Report Of Governor's Advisory Commission on Agriprocessing

February 14, 1983

REPORT OF
GOVERNOR'S ADVISORY COMMISSION
ON
AGRIPROCESSING

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GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

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GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

INTRODUCTION

Forty percent of the State's economy is directly or indirectly dependent upon agriculture. Thus, we commend the Governor for his initiatives in seeking recommendations to enhance agricultural processing in Minnesota for both domestic and international trade.

Twenty-two members served on this Commission. They represent the agri-processing industry, both private and cooperative; state government, both the executive and the legislative branch; educational institutions; financing institutions; farm communicators; farm organizations; a big-eight accounting firm and a farmer who has been involved for a long time in promoting Minnesota agriculture.

The Commission members are concerned about conservation, research, education, financing, the family farm, international trade and transportation and are interested in new ideas to promote Minnesota agriculture. Their task force reports reflect these concerns and they submit these reports as a first step in drawing to the Governor's attention some recommendations to promote not only agri-processing but agriculture in general in Minnesota.

This Commission stands ready to continue to develop these recommendations, to support any legislation activity needed and to help the Governor implement them in a spirit of cooperation between government and industry.

GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

EXECUTIVE SUMMARY

WHAT NEW INITIATIVES SHOULD STATE GOVERNMENT BE CONSIDERING TO FOSTER THE GROWTH OF THE INDUSTRY?

1. Financing Initiatives

We recommend that the State of Minnesota establish a Minnesota Agri-Processing Financing Authority to encourage development of agri-processing in Minnesota. Such an Authority would possess great flexibility in financing authority including:

-- providing loan guarantees to secure financing for agri-processing facilities,

-- making of direct loans subordinated to other loans incurred on the same agri-processing facility;

-- making of direct equity investments in agri-processing companies involved in constructing facilities in the State of Minnesota; and

-- negotiating with other government units for tax incentives considered necessary.

It would be an independent Authority governed by a 15 person board composed of financial people, agri-processing people, government representatives, farmers and labor. Day-to-day operations would be directed by an experienced agri-processing financial executive director hired by the board.

We also recommend that the State of Minnesota fund the Authority directly with a minimum of $30 million which could be leveraged five times to aggregate $150 million.

Assistance would be available to small, medium and large agri-processing operations to utilize Minnesota agricultural commodities and to expand employment.

2. Multi-State Consortium on Agriculture

We recommend that the Governor take the initiative in the convening and organizing of a multi-state consortium on agriculture.

Its purpose would be to:

-- promote the sale of Upper Midwest farm commodities (raw and finished) for both the domestic and international markets;

-- study the impact of federal and state legislation on this region;

-- seek a more unified approach to solving the problems of the region in the following areas as well as others:

- marketing activities, domestic and international
- agricultural finance
- transportation; rail, truck, waterway
- education and research; and

-- build upon and not duplicate those efforts that are underway by other multi-state organizations involved with agriculture.

3. Ethanol and Rural Energy Parks

The use of corn in the dry milling manufacture of ethanol, distillers dry grain and carbon dioxide is the best near term agri-processing operation that could be developed in the State of Minnesota. However, certain tax incentives would be required from the State.

Economic minimum size plant would be five million gallons annual production. This size plant would use two million bushels of corn annualy and would cost about $15 million.

The ethanol would be used as a motor fuel substitute blended with gasoline 1 to 4 and as a replacement octane enhancer for Tetra Ethyl Lead.

Distillers Grain (DDGS) is an excellent livestock feed and has a strong growing market in international trade.

Estimated initial market for ethanol is 20 million gallons within the State and 10 to 15 million gallons in adjoining states.

To be viable the industry would require 4¢/gallon state tax forgiveness for super unleaded gasoline with ethanol. A loan guarantee program would also be required of the state.

Thirty states have reduced state taxes on alcohol fuels to encourage its use and resultant benefits to their state.

All assumptions regarding economic viability, competition and industry capacity will be verified.

4. Vegetable Oils--Other Uses

We recommend the following in order to promote the use of vegetable oils in both the domestic and international markets:

-- The Governor should work with other Governors and the congressional delegation to urge the Federal Government to negotiate changes in GATT so as to eliminate the inequities that vegetable oils contend with in the export market;

-- continue to support the University of Minnesota and other research institutions in working towards higher producing oilseeds; and

-- enlist the help, financially and otherwise, of the various commodity organizations involved in oilseeds in further research and development of vegetable oils as an extender for diesel fuel, as a carrier for chemicals and other potential uses.

5. Agricultural Research and Technology Transfer

Minnesota's most important economic resource is its agriculture which comprises 40% of the state's economy. It is becoming increasingly a hi-tech industry deriving most of its productivity improvements from agricultural research and the agricultural experiment station. Because of the weak economic conditions and reduced enrollments the funds from the state to the University of Minnesota will be reduced in the next few years.

It is imperative that the funding for agricultural research and the agricultural experiment station be exempt from these cuts. Instead funding for these programs should be increased by a guideline in excess of inflation if we are to improve our total state economy and our agricultural economy.

Specifically, the Minnesota Legislature should:

-- restore the funds to the 83-85 biennial budget that were reduced for the Minnesota Agricultural Experiment Station;

-- fund in full the 1983-85 bienniel request of the Minnesota Agricultural Experiment Station;

-- provide funding to support the University of Minnesota Biotechnology Center to support research which would directly benefit Minnesota based agriculture and processing.

Also, the College of Agriculture and The Extension Division should increase their budget for marketing farm products and Minnesota produced agricultural products.

6. Keeping the Producer in Business

While all of the recommendations of this Commission will be of eventual benefit to the Minnesota farmer if enacted, there needs to be some suggestions for the immediate improvements in the farm economy.

One suggestion was the adoption of the Minimum Price Commodity Bill. While the Commission feels that the discussion of this issue has been very valuable in drawing attention to the farmers plight, the individual members have not had time as yet to fully read and understand the bill and its ramifications.

A second suggestion was to promote Minnesota specialty crops such as wild rice, maple sugar, honey, edible dry beans, among others.

A third suggestion was to provide in the Agricultural Department additional resources to fund feasibility studies of a number of agri-procesing projects. Some possible projects are:

-- Introduce beef hide tanning in Minnesota.

-- Develop a project within the Metropolitan Airport Commission for exporting high value perishable products such as fish and fresh meat by air cargo.

-- Direct sale of agricultural products in international trade such as cattle, swine, sheep, turkeys, specialty crops, bagged commodities and barrelled vegetable oils.

-- Develop more interest in the sheep industry in Minnesota.

-- Sunflower oil as fuel ingredient.

-- Investigate rabbit processing for Minnesota.

-- Investigate UHT Aseptic packaging of milk and milk products.

7. State Support of Federal Legislation Re Agriculture, International Trade, Etc.

We recommend the establishment of a Governor's Agriculture Policy Advisory Commission (hereinafter "Commission") to address the shortcomings of the Concurrent Resolutuon: limited availability, limited impact on Washington and limited legislative resources.

Commission membership would represent a broad cross-section of participants in Minnesota's agricultural economy: producers, ag-transport, ag-processors; ag-financers, state executive and legislative personnel.

The Commission would be responsible for providing the Legislature with a draft Concurrent Resolution (say in late January of each year and from time-to-time thereafter as necessary) that:

-- Identified specific federal legislative or regulatory proposals which have a proportionately greater (positive or negative) on Minnesota's economy than on other states (reactive);

-- identified specific proposals for federal policy initiatives (legislative or regulatory) which would positively impact Minnesota's economy;

-- identified specific proposals for state policy initiatives (legislative or regulatory) whch would positively impact Minnesota's economy; and

-- prioritized all identified proposals for action.

It is also recommended that if this Advisory Commission is appoined, it be directed to work with any multi-state consortium on agriculture that may be in place.

8. Dairy Processing and Research

We recommend the support of research into more efficient production, processing and distribution of dairy products and financing incentives on a short-term basis when economically viable in the long-term in the following areas as well as others:

-- Developing and/or evaluating genetic engineering technolocy directed at increasing milk production, increasing the more valuable milk components and improving culturing of commercial milk products such as cheese, yogurt and so forth.

-- Economic research and computer modeling for hauling systems related to picking up milk on farms and delivering it to production or milk-utilization facilities.

-- The hauling costs of milk being used for manufacturing could be reduced substantially with a respective improvement in farmers' revenues through the use of new technology which would eliminate a significant portion of the water in milk at the farm level. This technology, known as membrane technology, uses specialized membranes to separate the water from the valuable milk solids that are in milk. The reduced cost of hauling or transporting these concentrated solids to the milk manufacturing plants would provide an economic benefit to the dairy industry and particularly the dairy farmer.

-- Whey proteins are a relatively low-valued and priced component of milk and result as a by-product of basic cheese production. Research into the utilization of whey proteins as a base in flavored or recreational drinks would substantially increase the value of the whey protein and provide a significant nutritional benefit to those that would be normally drinking soda-types of soft drinks.

9. Railroad Bonding

We recommend the support of a Railroad Bonding bill to implement the adoption of Amendment No. 4 to the Minnesota constitution and provide the financing for the rehabilitation of railroads that are essential to service our rural communities.

GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

TASK FORCES

FINANCING INITIATIVES

MULTI-STATE CONSORTIUM ON AGRICULTURE

ETHANOL AND RURAL ENERGY PARKS

VEGETABLE OILS--OTHER USES

AGRICULTURAL RESEARCH AND TECHNOLOCY TRANSFER

KEEPING THE PRODUCER IN BUSINESS

STATE SUPPORT OF FEDERAL LEGISLATION RE AGRICULTURE, INTERNATIONAL TRADE, ETC.

DAIRY PROCESSING AND RESEARCH

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GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

RECOMMENDATIONS

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I.

FINANCING INITIATIVES

TASK FORCE REPORT

February 10, 1983

FINANCING INITIATIVES

The committee on financing incentives has undertaken to review a variety of different structures and financing arrangements that might be undertaken by the State of Minnesota. The objective of these incentives is to be an inducement to companies and individuals to locate new agri-processing facilities within the State of Minnesota and to induce the owners of existing facilities to upgrade those facilities and remain as corporate citizens of the State.

Analysts of industrial location decision making advance the theory that the process involves several stages. Factors taken into account in selecting a general area - the first stage - are substantially different from those considered in site selection - the second stage. In the first stage, selection is based on operational prerequisites such as markets, labor market conditions, raw materials, and transportation. Regional differences in construction, energy and labor cost are generally too large to be outweighed by any difference in state and local taxes or fiscal incentives. The subordinate role of taxes at this stage is borne out by a composite case history of new facility location based on responses to a comprehensive questionnaire prepared by The Industrial Development Research Council. Respondents on manufacturing projects idenfied taxes as a minor item in total annual cost at the location of the project.On a composite basis, the median tax cost represented 3% of annual cost, and the modal tax cost reached 4% of annual cost.

For most manufacturers, labor costs can be many times larger than state and local tax payments. A very small wage differential then becomes as important as a much greater tax differential, underscoring the significance of identifying other cost

factors relevant to location decisions. While regional manufacturing wage rates have been converted toward the national average, differentials of as much as 10% of the average remain and, along with right-to-work laws, probably exercise greater influence on location decisions than do state and local tax and fiscal incentive differentials.

All other aspects of the decision of plant location being equal, the committee believes that the following recommendations will provide substantial inducements for companies to locate planned facilities in Minnesota and to the birth of new Minnesota companies in the agri-processing industry.

The committee believes that the State of Minnesota should establish a Minnesota Agri-Processing Financing Authority as a public nonprofit corporation with a wide range of purposes in financing authority, including but not necessarily limited to:

a. Providing loan guarantees to secure financing for agri-processing facilities.

b. Making of direct loans subordinated to other loans incurred on the same agri-processing facility.

c. Making of direct equity investments in agri-processing companies involved in constructing facilities in the State of Minnesota.

d. Negotiating with other government units for tax incentives considered necessary.

Oversite

We recommend that the Authority be governed by a fifteen person board consisting of three state government officials (Secretary of Agriculture, Chairman of the Minnesota Senate Agricultural Committee, and Chairman of the Minnesota House Agricultural Committee), three representatives of the Minnesota financial community, three representatives of Minnesota agribusiness (agri-processing) community, and three members of Minnesota labor unions with bargaining units involved in agri-processing.

The Board should hire a qualified business financial consultant with agri-processing experience to act as Executive Director who would be responsible for day-to-day operations of the Authority. Staff assistants would be added when and as needed.

Funding

We recommend that the State of Minnesota fund the Aughority with a minimum of _____ millions of dollars which in the opinion of certain experts in financing could be leveraged _____ times to aggregate _____ million dollars in benefits to the agri-processing industry in Minnesota. We further recommend that consideration be given to negotiations with pension fund trustees of Minnesota labor unions with bargaining units in agri-processing to provide funding, possibly through low interest loans, to the Authority for purposes of supporting direct subordinate loan and direct equity investments.

The Minnesota Agri-Processing Financing Authority should be granted authority to issue bonds secured by collateral or revenues generated through its activities. Consideration should be given to whether these bonds can be guaranteed by the State of Minnesota.

Guidelines

In addition to normal prudent investment criteria, guidelines will necessarily need to be established by the Board of the Authority to be based, among other things, on the number of jobs projected to be established in relation to the dollars to be invested by the Authority and the investor (company).

Loans Guarantees

Loan guarantees to secure financing for the construction or significant renovation of agri-processing facilities should be available. Such guarantees should be available for commercial borrowings or for industrial revenue bond issues. Such guarantees should be to cover not more than _____ % of loans in excess of $_____, Y percent of loans between $_____ and $_____ and Z percent of loans less than $_____.

For established companies loan guarantees are encouraged to provide probable lower interest rates for the borrowings to the company. For new companies, loan guarantees would not only affect the interest rate on the loan but also assist in underwriting the safety of the loan to the lending institution (enhancement of collateral) and affect the level or amount of the front-end equity required. These guarantees can be coupled with the tax exempt status of industrial revenue bonds to further reduce cost of the necessary loans for construction of the facilities.

The loan guarantees will necessarily need to cover the interim construction period of financing as well as the permanent loan on the facility. Additionally, we believe the guaranteed loans must be marketable, that is they must be transferrable to another institution if the guaranteed loan is sold.

II.

MULTI-STATE CONSORTIUM ON AGRICULTURE

TASK FORCE REPORT

RECOMMENDATION

We recommend that Governor Perpich work in unison with other Upper Midwestern governors to initiate a bold new approach to promoting the region, its products and assets: a multi-states consortium on agriculture.

The purpose of this effort is to promote Upper Midwest farm commodities (raw and finished), to study the impact of state and federal legislation on this region, and to seek a more unified approach to solving the region's problems.

The consortium should study, develop and expand upon existing multi-state efforts; seek new alternatives in the interest areas of agricultural transportation, international marketing, finance, alcohol fuels, in-state processing, education/research; and consider other topics of mutual interest.

We ask that Governor Perpich take the lead in initiating this consortium.

Many states, including Minnesota, have already begun working on problems of mutual interest. A multi-states consortium would benefit all states involved by reducing duplication of efforts and pooling resources for mutual benefit.

Direct Subordinated Loans

In certain instances, it may be appropriate for the Authority to provide a limited amount of direct, low or non-interest bearing subordinated loans to a company or individual to facilitate their ability to secure adequate credit from commercial sources for the construction of an agri-processing facility. Granting of such a direct subordinated loan should not preclude a direct guarantee of other loans incurred for construction of the facility. The amount of such loans should be subject to established guidelines and the loan should be made for a limited time not to exceed _____ years.

Direct Equity Investment

Direct equity investment should be permitted in amounts not to exceed $_____, which shall constitute not less than 20% nor more than 50% of the equity of the investee. Such equity investments should contain a 'put' option. This option would permit the Authority to require the other equity investors of the corporation to re-purchase such shares after _____ years. Direct equity investment should preclude direct subordinated loans but not loan guarantees.

Success of the investee corporation accrues to the equity holders and the Authority will benefit directly from any risk taken on successful ventures.

Negotiation With Local Government Units

Certain tax incentives may be necessary to induce a potential employer to locate an agri-processing facility in certain locations. We believe that the Executive Director of the Authority should be authorized to negotiate with local units of government for a grant of property and other local tax abatement and tax increment financing when considered to that government unit's advantage. Such authority should include the negotiation with the Tax Authority for issuance of tax exempt bolds for purposes of financing the facility.

ORGANIZATION

Initially, the consortium should include North Dakota, South Dakota, Iowa, Nebraska, Kansas, Missouri, Wisconsin, Illinois, Indiana, and Minnesota.

These states have been chosen for several reasons:

*All have a substantial agricultural base.

*The consortium may help downplay a perceived rivalry within the region.

*Industry is more likely to participate with the larger population centers some states may offer.

*We foresee an increasing need for transportation links to the east that are provided through Chicago and other eastern cities included within these states; and through Kansas City to the south and west.

Direct involvement of each governor is absolutely necessary, at least in the early stages, to make the consortium productive. The governors can give the activities of the consortium needed visibility and importance. After the consortium is adequately established, each governor may choose whether to personally continue or to designate a representative on his or her behalf.

It is not our intent to create a new agency in each state to deal with the consortium. Rather, we anticipate that each department of agriculture will take a lead responsibility with the support of the economic development agency. This policy should not discourage the participation of other state agencies. It is important, however, that each state give the consortium equal high priority.

industry and trade groups should be invited to participate after the consortium has been established.

The consortium should become a quasi-governmental agency, with the needed support and visibility lent by government and the flexibility afforded by the private sector. From time to time, the consortium may find it advantageous not to be limited by federal State Department and other guidelines.

LOCATION AND FUNDING

We ask that Governor Perpich call an organizational meeting of the consortium within a reasonable time frame after receiving this report. Because Minnesota is a recognized policy leader, the governor is requested to offer to house a consortium office in Minnesota and appoint an initial staff person to act as coordinator until more permanent arrangements may be made.

We strongly believe a central office and limited professional staff is needed to coordinate efforts (to help focus and eliminate duplication) of all participating states.

The consortium should be in close communication with the Midwest-Northwest Congressional Caucus, but should not require approval from the caucus for consortium activities.

Funding may be obtained from several sources:

*We suggest that participating states consider pooling at least a portion of funding already allocated within their own budgets for the areas of research and promotion indentified by the group.

*Industry and trade groups may wish to contribute funds for specific activities beneficial to all concerned. Special projects may be taken on with the approval of a majority of states, with funds donated for that purpose.

The consortium office staff must have the final responsibility for carrying out or delegating activities. Industry and each state may contribute to the staff and total resources, both in financing and through in-kind contributions.

Perhaps one of the major contributions industry could make would be the loan of experts to work on specific projects, train constorium members, or carry out research.

MARKETING ACTIVITIES

A fundamental activity of the consortium should be the marketing of the region's agricultural products, both internationally and within the U.S. This requires a total regional effort: financial, type of commodity, and other considerations must be decided by what is best for the entire region. This marketing effort should include but not be limited to developing a marketing team to represent the Upper Midwest. Team members must be chosen for their

altruistic interest in promoting the region's products, not for their interest in benefiting a particular state.

SUGGESTED TOPICS FOR ACTION

The following pages list several questions that may be of interest to the consortium members. They are offered as topics for discussion and possible action:

International Marketing

A. What technical and/or legal obstacles confront multi-state grain agreements with foreign countries?

B. What areas need to be researched first in order to target products from this region for marketing in specific countries? Have the needs of each country been properly considered?

C. How may the experience of each state, interested companies, and trade groups be utilized in this effort?

D. How can the consortium work to insist on being consulted when embargoes and other export restrictions are being considered by the U.S. State Department? Would such an effort be of benefit to the Secretary of Agriculture?

E. How can the consotrium work for quality assurance of grain and other products exported to foreign countries?

F. How can the consortium best tailor Midwest products to the needs of the international market?

Agricultural Finance

A. Recognizing that some Upper Midwest states have state sponsored financing available for qualified young farmers, while others do not, is it reasonable to assume that the experience of such programs might greatly improve the chances to have similar legislation approved in other states?

Rail Transportation

A. Rail transportation routes to the West Coast seem to extend farther east each year. Is this trend likely to continue to eventually include Minnesota access to the West Coast? If so, what impact will this shift have on the Port of Duluth as a major grain shipment terminal?

B. During the late 1970s, preliminary plans were considered to develop a high speed rail line from Minnesota to Kansas City to improve year-round grain shipment. Is this option still a viable plan and one that the consortium should continue to explore?

C. What additional action can the consortium take to retain some rail lines that are currently being considered for abandonment?

D. Should the consortium develop a public policy to retain railroad beds (slow abandonment) until alternate, workable transportation is available to our rural communities?

E. Is there a need for a multi-state group to work with rail companies so that rail lines crossing state boundaries are improved to be of equal quality?

Waterway Transportation

A. What could the consortium do to get additional federal funds to extend the shipping season on the Great Lakes and the upper Mississippi River?

B. Is there adequate reason to expand the current U.S. - Canadian agreements concerning grain shipment on the Great Lakes? Could the consortium promote "Great Lakes" delivery systems to result in extra grain shipments on the Lakes?

C. Have Upper Midwestern states done enough to oppose increased user fees and/or inequitable fees on the Mississippi River and Great Lakes? Should we be more vocal in opposing user fees on the grounds that the shipment of Upper Midwestern grain is a matter of national security and therefore the nation should share in the upkeep of this system?

Alcohol Production and Regional Processing

A. Since farm exports are considered important to our national balance of trade ratio, and farmers and farm groups continue to seek the highest possible price of those exports, what steps could the consortium take to promote "value added" farm products?

B. Is alcohol fuels development a matter to be pursued on a regional basis?

Education/Research

A. Are our state governments sharing enough information on agricultural research?

B. With declining post high school enrollments, is it time to encourage each state to start targeting some of their research efforts to specific areas, so that the total Upper Midwestern region would cover all topics, but not duplicate efforts?

C. How can the consortium encourage research on the following topics of interest to the entire region:

*value added processing.

*market development -- both within the U.S. and internationally.

*marketing targeted to the area within the consortium boundaries.

D. How can we make better use of the teaching specializations of institutions within the region?

SUMMARY

Preservation of the family farming system is one of the primary concerns of this group. The entire rural community will benefit from the work of this consortium. Family farms and the rural community should be a major consideration in activities of the consortium, whether they be location of processing plants, promotion of regional products, etc. Rural small businesses are vital to family farmers and to the region as a whole.

In addition to the business side of the rural community, the human side must be considered. The impact of any consortium activity on education of rural children, road development, and many other "quality of life" considerations must be taken into account.

Overall, we request that the consortium identify a need in each area of interest it enters; that proper research into the subject be undertaken before action is started; and that all activities be considered for the good of the region. It is the unified approach that will make the consortium a stable, workable contribution to the Upper Midwest.

Respectfully submitted by the Subcommittee on Agriculture on the Upper Midwest States Consortium; Committee on Agriprocessing; Governor's Advisory Commission.

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III.

ETHANOL AND RURAL ENERGY PARKS

TASK FORCE REPORT

ETHANOL AND RURAL ENERGY PARKS
TASK FORCE ("SUBCOMMITTEE") REPORT

Opportunities for Minnesota
Ethanol Production for Fuel and Industrial Use

Submitted:
March 4, 1983

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I. EXECUTIVE SUMMARY

Production of ethanol and its byproduct high protein feed provides the most immediate and significant agri-processing opportunity for Minnesota. The Subcommittee recommends an aggressive and practical State program to capture these opportunities for Minnesota.

The production of ethanol from grain can be viewed from two important perspectives. First, ethanol production is a significant new addition to agri-processing. Minnesota needs new agri-processing facilities to process its agricultural crops into products of higher value to improve Minnesota's interstate balance of payments. Agri-processing no longer includes only foods, feeds and oils. Now a wide variety of chemicals can now be produced from agricultural crops for fuel and industrial uses. This creates an important new market for Minnesota agricultural products. Second, ethanol production is a major part of the emerging biomass energy technologies. Development of biomass energy is the State's most significant opportunity to decrease Minnesota's absolute dependence on imported energy. Minnesota has a serious need for both agri-processing plants and methods of energy production from State resources. Ethanol's ability to address both these critical needs makes this industry very important to Minnesota's future.

Minnesota needs an active economic development program which encourages the processing of the State's agricultural resources into products of higher value prior to export. This program must encourage the development of Minnesota's energy resources within the State. Development of the ethanol industry would strengthen Minnesota agriculture and benefit the State's high technology, manufacturing and construction industries. Most important, processing in Minnesota will improve our overall interstate balance of payments and return jobs and incomes to the State.

The petroleum shortages in the late 1970's created a great demand for Gasohol which used ethanol as a fuel extender for gasoline. The millions of miles driven on Gasohol proved in actual use in just a few years the value of ethanol not only as a fuel extender, but as a gasoline octane enhancer. Today, ethanol has been proven and approved as a widely applicable, cost effective, and environmentally safe octane enhancer.

Two recent U.S. Environmental Protection Agency (EPA) actions dramatically increase the opportunities of ethanol enhanced fuels. First, the new EPA lead phasedown regulations will require refiners to reduce total lead usage by over 34 percent on an industry-wide basis. In 1984 and 1985 alone, the required lead reduction of 7.1 and 11.9 billion grams is the octane equivalent of 1.42 and 2.38 billion gallons of ethanol, respectively (Herman & Associates). Second, the EPA has recently denied approval for use of methanol as an octane enhancer without co-solvents (the primary available co-solvent being ethanol). This leaves ethanol as one of the major proven environmentally safe

octane enhancers available in sufficient quantity to replace lead enhancers. Of course, ethanol's fuel extending capabilities may once again prove extremely valuable should petroleum shortages reappear as the world-wide recession abates.

Over 100 ethanol plants have been built in the past 4 years, primarily in the Midwestern U.S., totaling nearly $1 billion of new plant construction (Information Resources, Inc.). Considering the depths of the recession over this period, this is a truly remarkable capital expansion. Also, considering the generally unfavorable position taken by the Federal Office of Management and Budget, this growth is extraordinary. Ethanol blended fuel sales are up over 160% in the past year despite declines in gasoline prices (Federal Highway Administration statistics). In addition to the broad based support from the agricultural community, major agri-business and energy companies are currently capturing the opportunities presented by this rapid growth industry in other states.

According to a report prepared by Resource Planning Associates, Inc., for the U.S. Department of Energy (DOE), the production of 50 million gallons of alcohol per year can result in an annual increase in Minnesota's economic activity of $241 million, and a net increase of $27.3 million in direct local and state tax receipts. According to another study by Employment Research Associates, also prepared for the DOE, construction of processing plants to produce 50 million gallons of alcohol per year would result in roughly 1,330 construction jobs, 1,750 related industrial jobs, 325 jobs in the services sector, and 590 high quality full-time permanent operating and maintenance jobs - for a total of nearly 4,000 full-time positions.

