# JOURNAL OF NAL ASSOCIATES



NEW SERIES VOL. 4, NOS. 1 / 2 JANUARY / JUNE 1979

ENERGY AND AGRICULTURE

The Associates of the National Agricultural Library, Inc. Beltsville, MD 20705

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Cover photo: *At the USDA's Agricultural Research Center in Beltsville, Maryland, solar collectors on top of a milking parlor are part of an experiment to discover ways in which solar energy can be substituted for fossil fuels in the heating and powering of a milking operation. (Courtesy, U.S. Department of Agriculture).*

Journal of NAL Associates

New Series vol. 4, nos. 1/2
January/June 1979

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(Illustrations in this issue are from early issues of the *American Agriculturist*.)

This journal is indexed in AGRICOLA.

INTRODUCTION

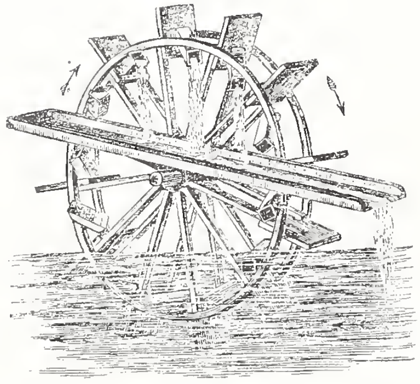
In the beginning, man's knowledge of energy evolved around one basic source - food energy for survival. In time, his use of fire for the energy of rapid combustion and the adoption of animal hides as clothing to conserve body heat increased his chances for survival.

Today, the average citizen in the United States uses over two hundred times as much energy as his ancestors. Man has explored, excavated, and exhausted many resources of the earth and currently is dependent upon a dwindling foreign oil supply. Reliance on this form of energy cannot continue for the beginning of the end of the fossil-fuel age is at hand. In particular, our system of food production faces very serious problems for our farms are dependent upon an extensive use of fossil fuels to power the machines used for planting, spraying, fertilizing, and harvesting of crops. T.S. Eliot once said that "Mankind cannot bear very much reality" yet it is abundantly clear that the future of the United States may well depend upon how well we effectively develop new attitudes and life-styles inclusive of alternative sources of energy such as solar, wind, and ocean power as well as other energy sources not yet discovered.

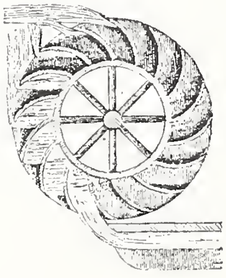
This double issue brings together five papers, news, legislation, and other items relating to the problems of energy in agriculture as well as a general acquisition section. With this issue, the title of the journal has been changed to *Journal of NAL Associates*. This title change reflects a thoughtful recommendation from a member of the Advisory Editorial Board and was approved at the last regular Board meeting.

Alan E. Fusonie
*Associate Editor*

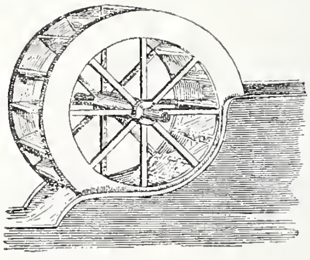
Waterwheels from *American Agriculturist*, November, 1880.



(An Under-shot Wheel for Raising water)



(An Over-shot Wheel)



(A Breast Wheel)

# DEVELOPMENTS IN WOOD AND WIND ENERGY AS A RURAL NEW ENGLAND REACTION TO THE ENERGY CRISIS.

by

Frank C. Kaminsky*

## Introduction

The purpose of this paper is to show that rural New England residents, as a reaction to the energy crisis, have changed their behavior toward the use of conventional non-renewable sources of energy. It will be shown that, over the past five years, wood has been revived as a major source of heat energy. In addition, examples will be given to show that private companies, formed by rural New England residents as a result of the oil embargo of 1973, have made significant progress in the development and testing of economically attractive wind energy systems.

Although this paper concentrates on the developments that are taking place in the areas of wood and wind energy it should be pointed out that similar progress is being made in the areas of conservation, hydroelectric systems, and solar energy. For an overview of each of these areas, including wood and wind energy, the reader should consult the Post Conference Report on the New England-Eastern Canadian Provinces Conference on Alternative Energy.[1]

New England fuel prices have been historically among the highest in the Nation and, in that sense, we have always been faced with an energy crisis. At the present time our energy costs are unsurpassed by any region of the country. Our location at the end of the natural gas pipelines and our heavy dependence on foreign oil make us extremely susceptible to an energy shortage such as the one created by the oil embargo of 1973. The increasing costs of nuclear power coupled with the growing resistance to the construction of nuclear power plants contribute further to the search for alternatives to make New England energy independent. The availability of both wood and wind make these alternatives most attractive.

The Dove™

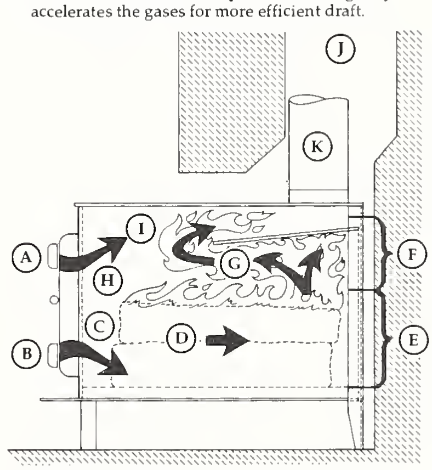
## Wood Energy Development

Although detailed regional studies have not been conducted to determine the extent to which New Englanders are using wood as an alternative source of fuel, there is clear evidence on a state and local level that shows a significant increase in the use of wood as a replacement for conventional sources of energy. Two documents are available to illustrate recent trends in the use of wood energy: a consulting report prepared for the State of Vermont Energy Office[2] and a report prepared by an Energy Conservation Task Force for Franklin County, Massachusetts.[3] Data from these reports will be used in the subsequent discussion.

Before the trends are shown it should be mentioned that wood burning systems have changed dramatically over the past several years. Prior to 1974 very few efficient wood stoves were manufactured in this country and, for the most part, systems were installed for aesthetic purposes. Non air-tight box stoves and inefficient fireplaces were commonplace. The entire situation has changed since 1974 and now the consumer is faced with the incredible task of choosing an efficient airtight stove from the hundreds of manufacturers that have emerged over the past four years. To assist the consumer in this task books have been written[4, 5, 6]; journals have appeared[7]; and wood stove directories are now available.[8]

An example of an efficient airtight stove is shown in Photograph 1 with a description of the burning principle attributed to the efficient Scandinavian design.

The primary fire burns from the front of the stove to the back. The flames and volatile gases play on the underside of the baffle, then curve forward bringing the heat to the front of the stove. As the volatile gases curve around the baffle, they are mixed with secondary air to continue combustion. The slope of the baffle gently accelerates the gases for more efficient draft.




(A) Secondary Air Vent
(B) Primary Air Vents
(C) Primary Air Feeds Primary Fire Zone
(D) Fire Burns In This Direction
(E) Primary Fire Zone
(F) Secondary Fire Zone
(G) Flames & Volatile Gases
(H) Secondary Air Feeds Secondary Fire Zone
(I) Secondary Fire Continues
(J) Chimney Flue
(K) Short Length of 6" Stove Pipe

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The Pillsbury Dove

Photograph 1

As an indication of the general increased popularity of the airtight wood burning stove, figures from the State of Vermont can be used where, in 1976, 17% of all wood stoves in use were of the airtight variety. This figure jumped to 43% for the year 1978. Since Vermont has traditionally led other New England states in the use of wood the percentages are likely to be higher than in other areas of New England. The significant figures for the State of Vermont are as follows:

- o Almost two-thirds (63%) of all homeowners burn wood to some degree;
- o Wood as a supplementary heat source is used in 46% of all households;
- o Wood as a primary heat source is used in 18% of all households;
- o The level of wood usage increased 9% from 1976 to 1978 (from 54% to 63%) and, more importantly, wood as a primary heat source more than doubled from 1976 to 1978 (from 7% to 18%).

Similar results were reported in the study conducted for Franklin County, Massachusetts, a rural area consisting of 26 towns in the North-Central part of Massachusetts. The significant figures for Franklin County for 1978 are as follows:

- o Approximately 40% of all homeowners use wood to some degree;
- o Wood as a supplemental heat source is used in 26% of all households.

The Franklin County study also indicates the effect that wood usage is having on oil consumption. It is estimated that conservation efforts (e.g. lower thermostat setting, insulation, etc.) and the increased use of wood burning appliances have reduced oil consumption from an average of 1,500 gallons per household in the early 1970's to 1,150 gallons per household in 1977—a 23.3% reduction. Most of this reduction has been attributed to wood burning systems where it is estimated that 31,834 cords of wood were used in Franklin County during the 1977-1978 heating season.

The trend in wood burning is expected to increase as more efficient systems become available, particularly in the use of wood burning furnaces and boilers and in the use of multi-fuel systems (e.g. wood/oil, wood/electric, and wood/gas).

## Wind Energy Development

Because of the high cost of energy in the New England area and as a consequence of the oil embargo of 1973 several companies were formed to provide energy to residential and commercial establishments using electric power from the wind. Over the past four years these companies have been involved in the design, development, and testing of wind energy conversion systems (WECS) and, because of their efforts, commercial systems are now available and are being installed as alternative sources of energy. For example, Enertech Corporation of Norwich, Vermont, became involved in the design of a wind driven generator that could be used in a good wind area as a supplement to electric power from the utility company. As design criteria they specified that the system should have the following capabilities: operate with minimal maintenance; have no requirement for batteries or sophisticated inverters to convert dc to ac; be able to operate in a co-generation mode (return power to the power company if production exceeded demand); produce 120 volt ac that was satisfactory to the power company and, finally, be inexpensive and easy to install. Over a period of three years their efforts in design and testing produced the machine shown in Photograph 2.

The Enertech 1500

Photograph 2

Photograph 3 was taken at a test site on Mt. Washington, New Hampshire, one of the windiest and coldest places in the United States. This machine has a 1500 watt capacity and operates down wind—the wind crosses the nacalle and then turns the blades. It is interesting to note the ice formation in the photographs. The wind is crossing from left to right as you view the photograph yet the ice forms up wind.

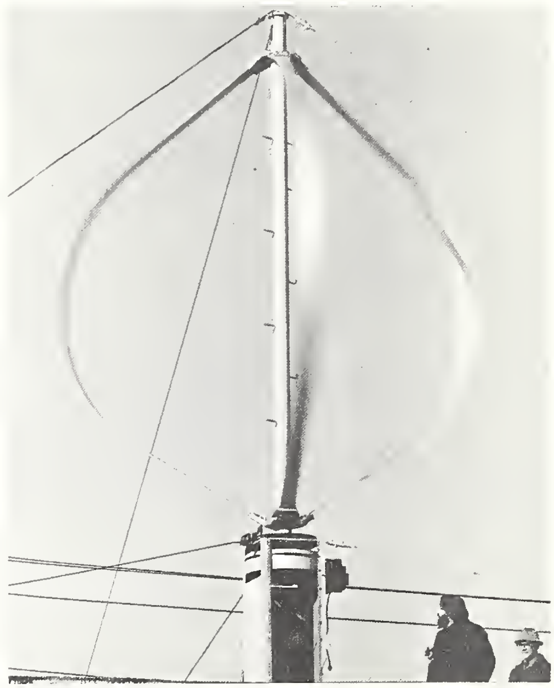
Enertech 1500 Test Site-Mt. Washington

Photograph 3

In an area with an average monthly wind speed of 6.7 meters/second (15 miles per hour) the machine will produce 500 kwh/month and can contribute substantially to the reduction of demand for conventional sources of energy. The system can be purchased for $2,900.00 and, depending on the type of tower that is used, can be installed for $1,000.00 to $2,500.00. The relatively low cost of this system along with the recent federal tax credits for installing wind energy systems, make the system an economically attractive alternative for those individuals fortunate enough to be in a good wind area. Further information on this system can be obtained by contacting the distributor, Energy Alternatives Incorporated of 52 French King Highway in Greenfield, Massachusetts 01301.

At the time of this writing six Enertech 1500's have been installed in the New England States. In addition four others will be installed at other locations throughout the United States. These ten systems will be operated as test installations during the winter of 1978, and, after a period of evaluation, the system is expected to be manufactured and available for large scale distribution.

A second company in the New England area, Dynergy, of Laconia, New Hampshire, was also formed as a result of the energy situation in the Northeast. Dynergy approached the problem differently from Enertech and decided to design, test, and manufacture a vertical axis wind turbine (VAWT) that could be used for space heating and provision of direct electric energy for domestic hot water. The result of their efforts is shown in Photograph 4. This system features a slow speed permanent magnet alternator that produces both variable frequency and voltage. An electrical output of this type can be easily connected to direct resistance heaters to provide domestic hot water and space heating. The basic unit shown in the photograph will produce 5KW of power at a wind speed of 9.8 meters/second (22 miles per hour). In addition, the basic prime mover (the three blades and vertical shaft) can



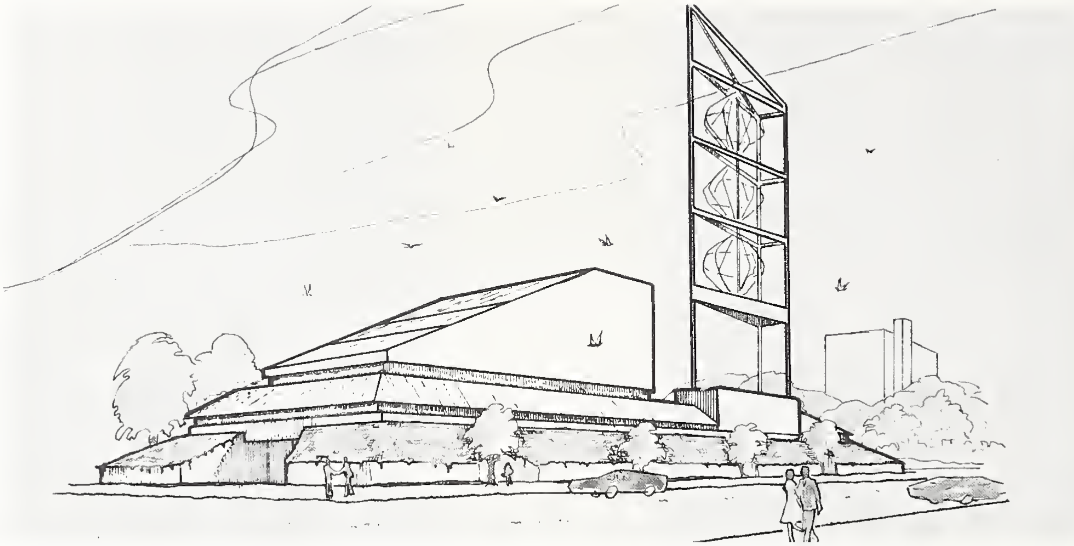
The Dynergy Vertical Axis Wind Turbine

Photograph 4

be stacked in an individual tower to give higher power output in multiples of 5KW. Photograph 5 shows an artist's conception of a stacked VAWT. This system is being designed and will be installed by Wind Engineering Corporation of Lubbock, Texas, at the proposed Times Publishing Company in Clearwater, Florida. It is anticipated that the system will be operational in the Spring of 1980. At the present time the basic system is operating at Laconia, New Hampshire, on the building occupied by Dynergy. A second system was installed at the University of Texas in Lubbock. A third system will be installed at the site of the controversial Seabrook nuclear power plant in Seabrook, New Hampshire, and will be used to provide domestic hot water for the observation facilities of the New Hampshire Public Service Corporation.

In addition to the developments that are taking place in the private sector, the university community is also participating in wind energy development. The most active New England school is the University of Massachusetts at Amherst where, over the past six years, faculty and students from several departments have conducted research in numerous areas, including the design and construction of a home that uses wind energy and solar energy for space heating.

Under the leadership of Professor William E. Heronemus and with funding from the National Science Foundation a major project dealing with the concept of a wind furnace was initiated in 1975. Continued support was provided in subsequent years through the Energy Research and Development Administration and International Rockwell.



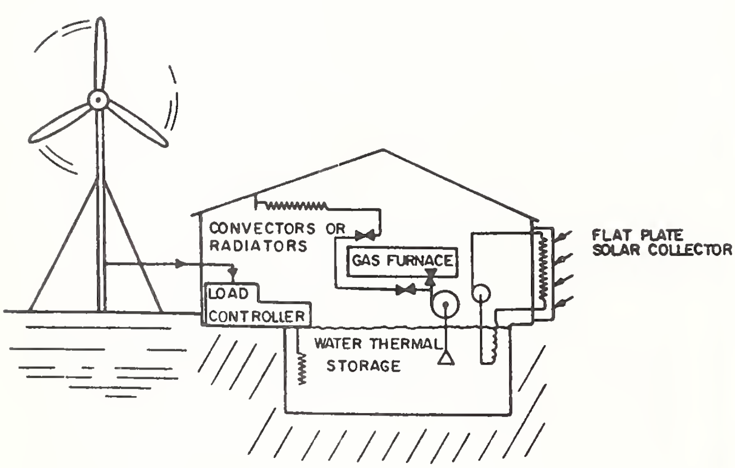
Artists Conception of Stacked Vertical Axis Wind Turbine

Photograph 5

As shown in Figure 1, the wind furnace is a space heating system consisting of a wind turbine, solar flat plate collectors, a storage system, and a heat delivery system. Water in the insulated thermal storage tank is heated by both the solar collectors and the electricity generated by the wind turbine. The heated water is then used to provide space heating by conventional base board hot water convectors. A gas fired warm air furnace serves as a back-up auxilliary heating system.

The completed home, located on the University campus, is shown in Photograph 6. It now serves as a laboratory station for the many undergraduate and graduate students enrolled in the Energy Studies Program of the School of Engineering at the University of Massachusetts.

The wind energy system used in this application is large compared to those developed by Enertech and Dynergy whereby it produces 25KW of power at a wind




WIND FURNACE CONCEPT

FIGURE 1

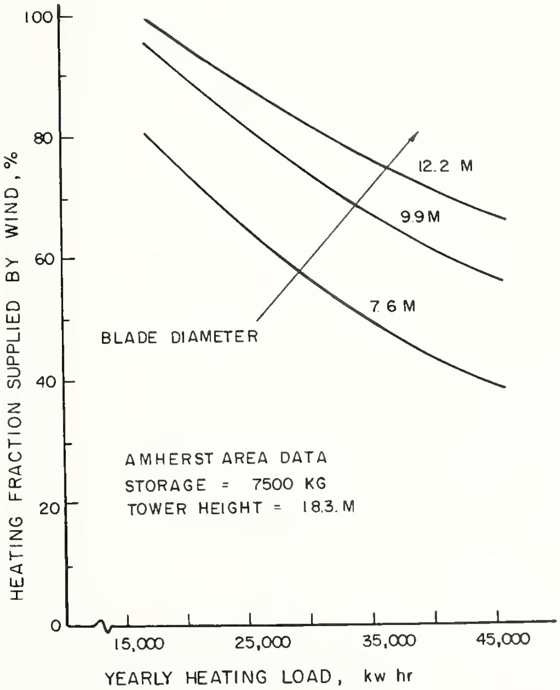
The Wind Furnace at the University of Massachusetts

Photograph 6

speed of 11.6 meters/second (26 mph). The down wind rotor is mounted on a guyed steel mast 18.3 meters (60 ft.) above ground level.

Using this system as a basis, research results are showing clearly that wind in combination with solar can contribute substantially in providing the energy requirements for space heating in colder climates. For example, Figure 2 shows, for different heating loads, the percentage of space heating that could be supplied in Amherst, Massachusetts, using the U Mass wind system with different blade diameters. This system and the research results are receiving national and international publicity and, as a result, private companies are now in the process of developing similar systems for commercial production.

Unlike wood burning systems the impact of wind energy systems has not been felt significantly at this time. There is indication, however, that the engineering accomplishments that have already taken place coupled with those planned for the future will make a significant contribution, both nationally and internationally, to the search for renewable sources of energy.




*HEATING FRACTION SUPPLIED BY WIND*
*FIGURE 2*

REFERENCES


1. *New England-Eastern Canadian Provinces Conference on Alternative Energy, A Post Conference Report* by the New England Regional Commission, Boston, Massachusetts, June, 1978.

2. *The Use of Wood as a Heat Source and the Quality of Insulation in Vermont Households, A Report for the Vermont Energy Office,* by Action Research Incorporated, Burlington, Vermont, June, 1978.

3. *Franklin County Energy Profile 1975-1978, A Report* by the Franklin County Energy Conservation Task Force, Greenfield, Massachusetts, October, 1978.

