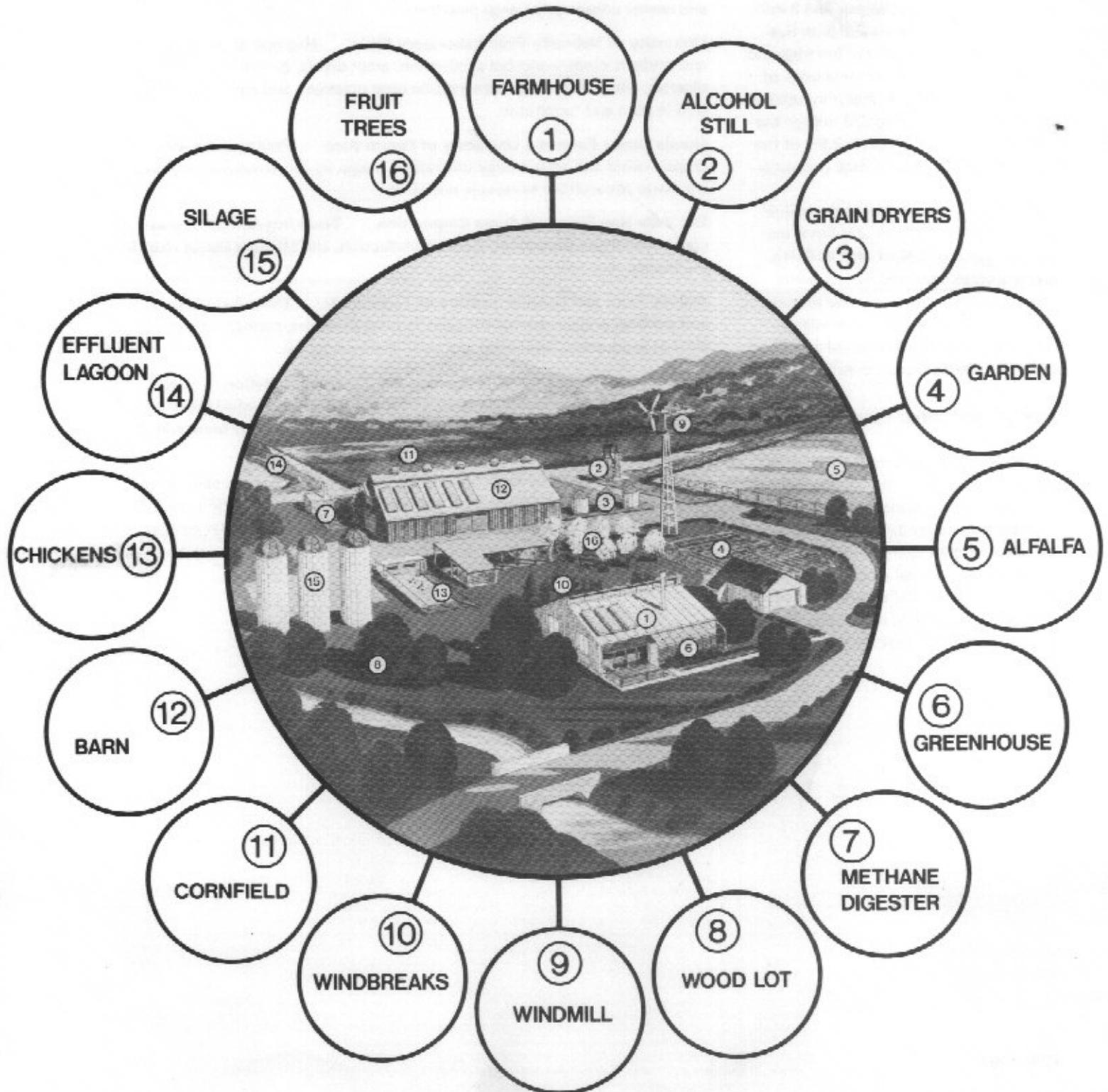


energy integrated farm systems



U.S. DEPARTMENT OF ENERGY, ASSISTANT SECRETARY FOR CONSERVATION AND SOLAR ENERGY, WASHINGTON, DC 20545



Energy and Agriculture

United States farms, with an annual production of 7 million bushels of corn, 3.5 million bushels of wheat, and 2 million bushels of soybeans and with live-stock populations of 60 million hogs and 395 million chickens, are large users of fuel. Agriculture is the largest industry in the United States, using 333 million barrels of oil per year, which is 2.5% of the country's total annual energy consumption.

On the farm, diesel fuel and gasoline power vehicles, tractors, and other machinery; gas and fuel oil heat buildings and dry crops; and electricity powers lights, water pumps, and other process equipment. Farming also uses energy indirectly in the production of fertilizers and pesticides for crop operations.

Energy Integrated Farm Systems

An energy integrated farm system is designed to combine diverse on-site energy sources to provide continuous energy and reduce the farm's dependence on energy produced by nonrenewable resources such as coal and oil. The objective is to promote self-reliance and self-sufficiency in farming operations. Energy conservation is the first step toward this end.

Energy Integrated Farm Concepts

Millbrook Farm and Cornell University. New York State dairy farm with corn and alfalfa crops—alcohol production, methane digester, cogeneration, and energy conservation crop practices.

University of Nebraska Field Laboratory Farm. Hog operation with grain and soybean crops—alcohol production, grain dryers, greenhouses, methane digester, windmill, energy conservation crop practices, and energy conservation in barn and farmhouse.