These are dramatic economic impacts when the effect on a rural community is considered. This income will be spread throughout the community, from the local service station, the truckers, the family farm, local merchants, etc. Also, since many of the jobs are high quality technical and craft positions, these opportunities have considerable potential to stop the out-migration of youth from the rural community.

One of the most striking elements of this industry is that virtually none of this growth is taking place in Minnesota. Technically and economically this is difficult to explain. Many of the most active firms in the ethanol industry are headquartered or have major offices in the State. Many of the industry pioneers are from the State. Minnesota is a major grain producer. The State has abundant water, land, raw materials, infrastructure and transportation systems. Iowa, South and North Dakota are all the sites of major development. By all accounts, Minnesota should be a center of this industrial expansion. It appears that a major impediment to this industry's growth in Minnesota has been the lack of State sponsored incentives. The record would indicate that this lack of incentives has been a formidable barrier to the growth of this industry in Minnesota. The main focus of this Report is to lay the groundwork for an aggressive, yet practical, program to recruit this rapidly growing industry to Minnesota. In other words, it's time Minnesota got a "piece of the action".

As of January, 1983, 32 states have some form of excise tax exemption for ethanol/gasoline blends ranging from 1¢ per gallon in Connecticut to 10¢ per gallon in New Mexico. As of August, 1980, nine states provided some type of sales tax forgiveness on sales of ethanol/gasloine blends. Also, nine states provide property tax deductions or exemptions. Four states provide income tax credits. Minnesota provides none of these benefits. The lack of these incentives has put Minnesota at a severe competitive disadvantage and has stunted the growth of this industry in Minnesota.

In addition, plants considering Minnesota locations face higher capital costs due to sales tax on process equipment and higher taxes on construction labor, higher business taxes, inflexible environmental regulation, shortages of capital, and a lack of coordinated state agency review and support. For example, a total of 33 different permits with 21 different state and federal agencies are required of an ethanol project in Minnesota. Anything less than the most cooperative and supportive agencies results in extreme difficulty in completing the permitting process. Certain State agencies have clearly demonstrated a less than enthusiastic support for ethanol plant development in Minnesota.

The Subcommittee recommends that the Minnesota Legislature pass legislation to support the following four needs of the ethanol industry:

- 1) provide excise tax exemption for ethanol/gasoline blends,
- 2) establish a loan guarantee program for plants built in the State,
- 3) establish a permit expediting authority (or Ombudsman) to support firms planning new facilities in the State, and
- 4) provide sales tax forgiveness for major process equipment installed in the ethanol plant.

The excise tax exemption should provide a 4¢ per gallon exemption for gasoline/ethanol blend patterned after the federal law. This exemption should be phased into effect with a 2¢ exemption starting as soon as possible and an additional 2¢ starting two years later. The phasing of the exemption will minimize the impact of imported ethanol in the State and allow Minnesota's own industry the incentive and the time to catch up with other states. The loan guarantee program should establish a $20 million reserve fund that can be leveraged through investor equity and private debt to develop $130 million in ethanol projects. The permit expediting authority will not relax environmental regulations, but will accelerate the review process and reduce many of the bureaucratic barriers facing developers. A limited sales tax exemption should be granted on main process equipment permanently installed in the plant. This is similar to the real estate exemption.

Implementation of the Subcommittee's recommendations will allow the State to capture the substantial opportunities presented by this new rapid growth industry.

II. INTRODUCTION

A. PREFACE

In January, 1983 Minnesota Governor Perpich appointed a special commission on agricultural processing to make recommendations for a State program to support the development of agri-processing plants in Minnesota. The Commission, Chaired by Ralph Hofstad of the Land O' Lakes Cooperative, established a subcommittee to investigate processing Minnesota agricultural crops into ethyl alcohol (ethanol) for fuel and industrial use. The Subcommittee was also to assess the feasibility of rural energy parks. The Ethanol and Rural Energy Parks Subcommittee is chaired by Burton M. Joseph, President of I.S. Joseph Company. The Subcommittee is comprised of senior members of Minnesota's farm cooperatives and agri-processors, the Governor's office, and Minnesota based research, engineering and construction firms (see Appendix D for brief background of Subcommittee members).

The focus of this Subcommittee Report is ethanol production from grain. The Subcommittee did not consider Rural Energy Park development in this Report due to the urgent need for information regarding pending ethanol legislation. Consideration of Rural Energy Park development will be the subject of future Subcommittee study.

B. OBJECTIVES OF SUBCOMMITTEE AND REPORT

The objectives of the Subcommittee were determined to be threefold. First, to examine the opportunities in Minnesota for ethanol production from agriculture. Second, to provide basic information about the ethanol industry to the agricultural, political and business leaders of the State. Third, make specific recommendations for legislative and administrative action by the State to capture these opportunities for Minnesota.

The Subcommittee Report which follows identifies the opportunities for Minnesota, provides an economic and financial analysis of ethanol production, analyzes the need for a State participation in development of this industry, and makes specific recommendations for a Minnesota program. The appendices contain responses to the most frequently asked questions regarding the ethanol industry, a description of a typical ethanol plant and the Report Bibliography.

C. SUBCOMMITTEE FINDINGS

As the following quote demonstrates, the need for development of an ethanol industry was apparent nearly 50 years ago:

> "We must alter our internal economy by processing surplus farm crops into alcohol to be mixed with gasoline in the proportion of 10 percent...We will be able to establish a balanced agriculture, a balanced industry and preserve for ourselves the greatest market in all the world, namely, the market in our own land for our own people. It is a kind of diversification through which we can preserve an internal prosperity and rid ourselves of a dangerous dependence on the other nations." (Representative Everett Dirksen (R-Ill), January 28, 1935, Congressional Record, Vol. 79, part 1, p.1099.)

IT IS THE UNANIMOUS CONCENSUS OF THE SUBCOMMITTEE THAT PRODUCTION OF ETHANOL AND ITS BYPRODUCT HIGH PROTEIN FEED PROVIDES THE MOST IMMEDIATE AND SIGNIFICANT AGRI-PROCESSING OPPORTUNITY FOR MINNESOTA. IT IS THE OVERALL OBJECTIVE OF THE SUBCOMMITTEE TO INITIATE AN AGGRESSIVE, YET PRACTICAL, STATE PROGRAM TO CAPTURE THESE OPPORTUNITIES FOR MINNESOTA.

The production of ethanol from grain can be viewed from two important perspectives. First, ethanol production is a significant new addition to agri-processing. Minnesota needs new agri-processing facilities to process its agricultural crops into products of higher value to improve Minnesota's interstate balance of payments. Agri-processing no longer includes only foods, feeds and oils. Now a wide variety of chemicals can now be produced from agricultural crops for fuel and industrial uses. This creates an important new market for Minnesota agricultural products. Second, ethanol production is a major part of the emerging biomass energy technologies. Development of biomass energy is the State's most significant opportunity to decrease Minnesota's absolute dependence on imported energy. Minnesota has a serious need for both agri-processing plants and methods of energy production from State resources. Ethanol's ability to address both these critical needs makes this industry very important to Minnesota's future.

MINNESOTA IS A STATE POOR IN FOSSIL FUELS. AS A RESULT, THE STATE IS HEAVILY DEPENDENT ON ENERGY PRODUCED BY OTHER STATES AND COUNTRIES. OUR LOCATION AT THE END OF THE ENERGY PIPELINE IS EXPECTED TO RESULT IN A DRAIN OF MORE THAN $460 BILLION FROM THE MIDWESTERN ECONOMY OVER THE NEXT FIVE YEARS AS A RESULT OF ENERGY IMPORTS. (MIDWEST GOVERNOR'S CONFERENCE-1982) THE MINNESOTA ENERGY AGENCY HAS ESTIMATED THAT THIS EXPORT OF FUNDS COULD COST APPROXIMATELY 95,000 FULL-TIME JOB EQUIVALENTS IN THE STATE OF MINNESOTA ALONE (MIDWEST GOVERNOR'S CONFERENCE-1982).

Minnesotans have already begun to feel the costs of high fuel bills, plant relocations, deferred plant expansions, and industries not opening new businesses in Minnesota. Businesses are directing their plant expansions to the energy-rich southern and western states. This exodus to energy-rich states has been elevated to crisis proportions by the perception of a difficult business climate in Minnesota.

AT THE SAME TIME THAT MINNESOTA IS LOSING INCOME, JOBS AND INDUSTRIAL GROWTH TO OTHER STATES, THE STATE IS ALSO NEGLECTING ITS OWN GREAT ENERGY POTENTIAL IN PRODUCING ENERGY FROM BIOMASS. Minnesota is rich in many forms of biomass, such as agricultural crops, agricultural and forest residues, and peat. It is important to understand that many products that can be produced from petroleum can be produced from biomass. It is simply the relationship of the cost of raw materials to the cost of processing the raw materials into products that determines which technology dominates the production of a particular product. This relationship has already turned in favor of production of ethanol, n-butanol, isopropyl, and acetone from biomass rather than the conventional method using petroleum and natural gas. There are many other chemicals and fuels which may also have great potential to be produced from biomass. Converting Minnesota's biomass resources with existing or developing technologies will give the State the capacity to produce a significant portion of its own energy needs while developing additional products for export. It only requires the application of new technology and capital to produce many additional products from biomass.

Unless the State develops a strong agri-processing program, Minnesota will continue to act as an underdeveloped country by shipping out raw materials to be processed into products of higher value elsewhere. As a result, the economic, social and political advantages of the prosperity generated from this value-added processing will be increasingly lost by Minnesota and its citizens.

The State contains the headquarters for many corporations capable of sponsoring major ethanol and other agri-processing facilities. However, these companies have located processing facilities elsewhere in recent years. A careful examination of two of Minnesota's three resource based industries, agriculture and mining, shows that major companies in these industries have become largely transportation companies. Most of Minnesota's major grain and mining companies are primarily dedicated to move the raw materials out of the state with as little processing as possible.

There is a general feeling that Minnesota's problems are temporary and simply a subset of the Nation's economic problems. Clearly, the worldwide recession has hit Minnesota. However, the loss of raw material processing industries represents a fundamental structural shift in the State economy. One clear example is how poorly the State has weathered this recession relative to previous national recessions. Analysis shows that with each successive economic cycle, Minnesota's ability to resist economic downturn has declined.

MINNESOTA NEEDS AN ECONOMIC DEVELOPMENT POLICY WHICH ENCOURAGES THE PROCESSING OF MINNESOTA RESOURCES TO PRODUCTS OF HIGHER VALUE PRIOR TO EXPORT. THIS MUST ALSO BE A POLICY WHICH ENCOURAGES THE DEVELOPMENT OF MINNESOTA'S ENERGY RESOURCES WITHIN THE STATE. SUCH A POLICY WILL HELP RETURN MINNESOTA'S ECONOMY TO A POSITION OF STRENGTH AND PROSPERITY. Development of an ethanol industry could substantially strengthen agriculture, which is an historic mainstay of the Minnesota economy. Development of the ethanol industry in Minnesota will also benefit the State's high technology and construction industries, and strengthen our overall inter-state balance of payments. Minnesota's response to the opportunities presented by the ethanol industry is a test case of the State's resolve to reverse this trend toward economic obscurity.

D. OPPORTUNITIES FOR MINNESOTA

The petroleum shortages in the late 1970's created a great demand for Gasohol which used ethanol as a fuel extender for gasoline. The millions of miles driven on Gasohol proved in actual use in just a few years the value of ethanol not only as a fuel extender, but as a gasoline octane enhancer. The Gasohol movement, largely supported by American agriculture, saved perhaps 10 or more years of necessary testing and permitting to have ethanol established as a main line octane enhancer. Today, ethanol has been proven and approved as a widely applicable, cost effective, and environmentally safe octane enhancer.

THE CRITICAL NEED TO REDUCE LEAD AS AN OCTANE ENHANCER IN GASOLINE HAS CREATED A SUBSTANTIAL OPPORTUNITY FOR ETHANOL USE AS AN OCTANE ENHANCER. Ethanol's gasoline octane enhancing market is distinctly different from the Gasohol's gasoline extender market. Ethanol as an octane enhancer is valuable even in times of petroleum surplus.

TWO RECENT U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) ACTIONS DRAMATICALLY INCREASE THE OPPORTUNITIES OF ETHANOL ENCHANCED FUELS. FIRST, THE NEW EPA LEAD PHASEDOWN REGULATIONS WILL REQUIRE REFINERS TO REDUCE TOTAL LEAD USAGE BY OVER 34 PERCENT ON AN INDUSTRY-WIDE BASIS. In 1984 and 1985 alone, the required lead reduction of 7.1 and 11.9 billion grams is the octane equivalent of 1.42 and 2.38 billion gallons of ethanol, respectively (Herman & Associates). Second, the EPA has recently denied approval for use of methanol as an octane enhancer without cosolvents (the primary available cosolvent being ethanol). THIS LEAVES ETHANOL AS ONE OF THE MAJOR PROVEN ENVIRONMENTALLY SAFE OCTANE ENHANCER AVAILABLE IN SUFFICIENT QUANTITY TO REPLACE LEAD ENHANCERS. Of course, ethanol's fuel extending capabilities may once again prove extremely valuable should petroleum shortages reappear as the world wide recession abates.

OVER 100 ETHANOL PLANTS HAVE BEEN BUILT IN THE PAST 4 YEARS, PRIMARILY IN THE MIDWESTERN U.S., TOTALING NEARLY $1 BILLION OF NEW PLANT CONSTRUCTION (Information Resources, Inc.). Considering the depths of the recession over this period, this is a truly remarkable capital expansion. Also, considering the generally unfavorable position taken by the Federal Office of Management and Budget, this growth is extraordinary. ETHANOL BLENDED FUEL SALES ARE UP OVER 160% IN THE PAST YEAR DESPITE DECLINES IN GASOLINE PRICES (Federal Highway Administration statistics). In addition to the broad based support from the agricultural community, major agri-business and energy companies are currently capturing the opportunities presented by this rapid growth industry in other states.

According to a report prepared by Resource Planning Associates, Inc., for the U.S. Department of Energy (DOE), THE PRODUCTION OF 50 MILLION GALLONS OF ALCOHOL PER YEAR CAN RESULT IN AN ANNUAL INCREASE IN MINNESOTA'S ECONOMIC ACTIVITY OF $241 MILLION, AND A NET INCREASE OF $27.3 MILLION IN DIRECT LOCAL AND STATE TAX RECEIPTS. According to another study by Employment Research Associates, also prepared for the DOE, CONSTRUCTION OF PROCESSING PLANTS TO PRODUCE 50 MILLION GALLONS OF ALCOHOL PER YEAR WOULD RESULT IN ROUGHLY 1,330 CONSTRUCTION JOBS, 1,750 RELATED INDUSTRIAL JOBS, 325 JOBS IN THE SERVICES SECTOR, AND 590 HIGH QUALITY FULL-TIME PERMANENT OPERATION AND MAINTENANCE JOBS - FOR A TOTAL OF NEARLY 4,000 FULL-TIME POSITIONS.

These are dramatic economic impacts when the effect on a rural community is considered. This income will be spread throughout the community, from the local service station, the truckers, the family farm, local merchants, etc. Also, since many of the jobs are high quality technical and craft positions, these opportunities have considerable potential to stop the out-migration of youth from the rural community.

Until three years ago, the industry was dominated by small "grass roots" local developers who were generally under-capitalized and highly-leveraged. A major impediment to an even more rapid expansion of the industry has been this grass roots nature of many of the developers. If these developers could generate the hundreds of projects formed in these early years, the results are expected to be impressive with stronger corporate entities entering the industry. In the last three years, several agri-processing and energy firms have ventured into ethanol production. Table II-1 contains a list of major corporations that are already investors in the fuel and industrial ethanol industry.

TABLE II-1

MAJOR CORPORATE PARTICIPANTS
IN THE ETHANOL INDUSTRY

Firm	Involvement
Texaco Oil Company	Co-owner of 50 million gallon per year (mmgpy) plant in Pekin, Illinois.
Ashland Oil Company	Co-owner of 60 mmgpy plant in South Point, Ohio. Announced plans for another 60 mmgpy plant in a location to be announced (Minnesota is being considered).
Publicker Industries	Co-owner of 60 mmgpy plant in South Point, Ohio.
Ohio Farm Bureau	Co-owner of 60 mmgpy plant in South Point, Ohio.
Chevron Oil Company	Co-owner of a 50 mmgpy plant under construction in Kentucky.
Corn Products Company (CPC International)	Co-owner of 50 mmgpy plant operating in Pekin, Illinois.
Archer Daniels Midland	Owns and operates 220 mmgpy of plant capacity in Illinois and Iowa.
A.E. Staley	Owner of 50 mmgpy plant recently completed in Loudon, Tennessee.
E.F. Hutton	Raised over $30 million and invested $15 million of own funds for co-ownership in the 50 mmgpy plant in South Bend, Indiana.
Midwest Solvents	Operates plants in Atchison, Kansas and Pekin, Illinois producing 20 mmgpy.
Kentucky Farm Bureau	Co-owner of Chevron Oil Plant at Franklin, Kentucky.

All of the plants listed in Table II-1 relied on State and Federal supports including energy tax credits, loan guarantees, excise tax exemptions and project development support from local authorities. These projects are now commercially successful businesses providing jobs, income and taxes for the community. Other major corporations such as Cargill, Peavey, U.S. Industrial Chemicals, and Union Carbide are known to be considering building similar plants in states other than Minnesota.

The following quote from a February 17, 1983 Minneapolis Star & Tribune article on Ashland Oil's consideration of a plant in Minnesota exhibits the importance of a Minnesota support program; "Ashland Oil, Inc. is considering building a $140 million ethanol plant in Washington County...The Ashland facility would create a new market for 24 million bushels of corn a year and would generate 500 construction jobs and 200 permanent jobs. In its first year alone, the state would harvest $7 million in state sales taxes...A key component of the discussions has been the possibility of state-backed loan guarantees."

All of the ethanol plants owned by major companies are successfully operating and profitable. Even a majority of the smaller poorly constructed, under-capitalized projects continue to operate. It is estimated that over 50 major projects (each exceeding $20 million in capital cost) are currently in the final planning stages (USDA, DOE and miscellaneous industry sources). ETHANOL PRODUCTION IS EXPECTED TO INCREASE TEN FOLD FROM THE CURRENT 225 MILLION GALLONS TO 2 BILLION GALLONS OVER THE NEXT FOUR YEARS. Actual production figures are always considerably less than plant capacity figures since the ethanol production capacity of corn wet milling plants is idle during much of the year while the corn starch is converted into other products such as fructose sugar. Anyone would be hard pressed to name another industry that has shown such growth over the past four years.

However, one of the most striking elements of this industry is that virtually none of this growth is taking place in Minnesota. Technically and economically this is difficult to explain. Many of the most active firms in the ethanol industry are headquartered or have major offices in the State. Many of the industry pioneers are from the State. Minnesota is a major grain producer. The State has abundant water, land, raw materials, infrastructure and transportation systems. Iowa, South and North Dakota are all the sites of major development. By all accounts, Minnesota should be a center of this industrial expansion. IT APPEARS THAT A MAJOR IMPEDIMENT TO THIS INDUSTRY'S GROWTH IN MINNESOTA HAS BEEN THE LACK OF STATE SPONSORED INCENTIVES. THE RECORD WOULD INDICATE THAT THIS LACK OF INCENTIVES HAS BEEN A FORMIDABLE BARRIER TO THE GROWTH OF THIS INDUSTRY IN MINNESOTA.

The ethanol industry has proven itself technically and financially in the short-run and is rapidly proving itself in the long-run. There is little any governmental program can do in the long run to distort the fundamental economics of an industry. In the case of ethanol production, the fundamental economics are being proven every day.

However, a governmental program can impact the timing and location of new commercial development. MINNESOTA CAN DEVELOP A PROGRAM TO ACCELERATE THE GROWTH OF THIS INDUSTRY AND INSURE ITS LOCATION IN MINNESOTA. THE MAIN FOCUS OF THIS REPORT IS TO LAY THE GROUNDWORK FOR AN AGGRESSIVE, YET PRACTICAL, PROGRAM TO RECRUIT THIS RAPIDLY GROWING INDUSTRY TO MINNESOTA. IN OTHER WORDS, IT'S TIME MINNESOTA GOT A "PIECE OF THE ACTION".

E. ETHANOL IN PERSPECTIVE

It is important to realize that ethanol is not a "flash-in-the-pan" remnant of the energy crisis. Ethanol production is the first step in a greatly expanded agri-processing and biomass energy program for Minnesota.

It is widely recognized that industrialized and developing economies desperately require fuels, chemicals and protein feeds. These chemicals and fuels are often referred to as petrochemicals. Petrochemicals are used in chemical products such as plastics, printing inks, paints, solvents, etc., and as liquid fuels, such as gasoline and diesel fuel. Protein feeds come in the form of animal, grain or processed proteins. Protein feeds can be used for feeding livestock, such as cattle, hogs, and poultry, and as human consumable protein supplements and substitutes.

The long term price instability and uncertain availability of petroleum and natural gas, coupled with growing world hunger, has created a substantial opportunity to capitalize on the microbiological conversion of carboyhdrates (in the form of renewable biomass) into fuels, chemicals and protein feeds. The production of ethanol from carbohydrate crops, such as corn, is one form of biomass energy. There are over 20 major industrial chemicals which can be produced by the microbiological conversion of carbohydrates (see Figure II-1 and Table II-2).

FIGURE II-1

CHEMICALS FROM CORN

This advertisement appearing in chemical industry magazines represents a major effort to market carbohydrates as a substitute feedstock for petroleum. The advertisement summarizes the chemical industry's emerging view of opportunities facing bioindustrial chemical technologies. (Reprinted by permission of Trout and Ries Advertising.)

TABLE II-2

CHEMICALS FROM FERMENTATION PROCESSES

CHEMICAL	CHEMICAL
Ethanol	Methanol
N-Butanol	Gluconic acid
2.3-Butylene glycol	2-Keto-gluconic acid
Glycerol	Itaconic acid
Acetic acid	Tartaric acid
Acetone	Pyruvic acid
Isopropanol	d-Keto-glutaric acid
Fumaric acid	L-Isocitric acid
Succinic acid	L-Alloisoacetic acid
Citric acid	5-Keto-gluconic acid
Lactic acid	D-Araboascorbic acid
Propionic acid	Koji acid
Malic acid	D-Xylonic acid

Carbohydrates can be found in all forms of plant material, such as grains and other crops, agricultural residues, food processing wastes, forest residues, etc. After processing, carbohydrates can be substituted for petroleum as a feedstock (raw material) in the production of many fuels and chemicals. Also, the byproducts of carbohydrate processing are high protein feed products. These high protein feeds provide as much, or more, food value as the original feedstock when combined with animal feed rations. As a result, the ability of carbohydrate conversion technologies to replace many petroleum conversion technologies presents an unprecedented opportunity to meet the most pressing energy and nutritional needs of the future. (See Figure II-2 and II-3)

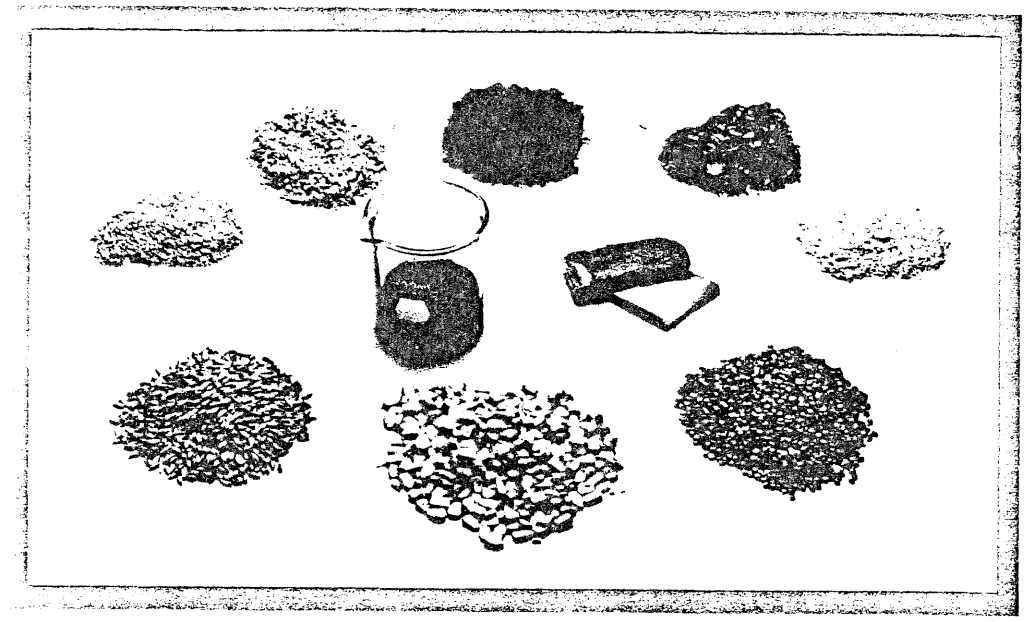


FIGURE II-2 - Several sources of carbohydrates (Clockwise from the top) - peat, sunflower hulls, rice hulls, grain sorghum (milo), corn, barley, flour mill waste, sawdust; Center) - molasses and wood chips.

FIGURE II-3 - Several uses of bioindustrial products. Shown are ethanol uses such as printing ink, vinegar, hairspray, industrial solvents, photographic supplies, gasoline octane enhancers, toiletries and other general chemical uses. Also shown are corn oil, yeast, protein feed, CO_2 and fructose (used in soft drinks) which are a few of the many valuable co-products of bioindustrial process technologies.

In addition, greatly expanded technical opportunities will result from genetic engineering developments in the microbiological conversion process. These biotechnology developments are rapidly creating new enzymes and micro-organisms capable of inexpensively converting carbohydrates to a variety of fuels, chemicals and protein products. The biotechnology industry already has a good start here in Minnesota. The University of Minnesota is very active in biotechnology and several new biotechnology firms are located in the State.

Biomass conversion technologies are already making steady inroads into the world energy stream. Biomass boilers are commonplace in the forest products industry. In just four years, use of liquid fuels from biomass has grown to represent over 2% of our Nation's fuel supply. Further, biomass derived ethanol is virtually eliminating petroleum derived ethanol in the industrial chemical market. Currently, biomass conversion technologies are estimated to produce as much useful energy as nuclear power. (DOE Report to Congress, 1982)

The uncertain supply of petroleum signals the beginning of an age of capital investment in new energy conversion processes. There has never been a energy shortage, or a shortage of raw materials for energy production in this Country. There is a shortage of processing plants required to produce liquid fuels and chemicals from the abundant sources of hydrocarbons available in the form of renewable biomass.