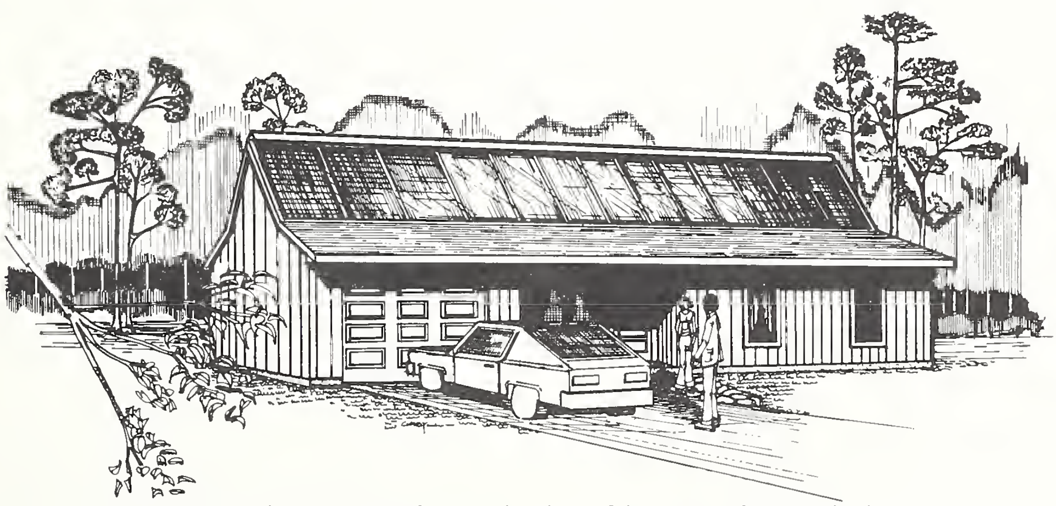
4. L. Gay, *The Complete Book of Heating with Wood* (Charlotte, Vt.: Garden Way Publishing Co., 1974)..

5. J. Shelton and A. B. Shapiro, *The Woodburners Encyclopedia* (Waitsfield, Vt.: Vermont Crossroads Press, 1976).

6. M. Twitchell, *Wood Energy: A Practical Guide for Heating with Wood* (Charlotte, Vt.: Garden Way Publishing Co., 1978).

7. *Woodstove Fireplace and Equipment Directory,* Vol. II (Manchester, N.H.: Energy Communications Press, 1979).

8. *Home Energy Digest and Wood Burning Quarterly,* 3, 2 (Fall 1978).

*Artistic rendering of a 3-bedroom solar heated house nearing completion outside of Greenville, South Carolina. Designed by the USDA's Agricultural Research Service, the house has been constructed with two layers of translucent fiberglass replacing conventional roofing on the south slope; these fiberglass layers transmit solar energy to the attic which serves as a heat collector. A 12-inch thick layer of crushed rock beneath the floor serves as a heat storage tank. It is predicted that solar energy can supply 75% of the home's heating requirements. (Courtesy, U.S. Department of Agriculture).*

# AGRICULTURAL ENERGY RESEARCH: A SAMPLE OF CURRENT PROJECTS IN CRIS

by

Philip L. Dopkowski*

The Current Research Information System (CRIS) serves as the USDA/State project documentation system for publicly supported agricultural and forestry research in the United States. Its basic purpose is to improve communication among agricultural and forestry research scientists and to provide research managers with up-to-date and coordinated information on total research programs of USDA and participating state institutions.

Of approximately 29,000 on-going and recently completed projects documented in CRIS, over 900 projects, or about three percent of the total file, are identified as energy-related. This represents most of the current Federal and State funded energy research directly linked to agriculture and forestry. About half deal with energy as a major component of the research, and the projects listed here are a sample of those in which energy appears as the principal target of investigation.

The projects listed below were obtained from a search of the CRIS online file which is publicly accessible through Lockheed DIALOG Information Retrieval Service. Online users may readily access and select the entire energy portion of the file on DIALOG through the use of two distinct codes in the CRIS descriptor block: EMP (Energy Major Projects) and ERP (Energy Related Projects). Additional searching for narrower concepts may then be performed within these subsets to insure energy relatedness.

While energy codes in the descriptor block facilitate subject access to the technical portion of the energy file for retrievals in the form of descriptive abstracts, it is anticipated that by 1980, all energy projects in CRIS will be special coded for management retrievals that can provide funding and staff support information in forms more useful to research managers and administrators. The special codes are based on the CRIS Energy Classification Table developed for the purpose and include three major and 31 minor categories of energy research.[1] Examples of these are the following: use of alternative sources and forms of energy (solar, wind, geothermal); development of energy and petrochemical substitutes from biomass (animal waste and crop residues, energy farming); socio-economic consequences of energy production, availability, and use, and conservation and use of energy in the production, processing, marketing, and consumption of crops, livestock, and forest products. In contrast to the descriptor block codes that are assigned by CRIS indexers, the energy classification codes, together with the percentage of effort applicable to each category, will be assigned by the research or administrative unit most closely identified with the research. When fully implemented the system will provide management with the decision-making information needed for more comprehensive and accurate reporting, planning, and coordination of agriculturally-related energy research.

In the pages which follow, the output format for the first project is an example of the CRIS Standard Technical Printout. This format is available for all projects in CRIS and is accessible online as format 7. The remain projects are listed in format 3 and are broadly grouped by energy source or application.

*Philip L. Dopkowski is Head, Technical Section, Current Research Information System, Technical Information Systems, Science and Education Administration, U.S. Department of Agriculture, Beltsville, Maryland.

## CRIS STANDARD TECHNICAL PRINTOUT

*0070992 AGENCY ID: SAES SD. PROJ NO: SD00754*
*PERIOD: 01 JUL 76 TO 30 SEP 79 INVEST: HELLICKSON M A*
*PERF ORG: AGRI ENGINEERING LOCATION: S DAKOTA STATE UNIV BROOKINGS SD*

*ENERGY EFFICIENCY AND UTILIZATION IN AGRICULTURAL PRODUCTION*

*OBJECTIVES:* Evaluate systems for more efficient use of electricity, fossil fuels, and other energy sources for agricultural production. Determine the energy requirements for performing selected agricultural operations in South Dakota. Investigate methods of substituting energy sources, such as, solar and wind, for agricultural systems currently using conventional energy sources. Study the effects of management and control on energy use for agricultural production.

*APPROACH:* Cold air crop drying and solar supplemented crop drying studies will be conducted on the Agricultural Engineering Farm. Low temperature, low cost solar collectors will be investigated as a source of supplemental heat for confinement livestock buildings. Work will be performed to develop a multi-purpose solar-intensifier-thermal storage system for agricultural uses.

*PROGRESS: 77/01 77/12*
A solar energy-intensifier system was developed that collected 77% of the solar energy on a horizontal surface during a 23-day corn drying study. A total of 3.9 x 109 J (906 kw-hr) of solar energy was collected and drying time of the corn was reduced by approximately 50%. A solar energy-intensifier-thermal energy storage system provided 2.7 x 107 J of energy for space heating during a 28-day period in February and March. Overall performance of the solar energy-intensifier-thermal energy storage system was less than expected with most of the problems being material related. Evaluation of three types of low cost, low temperature rise solar collectors mounted on the outside of a beef building showed a definite preference for a vertical side-wall collector. The vertical side-wall collector is expected to provide the equivalent of 0.13 kw-hr/meter. of energy per heating season in East-Central South Dakota. This will allow for a repayment period of 0.6 heating seasons based on electrical costs and 1.1 heating seasons based on propane cost.

*PUBLICATIONS: 77/01 77/12*
*HELLICKSON, M.A., PETERSON, W.H., SAIENGA, S.E. and JULSON, J.L. 1977.* Performance of a Solar Energy-Intensifier with Thermal Energy Storage. ASAE Paper No. 77-4533, ASAE, St. Joseph, Michigan.
*HELLICKSON, M.A., PETERSON, W.H., SAIENGA, S.E. and JULSON, J.L. 1977.* Agricultural Crop Drying and Space Heating Using a Solar Energy Intensifier, Paper Presented at the 4th Annual UMR-DNR Conference on Energy, Rolla, Missouri.
*HELLICKSON, M.A. 1977.* Non-Tracking Solar Concentrators, Solar Grain Drying Conference Proceedings, University of Illinois, pp. 104-120, January 11-12.
*YEXLEY, D.P., HELLICKSON, M.A. and WITMER, W.B. 1977.* Solar Energy for Supplemental Heating of Livestock Buildings, ASAE Paper No. 77-3004, ASAE, St. Joseph, Michigan.
*SAIENGA, S.E., HELLICKSON, M.A. and PETERSON, W.H. 1977.* Crop Drying with a Solar Energy-Intensifier. ASAE Paper No. NCR77-1005. ASAE, St. Joseph, Michigan.

## I. AGRICULTURAL USE/GENERAL

*INVEST: GAVETT F E*
*PERF ORG: INPUTS & FINANCE & FIBER SECTOR NEA DIV-ERS*
*PROJ NO: NEA-15-135-11-00*
*LOCATION: US DEPT OF AGRICULTURE WASHINGTON DC*

*ENERGY USE AND CONSERVATION IN U.S. AGRICULTURE*

*OBJECTIVES:* Develop, maintain, and project statistics of energy use on farms including direct fuel use such as gasoline, diesel, LPG and electricity and indirect or embodied energy in inputs such as natural gas in fertilizers, pesticides, and Btu in machinery and equipment. Determine the potential for conservation of energy use in farm production. Determine the impact of changes in energy prices on use on farms, production patterns, adoption of energy saving technology, and cost and returns to farmers by regions and States.

*INVEST: JUST R F*
*PERF ORG: AGRI & RESOURCE ECONOMICS*
*PROJ NO: CA-B*-AFC-3637-H*
*LOCATION: UNIV OF CALIFORNIA BERKELEY CAL*

*IMPACT OF ENERGY RESOURCE DEPLETION ON AGRICULTURE AND IMPLICATIONS FOR ENERGY POLICY ANALYSIS*

*OBJECTIVES:* Analyses of demand & supply of energy resources important to agriculture. Development of economic models of energy use appropriate in forecasting price increases & fuel shortages. Investigation of alternative energy scenarios with regard to farm investment activity & of the role of institutional structure as a determinant to energy Aricina. Assessment of the effect of government energy programs on agriculture & development of alternatives.

*INVEST: ROGERS L F*
*PERF ORG: POULTRY PRODUCTS PROGRAM AREA CE DIV-ERS*
*PROJ NO: CF-08-077-53-01-X1*
*LOCATION: WASHINGTON STATE UNIV PULLMAN WN*

*ENERGY USE IN MARKETING AND PROCESSING FOOD AND FIBER COMMODITIES*

*OBJECTIVES:* Develop estimates of energy required in marketing food and fiber commodities, present and future. Conceptualize and develop analytical models for aggregating and disaggregating energy data and studying alternatives relating to energy forms, locational, geographical and seasonal problems, commodity shifts, and long-range programs. Analyze potential energy use with alternative marketing methods, new technology, and conservation practices. Determine effects of modification of regulations on energy use by agricultural marketing firms and of national and international energy policies on costs, prices, location of production and marketing functions, and commodity mix. Suggest policy alternatives which would maintain a viable agriculture.

## II. FAMILIES/HOUSEHOLDS/RURAL AREAS

*INVEST: CHRISTIANSON L I*
*PERF ORG: AGRI ENGINEERING*
*PROJ NO: MO-00077*
*LOCATION: UNIV OF MISSOURI COLUMBIA MO*

*ENERGY UTILIZATION AS RELATED TO FARMSTEAD MECHANIZATION, MATERIALS HANDLING, AND RURAL LIVING*

*OBJECTIVES:* Investigate feasibility, performance, costs, benefits related to optimum use of electricity (independently and/or in combination with other forms of energy, especially solar) as such relate to: Improved crop and livestock production facilities, handling and preservation of food products, and the effects of energy reductions and/or conservation in rural Missouri.

*INVEST: CHEN D Y*
*PERF ORG: ECONOMICS*
*PROJ NO: NC.X-PR-0007-20095*
*LOCATION: AGRIC & TECH UNIV OF N C GREENSBORO NC*

*ENVIRONMENTAL IMPACT OF ENERGY RESOURCE UTILIZATION ON LIMITED-SOURCE FARMS IN RURAL NORTH CAROLINA*

*OBJECTIVES:* Construct energy utilization coefficients by farm operations and house-hold consumption based on first-hand data study the environmental impact of energy resource usage on farms; map strategies for conservation and management of energy resource under varying availability and provide estimates for basis of comparison for state and federal agencies.

*INVEST: HAWKES G R*
*PERF ORG: APPLIED BEHAVIORAL SCIENCE*
*PROJ NO: CA-D*-ABS-3573-N*
*LOCATION: UNIV OF CALIFORNIA DAVIS CAL*

*CHARACTERISTICS OF NEW ENERGY CONSERVING COMMUNITIES*

*OBJECTIVES:* Identify the personal and environmental characteristics which promote energy and resource conservation and/or the early adoption of innovative or alternative technology. These include: Organizational factors, Political factors, Social factors, Lifestyle factors, Economic factors. Compare the actual energy requirements of households in communities designed to be low energy and resource consuming to that of households in traditional developments.

*INVEST: HOGAN M J*
*PERF ORG: HOME ECONOMICS*
*PROJ NO: MIN-52-042*
*LOCATION: UNIV OF MINNESOTA ST PAUL MIN*

*FAMILY ENERGY CONSUMPTION & CONSERVATION PRACTICES*

*OBJECTIVES:* Identify energy consumption patterns of families for transportation, home heating and cooling and the use of electrical appliances. Identify conservation practices adopted by family members to achieve a reduction in energy consumption. Also identify practices not adopted or aborted. Estimate the potential for energy conservation by families on different socio-economic levels.

## III. SOLAR ENERGY

*INVEST: DALE A C*
*PERF ORG: EASTERN BRANCH STATION*
*PROJ NO: IND046015*
*LOCATION: PURDUE UNIV LAFAYETTE IND*

*SOLAR ENERGY COLLECTION, STORAGE, AND UTILIZATION FOR THE IMPROVEMENT OF LIVESTOCK AND CROP PRODUCTION*

*OBJECTIVES:* Develop solar energy collection systems, solar energy storages, and procedures for the utilization of solar energy to modify the environment for the improvement of both animal and crop production in cold and hot weather.

INVEST: WIERSMA F
PERF ORG: SOILS WATER & ENGINEERING
PROJ NO: 7092-20401-012-A(2)
LOCATION: UNIV OF ARIZONA TUCSON ARIZ

SOLAR ENERGY UTILIZATION IN DAIRIES

OBJECTIVES: Develop design criteria for use of solar energy for heating and cooling needs in dairy facilities in various climatic regions, develop a computer simulation model for evaluation of solar energy systems for dairies, and determine economic feasibility of use of solar energy systems for dairies.

INVEST: HELLICKSON M A
PERF ORG: AGRI ENGINEERING
PROJ NO: 7003-20400-015-A
LOCATION: S DAKOTA STATE UNIV BROOKINGS SD

SOLAR ENERGY SYSTEM TO HEAT AIR FOR SWINE SHELTERS AND GRAIN DRIERS

OBJECTIVES: Develop design criteria for a multipurpose, diurnally-tracking solar intensifier to improve the energy collector system for swine shelter heating and corn drying.

INVEST: CAIN J L
PERF ORG: AGRI ENGINEERING
PROJ NO: MD-RAM-49
LOCATION: UNIV OF MARYLAND COLLEGE PARK MD

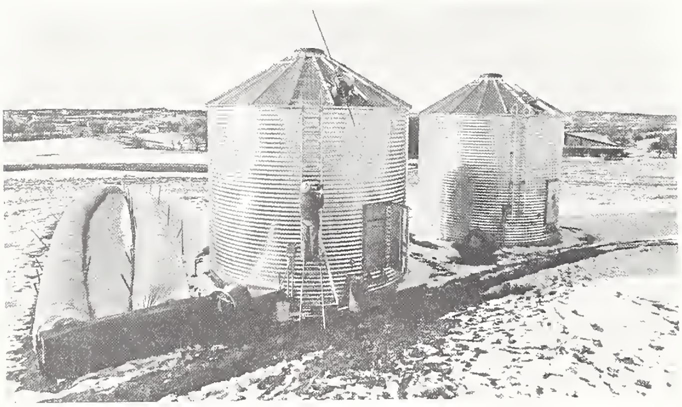
UTILIZATION OF SOLAR ENERGY IN BROILER PRODUCTION

OBJECTIVES: Determine fossil-fuel savings by introducing heated air from a solar collector directly into the ventilation air inlet of a broiler facility with excess heat going to rock storage. Retrofit a broiler facility using the roof as a solar collector. Study the physiological response of broilers to determine if introducing heated air from a solar collector significantly affects their behavior or performance. Conduct an economic analysis to determine cost-benefit ratios for the system.

INVEST: THOMPSON T L
PERF ORG: AGRI ENGINEERING
PROJ NO: 8090-20595-026A(1)
LOCATION: UNIV OF NEBRASKA LINCOLN NEB

SOLAR ENERGY FOR DRYING CORN IN U.S. PRODUCING AREAS

OBJECTIVES: Determine through computer simulation, the relative effectiveness of solar energy for in-storage of corn in the principal U.S. corn producing areas.



*Technicians for USDA's Agricultural Research Service at Manhattan, Kansas emerge from the storage bin connected to the solar dryer after probe sampling at given depths and locations in the bin. These samples are used to determine moisture content and storage mold invasion. (Courtesy, U.S. Department of Agriculture).*

INVEST: BARRETT J R
PERF ORG: USDA-ARS INSECT CONTROL RES AGRI ENGINEERING
PROJ NO: 3302-20590-001
LOCATION: PURDUE UNIV LAFAYETTE IND

SOLAR DRYING OF WHEAT AND OTHER GRAINS

OBJECTIVES: Determine the feasibility of using air heated by solar energy to dry wheat and other grain.

INVEST: BERRY P F
PERF ORG: USDA-ARS CITRUS SUBTROPIC PRODUCT RES
PROJ NO: 7608-20510-013
LOCATION: PO BOX 1909 WINTER HAVEN FLA

DEHYDRATION OF SOUTHEASTERN FRUITS AND VEGETABLES BY SOLAR ENERGY

OBJECTIVES: Develop practical dehydration process for food and agricultural products using solar energy augmented by fossil energy sources when necessary, to develop new dehydrated fruit and vegetable products.

INVEST: FEDER W A
PERF ORG: SUBURBAN EXPER STATION
PROJ NO: MAS00429
LOCATION: UNIV OF MASSACHUSETTS WALTHAM MAS

SOLAR ENERGY FOR GREENHOUSE HEATING

OBJECTIVES: This is a joint effort of Federal agencies (ERDA, USDA), State agencies (Agr. Exper. Stn.) and private industry to determine and demonstrate the practical feasibility of growing commercially important plant materials in a greenhouse heated by solar energy systems.

## IV. WIND ENERGY

INVEST: VERMA L R
PERF ORG: AGRI ENGINEERING
PROJ NO: SD00796
LOCATION: S DAKOTA STATE UNIV BROOKINGS SD

WIND ENERGY FOR AGRICULTURAL APPLICATIONS

OBJECTIVES: Calculate the wind energy available at selected sites in SD. Study the intensity and variation in this energy on a daily and monthly basis. Study the relative potential of wind energy as compared to other alternate energy sources. Evaluate the combined potential of wind and solar energies at selected sites in South Dakota. Investigate the potential of wind energy for agricultural applications.

INVEST: HAGEN L J
PERF ORG: USDA-ARS SOIL EROSION RES WATERS HALL
PROJ NO: 3707-20740-001
LOCATION: KANSAS STATE UNIV MANHATTAN KAN

WIND ENERGY FOR PUMPING IRRIGATION WATER

OBJECTIVES: Determine the seasonal wind energy distribution in the Great Plains and develop strategies to utilize wind energy for pumping irrigation water.

INVEST: GUNKEL W W
PERF ORG: AGRI ENGINEERING
PROJ NO: 3090-20401-002-C
LOCATION: CORNELL UNIV ITHACA NY

WIND ENERGY SUBSTITUTION AT DAIRY MILKING CENTER

OBJECTIVES: Determine the feasibility of heat generation from wind energy by fluid friction heating and measure the performance of an experimental system designed to generate heat by this means.

*INVEST: SODERHOLM L H* — *PROJ NO: 3408-20690-002*
*PERF ORG: USDA-ARS AGRIC ENG RESEARCH* — *LOCATION: IOWA STATE UNIV AMES IOW*

*HEATING OF RURAL STRUCTURES WITH WIND-DERIVED ENERGY*

*OBJECTIVES:* Development of heating systems for rural structures using wind energy to reduce consumption of nonrenewable energy resources for heating, to provide standby heating in case of failure of other heating sources, assist in reducing electrical peak demand, and provide load leveling for heating systems using electricity as an energy source.

