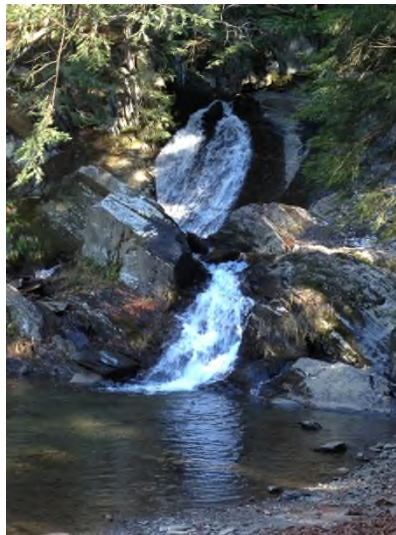




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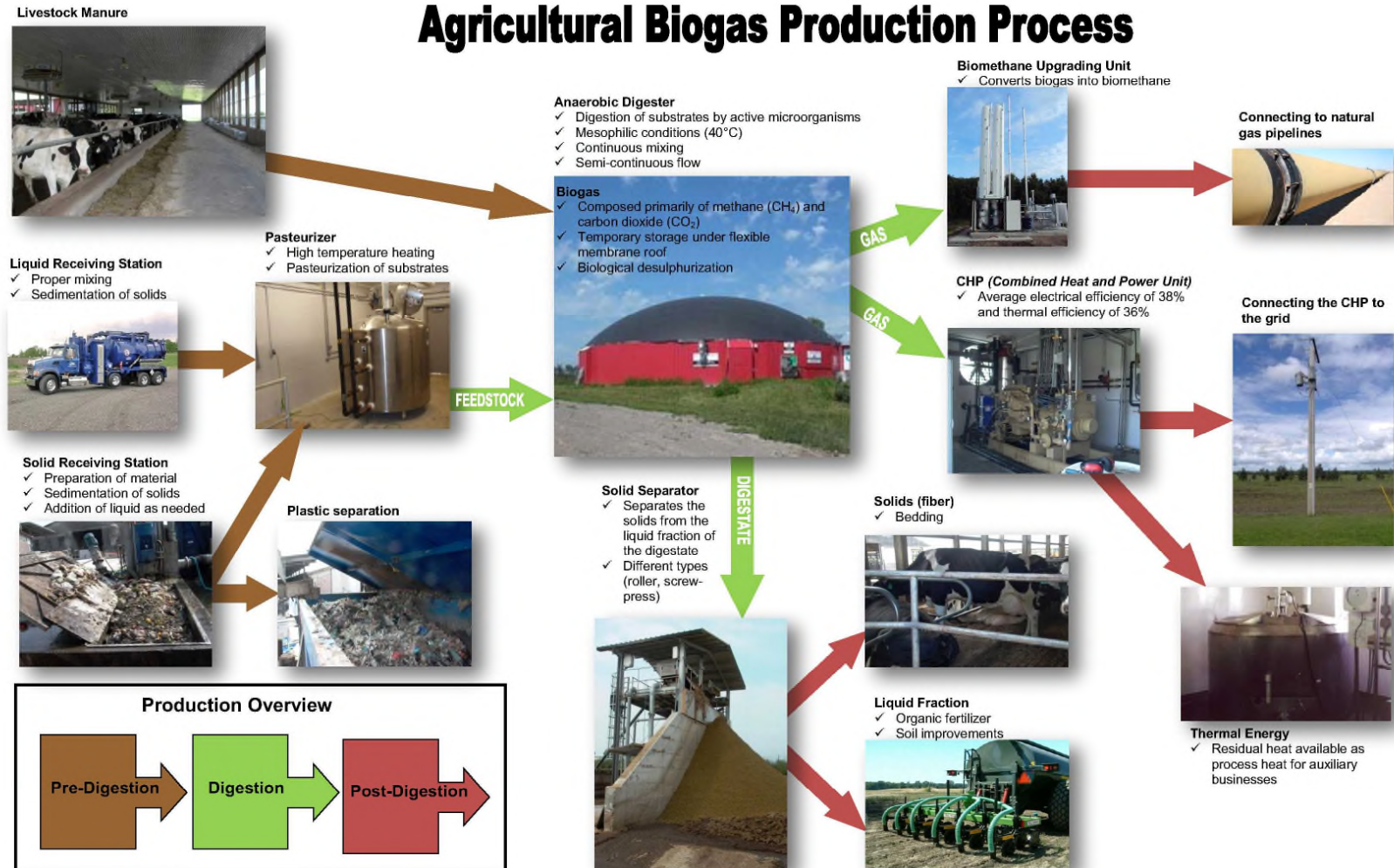
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SCHEMATIC DIAGRAM FARM-BASED ANAEROBIC DIGESTER SYSTEMS