The choice facing the Minnesota and the U.S. is to anticipate the capital formation needs and to structure a smooth transition from absolute petroleum dependence. The various governmental bodies of the U.S., including the State of Minnesota, can act to insure that this alternative energy conversion capital formation takes place in a timely and orderly fashion.

In conclusion, the establishment of an ethanol production industry in Minnesota is the first step in developing a biomass energy program and an expanded agri-processing industry. THE POTENTIAL FOR IMPROVING THE STATE'S BALANCE OF PAYMENTS, MINIMIZING THE STATE'S DEPENDENCE ON IMPORTED ENERGY, AND CREATING A WIDE DIVERSITY OF PROCESSING INDUSTRIES IN THE STATE PROVIDES STRONG IMPETUS FOR AN ACTIVE STATE INCENTIVE PROGRAM. THIS WILL BE ACCOMPLISHED WHILE CONTINUING TO EXPORT PROTEIN FEEDS AND REVITALIZING THE FARM ECONOMY. OTHER BENEFITS INCLUDE USE OF AVAILABLE TECHNOLOGY, PROVEN COMMERCIAL VIABILITY, MINIMUM ADVERSE ENVIRONMENTAL CONSEQUENCES, AND THE USE OF RENEWABLE RESOURCES. CLEARLY, THERE IS MUCH MORE TO ETHANOL PRODUCTION THAN ENVISIONED BY THE GASOHOL MOVEMENT.

III. ETHANOL MARKETING & PRODUCTION ECONOMICS

A. MARKETING OF ETHANOL AND BYPRODUCTS

In order for an ethanol production venture to be successful, a thorough analysis of the potential markets for all products produced at the plant is required.

THE DEMAND FOR ETHANOL ON A NATIONWIDE BASIS HAS INCREASED MORE THAN 160% OVER THE LAST 12 MONTHS DUE TO AN INCREASE IN THE DEMAND FOR PREMIUM OR OCTANE ENHANCED UNLEADED FUELS WHICH USE ETHANOL, AND DUE TO AN INCREASE IN THE FEDERAL EXCISE TAX EXEMPTION ON AGRICULTURALLY DERIVED ETHANOL (FROM $.04/GAL. TO $.05/GAL.). ETHANOL INCREASES THE OCTANE RATING OF UNLEADED FUEL FROM 88 TO 91, THUS PERMITTING IT TO BE MARKETED AS "UNLEADED PREMIUM" OR "SUPER UNLEADED". THERE WILL ALSO BE FURTHER INCREASES IN DEMAND RESULTING FROM RECENT EPA LEAD PHASEDOWN REGULATIONS.

The most recent EPA lead phasedown regulations would require 20 billion gallons of ethanol over the next 8 years based on octane equivalent of the displaced lead. Other octane enhancers, such as benzene, xylene and toluene will make up much of the octane deficit created by lead phasedown. However, it is estimated that a new market for at least 1.5 billion gallons of ethanol per year has been created by EPA lead phasedown regulations (Texaco and Herman & Associates)

THE FEDERAL AND STATE PRICE SUPPORTS IN THE FORM OF GAS TAX EXEMPTIONS PROVIDE A PRICE ADVANTAGE FOR ETHANOL OVER COMPETING OCTANE ENHANCERS IN THE PRODUCTION OF HIGH OCTANE UNLEADED GASOLINE. Figure III-1 indicates how demand for ethanol/gasoline blended fuels has increased in the past two years.

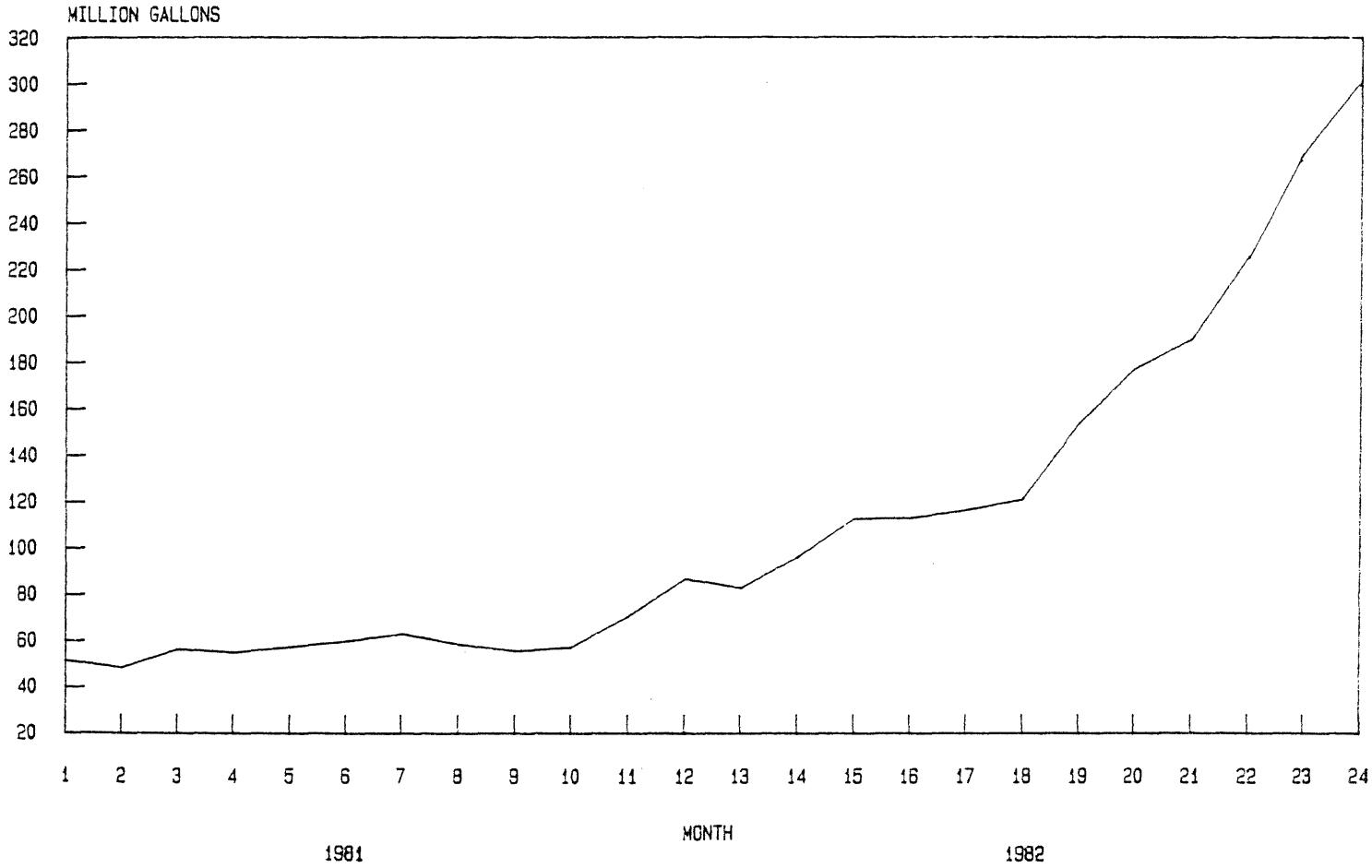
Nationwide ethanol production capacity is approximately 225 million gallons per year, with an estimated 557 million gallons of capacity currently under construction. Minnesota currently has less than 2.0 million gallons/year of fuel grade ethanol production capacity with no additional plants under construction, although some 54 million gallons/per year of capacity is in the planning stage awaiting financing.

MINNESOTA IS ONE OF THE FEW MAJOR AGRICULTURAL STATES WHICH DOES NOT CURRENTLY PROVIDE ANY GASOLINE TAX EXEMPTIONS FOR FUEL GRADE ETHANOL. The State previously had a 4¢/gallon exemption which was struck down by the Supreme Court in 1982, since it restricted the exemption to Minnesota produced ethanol. Since most gasoline/ethanol blends are marketed on a 9 to 1 ratio of regular unleaded to ethanol, every 1¢/gal. tax exemption for gasoline/ethanol blends (state or federal) provides a 10¢/gal. price support for ethanol. With the average wholesale market price of ethanol at $1.70/gal. and the average wholesale price of regular unleaded gasoline at $.90 there currently exists an 80¢ per gallon price differential between ethanol and unleaded gasoline. Since ethanol is only 10% of gasoline/ethanol blends, an 80¢ ethanol gasoline price differential results in only an 8¢ price differential between gasoline/ethanol blends and competing premium unleaded without ethanol.

A combined state and federal tax exemption for gasoline/ethanol blends will make them competitive with premium unleaded without ethanol in the short-term while unleaded gasoline is less costly than ethanol. Industry experts believe that this differential will disappear as gasoline prices rise in the end of the decade and technical advances and adequate grain supplies keep ethanol prices constant or declining. This is the reason most excise tax exemptions for gasoline/ethanol blends are scheduled to be eliminated in the late 1980's or early 1990's. By providing these price supports, the government is effectively anticipating these gasoline price increases and enabling an alternative source of liquid fuels to be in place and fully operational.

A State excise tax exemption is recommended to stimulate the market for ethanol in Minnesota. With a 5¢ excise tax exemption provided by the federal government, a 4¢ State excise tax exemption will provide the necessary market incentive for ethanol blends in Minnesota. The total of 9¢ state and federal excise tax exemption will eliminate the 8¢ differential, plus provide an additional 1¢ to stimulate and accelerate industry growth in Minnesota.

FIGURE III-1
ETHANOL/GASOLINE BLEND SALES
1981 & 1982



Gasoline consumption in Minnesota averages about 2 billion gallons annually (State Energy Information Center). Table III-1 indicates the potential market penetration of ethanol/regular unleaded blends which could be purchased by blenders and refiners for octane enhancement and the ethanol production required to meet this market. This growth in market share is consistent with ethanol market penetration in states such as Iowa, which already support ethanol use. It should be noted that demand for ethanol will be further stimulated by an increased phasedown of leaded fuel use being mandated by the EPA.

TABLE III-1

MINNESOTA ETHANOL MARKET SHARE AND PRODUCTION REQUIREMENTS

Year	Potential Market Shares: % of All Gasoline/ Ethanol Blends Pre Lead Removal	Potential Market Shares: % of Gasoline/ Ethanol Blends Post Lead Removal	Ethanol Required (Production in million gallons)
1984	10%	15%	20 to 30
1985	20%	25%	40 to 50
1986	30%	35%	60 to 70
1987	35%	40%	70 to 80
1988	40%	45%	80 to 90

The other major byproduct of the dry milling process is distillers dried grain and solubles (DDGS). This material is considered a medium grade protein feed (28% to 30% protein - soymeal is 44% protein) for all forms of livestock, but is primarily fed to ruminant animals due to its relatively high fiber content. It compares favorably with soybean meal on a nutritional basis and thus can currently be sold for about $150/ton. Regional, national and export markets exist for DDGS. Export markets have been particularly favorable in pricing. With the Mississippi River and Great Lakes transportation systems available to Minnesota, overseas trade for DDGS ranks high.

A third potential byproduct of the fermentation process is carbon dioxide (CO_2), which can be marketed as an industrial chemical, beverage ingredient, refrigerant, and may have potential as a growth stimulant for certain types of greenhouse plants. Raw CO_2 sells for approximately $6-10/ton with processed CO_2 selling for $45-$100/ton. However, a medium size ethanol plant generally cannot justify installation of CO_2 processing facilities. CO_2 recovery and marketing from medium size ethanol plants is very location sensitive, and thus CO_2 should be considered a marginal byproduct.

OVERALL, THE MARKET POTENTIAL FOR ETHANOL APPEARS TO BE STRONG, GIVEN APPROPRIATE TEMPORARY TAX EXEMPTIONS. THESE INCENTIVES ARE NEEDED TO BOTH ESTABLISH A MARKET FOR FUEL ETHANOL, AND TO PROVIDE NECESSARY INCENTIVES FOR POTENTIAL INVESTORS IN ETHANOL PRODUCTION FACILITIES. THE FEDERAL EXEMPTION ON AGRICULTURALLY DERIVED ETHANOL HAS BEEN EXTENDED TO 1992 AND MANY STATE INCENTIVES ARE CONCURRENT WITH THE FEDERAL PROGRAM (SEE SECTION IV). WHEN THE TAX INCENTIVES EXPIRE, THE MARKET FOR ETHANOL WILL THEN DEPEND ON THE GASOLINE AND RAW MATERIAL PRICES WHICH EXIST AT THAT TIME. IN THE INTERIM, THE POTENTIAL EXISTS FOR IMPROVING THE EFFICIENCY OF THE ETHANOL PROCESS AND THE DEVELOPMENT OF CHEAPER FEEDSTOCKS, PRIMARILY CELLULOSE, WHICH COULD ENABLE ETHANOL TO REMAIN COMPETITIVE WITH PETROLEUM BASED FUELS WITHOUT THE TAX INCENTIVES.

B. PRODUCTION ECONOMICS

The current primary feedstock for the production of ethanol is corn. The production of ethanol from corn is generally achieved via either wet milling or dry milling of the grain to separate the fermentable material from other byproducts. Wet milling plants tend to be large fully integrated plants capable of producing a wide variety of products based upon the market potential of each. Such plants tend to be capital intensive and highly site sensitive relative to raw materials and markets. In general, the economies of scale of wet milling plants dictate a minimum annual production capacity of 20 million gallons of ethanol per year in order to be competitive.

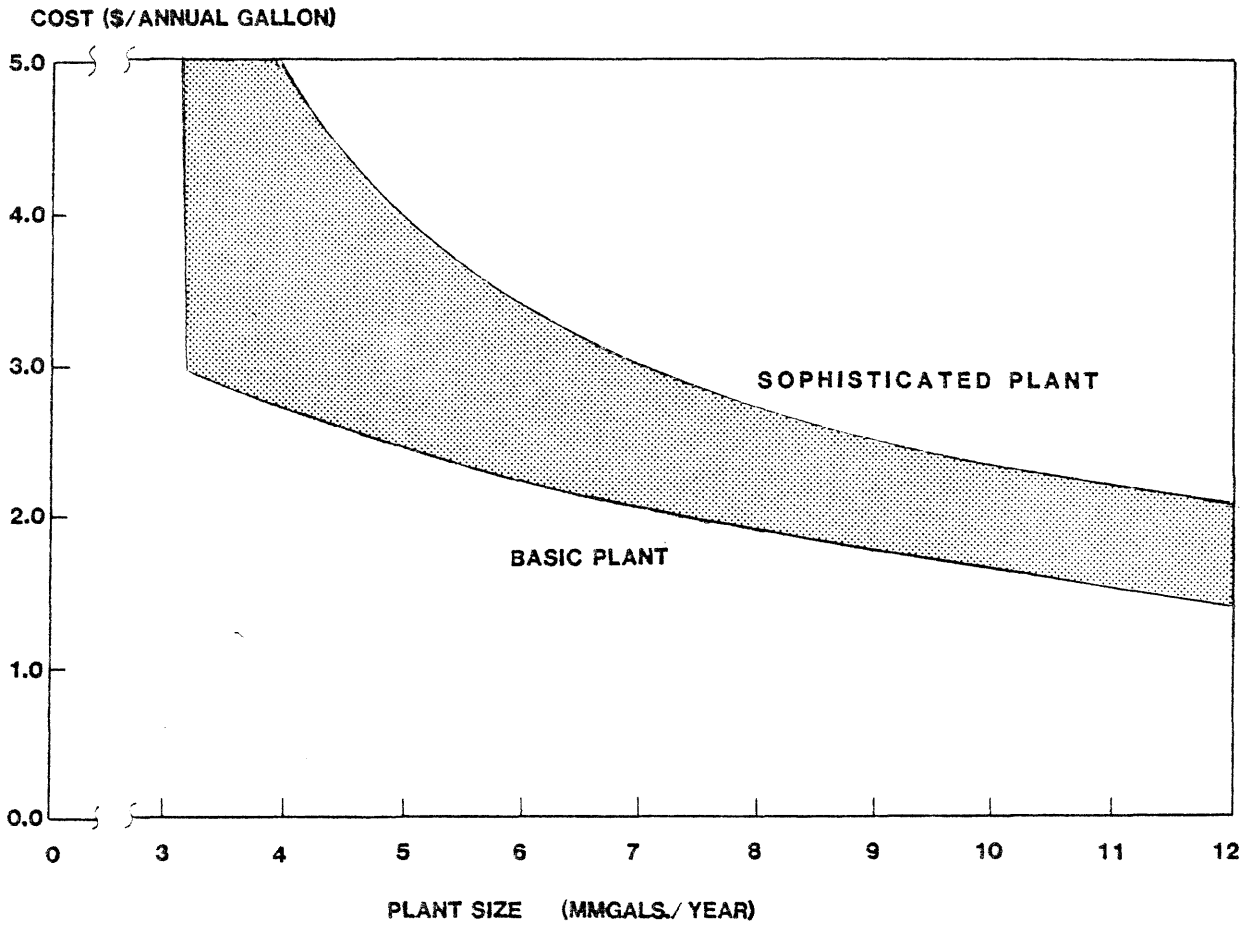
Dry corn milling ethanol plants tend to be smaller and less complex than wet milling plants, and are not as sensitive to location. Besides ethanol, the primary byproducts of dry milling are distillers dried grains and solubles (DDGS) and carbon dioxide. These plants generally range in production capacity from 4 to 20 million gallons per year.

Dry milling plants are considered a more likely candidate for development in Minnesota due to their greater versatility as to location, feedstock flexibility, and potential access to local cash grain markets and other lower cost feedstocks. Dry corn milling ethanol plants can vary greatly in capital cost according to plant capacity and sophistication. Figure III-2 indicates the range of estimated capital cost per annual gallon of production capacity as a function of plant size and complexity. In general, the complexity of a plant will depend on: 1) how the byproducts are to be recovered and marketed; 2) whether or not there are existing infrastructures such as grain handling and storage facilities; 3) what type of primary fuel is to be used in the plant; 4) materials of construction; and 5) type of controls used to operate the plant.

The lower line in Figure III-2 would be the average cost for a basic ethanol plant with carbon steel surfaces, a gas/oil boiler, no solubles recovery or drying equipment, and simple controls. The upper line indicates the average cost of a sophisticated ethanol plant with stainless steel surfaces, a coal boiler, DDGS drying, and solubles recovery system. In most cases the sophisticated plants show greater profitability in plant sizes above 5 million gallons due to lower operating costs and higher byproduct revenues.

FIGURE III-2

PLANT COST VS. SIZE



Tables III-2 through III-5 provide cost estimates for "typical" 5 and 10 million gallon per year ethanol plants. The capital cost estimates were based on equipment and facilities necessary to construct an operating ethanol plant capable of producing anhydrous ethanol and associated byproducts. The construction cost estimates include both the direct and indirect costs associated with project construction. Contractors fees, field offices, mobilization, etc., are the indirect costs incurred during construction. Capital costs for the 5 million gallon per year plant are itemized in Table III-2 and are summarized in Table III-3. Capital costs for the 10 million gallon plant are itemized in Table III-4 and are summarized in Table III-5.

TABLE III-2

EQUIPMENT INSTALLATION COST SUMMARY
5 MM GALLON PER YEAR FUEL GRADE ETHANOL FACILITY
(Labor & Materials)

DESCRIPTION (EXAMPLE ONLY)	COST
Equipment	
Section 01 - Grain Storage & Handling	$ 353,400
Section 02 - Cooking Process	100,300
Section 03 - Hydrolysis	153,800
Section 04 - Fermentation	1,065,000
Section 05 & 06 - Binary Distillation and Dehydration	1,195,700
Section 07 - Liquid Solid Separation	392,000
Section 08 - Evaporation	542,000
Section 09 - Drying/Pelletizing	406,100
Section 10 - Denaturant/Ethanol Storage	132,000
Section 11 - DDGS Storage & Handling	127,000
Section 12 - Miscellaneous	393,000
Section 13 - Energy System	1,010,000
Total Equipment (Inc. Freight)	$ 5,870,300
Equipment Erection	$ 790,000
Major Foundations & Footings	$ 710,000
Instrumentation (Includes Instrument Air Package)	$ 920,000
Piping	$ 1,025,000
Electrical	$ 725,000
Other Installation Costs	
Fire Protection	$ 170,000
Painting	$ 17,000
TOTAL DIRECT INSTALLATION COSTS	$ 10,227,300

Source: Standard cost estimating procedures, vendor and contractor quotations (January, 1983), Butler Research and Engineering Company.

Note: Plant costs vary widely according to plant location, trade-offs in design, capital cost and plant operating costs, quality of materials, etc. This table is only an example to provide an "order of magnitude" estimate of project cost.

TABLE III-3

PROJECT COST SUMMARY
5 MM GALLON PER YEAR FUEL GRADE ETHANOL FACILITY

ITEM (EXAMPLE ONLY)	COST
Direct Costs	
Site Development (Incl. Wastewater Treatment)	$ 640,000
Buildings	675,000
Installed Equipment (from previous page)	10,227,300
Sales Taxes (6% on 80% of site, buildings and equipment)	554,030
Total Direct Costs	$ 12,096,330
Indirect Costs	
Construction Plant	$ 200,100
Bonds & Insurance	105,000
Contractor's Fee	360,000
Total Indirect Costs	$ 665,100
Engineering, Construction Management, Start-up, etc.	$ 1,500,000
Process Warranty Insurance	$ 195,000
Land	$ 75,000
ESTIMATED TOTAL PROJECT COST (April, 1983)*	$ 14,531,430

*Does Not Include Construction Interest or Working Capital.

Source: Standard cost estimating procedures, vendor and contractor quotations (January, 1983), Butler Research and Engineering Company.

Note: Plant costs vary widely according to plant location, trade-offs in design, capital cost and plant operating costs, quality of materials, etc. This table is only an example to provide an "order of magnitude" estimate of project cost.

TABLE III-4

EQUIPMENT INSTALLATION COST SUMMARY
10 MM GALLON PER YEAR FUEL GRADE ETHANOL FACILITY
(Labor & Materials)

DESCRIPTION (EXAMPLE ONLY)	COST
Equipment	
Section 01 - Grain Storage & Handling	$ 659,645
Section 02 - Cooking Process	144,840
Section 03 - Hydrolysis	214,590
Section 04 - Fermentation	1,614,370
Section 05 & 06 - Binary Distillation and Dehydration	1,788,450
Section 07 - Liquid Solid Separation	763,970
Section 08 - Evaporation	807,995
Section 09 - Drying/Pelletizing	799,760
Section 10 - Denaturant/Ethanol Storage	224,000
Section 11 - DDGS Storage & Handling	190,700
Section 12 - Miscellaneous	587,900
Section 13 - Energy System	1,660,000
Total Equipment (Inc. Freight)	$ 9,456,220
Equipment Erection	$ 1,200,000
Major Foundations & Footings	$ 1,070,500
Instrumentation (Includes Instrument Air Package)	$ 1,315,000
Piping	$ 1,554,000
Electrical	$ 1,080,000
Other Installation Costs	
Fire Protection	$ 260,000
Painting	$ 25,000
TOTAL DIRECT INSTALLATION COSTS	$ 15,960,720

Source: Standard cost estimating procedures, vendor and contractor quotations (January, 1983), Butler Research and Engineering Company.

Note: Plant costs vary widely according to plant location, trade-offs in design, capital cost and plant operating costs, quality of materials, etc. This table is only an example to provide an "order of magnitude" estimate of project cost.

TABLE III-5

PROJECT COST SUMMARY
10 MM GALLON PER YEAR FUEL GRADE ETHANOL FACILITY

ITEM	COST
Direct Costs	
Site Development (Incl. Wastewater Treatment)	$ 990,000
Buildings	1,022,500
Installed Equipment (from previous page)	15,960,720
Sales Tax (6% on 80% of site, buildings, and equipment)	862,715
Total Direct Costs	$ 18,835,935
Indirect Costs	
Construction Plant	$ 316,650
Bonds & Insurance	183,500
Contractor's Fee	710,169
Total Indirect Costs	$ 1,210,319
Engineering, Construction Management, Start-up, etc.	$ 2,400,000
Process Warranty Insurance	$ 293,125
Land	$ 100,000
ESTIMATED TOTAL PROJECT COST (April, 1983)*	$ 22,839,379

*Does Not Include Construction Interest or Working Capital.

Source: Standard cost estimating procedures, vendor and contractor quotations (January, 1983), Butler Research and Engineering Company.

Note: Plant costs vary widely according to plant location, trade-offs in design, capital cost and plant operating costs, quality of materials, etc. This table is only an example to provide an "order of magnitude" estimate of project cost.

B. PROJECT FINANCING AND RETURNS

Table III-6 is a typical income statement and financial return calculation for two dry milling ethanol plants, of 5 and 10 million gallon per year capacity. Both plants include drying and solubles recovery equipment and coal fired boilers. Note that while both plants show comparable operating margins, the 10 million gallon/year plant is more profitable due to lower fixed costs per unit of production.

Both of the plants shown on Table III-6 assume a corn price of $2.35/bushel and an ethanol selling price of $1.70/gallon. DDGS price is assumed to be $150/ton for both plants. Both plants assume 20% equity financing with a 13% interest rate on the debt portion. The capital cost estimates include equipment, building, engineering, site development, land and interim interest costs. Capital costs utilized in the income and expense analysis were obtained from Tables III-3 and III-5. Working capital includes cash, receivables, inventory, raw materials, working progress and start-up costs.

It is important to look at financial projections in light of their sensitivity to changes in the base case assumptions. One of the chief concerns of potential investors in ethanol facilities is the sensitivity of returns to such variables as plant capital cost, raw material prices, and byproduct selling prices.

As Figure III-3 indicates, approximately 45-50% of the ultimate sale price of the ethanol is taken up by raw material costs (corn and chemicals). Thus, return on investment is most sensitive to corn prices. One reason dry milling may have an advantage over other processes is that the smaller size of dry milling plants should enable access to local cash grain markets, thus lower cost raw materials which are not as subject to commodity price fluctuations as larger regional plants. Dry milling plants also have the advantage of being easily convertible to other feedstocks (i.e. other grains or cellulose) which may be more economical in the future.

Return on total investment is also sensitive to plant capital cost and byproduct selling price. Clearly, both of these factors must be studied and weighed heavily before the decision to proceed with a plant is made.