*The Pon Ponder Farm in Tuscola, Illinois, is the site of one of several solar projects near the Champaign-Urbana area. Dr. G.C. Shove, professor at the University of Illinois, checks the temperature of air as it enters the solar collector. (Courtesy, U.S. Department of Agriculture).*

## V. TILLAGE/IRRIGATION

*INVEST: FRISBY J C* — *PROJ NO: MO00085*
*PERF ORG: AGRI ENGINEERING* — *LOCATION: UNIV OF MISSOURI COLUMBIA MO*

*MANAGEMENT OF AGRICULTURAL MACHINE SYSTEMS TO CONSERVE ENERGY*

*OBJECTIVES:* Measure draft and fuel consumption for tillage tools in sandy, loam, and clay soils. Estimate the number of good, working days available throughout Missouri for selected field operations.

*INVEST: SMITH J L* — *PROJ NO: COL00120*
*PERF ORG: AGRI ENGINEERING* — *LOCATION: COLORADO STATE UNIV FORT COLLINS COL*

*ENERGY EFFICIENCY IN TILLAGE AND TRACTION*

*OBJECTIVES:* Evaluate and develop tillage procedures for efficient expenditure of energy with particular emphasis on irrigated agriculture. Evaluate the effect of chassis mechanics of four-wheel-drive tractors on traction devices and systems for optional traction. Develop interface systems for coupling tillage implements to four-wheel-drive tractors.

*INVEST: HUNF D D* — *PROJ NO: ILLU-10-0334*
*PERF ORG: AGRI ENGINEERING* — *LOCATION: UNIV OF ILLINOIS URBANA ILL*

*TIME AND ENERGY REDUCTIONS FOR FIELD MACHINE OPERATIONS*

*OBJECTIVES:* Identify factors contributing to non-productive time and energy waste in field machine operation systems. Determine practices and procedures which will minimize these losses. Develop techniques for helping farm managers make decisions in this problem area.

*INVEST: WENSINK R B* — *PROJ NO: ORE00314*
*PERF ORG: AGRI ENGINEERING* — *LOCATION: OREGON STATE UNIV CORVALLIS ORE*

*ENERGY REQUIREMENTS OF IRRIGATION SYSTEMS*

*OBJECTIVES:* Determine energy requirements of selected irrigation systems. Determine the effects of escalating energy and labor cost on the design of irrigation systems.

## VI. FOOD PROCESSING

*INVEST: DAVIS D C* — *PROJ NO: WNP00403*
*PERF ORG: AGRI ENGINEERING* — *LOCATION: WASHINGTON STATE UNIV PULLMAN WN*

*UTILIZATION OF SOLAR ENERGY IN FOOD PROCESSING*

*OBJECTIVES:* Characterize energy use of specific unit processes that are important to the food processing industry of Washington State. Characterize solar energy availability at representative locations that are important centers for food processing in the state. Determine the potential for solar energy use at specific processing sites and necessary energy storage capacities. Adapt existing processes or develop new processes that can efficiently utilize solar energy for food processing.

*INVEST: ASHBY B H* — *PROJ NO: 1104-10614-005*
*PERF ORG: TRANS & PACKAGING RES LAB AGR MKTG RESEARCH* — *LOCATION: RM 210 BLDG 006 BAPC-W BELTSVILLE MD*

*REDUCING ENERGY USE DURING THE TRANSPORTATION AND STORAGE OF FROZEN FOODS*

*OBJECTIVES:* Determine quality changes in frozen foods resulting from fluctuating temperatures caused by shutting off refrigeration overnight in freezer storage rooms and determine the relative amounts of energy saved by this procedure.

*INVEST: BUCK R Y* — *PROJ NO: MAS00413*
*PERF ORG: FOOD SCIENCE & NUTRITION* — *LOCATION: UNIV OF MASSACHUSETTS AMHERST MAS*

*REDUCING ENERGY REQUIREMENTS FOR COOKING MEAT*

*OBJECTIVES:* Reduce energy requirements for cooking meat. Develop water bath method of cooking at low temperature.

*INVEST: AMUNDSON C H* — *PROJ NO: WIS 02266*
*PERF ORG: FOOD SCIENCE* — *LOCATION: UNIV OF WISCONSIN MADISON WIS*

*ENERGY BALANCE DETERMINATIONS IN WISCONSIN CANNING PLANTS*

*OBJECTIVES:* Determine the quantitative energy requirements for processing canned peas and corn and identify the most promising potential areas for more efficient energy utilization and conservation. At the conclusion of this project the data will be used to prepare energy use guidelines for the processing of vegetables.

## VII. BIOMASS/WASTE/RESIDUES

*INVEST: COCHRAN B J* *PROJ NO: LAB01952*
*PERF ORG: AGRI ENGINEERING* *LOCATION: LOUISIANA STATE UNIV BATON ROUGE LA*

*ENGINEERING SYSTEMS FOR MANAGEMENT AND USE OF ENERGY FROM BIOMASS*

*OBJECTIVES:* Determine the feasibility of designing and constructing an on-farm fuel generator using biomass material as an energy source. Determine alternate means of utilizing agricultural products as sources of energy. Characterize and improve energy management strategies for environmentally and economically acceptable crop production systems.

*INVEST: BRINK D L* *PROJ NO: CA-F*-FPL-2905-H*
*PERF ORG: FOREST PRODUCTS LABORATORY* *LOCATION: UNIV OF CALIFORNIA BERKELEY CAL*

*PYROLYTIC UTILIZATION OF ORGANIC RESIDUES--FOREST AND AGRICULTURE--FOR ENERGY AND PRODUCT RECOVERY*

*OBJECTIVES:* Develop data for and design technically and economically feasible, environmentally compatible, and socially acceptable pyrolysis processes utilizing organic residuals generated in forestry and agricultural enterprises.

*INVEST: JEWELI W J* *PROJ NO: NYC-123360*
*PERF ORG: AGRI ENGINEERING* *LOCATION: CORNELL UNIV ITHACA NY*

*ANAEROBIC FERMENTATION OF AGRICULTURAL WASTES--POTENTIAL FOR IMPROVEMENT AND IMPLEMENTATION*

*OBJECTIVES:* Determine the potential for optimizing technology related to anaerobic fermentation of agricultural wastes; identify fermentor designs capable of more rapid or more efficient recovery of energy containing by-products of gas, nutrients and solid residues, and to demonstrate the feasibility of improved fermentors using small laboratory models followed by large scale pilot plants. Studies will be conducted with dairy cow wastes.

*INVEST: BARTLETT H D* *PROJ NO: PEN02345*
*PERF ORG: AGRI ENGINEERING* *LOCATION: PENNSYLVANIA STATE UNIV UNIVERSITY PARK PA*

*BIOGAS PRODUCTION FROM ANAEROBIC DIGESTION OF ANIMAL MANURE*

*OBJECTIVES:* Determine the effects of operational and environmental factors on methane production by anaerobic digestion of animal residue at raised temperatures.

*INVEST: ZEIKUS J G* *PROJ NO: WIS02376*
*PERF ORG: BACTERIOLOGY* *LOCATION: UNIV OF WISCONSIN MADISON WIS*

*MICROBIAL CHEMICAL AND FUEL PRODUCTION FROM FERMENTATION OF CELLULOSE AND STARCH*

*OBJECTIVES:* Identify the organisms and experimental conditions that are optimal for the microbial conversion of cellulose and starch to ethanol and acetic acid. New species of thermophilic anaerobic saccharolytic bacteria will be isolated and characterized. Cultural parameters optimal for ethanol and acetate production by Clostridium thermocellum will be determined. The catabolic pathway and its regulation will be studied.

*INVEST: ALEXANDER A G* *PROJ NO: PR-C-00481*
*PERF ORG: CROP SCIENCE* *LOCATION: UNIV OF PUERTO RICO MAYA RIO PIEDRAS PR*

*PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE*

*OBJECTIVES:* Determine the agricultural and economic feasibility of mechanized, year-round production of dry biomass, through the intensive management of sugarcane and napier grass as tropical forages; examine alternate tropical grasses as potential sources for intensive biomass production; and select and breed new sugarcane clones having superior biomass productivity as their main attribute.

*INVEST: BLANKENHORN P R* *PROJ NO: PEN02173*
*PERF ORG: FOREST RESOURCES* *LOCATION: PENNSYLVANIA STATE UNIV UNIVERSITY PARK PA*

*FOREST BIOMASS AS A SOURCE OF ENERGY AND BYPRODUCTS*

*OBJECTIVES:* Determine the feasibility of using forest biomass as fuel for generating electricity for small-sized communities (10,000) or manufacturing firms in Pennsylvania, and the by-products from alternate processes.

*INVEST: KAUFMAN K R* *PROJ NO: ND01437*
*PERF ORG: AGRI ENGINEERING* *LOCATION: NORTH DAKOTA STATE UNIV FARGO ND*

*NON-PETROLEUM FUELS FOR POWER UNITS USED BY AGRICULTURE*

*OBJECTIVES:* Evaluate the use of non-petroleum fuels such as ethyl alcohol, methyl alcohol and methane for internal combustion engines.

## VIII. MINING/RECLAMATION

*INVEST: JACOBS J J* *PROJ NO: WYO00998-WS*
*PERF ORG: AGRI ECONOMICS* *LOCATION: UNIV OF WYOMING LARAMIE WYO*

*IMPACTS OF COAL-ENERGY DEVELOPMENT IN N. E. WYOMING ON AGRICULTURE AND RELATED ENVIRONMENT ASPECTS*

*OBJECTIVES:* Identify the nature and magnitude of land and water transfers associated with coal-energy development in northeastern Wyoming. Quantify the benefits and costs of coal mineland reclamation. Evaluate the potential impact of coal mines on the surrounding groundwater aquifer, and estimate the impact on agriculture of alternative levels and types of coal-energy development.

*INVEST: BARSE J* *PROJ NO: NRE-42-309-11-00*
*PERF ORG: NATURAL RESOURCE ECON DIV ERS* *LOCATION: US DEPARTMENT OF AGRICULTURE WASHINGTON DC*

*ECONOMICS OF COAL AND OIL SHALE DEVELOPMENT ON ENVIRONMENTAL QUALITY IN RURAL AREAS*

*OBJECTIVES:* Assess the economic implications of alternative coal and oil shale development and associated activities on environmental quality and the competition for resources in rural areas.

*INVEST: JANSEN I J*
*PERF ORG: AGRONOMY*

*PROJ NO: ILLU-15-0331*
*LOCATION: UNIV OF ILLINOIS URBANA ILL*

*RECLAMATION OF SURFACE MINED LAND*

*OBJECTIVES:* Characterize strip mine spoils. Relate their properties to geographic region, pre-mine landscape, overburden materials, coal strata mined, mining procedure, age of spoils. Identify factors that limit stand establishment, crop performance, farming operations. Determine rate of organic matter accumulations, structure development, weathering down of compaction zones and shale fragments, chemical changes in mine spoils. Relate physical properties of reclaimed soils to soil moisture content at time of mining and grading.

*INVEST: MORSE R D*
*PERF ORG: HORTICULTURE*

*PROJ NO: VA-0336923-1*
*LOCATION: VIRGINIA POLY INST BLACKSBURG VA*

*SOIL AMENDMENTS AND TILLAGE REGIMES INFLUENCE ON PRODUCTIVITY OF STRIPMINE SPOILS FOR VEGETABLES*

*OBJECTIVES:* Determine the value of organic amendments on soil condition and crop yield of stripmine spoils. Compare different tillage regimes as to their influence on soil condition and crop yield. Ascertain the interactions between organic amendments and tillage regimes on soil condition and crop yield.

REFERENCES

1. U.S. Department of Agriculture, Current Research Information System, *Manual of Classification of Agricultural and Forestry Research*, Rev. III, Washington, D.C., 1978.

*The cover plate of the solar collector being used in this cooperative experiment at Iowa State University, Ames, is a rigid structure made of acrylic plastic. (Courtesy, U.S. Department of Agriculture).*

# MINIMUM TILLAGE—ENERGY SAVING ON THE FARM

by

Patricia J. Devlin*

The adopting of minimum tillage techniques on U.S. farms may be considered to be one of the outstanding agricultural developments of the late twentieth century. Conventional tillage, which can require as many as nine separate trips over the fields (for plowing, replowing, disking, harrowing, planting, cultivating, etc.) has received some modification among the majority of American farmers. The modification developed from the realization that so many trips are not necessary to maintain acceptable yields, for this type of tillage is both time and labor consuming and requires large machinery investments and maintenance costs. At the same time, excessive working of the land creates problems of soil and water erosion and uses much energy. Recognition of some of the more negative aspects of conventional tillage has been a phenomenon of rather recent origin. Whereas Edward Faulkner questioned the rationality of total reliance on the plow in 1943, it was not until very recent times that modern practices supported his insight.[1] The degree to which such insight has been recognized is illustrated by the tremendous increase in minimum tilled acreage (see Table 1).

TABLE 1. Estimated Total and Annual Rate of Increase in Minimum Tilled Acreage, Fiscal Years 1963-74.

| Year | Total Acreage | Increase from Preceeding Year |
|---|---|---|
| 1970 | 18,582,842 | 11,963,343* |
| 1971 | 21,804,073 | 3,221,231 |
| 1972 | 24,073,423 | 2,269,089 |
| 1973 | 29,183,423 | 5,410,261 |
| 1974 | 32,630,000 | 3,446,577 |

*Increase from 1965

Source: U.S. Department of Agriculture, Office of Planning and Evaluation. "Minimum Tillage: A Preliminary Technology Assessment." Prepared for Senate Committee on Agriculture and Forestry, September 1975, p. 64, table 2.

While conventional tillage relies upon plowing for soil preparation to combat weeds and undesirable vegetation, minimum tillage cuts out or down upon this operation. Rather than plowing before planting, minimum tillage implies planting new crops in the stubble or residue of the preceding crop. With minimum tillage, surface disturbance of the field is very limited, and with no-tillage, only the intermediate seed bed is prepared.[2] Chemical means are substituted for plowing in the control of weeds. Greater pesticide application is also a characteristic associated with minimum tillage.

*Patricia J. Devlin, Economist, National Economic Analysis Division, Economics, Statistics, and Cooperatives Service, USDA.

Because minimum tillage does not require inversion of significant amounts of topsoil, areas previously unsuitable for crop growing can often be brought into production. For example, hilly land can often be farmed using minimum tillage techniques because of the decrease in soil erosion which ensues. Other land which may have been left in permanent vegetative cover to ward off erosion can also benefit from minimum tillage crop planting. Additional factors which are instrumental in charting the trend from conventional to minimum tillage include soil and water conservation, reduction in labor and machinery expenses, and direct savings of fuel used to power machinery on farms. The latter saving in energy must be measured against an increased use of energy which is embodied in herbicides and pesticides required for minimum tillage farming. Other factors include the possibility of double cropping, which helps to counteract the sometimes reduced yields on minimum tilled fields, and more efficient use of land, i.e. the ability to plant on marginal lands, or land subject to extensive erosion. Each of these factors can play an important role in farmers' decisions to institute minimum tillage farming.

## Soil and Water Conservation

Soil erosion is a problem that has been a constant plague to farmers. The loss of soil from fields depletes its fertility while causing problems of water and air pollution. Soil types, cropping patterns and types of crop grown, incline of the land and amount of exposure to and duration of rainfall all take their toll in soil erosion. Tillage practices can aggravate or alleviate the amount of surface runoff, with minimum tillage practices providing a protective vegetative cover.

Some crops seem to experience more of a problem with soil erosion than others. In particular, corn and cotton have been cited as being especially susceptible.[3] An example of the difference minimum tillage can make for the prevention of soil loss is illustrated by Table 2. This table provides results from an experiment carried on in Ohio.

TABLE 2. Soil Losses under Conventional and No-Tillage Practices in Corn Production, Experiments at Coshocton, Ohio (expressed in tons/acre).

| Year | Conventional Tillage | No-Tillage |
|---|---|---|
| 1964 | 2.85 | 0.06 |
| 1967 | 0.97 | 0 |
| 1969 | 4.41 | 0.01 |
| 1965-66, 1968, 1970-71 | * | * |
| Average, 8 years** | 1.04 | 0.01 |

*None or negligible.

**Excludes duplicate plots no-tilled during 1969-71 on land with 21 percent slope.

Source: Loyd L. Harrold, "Soil Erosion by Water As Affected by Reduced Tillage Systems," in *Proceedings, No-Tillage Systems Symposium,* cited by U.S. Department of Agriculture, Office of Planning and Evaluation, "Minimum Tillage," p. 83, Table 9.

The importance of minimum tillage for maintenance of soil welfare has been well documented. While plowing up the land is a good method for controlling persistent weeds and unwanted growth and also seems to discourage other pests, it leaves no protective cover to inhibit runoff. Moreover, streams and rivers can become polluted from the eroding soil. By planting crops into the mulch or stubble cover left with minimum or no tillage, many of the problems of soil runoff can be alleviated.

Minimum tillage also works to conserve water on the fields. The soil's water absorption capacity is enhanced through the buildup of surface material. This is important in preventing or relieving stress on crops from lack of moisture. Moreover, the more efficient use of water can cut costs while leading to better yields.

However, there are also some negative aspects which derive from the layer of surface material which remains from minimum tillage, and these aspects must be included in the farmer's assessment of the potentiality and the extent of minimum tillage for his fields.

One of these problems is soil temperature. Since germination of seeds requires a certain minimum temperature (around 50$^{o}$ and above for corn) to insure plant development, failure to maintain this temperature after planting can lead to lower yields. Therefore, the positive aspect of planting early can be counteracted in some agricultural areas by the insulating effect of the mulch cover. In areas where colder weather prevails into the spring (e.g. the more northern states) minimum tillage may mean only cutting out one or two field operations, while continuing enough plowing to expose the soil to the air. However, in southern states, and in central states where temperatures are not too extreme, minimum tillage and in some cases no-tillage, can be carried out safely and profitably.

Another problem which can arise with minimum tillage is a function of soil type. Poorly drained soils may not take well to strip tillage in crop residue. This also could lead to diminished yields.[4] Furthermore, in areas which tend to have significant problems with hard to control weeds such as Johnson grass, chemical means may not suffice and plowing often remains the only successful method of weed control. However, minimum tillage, under the correct soil conditions, can greatly check soil erosion and can even add to yields.

## Labor Saving

A reduction in labor time required to plant, tend, and harvest fields is another characteristic of minimum tillage that makes it attractive to farmers. Because of the elimination of certain of the preharvest operations such as soil conditioning and weed control, labor requirements can be decreased by 50 percent or more. Actual labor savings, of course, will vary by crop as well as by type of minimum tillage system utilized.[5] The impact of the savings in labor can be experienced in two forms. A reduction in the hours worked by hired labor will imply a direct reduction in production expenditures for this factor. On the other hand, the freed labor time, either hired or family, may be used to bring more land into production, or for other associated needs.

## Efficiency of Land Use

Minimum tillage permits increased use of land both through expanded acreage and because of the possibility of milticropping. In this way, some of the adverse impacts on yield from tillage transition can be counteracted. In fact, it is likely that the more extensive and intensive use of land will lead to some overall increase in yields.

The potential for multicropping has begun to shift north from its common realm of practice in the south. Concurrent with the labor saving common to minimum tillage, there is a saving in time needed to grow and harvest a crop. The second crop can be planted as soon as the first crop is harvested. This expands the growing season long enough for areas as far north as southern New Jersey to take advantage of the returns from a second crop.[6]

## Machinery

Machinery requirements will be lowered in a minimum tillage system as compared to a conventional one. This is particularly important for farmers on the verge of making an investment in major farm machinery, whether an initial farm investment or for replacement capital. Minimum tillage or no tillage requires a smaller tractor than does conventional tillage, and eliminates the need for other equipment and implements that are required for most pre-plant operations. The equipment typically necessary for minimum tillage includes special planters, pesticide and herbicide applicators, and harvesting machinery. Equipment for plowing, disking, harrowing, etc. is usually eliminated.

TABLE 3. Fuel Equivalents: Tillage, Planting and Harvesting.

| Fuel | Conventional | Till Plant | Slot Plant |
|---|---|---|---|
| Gasoline | 7.40 | 3.40 | 1.25 |
| Diesel | 5.33 | 2.46 | 0.90 |
| LP Gas | 8.90 | 4.10 | 1.50 |

Source: U.S. Department of Agriculture, "Minimum Tillage," p. 79, Table 7.

## Fertilization

The fertilization of reduced tillage fields is usually different from that of conventionally tilled fields. With minimum tillage, soil disturbance is generally kept to a minimum. For fertilizer application this means that fertilizer is broadcast rather than plowed deeply into the soil near the root zone. Different crops will require different methods of fertilizer application. Some soil disturbance will be implied in certain fertilization operations, e.g. sidedressing of rows to be planted to corn, etc. In other uses, dry fertilizer can be broadcast and incorporated into the soil by irrigation.