Agricultural Biogas Production Process



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SYSTEM OVERVIEW
FARM-BASED ANAEROBIC DIGESTER SYSTEMS



ANAEROBIC DIGESTERS WITH RECEIVING TANKS (1 OF 2)
TO RECEIVE & PRE-PROCESS
LIQUID AND SOLID FOOD WASTE

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ADVANTAGES OF FARM-BASED ANAEROBIC DIGESTER SYSTEMS: ENERGY/EFFICIENCY

- TYPICALLY 92% AVAILABLE 24 HOURS/DAY, 7 DAYS/WEEK AT FULL OUTPUT, BASELINE RENEWABLE ENERGY SYSTEMS.
- ~40% ELECTRICAL EFFICIENCY , PLUS ~40% HEAT EFFICIENCY
 - HEAT EXCHANGERS TO CAPTURE WASTE HEAT FROM THE GENERATOR SET TO BE USED FOR HEATING NEARBY FACILITIES, HOUSES, GREENHOUSES, ETC.
- MIXING SYSTEM THAT FORCES BACTERIA AND “FOOD” FROM FEEDSTOCKS TO FULLY INTERMINGLE FOR MAXIMUM BIOGAS AND ENERGY OUTPUT
- SIGNIFICANT ENERGY GAIN (3 TO 10 TIMES MANURE ONLY) FROM ADDING OFF-FARM FEEDSTOCKS
- REDUCTION IN DEPENDANCE ON FOSSIL FUELS FOR ELECTRICITY AND HEAT



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FARM-BASED ANAEROBIC DIGESTER SYSTEMS:

FARM-BASED A.D. EXAMPLES

NEW ANAEROBIC DIGESTERS



SMALL FARM

(45 COWS)

ENERGY- HOT WATER: ~100,000 btu/hr.

(HEAT FOR CHEESE PROCESSING)

FEEDSTOCK: ON-SITE CHEESE WHEY

MEDIUM FARM

(450 COWS)



ENERGY- CHP UNITS: 2@ 95 kW= 190 kW

FEEDSTOCKS: FOOD PROCESSING WASTE

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FARM-BASED ANAEROBIC DIGESTER SYSTEMS:
FARM-BASED A.D. EXAMPLES

ANAEROBIC DIGESTER UPGRADES

SMALL FARM
(350 COWS)



ENERGY- CHP UNIT: CURRENTLY 300 kW;
REPLACING WITH 500 kW

FEEDSTOCKS: FOOD PROCESSING WASTE,
FATS, OILS & GREASE (FOG)

MEDIUM FARM
(600 COWS)



ENERGY- CHP UNIT: CURRENTLY 225 kW;
ADDING SECOND 225 kW, TOTALING 450 kW

FEEDSTOCKS: FOOD PROCESSING WASTE

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ADVANTAGES OF FARM-BASED ANAEROBIC DIGESTER SYSTEMS: ENVIRONMENTAL

- AIR QUALITY:

- ODORS ARE REDUCED >90% DUE TO REDUCTION IN VOLATILE SOLIDS
- CARBON CREDITS/RENEWABLE ENERGY CERTIFICATES FROM REDUCED CARBON FOOTPRINT
- SIGNIFICANT REDUCTION IN CARBON DIOXIDE FROM MANURE LAGOONS
- VIRTUALLY ODORLESS LIQUID FERTILIZER



- LANDFILL CAPACITY/ACT 148 IMPLEMENTATION:

- EXCELLENT METHOD TO HELP IMPLEMENT ACT 148, WHICH WILL SOON PROHIBIT ALL ORGANICS FROM LANDFILLS
- BENEFICIAL REUSE OF FOOD WASTE AND OTHER ORGANICS DIVERTED FROM LANDFILLS, PRODUCING RENEWABLE ENERGY AND LIQUID FERTILIZER