TABLE III-6

INCOME & EXPENSE STATEMENT
FOR TYPICAL DRY MILLING ETHANOL PLANTS

ITEM	5 MM gal/yr. Plant	% of total Revenue	10 MM gal/yr. Plant	% of total Revenue
	(000's)		(000's)	
Revenue				
Alcohol	$ 8,500	74.1%	$17,000	74.1%
DDGS	2,828	24.6%	5,655	24.6%
Carbon dioxide	150	1.3%	300	1.3%
TOTAL REVENUE	$11,478	100.0%	$22,955	100.0%
Cost of Goods Sold				
Corn & chemicals	$ 5,344	46.6%	$10,688	46.6%
Direct labor	340	3.0%	596	2.6%
Utilities	1,300	11.3%	2,500	10.9%
Admin. & burden	530	4.6%	985	4.3%
TOTAL COST OF GOODS	$ 7,514	65.5%	$14,769	64.0%
NET OPERATING MARGIN	$ 3,964	34.5%	$ 8,186	36.0%
Fixed Expenses				
Interest	$ 850		$ 1,354	
Depreciation	1,468		2,226	
TOTAL FIXED EXPENSES	$ 2,318	20.0%	$ 3,580	15.5%
NET PRETAX INCOME	$ 1,646	14.3%	$ 4,606	20.1%
CAPITAL COST				
Plant & equipment	$14,531		$22,839	
Working capital, Construction interest, Escrow accounts, Financing fees	1,200		2,200	
TOTAL INVESTMENT	$15,731		$25,039	
RETURN ON TOTAL INVESTMENT				
Before taxes	10.5%		18.3%	

IV. STATE OF MINNESOTA PARTICIPATION

In comparing the fifty states' initiatives on alcohol fuel as of January 1983, 32 states have some type of net state tax exemptions for ethanol/gasoline blends. The percentages of exemptions vary from state to state (see Table IV-1). Minnesota has legislation pending which will allow a 2¢ per gallon exemption as of July 1, 1983 and a 4¢ per gallon exemption as of July 1, 1985. This legislation is expected to be effective until 1992.

As of August 1980, nine states provided some type of sales tax forgiveness for ethanol/gasoline sales. The percentages varied from state to state. Minnesota currently has no such laws.

Nine states provide a state property tax deduction or exemption for ethanol plants. One state, Kentucky, allows a local property tax deduction. Minnesota currently provides no property tax deduction.

Four states provide income tax credits. Three states have income tax deductions and one state has an income tax reduction. North Carolina allows a 20% corporate and personal income tax credit. Minnesota Statutes 1978, Section 273.11, Subdivision 6, provided for a 20% income tax deduction on the first $10,000 spent by a producer of renewable energy (including ethanol, methane and methanol) for on-farm use only. However, this exemption expired December 31, 1982.

The following provides a comparison of states which are similar to Minnesota in crops, climate, geography and proximity.

Colorado

- 5¢ per gallon excise tax exemption, expires July 1, 1985.
- 98% property tax reduction which is temporary and has a decreasing scale rate.
- Alcohol must be produced in Colorado.

Illinois

- 3¢ per gallon decreasing excise tax exemption which will expire in 1986.

Indiana

- 5¢ per gallon excise tax exemption.
- Has an income tax deduction.

Iowa

- Has a decreasing excise tax exemption which will expire in 1987.

Kansas

- o Has a decreasing excise tax exemption which will expire in 1985.
- o The alcohol must be produced from grain products grown in Kansas.
- o Production of alcohol must utilize 10 less energy units than would be contained in the converted motor vehicle fuel.

Kentucky

- o Has a decreasing excise tax exemption which will expire in 1987.
- o 99% state property tax reduction.
- o 99% local property tax reduction.
- o Alcohol plants must burn coal produced in Kentucky or convert to such use within 2 years of certificate receipt to qualify for the exemptions.

Nebraska

- o 5¢ per gallon excise tax exemption.
- o Alcohol must be produced in Nebraska.
- o Beginning in 1982, the 5¢ excise tax exemption applies only to alcohol produced in a plant under construction or in operation by July 1, 1980.

North Dakota

- o 4¢ per gallon excise tax exemption.
- o 3% sales tax exemption which only applies when the gasohol is used for agricultural or industrial purposes.

Ohio

- o 3.5¢ per gallon excise tax exemption.

Oklahoma

- o 6.5¢ per gallon excise tax exemption which expires on October 1, 1984.

Oregon

- o 100% income tax exemption.
- o 50% investment tax credit, which has a decreasing scale rate and expires on January 1, 1985.
- o 100% property tax reduction, which applies only to commercial plants and expires on October 3, 1985.

South Dakota

- o 4¢ per gallon excise tax exemption which expires in June, 1983.
- o 4% sales tax exemption which expires on June 30, 1985; legislation pending to extend exemption.
- o 100% property tax credit which has a decreasing scale rate and has differing rates for small-scale and large-scale plants.
- o 100% property tax credit which expires on July 1, 1986.

Wisconsin

- o No excise tax exemption; bill currently pending.
- o Allows alcohol fuel production systems to qualify for individual and corporate income tax credits.
- o All State cars must run on fuel containing at least 10% ethanol.

There are four very common trends in state legislation:

1) Tax rates in most cases are decreasing with expiration dates in the mid to late 1980's.
2) Many states require that the alcohol be produced from products grown in that state.
3) Many states have alcohol promotion councils that promote the use of alcohol in the state or have a reciprocity clause with other states.
4) Most states have a program of testing alcohol fuels in state owned and operated vehicles.

TABLE IV-1

NET STATE TAX EXEMPTIONS FOR ETHANOL/GASOLINE BLENDS
IN THE UNITED STATES

(January 1983)
Expressed in cents per gallon

STATE	1982	83	84	85	86	87	88	89	90	91	92
Alabama	3	3	3	3	3	3	3	3	3	3	3
Alaska	8	8	8	8	8	8	8	8	8	8	8
Arizona	-	-	-	-	-	-	-	-	-	-	-
Arkansas*	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5/0	-
California	4	3	2	1	-	-	-	-	-	-	-
Colorado*+	5	5	5	5	-	-	-	-	-	-	-
Connecticut	1	1	1	1	1	1	1	1	1	1	1
Delaware	-	-	-	-	-	-	-	-	-	-	-
Florida	5	5/4	4	4/2	2	2/0	-	-	-	-	-
Georgia+	-	-	-	-	-	-	-	-	-	-	-
Hawaii*	4	4	4	4*	4*	4*	4*	4*	4*	4*	4*/0
Idaho*	4	4	4	4	4/0	-	-	-	-	-	-
Illinois+	3%	3/2%	2%	2/0	-	-	-	-	-	-	-
Indiana	4%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Iowa+	5	5/3	3/2	2/1	1/0	-	-	-	-	-	-
Kansas*+	2	2/1	1/0	-	-	-	-	-	-	-	-
Kentucky*	3.5	3.5	3.5	3.5	3.5/0	-	-	-	-	-	-
Louisiana*+	8	8	8	8	8	8	8	8/0	-	-	-

TABLE IV-1 (continued)

NET STATE TAX EXEMPTIONS FOR ETHANOL/GASOLINE BLENDS
IN THE UNITED STATES

(January 1983)
Expressed in cents per gallon

STATE	1982	83	84	85	86	87	88	89	90	91	92
Maine+	-	-	-	-	-	-	-	-	-	-	-
Maryland+	-	-	-	-	-	-	-	-	-	-	-
Massachusetts+	-	-	-	-	-	-	-	-	-	-	-
Michigan+*	5	5/4	4	2	1	-	-	-	-	-	-
Minnesota+	-	-	-	-	-	-	-	-	-	-	-
Mississippi+	-	-	-	-	-	-	-	-	-	-	-
Missouri+	-	-	-	-	-	-	-	-	-	-	-
Montana+	7	7	7	7/5	5	5/3	3	3	-	-	-
Nebraska+	5	5	5	5	5	5	5	5	5	5	5
Nevada	1	1	1	1	1	1	1	1	1	1	1
New Hampshire*+	5	5/0	-	-	-	-	-	-	-	-	
New Jersey	-	-	-	-	-	-	-	-	-	-	-
New Mexico*	10	10	10	10	10	10/0	-	-	-	-	-
New York+	-	-	-	-	-	-	-	-	-	-	-
North Carolina	2	2/1	1/0	-	-	-	-	-	-	-	-
North Dakota	4	4	4	4	4	4	4	4	4	4	4
Ohio	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Oklahoma+	6.5	6.5	6.5/0		-	-	-	-	-	-	-
Oregon	-	-	-	-	-	-	-	-	-	-	-
Pennsylvania+	-	-	-	-	-	-	-	-	-	-	-
Rhode Island	-	-	-	-	-	-	-	-	-	-	-

TABLE IV-1 (continued)

NET STATE TAX EXEMPTIONS FOR ETHANOL/GASOLINE BLENDS
IN THE UNITED STATES

(January 1983)
Expressed in cents per gallon

STATE	1982	83	84	85	86	87	88	89	90	91	92
South Carolina+	7	-	-	-	-	-	-	-	-	-	-
South Dakota+	4	4/0	-	-	-	-	-	-	-	-	-
Tennessee*	-	4	4	4	4	4	4	-	-	-	-
Texas*	5	5	5	5	5/4	4/3	3/2	2/1	1	-	-
Utah*	5	5	5	5/0	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-	-	-	-
Virginia*+	8	8	8/6	6	6/4	4	4/2	2	2/0	0	0
Washington, DC	-	-	-	-	-	-	-	-	-	-	-
Washington State+	1.5	1.5	1.5	1.5	1.5	-	-	-	-	-	-
West Virginia	-	-	-	-	-	-	-	-	-	-	-
Wisconsin+	-	-	-	-	-	-	-	-	-	-	-
Wyoming	4	4	4/0	-	-	-	-	-	-	-	-

*Qualifications apply
+New Legislation Expected in 1983

Source: Information Resources Incorporated

B. DIFFICULTIES OF DEVELOPMENT IN MINNESOTA

There are many institutional barriers and disincentives to establishing new industries in Minnesota. Obviously, Minnesota's state government cannot support all of the key ingredients required for a successful business; good management judgement, aggressive marketing of products, inexpensive processing procedures, protection from changes in the market place and consumer preferences, etc. However, the Subcommittee has identified certain legislative and administrative difficulties to establishing ethanol and other agri-processing facilities within the State. The Subcommittee believes that overcoming these project development difficulties is as important as providing incentives.

The Subcommittee did not attempt to address issues of unemployment, income and excise taxes, or workman's compensation costs since it is expected that these issues will be addressed in other forums.

Lack of Ethanol Product Market Development Incentives

The federal government, to encourage the development of alternative energy production facilities, has established a marketing tax incentive for wholesalers/retailers who market ethanol blended fuels. Further, as noted in this Report, nearly every major agricultural state, except Minnesota, has an additional tax exemption. Minnesota has a population of four million people, uses approximately two billion gallons of gasoline a year, has a refinery production capacity of 1.2 billion gallons per year, yet sold only a very small amount of ethanol/gasoline blends in 1982. On the other hand, Iowa, which has a population of 2.9 million, and has no refinery production, sold 407 million gallons of ethanol blended fuel between January and October, 1982. THIS REPRESENTS APPROXIMATELY 30 PERCENT OF THE TOTAL MOTOR FUEL CONSUMED IN THE STATE OF IOWA. THE ABILITY OF THE ADDITIONAL STATE EXCISE TAX EXEMPTION TO STIMULATE ETHANOL MARKETING IS CLEARLY EVIDENT BY THIS COMPARISON.

Higher Capital Cost

Construction of a 5 to 10 million gallon per year fermentation ethanol plant typically involves a capital investment of between $2.00 and $3.00 per annual gallon of production. This amounts to a range of $10 million to $30 million per project. Minnesota is one of a small group of states which charges full sales tax on all major process equipment in a commercial facility. Coupled with higher employment taxes and sales tax on materials, construction costs are higher in Minnesota. THEREFORE, A PLANT BUILT IN MINNESOTA CAN EASILY COST 10% MORE THAN IN THE DAKOTAS OR IOWA. ON A $30 MILLION PROJECT, $3 MILLION IN ADDITIONAL COST DOES NOT GO UNNOTICED BY THE DEVELOPER.

Inflexible Environmental Regulation

STATE ENVIRONMENTAL REGULATIONS NOT ONLY EXCEED THE FEDERAL STANDARDS IN MOST CASES, BUT ALSO ARE REQUIRED TO BE MET PRIOR TO START OF PLANT CONSTRUCTION. THIS CAUSES ADDITIONAL COST, AND DELAYS PROJECT DEVELOPMENT. The Subcommittee is not asking for an across-the-board relaxation of environmental regulations for ethanol projects. The Subcommittee feels the State would be better served by regulations that are administered expeditiously and with some flexibility. MOST STATES HAVE AN EFFECTIVE INDUSTRIAL DEVELOPMENT AUTHORITY WHICH WORKS WITH THE ENVIRONMENTAL REGULATORY AUTHORITY TO BALANCE STATE ECONOMIC AND ENVIRONMENTAL GOALS.

Lack of Capital Availability

THERE IS A REAL LACK OF CAPITAL AVAILABILITY FOR PROJECT CONSTRUCTION IN MINNESOTA. FEWER THAN A DOZEN BANKS IN MINNESOTA HAVE LEGAL LENDING LIMITS ALLOWING THEM TO MAKE MORTGAGE LOANS LARGE ENOUGH TO QUALIFY FOR EVEN THE MANDATORY 5% PORTION OF A $20 MILLION FARMERS HOME ADMINISTRATION LOAN GUARANTEE. Furthermore, in the past, most State operated pension funds and insurance funds have invested in large facilities and companies outside of Minnesota, reducing available capital for home grown businesses. Finally, construction loans for facilities costing $10 to $30 million can be organized by smaller banks, although only a few banks within the State have legal lending limits high enough to make these loans. Thus, the State needs to examine what it can do to encourage capital to remain invested in Minnesota and attract capital from outside the State to construct these facilities.

Lack of Coordinated State Agency Permit Processes

MINNESOTA'S ADMINISTRATIVE SERVICES DO NOT COMPARE FAVORABLY WITH THOSE OF OTHER STATES. Since ethanol is a new industry with little environmental impact history, the discretionary authority of these agencies can either be very supportive or very discouraging. MOST STATES ARE WILLING TO WEIGH A LARGE VOLUME OF EVIDENCE, STUDY, AND HISTORY OF SIMILAR FACILITIES AND REACT TO A "MOST-LIKELY-TO-OCCUR" SCENERIO. MINNESOTA'S POSITION HAS BEEN ONE OF TAKING THE "WORST-POSSIBLE-OF-ALL-CASES" APPROACH. While permitting officials from other states encourage ethanol project development by offering various types of assistance, including temporary construction permits, Minnesota agency personel have been found to be less helpful. This causes three main difficulties; 1) uncertainty as to whether the permit will be approved (and final conditions of the approval); 2) delays in responses for approval, which increase project costs; and 3) confusion, caused by a lack of coordination among the regulators who often require plants to meet specifications which are contradictory to manufacturers' recommendations or rules from other agencies.

As is the case with other industrial development and agri-processing projects, a number of permits are typically required prior to construction of an ethanol plant. These permits generally include air quality, water quality, building and water appropriations permits, zoning and land use approvals. A total of 33 different permits with 21 different state and federal agencies are required for ethanol plants in Minnesota. Anything less than the most cooperative and supportive agencies results in extreme difficulty in completing the permitting process. A case study follows:

Case Study

In order to demonstrate the impacts of existing State agency barriers to the development of agricultural processing facilities in Minnesota, a case study has been prepared to describe the experience of a Minnesota developer. Agri-Energy, Inc., a Minnesota corporation, is planning an ethanol plant in Crookston, Minnesota, and wishes to build other plants in the Red River Valley area. The engineering and development work on the Minnesota plant coincided with a similar ethanol project in Kansas. A comparison of the level of cooperation provided to these projects by the two states, as experienced by the Minnesota based project engineer, is provided below:

Well Water Permit

Kansas: Orderly procedure of application, administrative review, and permit award.

Total time required - 1 month.

Minnesota: Cumbersome and costly process of application.

Numerous meetings with agency personnel.

Requirements of aquifer testing, reports, additional information, etc.

Total time required for 150 gpm well permit on under-utilized aquifer - 6 months.

Total cost of testing, reports, etc. - $5,000.

Wastewater Permit

Kansas: Orderly process of application, design, administrative review, revision, public notice and permit award.

General cooperation from agency.

Total time required - 3 months.

Minnesota: Agency ignored sophisticated lab analysis conducted to substantiate design of wastewater facility.

Required overdesign of wastewater facilities based on State sewage sludge standards.

Cost developer extra $20,000 for lab analysis and $90,000 for overdesign.

Permit still pending after 1 year.

Air Quality Permit

Kansas: Orderly permit application, review and permit process.

Total time required--2 months.

Minnesota: Refused to accept boiler manufacturer's air quality performance guarantees.

Total time required - 6 months.

General State Support

Kansas: Governor Carlin, Senator Dole and more than 30 local and State officials at groundbreaking ceremony.

Helpful advice and support such as contacting federal agencies for clearances, temporary review waivers, and federal loan guarantee support.

Minnesota: No representatives from Energy Division of DEPD or former Governor's office at groundbreaking ceremony (although several local Minnesota legislators and more than 5 North Dakota state officials were present).

Minnesota DEPD - Energy Division official (untrained in investment counseling) advised potential investors that ethanol industry is "not a good investment."

No tax credits, higher workmen's compensation rates, no sales tax exemption.

After the experience with the first plant in Minnesota, the developer selected four new sites for subsequent plants, three of which were in North Dakota.

The Energy Division of the Minnesota Department of Energy, Planning and Development (DEPD) required that another Minnesota developer (not Agri-Energy) undergo a "Certificate of Need" hearing process for its proposed ethanol plant, as is required of large electrical generation facilities. Certificates of Need are not known to be required for ethanol plants in any other state. This process cost the developer over $20,000.

These are just a few examples of events that have occured between certain Minnesota agencies and ethanol project developers which have made the industry feel less than welcome in Minnesota.

V. RECOMMENDATIONS

It is clear to the Subcommittee that the State must focus its initiatives in two areas to capture the ethanol opportunities in particular, and the agri-processing opportunities in general. First, the State must develop a general multi-program approach to encourage industry retention, expansion and recruitment in Minnesota. Second, Minnesota must develop a specific incentive program for the ethanol industry to match the programs offered by surrounding states.

A. GENERAL INDUSTRIAL DEVELOPMENT SUPPORT

AGRI-PROCESSING IS PARTICULARLY HARD HIT BY THE LACK OF COMPREHENSIVE STATE INDUSTRIAL SUPPORT LEGISLATION. In Minnesota, industrial development is largely left to the major Metropolitan areas. In fact, Minneapolis, St. Paul, Duluth, Mankato, and Rochester have exceptionally good industrial recruitment programs. However, these urban sponsored programs do little for industrial development in the rural area. Industrial development in rural areas primarily means agri-processing. THEREFORE, THE LACK OF A STATEWIDE INDUSTRIAL DEVELOPMENT PROGRAM ARMED WITH THE LEGISLATIVE AUTHORITY TO GRANT SPECIAL INCENTIVES FOR SPECIFIC INDUSTRIAL PROJECTS HAS HAD A SEVERE IMPACT ON AGRI-PROCESSING FACILITIES.

Historically, the State Department of Economic Development, now part of the Department of Energy, Planning and Development, has focused on tourism, planning and administering federal development programs. An enhanced Department of Energy, Planning and Development focusing on industrial development would be extremely useful to the ethanol industry. The attention of a Statewide industrial development authority to the difficulties of industrial development discussed in this Report would be an important step in recruiting the ethanol industry to Minnesota.

B. SPECIAL INCENTIVES FOR ETHANOL PRODUCTION

The ethanol industry incentives recommended by the Subcommittee fall into two categories; 1) Legislative recommendations, and 2) Administrative recommendations.

Legislative Recommendations

The Subcommittee recommends that the Minnesota Legislature pass legislation to support the following four needs of the ethanol industry: 1) provide excise tax exemption for ethanol/gasoline blends, 2) establish a loan guarantee program for plants built in the State, 3) establish a permit expediting authority (or Ombudsman) to support firms planning new facilities in the State, and 4) provide sales tax forgiveness for major process equipment installed in the ethanol plant.

Excise Tax Exemption

The Subcommittee recommends the State provide a 4¢ per gallon State excise tax exemption on unleaded gasoline blended in a 9 to 1 ratio with ethanol. The legislation should be patterned after the federal exemption and should be legislatively mandated to remain in effect until 1992. The excise tax exemption should be phased into effect with a 2¢ per gallon exemption starting as soon as possible and an additional 2¢ exemption effective two years later. This phased approach is intended to avoid "flooding" of the Minnesota ethanol market with product produced outside of Minnesota. THE 4¢ EXEMPTION WILL PROVIDE THE STIMULUS FOR A MARKET DISTRIBUTION SYSTEM AND INFRASTRUCTURE REQUIRED FOR A STATEWIDE INDUSTRY.

Initially this will benefit ethanol producers outside the State. However, the Subcommittee believes that the 5¢ to 10¢ per gallon local transportation cost advantage to producers within the State will quickly create sufficient incentives for ethanol production in Minnesota. This will be particularly true when the tax exemption is combined with a State loan guarantee program. The partial excise tax exemption would be comparable to the support of surrounding states.

The four cent per gallon gasoline excise tax exemption is the key to marketing ethanol in Minnesota. As the marketing section of this Report indicates, a ten cent per gallon support for gasoline blended with ethanol will make ethanol competitive with any other octane enhancer in the short-run. In the long-run ethanol will be cost effective on its own. Therefore, the Subcommittee supports the 1992 sunset provision. The State's five cents per gallon exemption, plus the federal government's five cent per gallon exemption will provide the necessary 10¢ support. THE TAX EXEMPTION WOULD HAVE NO EFFECT ON THE STATE'S GENERAL FUND SINCE ALL HIGHWAY TAX REVENUES ARE DEDICATED TO THE HIGHWAY USER DISTRIBUTION FUND.

In defining ethanol for this legislation, the law must be careful not to specify ethanol as "anhydrous" or 198 to 200 "proof." These terms are often used, but are not legally correct. A special fuel grade ethanol should be defined according to the proposed new ASTM standards for fuel grade ethanol. The standard for fuel grade ethanol should be summarized as follows: "Agriculturally derived fermentation ethyl alcohol containing not more than 1.25 percent water by weight at point of blending with gasoline, nor more than two percent (2%) by weight heads and fusel oils normally derived during fermentation, nor more than the U.S. Bureau of Alcohol, Tobacco and Firearms required amount of denaturant compatable for use in blending with unleaded gasoline. Water content shall be determined by method E203 test for water using Karl Fisher Reagent as published in The Annual Book of ASTM Standards Part 30.

Loan Guarantee Program

The Subcommittee recommends the establishment of a loan guarantee program to provide a one time capital formation stimulus to encourage development of the first generation of ethanol plants to be located in Minnesota. The loan guarantee program will work in conjunction with the excise tax exemption to support new plants in the State.

OVER $130 MILLION OF NEW PLANT CONSTRUCTION COULD BE GENERATED BY LESS THAN A $20 MILLION RESERVE FUND (WHICH COULD BE RETURNED TO THE STATE) USING A LOAN GUARANTEE PROGRAM. This can be demonstrated by the following program funding description. Of the $130 million in project construction, 20% or $26 million would be provided by investors in the form of equity. The remaining 80%, or $104 million, would be financed as debt. The State could provide loan guarantees for 95% of the debt portion or $98.8 million. Sponsoring banks should be required to be at risk for the unguaranteed portion of the loan. Since the equity and capital purchased under the loan would substantially collateralize the loan guarantee, the State would need to maintain a reserve fund for the guaranteed portion of the loans of only $19.76 million (a 5 to 1 leverage). Unless there were major loan defaults, the reserve fund would be repaid by the projects and could be retired on a pro-rata basis with the retirement of the loans. THROUGHOUT THE LIFE OF THE PROGRAM THE RESERVE FUND WOULD BE SHOWN AS AN ASSET ON THE STATE'S ACCOUNTS, RATHER THAN AN EXPENDITURE. THIS EXPLAINS THE POPULARITY OF LOAN GUARANTEE PROGRAMS WITH THE FEDERAL GOVERNMENT. This will enable the construction of 40 to 50 million gallons per year of ethanol production capacity. A loan guarantee fee and a grain check-off of 1¢ per bushel to be collected by the ethanol plant should be used to cover administrative costs of the program.

Permit Expediting Authority

Establish Permit Ombudsman office in Governor's office with broad authority to expedite permit issues. For example, the legislature could establish mandatory review periods which fix the period during which a permit application review must be completed. The intent of this office is not to provide ethanol projects special exemptions from the environmental requirements of similar projects. The intent of this office is to accelerate the review process and ameliorate many of the bureaucratic barriers facing developers.

Sales Tax Forgiveness

The Subcommittee recommends a limited sales tax exemption for main process equipment permanently installed in an ethanol plant. This would be similar to the current exemption on real estate. Sales tax would continue to be paid on construction materials and consumables used by the plant. THE SUBCOMMITTEE DOES NOT RECOMMEND PROPERTY TAX FORGIVENESS, SPECIAL ENERGY INVESTMENT CREDITS, ETC. The Subcommittee understands that under limited circumstances, potential property tax breaks are already available under M.S. 273.86 and M.S. 273.1313 and M.S. 273.13, Subdivision 9, clause 4. Various bills have been introduced in the legislature in previous years to provide sales tax breaks for new or expanding industry, which often do not even receive committee hearings. In spite of this history, the Subcommittee recommends a partial sales tax forgiveness on main process equipment

for ethanol plants as an effective means of encouraging development of the industry in Minnesota. It should be noted that a portion of this State forgiveness would be offset by other taxes to be paid by the new plant.

Administrative Recommendations

The Subcommittee has the following recommendations regarding the administration of the loan guarantee program and eligibility requirements for projects:

1) A special project review and program oversight committee comprised of knowledgeable individuals should be established by the Governor. The membership might be as follows:

   a) Member of Governor's staff
   b) Commissioner of Agriculture
   c) Representative of Agri-business
   d) Representative of Technical Fields
   e) Representative of Construction Industry
   f) Representative of Chemical/Energy Industry
   g) Representative from Agriculture
   h) Representative from Banking Industry

   Duties would be to review and approve policies established by program administrator and to review and approve projects.

2) Program should be administered through the State Department of Agriculture or directly through the Governor's office with a full-time administrator. The cost of funding the administration of the program can be handled by a loan fee to be charged for each loan guarantee awarded and the grain check-off fee for each bushel processed into ethanol.

3) A simple eligibility criteria document should be published with the program announcement. All applications should be due on a specified date and reviewed simultaneously. Committee can select from the best of the projects.

4) Overview of Application processing is as follows:

   a) Interested project sponsor obtains eligibility document and application and determines if proposed project meets criteria.
   b) Project Sponsor completes application and submits to program administrator.
   c) Program administrator has a fixed amount of time to verify completeness, accuracy and eligibility, and forwards application to Review Committee.
   d) Review Committee approves project and issues a Conditional Commitment. Commitment should be conditional on securing necessary loans, equity and permits.
   e) Review Committee issues final approval.
   f) Construction begins.