The possibility of utilizing nitrogen fixing crops in alternation with the main cash crops as a source of soil restitution is a technique amenable with minimum tillage. CAST (Council for Agricultural Science and Technology) reports that the amount of nitrogen fertilizer required for corn growth and development has been cut approximately two-thirds by the interplanting of crown vetch. Such a system could have very significant impacts on the amount of energy required for fertilization. In fact, CAST reports that if this system proves adequate, a savings equivalent to 19 gallons of gasoline on affected acres is possible. This 19 gallons includes the "annual saving of energy for the manufacture of the nitrogen fertilizer otherwise needed."[7]

## Herbicides and Pesticides

Reduced tillage is feasible to a large degree because of the substitution of chemicals for the plow. This substitution takes place out of necessity to control weeds and pests. Plowing normally is used to turn unwanted vegetation back below the soil surface. It also helps to induce an environment which is less amenable to the spawning of insects, rodents, etc. When the plow is abandoned, many of the negative effects associated with its use (especially soil and water erosion) are no longer major problems. However, the positive effects of the plow disappear too, and the control of weeds and insects, etc. becomes of vital concern to the farmer. It is in this aspect of farming that the trade-offs between minimum and conventional tillage become most clear in terms of costs and benefits. Plowing creates environmental costs in terms of soil and water erosion and the pollution that ensues therefrom. However, the increased use of herbicides and pesticides creates environmental costs too. This is quite obvious from recent legislation banning the use of certain chemicals from agriculture which were previously widespread in use. To the favor of minimum tillage systems, the avoidance of soil runoff also inhibits chemical pollution, since the soil generally acts as a carrier of these (e.g. into water systems).

The energy embodied in the production of herbicides and pesticides is another significant cost, to be balanced against the costs in energy required to operate machinery over conventionally plowed fields.

Estimates for the energy components of pesticides compute to approximately .66 gallons of gasoline per acre, of which .11 gallons is for application and .55 gallons per acre is the energy invested in the pesticide during its manufacture (Table 4). Additional herbicide applications, or applications of insecticides, etc. would require added energy inputs.

Table 4 provides a comparison of diesel fuel consumption with different tillage practices for such crops as corn, sorghum, or soybeans.

TABLE 4. Gasoline Fuel Consumption with Different Agricultural Production Practices (gallons/acre)

| Operation | Cultural Only (No Herbicide) | Usual Production (Herbicide & Cultivation) | No Till (Herbicide Only) |
|---|---|---|---|
| Plow 8" Deep | 1.91 | 1.90 | 0 |
| Heavy Offset Disk | 1.07 | 1.07 | 0 |
| Planting | 0.56 (4 times) | 0.56 | 0.40 |
| Cultivation | 2.03 (4 times) | 0.51 (1 time) | 0 |
| Spray | 0 | 0.11 (1 time) | 0.33 (3 times) |

Source: E. F. Alder et al., "Herbicides in the Energy Equation," *Weed Science*, January 1974.

Summary

Minimum tillage, as an alternative to conventional tillage, has received increasing attention and support by farmers in recent years. Energy costs are one of the reasons for this increasing level of interest. Because minimum tillage, or in the limit, no-tillage, poses a way of coping with potential energy shortages, its importance to crop production is great. The expansion of minimum and zero tilled acres is projected to increase rapidly through the turn of the century. USDA estimates project the percentage of reduced tillage cropland to increase from 2 percent to 80 percent by year 2000. An increase of zero tilled cropland from 2 percent to 45 percent is also projected. In acreage terms, these percentages translate into 275 million reduced tillage acres of which 153 million could be zero tilled.[8]

The reduction in energy required in the preplant operations of minimum tillage must be balanced against a substantial increase in the energy embodied in herbicides and pesticides. Increasing the use of chemical deterrents to weeds and insects will require increases in the energy resources required for their production. However, on balance, the energy saved through reduced operations outweighs the energy invested in pesticides, therefore making chemical pest and weed control a crucial component of minimum tillage.

The reduction in other energy and dollar costs are also important aspects of minimum tillage farming. While pesticide costs will increase, those for labor, machinery, etc. will decrease. Furthermore, the additional minimum tillage benefits deriving from reduced soil and water runoff, make minimum tillage a viable alternative for crop production.

As with any new technology there are negative as well as positive associated returns. Minimum tillage is no different in this regard. However, the conservation of energy in agriculture will require that certain costs be borne, at least until the science can develop appropriately. For minimum tillage, as an energy saving alternative, the benefits appear to outweigh the costs.

REFERENCES

1. U.S. Department of Agriculture, Office of Planning and Evaluation, "Minimum Tillage: A Preliminary Technology Assessment." Prepared for Senate Committee on Agriculture and Forestry, Print 57-398, September 1975, p. 82.

2. "Charting the Trend in Low-Till," *Implement and Tractor*, May 7, 1976.

3. Ortho, Chevron Chemical Company, "Getting Started with No-Till," September, 1975.

4. Phil B. Jones, "Tillage—How Much is Needed?" *DeKalb Crop Management*, 1974.

5. U.S. Department of Agriculture, "Minimum Tillage," *op. cit.*, p. 76.

6. *Ibid.*, p. 74.

7. CAST, "Potential for Energy Conservation in Agricultural Production," Council for Agricultural Science and Technology, Report No. 40, February 6, 1975, p. 17.

8. U.S. Department of Agriculture, "Minimum Tillage," *op. cit.*, pp. 68-70.

## BIBLIOGRAPHY


Alder, E.F., Klingman, G. C., and Wright, W. L. "Herbicides in the Energy Equation." *Weed Science,* vol. 24, issue 1, January 1976.

Barnes, Kenneth K. "Energy, Field Operations and Timeliness." Engineer's Corner, *Implement and Tractor.*

Buckingham, Frank. "Big Tractor Use—How Many Hours per Year?" Engineer's Corner, *Implement and Tractor,* September 7, 1976.

Cooke, Fred T., Jr. and Spurgeon, W. I. "The Economics of Limited Tillage." A paper presented at the Annual Meeting, Georgia Chapter, Soil Conservation Society of America, Rome, Georgia, June 21, 1974.

Doering, Otto C., III, Considine, Timothy J., and Harling, Catherine E. "Accounting for Tillage Equipment and Other Machinery in Agricultural Energy Analysis." Report prepared with the support of the Research Applied to National Needs Program, National Science Foundation, Grant No. SIA 75-18726, October 2, 1976.

Federal Energy Administration, Office of Energy Conservation and Environment and the U.S. Department of Agriculture, Economic Research Service. *Energy and U. S. Agriculture: 1974 Data Base.* Washington, D.C.: U.S. Government Printing Office, 1976.

Lane, D. E., Fischbach, P. E., and Teter, N. C. *Energy Uses in Nebraska Agriculture.* Extension Service, University of Nebraska—Lincoln College of Agriculture cooperating with the U.S. Department of Agriculture and the College of Home Economics. February 1974.

Nalewaja, John D. "Energy Requirements of Various Weed Control Practices." Reprint from *Proceedings of the North Central Weed Control Conference,* vol. 29, 1974.

Nalewaja, John D. "Herbicidal Weed Control Uses Energy Efficiently." *Weeds Today,* Fall 1975.

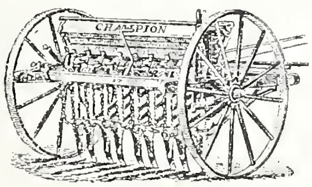
Phillips, S. H. and Young, H. M., Jr. *No-Tillage Farming.* Milwaukee, Wis.: Reiman Associates, Inc., 1973.

Pimentel, David, et al. "Land Degradation: Effects on Food and Energy Resources." *Science,* vol. 194, October 8, 1976.

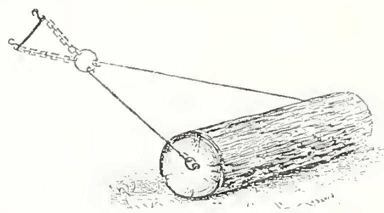
U.S. Department of Agriculture, Economic Research Service. *The U.S. Food and Fiber Sector: Energy Use and Outlook.* Prepared for the Committee on Agriculture and Forestry, U.S. Senate, Committee Print, 1974.

University of Illinois at Urbana-Champaign, College of Agriculture, Cooperative Extension Service. *Illinois Agronomy Handbook, 1974.* Circular 1090, December 1973.

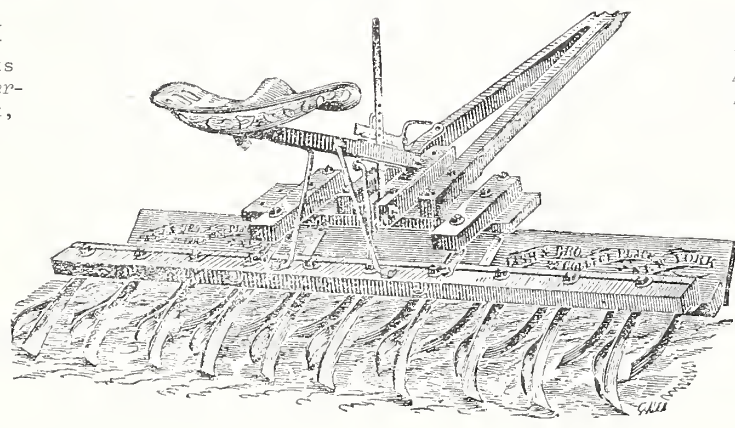
Wittmuss, Howard, Olson, Larry, and Lane, Delbert. "Energy Requirements for Conventional versus Minimum Tillage." *Journal of Soil and Water Conservation,* March-April 1975.

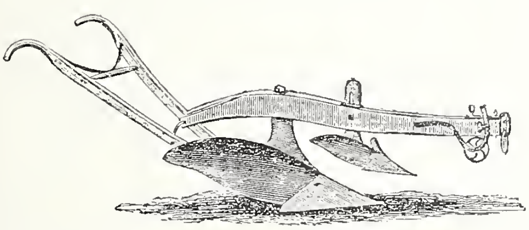

("The Champion Grain Drill with or without fertilizer or grass seeder attachments or gum spring hoes" in *American Agriculturist,* August, 1880).



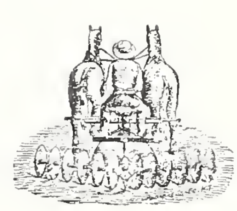
(An inexpensive log field roller for two horses in *American Agriculturist,* April, 1882).



("Acme's Pulverizing Harrow, Clod Crusher & Leveler" in *American Agriculturist,* February, 1882).



("Allen's Patent Cylinder Plow" in *American Agriculturist,* August, 1880).



("La Dows Jointed Pulverizing and Smoothing Disc Harrow" in *American Agriculturist,* August, 1880).

# THE ROLE OF EXTENSION SERVICE IN ENERGY EDUCATION

by

Glenda Pifer*

Families throughout the country are concerned about the rapid increases in energy costs and the prospects for continued increases. Many are frightened by the prospect of not having enough energy at reasonable prices. Whether or not they believe there is an energy shortage is debatable. The cost increases, however, are real.

In 1973 when energy costs began increasing, the Cooperative Extension Service began stressing the need for a greater emphasis on conservation. The first programs focused on more efficient agricultural crop production and on more efficient home heating and cooling. Since that time, the Cooperative Extension Service has broadened its energy concerns to include energy supply, sources, cost, conservation, and life style adjustments as well as focusing upon the role of youth in a changing value system.

Reduced energy consumption can be achieved through education. People must acquire an understanding of and an appreciation for the impact of present lifestyles upon the wasteful use of energy, real energy needs, and the effective management of energy in providing the most essential goods and services.

## The Cooperative Extension Service System

The mission of the Science and Education Administration-Extension and the Cooperative Extension Service is to transfer knowledge and timely information from the Department of Agriculture, the Land-Grant Universities, and other relevant sources to enable people to make individual, family, and community decisions that contribute to a satisfying lifestyle.

Cooperative Extension staff in more than 3,000 Extension offices across the country are responsible for planning and conducting educational programs in cooperation with community leaders and volunteer workers. Specialists, located at the Land-Grant Universities, provide leadership and backup information to the county or area staff. Specialists and program leaders at the Federal level provide national leadership and program coordination among states.

## Extension's Energy Philosophy

Analysis of the concerns and problems confronting families reveals the vital importance of the family's need to understand the energy-economic situation and future projections, in order to make appropriate adjustments in everyday living. People must perceive the problem before change will occur. To make changes, people must be better informed about energy resources and the environmental, economic, and social costs involved.

To the consumer, energy use is a means and not an end in itself and solutions must be approached from this perspective. To achieve a slowdown in the use of energy and finite resources, it will be necessary for families and/or individuals to understand and to examine their attitudes and values about their lifestyle and their use of energy and other scarce resources, and make adjustments that are less energy intensive.

*Glenda Pifer, Housing Specialist, Science and Education Administration-Extension, USDA, Washington, D.C., is contact person for Extension Energy Programs.

The Cooperative Extension Service interprets energy implications in all program areas. The availability of energy determines the availability of goods and services, employment, and quality of life in the home, community, and country.

Conservation must come from the application of many small energy saving techniques in the food and fiber system, in housing, family living, and transportation. To do this families need information that will help them make sound decisions about the use of energy and in the application of techniques that will be cost effective.

Changes in applied technology will occur more rapidly than changes in habits. In order to effect lasting changes in energy consumption, attitudinal changes must occur. New technologies that are less energy intensive must be developed, demonstrated, and implemented. Program delivery from a research base is necessary to insure program credibility.

Effort is being made to cooperate with other agencies at the Federal, state, and local levels in order more effectively to carry out the educational responsibility of the Cooperative Extension Service. Extension's resources have been shifted and additional resources from the Department of Energy and state energy offices have been sought; the goal is to expand programs that have the greatest impact on decreasing energy consumption and exploring alternate and renewable energy sources.

## Audiences

Target groups which Science and Education Administration-Extension and the Cooperative Extension Service serve are the following:

1) Farmers and agribusiness who are responsible for the production of our nation's food supply;

2) Consumers in the residential sector where a long tradition exists especially in the rural and urban areas and, to some extent, in the metropolitan areas;

3) 4-H and Youth where energy education and a reduction in energy use have been determined a major concern for they are the adults of tomorrow;

4) Community groups and the local government bodies who greatly influence group decision making about the use of resources in the community;

5) The general public who are served by the various media methods used throughout Cooperative Extension Service.

## Educational Thrusts:

1) Reduce energy consumption through more efficient operation of farm powered equipment;

2) Use minimum tillage to reduce energy necessary to produce food and fiber;

3) Demonstrate the use of solar energy for grain drying and heating farm structures, including the family house;

4) More efficient management of energy used in the irrigation process, especially the pumping of water, and improving water use efficiency;

5) Reduce energy requirements in housing by weatherization, remodeling, and more efficient planning;

6) Reduce energy consumption in family living by improving the management skills used in the household operation, recreation, entertainment, and transportation;

7) Develop positive attitudes toward energy education and help families make adjustments toward a less energy intensive lifestyle;

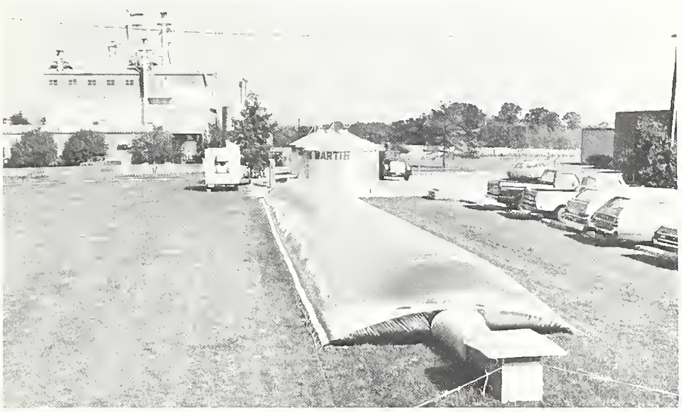
8) Increase knowledge of alternative energy sources;

9) Explore wood and other agricultural products as a substitute for fossil fuel;

10) Assist communities and local governments in taking action which will bring about more efficient use of energy;

11) Help communities and local governments look at the public policy issues involved in energy needs, costs, and alternatives;

12) Identify research needs and stimulate the application of new research information to provide solutions to problems that will be economically, socially, and environmentally acceptable.



*Extension demonstrations show the use of solar energy to dry grain and save fossil fuel.*

Program Examples

A review of state reports indicates Cooperative Extension Service involvement in addressing the following energy concerns:

1) The agricultural reports show programs are designed to make the greatest impact on localized needs;

2) Almost all States have programs for reducing the tractor fuel usage through the use of minimum tillage or reduced tillage operation;

3) States that have any sizable greenhouse operations are reducing fuel for greenhouse heating through conservation as well as application of solar heating;

4) The use of solar energy to heat homes and livestock structures is increasing as the technology is improved and the cost benefit is assured;

5) Many States are reducing the fossil fuel usage or at least the fossil fuel used to produce fertilizer by utilizing soil tests to use optimal amounts of fertilizer without over fertilizing. This also helps to eliminate the pollution problem caused by excess fertilizing;

6) The poultry industry is conserving fuel for brooding by heating only a portion of the house. Arkansas calculated that during the last brooding season they saved 700,000 gallons of liquified petroleum fuels by changing operations. In addition, fuel usage in poultry houses has been reduced by more efficient fan operations or by using more efficient ventilating fans;

7) Experimental solar preheaters to heat the incoming ventilating air reduces fuel required by 65%;

8) Irrigation scheduling has permitted those engaged in irrigated agriculture to minimize the irrigation water usage as well as reduce the power required for pumping water;

9) Wisconsin has had an active program in agricultural transportation whereby farm trucks used to haul produce to market have been used more efficiently and are better scheduled so that they will not be waiting in line at grain elevators. Return loads have been arranged so that the amount of fuel used by these trucks has been minimized;

10) Kansas reported there are some encouraging changes taking place in attitudes on the part of farmers toward more efficient use of farm machinery and energy. In general, agricultural producers are demonstrating an increased interest in energy conservation, particularly in regard to machinery selection. Farmers are becoming more aware of the fact that purchasing decisions when buying a large tractor can easily make $8 to $10,000 difference in fuel costs over the life of the tractor.

According to State reports, the most comprehensive efforts in energy education have been for the residential sector. Reports specify three major areas of emphasis: reduce energy requirements in housing by use of insulation, storm windows and doors, caulking, etc.; reduce energy waste by adjusting temperature levels, controlling lights, and more efficient use of appliances; help families examine their attitudes and values and make rational adjustments in their lifestyle that will be less energy intensive.

*Programs encouraging the installation of storm windows in the home are a part of the Extension energy conservation program with homemakers.*

The energy message has been carried to almost every county in the United States through Energy Expos, community meetings, youth programs, television, radio, newspapers and magazines, newsletters, conferences, exhibits, telephone, and personal contacts. The following are illustrative examples at the state level:

1) Many states developed computer-assisted programs for home energy audits. When cost benefit and payback

information is provided on various alternatives, follow-through is more likely to occur;

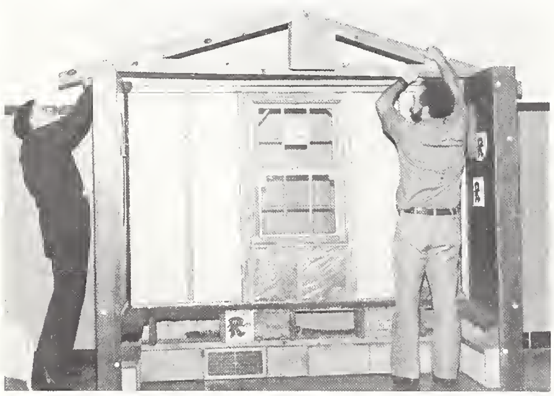
2) Kentucky reported the first edition of their energy newspaper reached one home in three in the state. The second edition reached 400,000 homes. A third is currently being planned. A form was printed in the newspaper for consumers to complete and mail to the University of Kentucky to obtain a computer printout of the cost benefit of additional weatherization. Approximately 8,000 computer printouts were made in the first year;

3) Iowa is taking their computer terminal to scheduled locations in shopping centers to assist families;

4) Energy audits, conducted by Cooperative Extension Service's trained and supervised CETA workers going door-to-door have been successfully used in Massachusetts. In the first year of the program, 70 CETA workers were trained and performed 3,514 home energy audits. At the end of the first year, a survey was taken of half of the 3,514 participating homes to determine how they responded to the energy audit. On the basis of the survey, it is estimated, as a result of the project, home owners spent $831,000 on energy-conserving home improvements and these improvements saved about $327,000 worth of fuel per year at current fuel prices. Also, an additional $133,000 worth of fuel per year could be saved if home owners make the additional planned improvements. Already eight percent of the families have followed recommendations or have plans to follow through.

