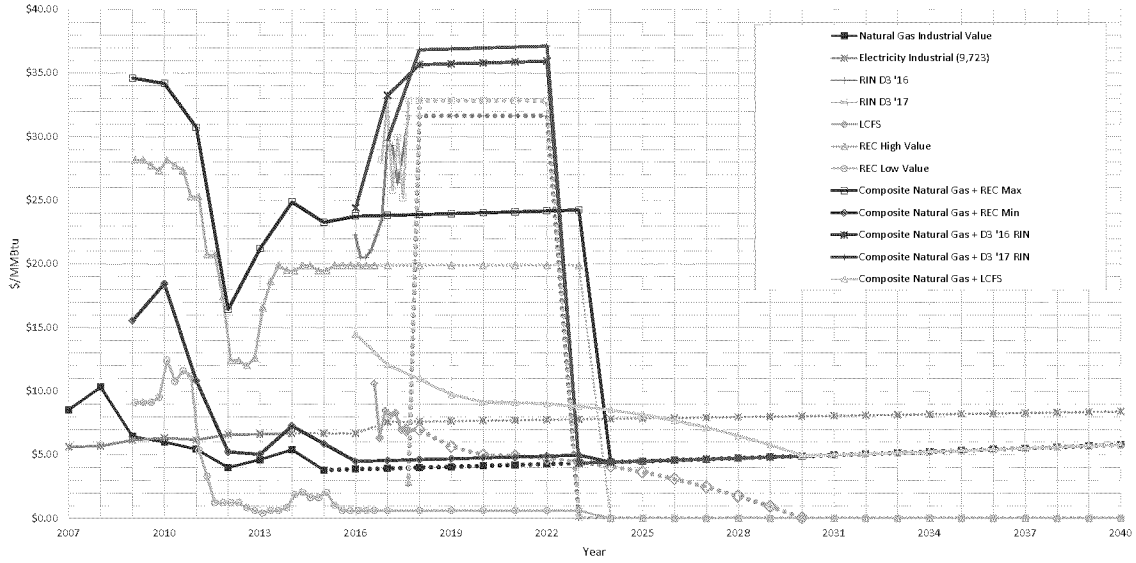
By UPS | May 11, 2015

"UPS has announced it has entered into an agreement to purchase renewable natural gas (RNG) for its delivery vehicle fleet..."

Biomass Magazine, May 2015



What Offtakers are Paying: Indicative Market Prices



What Could Make This Fail?

- Collapse of voluntary offtake markets
- Utility obstructionism
- Industry-wide manure cessation
- “Better” sources of “green” biogas



Overall notes:

For future presentations, get Kiara? And others to put together presentation

"who" is required to make this work? Companies, politicians, other advocates that we need to be engaged or at least not overlooked. Add the 'who' are the critical partners for each of the outcomes?

Finish with "what could make this fail?"

Make the presentation 'simpler'

Add big question to the last slide: "Who owns this?"