5) Loan guarantee to cover both construction and permanent loan and be effective from first construction drawdown to retirement of permanent mortgage.

6) Loan guarantee to be merchantable in the secondary financial market (similar to a Fanny Mae)

7) Owner equity should be 20% of project capitalization, 80% should be debt. Project capitalization shall include plant and equipment, engineering, construction, insurance and bonds, construction interest, real estate, working capital, legal and accounting, equity syndication and other project development costs amortizable as a capital expense under IRS regulations.

8) Loan guarantee program should guarantee 95% of the 80% debt portion of project capitalization. The sponsoring bank should be required to have some exposure. This is extremely important to maintaining project discipline.

9) "At risk" equity portion of the project cost should be drawn down pro rata with the construction loan funds.

The Subcommittee also makes the following recommendations relating to project eligibility for loan guarantee:

1) Marketing - Developer should have market commitment, at least in the form of a firm letter of intent, from a bona fide purchaser/user of plant products for at least 50% of anticipated production. A market plan should be presented for the remaining portion.

2) Project Size - The program should be targeted to plants in the 5 to 10 million gallon per year size. Smaller or larger plants are not precluded, but should be discouraged under the loan guarantee program. The smaller plant developers must demonstrate some clear cost advantages which insure the profitability of the project. Under comparable circumstances the profitability of plants under 5 million gallons per year can become questionable. Larger projects are not precluded, but would require a disproportionate share of the funds available. The Subcommittee recommends spreading the available funds and risk among several projects.

3) Technology - Eligible plants should use grain dry milling and produce anhydrous ethanol using conventional yeast, batch fermentation, molecular sieves or azeotrope ethanol dehydrators. Allowable plant feedstock (raw material) should only be those usable by commercially proven conventional fermentation technologies. This should include use of feedstocks such as corn, wheat and barley. Feedstocks requiring the exclusive use of commercially unproven technologies such as wood chips, cattails, municipal waste, Jerusalem artichokes, potatoes, or sugarbeets should be ineligible for the loan guarantee. Multiple feedstock projects (i.e. combinations of the above) should be considered as long as the primary feedstock is grain.

4) Energy Systems - Priority should be given to projects that utilize fuels other than natural gas or petroleum. The Subcommittee encourages alternative fuel systems, such as wood or agricultural residues, cogeneration, or solid fuel such as coal. However, conventional fueled plants will not be ineligible if plant economics so dictate.

5) Construction - Plants in the recommended size range should be designed and constructed according to specifications developed specifically for the plant. Packaged pre-engineered, pre-constructed plants in the over 5 million gallon per year size have not proven themselves technically feasible. In addition to new construction, plant retrofits, expansions and conversions should be eligible for loan guarantee awards.

6) Project Costs - Project capital costs should fall within the range indicated in Figure III-2. Projected Income and Expenses for the proposed projects should approximate those shown in Figure III-6.

7) Equipment - Virtually all of the equipment selected to meet the requirements of the State loan guarantee program should be selected from existing industrial applications. Nearly every piece of equipment should be supplied "off-the-shelf" by long established and reputable manufacturers with operating histories in other industries. Equipment should be supplied complete with full manufacturer's warranties, parts inventories, service and maintenance support. The use of plant equipment manufactured in Minnesota should be encouraged, whenever possible.

8) Contractor - The project should have a prime contractor for all construction functions capable of being bonded for both performance and payment for the entire project. Contractor insurance coverage must include property coverage for fire, vandalism, etc., worker's compensation insurance, liability insurance for general liability to cover bodily injury and property damage. Contractor should have industrial process experience of at least one project within the past 5 years of a similar type and of at least 50% of size in terms of dollar volume of contract. Contractor should provide a 1 year warranty on workmanship. Contractor must build under a firm fixed price lump sum contract. Cost plus or flexible pricing is not appropriate for ethanol projects with loan guarantees. Projects utilizing Minnesota contractors and labor should be given priority over projects specifying non-Minnesota contractors. However, projects utilizing non-Minnesota contractors shall not be ineligible for loan guarantee awards.

9) Engineer - Must be able to assign to the project at least one Registered Professional in Minnesota for each of the Chemical, Mechanical, Electrical, Civil and Structural Engineering disciplines. A construction field engineer must be stationed on the site. Projects utilizing Minnesota engineers should be given priority over projects specifying non-Minnesota engineers. However, projects utilizing non-Minnesota engineers shall not be ineligible for loan guarantee awards. Engineer must be able to provide Errors & Omissions Insurance of at least a $1 million limit and Process Design and Plant Performance Warranty Insurance of at least a $5 million limit. Process Warranty Insurance shall guarantee the plant to perform at a minimum as follows:

   a) 2.4 gallons per bushel of corn (2.2 gallons per bushel of barley)
   b) 330 days per year of 24 hour per day operation
   c) Quantity of DDGS
   d) Quality of ethanol and DDGS, (i.e. ethanol at 1% moisture and DDGS at 10% moisture)

10) Safety & Codes - All construction design should be required to meet or surpass standards of the Minnesota State Building Code for General Construction. All appropriate ASTM, ACI, AISC and UBC standards must also be met. All roadways, foundations, fire protection devices, plumbing, electrical and piping installation must meet building code and industry standards. The process design, equipment, buildings and facilities specified to be utilized in the applicant plant should be reviewed by a major industrial insurance underwriter. The following are several safety features which should be included in the plant design:

   a) Explosion-proof electrical system
   b) Safety shut-off switches
   c) OSHA approved guards, ladders, walkways, etc.
   d) Foam fire protection system

APPENDIX A - INDUSTRY ISSUES

The increasing interest in developing ethanol into a major alternative energy and chemical source raises a series of important questions. In this Appendix, various issues are presented in an effort to fairly represent the current status of ethanol production. General issues such as food vs. fuel, need for government support, energy production or efficiency, status of the technology, plant cost, byproduct price and commodity prices are discussed.

FOOD VS. FUEL

One question often asked is; will the production of alcohol from farm commodities force a choice between food or fuel? In reality, the plants are designed to produce both food and fuel and do not force such a choice.

Only the starch (carbohydrate) is removed when grains are processed to produce ethanol. Nearly all the protein, vitamins and minerals in the original grain are recovered in the byproduct (DDGS). In fact, the yeast actually adds protein to the byproduct. This byproduct is equal in weight to about one-third of the original grain but has concentrated the protein from 6% - 9% to 27% - 30% protein.

In the 1981-1982 crop year, 6.95 billion bushels of U.S. corn were consumed. Of this amount, 4.17 billion bushels were fed to livestock, 1.96 billion bushels were exported (primarily for use as livestock feed), and 811 million bushels (or about 11% of the total) was used for food, alcohol and seed purposes. Much of that used for food went into the production of corn fructose (a sugar substitute) in wet milling plants. Approximately 6.13 billion bushels, 88% of the total, was fed to livestock in the U.S. or overseas. Current surpluses of corn are at record levels with supply in excess of demand to the point that a large quantity of corn is spoiling, and USDA has provided some of this corn to ethanol plants at attractive prices for immediate processing. The U.S. Department of Agriculture has also proposed a program called PIK to try to reduce this over supply.

Studies recognize the superior quality of the high protein byproduct (DDGS) as a livestock feed. The protein in the byproduct has a high "by-pass" value, which allows feed ingested by the animal to be converted to meat in a highly efficient manner. DDGS protein is used more effectively than when corn is fed directly. This allows much of the corn in the ration to be replaced by roughage, such as corn silage.

These tests clearly indicate that the starch from the corn can be removed for conversion into ethanol with little or no impact on red meat production. The meat produced from the feeding of protein byproduct and crop residue would be of the leaner variety that is increasingly in demand by consumers today.

NEED FOR GOVERNMENT SUPPORT

Regardless of the potential profitability of an industry such as ethanol, it would continue to be difficult to obtain capital financing for first generation projects. Lack of investor understanding of the dimensions of the multi-faceted aspects of this industry has been a major impediment to capital acquisition in the ethanol industry. Over the recent history of severe capital scarcity in all industries, investors have focused on industries they know and understand. Also, venture capital is very rarely available for large industrial processing facilities, and is usually reserved for high technology product development. Historically, U.S. capital markets have left capital financing for major industrial projects to the companies within that industry.

However, ethanol does not fit into the main line of business of any existing industry. It has the components of both the chemical/energy and the agri-processing industries. Whereas the chemical/energy processing industry is very confident in their ability to produce and market ethanol, they have not had a basis for understanding commodity markets and price fluctuations. They also have had little experience with marketing the significant byproduct, DDGS. In the case of the agri-processing industry, which has a wide variety of experience dealing with the fluctuations of commodity pricing and marketing of DDGS, they have little experience with marketing ethanol.

As a result, ethanol production became an industry caught between chemical/energy production industries and agri-processing industries. Without one of these industries to champion projects and produce capital for industrial expansion, it has been inordinately difficult to finance the first generation of projects. This, of course, has created a significant opportunity to form an entirely new industry, one that bridges both agri-processing and the chemical/energy industries. This is the reason that several grass-roots developers are successfully operating in the ethanol industry. Also, most of the major projects operating today are joint ventures of agri-processing and chemical/energy companies.

Therefore, the government support programs, particularly the loan guarantee programs, which provide capital financing, are necessary only to build the first generation of projects. After the new businesses and the first generation of plants have proven themselves, it is the general concensus within the industry that government support for capital formation will no longer be necessary. The question, "Why should Minnesota develop subsidy and support programs?" is also a fair question. The federal programs obviously have been successful in stimulating a large amount of growth in this industry as discussed earlier in this Report. The need for a Minnesota program is to insure that this growth will take place in Minnesota, rather than surrounding states.

PLANT ENERGY EFFICIENCIES

In the early days of the fuel alcohol programs, many detractors claimed that production of fuel alcohol from biomass was not energy efficient because it "used more energy than it produced". This issue arose when initial research indicated large energy consumption in beverage alcohol plants built in the early to mid 1900's. Although the media tends to cling to this issue, it is almost universally considered invalid under current production strategies and technology. Following excerpts from a report by the Energy Systems Division of TRW, Inc. prepared for the DOE summarize this issue:

- "By necessity, any energy conversion process - for example, generation of electricity from coal or refining of gasoline from crude petroleum - reduces the total energy that is eventually available to consumers. This phenomenon is commonly accepted in transforming a less desirable form of energy to a more desirable form. Thus, a coal-fired power plant that is only 33 percent efficient is considered acceptable because it transforms coal to a more useful form of energy, electricity.

- "The essential question that must be asked is, 'Does the production of ethanol achieve a net gain in a more desirable form of energy?' Put more simply, can the production of ethanol and its use as a motor fuel or chemical feedstock reduce the need for imported petroleum in this country? Or does the production of ethanol create a premium form of energy which is more useful to consumers than grains?

- "In this study the investment of energy (in the form of premium fuels) in alcohol production includes all investments from cultivating, harvesting or gathering the feedstock and raw materials, through conversion of the feedstock to alcohol, to the delivery to the end-user.

- "Total net energy gain defined to include all energy inputs (low-grade fuels and premium fuels) does not focus attention on the advantages that biomass alcohol processes offer in using low-utility fuels (such as coal and solar energy) to produce premium transportation fuel.

- "For all the specific processes and options considered, ethanol can be produced from biomass with net gains in premium fuels. This conclusion holds even when the ethanol production processes are treated as being premium fuel (petroleum or natural gas) intensive, if the plant utilizes the innovative, energy-efficient designs which are currently available."

STATUS OF THE TECHNOLOGY

There are two important aspects of plant technology for small and medium size plants which are of considerable interest; 1) Fuel alcohol as a proven technology and 2) Resistance of plant equipment to premature obsolescence.

Ethanol as a Proven Technology

Ethanol produced from grain represents the most commercially viable technology currently available for the production of alternative liquid fuels and chemicals. A well engineered ethanol plant is a balance of conventional technology to insure plant reliability and design innovation to insure long term competitiveness of the production facility. Nearly every piece of equipment specified in the plant will be supplied by one or more long established and reputable manufacturers. This equipment is widely used in other industries and therefore has an established market and resale value. Each piece of equipment can be supplied complete with warranties, parts, service and maintenance support. Most companies are fortifying this conventional technology by utilizing highly specialized knowledge in new control systems, energy efficient equipment, modern microbiology and biochemistry, and advanced process technology to insure maximum plant efficiency. Reputable engineering and contracting firms can offer complete surety bonds which guarantee plant performance.

Resistance of Plant to Premature Obsolescence

A well designed ethanol plant can benefit from the advantages of the use of conventional technology without being susceptible to premature obsolescence. The conversion of grain to ethanol involves many individual process steps. The equipment required for each process step does not represent more than 15% of the total project cost depending on plant size. Therefore, if a substantially new development were to become commercially available for a particular process step, plant management could afford to acquire this technology without major capital reinvestment.

Similarly, the cost of production represented by each process step (excluding grain) is less than 11% of the total cost of production (depending on plant size and process technologies). The net effect on the total cost per unit of production for the entire operation would be negligible even if a major breakthrough were to substantially reduce the cost of a particular process.

This inherent protection from obsolescence and relative flexibility for plant modification is important when considering the alternative products and feedstocks that the plant may be required to process in the future. The significant breakthrough anticipated in ethanol production technology pertains to microbiological developments that could be readily applied to plants currently being planned and built.

PLANT COST

This variable refers to the capital cost of facilities and equipment which is particularly critical with current high interest rates. Plant capital costs (not production costs) currently range from $1.50 to $3.50 per annual gallon of production. This relatively wide range results from the variability of technical approaches and the many options for byproduct production. Most plants typically cost in the area of $2.50 per annual gallon of production. It is widely recognized that overall plant economics plant are impaired above the $3.00 level unless the additional capital results in substantial operating cost saving or substantial added value in products.

BYPRODUCT PRICE

Byproduct price refers to the price per ton of DDGS. Although this is not a true operating cost when considering the costs of ethanol production, the revenue from byproduct sales may be credited against the cost of production of ethanol. The relationship of byproduct price to grain price is an important aspect of plant economics. As discussed in the following commodities risk section, byproduct price tends to increase with grain prices. Therefore, the sensitivity of byproduct prices often works in favor of plant economics.

GRAIN PRICES AND COMMODITY RISK

Ethanol production facilities are faced with price uncertainty for inputs as well as finished products. The specific risks center around the cost of agricultural commodities used as a feedstock for production. Grain, which is the primary feedstock for ethanol plants, may comprise up to 40% of the cost of the final product. Therefore, operating costs and product prices will be directly linked to the variable price levels commonly found in agricultural markets. However, these risks are reduced by several influencing market characteristics.

While the Chicago cash market price for corn peaked at $3.98 per bushel in early 1981, this price includes transportation costs and does not indicate the prices paid to farmers at most proposed plant sites. Farmers were paid approximately $3.00 per bushel for their corn in May, 1982, with an annual average of $2.50 per bushel for 1980. This difference between local and Chicago Board prices reflects transportation expenses and is often referred to as the "Basis". The Basis at various Minnesota locations has been as high as $.80 per bushel due to increasing transportation costs. The current price for corn on the Chicago board is $2.69 per bushel (February 28, 1983).

The best hedging mechanism is to sell the ethanol and the DDGS at the same time the corn is purchased. However, if product sales cannot be made immediately, the corn may be hedged on the Chicago Board of Trade. Minnsota corn generally sells at a discount to Iowa and Illinois corn, due to greater distances from the major markets. Given increased demand by Minnesota-based plants, the discount for Minnesota corn will be substantially narrowed. This will benefit the Minnesota farmer, while not appreciably diminishing the plant's economics.

Increases in the price of grain will have a much smaller effect on overall profit than would generally be expected, since a portion of end product prices rise along with the price of inputs. As grain prices rise, the market prices for DDGS have historically followed these increases. Based on historical trends, DDGS price increases could be expected to offset 40 to 60% of the increased costs experienced due to grain price increases.

Based solely on the profit margins of plants currently planned, it is estimated corn could rise to $4.00 per bushel before the plant would begin to lose money at current revenues and costs. Considering the history of DDGS revenue offset, corn could actually rise 50% higher or $6.00 per bushel. These figures are considerably higher than the highest historical price paid for corn. These relationships hold true for all grains.

Measures similar to those used by farmers and grain merchants can be employed to reduce the risks caused by price instability. Hedging in the futures market for grain and grain products can reduce the overall impact of markets fluctuations on these facilities. If the proper measures are taken, set prices for inputs and associated profit margins can be "locked-in". Although there are transaction costs associated with hedging, this type of price insurance is sometimes extremely valuable. A careful review of commodities price and plant economics demonstrates that properly designed and managed ethanol plants are not as sensitive to input and product price fluctuation as they may appear upon first inspection.

PLANT SIZE AND LOCATIONS

The basic ethanol production technology can be applied to three groups of plant sizes which have been adopted by the industry:

- o Farm (small) scale plants. These plants typically use a dry milling process to produce between 5,000 and 2 million gallons per year of hydrous (160 proof to 190 proof) ethanol primarily for direct fuel use in farm equipment. Wet protein feed is produced and fed to farm livestock.

- o Community (medium) sized plants. These plants typically use a dry milling process to produce between 2 and 20 million gallons of anhydrous (198+ proof) ethanol for use as direct fuel, a fuel additive or octane booster, or as an industrial chemical. Dry high protein feed as Distillers Dried Grain and Solubles (DDGS) is produced and sold as a livestock feed supplement locally, nationally or internationally. Human consumable protein can also be produced for sale to national or international markets.

- o Regional (large) scale grain processing plants. These plants typically use wet milling to recover more products from grain such as fructose (corn sugar), corn oil, corn syrup, germ, gluten as well as producing 20 to 100 million gallons per year of anhydrous ethanol.

A comprehensive analysis of raw materials (feedstocks) production systems, product markets, technology of production and transportation economics of both inputs and end products should be considered when making a determination of plant size and location. However, this type of decision is primarily determined by the relationship of economies of scale in the production process and the economics of transportion of raw materials and finished goods.

The major transportation cost in ethanol production is the cost of shipping raw material feedstocks. Feedstock costs increase dramatically as the distance over which these inputs must be transported grows. Thus, the issue becomes whether to locate the plant near its source of feedstocks and transport the finished products to market or vice versa. Locating the plants at the feedstock source will lower transportation costs if the feedstocks have a higher bulk than the finished product. Since feedstocks have a bulk substantially higher than ethanol, locating plants at the source of the feedstock will greatly reduce transportation cost. Also, the feedstocks for ethanol production are dispersed over a wide geographic area. A dispersed feedstock source will increase the magnitude of the effects of transportation costs. The inherent high transportation costs of feedstock of ethanol plants and their rapid escalation as plant size increases suggest careful consideration of the size and locational relationships in ethanol production is required.

The major offsetting factor in considering transportation cost is economies of scale in production. Economies of scale refer to the concept of increased efficiency and reduced cost of operations per unit of production as a plant increases in size. However, the larger the plant, the greater the volume of material and product that must be transported to and from the plant site. Therefore, it is the optimal balance of transportation cost and economies of scale which determine the most desirable plant size and location.

Detailed capital and operating cost analyses have been conducted on plants ranging from 100,000 gpy to 25 mmgpy using a dry milling process and from 20 mmgpy to 50 mmgpy using a wet milling process. The results of these analyses have shown that there are substantial economies of scale from 100,000 gpy to 5 mmgpy with conventional technology. As a result, the costs per unit of production rise dramatically as plant size is reduced below 5 mmgpy. (However, research has shown that smaller plants could obtain scale economies by the development of a fully integrated, microprocessor controlled small scale production technology.) The analysis revealed smaller economies of scale in dry milling plants between 5 and 20 mmgpy in size as a result of enlarging plants from 5 to 20 mmgpy. Finally, substantial economies of scale were identified in all wet milling plant sizes, particularly in the 20 mmgpy to 50 mmgpy range.

The conceptual trade-off between feedstock transportation costs and economies of scale in production can be demonstrated in the developing structure of the industry. For example, a 20 mmgpy dry milling plant will be somewhat more efficient in terms of cost of production than a 5 mmgpy plant. However, the 20 mmgpy plant in most cases will be forced to purchase a majority of its grain in the regional commodities market. As discussed in the section on Commodities Risk, the regional market price for feedstocks may be considerably higher. Since feedstock costs represent 40% of the total costs of production, some of the efficiencies of the larger plant size are offset by the increased feedstock cost. The 5 mmgpy plant can purchase all grain locally to partially offset the loss of efficiency from the small plant size. A wet milling process, or other method of significantly enhancing the value of products, is required to offset the inherent transportation cost disadvantage of larger plants

Three business segments emerge as a result of the analyses. The first includes the large regional wet milling grain processing plant which produces a multitude of end products. This plant would be in excess of 20 mmgpy in production and require a very large capital investment. However, these plants have sufficient value added due to the many products resulting from the wet milling process to offset the feedstock price disadvantage resulting from transportation costs. The second segment is the community based plant which produces only ethanol and DDGS. This plant would be in the 2 to 20 mmgpy size range. These plants have the majority of the advantages of scale economies and can buy feedstock at substantially reduced prices by buying feedstocks

locally. The Subcommittee recommends that the State of Minnesota should target its loan guarantee program to the midrange of the second segment (i.e., 5 to 10 mmgpy). The third segment is the small farm scale system. Although these plants are not as efficient as the large plants, the substantial feedstock price advantages could make these potential plants cost competitive. However, the small scale technology has not yet proven itself.

APPENDIX B - PLANT DESCRIPTION

A. BASIC PROCESS DESCRIPTION

The design criteria for an ethanol plant is based on site conditions and on operating parameters that are dictated by plant size, raw materials, and local marketing requirements. However, this Appendix outlines the basic ethanol production process. There are essentially seven steps to producing ethanol from grain: 1) grain milling, 2) mash preparation, 3) fermentation, 4) liquid/solid separation, 5) ethanol recovery, 6) ethanol dehydration, and 7) high protein feed processing. (See Figure B-1)

Milling

In a dry milling process the milling of starch grains is required to expose the starchy substrate of the grain to the processing media. Grain feedstocks are normally ground to an average particle size of 0.42 mm. The milled grain is then transferred to surge bins for subsequent introduction into the process.

Mash Preparation

Preparation of the starch grains for fermentation is the key process in an ethanol plant. The first step in this preparation process involves the sterilization and gelatinization of the starch. Sterilization of the grains is essential for controlling the microbiological environment in ethanol fermentation. Gelatinization of the grain occurs simultaneously with sterilization and results in the solubilization of the starch substrate. Solubilization of the starch renders the substrate vulnerable to enzymatic processing of the starch into simple sugar (saccharification) for fermentation.

Saccharification of the grain starch to fermentable sugar is accomplished by utilizing a dual enzyme conversion system. The first enzyme acts to break down the large starch polymer (a large complex sugar molecule) into smaller sugar molecules (dextrins). Reaction conditions are carefully controlled to provide for optimal activity of the enzymatic reaction.

A second enzyme is added to the media and reacts with the dextrins and hydrolyzes the dextrin (a complex sugar) to produce glucose (a simple sugar). After these enzymatic processing steps, the glucose rich media is introduced to the fermenters for ethanol production via fermentation.

The use of sugar based feedstocks, such as sugar cane or sugar beets, enables the cooking and hydrolysis to be omitted. The sugar syrup can be fermented directly following a preparation and sterilization step.

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APPENDIX D - SUBCOMMITTEE MEMBERS

Burton M. Joseph, Subcommittee Chairman - President, I.S. Joseph Company, a marketing specialist in the agricultural byproduct field for domestic and export activity, Minneapolis, Minnesota

Dave A. Boyles, Manager of Energy Engineering, Corporate Engineering, Land O'Lakes, an agricultural commodities marketing and food processing cooperative, St. Paul, Minnesota

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Steve Wenzel, State Representative, Chairman, House Agriculture Committee, Little Falls, Minnesota

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IV.

VEGETABLE OILS -- OTHER USES

TASK FORCE REPORT

PRIORITY ITEMS FOR VEGETABLE OILS

1. Work in conjunction with others to eliminate the inequities that vegetable oils contend with in the export market.

   Suggested approaches:

   Governor Perpich work with other Governors to urge the Federal Government to negotiate changes in GATT.

   Contact U.S. Representatives and U.S. Senators from Minnesota, urging them to also work toward this end.

   As an example as to how other countries approach this program, the EEC has a 10% tax on incoming vegetable oils while beans and meal are duty-free. During the last two or three years, they have made repeated efforts to eliminate the duty-free status of meal.

   Brazil has used quotas and taxes to encourage exportation of value added products rather than raw soybeans.

   Malaysia also uses taxes to encourage the export of refined instead of crude palm oil.

   Spain and Mexico subsidize their processors, and Spain has a quota on the amount of soybean oil that may be consumed within the country.

2. Continue to support the University of Minnesota and all others who are working toward higher producing oilseeds. Increased yields per acre would make U.S.-produced oilseeds more competitive with other oils, for both domestic and export markets. To this end we should enlist the support of the Minnesota Soybean Growers, the Sunflower Association, University of Minnesota and our Commissioner of Agriculture.

3. Use of soybean oil as a carrier for chemicals. This requires a good deal of expert technical assistance. I suggest that we enlist the support of the University of Minnesota, Minnesota Soybean Growers (who have done extensive work on this) and major companies who either manufacture or sell the chemicals used by oilseed producers.

4. Re-evaluate the feasibility of the installation of a drumming and canning facility for vegetable oils at the Port of Duluth. This study has been done before, and due to lack of business volume and high freight rates from the Duluth Port, it was considered not feasible. We will ask Minnesota oilseed crushers and refiners to re-evaluate.

5. Monitor possible use of vegetable oil as an extender for diesel fuel. At the present time, this does not seem to be economically feasible. The American Soybean Association has done extensive studies on this and concurs that the economics are not right as of now.

VEGETABLE OIL IN AGRICULTURAL USE

Dr. Bob Robinson of the Minnesota Agricultural Experiment Station is father of this whole idea -- the use of vegetable oils to replace petroleum oils as herbicide carriers. Original article is in Soybean Digest 30:14-15 1970.

Bob Robinson and Wally Nelson, Superintendent of the Southwest Experiment Station, have a more scientific article in "Economic Botany."

Petroleum oil and emulsifiers at low concentrations at 1 gal. per acre became quite popular for use with atrazine. (These are Crop Oils.) Later came vegetable oils or petro. oils, often used at 1 qt. per acre but these contained 17-20% of expensive additives -- emulsifiers and surfactants. (These are Crop Oil Concentrates.)

There is considerable evidence that vegetable oils (soybean, sunflower, cotton seed and linseed) could be directly substituted for petroleum oils in "Crop Oils" or "Crop Oil Concentrates." Usually vegetable oils have been used as "Crop Oil Concentrates" -- combined with additives.