5) New York State reported that their media effort was the largest single information dissemination of printed materials in the history of Cooperative Extension Service in the State. Distribution of energy fact sheets, a series of 21, exceeded three and one-half million copies. More than 35,000 copies of "Save Energy/Save Dollars" manuals were sold, ranking it as the most widely requested publication. In a 20 week period radio stations devoted more than 18,000 airings of energy information throughout the State with a potential listening audience of 18,000,000 people. Television support included a five-part series that was used on prime time evening news, reaching a potential audience of 27.5 million people in a two month period. A total of 72 newspaper supplements appeared last fall, reaching half the homes in the State. Energy exhibits have been viewed by an estimated half-million people.

6) Texas reports that housing and home furnishings programs conducted in 163 counties reached approximately 127,000 people. Major emphasis was on home energy conservation, remodeling care and maintenance, selection and care of furnishings, and housing choices. Some 44,450 persons were involved in 99 counties with "Save Home Energy" programs learning about (or acquiring skills in) caulking, weatherstripping, insulation, ventilation, moisture control, and heating and cooling. Skills in home remodeling, care, and maintenance were acquired by 13,240 persons in over 71 counties. Two hundred thirty-four TV programs, 490 radio programs, 1,300 news releases and photographs were prepared; 175 families conducted result demonstrations to show others what they had done in their homes.



*Extension workshops for builders and homeowners teach proper methods of installing insulation.*

4-H programs in states have incorporated energy concerns and information into many of the project areas; energy days at fairs and camps have been held; youth demonstration programs have focused on energy conservation; 4-H agents have been serving as energy resource people in school programs.

*Youth learns about energy conservation by using personal insulation through the 4-H Program.*

1) The National 4-H Congress program emphasis this year was on energy. Both energy sources for the future and energy use were explored.

2) Michigan Cooperative Extension Service contracted with the Extension Energy Service pilot program to carry out a youth program on energy education. Their goal is to create an energy conservation ethic in at least 50,000 high school youths, and reduce the energy consumption at least five percent in at least 50 percent of the families with members in the high schools in the target areas.

3) The community development staff throughout the country is becoming more involved in helping communities understand energy issues as they relate to public policy at the community, state, or national level.

4) The Northeast Region Energy Committee is giving leadership in training staff to help communities study public policy issues relating to energy policies affecting geographic regions characterized by different energy supply mixes, source dependencies, and use consideration, economic structures, environmental implications, and climatic conditions. An attempt is being made to help communities look at where conflicts may exist in building codes and zoning ordinances.

Program examples were selected to show the diversity of the program but do not represent the entire effort of any one state in energy education.

Conclusion

In the 1980's, energy will continue to be both a problem and a challenge requiring the dissemination of the latest and most relevant information as well as the participative inputs of all the American people. In this regard, those involved in the diversity of energy education efforts at the local, state, and national levels will have to keep abreast of the latest developments in order to maximize the effectiveness of their own outreach efforts.

# ENERGY INPUTS AND FOOD PRICES

by

John A. Barton*

The food system is dependent upon energy inputs at each stage of production, from fertilizer manufacturing to food retailing. Given the importance of food prices with respect to the rate of inflation and the uncertainties associated with future energy prices and supplies, it is important that we develop an understanding of the relationship between energy and food costs. This paper outlines some of the major aspects of the energy food price interface.

The food system is composed of four major sectors: preproduction, input manufacturing (including fertilizers, pesticides and other chemicals, farm machinery, etc.), agricultural production, food processing, and wholesale-retail operations. Transportation services are an important input in each sector. The input manufacturing sector consumes the largest amount of energy (Table 1), mostly in the manufacture of fertilizers. In addition to direct energy uses in each major sector, energy is required for the manufacture of inputs used at each level of production. For example, energy is required to manufacture metal cans used in the food processing sector, the metals used to produce metal cans, etc. All of these energy costs eventually show up in retail food prices. Figure 1 shows an abbreviated food system product flow chart.

FIGURE 1

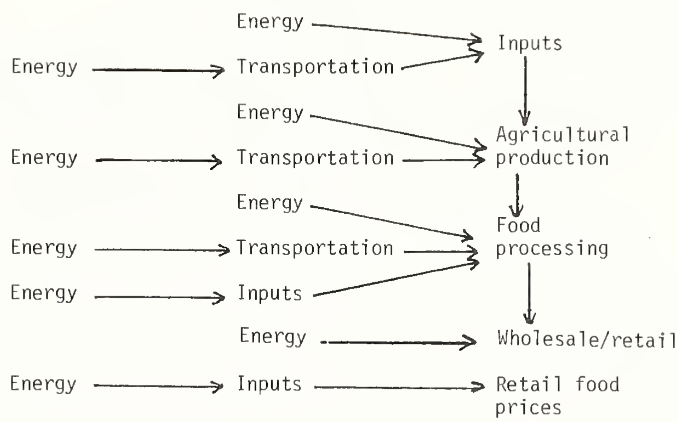



Table 1--Estimated current annual fuels and electricity consumption in the food system

| | Coal | | Natural gas | | LP gas | | Petroleum fuels | | Electricity | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,000 tons | Btu x $10^{12}$ | Billion cu. ft. | Btu x $10^{12}$ | Million gallons | Btu x $10^{12}$ | Million gallons | Btu x $10^{12}$ | Billion kWh | Btu x $10^{12}$ | Btu x 1012 |
| Preproduction inputs 1/ | 400 | 10 | 1,376 | 1,444 | N/A | N/A | 800 | 112 | 19 | 63 | 1,629 |
| Agricultural production | N/A | N/A | 167 | 176 | 1,510 | 143 | 6,820 | 900 | 33 | 112 | 1,331 |
| Food processing | 3,150 | 81 | 458 | 481 | 1,000 | 95 | 1,330 | 187 | 42 | 147 | 987 |
| Retail food stores | N/A | N/A | 8 | 8 | N/A | N/A | 60 | 8 | 42 | 43 | 163 |
| Transportation | N/A | N/A | N/A | N/A | N/A | N/A | 2,980 | 412 | N/A | N/A | 412 |
| Total | 3,550 | 91 | 2,009 | 2,109 | 2,510 | 238 | 11,990 | 1,619 | 137 | 465 | 4,522 |

1/ Includes fertilizers, pesticides, and farm machinery.

In examining the energy situation as it relates to food costs, it is necessary to distinguish between energy shortages and higher energy prices. Energy or other input shortages violate the technical constraints of production and automatically result in a decrease in food production. Because the elasticity of demand (the percentage change in quantity demanded given a percentage change in price) is low, food shortages would have immediate and serious impacts on prices. Higher energy prices, on the other hand, are more amenable to economic adjustments and may or may not have a large impact on food prices.

The direct or first-round impacts of energy price increases depend on the reaction of food system participants to higher energy costs, as product pricing behavior can be varied. At one extreme, all increases in production costs could be absorbed by producers, resulting in income losses from input manufacturers, farmers, food processors and so on. At the other extreme, all increases in costs could be passed along to the consumer, assuming that the demand for food is perfectly inelastic.

In all likelihood the actual increase in consumer costs will fall somewhere in between. Farmers are generally unable to pass on increased production costs

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in the short run. Processors and retailers, on the other hand, may have some influence over market price and be able to maintain a more stable profit.

In the longer run, energy price increases cause the prices of non-energy inputs to rise. Energy costs in the U.S. economy have been estimated at around four percent of GNP. It has not been demonstrated that the food system is substantially more energy intensive (consumes more energy than non-energy inputs) than the rest of the economy. Therefore, it is not likely that increasing energy costs will have disproportionate direct impacts on price of food versus non-food items.

It is important to put the energy costs consideration in perspective. The short run agricultural supply situation, as affected by such factors as weather and export demand, has a far greater impact on farm prices than energy costs. In the processing and marketing sectors, labor is about twenty times as large as energy as a percentage of total costs. Food processing and distribution costs are therefore more sensitive to the rate of inflation and wage demands than they are to increases in energy prices.

The specter of energy shortages is far more serious than forecasts of higher energy prices in terms of impacts on the consumer food dollar. Fuel shortages may result in declines in crop production, shutdowns of food processing plants, and/or transportation bottlenecks. The availability of food system inputs such as packaging materials may also be limited by plant shutdowns or cutbacks in production. Clearly, production shortfalls at any stage of food production will affect the quantity of food delivered to consumers.

The reaction of prices to actual or perceived food shortages (in the absence of price controls) can be quite pronounced. An example of what could happen would be the recent shortage of granulated sugar. When sugar supplies were particularly tight, predictions of shortages sent consumers rushing to the supermarket to stock up, thus making the supply situation worse and driving prices up further. Even discounting the potential for short term food "hoarding," food prices are particularly sensitive to food supplies. Because demand remains relatively stable over time, changes in supply have a large impact on price.

Figure 2 shows typical short run demand and supply curves for food products. A decrease in the quantity of food supplied would be represented by a shift in the supply curve from SS to SS'. The price of food would increase from $P_0$ to $P_1$. Typical supply and demand curves for non-food goods are shown in Figure 3. The change in price resulting from an equal decrease in supply is clearly less than the hypothesized food price increases.

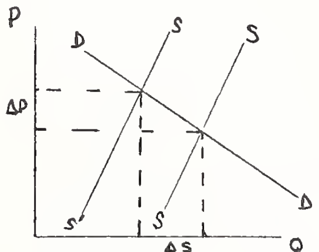


Figure 2

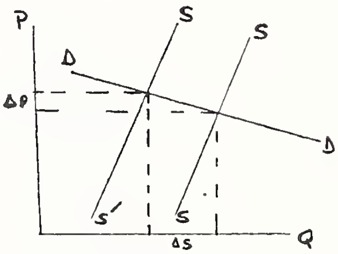


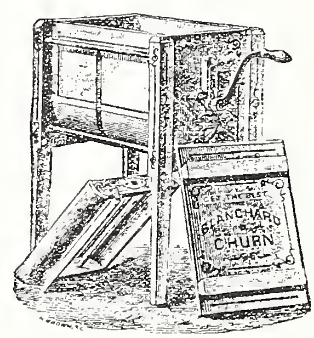
Figure 3

The impacts of fuel shortages on food production can be reduced by fuel conservation and switching among fuels. For example, if a food processor has available only 80 percent of natural gas requirements for full production, it may be possible to use alternative processes (substitute labor and/or capital inputs) and hold output constant. Alternatively, it may be possible to switch from natural gas, where supply may be limited, to coal where supply may be plentiful, and again hold output constant. This second alternative is most applicable where energy consumption is related to boiler use and process steam.

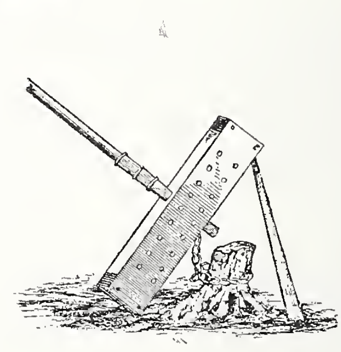
Government policies seek to protect the food system from energy shortages because of the importance of full food production and the potentially disastrous effects of food shortages. The Mandatory Petroleum Allocation Act provides for agricultural uses to receive a priority in petroleum product allocation procedures. Likewise, the Natural Gas Policy Act provides protection of "essential agricultural uses," including food production, processing, and food quality maintenance. These uses are accorded a number two priority classification in interstate pipeline curtailment schemes behind residential, small commercial uses, schools, and hospitals.

In an effort to hold down food prices, essential agricultural users are offered relief from incremental pricing of natural gas.

In summary, the relationship between the energy situation and food price must be looked at separately in terms of a) higher energy prices, and b) energy shortages. Although higher energy prices have an impact on food prices, moderate economic adjustments are possible and food production is not significantly impeded. It is likely that higher energy prices do not have disproportionate effects on food products compared with non-food products. However, energy shortages can have large impacts on food prices by causing bottlenecks in food and food system input availabilities and can have serious effects on food prices. Food prices are much more sensitive to shortages than are many other consumer goods.



("The Blanchard Churn for converting cream into butter" in *American Agriculturist*, October, 1879).


("A 'Samson' Lever or Stump Puller" in *American Agriculturist*, August, 1882).

NEW  ACQUISITIONS

This section provides a selective listing of recent NAL acquisitions, including books, periodicals, and series. The NAL call number is provided with the citation (if available).

Persons having questions or suggestions concerning this listing should contact Beth Whiting, Selection Section, Room 112, NAL Building, Beltsville, Md. 20705.

Adkinson, Burton W. *Two centuries of Federal information.* Stroudsburg: Dowden, Hutchinson and Ross, 1978. (Q224.3.U6A35)

*Aspects of mechanism and organometallic chemistry.* Edited by James W. Brewster. New York: Plenum Press, 1978. (QD501.A834)

Australia. Department of Health. *Pesticides: synonyms and chemical names.* 4th ed. Canberra: Australian Government Publishing Service, 1978.

Barbour, Beverly. *The complete food preservation book.* New York: David McKay, 1978. (TX601.B35)

Baumel, Howard B. *Biology: its historical development.* New York: Philosophical Library, 1978. (QH305.B38)

Berger, Melvin and Gilda Berger. *The new food book: nutrition, diet, consumer tips, and foods of the future.* New York: Thomas Y. Crowell, 1978. (TX355.B468)

Brockman, C. Frank. *Recreational use of wild lands.* 3rd ed. (McGraw-Hill series in forest resources) New York: McGraw-Hill, 1979. (SB481.B66)

Burch, John G. *Information systems: theory and practice.* 2nd ed. New York: Wiley, 1979.

Chirlian, Paul M. *Understanding computers.* (DP series in hardware, volume 3) Portland, Ore.: Dilithium Press, 1978. (QA76.C4794)

*Clinical application of carcinoembryonic antigen assay; Proceedings of a symposium, Nice, October, 1977.* Edited by B. P. Krebs. (International Congress Series no. 439) New York: Elsevier/North-Holland, 1978. (RC270.C49)

*Cognitive processes in animal behavior.* Hillsdale, N.J.: L. Erlbaum Associates, 1978. (QL785.C53)

*Comparative biology of skin; Proceedings of a symposium held at the Zoological Society of London, 1975.* Edited by R. I. C. Spearman. London: Published for the Zoological Society of London by Academic Press, 1977. (Symposia of the Zoological Society of London, no. 39)

Croley, Thomas E. *Reservoir sedimentation model with continuing distribution, compaction, and sediment slump.* Iowa City: Iowa Institute of Hydraulics Research, University of Iowa, 1978. (IIHR report, no. 198) (TC175.C72)

Dahlberg, Kenneth A. *Beyond the Green Revolution; the ecology and politics of global agricultural development.* New York: Plenum Press, 1978. (HD1415 .D273)

Duncan, Patricia D. *Tallgrass prairie: the inland sea.* Kansas City: Lowell Press, 1978. (QH105.K3D85)

Eckbo, Garrett. *Public landscape.* Berkeley: Institute of Governmental Studies, University of California, 1978. (HT394.S25E28)

*Estuarine transport processes: symposium.* Edited by Bjorn Kjerfve. Columbia, S.C.: University of South Carolina Press, 1978. (Belle W. Baruch Library in Marine Science, no. 7) (GC96.5.E78)

Faegri, Knut. *Principles of pollination ecology.* 3rd rev. ed. Oxford: Pergamon Press, 1978. (QK926.F3 1978)

Flock, Warren L. *Electromagnetics and the environment: remote sensing and telecommunications.* Englewood Cliffs, N.J.: Prentice-Hall, 1979. (QC760.F56)

Forestry Symposium. 27th, Louisiana State University, Baton Rouge, 1978. *Energy and the southern forest.* Edited by E. T. Choong and J. L. Chambers. Baton Rouge: Louisiana State University, 1978. (99.9L935)

Foster, Janet. *Working for wildlife.* Toronto: University of Toronto Press, 1978. (QL84.24.F67 1978)

Foster, William Murchison. *Homeowner's guide to solar heating and cooling.* Blue Ridge Summit, Pa.: G/L Tab Books, 1976.

Gabbay, Rony. *Communism and agrarian reform in Iraq.* London: Croom Helm, 1978. (JQ1825.I773S494)

Gutcho, Marcia. *Edible oils and fats; recent developments.* (Food Technology Review, volume 49) Park Ridge, N.J.: Noyes Data Corp., 1979. (TP370.F62 no. 49 1979)

Hall, Carl W. *Processing equipment for agricultural products.* 2nd ed. Westport, Conn.: AVI, 1979. (S698.H3 1979)

Hall, Dorothy. *Natural health book.* Melbourne: Nelson, 1978. (RA784.H34)

Harrington, H. D. *How to identify grasses and grasslike plants.* Chicago: Swallow Press, 1977.

Hawthorne, Edward P. *Management of technology.* Maidenhead: McGraw-Hill, 1978.

Heller, Jules. *Papermaking: the white art.* New York: Watson-Guptill, 1978. (TS1105.H54)

Hosken, Michael. *Farm office: how to cope with paperwork.* 2nd rev. ed. Ipswich: Farming Press Ltd., 1978. (S567.H62 1978)

Hunt, V. Daniel. *Energy dictionary.* New York: Van Nostrand Reinhold, 1978. (TJ163.2.H9)

Hunter, Beatrice Trum. *Great nutrition robbery.* New York: Charles Scribner's, 1978. (TX357.H83)

Huxley, Anthony Julian. *Illustrated history of gardening.* New York: Paddington Press, 1978. (SB451.H87)

IFIP Working Conference on Modeling and Simulation of Land, Air, and Water Resources Systems, Ghent, 1977. *Modeling, identification, and control in environmental systems.* New York: Elsevier/North-Holland, 1977. (TD5.I15 1977)

International Symposium on Melliferous Flora, Budapest, 1976. *Honey plants: basis of apiculture.* Bucharest: Apimondia Publishing, 1977. (SF535.I55 1976)

International Workshop on Nude Mice, 1st, Scanticon, Aarhus, Denmark, 1973. *Proceedings of the first international workshop on nude mice.* Edited by Jorgen Rygaard and C. O. Povlsen. Stuttgart: Gustav Fischer Verlag, 1974. (QL737.R638I57 1973)

Jakubke, H. D. and H. Jeschkeit. *Amino acids, peptides and proteins.* New York: Wiley, 1977. (QD431.J32)

Johnson, Paul C. *Farm power in the making of America.* Des Moines: Wallace-Homestead Book, 1978. (TJ712 .J63)

Karnes, Thomas L. *Tropical enterprise: the Standard Fruit and Steamship Company in Latin America.* Baton Rouge: Louisiana State University Press, 1978. (HD9249.S7K37)

Kirk, John T. O. *Plastids, their chemistry, structure, growth, and inheritance.* 2nd rev. ed. New York: Elsevier/North-Holland, 1978. (QK899.K5 1978)

Krause, Marie V. *Food, nutrition and diet therapy.* 6th ed. Philadelphia: W. B. Saunders, 1978. (RM216.K7 1978)

Krebs, Alfred H. *Agriculture in our lives.* 4th ed. Danville: Interstate, 1978. (S495.K7 1978)

*Laboratory engineering and manipulations.* 3rd ed. Edited by Edmond S. Perry and A. Weissberger. (Techniques of chemistry, volume 13) New York: Wiley, 1979. (QD61.L3 1979)

Lancaster, Frederick Wilfred. *Toward paperless information systems.* New York: Academic Press, 1978. (Z699.L353)

*Marketing management: strategies and cases.* Edited by M. Wayne DeLozier and A. Woodside. Columbus: Charles E. Merrill, 1978. (HF5415.13.M355)

Martin, Ethel Austin. *Nutrition in action.* 4th ed. New York: Holt, Rinehart and Winston, 1978.

Matthews, Robert W. *Insect behavior.* New York: Wiley, 1978. (QL496.M392)

Midwest Conference on Endocrinology and Metabolism, 12th, University of Missouri, 1976. *Hormones and energy metabolism.* Edited by David M. Klachko, et al. New York: Plenum Press, 1979. (Advances in experimental medicine and biology, volume 111) (QP901.A33 no. 111 1979)

*Molecular base of malignancy; new clinical and therapeutic evidence.* Edited by E. Deutsch, et al. Stuttgart: Georg Thieme Publishers, 1976. (RC268.5 .M63)

Moore, Shirley T. *A vegetarian diet.* Santa Barbara: Woodbridge Press, 1978. (TX392.M83)

Nagl, Walter. *Endopolyploidy and polyteny in differentiation and evolution.* New York: North-Holland, 1978. (QH461.N33)

National Research Council. Board on Science and Technology for International Development. *Postharvest food losses in developing countries.* Washington, D.C.: National Academy of Sciences, 1978.

