Focus on Vermont Farm Projects:
Single and Two-Stage Dairy Manure Separation

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NativeEnergy: An experienced and expert partner

- NativeEnergy has been an innovator and a leader in developing carbon offset and corporate sustainability projects since 2001
- We have worked with dozens of leading brands to enable them to meet their climate and sustainability goals
- Our Help Build™ carbon financing model has moved over 50 projects forward
NativeEnergy
Serving renewable energy, carbon and sustainability investment markets

• Custom project development and ownership
• Products & Services:
  – Carbon Offsets
  – Renewable Energy
  – Ancillary products (e.g. nutrients, bedding, power, heat)
  – Consulting & Carbon-tracking Software

NativeEnergy is vertically integrated – active in all value chain components
NativeEnergy’s

Help Build Financing Model

Help Build™ — a unique program through which our customers provide key funding for the development of sustainability projects that deliver distinctive benefits to business, society, and the environment

**Water** - Reducing CO₂ and delivering health with filtration that provides safe water in the Developing World

**Wind** - Community scale clean energy projects at schools, and on farms and Tribal lands

**Farm** - Reducing methane at dairy farms and supporting the agricultural economy

**Forest** - Recreating and protecting forests to capture CO₂ and rebuild natural capital

**Biomass** - Capturing biogas to fuel local business

**Solar** - Pollution-free rooftop generation on corporate facilities
Projects enabled by Help Build™ funding model include:

Native American projects, like the Rosebud Sioux Wind Turbine

Farmer-owned wind and farm methane reduction projects across the country

Clean Water projects in Kenya, Ghana and Honduras

Landfill gas projects sustaining a local business in Oklahoma

The Greensburg Wind Farm supplying a town in Kansas rebuilding from a devastating tornado
Single Stage Dairy Manure Separation: Process

1. Cow Manure
   - ~20% reduction in material going to the lagoon
   - Less manure to haul and spread
   - Better utilize a waste stream

2. Screw Press Separator
   - Simple process, proven technology
   - Removes ~45% of the manure solids
   - Solids content ~35%

3. Rotary Drum Composter
   - Automates the process of bedding production
   - 130+° F for 1.5-2 days
   - Dries and sanitizes manure

4. Bedding Material
   - Cows produces 2x the bedding material the farm needs
   - Ability to supply bedding to neighboring farms
   - Potential for farms to generate revenue
Single Stage Separation: Environmental

• Reduce Methane Emissions:
  • ~45% of solids kept out of lagoon
  • Less solids = less anaerobic decomposition = less GHG

• Improve Nutrient Management:
  – Reduced liquid manure volume to store and spread
  – Separated solids capture portion of nutrients
    • Nitrogen: ~15% reduction
    • Phosphorus: ~20% reduction
    • Potassium: ~10% reduction

• Beneficial use of “composted” manure as bedding
Single Stage Separation: Farmer Benefits

• Avoid purchase of bedding material
• Reduced manure storage
• Reduce hauling volume of liquid manure
• Odor Reduction
• Cow Comfort
• Milk Production
• Herd Health
Recent Single-Stage VT Project

• Green Dream Farm, Enosburg Falls
  – Contracts completed with farm and equipment vendor in 2013
  – Ownership assumed by NativeEnergy to establish first operating system as demonstration
  – Ben & Jerry’s provided exceptional carbon funding support
  – Site work Fall 2013
  – Equipment delivered to site in May 2014
  – Commissioned Fall 2014
  – Has been visited by many farmers interested in similar systems or purchase of excess bedding

See video at:
http://www.nativeenergy.com/farm-methane-reduction1.html
Two Stage Separation: Added Benefits

- Add a decanter centrifuge following a screw press separator
- Further separates solids to reduce methane emissions:
  - Increases CO2e reduction by 50% [over single stage]
- Reduces nutrient content in remaining liquid manure, with total removal rate:
  - Nitrogen: ~40% reduction
  - Phosphorus: ~70% reduction
  - Potassium: ~25% reduction
- If farm requires replacement nutrients, strategic spreading of P-cake should result in less runoff than baseline
- If P-cake is sold, replacement that is required can be through commercial fertilizer, also with less runoff potential
- Less fuel consumed to haul and spread liquid manure
Decanter Centrifuge: How it Works

- Liquids from screw press fed to centrifuge
- Barrel spins at high rpm
- Exerts > 3000 g’s on fine manure particles
- Phosphorus laden particles cake on inner surface of barrel
- Auger inside barrel scrapes out solids: “P-cake”
VT CEED-Funded Centrifuge Project

- CEED grant of $225k awarded by GMP to support two stage separation
- Ben & Jerry’s has committed carbon financing support
- Farm host selected, P-cake buyer pending
- Equipment ordered, September 2015 installation planned
- Will be first of its kind in VT
Project Development & Costs: Need for collaborative approach

- **NativeEnergy / Equipment Manufacturers / NGO’s**
  - Identify interested farmers with emphasis on critical source areas for P-runoff
  - Develop projects to reduce and monetize GHG emissions to bring funding to the project
  - Seek corporate support for projects based on environmental benefits

- **Farm**
  - Owns and operates the system or lease to own arrangements possible
  - Avoids purchase of bedding from third party, and sells ~50% of bedding to other farms
  - Avoids manure hauling costs

- **State/Federal Agencies / Funding**
  - For single-stage separation with composter, less than 500 milking head farms need outside funding, beyond carbon financing, for less than 4 year payback
  - For two-stage with centrifuge, funding will be required on most farms
  - Unlike single-stage, direct benefit to farms is much less
Applying Carbon Market Lessons to P

• Early carbon offset project developers had complete freedom and no guidance
• Lack of confidence in credits resulted

• Solution was independent 3rd party (NGO) “Standards” – overarching requirements for all project types – and
• Standard-approved protocols for specific project types
• Ensures credits represent reductions that are real, additional, measurable, verifiable and permanent
• Confidence restored
Applying Carbon Market Lessons to P

• Carbon lessons as applied in Chesapeake Bay Nutrient Trading went too far
  – Perceived need for accuracy in “measurable” made it overcomplicated and too expensive, few projects resulted

• Balance needed: “reasonably predictive” is the best that can be hoped for early-on
  – Employ carbon market-like protocols to quantify baseline and reductions

• Focus on reduction in risk >>> pollution reduction will follow
CIG Proposed Project

• CIG Proposal for Two Stage Project with P-quantification assessment and protocol development, pending award
  – Supports new separation project with centrifuge
  – Demonstrates corporate sustainability support
  – Will establish baseline assumptions for P and P-runoff
    • Stone Environmental engaged to calibrate Agricultural Policy/Environmental Extender (APEX) model to host farm and watershed
    • Results and experience to be used to create web-based tool for farmers/stakeholders to predict future project outcomes
    • NativeEnergy will create P-reduction “Standard” and project-specific “Protocol”