There is little doubt that soybean oil (or other vegetable oils) could be directly substituted for petroleum oils for use with atrazine. There is evidence that there may be somewhat more safety to the crop (corn) when using vegetable oils.

With Bladex (cyanazine) vegetable oils may give slightly better weed control and safety to the crop is better with vegetable oils.

Vegetable oil could substitute for petroleum oil for use with Basagran (bentazon). Perhaps more research or a better review of literature is required before I state this strongly. The interest now is directed at use of oils with the new postemergence grass herbicides (Poast and Fusilade). These will require oil additives for maximum effectiveness.

The use of vegetable oils with these products has not been studied in detail -- however, John Nalawaga (NDSU) believes from preliminary work that the substitution could be made in these cases.

As to using ultra-low volumes and vegetable oil as the only carrier, I think more research is required. If the concept works with petroleum oils I see no reason why vegetable oils could not be substituted.

I have mentioned only herbicides. Vegetable oils could be used, perhaps, with insecticides.

References:

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5. SoyCot™ article from Beltwide Cotton Production Mech. Conf. 1982

Agrichemical Use of Soy Oil

Minnesota farmers produce about 170 million bushels of soybeans annually. There is the capacity to process over 100 million bushels in Minnesota. There is a world wide oversupply of vegetable oils, and increased useage of soy oil will result in 18 to 54 million dollars of increased income to Minnesota farmers for every one cent/per pound increase in soy oil prices.

There are three areas where soy oil may be substituted for petroleum based oils in agrichemical uses:

A. As a chemical carrier in the formulation of pesticides at the manufacturers.

B. As a additive when spraying some pesticides with water.

C. As a carrier when mixed with the chemicals in ultra low volume application or water and oil in low volume application of pesticides.

The following is to briefly outline some of the advantages and problems in the three uses of soybean oil.

A. As a chemical carrier in the formulation of pesticides at the manufacturers.

Advantages

1. Use of renewable resource instead of petroleum resources i.e., if the manufacturers of Sutan used soy oil to formulate, it would require 43 million pounds of soy oil for that product alone.

2. Use of a product grown in Minnesota.

3. Soy oil is less expensive than other vegetable oils.

Problems

1. Needs EPA approval. This would require a one year test period.

2. May not be enough variety of refined soy oils to fill all the needs of different formulations.

3. Will require pressure on the formulators to switch from petroleum based oils.

B. As a additive when spraying some pesticides with water.

Advantages

1. Already being done to a limited extent i.e., E. V. Concentrate.

2. With some pesticides it increases the effectiveness.

Problems

1. Need more research on effects.

C. As a carrier for ultra low volume and with water in low volume application of pesticides.

1. Possible lower use of chemical for the same results.

2. Decreased drift of pesticides from target area due to less evaporation of droplets.

3. Much lower volume applied. Increase the efficiency of the operator.

Problems

1. Need label changes by manufacturer to allow use.

2. Need more research on effectiveness to better determine the amount of chemicals to be used under different conditions.

3. Requires use of controlled droplet applicators.

V.

AGRICULTURAL RESEARCH AND TECHNOLOGY TRANSFER TASK FORCE REPORT

AGRICULTURAL RESEARCH

One of the current and potential future strengths of the University of Minnesota is the diverse program in agricultural research and education. For research in agriculture and related fields funds have been made available for many years through special state appropriations (GAR), and by federal formula funds through the United States Department of Agriculture (Hatch and McIntire-Stennis), as well as grants and contracts from government agencies and industry. This public system of research has led to the abundant agriculture of America which is the envy of the developing world.

As the State of Minnesota faces critical financial issues over the next several years as well as enrollment declines in secondary and higher education institutions, there will be temptation on the part of the executive and legislative branches of government to uniformly reduce approrpiated program dollars for education and research. A strong university affords to its students and the people of the state strong commitments to graduate education and research. This is true across the University but is especially true in the case of agriculture.

With 40% of Minnesota's economy coming from the agricultural industry it is important to continue to fund opportunities for aggressive, imaginative research which will assure Minnesota a continuing strong role in meeting world food needs. Attached is information which reinforces the need for continued increased production at a profit level to meet the critical world food situation. (Attachment A)

Agricultural Research and Technology Transfer

The American public agricultural research establishment has two great strengths, and one great problem.

One of its great strengths is the interaction it promotes between research and extension, and between technology-oriented and science-oriented research. The system allows cooperation among scientists advancing knowledge, scientists inventing technology, extension specialists and county agents disseminating knowledge and technology, and farmers and agribusiness clientele producing, processing, transporting and marketing food and fiber. The agricultural components of the University of Minnesota and other land grant universities have set an example for other segments of these universities to follow.

The other of its great strengths is its decentralization, through a central State Agricultural Experiment Station and branch stations within each state, as well as field locations of the USDA agricultural research agencies. This decentralization has benefited society through a positive effect within each state on the productivity of technology-oriented research. Further, research conducted in one state increases productivity in other states with similar soils and climate.

Its one great problem, however, is that the benefits of agricultural research have been undervalued by American society. Public investments in agricultural research remain static, despite annual rates of economic return to society of 50% and above. Two reasons are given for the underinvestment in public agricultural research: 1) the benefits to farmers spill over across state lines to those who do not pay for the research; and 2) the benefits to consumers are partitioned into such small amounts that the individual consumer cannot feel the connection, even though Americans spend a smaller share of their after-tax income for food than any other people in the world.

The public's refusal to expand real investments in agricultural research in recent years has created a great deal of concern within the public agricultural research system. The research system faces 1) difficulties in convincing public decision-makers of the need for expanded real investments in agricultural research, 2) greater demands for work to be done in the face of constant or declining research resources, 3) increasingly complex problems requiring increases in real dollar support to show progress, 4) less freedom in the management of research programs associated with more earmarking and other constraints, and 5) increased proportion of time being spent in justifying and defending research programs rather than in conducting them.

The system also is inhibited, at times, by its traditions of always providing the results of its research freely to all clientele. It is reluctant to enter into proprietary contracts with individual firms which would provide these firms with exclusive licenses or even patent rights to the products or processes resulting from the research. Yet without such proprietary arrangements some research results may never be made available to benefit the public good, or they be made available only after unnecessary delays.

Clearly, had the public not decided to invest in agricultural research in the past, the current well-being of the United States and Minnesota would have been greatly decreased. Unfortunately, it is not known with certainty how much our well-being will be jeopardized in the next decade and beyond by current underinvestment in agricultural research.

From what sources should funding for agricultural research come? Though the argument can be made for real increases in agricultural research funding by the federal government, the likelihood of that happening within the next two to five years seems remote. In fact, the erosion in federal funding which began during the previous two administrations has accelerated during the current administration.

The State of Minnesota has invested well in agricultural research, through the Minnesota Agricultural Experiment Station of the University of Minnesota. This was especially true during 1965 to 1980. However, the growth has slowed dramatically since then and retrenchments in appropriations for the University, shared by the Agricultural Experiment Station, have made the situation even more critical.

The private sector has maintained its investment and has even increased its efforts significantly in real terms in some areas. It will continue to invest as long as the expectations of profit exist. However, reducing public expenditures in the hope that the private sector will increase investment would mean that the focus of agricultural research would shift toward technology that can be sold. As a result basic research, at least that portion which does not lend itself to a marketable product within a reasonable time, would probably be reduced. Basic research investments today build the base for technology transfer in the future. In the past, the agricultural research conducted in Minnesota, by the Minnesota Agricultural Experiment Station and by the private agricultural and food corporations based in Minnesota, has meant substantial benefits to the state's economy and hence to its citizens. However, the potential for contributions to Minnesota's economy is even greater and this potential must be realized if Minnesota's economy is going to regain its strength and vitality.

There are also increasing opportunities to bring private and public sector research closer together. This will assure that front line research can be move into application sooner to the benefit of Minnesota and U.S. citizens. This provides possibility for exchange of positions and work in laboratories between private sector and public sector scientists. This also should provide opportunities for expanded graduate student experience. There are several examples of this, one being the "Biotechnology Center concept" which is being discussed at the University of Minnesota, and other activities proposed by the High Technology Council and other advisory groups which bring public and private sectors more closely together. Attachment B is additional information about the Experiment Station and Extension Service requests currently before the legislature.

The importance of the Extension Service is to assure that information generated through an aggressive research program is moved to the user level as quickly as possible. The request asks for increased resources in some [illegible] areas at the University of Minnesota which are already established but need strengthening. These are growth commitments for the future. Investments at this time will pay large dividends as has been experienced in the past with other public funds invested in agricultural research.

Proposed recommendations for the Governor's consideration:

1. The Minnesota legislature should restore to the 1983-85 biennial budget the erosion in funding for the Minnesota Agricultural Experiment Station which occurred during the 1981-83 biennium. The restored funding should not be used to fund long-term commitments to permanent faculty positions but rather to support new initiatives with present faculty and/or by employing temporary scientists. This should be research designed to contribute to the economic development of Minnesota's agriculture, forestry and related industries. These initiatives

should include developing new cooperative relationships with Minnesota's private sector which would lead to potential proprietary products and processes for those firms to market.

2. The Minnesota legislature should fund in full the 1983-85 biennial request of the Minnesota Agricultural Experiment Station as all items in the request will contribute to economic development and/or reduce other state expenditures. The strong research and education programs in agriculture at the University of Minnesota should be continued at growth levels not less than 5% a year over inflation.

3. The Minnesota legislature should provide state funding, or an appropriate matching basis with private sector funding, to support the University of Minnesota's Biotechnology Center, on the condition that the funding be used to support biotechnology research of potential direct benefit to Minnesota-based agricultural and food firms as well as other high technology industry.

4. The University of Minnesota, including the Agricultural Experiment Station, should be encouraged to develop policies and procedures for enhancing cooperative research between the University and Minnesota-based industries to the benefit of society. The purpose would be to assist in making the considerable research resources of the University and the results of that research available to the rest of society through the private sector for the good of the public and the health of Minnesota's economy, while attracting private sector funds to sustain and enhance the University's research related to agriculture.

5. As the University and the Minnesota legislature consider retrenchment of the University's state funding and the possible closing of campuses and/or collegiate units in response to projected declining enrollments, they should keep in mind that research of the Agricultural Experiment Station and some other University units serves a separate mission. As enrollment declines, it does not follow that the agricultural research needs of the state will do likewise. In fact, because of state, national and world food issues, the needs will most likely grow. Almost every new improvement in agricultural technology requires a larger total quantity of resources than the previous one. Often what one researcher used to do now takes several researchers working as a coordinated team and much more sophisticated scientific equipment. Thus, University units which conduct agricultural research, including branch stations, should not be included in any retrenchment of state funding which directly supports their research mission.

6. Scholarship programs should be developed to encourage young people to come into agriculture. These scholarships should be based on scholarship, not need. They should be of sufficient stipend that students can finish their work both at the undergraduate and graduate levels in sufficient time to gain good experience, but also to become available to the needed work force in the agricultural sector.

7. Appropriations should be given to continue significant upper division and graduate course support to assure that high technology graduate programs can be strengthened, while at the same time the University may be reducing its undergraduate enrollments.

Attachment A

THE ECONOMIC URGENCY OF HIGHER YIELDS

David W. Dibb, Phosphate & Potash Institute

The urgent need for higher yields is focused on two general areas--expanding world food needs and the economic necessity for the farmer.

To help understand expanding world food needs, a recent film, A Gift of Harvest (NACA), proposed that if world population doubles in the next 35 years as expected, we will have to produce as much food in the next three decades as has ever been produced. Whether this estimate is exactly correct or not, the magnitude of the challenge facing those engaged in food production is almost incomprehensible.

To put the rapid rate of this demand increase into perspective, I would like to share some information:[1]

IN THE LAST 60 SECONDS:

164 people have been added to the world population.

About 33 (one-fifth) of these will be fed by the U.S. which has 5% of the world population.

IN THE LAST 60 SECONDS:

Annual world demand for agricultural products has increased by:

- 1,240 bushels of coarse grains (as corn)
- 690 bushels of wheat
- 690 bushels of rice
- 200 bushels of oilseeds (as soybeans)
- 4,050 lbs of beef (6 steers)
- 3,840 lbs of port (23 hogs)
- 2,140 lbs of poultry (765 chickens)
- 1,150 lbs of cotton (2.4 bales)
- 490 lbs of mutton/lamb (15 sheep)

IN THE LAST 60 SECONDS:

Annual world consumption of fertilizer has increased by:

- 7.5 short tons of N
- 3.6 short tones of P_2O_5
- 2.4 short tons of K_2O

13.5 short tons of nutrients

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[1] Nitrogen and Phosphate Supply/Demand, Now and in 1985. L.L. Jaquier, 1981 TFI Annual Meeting, Chicago, Illinois.

ATTACHMENT B

1983-85 REQUESTS

UNVERSITY OF MINNESOTA

THE INSTITUTE OF AGRICULTURE, FORESTRY AND HOME ECONOMICS

Summary of Legislative Requests for 1983-85

Institute of Agriculture, Forestry and Home Economics

Program	Current level of state support 1982-83	Proposed 2-year increase 1983-85
College of Agriculture	$7,423,551	(see
College of Forestry	1,211,616	pages
College of Home Economics	2,144,756	4-6)
Agricultural Extension Service	10,240,761	909,400*
Agricultural Experiment Station	10,026,350	1,400,000
International Agricultural Programs	50,000	275,000
Total Program	**$31,097,034**	**$2,584,400**

*Includes $209,400 on a nonrecurring basis for purchase of microcomputers.

General Operations and Maintenance Requests

The general operations and maintenance budget of the University of Minnesota includes the basic funding for salaries, supplies, and other expenses of teaching in most of the colleges of the university, including the Colleges of Agriculture, Forestry, and Home Economics. The university has decided not to seek funding for new teaching positions in these three colleges in the 1983-85 biennium.

COLLEGE OF AGRICULTURE

The College of Agriculture, historically one of the finest in the nation, has served the people of Minnesota throughout its history in the spirit of the land-grant tradition, closely linking its educational programs to the needs of the food and agricultural industry of the state. The college provides the state's only comprehensive educational program leading to the degrees of Bachelor of Science, Master of Science, Master of Agriculture, and Doctor of Philosophy in agricultural and closely related fields.

The challenges and opportunities facing Minnesota's agricultural and food industry in the 80s have never been greater or more exciting. This industry is vital to the economy of the state, providing more than 30 percent of its jobs. It will continue to be so, just as it will continue to be crucially important in providing food for a hungry world. Its continued vitality will depend upon its ability to meet the technologic, economic, and social challenges that directly relate to the production, processing, transport, and marketing of Minnesota's agricultural commodities, locally, nationally, and internationally. Success in meeting these challenges and in taking advantage of new opportunities sure to come along will depend on the continued availability of people who are well educated in the agricultural arts and sciences — talented, motivated, and committed people who teach and conduct research. There is a direct link between the vitality of Minnesota's food and agricultural industry and the educational programs of the College of Agriculture.

The college faces its own challenges and opportunities as it responds to the needs of the industry in the 80s. Maintaining the historically high quality of its programs has been and continues to be a major challenge for the college. There is a critical and immediate need for increased support for undergraduate programs in the plant, soil, animal, food, and social sciences. In response to the challenges of the 80s, new interdisciplinary programs are emerging in integrated pest management, resource and community development, agricultural communications, farm management systems, and extension education. Adequate funding is critically important for these programs

Undergraduate enrollments are stabilizing at a time when the demand for agricultural college graduates continues to increase. There are shortages in certain fields now, and these shortages will grow. Graduate enrollments are increasing but are not great enough to meet the demand, and the shortage of teachers, researchers, and extension specialists will grow in the coming years. The situation has created a need for special programs in career development to bring a new awareness of opportunities in agriculture and to encourage people to enter the College of Agriculture, successfully complete their studies and, when appropriate, enter graduate school.

Both the faculty and the administration of the college see the direct relationship between program quality and the vitality of the food and agricultural industry of Minnesota. Both the university and the state are

responsible to the agricultural sector to provide educational programs of the highest quality to ensure enough graduates to meet the demand.

Education is an investment in human capital — capital that is shared by the society as a whole. The responsibility for making that investment wisely has never been more crucial. The challenges for agriculture are there. Sufficient resources are essential to make sure those challenges become working opportunities.

COLLEGE OF FORESTRY

The College of Forestry, one of the leading forestry schools in the country, offers the only undergraduate and graduate professional forestry and forest products educational programs in Minnesota.

More than one-third of Minnesota's land is in forests. There is a growing emphasis on the long-term importance of forests as a resource for meeting our material, aesthetic, and environmental needs. It is important that the college's ability to provide education for the development of forestry professionals and scientists and to carry out research and service missions be maintained and strengthened as the pressures grow on a limited forest resource base.

The College of Forestry has served the people of Minnesota for 79 years through education and research. Graduates hold important staff and administrative posts in schools and colleges of forestry around the country, in federal and state agencies, and in the private forest sector here and elsewhere. Research and extension programs have served to strengthen forestry contributions in the state.

The college has attempted to meet its educational goals despite declining funding for its programs. Some internal adjustments have been made by reducing support services and using temporary funds. This has permitted strengthening of the graduate program and development of course offerings that recognize the increased complexities in resources management and utilization. The college continues to emphasize specific curricula and specializations. When support can be found, there are important unmet needs we are prepared to address.

The space available for the forestry education program requires major improvement. There is also a need to update and increase space for forestry research and extension. The university is requesting capital improvement funds for working drawings for an addition to and remodeling of Green Hall. This request is critical to the college's ability to adapt to the changing requirements in forestry research, extension, and teaching.

COLLEGE OF HOME ECONOMICS

The College of Home Economics, through its teaching, research, and outreach activities, is concerned with the functioning of individuals within family and other units and with policies and programs related to design, food and nutrition, textiles and clothing, housing, and human relationships involving people of all ages.

The college offers courses of study for undergraduate, graduate, and nondegree students. Its teaching programs draw upon the broad resources of the university and the metropolitan and statewide communities. The instructional programs reflect the college's commitment to experiential learning and problem-solving. They are designed to prepare students as skilled and knowledgeable professionals as well as to contribute to their personal growth and ability to participate as responsible members of society.

Research efforts in the college seek to identify and illuminate better ways to address the diverse, inteconnected problems and opportunities confronting individuals and families. Faculty members work

closely with others who have common interests but perhaps differing points of view, both within the college and throughout the university.

Through its relationships with the Agricultural Experiment Station and the Agricultural Extension Service, the college serves statewide, national, and international audiences.

Although home economics has always recognized the importance of strengthening the family and maintaining a positive home environment, today it also reaches out to industry and business, government agencies, and other units of society dealing with nutrition, housing, clothing, and the aesthetics of the environment.

Agricultural Extension Special Appropriation

The mission of the Agricultural Extension Service is to develop and implement educational programs to meet the needs of Minnesotans in agriculture, animal health, forestry, home economics and family living, 4-H youth, and community resource development. In doing this it draws on the knowledge base of the University of Minnesota, with particular attention to the results of new research in the Agricultural Experiment Station.

The special appropriation for the Agricultural Extension Service is its major support from the state of Minnesota. This support, combined with county contributions and federal appropriations, makes possible a program that involves hundreds of thousands of people in every county of the state.

The 1983-85 legislative request has two major purposes:

- to continue to implement a statewide computer-assisted communication system, and
- to strengthen educational efforts in the area of economic development.

Funds are requested to continue the development of a system for distributing computer-based information and communication throughout the state. The system begun in 1981, EXTEND, features intelligent terminals (microcomputers) in county extension offices linked to the university host computers. The request provides for the purchase and installation of intelligent terminals in 15 additional counties, 3 area offices, and 5 campus units. It also provides for staff and educational materials to develop additional software for use in educational programs.

The economic development component of the request includes:

- reinstatement of 8 county extension positions which were eliminated or reduced in the recent retrenchment;
- faculty positions to work in the value-added area of commercial horticulture and forest products to create more employment in Minnesota by processing vegetables and under-utilized tree species (joint requests with the Agricultural Experiment Station);
- a marketing position to help the Minnesota agriculture and forestry industries market processed products;
- a continuing education program for foresters;
- a faculty position to help youth increase employability skills (joint request with the Agricultural Experiment Station);
- an area extension agent position to work in small business development in northeastern Minnesota; and
- a position for a half-time extension specialist in swine health.

Agricultural Extension Service
Requested Biennial Increase

	Year 1 1983-84	Year 2 1984-85
Computer-assisted communication system	$204,700*	$204.700*
County extension agent positions	80,000	80,000
Economic development		
A. Value-added		
Horticulture: S.E. and S.C. Minnesota**	20,000	30,000
Forestry: utilization**		30,000
Marketing		60,000
B. Forest management		60,000
C. Youth employability skills**		
4-H/Center for Youth Development and Research		30,000
D. Northeastern Minnesota small business development		40,000
E. Swine health		30,000
F. Helping Minnesota families live resourcefully		40,000
Total	$304,700	$604,700

*Includes $104,700 each year of the biennium on a nonrecurring basis for purchase of microcomputers.

**Joint request with Agricultural Experiment Station.

Total Funding	1982-83	1983-84	1984-85
	$10,240,761	$10,545,461	$10,845,461

General Agricultural Research Special Appropriation

The Minnesota Agricultural Experiment Station organizes and supports basic and applied research in agriculture, forestry, home economics, veterinary medicine, and related areas. This research has resulted in substantial benefit to the economy and the people of the state.

A major area of research is the production, processing, marketing, and distribution of food and other agricultural products. Research is also directed at examining and improving public policies, at forests and forest products, other natural resources, human nutrition, family life, rural development, recreation and tourism, and overall environmental quality.

The program of the station is closely integrated with that of the Agricultural Extension Service, with the latter serving as a primary disseminator to the public of applied research results. Included in this legislative request are three faculty positions and accompanying support that are being requested jointly with extension: that is, a share of each position and support is in each request.

A portion of the request ($105,000 in 1983-84 and $305,000 in 1984-85) will be used to match private gifts and endowments.

Funds for 1983-85 are requested to support new initiatives in the following areas.:

1. Animal health research — One of the most effective ways of improving the efficiency of animal production is by improving the health of livestock and poultry. The funds requested will support the first phase of a long-range research program addressing the health needs of Minnesota's animal agriculture.
2. Molecular biology of plants — The technology exists to isolate and purify individual genes from crop plants, thus allowing scientists to improve crops by molecular means in the laboratory in addition to sexual crossing methods in the field. An interdisciplinary team of five faculty members is developing a research program in molecular biology of economic plants which will coordinate the talents of molecular biologists, geneticists, biochemists, cell biologists, cytogeneticists, plant physiologists, and plant breeders. Gene transfer by molecular means is not provided for in the current program; therefore a faculty position and support in cell transformation is requested.
3. Value-added: vegetables and forest products — The state's economy can be greatly enhanced by increasing the production of vegetable crops and forest products and by processing more of these products within Minnesota rather than sending them elsewhere for processing. The requested funds will support research in developing the production and processing of vegetables and in developing industrial uses for paper birch (the most under-utilized timber resource in the state) and other forest species. This research will lead to more jobs and new businesses, more value added to the land, and an increase in local and state tax revenues.
4. Research projects for endowed faculty chairs — The university has received private endowments that will provide all of the salary and fringe benefits on a continuing basis for two faculty chairs in agriculture; several other endowments are under development. Funds are requested to support research for three endowed positions, one in the College of Veterinary Medicine and two in the College of Agriculture. Such support will help attract top-quality scientists and will

assist the station in attracting additional private funds.

5. Increased agricultural and forestry productivity and profitability — Funds requested will support research in several different subject-matter areas, all aimed at improving productivity and profitability: computer programs in agricultural economics and plant pathology/integrated pest management; agricultural and forest weed control; poultry research; and soil fertility and plant nutrition.

Agricultural Experiment Station Requested Biennial Increase

	Year 1 1983-84	Year 2 1984-85
Animal health research	$100,000	$200,000
Additional animal health research if College of Veterinary Medicine generates private sector matching		200,000
Molecular biology of economic plants directed toward applications in agriculture	85,000	85,000
Value-added		
A. Horticulture: S.E. and S.C. Minnesota*	60,000	60,000
B. Horticulture: N.C. Minnesota		25,000
C. Forestry: utilization*		50,000
Matching funds for endowed faculty chairs	105,000	105,000
Increased agricultural and natural resource productivity and profitability		
A. Computer applications	50,000	50,000
B. Agronomic weed control		60,000
C. Farm animal attendant/poultry		20,000
D. Soil chemistry/plant nutrition		73,000
E. Forestry herbicides specialist		29,500
Youth Research: 4-H/Center for Youth Development and Research*		42,500
Total	$400,000	$1,000,000

*Joint request with Agricultural Extension Service.

Total Funding	1982-83	1983-84	1984-85
	$10,026,350	$10,426,350	$11,026,350

6. Research for youth development — The university's Center for Youth Development and Research in collaboration with 4-H hopes to develop 4-H programs that will reach new, hard-to-reach populations and enhance youth development towards productive adulthood and employability. Model projects need to be established and tested by the station before new techniques can be incorporated in the regular 4-H program, much as demonstration plots are used to test and validate agricultural innovations. The aim is to help 4-H fulfill its youth development mission as efficiently and effectively as possible.

These new research projects will require a total of 16.85 new academic positions and 17.5 new civil service positions for the biennium; during the first year the number of new positions requested totals 5.1 academic and 9.0 civil service.

International Agricultural Programs

Agriculture is an international science and industry. One of the greatest challenges now and in the future is to produce, process, and transport enough food to feed exploding world populations. Minnesota agriculture has played a critically important role in meeting this need; in 1981, the state exported more than $2.3 billion in agricultural commodities. International transfer of technology and agricultural trade are major and growing sources of Minnesota's wealth.

Minnesota agriculture's ability to deal with the challenges of international agriculture needs strengthening. The mission of the College of Agriculture includes teaching, research, and extension in the international dimensions of agriculture to the benefit of Minnesota farmers and citizens. Because the College of Agriculture interacts with programs in the Colleges of Forestry and Home Economics, international concerns are shared with these units. There is a critical need to strengthen the international abilities of students, faculty, and staff of these colleges.

The college has generated more than $5 million in federal funds each year for international projects of benefit to the state. In 1981-83, for the first time, the state legislature earmarked funds for international agricultural programs. The report of the Presidential Commisssion on World Hunger recommends increased federal, state, and university funding for internationaliy oriented research on food and nutrition and a major effort to educate the American public about international food, hunger, and agricultural production. Farmers, agricultural and food suppport organizations, farmer cooperatives, and the agribusiness community in Minnesota have urged the college to strengthen its activities in international agriculture.

In response to this, the College of Agriculture is requesting an increase of $125,000 in the first year of the biennium and $150,000 in the second to:

- conduct educational programs related to the international dimensions of agriculture and world food, with particular emphasis on undergraduate education, inlcuding nonagricultural students;
- develop international dimensions of agricultural research to enhance the development of technology for the benefit of Minnesota farmers and consumers; and
- develop extension, community outreach, and support programs to educate farmers, farm families, and other consumers, and the general public on world aspects of food, nutrition, and agriculture.