National Research Council. World Food and Nutrition Study Steering Committee. *Supporting papers, World food and nutrition study.* Washington, D.C.: National Academy of Sciences, 1977. 5 volume set. (HD9000.6.N33)

Nelson, Paul V. *Greenhouse operation and management.* Reston: Reston Publishing, 1978. (SB415.N44)

*Nitrogen in desert ecosystems.* Edited by Neile E. West. Stroudsburg: Dowden, Hutchinson and Ross, 1978. (US/IBP Synthesis series, volume 9)

*Nutritional and safety aspects of food processing.* Edited by Steven R. Tannenbaum. (Food science, volume 6) New York: Marcel Dekker, 1979. (TP372.5.N87)

*Nutritional impacts on women.* Edited by Kamran S. Moghissi and T. N. Evans. Hagerstown, Md.: Medical Department, Harper and Row, 1977. (RG559.N87)

PAG International Symposium on Investigations on Single-cell Protein, Milan, 1977. *Single-cell protein: safety for animal and human feeding.* Proceedings of the Protein-Calorie Advisory Group of the United Nations System Symposium "Investigations on single-cell protein," held at the Istituto di Ricerche Farmacologiche "Mario Negri," 1977. Edited by Silvio Garattini, et al. New York: Pergamon Press, 1977. (TP453.P7P2 1977)

*Pests of grain legumes: ecology and control.* Edited by S. R. Singh, et al. New York: Academic Press, 1978.

*Plant cold hardiness and freezing stress: mechanisms and crop implications.* Edited by P. H. Li. New York: Academic Press, 1978. (QK756.P53)

*Prevention of farm-level food grain storage losses in India: a social cost-benefit analysis.* R. A. Boxall, et al. (IDS Research Reports) Brighton: Institute of Developmental Studies, 1978.

Pruppacher, Hans R. and J. D. Klett. *Microphysics of clouds and precipitation.* Boston: D. Reidel Publishing Co., 1978. (QC921.5.P78)

Sainsbury, David. *Livestock health and housing.* 2nd ed. London: Bailliere Tindall, 1979.

Sanderson, Fred H. *Japan's food prospects and policies.* Washington, D.C.: Brookings Institution, 1978. (HD9016.J3S238 1978)

Schulz, Georg E. *Principles of protein structure.* New York: Springer Verlag, 1979.

Sodano, Charles S. *Animal feeds and pet foods: recent developments.* Park Ridge, N.J.: Noyes Data Corp., 1979. (Food Technology Reviews, volume 50) (TP370.F62 no. 50 1979)

*Soil, water and crop production.* Westport, Conn.: AVI, 1979.

*Solar age catalog: a guide to solar energy knowledge and materials.* Port Jarvis, N.Y.: Solar Vision, 1977. (TJ810.S59)

Symposium on Fundamental Cancer Research, 31st, Anderson Hospital and Tumor Institute, 1978. *Carcinogens: identification and mechanisms of action.* Edited by A. Clark Griffin. New York: Raven Press, 1979. (RC268.6.S94 1978)

Symposium on Gene-environment Interaction in Common Diseases, Tokyo, 1976. *Gene-environment interaction in common diseases.* Edited by Eiji Inouye and H. Nishimura. Baltimore: University Park Press, 1976. (RB155.S937 1976)

Symposium on Purine and Pyrimidine Metabolism, London, 1976. *Purine and pyrimidine metabolism.* (Ciba Foundation Symposium 48) New York: Elsevier/Excerpta Medica/North-Holland, 1977. (QP801.P8S94 1976)

Symposium on the Nursery Care of Nonhuman Primates. *Nursery care of nonhuman primates.* Edited by Gerald C. Ruppenthal. New York: Plenum Press, 1979. (SF407.P7S97)

U.S. Congress. House. Committee on Agriculture. Subcommittee on Dairy and Poultry. *Nitrite restrictions on poultry, hearings . . .* 95th Congress, 2nd session, September 28, 1978. Washington, D.C.: GPO, 1978. (KF27.A3326 1978a)

U.S. Congress. House. Committee on Agriculture. Subcommittee on Tobacco. *Economic impact of tobacco program, hearing . . .* 95th Congress, 2nd session, 1978. Washington, D.C.: GPO, 1978.

U.S. Congress. Office of Technology Assessment. *Emerging food marketing technologies.* Washington, D.C.: GPO, 1978. (HD9005.6.U52 1978)

U.S. General Accounting Office. *Food waste: an opportunity to improve resource use, Department of Agriculture: report to the Congress.* Washington, D.C.: U.S. General Accounting Office, 1977. (HD9005.U55)

*Virus survival in water and wastewater systems.* Edited by Joseph F. Malina, Jr. and B. P. Sagik. (Water Resources Symposium, no. 7) Austin: Center for Research in Water Resources, University of Texas at Austin, 1974. (QR48.V57)

Workshop on Rat Liver Neoplasia, Woods Hole, Mass., 1974. *Rat hepatic neoplasia.* Cambridge: MIT Press, 1978. (RC280.L5W66 1974)

Zacharin, Robert Fyfe. *Emigrant eucalypts: gum trees as exotics.* Melbourne: Melbourne University Press, 1978.

New Series

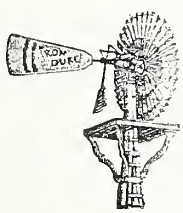
*Developments in food science.* volume 1- 1978- New York: Elsevier/North-Holland. (TX541.D33)

*Developments in halophilic microorganisms.* volume 1- 1978- New York: Elsevier/North-Holland. (QR97.S3D4)

*Developments in plant biology.* volume 1- 1978- New York: Elsevier/North-Holland. (QK710.D33)

*Membrane transport in biology.* volume 1- 1978- New York: Springer-Verlag.

*Progress in macrocyclic chemistry.* volume 1- 1978- New York: Wiley-Interscience. (QD331.P75)



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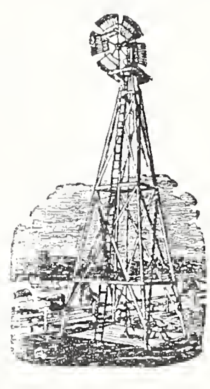
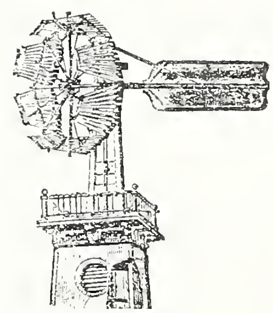
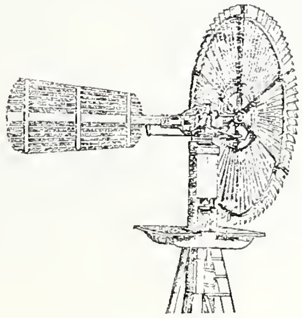


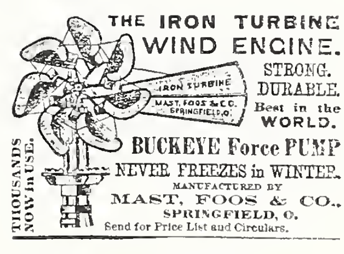
("The Champion Wind Mill" in *American Agriculturist*, October, 1879)



("The Halliday Windmill" in *American Agriculturist*, November, 1880)



("The Eureka Windmill" in *American Agriculturist*, November, 1880)




(*American Agriculturist*, August, 1880)

# BOOK REVIEWS

*Persons interested in reviewing books, having books reviewed, or simply having questions about the reviews should address correspondence to Tom Fulton,* Journal of NAL Associates, *Room 150, GHI Building, 500 12th Street, S.W., Washington, D.C. 20250.*

Machado, Manuel A., Jr. *Listen Chicano! An Informal History of the Mexican American.* Foreword by Barry M. Goldwater. (Chicago: Nelson-Hall, Inc., 1978, xviii, 196 pp., illus., bibliography, index, $7.95.)

This is not the usual sort of history book, the kind where every sentence is laden with obscure footnotes and every paragraph is couched in the cautious circuitous language of the historian. In fact, there is not a single footnote in the entire text and, where warranted, the author unabashedly gives us his opinion of the subject at hand. One is warned in the introduction:

> From the outset, the preparation of a personal analysis of the historical evolution of the Mexican-American proved formidable and at first impossible. Why? God knows other scholars have tackled equally thorny questions, loaded with statistical data, fraught with politico-economic nuances, and leading the researcher down the perilous road of supercaution and timidity in things academic and intellectual. Perhaps it results from pent-up rebelliousness, for woe to he who generalizes without pages of redundant data to substantiate even the most minor conclusion! A pox on the *pobre cristiano* who might consciously put himself out on an intellectual limb because he gave recognition to his experiences and conditioning during the preparation of his work . . . in this business we need to have some fun with our work rather than surrender to the sterility of the footnote and the guarded phrase.

And fun is exactly what Professor Machado has while at the same time providing a fresh interpretation of the role played by the Chicano in American history. As an historical work the book traces the role of Chicanos, or Mexican-Americans, from the nineteenth into the twentieth century. Machado is also careful to interrelate the evolution of Mexican-American society in the United States with the wide panorama of events across the border in Mexico.

The major issues relating to the Mexican-American experience in the United States are covered in the book. Repatriation during the Great Depression, the Bracero program, the zoot suit riots, the sleepy lagoon incident—each of these offers a chapter in the growth of a cultural entity within an American milieu.

In his book, Machado, a Mexican-American and a professor of history, creates the feeling of a pending awakening on the part of Chicanos to their own cultural past. This book is both informative and informal. It is history the way history is not often written.

Reviewed by Tom Fulton, Historian, Agricultural History Branch, National Economics Division, Economics, Statistics and Cooperatives Service, U.S. Department of Agriculture.

Waltmann, Henry G. *Pioneer Farming in Indiana: Thomas Lincoln's Major Crops, 1816-1830.* (West Lafayette, Ind.: Department of History, Purdue University, 1975. Published by The Association for Living Historical Farms and Agricultural Museums, Smithsonian Institution, Washington, D.C. ii, 120 pp., introduction, map, sketches, appendix, bibliography, and index.)

Conceived as a supplement to *Lincoln Boyhood as a Living Historical Farm,* a report on the projected use of the Lincoln National Boyhood Memorial by Edwin C. Bearss, Waltmann's study of crops proceeds from a narrowly defined set of objectives: "first, to ascertain and briefly describe the most probable crop varieties [raised by the Lincolns]; and second, to examine and summarize the agricultural practices and natural enemies which may have affected the growth of these farm products." Such highly specialized works usually accomplish their stated ends with precision, but have little relevance beyond those ends. *Pioneer Farming in Indiana,* however, stands as a refreshing exception. While it fulfills its goals in detail, it goes beyond, surpassing the limits of its genre, to offer both a model for succeeding studies and a cameo of a phase of farming at a specific time and place.

The book covers such crops as maize, wheat, oats, hay, flax, tobacco, cotton, pumpkins, beans, turnips, apples, peaches, pears, plums, and cherries, and the author unfolds his material methodically. With each crop he proceeds by examining the data most relevant to Lincoln's boyhood farm, then discusses that evidence in light of information about the crop in the general area and period to recommend varieties for use at the Memorial, and finally mentions procedures which should be used in cultivation. Often, a drawing of the preferred historical crop types accompanies the descriptive text. The extent of the author's scholarship is impressive. While commenting on Bearss's treatment of types of Indian corn, for example, Waltmann identifies a confusing statement as an "undesignated quotation from R. Carlyle Buley's *The Old Northwest,*" traces the remarks from Buley to a "1918 essay on early Ohio agriculture" and ultimately to an "annual report for 1858." It should be noted that such cross-checking occurs throughout the monograph.

As in any scholarly work, footnotes document the author's path and a bibliography lists the pertinent sources he considered—those noted and those not. This bibliography by itself constitutes a valuable tool with 18 subcategories that include, along with the usual historical classifications, entries under "Farmers' and Orchardists' Guide," "Agricultural and Horticultural Encyclopedias," and "Field and Orchard Crop Studies." More valuable to those concerned with the aspect of planting, though, is the appendix which gives "addresses of specialists, research agencies, seed firms, and nurseries to be consulted on the acquisition and/or development of recommended varieties." That these aids will be useful to other living historical farms and individuals interested in historical agriculture should be obvious.

The weakest sections of the report are those dealing with the treatment of crops. While the author discusses the southern method of topping and picking corn, he fails to mention the various patterns of the wheat shocks or types of hay stacks that exist. As for associated cultural activities, he glosses over husking festivities and ignores last sheaf customs. Granted, sources on such practices as these are scattered and are not the sort commonly encountered by historians, but considering their utility in historical farm interpretation, their omission is regrettable.

Waltmann has produced, however, a remarkably full account of the crops probably raised by Thomas Lincoln. *Pioneer Farming in Indiana* stands as a model and a benchmark for future living historical farm research. In spite of its narrow focus, this book will reward any reader who has a serious interest in early agrarian landscapes.

Reviewed by Ormond H. Loomis, 7642 E. John Young Road, Unionville, IN 47468.

*On Wednesday, June 30, 1979, President Carter dedicated a newly installed solar system at the White House (Courtesy, Ellsworth Davis, The Washington Post)*

## PUBLICATIONS AND NEWS OF NOTE

BOOK NOTES

Advanced Publication Information

*Solar Energy and Non-fossil Fuel Research; A Directory of Projects Related to Agriculture: 1976-79.* (Washington, D.C.: GPO, 1979).

Prepared by the Smithsonian Scientific Information Exchange (SSIE) under contract with the U.S. Department of Agriculture, Science and Education Administration, this directory is due to be published in July, 1979. An annual publication, it will consist of three sections—solar energy; biomass; other non-fossil fuel—each of which will include Federal, State, and privately funded projects. Detailed information will be given for each project and will include principal investigator, performing organization, institution name and address, initiation and completion dates, and detailed narrative information describing the research. Approximately 1,000 projects will be covered. There will be four indexes which will include an index of investigators, a supporting organization index, a performing organization index, and a key word subject index with titles. It will be printed by and available to the public through the Government Printing Office. A limited number of copies will be available upon request to USDA researchers and USDA cooperators. A self-addressed mailing label should be sent with request to:

Library Services
USDA-SEA-TIS
Room 111, NAL Building
Beltsville, Maryland 20705

*Guide to Sources for Agricultural and Biological Research.* Edited by J. Richard Blanchard and Lois Farrell. (Berkeley: University of California Press, 1979, in press).

Sponsored by the National Agricultural Library, which is now a part of the Technical Information System of the Science and Education Administration, this guide is to be released soon. Many distinguished contributors and consultants have assisted in preparing the guide, which is an updated and enlarged version of *Literature of Agricultural Research* (University of California Press, 1958) by J. Richard Blanchard and Harald Ostvold. The terms agriculture and biology are broadly interpreted to include all phases of food production, also incorporating a few topics only indirectly concerned with food production such as wildlife management and environmental sciences, particularly the agricultural implications of pollution control and maintenance of the environment. Library reference sources such as reviews, abstracts, indexes, bibliographies, directories, dictionaries, and encyclopedias are described and evaluated. Information is also provided about machine readable data banks, including informational services and networks administered by libraries and documentation centers. Methods of literature searching by scientists are discussed in the introduction. The references are arranged by broad subjects using the following headings to bring together related references: agriculture and biology in general; plant sciences; crop protection; animal sciences; physical sciences; food sciences and nutrition; environmental sciences; social sciences, and computerized data bases for bibliographic research.

Book Notes

*Sun: Mankind's Future Source of Energy; Proceedings of the International Solar Energy Congress, January 1978, New Delhi, India.* Edited by F. De Winter. 3 volumes. (Fairview Park, New York: Pergamon Press, 1979, 2,250 pp., $200).

This three volume set contains over 340 research and review papers with more than 2,500 literature references. Fifteen major subject areas are covered which include, among others, solar radiation, energy storage, photochemistry, photobiology and biomass, economic aspects, wind power, agricultural and industrial applications including refrigeration, solar pumps, greenhouses, and distillation.

*Working Paper Series*

The following titles are a part of the Agricultural History Center's (University of California, Davis) new Working Paper Series:

1. Robert E. Ankli, H. Dan Helsberg, and John Herd Thompson, *The Adoption of the Gasoline Tractor in Western Canada;*
2. Robert E. Ankli, *Horses vs. Tractors;*
3. Gerald T. White, *Archival and Library Resources in California for the Study of Economic History.*

A limited number of copies are available through the Agricultural History Center.

*Chronological Landmarks in American Agriculture.* By Maryanna S. Smith. U.S. Department of Agriculture, ESCS, Agriculture Information Bulletin No. 425 (Washington, D.C.: GPO, May 1979, 103 pp.)

This chronology lists major events in the history of U.S. agriculture. Sources of additional information are included with most events. There is no charge for this publication, which may be ordered by writing to:

Maryanna S. Smith
USDA-ESCS
500 12th Street, S.W.
Room 144
Washington, D.C. 20250

*Preliminary Inventory of the Records of the Office of the Secretary of Agriculture.* Compiled by Helen Finne Ulibarri. Record Group 16. 1979. 59 pp.

Included in this inventory spanning the years 1839 to 1970 are the records of the Secretaries of Agriculture and their predecessors, the Commissioners of Agriculture. These men were responsible for formulating policies and plans for the agricultural work of the Federal Government, conducting the external relations of the Department of Agriculture, coordinating the work of subordinate units of the Department, and providing general supervision for the Department's housekeeping activities. A copy may be obtained by writing to:

National Archives & Records Service
General Services Administration
Washington, D.C. 20250

*Pollution in Horticulture.* By D. P. Ormrod. (New York: Elsevier, 1978, xii, 260 pp., $39. Fundamental Aspects of Pollution Control and Environmental Science, 4)

In this work, Ormrod, who is Professor of Horticulture in the Department of Horticultural Science at Ontario Agricultural College, University of Guelph, Ontario, Canada, summarizes and collates a number of studies and provides information on the current state of knowledge in the field. He explains underlying concepts of plant responses to pollutants, and the nature of pollutants impacting on horticulture. There are over 700 references with numerous tables and photographs; indexed appendices of chemical names and species as well as a glossary of terms are also included.

Movie Review

*Farming the Land.* 16mm sound and color. 30 minutes. Produced by Michael Hall, 1977. Distributed by Image Resources, Box 315, Franklin Lakes, N.J. 07417. Rental, $50.

This movie grew out of Michael Hall's concern for the threatened existence of small family farms in America. In particular, he was worried about farms in southern New Hampshire, where he grew up.

The picture painted of American family farms is a bleak one indeed—one of an agricultural minority rapidly disappearing. *Farming the Land* suggests that if there were a free market economy in this country small farms might better survive. Based on a series of interviews, Hall talked with small farmers, their customers, and others affected by farmer dislocation. Hall focuses on the problems faced by the small farmer although he does not offer any solutions.

## NEWS OF NOTE

### Ten USDA Employees Honored for Outstanding Work at Beltsville.

On June 12, 1979, ten federal employees were recognized for their outstanding work in library, technical information, data services, and communications fields in a ceremony held at the National Agricultural Library building of the U.S. Department of Agriculture (USDA). The awards were presented by Dr. Ralph McCracken, USDA's Associate Director of the Science and Education Administration. Twenty-seven length of service awards were also given by Dr. McCracken to persons who worked for the federal government from ten to thirty-five years.

### Mary Cokely Wood Rare Book Collection Donated

Ikebana International through its Washington, D.C. Chapter recently presented the Mary Cokeley Wood Rare Book Collection on Japanese classical flower arrangement to the National Agricultural Library in memory of its founder, Ellen Gordon Allen. The 53 book special collection, ranging in imprint dates from 1684 to 1954, will be housed eventually in NAL's branch library at the National Arboretum.

*Participating in the special ceremony held at the Fort McNair Officers Club were (from left) Mrs. Paul Godbey, chapter member, Dr. Richard A. Farley, deputy director for Technical Information Systems at NAL, Laura Weir, chapter member, Dr. Alan Fusonie, the library's rare book specialist, and Mrs. Hale Taylor, chapter president.*

### Agricultural Fuel Priority Suspended

As shortages of meat, produce, and other items began appearing at the wholesale level in the Washington, D.C., area on June 22, predictions held that shortages could reach the grocery counter within weeks. The Carter administration moved on several fronts in an attempt to end the increasingly violent nationwide strike by independent truckers who are angry at the ever higher prices and low availability of diesel fuel coupled with constricting price regulations. In separate actions, the Department of Energy (DOE) suspended a federal regulation, DOE Rule No. 9, that gave farmers priority status in the purchase of diesel fuel, and the Federal Highway Administration urged governors in a number of states to consider temporarily lifting weight and length limits of trucks using their highways. DOE's Special Rule No. 9 had previously allotted farmers all the diesel fuel they needed for spring planting and would have remained in effect until July 31 without the suspension. The DOE action gives truckers more access to diesel supplies and could result in lower prices at the pump because many truck stops have had to buy diesel fuel at higher "spot" market prices and, in turn, have had to charge more for it. Earlier in the week, the Interstate Commerce Commission decided to allow truckers to pass on diesel fuel price increases to their customers but this action alone has not been sufficient to end the truckers' strike.