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ADVANTAGES OF FARM-BASED ANAEROBIC DIGESTER SYSTEMS: ENVIRONMENTAL

- REDUCED/IMPROVED STORMWATER RUNOFF:
 - SIGNIFICANT REDUCTION IN STORMWATER RUNOFF ISSUES INCLUDING REDUCTION OF PHOSPHORUS AND OTHER NUTRIENTS GOING INTO LAKES AND STREAMS
 - SMALL FOOTPRINT MINIMIZES IMPACT ON THE ENVIRONMENT
 - MOST OF THE LIQUID SOAKS INTO THE GROUND, THEREFORE IT IS MUCH LESS LIKELY TO REACH NEARBY STREAMS, EVEN IN LARGE RAINSTORMS
- IMPROVED NUTRIENT MANAGEMENT:
 - NUTRIENTS ARE IN MORE SOLUABLE AND MUCH MORE READILY AVAILABLE FORMS (FOR CROP UPTAKE). THEREFORE, LESS FERTILIZER IS USED AND LESS CHEMICAL FERTILIZER NEEDS TO BE BROUGHT IN.

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BEFORE A.D.:
SPREADING
12% SOLIDS “SLUDGE”



AFTER A.D.:
DRIZZLING
3% SOLIDS LIQUID



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ADVANTAGES OF
FARM-BASED ANAEROBIC DIGESTER SYSTEMS:
FINANCIAL STABILITY



- BASE-LINE INDUSTRY FOR THE NEXT GENERATIONS OF FARM FAMILIES
- WELL SUITED FOR SMALL TO MEDIUM SIZED (200 - 500 HEAD) FARMS WITH PROVEN TECHNOLOGY ADAPTED FOR THE MIXED-SUBSTRATE MARKET
- TYPICALLY A 5 TO 7 YEAR PAYBACK (WITH GRANTS)
- TYPICAL REVENUES AND SAVINGS INCLUDE:
 - FIXED ENERGY RATES FROM FEED-IN-TARIFFS
 - RENEWABLE ENERGY CERTIFICATES/CARBON CREDITS
 - TIPPING FEES FROM OFF-FARM FEEDSTOCKS
 - ENERGY SAVINGS/ENERGY REVENUE FROM CAPTURED HEAT ENERGY
 - SIGNIFICANT SAVINGS ON ANIMAL BEDDING COSTS
 - MAJOR SAVINGS FROM REDUCTION IN PURCHASE OF CHEMICAL FERTILIZER



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ANAEROBIC DIGESTER SYSTEMS: MUNICIPAL/COMMERCIAL A.D. EXAMPLES



COMPOST FACILITY:

- ADD A.D. W/200 kW CHP
- FEEDSTOCKS: FOOD WASTE, F.O.G., DAF
- DEWATERED DIGESTATE (WITH ENHANCED NUTRIENTS) TO EXISTING COMPOST FACILITY

LANDFILL:

- ADD A.D. AND SOLID SEPARATOR
- A.D. BIOGAS TO SUPPLEMENT METHANE TO EXISTING CHP'S
- FEEDSTOCKS: WWTF SLUDGE, POST-CONSUMER FOOD WASTE, F.O.G., S.S.O.
- DEWATERED DIGESTATE TO ADDED COMPOST FACILITY



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ANAEROBIC DIGESTER SYSTEMS: MUNICIPAL/COMMERCIAL A.D. EXAMPLES

TRANSFER STATION:

- ADD A.D. W/500 kW CHP
- ADD SOLID SEPARATOR
- FEEDSTOCKS: WWTF SLUDGE, POST-CONSUMER FOOD WASTE, F.O.G., S.S.O.
- DEWATERED DIGESTATE TO ADDED COMPOST FACILITY



WASTEWATER TREATMENT FACILITY:

- ADD A.D. W/500 kW CHP OR W/OPTIONAL BioCNG
- FEEDSTOCKS: WWTF SLUDGE, POST-CONSUMER FOOD WASTE, F.O.G.
- DEWATERED DIGESTATE TO NEARBY COMPOST FACILITY

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ANAEROBIC DIGESTER SYSTEMS



- QUESTIONS?

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