AGRICULTURAL EXTENSION SERVICE

UNIVERSITY OF MINNESOTA

Department of Horticultural Science
Alderman Hall
1970 Folwell Avenue
St. Paul, Minnesota 55108

TO: Roy L. Thompson

FROM: Luther Waters

SUBJ: The Governors Council on Agri-Processing

DATE: February 7, 1983

Jerusalem Artichokes.

Jerusalem artichokes have been promoted in the State of Minnesota and much of the rest of the United States actively for the past one and one-half years more or less. The company doing most of the promotion is America Energy Farming Systems in Marshall, Minnesota. To date as nearly as I can tell there is somewhere in the neighborhood of 2,000 acres of Jerusalem artichokes planted in Minnesota alone and an additional 3,000 to 4,000 planted in states outside of Minnesota all in connection with the company in Marshall. Their stated goals some 6 months ago was for 30,000,000 acres in the United States. Their stated intentions were that these acreages be devoted to the production of alcohol, fructose, various food products, and livestock forage. I am attaching a copy of a letter I sent to our county agents in Minnesota approximately one year ago that describes some of the cultural practices that might be used and the current state of our knowledge regarding these cultural practices. I am also attaching a copy of a summary report of some Jerusalem artichoke trials which were conducted by myself, Dave Davis, and Mel Weins at Staples in 1981. I should point out that the trials conducted in 1981, despite the fact that they were conducted in three locations, nevertheless represent one year's data and should be viewed in that light.

In addition to the disease and insect problems listed in my letter to the county agents, there are some 5 or 6 additional diseases which can be expected to be problems should large acreages develop. These include: rust, powdery mildew, southern stem blight, Pseudomonos sp. as well as the traditional soil borne diseases fusarium and verticillium. Insects have also been reported to me by several growers. These included both tuber boring and stem boring insects which were not identified as to the genus and species.

Markets to my knowledge have not changed since I sent the letter to our county agents in April 1982. Jerusalem artichokes used as a forage I am told is only of mediocre quality unless the tops are harvested when the plants are quite immature, however, harvesting at this stage seriously reduces tuber yields.

One additional point should be made regarding the maturity of this crop. Most of the varieties currently being used do not flower until near mid-September. Tubers do not begin to enlarge rapidly until about this time, consequently if we were to encounter a severe freeze in mid-September or shortly thereafter, the crop would be in serious jeapordy since the translocation of carbohydrates from the shoots to the tubers doing this period is probably the major source of tuber enlargement. Anything that would disrupt the translocation of these sugars would also disrupt tuber fill and enlargement.

Vegetables.

Vegetables in light of the comments of the council on agri-processing probably falls under the category of unconventional crops. We are currently working with three crops which have demonstrated potential value to the state both to the farmers, to the processors in the fresh market sector, and value in keeping the Minnesota dollar in Minnesota. The consumption of asparagus, broccoli and cauliflower continues to increase across the nation as well as in Minnesota. An export market expecially to Canada also exists. Evidence of the great need of at least asparagus in Canada is demonstrated by the fact that Canadian government has authorized the payment of $500.00 per acre to grower who are willing to establish asparagus plantings in Canada, notably in British Columbia and the Ontario provinces.

The conditions for production of these three crops in Minnesota is excellent and reseach at the University of Minnesota over the last 3 to 4 years has demonstrated both productivity and the potential for a high quality product in most of our farming communities.

We also have a reasonably high level of grower interest in these crops. In 1982 we conducted a grower tour to the producing areas in California and 27 people participated in this tour. A similar tour is being conducted in 1983 in February and 50 people will be participating in this tour.

The concerns of those interested in these crops in the growing sector are twofold: 1. the cost of establishment of asparagus plantings and the production costs involved in broccoli and cauliflower. The markets exist, however, it is necessary to have either processing facilities to utilize the product or packing houses to prepare the fresh product for market in a competitive manner. Both of these require capital which growers and processors are not readily able to obtain at this point. The availability of low interest capital and tax incentives would go a long way in encouraging processing plants which need renovation. To be renovated and maintained in Minnesota, the establishment of processing plants which do not exist for commodities for which there is a current demand and the establishment of fresh market packing houses which enable large numbers of growers to excess

the very large fresh markets of the Twin Cities, Chicago, St. Louis, Kansas City, New York etc. A third area of major concern is the existence of available technology in the state that would be supportive of these developing industries. Currently, Minnesota is far behind her competitors to the east namely Wisconsin, Michigan, New York etc. in the number of people in the state who are able to assist in production, handling, research, and marketing of processed and fresh vegetable crops.

Other vegetable crops besides asparagus, broccoli, and cauliflower also have potential for growth in the state. These include a number of the root crops, the leaf crops and legumes. The same concerns exist for those crops as was described above for asparagus, broccoli and cauliflower.

mp

CC: R. Sauer

AGRICULTURAL EXTENSION SERVICE

UNIVERSITY OF MINNESOTA

Department of Horticultural Science
Alderman Hall
1970 Folwell Avenue
St. Paul, Minnesota 55108

April 22, 1982

TO: County Extension Directors
Area Extension Agents

FROM: Luther Waters
Extension Vegetable Specialist

SUBJECT: Jerusalem Artichoke Production in Minnesota

Over approximately the last 6 months, I have received numerous calls regarding Jerusalem artichoke production in Minnesota. More specifically the calls relate to contracts being offered to growers to produce the crop and use the tubers and tops for alcohol production. The traditional use of the crop (tubers) is as a gourmet vegetable. It is high in sugars and quite sweet.

Realistic tuber yields are approximately 15 tons per acre. Yields for tops depends on when they are cut and the variety. There are 2 varieties currently available - French Mammoth White and Oregon White. A new variety from Canada, 'Columbia', will be available sometime in the future. The Canadian variety is a shorter plant and flowers earlier.

Production Problems

Planting — Tuber pieces of 25-50 gms per piece are planted in rows similar to potatoes. Spacing in the row is 12-24 inches and 30-36 between rows. The literature indicates that it is possible to plant in the fall before the ground freezes or in the early spring. A fall planting at the Staples Irrigation Center in 1980 was almost completely killed over the winter.

Fertility — We know very little about crop response to fertilizer in Minnesota but it should respond in a manner similar to sunflowers since it is a relative.

Weed Control — Jerusalem artichokes are extremely vigorous plants and will compete strongly with weeds. One or 2 cultivations when plants are small should suppress most weeds but expect some problems.

Insects — Insects are not normally serious problems but should large acreages develop, insect problems can also be expected.

(OVER)

Diseases — There is one serious problem - Sclerotinia. They are very susceptible and it is probably the same organism that infects sunflowers and beans. There is no cleared chemical control to my knowledge. Some other disease problems can be expected with large acreage development.

Maturity — The two current varieties in use flower quite late (late August-September). Consequently, there is some risk associated with early severe freezing temperatures.

Harvesting — The tuber crop is harvested in a manner similar to potatoes with some exceptions. The tubers are smaller than potatoes and are more strongly attached to the roots. They can also be expected to be in a large clump under the plant and sometimes not easily separated. The tops are massive and may constitute a major problem in the harvesting operation if not managed properly.

Storage — Storage can be a problem. The tubers should be kept just above freezing in a very high humidity. Diseased tubers may rot in storage. The most common storage methods is in polyethylene bags at 33-34°F.

Markets — The only stable market is a limited one for the tubers as a gourmet vegetable. The forage value of the tops is very limited compared to other crops available. For alcohol production, tubers, and possibly tops, may have value but to my knowledge there are no existing processing plants and I am not aware of concrete plans to build any in Minnesota. Currently, the biggest current market is for seed tubers required for expanding production.

Other Problems

If a grower decides to stop producing Jerusalem artichokes, they may be a weed problem for one season. If sclerotinia is encountered during production, the disease may be expected to build up.

As you encounter questions about Jerusalem artichoke production, I hope these comments will be helpful to you. The results of our 1981 research will be available soon, but they do not deal with every possible problem you may encounter.

UNIVERSITY OF MINNESOTA
TWIN CITIES

Department of Agronomy and Plant Genetics
Agronomy Building
1509 Gortner Avenue
St. Paul, Minnesota 55108
(612) 373-0855

February 8, 1983

Dr. Richard J. Sauer
Minnesota Agricultural Experiment Station
Coffey Hall
St. Paul Campus

Dear Dr. Sauer:

I am responding to your letter of February 2. The Advisory Commission On Agriprocessing does not necessarily have to restrict crop production to Minnesota because unconventional crops are often grown elsewhere and processed here. When I worked on the pyrethrum crop, McLaughlin Gormley King Co. of Minneapolis was the world's largest manufacturer of pyrethrum insecticide but obtained all of their raw product from Kenya, Africa. Likewise until we released Mingren sunflower, the Fisher Nut company of St. Paul relied entirely on other states and countries for their nuts. (Manager Lou Smerling told me about 25 years ago that Georgia was their nearest nut supplier.)

Producers of field crops in Minnesota are informed and flexible and their choice of crops each year is determined by expected return which is based on production costs, expected market demand, and government programs. Consequently, there is no problem in getting farmers to produce unconventional crops if the production appears economically practical. Unconventional crops are unconventional because there is something wrong with them. But new varieties, new cultural practices, new pesticides, new farm machinery, or new markets have made production of some previously unsatisfactory crops practical in Minnesota. And this continual evolution will continue. For example, sunflower research started in 1948 and sunflower was tested in comparison to other oilseed crops such as soybean, flax, rape, and safflower. At the same time we recognized that the only use of sunflower in Minnesota was in the form of birdfeed imported from California. Consequently, we started a program to work on both varieties for birdfeed and to increase the oil percentage for a potential oilseed crop. A birdfeed variety was released in 1953. Minnesota sunflower acreage increased from 300 acres to nearly 30,000 acres by 1963. We also noted that all of the in-shell confection sunflowers being sold in Minnesota were being imported from other states, mainly California. Consequently, research was started to develop a variety that was large seeded and could be dehulled with an oat dehuller. This led to the release of Mingren in 1963 which was grown on more than 100,000 acres in North America by 1970. Research to develop a high oilseed variety progressed to where by 1960 lines that were 36% oil were developed. But in 1961, after many years of trying, we obtained some Russian material from the USDA and from Western Europe. Our 1961 data showed that Russian varieties yielded satisfactorily here and had over 40% oil. Our 1961 data were published, given nationwide distribution, and those

were the first data in the United States showing that high oil Russian varieties were truly high oil and would produce satisfactorily here. This led to the start of the oilseed industry in 1966 in the United States which initially was started by Cargill in Minnesota.

Field crops that produce the greatest yield of product per acre have the greatest potential because the product can often be modified by processing to various desired characteristics. Some categories of unconventional field crops for Minnesota follow:

1. Fiber, Pulp, and Phytomass Crops - Our research in cooperation with a Minnesota company in hemp almost led to contract production in the 1960's but the marijuana controversy stopped it. Kenaf was also promising but, in contrast to hemp, seed would have to be imported every year. Pulp sorghums of various species are productive but with surpluses of aspen, etc. there is no need for it. For phytomass (incorrectly called biomass) or gasohol, sweet sorghums offer the greatest possibility. Research on sunchokes in the 1960's and Jerusalem artichoke in the early 1970's was not continued because it appeared that other crops had higher priority on my time. The work was not renewed because Horticulture started research on Jerusalem artichoke.

2. Carbohydrate feed grain crops - Grain sorghum is second to corn in productivity in southern Minnesota, but it will take some change to expand a No. 2. However, grain sorghum would be a good feed grain crop for northern Minnesota except for the sterility problem caused by cool August nights. We plan to test some new cool-set varieties in 1983.

3. Birdfeed crops - Visits with birdfeed dealers in the mid-1950's led to extensive work with millets, sorghum, canarygrass, rapes, hemp, Nigerian thistle, pigeonpea, vetch, buckwheat, and numerous other species to determine if a more complete line of birdfeed crops could be grown in Minnesota. Minnesota became the leading state in birdfeed conditioning (processing). Some movement of Minnesota birdfeed plants to North and South Dakota have recently occurred but Minnesota is still near or at the top.

4. Oilseed crops - Sunflower has the potential of producing more oil per acre than any other crop in Minnesota. Another idea is to breed it for high protein and low oil to improve nutritional quality. This has not been attempted although I have suggested it to some commercial company breeders. Research I have done on nutritional quality of sunflower indicates that it can be used as a staple food crop and consequently breeding for high protein would make it a superior crop for this purpose. Safflower could be a good crop for Minnesota if the sterility problem was solved. It has some agronomic and quality advantages over sunflower. Rapes, crambe, and other oilseed crops can be grown here but price and markets are not enticing.

5. Pulse or protein concentrate crops - Research on pulse crops was started in 1948 with fieldpea and in 1953 with fieldbean. The fieldbean industry has grown from 1 plant in Oslo started in 1963 to probably over ten plants in rural Minnesota. Each plant provides year round employment for several employees. The owner of the largest plant came here from Michigan about 12 years ago, and in negotiating with

state business and area development officials as to where to locate his first plant he stated that experiment station agronomic research publications are what brought Minnesota to his attention and influenced him to locate here. The potential for increased pulse crop production in Minnesota is good because I think that our production costs are lower than for some other areas where the crop is produced. However, pulse crops are in surplus and unless export markets are opened up or unless the American diet is altered there is little room for expansion. Government policies could help; for example, replacement of some food stamp and welfare cash payments with commodities such as dry beans, dry peas, etc. These unprocessed commodities are very cheap and can be stored without great expense. Consequently, many of our food reserves would be better in the form of pulse crops than in the form of grain commodities. Fieldpea acreage has not increased like that of fieldbean. Nonetheless, fieldpea has nutritional advantages over fieldbean. There is no flatulence problem with the crop, but despite these advantages there is little hope for Minnesota to develop a large industry in fieldpea because there is little market demand for more than is being produced already. Aside from their use for human food, pulse crops can replace the processed oilmeals and urea that Minnesota livestock farmers buy for protein concentrate. Fieldpea, fababean, and lupine have potential but yields of fababean and lupin need to be increased and a serious disease problem in lupine must be solved. Fieldpea yields are low, but it is interesting that fieldpea is an important food and feed crop on expensive farm land in Holland.

6. Condiment crops - Mustard of various kinds can be grown here and conditioning industry has been established in Minnesota, but most of the acreage and industry has slipped over into North Dakota. The export market is large and is being filled by Canada. Coriander is adapted here.

7. Export crops - Most of the crops in this report are export crops but buckwheat, annual canarygrass, and adzuki are especially dependent on export. A few years ago it became possible to economically export buckwheat to Japan and we were ready with the varieties and techniques to supply this market. However, there has been no improvement in buckwheat varieties. The only thing that changed was the potential for exporting to Japan and this market is potentially much greater. Annual canarygrass is a successful new crop and the USA (Minnesota, North Dakota) is a major exporter whereas 25 years ago the USA was importing 20 million pounds/year. Great expansion is not likely because its only use is birdfeed but it could be used for human food and that development would be a great boost for the crop. We started research on adzuki in the early 1960's. It has great potential from a market standpoint but a disease is causing so much trouble that large expansion in Minnesota looks risky. Again the market is based on the potential for export to Japan because the USA market is not large. The development of these and other unconventional crops depends a great deal upon government policies that are not part of agriculture. Several unconventional crops could expand greatly in Minnesota if the United States dollar and foreign policy encouraged exports. It is unlikely that this will occur because unions and other nonagricultural interests will not permit unrestricted entry of manufactured goods that will allow the other country to purchase Minnesota farm products.

8. Soil cover crops - Research on crown vetch started in 1955 and in the late 1960's Minnesota led the USA in certified seed production but apparently market demand did not materialize. Nonetheless, this cover crop could be more extensively used on sloping areas for permanent soil cover.

9. Industrial crops - Species of interest to industry are generally unsatisfactory agronomically.

10. Naked-seeded pumpkin is a promising snack and potential dual purpose crop, but commercial exploitation is dependent upon plant breeding. It is a good food crop for home production and consumption now.

Cordially yours,

Robert G. Robinson
Professor

RGR/gl

cc: Dr. Roy Thompson
Dr. H. W. Johnson

4 February 1983, Volume 219, Number 4584 SCIENCE

Perspective on Agricultural Research

Recent commentators on the status of agricultural research have expressed concerns about long-range program priorities, resource allocations, and the capacity of the system to provide leadership in fundamental aspects of the agricultural sciences. The discussions have involved primarily the programs of the federally and state-supported research and education system. Some critics contend that the system is giving insufficient attention to basic research. Others argue that the system has demonstrated its capacity to adjust and accommodate to new scientific and technological developments. Finding a consensus is a priority concern of the Department of Agriculture's Science and Education agencies and our partners—the state-based institutions, the Agricultural Experiment Stations, and the Cooperative Extension Service.

Over the next 12 months, our agencies will be taking a new look at research priorities and directions. An assessment will be made of the long-term food, fiber, and forest products needs for the 21st century and the role of science and education in meeting those needs. A 5-year plan will then be prepared for research, higher education, and extension programs, including an examination of the roles of federal, state, and private agencies.

The Agricultural Research Service has already prepared a long-range strategic national research plan. Through its Office of Education, it is examining the supply-demand picture for agricultural expertise. The Forest Service, in cooperation with forestry schools, recently completed a 10-year national program of research on forests and associated rangelands. The Cooperative State Research Service is looking to new approaches for identifying research priorities. The Extension Service is completing a comprehensive study of its program designed to develop guidelines for its activities in the 1980's and beyond. A common denominator in all of these studies is a reevaluation of the role of research and development in relation to expanding opportunities for institutional-industry interactions that can strengthen our national research and education capacity in agriculture.

This is a time to intensify the use of the scientific and educational resources of the agricultural community and to find answers to critical questions. Will it be possible to reduce severe soil erosion and increase the water use efficiency of crops? Will new developments in molecular biology provide a much better understanding of genetic linkages to basic physiological functions? What new scientific developments can be employed to expand the use of agricultural products and develop new markets? Finally, what programs can be instituted to encourage more high-potential students to prepare for careers in the agricultural sciences? Already, new developments in plant and animal genetics and in the field of bioregulation promise to increase yields of major food and fiber crops and improve the efficiency of animal production. Nutrition research must address the special dietary problems of the more vulnerable segments of the population, including children and the elderly. Research must also be carried out on the effects new production practices might have on the composition of the food we eat. Other areas needing attention concern the impact of technology on the environment and the effects of changing social, political, and economic conditions on the quality of family life, especially in rural America.

Today's budgetary realities may slow adjustments, but we must prepare to seize promising scientific developments in the years ahead and apply them to our food and fiber production system. Scientists and institutions involved in agricultural science and education are not only receptive to new ideas, but anxious to adopt approaches that will bring stronger programs. The foundation for science and education is strong within the agricultural sciences and has demonstrated a capacity for change and progress. American agriculture is at a crossroads of significant proportions, and all those involved must reexamine ways of collaborating and marshalling resources for the future.—ORVILLE G. BENTLEY, *Assistant Secretary, Science and Education, Department of Agriculture, Washington, D.C. 20250.*

21 January 1983, Volume 219, Number 4582

SCIENCE

High-Technology Jobs

Unemployment was a dominant issue in many states in the last election, and it could remain so for some years. The older industries such as steel and autos may eventually partially recover, but they face great international competition. Governors of states are under pressure to do something that promises to lead to more jobs. Many governors are pinning their hopes on high-technology industries, which have grown while other industries have been stagnant or decaying. The National Governors' Association has sponsored meetings and committee work on the topic. About half of the governors are fostering some kind of activity, such as the formation of an advisory council on high technology, in their own states.

Representing the National Governors' Association, Charles S. Robb of Virginia stated in testimony before a congressional subcommittee* that "the industrialized world stands on the threshold of a technological revolution that will change the American way of life and the composition of the nation's work force as much as the industrial revolution did a century ago. . . . Our ability to lead this technological revolution, as indeed the United States led the industrial revolution a century or so ago, will bear directly on our share of world markets—a share that will continue to erode unless we act promptly and wisely." Governor Robb also touched on the importance of interactions between universities and industries in fostering innovation in high technology.

At a juncture at which governors are under pressure to increase jobs, they find themselves with limited resources. At the same time, outlays for education are large. They are aware of activities around Route 128 in Massachusetts and near Palo Alto in California. They have to ask themselves whether their state universities can do what Stanford and the Massachusetts Institute of Technology have done for their regions. If the recession continues, other universities can expect increasing pressure and questions from governors and legislators.

There is a large gap between a belated recognition of the importance of high technology and achieving something in the way of jobs. The translation of research into substantive applications usually takes a decade or more. The transformation of small innovative companies into giants takes time. Governors may be well advised and have great plans, but their tenure is limited. Many were swept out of office in the last election. Their successors will wish to formulate their own programs.

For alert states there may be a partial solution for some economic problems. Many of the high-technology companies currently centered on Route 128 or in Silicon Valley are looking elsewhere for expansion as costs of labor, housing, and land have become excessive. A congressional staff study† describes responses of 671 companies to a questionnaire concerning factors that influence their decisions to locate facilities.

The high-technology companies are science-based. Research and development outputs are more important to them than to other manufacturing industries. Major determinants in their decisions to locate facilities include availability of skilled labor, labor costs, and state and local taxes. Other factors include community attitudes, costs of property and construction, transportation systems, available area for expansion, good schools, and proximity to recreational and cultural resources. The study indicates that high-technology companies plan to expand at highest rates in the Midwest, Southeast, Southwest, and Mountain and Plains states. Where they will actually locate may well depend on local initiatives. Michigan, North Carolina, and Arizona have been especially active in seeking to foster high technology and are meeting with some success. In the majority of states there has been more talk than action.—PHILIP H. ABELSON

*Testimony before the Subcommittee on Science, Research and Technology, Committee on Science and Technology, U.S. House of Representatives, 29 April 1982. †"Location of high technology firms and regional economic development," staff study prepared for the Subcommittee on Monetary and Fiscal Policy, Joint Economic Committee, 1 June 1982.

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BIOTECHNOLOGY RESEARCH CENTER

1. Objectives:

The basic goal of the Biotechnology Research Center is to bring together the academic and private sectors, with the support of state government, to build the research and educational programs that will contribute to the economic growth of Minnesota through the development of new biotechnology-based industry. We intend to

- Optimize the utilization of scarce resources of trained people and facilities through cooperative research programs;
- Build on existing nodes of excellence in order to achieve the critical mass necessary for state-of-the-art research;
- Facilitate collaboration between university and industrial researchers;
- Educate people to understand and participate productively in new developments in biotechnology.

2. Scope

The Biotechnology Center will include researchers and associated facilities in basic biology, engineering, agriculture, and the health sciences. Emphasis will be on basic research and education that will lead to the scientific and manpower base required for the development of new biotechnology industry. Potential areas of development include

- Molecular approaches to plant and animal breeding
- Microbial and biochemical engineering
- Human and veterinary pharmaceuticals
- Biomedical devices
- New clinical diagnostic approaches
- Microbial approaches to pollution control

3. Existing strengths in university and community

The University of Minnesota has an extremely broad range of high quality research programs in biochemistry, genetics, microbiology, chemical, mechanical, and electrical engineering, agronomy and plant genetics, veterinary biology, immunology, laboratory medicine, surgery, and pharmacology. These are complemented by major state and regional companies involved in the development, manufacture, and sale of agricultural commodities, foodstuffs, pharmaceuticals, medical products, and biomedical devices. In addition, numerous smaller firms are springing up that are attempting to commercialize new developments in recombinant DNA technology, immunology, and clinical

diagnostic techniques. Particular strengths exist in the following areas:

Microbial transformations
Plant molecular biology
Pharmacology
Animal breeding
Biomass conversion
Biomedical devices and biomaterials
Clinical diagnostics
Immunology and monoclonal antibodies

4. Other biotechnology centers

Recent excitement about the scientific and economic potential of recombinant DNA technology has led to the establishment of a number of industry-university programs. The Monsanto programs at Harvard and Washington University, the Whitehead Institute at MIT, and the Center for Biotechnology Research at Stanford and the University of California, Berkeley, sponsored by Engenics, have drawn the most attention. Lehigh University has established a Biotechnology Research Center focused on industrial microbiology, and the University of Maryland Baltimore County has developed an undergraduate program in applied molecular biology. A substantial number of academic researchers, notably at Harvard, MIT, Stanford, California, and Wisconsin, have participated in the establishment of genetic engineering companies.

However, to the best of our knowledge, only North Carolina has proposed a university-industry-government collaboration of the scope envisioned here. Like our efforts, it is new and still on a small scale; but it is motivated by the same perception that concerted effort can have a major impact on the state economy. This emphasis on arrangements that will have broad benefits, rather than being advantageous only to a single company or a small group of researchers, seems both novel and particularly appropriate to the social and political values of Minnesota.

5. Benefits to Minnesota

Quality of the University of Minnesota: The new resources will enhance already strong programs and enable some types of research that cannot now be done because of lack of appropriate facilities or sufficient personnel. The coordinating activities of the Center will catalyze collaborations and assure efficient use of resources. Increased interactions with industry will lead to new ideas and exchange of personnel and facilities. The existence of the Center will bring favorable publicity to the University, enhancing our

ability to attract outstanding faculty and students and to garner external support.

Jobs: The new research ideas and trained personnel will lead to many new jobs, if past experience with high technology is any indication. As new companies are formed and existing ones expand, employment opportunities are created not just for scientists and managers, but also for people involved in production, marketing, clerical and accounting work, maintenance, and construction.

Business: Continued economic health, for Minnesota and for the United States, depends on the commercial development of new scientific and technical ideas. Traditionally, business has depended on the universities for new ideas and trained people. Today these needs have become even more urgent. In biotechnology, ideas are emerging so rapidly that more efficient communication between university and industrial laboratories is imperative. In recombinant DNA technology and fermentation engineering, the shortage of qualified scientists is severely hampering industrial growth. The new educational and communications programs, and the exchanges between university and industrial researchers that the Center will develop, should provide the collaborative and consultative arrangements that business needs for continued growth.

Prestige: Biotechnology is one of the most exciting developments of recent times. It seems likely to revolutionize many industrial, agricultural, and medical processes. Those states that are leaders in biotechnology will achieve not only economic power, but also the stature that comes with recognized accomplishment by industry, university, and government working together in setting a model for others. Successful implementation of the Biotechnology Center will maintain and enhance Minnesota's already fine reputation for intellectual, political, and social innovation.