## Museum Cuts Energy Costs

The Agricultural Hall of Fame in Bonner Springs, Kansas, has discovered that it is sitting on a deposit of natural gas and has tapped that supply for its heating and cooling systems. According to Director Harold Adkins, the museum has turned the corner to prosperity.

## Viable Commercial Waste Treatment System from Space Program

Initially designed for possible use in future manned spacecraft, a physiochemical process called wet oxidation is becoming an important method for the treatment of wastewater. It has now become both a practical and economical solution to many industrial liquid waste disposal problems. In simple terms, it is a flameless combustion process which proceeds at moderate temperatures and at pressures somewhat higher than the pressure of steam at the temperature of operation. It is particularly capable of handling toxic wastes that will not respond to normal biological treatment. This includes wastes high in organic sulfur, nitrogen or chlorides which would become an air pollution problem if incinerated. Called the ASTROL process by ASTRO Metallurgical Corp., who developed it, the process can either be tested on a laboratory scale or evaluated on site by means of the company's traveling pilot plant.

## Radioisotope Shows Promise to Sanitize Sewage Sludge

A sewage treatment plant in New Mexico may represent a major technological step in terms of cost of sewage sludge disposal. It is a $350,000 facility developed by the Department of Energy's Sandia Laboratory and is another project having some of its roots in the space program. The DOE is investigating both the economic and the technical aspects of using radioisotopes to irradiate dried or composted sewage sludge and convert it into soil conditioners, crop fertilizer, and animal feed supplement. The cost of the process is significantly less than other traditional methods. Sale of the end product could result possibly in large annual savings.

## General Motors Favors Alcohol as Fuel

General Motors along with most other auto manufacturers sees a strong future for alcohol but has recommended the use of pure methanol, rather than ethanol or gasohol as the fuel of the future. Methanol can be produced from readily available sources that include garbage and agricultural waste such as manure and cornstalks. Ethanol, on the other hand, is made from corn, sugar beets, and other food grains and is three times as expensive to produce. Texas A & M University has developed a method to solve a number of the problems associated with the use of alcohol as a fuel for gas powered vehicles by combining separate gasoline and methanol systems. Hard starting due to poor vaporization is solved by using gasoline until the engine warms up, at which point an automatic switchover takes place. Vapor lock and the need for manifold heating are eliminated by a separate tank, heated by exhaust, that vaporizes the methanol before it gets to the carburetor.

## Burlington Electric Converts to Wood Chips

Vermont's municipally owned Burlington Electric Department has converted one of its three boilers to burn wood chips instead of coal. The company now plans to convert a second boiler to wood this year and to erect a new 50 megawatt wood-fired plant by late 1982. The wood burning facilities will provide 35% of the utility's electric needs when completed. Since Vermont has more trees than it did 100 years ago, forestry officials believe that the utility's need for wood will improve the quality of the forests by culling and using the defective trees.

## Water Reclamation System Saves Energy

The water reclamation system at the Oconomowoc Canning Company in Poynette, Wisconsin, which has been in operation for about two years, has reduced water use by 30 percent, nearly eliminated the need for water softening chemicals, and cut energy costs by lowering water heating requirements. The firm operates five vegetable processing and canning plants and one can manufacturing plant in Wisconsin. Produce is brought in on a contract basis from farmers throughout the state. With the installation of a newly designed boiler, water is being reclaimed from the cooker at over 160 degrees F., as opposed to the 50 degrees F. of raw water which formerly came into the plant from its wells. The heated water is then used for boiler feedwater. The 110 degree F. temperature difference provided substantial energy savings. In fact, the energy savings from one twelve-week season repaid the company for the money invested in the reclaim system equipment.

## Windmill Generator Dedicated in Boone, N.C.

The world's largest electricity-generating windmill was dedicated July 11th atop a 4,200-foot mountain in a ceremony attended by energy officials, townspeople, and hundreds of tourists.

Officials from state and federal energy departments hailed the development of the $3.5 million windmill as a signal that the United States is moving to end its reliance on foreign oil for energy needs.

The windmill, which sits atop Howard's Knob, was a joint project of the U.S. Department of Energy and the National Aeronautics and Space Administration.

## Synfuel Catching On

President Carter's recent Tokyo pledge to hold down oil imports makes it more likely than ever that there will be a switch from oil to coal. Synthetic fuel, or Synfuel as it is becoming known, can be made from vegetable wastes, oil shale, tar sands and, most easily, coal. There are nearly 50 bills advocating Synfuel awaiting action in Congress at present. The final sorting will probably produce a package built around price supports, incentives for private industry, a speeded-up regulatory process, and up-front government money due to the large investment involved. Senate Majority Leader Robert Byrd (D-W. Va.) plans to push through a Senate Synfuel bill this month. Although costly and not without tremendous environmental problems, Synfuel offers possibilities.

## SOLET: A New Solar Energy System on the Market

Power Conservation Corporation, a small public company in Fort Lauderdale, Florida, and Robert M. Edwards, a research scientist, have formed a jointly-owned company called Solar Solet Corporation to hold rights for the Solet (Solar Optical Laser Electrical Turbine) electrical power generating system that operates from sun radiation during the day and artificial radiation at night. In this system, the fluid moves from a preheated holding tank to a solar optical-laser light concentrating unit. The steam turns a turbine that turns twin generators, thereby creating electricity both for use and for thermal storage heating. The spent steam is cooled, converted back to fluid, and returned to the starting point. The Solet system is designed to generate electricity 24 hours a day. During the day, electrically created thermal power is stored to make steam and to power radiant lamps for the alternate night energy system. Solet is projected to generate electricity at a fraction of the operating costs of known generating units. Equipment wear is minimal, the system produces no harmful side effects, creates no pollution, and is designed so that technicians can be trained easily to operate it. And, best of all, the system can be designed to meet any size specifications from a mountain cottage unit to a huge power generating plant.

Exclusive sales rights have been retained by Power Conservation Corporation, which will market the units through a dealer network in the U.S. and abroad. For further information on the Solar Solet system, address inquiries to:

John Holmes
New Product Development
Power Conservation Corporation
2601 Davie Boulevard
Fort Lauderdale, Florida 33312

New Organization Established

A new organization concerned with land use, The American Land Forum (ALF), was established in 1978 by a group of land resource specialists, policy analysts, and writers to provide a national forum for the resolution of major issues concerning the use and conservation of American land resources. A recent forum was sponsored by the ALF on the Mall in Washington, D.C. Information can be obtained about this organization from:

The American Land Forum, Inc.
1025 Vermont Ave., N.W.
Washington, D.C. 20005
(202) 347-4516

Research in Progress

G. E. Fussell has finished Vol. III (1793-1839) of *Old English Farming Books*. It is now being considered for publication by Campbell Press. This study as well as his other two volumes are intended to assess contemporary textbooks as a guide to the history of farm practices.

The Agricultural History Center at the University of California, Davis, has expanded research activities. The Center's staff is investigating the causes and consequences of technological changes in American agriculture and the history of American forest policy.

Russians Likely to Buy Wheat Again

Wheat prices have risen from around $3.00 to between $4.00 and $5.00 a bushel. Reports of a poor harvest in Russia's European growing areas have triggered this price explosion. USDA estimates that Russia needs about 230 million metric tons of grain. Though last year the harvest was a record 237 million metric tons, this year U.S. experts have predicted 179 million to 210 million metric tons, falling short of the Soviet goal of 227 million tons. So they must use their grain reserves (no one knows the actual size) or reduce their grain-eating poultry flocks and cattle herds, or import, or a combination of all these alternatives. Under the United States' grain agreement with the Soviet Union, a five-year pact now in its third year, the Soviets are committed to buy at least 6 million metric tons and may buy up to 8 million without consultation. Last year they bought 14.8 million tons. This year's estimate is for 15 million with more needed late this year and next if the harvest is poor. Agriculture exports this year are now expected to exceed the old forecast of $32 billion, and the old projection for next year of $33 to $37 billion is considered a conservative estimate by USDA experts. With grain prices up and costs climbing for fuel and fertilizers based on petrochemicals, transportation, and wages, food price increases may not be as small as anticipated.

MEETINGS

October 16-18, 1979

Second Symposium of Environmental Concerns in Rights of Way Management. University of Michigan
Selected topic areas are site selection, right of way impact, policy trends of utility companies, ecological aspects of maintenance techniques, vegetation studies, wildlife surveys. For general information on the symposium write to:

Dr. Dale H. Arner
Dept. of Wildlife & Fisheries
P. O. Drawer L W
Mississippi State, MS 39762

April 18-24, 1980

Operational Modelling of Ecological Networks. Second International Conference of State-of-the-Art of Ecological Modelling. International Society for Ecological Modelling at Liege, Belgium. For further information write to:

Daniel M. Dubois, Chairman
University of Liege, Institute of Mathematics
15 Avenue des Tilleuls
B-4000 Liege, Belgium

May 13-15, 1980

Symposium on the History of Agriculture in the Southwestern United States. College Station, Texas
This symposium is sponsored by Texas A & M University and the Agricultural History Society in cooperation with the U.S. Department of Agriculture. Proposed topics may include, but are not limited to, energy in agriculture, veterinary medicine, pre-Columbian agriculture, agricultural extension services, feed grains, and livestock. This is an open call for proposals which should include a one or two page summary stating tentative title, scope, general outline, and tentative bibliography. Send to:

Dr. Irvin M. May, Jr.
Research Historian
Dept. of Agricultural Economics
Texas A & M University
College Station, Texas 77843
(713) 845-5043

or

Professor Henry C. Dethloff
Dept. of History
Texas A & M University
College Station, Texas 77843
(713) 845-7151

("A root cellar with barrels" in *American Agriculturist*, November, 1880).

# LEGISLATION OF  NOTE

As gasoline lines swell and tanks empty, energy seems to be on everyone's mind. Not only is there no gas, one mumbles while sitting in an overheated car, but skylab is falling as well! We each rush to buy gas and hope for the best, but somehow we know that this crisis is real. For nearly a decade now we have been waiting, waiting for a forcible end to our extravagant ways. We are seeing confirmation of what the physicists call entropy, what from a gas line appears to be the running down of the universe. Stated another way, we are observing the second law of thermodynamics in operation: in every closed system over a finite period of time the amount of energy available to perform work must decrease. There are no exceptions to this rule—in general. But there are local exceptions, isolated improvements in efficiency, increases in order, decreases in entropy. With this in mind, in this issue we have chosen to focus on energy legislation, or legislation aimed at either increasing the amount or the kind of energy available, or aimed at improving the efficiency or economy with which we produce and use it.

Hundreds of bills have already been introduced into the 96th Congress referencing energy, some relating to research and development, interstate and foreign commerce, financing (ways and means), and government operations. There are bills pertaining to gasohol and the production of alcohol from waste products, bills requiring federal vehicles to drive on at least ten percent gasohol, bills to revise the Internal Revenue Code to encourage production investments. All of these bills reflect the feeling on the part of Congress that something must be done. Unfortunately, most of the bills introduced so far appear remedial. They aim at either supplementary production or improved efficiency. They do not address in any serious manner the very lifestyle, prototypically American, which encourages the production and consumption of useless material goods, and results in a radically uneven distribution of wealth among the American people. Perhaps a greater crisis than the present one is needed to bring these changes about. In the meantime we can only hope that research into the decentralized production and use of such non-corporate sources of energy as gasohol, wind, solar, and thermal power will continue. Watch for these bills as they make their way slowly through the 96th Congress.

## Legislation Entered on Gasohol

H.R. 1006 HOUSE INTERSTATE AND FOREIGN COMMERCE
REP. EDWARDS, D., ET AL.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO PROVIDE FOR THE USE OF ALCOHOL PRODUCED FROM RENEWABLE RESOURCES AS A MOTOR VEHICLE FUEL.*

SUMMARY:
Requires the Secretary of Energy to establish a program to promote the development and use of alcohol-blended fuels in the United States.

H.R. 3029 HOUSE GOVERNMENT OPERATIONS
REP. SMITH, V.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE FEDERAL PROPERTY AND ADMINISTRATIVE SERVICES ACT OF 1949 TO REQUIRE THE GENERAL SERVICES ADMINISTRATION TO PROVIDE FOR FUELING NOT LESS THAN 10 PERCENT OF FEDERAL NON-MILITARY VEHICLES WITH GASOHOL FUELS, AND FOR OTHER PURPOSES.*

SUMMARY:
Amends the Federal Property and Administrative Services Act of 1949 to require the Administrator of General Services to convert a certain percentage of the Government's nonmilitary motor vehicles to exclusive use of gasohol fuels within a specified time period.

H.R. 3792 HOUSE WAYS AND MEANS
REP. GRASSLEY
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE INTERNAL REVENUE CODE OF 1954 TO EXCLUDE FROM GROSS INCOME INTEREST ON INDUSTRIAL DEVELOPMENT BONDS THE PROCEEDS OF WHICH ARE TO BE USED TO PROVIDE FACILITIES FOR THE PRODUCTION OF ALCOHOL FOR USE IN THE PRODUCTION OF GASOHOL OR OTHER FUEL.*

H.R. 3938 HOUSE WAYS AND MEANS
REP. CAVANAUGH
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE INTERNAL REVENUE CODE OF 1954 TO EXCLUDE FROM GROSS INCOME INTEREST ON INDUSTRIAL DEVELOPMENT BONDS THE PROCEEDS OF WHICH ARE TO BE USED TO CONSTRUCT FACILITIES FOR THE PRODUCTION OF ALCOHOL FOR USE IN MAKING GASOHOL OR OTHER FUEL.*

H.R. 3958 HOUSE INTERSTATE AND FOREIGN COMMERCE
REP. DASCHLE
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE PETROLEUM MARKETING PRACTICES ACT TO FACILITATE THE SALE OF GASOHOL BY FRANCHISED GASOLINE DEALERS.*

H.R. 4056 HOUSE GOVERNMENT OPERATIONS
REP. HUGHES
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO PROMOTE THE GROWTH OF THE ALCOHOL FUELS INDUSTRY BY PROVIDING A DEPENDABLE MARKET FOR ALCOHOL FUELS THROUGH PREFERENTIAL FEDERAL PURCHASES OF GASOHOL.*

S. 861 SENATE FINANCE
SEN. DOLE
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO EXTEND THE EXEMPTION FROM FEDERAL EXCISE TAX ON THE USE OF GASOHOL AND FOR OTHER PURPOSES.*

S. 1042
SEN. DURKIN SENATE FINANCE
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO STIMULATE THE CONVERSION TO WIDE-SPREAD USE OF FUEL-EFFICIENT GASOHOL MIXES BY PROVIDING A FINANCIAL INCENTIVE TO STATES AND LOCALITIES WHICH CONVERT ALL OR PART OF THEIR AUTOMOTIVE FLEETS TO SUCH MIXES.*

S. 1208 SENATE ENERGY AND NATURAL RESOURCES
SEN. DURKIN
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO STIMULATE THE CONVERSION TO WIDE-SPREAD USE OF FUEL-EFFICIENT GASOHOL MIXES BY PROVIDING A FINANCIAL INCENTIVE TO STATES AND LOCALITIES WHICH CONVERT ALL OR PART OF THEIR AUTOMOTIVE FLEETS TO SUCH MIXES.*

S. 1268 SENATE ENERGY AND NATURAL RESOURCES
SEN. BAYH
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE PETROLEUM MARKETING PRACTICES ACT TO FACILITATE THE SALE OF GASOHOL BY FRANCHISED GASOLINE DEALERS.*

Legislation Entered on Energy Recovery from Wastes

H.R. 39 REFERRED TO MORE THAN ONE COMMITTEE
REP. UDALL, ET AL.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO PROVIDE FOR THE DESIGNATION AND CONSERVATION OF CERTAIN PUBLIC LANDS IN THE STATE OF ALASKA, INCLUDING THE DESIGNATION OF UNITS OF THE NATIONAL PARK, NATIONAL WILDLIFE REFUGE, NATIONAL FOREST, NATIONAL WILD AND SCENIC RIVERS, AND NATIONAL WILDERNESS PRESERVATION SYSTEMS, AND FOR OTHER PURPOSES.*

SUMMARY:
Designates specified public lands and waters in the State of Alaska for inclusion in the National Park, National Wildlife Refuge, National Wild and Scenic Rivers, National Forest, and National Wilderness Preservation Systems. Makes provisions for management of subsistence uses of fish and wildlife on national lands. Amends the Alaska Native Claims Settlement Act.

CHRONOLOGY OF ACTIONS:
5/24/79 SCRM010 Referred to Senate Committee on Energy and Natural Resources
5/16/79 HFAC080 Measure passed House, amended, roll call 153 (360-65) (Inserted provisions of H.R. 3651 as amended)
5/16/79 HFAC072 Motion to recommit to the Committee on Interior and Insular Affairs rejected in House
5/16/79 HFAC050 Measure considered in House
5/15/79 HFAC050 Measure considered in House
5/4/79 HFAC050 Measure considered in House
5/4/79 HFAC040 Measure called up by special rule in House
4/23/79 HCAC080 Reported to House from the Committee on Merchant Marine and Fisheries with amendment, H.Rept. 96-97 (Part II)
4/18/79 HCAC080 Reported to House from the Committee on Interior and Insular Affairs with amendment, H. Rept. 96-97 (Part I)

H.R. 1048 HOUSE INTERSTATE AND FOREIGN COMMERCE
REP. LAFALCE, ET AL.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE SOLID WASTE DISPOSAL ACT (AS AMENDED BY THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976) TO ESTABLISH A PROGRAM FOR THE IDENTIFICATION AND RECLAMATION OF ABANDONED HAZARDOUS WASTE SITES, TO ESTABLISH A FEE FOR THE STORAGE OR DISPOSAL OF HAZARDOUS WASTES, AND FOR OTHER PURPOSES.*

SUMMARY:
Amends the Solid Waste Disposal Act to establish a program for the identification, reclamation, and prevention of adverse effects of abandoned hazardous waste sites and for the control of new hazardous waste sites.

H.R. 2676 HOUSE SCIENCE AND TECHNOLOGY
REP. AMBRO, ET AL.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AUTHORIZE APPROPRIATIONS FOR ENVIRONMENTAL RESEARCH, DEVELOPMENT, AND DEMONSTRATIONS FOR THE FISCAL YEAR 1980, AND FOR OTHER PURPOSES.*

SUMMARY:
Authorizes appropriations for environmental research, development, and demonstrations for fiscal year 1980.

CHRONOLOGY OF ACTIONS:
5/23/79 SFAC152 Measure passed Senate, amended
5/23/79 SFAC080 Measure considered in Senate
5/23/79 SFAC033 Call of Calendar in Senate
5/15/79 SCAC080 Reported to Senate from the Committee on Environment and Public Works with amendment, S. Rept. 96-158
3/28/79 SRCM010 Referred to Senate Committee on Environment and Public Works
3/27/79 HFAC080 Measure passed House, amended
3/27/79 HFAC050 Measure considered in House
3/26/79 HFAC050 Measure considered in House
3/26/79 HFAC040 Measure called up by special rule in House
3/20/79 HCAC080 Reported to House from the Committee on Science and Technology with amendment, H. Rept. 96-58

H.R. 3000 REFERRED TO MORE THAN ONE COMMITTEE
REP. STAGGERS, ET AL.
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AUTHORIZE APPROPRIATIONS TO THE DEPARTMENT OF ENERGY FOR CIVILIAN PROGRAMS FOR FISCAL YEAR 1980 AND FISCAL YEAR 1981, AND FOR OTHER PURPOSES.*

CHRONOLOGY OF ACTIONS:
5/23/79 HCAC070 Reported to House from the Committee on Interior and Insular Affairs, H. Rept. 96-196 (Part IV)
5/15/79 HCAC080 Reported to House from the Committee on Science and Technology with Amendment, H. Rept. 96-196 (Part III)
5/15/79 HCAC080 Reported to House from the Committee on Interior and Insular Affairs with Amendment, H. Rept. 96-196 (Part II)
5/15/79 HCAC080 Reported to House from the Committee on Interstate and Foreign Commerce with amendment, H. Rept. 96-196 (Part I)

H.R. 3797 HOUSE INTERSTATE AND FOREIGN COMMERCE
REP. LAFALCE
OFFICIAL TITLE AS INTRODUCED:
*A BILL TO AMEND THE SOLID WASTE DISPOSAL ACT (AS AMENDED BY THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976) TO ESTABLISH A PROGRAM FOR THE IDENTIFICATION AND RECLAMATION OF ABANDONED HAZARDOUS WASTE SITES, TO ESTABLISH A FUND TO BE USED FOR THE RECLAMATION OF HAZARDOUS WASTE SITES AND FOR THE COMPENSATION OF PERSONS INJURED BY HAZARDOUS WASTE, TO PROVIDE A FEDERAL CAUSE OF ACTION FOR DAMAGES CAUSED BY HAZARDOUS WASTE, AND FOR OTHER PURPOSES.*

S. 222 SENATE ENERGY AND NATURAL RESOURCES
SEN. DURKIN, ET AL.
OFFICIAL TITLE AS INTRODUCED:

*A BILL TO PROVIDE FOR THE DESIGNATION AND CONSERVATION OF CERTAIN PUBLIC LANDS IN THE STATE OF ALASKA, INCLUDING THE DESIGNATION OF UNITS OF THE NATIONAL PARK, NATIONAL WILDLIFE REFUGE, NATIONAL FOREST, NATIONAL WILD AND SCENIC RIVERS, AND NATIONAL WILDERNESS PRESERVATION SYSTEMS, AND FOR OTHER PURPOSES.*

SUMMARY:

Designates specified public lands and waters in the State of Alaska for inclusion in the National Park, National Wildlife Refuge, National Wild and Scenic Rivers, National Forest, and National Wilderness Preservation Systems. Makes provisions for the management of subsistence uses of fish and wildlife on national lands. Amends the Alaska Native Claims Settlement Act.