Granja Caribe Farm and University of Puerto Rico. Poultry farm with crops—wind and solar energy utilization, biogas by fermentation, and poultry waste aquaculture to recycle nutrients.

Del Valle Hog Farm and Sumx Corporation. Texas hog farm with grain crops—methane generation, alcohol production, and efficient use of electrical energy.

Aubrey Farm and Georgia Institute of Technology. Dairy farm with corn and soybean crops—energy-efficient farming practices, methane digester, alcohol production, and wood and solar energy systems.

North Dakota State University Agricultural Experiment Station. Dairy farm with wheat, barley, sugar beet, and sunflower crops—wind break and solar energy for building heating, methane digester, and energy conservation crop practices.

Foxlease Farm and Archbold Investment Company. Virginia dairy farm and stock breeding operation with corn crop—methane generation, alcohol production with protein supplement from stillage, and use of solar energy.

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DOE/TIC-11007

University of Nebraska Field Laboratory Farm

Project Descriptions
Office of Industrial Programs
Conservation and Solar
Energy
U.S. Department of Energy

The Farm Site

The University of Nebraska Field Laboratory Farm near Mead, Neb., is composed of 157 acres of farmland devoted to the production of corn, soybeans, and sweet sorghum. Presently there are no animals; but the farm will be expanded to include a 10-sow farrow-to-finish swine facility. Five acres will be reserved for the expansion of farmstead operations. The farm has a storage capacity of 12,000 bushels of grain. Existing on the farm are center-pivot and gated-pipe irrigation systems. The gated-pipe system is controlled by a photovoltaic solar array.

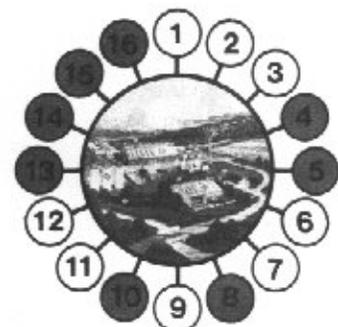
Current Energy Use and Contemplated Energy Savings

The State of Nebraska uses 30.5 million gallons of fuel to produce 5 million pigs per year. In 1979 irrigation scheduling on 25% of the irrigated acreage conserved the equivalent of 22 million gallons of diesel fuel and 1.08 million cubic feet of natural gas. Low-pressure center-pivot nozzles would reduce irrigation energy by 40%; tillage conservation would reduce indirect fuel usage by 50%; and efficient construction of swine facilities would reduce energy consumption in that area by 50%. A statewide saving of 296,000 gallons of diesel fuel per year would be realized if the concepts to be demonstrated by the University of Nebraska were implemented by 10% of Nebraska's farms.

The specific energy objective for this farm demonstration project is significant reduction of all petroleum inputs. Fuel for tractors, machinery, and trucks will come from alcohol produced from sweet sorghum.

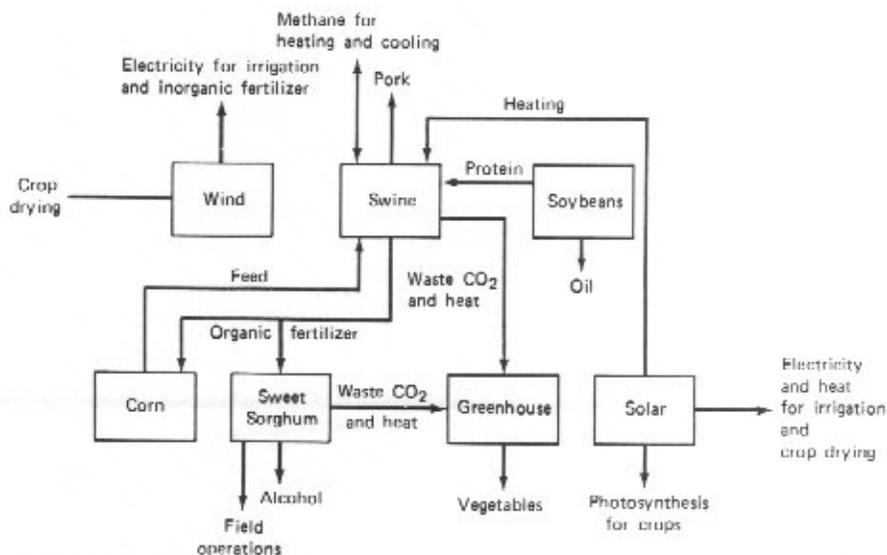
Integrated Energy Concepts to Be Demonstrated

- Methane production from swine wastes in an anaerobic methane generator.
- Production of alcohol from sweet sorghum.
- Computerized farm energy management and conservation system.
- Use of solar energy and methane gas in grain drying, water heating, and space heating for swine production shelters.
- Use of waste heat and CO₂ from the ethanol plant in the greenhouse system.
- Energy conservation in crop production through conservation tillage, conservation of fertilizer, and irrigation scheduling.



- Energy conservation by optimized construction of swine units and control of ventilation and temperature.
- Integration of biomass and solar energy to produce power for irrigation.

Energy integrated farm, University of Nebraska.



Specific Energy Technologies to Be Implemented

- Alcohol fermentation unit with a plate still
- Anaerobic digester
- Greenhouse
- Farrow-to-finish swine facility
- Crop drying and processing facilities
- Solar collectors, active and passive
- Microprocessor, for irrigation scheduling
- Propane gas engines, converted to alcohol and methane

Project Director	Dr. William E. of Nebraska Splinter, University
Program Duration	4 years
Total Estimated Program Cost	\$1,720,400
Government Share	860,200
Private Share	860,200