S. 688 SENATE ENERGY AND NATURAL RESOURCES
SEN. JACKSON
OFFICIAL TITLE AS INTRODUCED:

*A BILL TO AUTHORIZE APPROPRIATIONS TO THE DEPARTMENT OF ENERGY FOR CIVILIAN PROGRAMS FOR FISCAL YEAR 1980 AND FISCAL YEAR 1981, AND FOR OTHER PURPOSES.*

## Bills Relating to Solar Energy

- H.R. 298: SPON=REP. DRINAN: *SOLAR AND ENERGY CONSERVATION COMMERCIALIZATION ACT*
- H.R. 605: SPON=REP. NEAL, ET AL.: *SOLAR ENERGY BANK ACT*
- H.R. 746: SPON=REP. SEIBERLING: *ENERGY TECHNOLOGY AVAILABILITY ACT*
- H.R. 2288: SPON=REP. PURSELL: *NATIONAL ENERGY TRUST FUND ACT*
- H.R. 2335: SPON=REP. FLIPPO, ET AL.: *SOLAR POWER SATELLITE RESEARCH, DEVELOPMENT AND EVALUATION PROGRAM ACT OF 1979*
- H.R. 2343: SPON=REP. MCKINNEY: *SOLAR ENERGY BANK ACT*
- H.R. 3401: SPON=REP. JEFFORDS: *SOLAR GLOBAL MARKETING SURVEY ACT*
- H.R. 3525: SPON=REP. JEFFORDS, ET AL.: *SOLAR ENERGY EMPLOYMENT AND TRAINING ACT*
- H.R. 3532: SPON=REP. MINETA, ET AL.: *SOLAR ENERGY EMPLOYMENT AND TRAINING ACT*
- H.R. 3947: SPON=REP. NEDZI, ET AL.: *MILITARY CONSTRUCTION AUTHORIZATION ACT, 1980*
- S. 524: SPON=SEN. MORGAN: *SOLAR ENERGY BANK ACT*
- S. 950: SPON=SEN. DURKIN, ET AL.: *OMNIBUS SOLAR ENERGY COMMERCIALIZATION ACT OF 1979*
- S. 1066: SPON=SEN. PERCY, ET AL: *SOLAR GLOBAL MARKETING SURVEY ACT*

## Bills Relating to Wind Energy

- H.R. 3556: SPON=REP. BLANCHARD, ET AL.: *WIND ENERGY SYSTEMS RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 1979*
- H.R. 3557: SPON=REP. JEFFORDS, ET AL.: *WIND ENERGY SYSTEMS RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 1979*
- H.R. 3558: SPON=REP. MINETA, ET AL: *WIND ENERGY SYSTEMS RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 1979*
- H.R. 4335: SPON=REP. STUDDS: *WIND ENERGY SYSTEMS UTILIZATION ACT*

## Other Bills Related to Energy and Agriculture

- H.R. 37: SPON=REP. MOORHEAD, W.: *DEFENSE PRODUCTION ACT EXTENSION AMENDMENTS OF 1979*
- H.R. 369: SPON=REP. GUYER: *FOOD STAMP PLAN*
- H.R. 602: SPON=REP. MOORHEAD, W: *DEFENSE ECONOMICS*
- H.R. 1732: SPON=REP. RANGEL: *FOOD RESEARCH CORPORATION ACT OF 1979*
- H.R. 1980: SPON=REP. HAGEDORN, ET AL.: *GRAIN PRODUCTS UTILIZATION ACT OF 1979*
- H.R. 2199: SPON=REP. HUCKABY: *ALASKA NATIONAL INTEREST LANDS*
- H.R. 2219: SPON=REP. MURPHY, J., ET AL.: *ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT*
- H.R. 2465: SPON=REP. PREYER, ET AL: *CONFIDENTIALITY OF TAX RECORDS ACT*
- H.R. 2480: SPON=REP. ZABLOCKI (BY REQ.), ET AL: *INTERNATIONAL DEVELOPMENT ASSISTANCE ACT OF 1979*
- H.R. 2588: SPON=REP. WAMPLER, ET AL.: *DEPARTMENT OF AGRICULTURE RESTORATION ACT OF 1979*
- H.R. 3166: SPON=REP. WAMPLER, ET AL.: *DEPARTMENT OF AGRICULTURE RESTORATION ACT OF 1979*
- H.R. 3324: SPON=REP. ZABLOCKI, ET AL.: *INTERNATIONAL DEVELOPMENT CORPORATION ACT OF 1979*
- H.R. 4313: SPON=REP. D'AMOURS: *FOREST FUEL UTILIZATION ACT OF 1979*
- S. RES. 22: SPON=SEN. BYRD, R.: *CONGRESSIONAL COMMITTEES (SENATE)*
- S. RES. 23: SPON=SEN. BAKER: *CONGRESSIONAL COMMITTEES (SENATE)*
- S. 9: SPON=SEN. JACKSON: *ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT*
- S. 14: SPON=SEN. CHURCH, ET AL: *RECLAMATION REFORM ACT OF 1979*
- S. 95: SPON=SEN. CHURCH: *RIVER OF NO RETURN WILDERNESS ACT OF 1979*
- S. 96: SPON=SEN. CHURCH: *CENTRAL IDAHO WILDERNESS AND MANAGEMENT ACT OF 1979*
- S. 97: SPON=SEN. CHURCH: *WILDERNESS AREAS*
- S. 382: SPON=SEN. KENNEDY, ET AL.: *COMPETITION IMPROVEMENTS ACT OF 1979*
- S. 490: SPON=SEN. DOMENICI, ET AL: *ARCHAEOLOGICAL RESOURCES PROTECTION ACT OF 1979*
- S. 588: SPON=SEN. CHURCH: *INTERNATIONAL DEVELOPMENT ASSISTANCE ACT OF 1979*
- S. 633: SPON=SEN. MCCLURE, ET AL.: *FARM WATER ACT OF 1979*
- S. 812: SPON=SEN. HATFIELD: *WILDERNESS AREAS*
- S. 813: SPON=SEN. CRANSTON, ET AL.: *NATIONAL PARKS*
- S. 835: SPON=SEN. RANDOLPH, ET AL.: *REGIONAL DEVELOPMENT ACT OF 1979*
- S. 912: SPON=SEN. BURDICK: *REGIONAL DEVELOPMENT ACT OF 1979*
- S. 924: SPON=SEN. MCCLURE: *HISTORIC SITES*
- S. AMDT. NO. 132: SPON=SEN. MOYNIHAN: *EXECUTIVE REORGANIZATION*

## For Further Information:

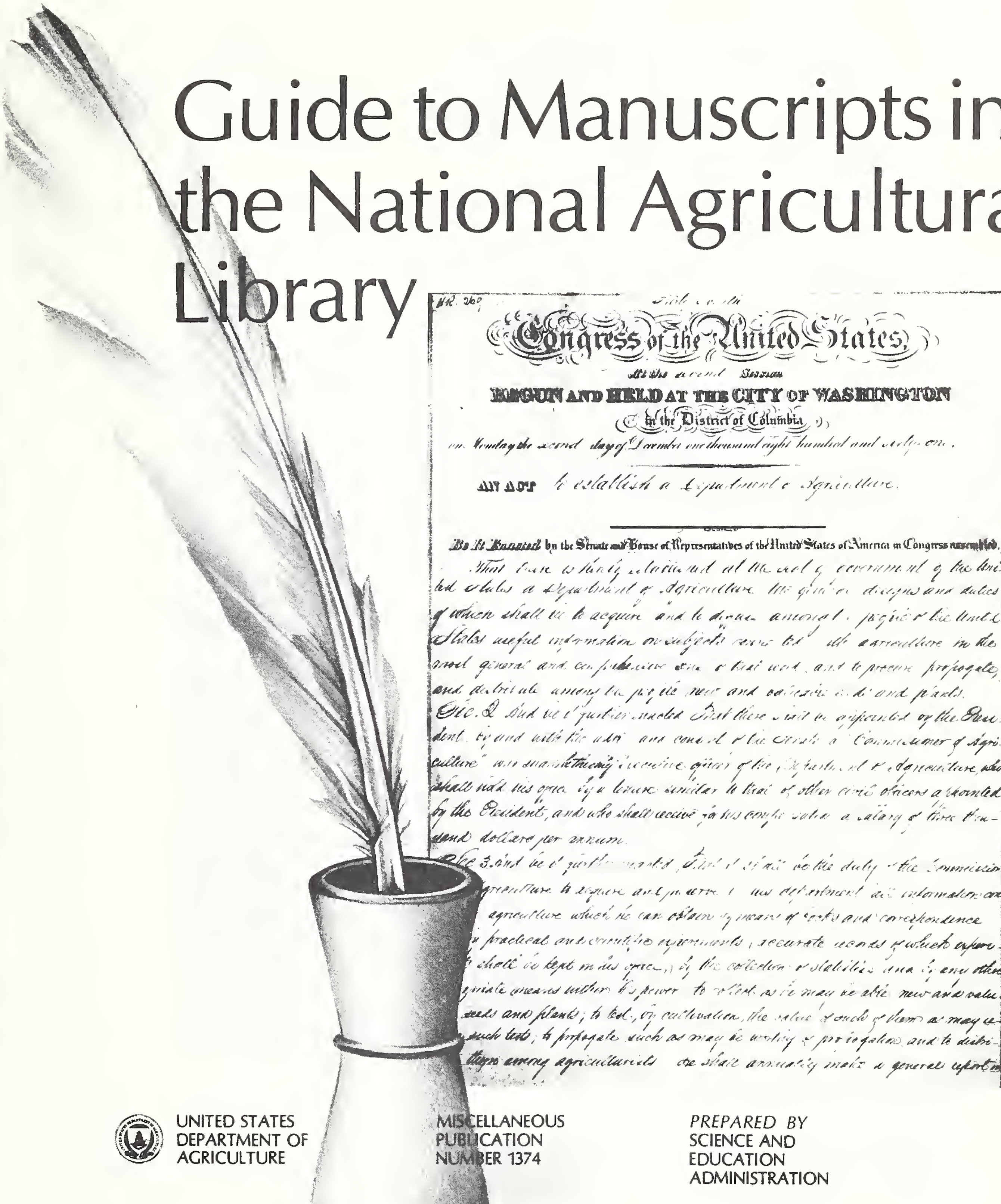
For more information on any of these bills contact either the House Bill Status Office (202-225-1772) or the Senate Bill Status Office (202-224-2971), or call the Capitol Hill Switchboard (202-224-3121) and ask to be connected to the committee actively considering the bill in question. A call to the committee staffer responsible for monitoring a particular bill can usually get you a full explanation of its background, purpose, and likelihood of becoming law. To obtain copies of any cited legislation call either the committee in question, or the Document Room (Senate: Rm S325 Capitol/202-224-4321; House: Rm H226 Capitol/ 202-225-3456).

For an AGRICOLA print-out of research relative to gasohol or alcohol produced from grain and biomass products call or write the Reference Branch, National Agricultural Library, Beltsville, Maryland, 20705 (301-344-3704) requesting a copy of NAL Quick Bibliography 79-16 entitled *Gasohol, Alcohol, and Other Fuels, from Grain and Biomass Products,* searched by Charles Bebee and David Hoyt.

*(American Agriculturist,* September, 1880).

CUMULATIVE INDEX FOR 1978

# Guide to Manuscripts in the National Agricultural Library



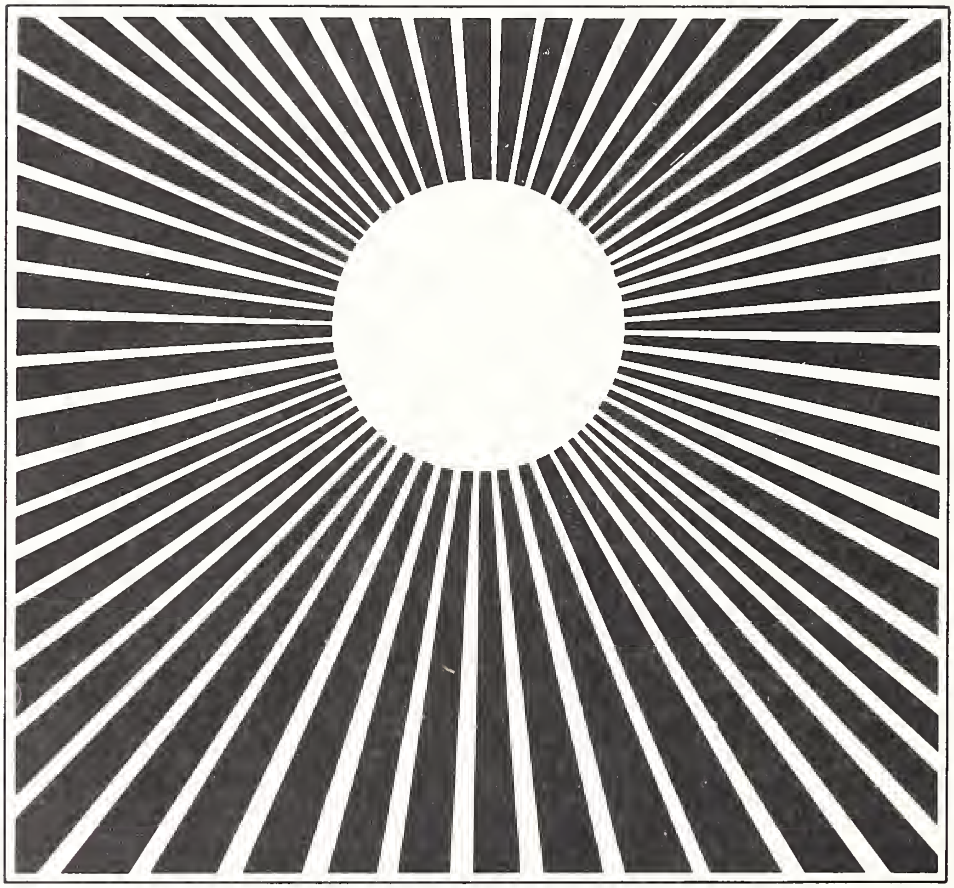

UNITED STATES
DEPARTMENT OF
AGRICULTURE


MISCELLANEOUS
PUBLICATION
NUMBER 1374


PREPARED BY
SCIENCE AND
EDUCATION
ADMINISTRATION

# SOLAR ENERGY AND NONFOSSIL FUEL RESEARCH

*A Directory of Projects Related to Agriculture 1976-79*

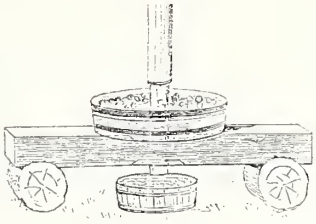


UNITED STATES DEPARTMENT OF AGRICULTURE

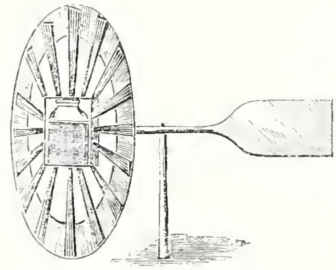
SCIENCE AND EDUCATION ADMINISTRATION

MISCELLANEOUS PUBLICATION No. 1378

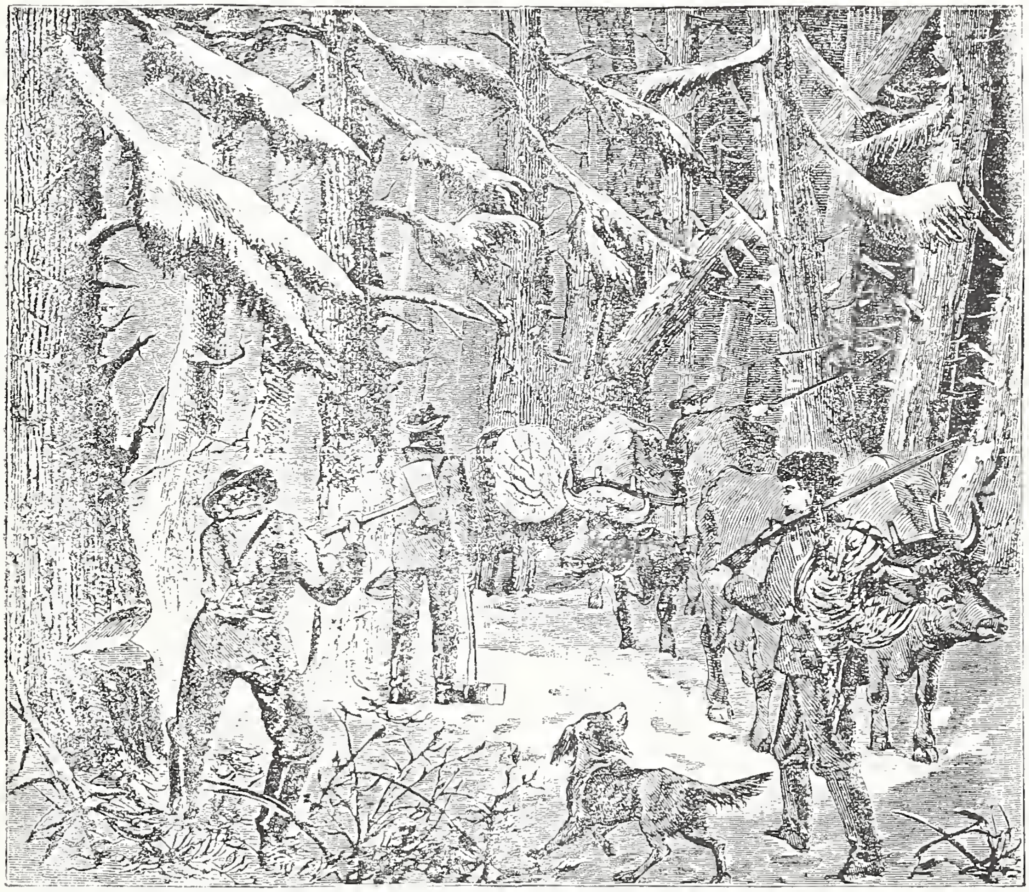
(Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 001-000-04055-3)



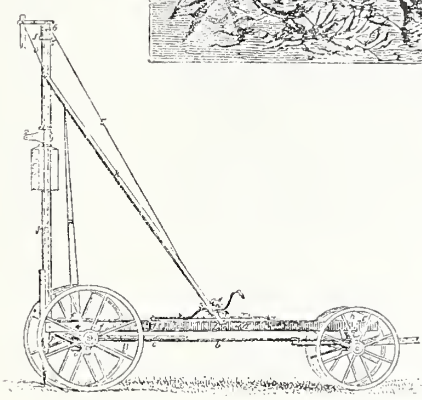
("A homemade apple pulper" in *American Agriculturist,* January, 1882)



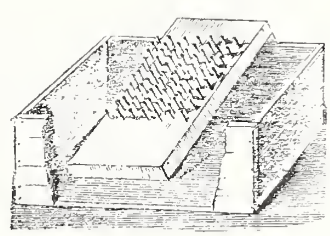
("A windmill 'churn'" in *American Agriculturist,* August, 1882)



(*American Agriculturist,* December, 1880)



("The post-driver" in *American Agriculturist,* July, 1882)



("A handy corn sheller" in *American Agriculturist,* November, 1880)

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