6. Plans of the Biotechnology Center

Research and education: New research facilities, replacement of obsolescent equipment, renovation of space, and seed money for new research ventures are required to conduct modern research in biotechnology at the U of M. Sophisticated equipment will be available to industrial as well as academic researchers in cooperative ventures. Increased fellowship support, and some new laboratory and degree

programs, are needed to train young scientists for work in biotechnology.

*Pilot plant scale fermentation facilities
*Research equipment
*Remodelling of laboratory space
*Competitive grants program
*Predoctoral and postdoctoral fellowships
*Equipment for recombinant DNA lab instruction
*Instructional program in fermentation engineering

University-industry collaboration: New cooperative educational ventures between university and industry will be developed. A program of Corporate Fellowships will bring industrial scientists into university laboratories to learn new research methods and ideas, while university faculty may also take sabbatical leaves in industrial laboratories. The UNITE system will be expanded to include the St. Paul campus and the Health Sciences, and biotechnology industry. Joint university-industry conferences and lectures will be developed. A cataloging of biotechnology research activity in Minnesota will be begun, to enhance communication among researchers.

*Industry/university sabbatical exchange programs
*Corporate fellowships
*Cooperative work-study programs
*Extend UNITE system
*Sponsor conferences on biotechnology topics
*Industry-university joint sponsorship of lectures
*Development of regional biotechnology data base

Topic areas: The major scientific areas have been listed earlier. They include

*Molecular approaches to plant and animal breeding
*Microbial and biochemical engineering
*Human and veterinary pharmaceuticals
*Biomedical devices
*New clinical diagnostic approaches
*Microbial approaches to pollution control

These are all areas of current strength, but ones where new resources and enhanced collaboration would produce real excellence.

7. Management of the Center

The overall supervision of the Biotechnology Center will be the responsibility of an Advisory Council, consisting of the deans of the involved colleges of the University, representatives of biotechnology-related industry, and the public. The Director of the Center will be a faculty member of the University, appointed by the

President. The Advisory Council, or an Executive Committee thereof, shall in consultation with the Director appoint such committees or task forces as are necessary to carry out the work of the Center. The management structure must be approved by the Board of Regents.

8. Growth plan and budget

We shall begin by emphasizing the research collaboration and educational aspects of the program, that can be accomplished without large investment, and by acquiring some necessary facilities and equipment. As matching contributions grow, we will attempt to build an endowment for two professorial chairs in fields related to biotechnology, to attract internationally prominent scientists to the University who will serve as foci for the program. With the exception of these two positions, we will not seek to add more faculty through this program, but rather to maximize the effectiveness of existing academic and industrial scientists. This will be accomplished by fostering communication and collaboration, by providing research support through fellowships and a competitive grants program, by devising new educational programs, and by sponsoring industry-university exchanges.

CBS FACULTY MEETING
239 Gortner
Friday, February 11, 1983
3:30 p.m.

Subject: The Development of Fermentation Biology and Technology at the University of Minnesota

For the past two or three years, in concert with college long-range plans, CBS faculty members have been involved in numerous discussions with their colleagues in other colleges relating to the development of biotechnology at the University. In a variety of formal and informal meetings these discussions have also been extended to involve many members of the local industrial community. They resulted in the development of a Biotechnology Research Center at the University which is chaired by Dr. V. Bloomfield.

In the past week the Minnesota High Technology Council, a lobbying support group for the University which consists of representatives from many major Minnesota corporations, urged the Vice President to give his approval for their lobbying at the legislature in behalf of funding for biotechnology. The Vice President agreed, under circumstances which I shall relay to you at the faculty meeting. Subsequently, a few faculty members were called together to determine what initial information could be provided to the High Technology Council to make their efforts meaningful. The attached three pages were developed in an area which would involve faculty members from many different colleges.

The purpose of the faculty meeting is to discuss the role CBS should play in this new opportunity. Faculty members from other interested colleges will also be present.

Development of Fermentation Technology at the University of Minnesota

Goals

1. To establish as rapidly as possible a training program in Biotechnology using newly hired Core personnel and faculty from cooperating departments.

2. To develop a high quality research program which will serve as a resource for fostering new industrial development in Minnesota as well as training technical personnel.

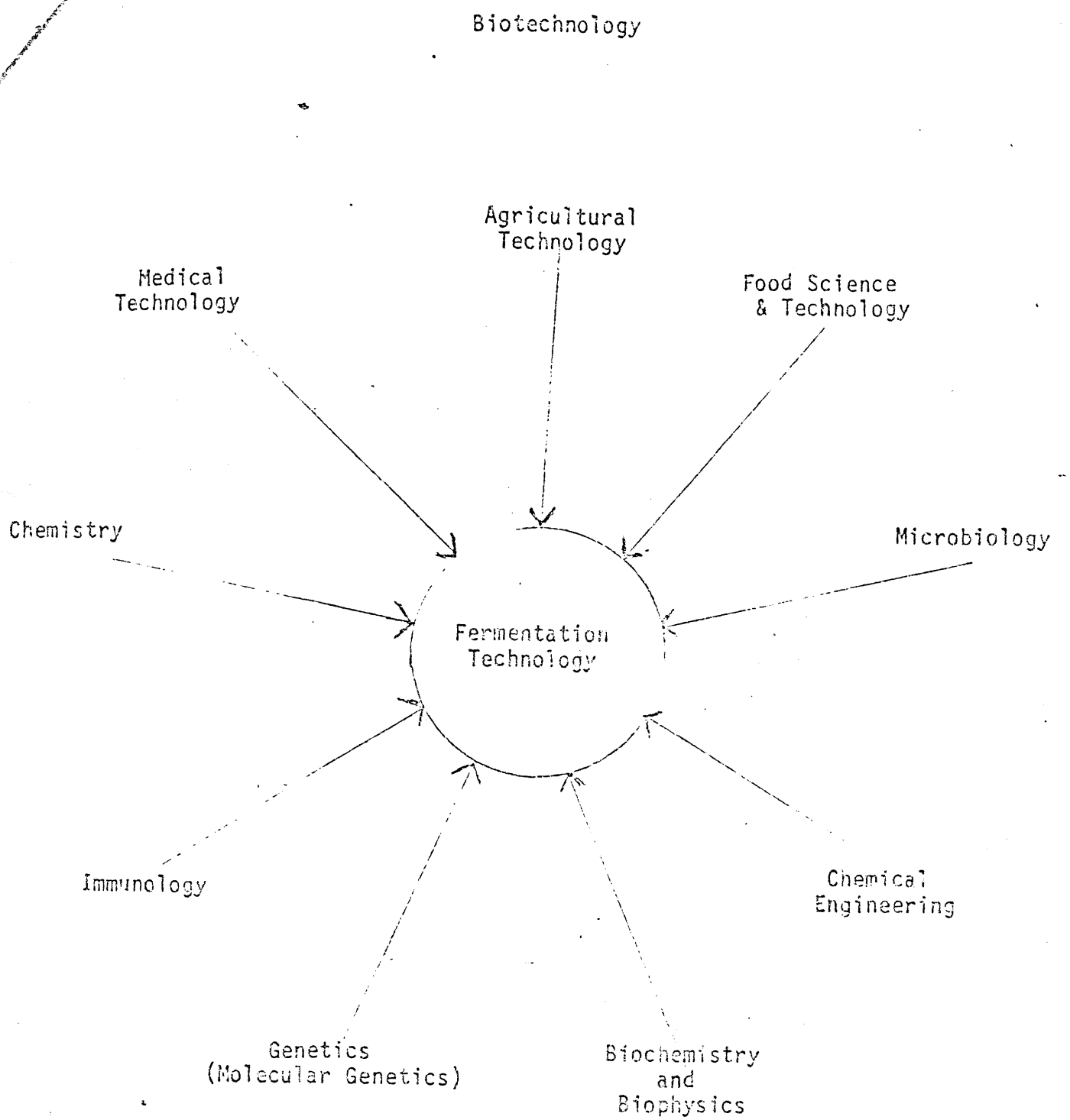
Fermentation Technology - The Core

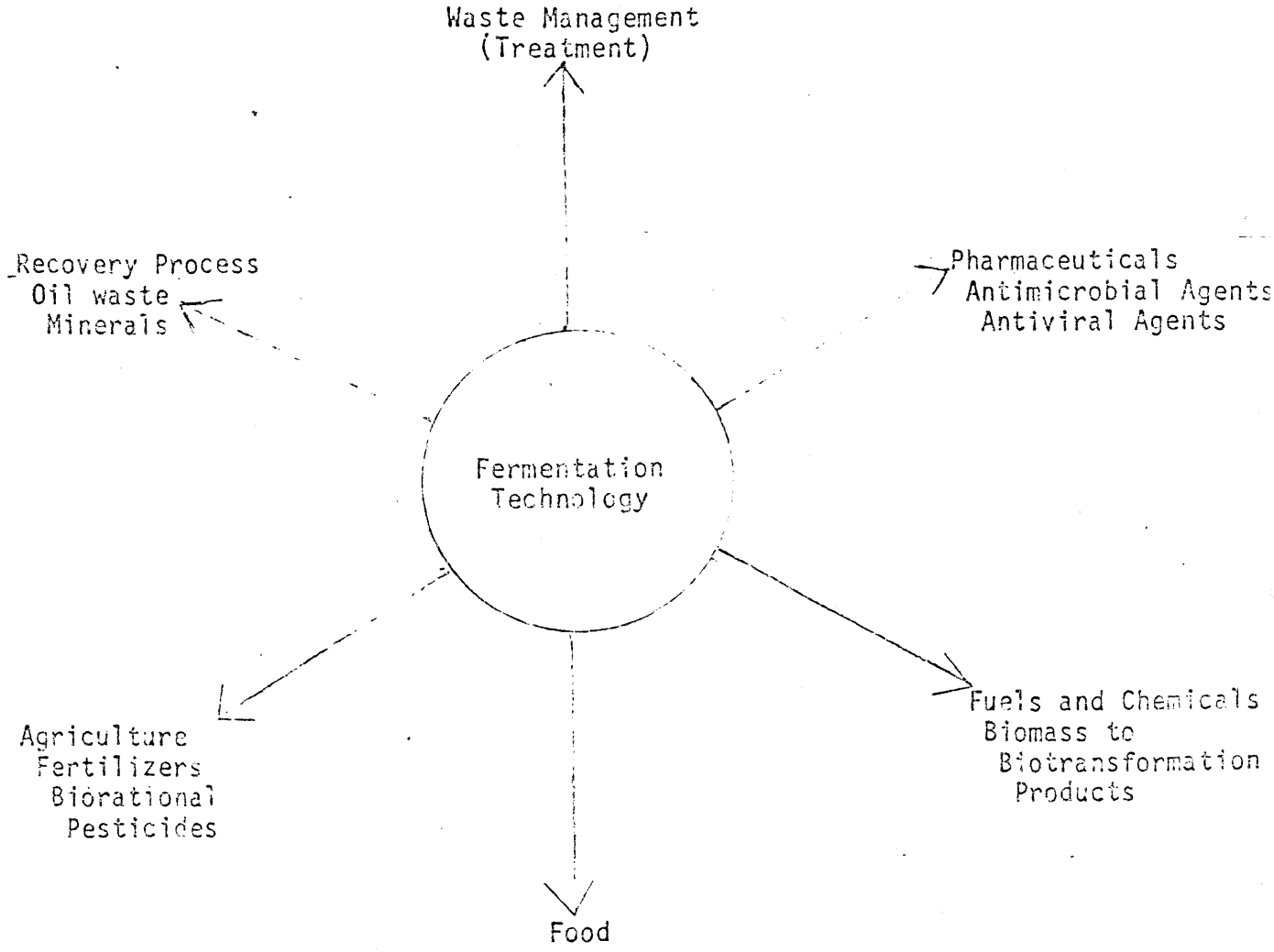
Equipment

Computer controlled fermentation facility	$1,000,000	
Centrifuges	35,000	
Ultra filtration unit	25,000	
Chemical extraction and recovery equipment	100,000	
Cell dryers and freeze dryers	100,000	
Preparation room and equipment	50,000	
Culture cultivation room and equipment	20,000	
Sterilizers	60,000	
Washers and dryers	100,000	
Development of laboratory space	500,000	
		$1,990,000

Faculty Acquisitions	Salary and Fringe Benefits	
Immobilized enzymes in cells	$ 72,000*	
Streptomyces microbiologist	40,000	
Mycologist	40,000	
Fermentation microbiologist	40,000	
Tissue Culture specialist - Plant	40,000	
Tissue Culture specialist - Animal	40,000	
Product Recovery expert	40,000	
		$ 312,000
Technicians to serve facility (2)	$ 40,000	
Grad Student stipends (12)	90,000	
Post Docs (6)	120,000	
Secretarial (2)	30,000	
		$ 280,000
		$2,582,000

*The $72,000 item is to cover the salary of a Director. Depending on the disciplinary area of the Director, the sum could be attached to any one of the other specialists that are identified.


Biotechnology
Agricultural Technology
Medical Technology
Food Science & Technology
Chemistry
Microbiology
Fermentation Technology
Immunology
Chemical Engineering
Genetics (Molecular Genetics)
Biochemistry and Biophysics


Waste Management
(Treatment)
Recovery Process
Oil waste
Minerals
Pharmaceuticals
Antimicrobial Agents
Antiviral Agents
Fermentation
Technology
Agriculture
Fertilizers
Biorational
Pesticides
Fuels and Chemicals
Biomass to
Biotransformation
Products
Food

VI.

KEEPING THE PRODUCER IN BUSINESS

TASK FORCE REPORT

GOVERNOR'S ADVISORY COMMISSION ON AGRIPROCESSING

KEEPING THE PRODUCER IN BUSINESS TASK FORCE

Minnesota Commodity Exports

1. Instate Tanning of Beef Hides

Pos. Beef leather has survived the competition of plastics. Beef hides processing tanning and manufacturing of all leather goods increase in value and provide jobs in Minnesota. Japan representatives stopped at the plant in North Redwood and by looking at a sample of hide were able to tell geographically where it was from and also the sex, age and breed of the animal.

Neg. Instate tanneries would stop related jobs and transportation of three car loads of hides from one plant per week to Germany and Japan.

Pollution Control Agency would have to find a way to accept tanneries in the state.

2. Air Freight Quality Processed Beef

Pos. Out-of-state locker plants process fresh quality identified boxed meat. Ship by truck on schedule to Minneapolis/St. Paul air freight port--fly to new pilot project distributing markets worldwide.

Young bull beef may be in demand over steers in certain markets.

Neg. Trade barriers on beef in foreign countries. Horses slaughtered at Blaine, Minnesota -- 40¢ @ lb. live weight boxed fresh horse meat shipped to O'Hare Airport by truck -- 40¢ @ lb. air freight to France and fresh horse meat consumed in France within seven days of slaughter.

Catfish air freight daily to Texas from Iceland. Shrimp and Lobster air freight daily from Gulf to North Dakota. Fresh turkey meat air freight from Willmar to East Coast.

3. Grain Pipe Line

Pos. Certain areas utilize movement of grain through pipelines. Provide jobs to build lines, as in Denmark. New service to isolated transportation areas. Save Minnesota roads.

Neg. Pipeline would compete with truck and rail transportation.

4. Sell Minnesota Agriculture Products on Direct Basis to Foreign Countires

Pos. Cattle, hogs, sheep, turkeys and specialty crops -- sell direct.

Neg. Transportation -- difficulty in finding and establishing markets.

5. Councils and Commodity Associations

Pos. Keep Governor's office informed of all trade groups and their schedules coming to Minnesota.

Neg. Governor would be unable to meet with all of them.

6. Sheep Industry -- Feed and Sell Buck Lambs

Pos. Buck Lambs -- more muscle -- less fat. Consumers like them better. Potential use of pelts for leather.

Neg. Difficulty to establish a wide demand and change habits of the trade.

Watertown, South Dakota, is building new sheep slaughter plant.

7. Sunflower Seed Oil as Fuel

Pos. 12 acres of sunflower oil provides fuel for 320-acre farm from on-farm crusher.

Neg. Cost of crusher hard to amortize.

8. Governor Host Importing Embassy Representatives

Pos. Personally invite foreign importing countries. Show them what we have to sell in Minnesota, ask them what they can use and in what form and type of transportation. Offer to barter to open some doors.

Neg. Big load for the Governor to carry and time consuming.

9. Rabbit Industry

Pos. Building a processing plant in Goodhue. There is a commercial operation by Bird Island. It is the fastest growing 4-H project. Rex rabbits are used for fur and white rabbits are used for meat. 600 rabbits can provide a family living and cost about $10.00 a piece to start. It would create jobs for processing and feed industry.

Neg. Establishing wide use and acceptability.

10. Encourage Corn Processing Plants at Marshall and Mankato

2/9/83
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An additional recommendation of the Keeping the Producer in Business Task Force was the adoption of the Minimum Price Commodity Bill. While the Commission feels that the discussion of this issue has been very valuable in drawing attention to the farmers plight, the individual members have not had time as yet to fully read and understand the bill and its ramifications. A copy of the proposed bill is attached.

PRELIMINARY DRAFT 1/28/83

A bill for an act

relating to agriculture; providing for the prevention of economic waste in the marketing of certain agricultural crops produced in Minnesota by establishing minimum prices; providing for supply management and orderly marketing, administration, and enforcement; imposing a penalty; proposing new law coded in Minnesota Statutes, chapter 17.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

Section 1. (LEGISLATIVE INTENT.)

Sections 2 to 7 are enacted in the exercise of the power of the state to protect and further the public health and welfare. It is declared that Minnesota agriculture is affected with a public interest in that:

(a) The production, processing, and distribution of agricultural products constitute a paramount industry of this state which provides substantial required revenues for the state and its political subdivisions, provides employment and a means of livelihood for a substantial portion of the population of Minnesota, and furnishes essential foods that are vital to the public health and welfare;

(b) During times when the state's producers have received parity prices for their commodities, the economy of the entire state has prospered. Parity prices promote balanced economic growth because the income earned from agricultural production has a multiplier effect in the state economy by creating more jobs and tax revenue as raw commodities are marketed, processed, and distributed.

(c) The stabilization, maintenance, and expansion of Minnesota agriculture and domestic and foreign markets for its products are necessary to assure the consuming public an adequate supply of foods which are indispensable in a proper human diet, to protect for the state and its political subdivisions

a necessary source of tax revenue, to provide and maintain an adequate standard of living for a large segment of Minnesota's population, to maintain proper income levels for those engaged in agriculture, and to maintain existing employment; and

(d) The inability of individual producers to secure a reasonable return and parity for Minnesota grown agricultural products prevents producers from maintaining a reasonable standard of living, increases economic insecurity due to unemployment, and is a matter of general interest and concern requiring appropriate action by the state to reduce unemployment, financial depression, and economic instability. The depressed income of agricultural producers has resulted in a marked decrease in the number of producers and is a deterrent to young persons engaging in agriculture.

An emergency now exists resulting from the depressed condition of agriculture in this state and particularly the loss of income to those engaged in the production of agricultural products. As a result, the program established in sections 2 to 7 should be pursued with all deliberate speed, with the intent of providing producers the chance to earn 100 percent of parity in the marketplace.

Sec. 2. (17.703) (DEFINITIONS.)

Subdivision 1. (SCOPE.) For the purposes of sections 2 to 7, the terms defined in this section have the meanings given them.

Subd. 2. (AGRICULTURAL COMMODITY.) "Agricultural commodity" means milk, corn, soybeans, wheat, oats, rye, barley, buckwheat, flaxseed, sunflowers, sorghum, peas, beans, or any other commodity as determined by the commissioner.

Subd. 3. (STATEWIDE AVERAGE COUNTY LOAN RATE.) "Statewide average county loan rate" means the average of all county loan rates in the state.

Subd. 4. (COMMISSIONER.) "Commissioner" means the commissioner of agriculture.

Subd. 5. (COUNTY LOAN RATE.) "County loan rate" means the amount of money the United States department of agriculture will loan per bushel on an agricultural commodity in each county of the state.

Subd. 6. (PERSON.) "Person" means an individual, corporation, partnership, trust, association, cooperative association, or other business unit or organization.

Subd. 7. (PROCESSOR.) "Processor" means a person who buys or takes title to or possession of an agricultural commodity identified in subdivision 2 for the purpose of processing or manufacturing it, or selling, reselling, or redelivering it in its original or processed form, including a person or exchange that conducts such a business and a person or exchange that buys the commodity from the producer for the purpose of reselling it to a person or exchange that conducts such a business.

Subd. 8. (PRODUCER.) "Producer" means any person who is engaged in the business of growing or producing any agricultural commodities within the state or any shareholder of the commodities.

Subd. 9. (WORLD CARRYOVER STOCKS.) "World carryover stocks" means the total quantity of world stocks of any agricultural commodity in excess of consumption or utilization on an annual basis.

Subd. 10. (WORLD USE.) "World use" means total world consumption or utilization of any agricultural commodity on an annual basis.

Sec. 3. (17.704) (MINIMUM PRICE.)

Subdivision 1. (AUTHORITY OF COMMISSIONER.) The commissioner shall establish the minimum price of any agricultural commodity listed in section 2, subdivision 2 according to the provisions of this section. The minimum price established by the commissioner shall apply to all grades and types of the commodity produced, bought, or sold in the state subject to normal price differentials reflecting grades and quality.

Subd. 2. (MINIMUM PRICE TRIGGER.) The minimum price of an agricultural commodity listed in section 2, subdivision 2 shall be effective when at least 60 percent of the previous year's United States production of the commodity, including the volume of the commodity produced in the state, is subject to a minimum price equal to the minimum price established in the state under section 3, subdivision 1.

Subd. 3. (MINIMUM PRICE LIMITS.) The minimum price established by the commissioner for an agricultural commodity, except sunflowers, shall not be less than 80 percent of parity nor greater than 100 percent of parity as defined by United States Code, title 7, section 1301, as in effect on the date of enactment of this act. The minimum price established by the

commissioner for sunflowers shall not be less than 80 percent of parity nor greater than 100 percent of parity as determined by the commissioner.

Subd. 4. (COUNTY MINIMUM PRICES.) The minimum price established by the commissioner for an agricultural commodity for a county shall not be less than the product of the state minimum price for that commodity divided by the statewide average county loan rate, multiplied by the county loan rate of the county in question. For counties in which no county loan rates are available, the commissioner shall determine transportation adjustments based on normal price differentials.

Subd. 5. (DATE FOR DETERMINATION OF MINIMUM PRICE.) The commissioner shall establish the minimum price within ten days after the effective date of this act, based on the parity price, as defined in section 3, subdivision 3, in effect on or before February 1 of the year of enactment and on or before February 1 of each year thereafter.

Subd. 6. (MINIMUM PRICE NOTIFICATION AND PETITION.) The commissioner shall publish notice of the establishment of any minimum price in the state register. Minimum prices established by the commissioner and the procedures established by the commissioner for payment of the checkoff fees, as authorized under section ___, subdivision 2, shall not be subject to the provisions of the administrative procedures act, Minn. Stat. § 14.01, et seq (1982). The commissioner, however, shall maintain all data utilized in determining each minimum price and checkoff procedure. Any person aggrieved by such price or procedure as determined by the commissioner may, within 30 days of the publication of that price or procedure, petition the district court for judicial review thereof. Upon notice of the petition, the commissioner shall file with the district court a copy of all data utilized, which data shall constitute the record for review by the district court.

Sec. 4. (17.705) (SUPPLY MANAGEMENT AND ORDERLY MARKETING.)

Subdivision 1. (TRIGGER.) For any commodity listed in section 2, subdivision 5, if world carryover stocks as a percent of total world use for that commodity exceed by 25 percent the previous 20-year average of world carryover stocks as a percentage of total world use of the commodity, the commissioner shall implement supply management or orderly marketing procedures as provided in subdivision 3, within 24 months.

Subd. 2. (ALTERNATE TRIGGER.) Notwithstanding subdivision 1, the commissioner shall implement supply management or orderly marketing procedures, as provided in subdivision 3, if the commissioner determines that the volume of production of a commodity listed in section 2, subdivision 5 threatens, or is likely to threaten, the productivity of the state's agricultural land and is disrupting, or is likely to disrupt, normal marketing patterns.

Subd. 3. (SUPPLY MANAGEMENT AND MARKETING PROCEDURES.) The commissioner, after consultation with the state's agricultural producers and their representatives, shall adopt supply management or orderly marketing procedures which establish the production history of each farm producing the commodity involved. Such procedures shall not be subject to the provisions of the administrative procedures act, Minn. Stat. § 14.01 et. seq. (1982). Any adjustment of production or market shares shall be on a pro rata basis among all producers of the commodity involved. The magnitude of the pro rata adjustment shall be sufficient to protect the productivity of the state's agricultural land and prevent the disruption of normal marketing patterns.

Subd. 4. (VETO BY LEGISLATURE OR PRODUCERS.) The supply management or orderly marketing rules authorized in subdivision 3 shall become effective 30 days after being adopted by the commissioner unless, within the 30-day period (a) both houses of the Legislature, in regular or special session, adopt, by an affirmative vote of a majority of those present and voting in each house, a resolution stating in substance that the two houses do not favor the rules, in which case the rules shall be withdrawn by the commissioner, or (b) 25 percent of the state's producers of the commodity involved petition the commissioner for a referendum on the rules.

Not later than 30 days after receipt and validation of a petition under clause (b), the commissioner shall authorize a referendum to be conducted by secret ballot. Any state producer of the commodity involved is eligible to vote in the referendum. If a majority of the producers voting in the referendum vote against the rules, they shall be withdrawn by the commissioner and the minimum price for the commodity involved, as authorized in section 2, subdivision 5, shall not be applicable for the year during which the rules would have been in force.

Subd. 5. (RELATION TO PLANTING PERIODS.) The supply management or orderly marketing rules authorized in subdivision 3 shall become effective not less than 180 days before the beginning of the planting period for the commodity involved, or not less than 180 days before the beginning of the calendar year, whichever is appropriate, if the commissioner determines that the implementation of the rules is likely to have no comparative disadvantage for state producers of the commodity involved.

Sec. 5. (17.706) (ENFORCEMENT.)

Subdivision 1. (RESTRAINING ORDER.) The commissioner shall monitor commodity transactions. Upon reasonable cause to believe that an ongoing violation of sections 2 to 7 is occurring or that a violation may occur, and upon notification to the party involved, the commissioner shall issue an order to restrain the violation, which shall remain in effect for ten working days during which time the commissioner will seek a permanent restraining order in a court of proper jurisdiction.

Within 60 days of a reported violation of sections 2 to 7, the commission shall initiate proceedings to determine if a violation has occurred. If a violation has occurred, the commissioner may negotiate a settlement with the offending party, including payment of a fine or penalty in an amount not less than the difference between the lower price and the established minimum price for the commodity involved. If a settlement cannot be reached within 60 days, the attorney general shall take other appropriate legal action.

Sec. 6. (17.707) (EXEMPT TRANSACTIONS.)

Sections 2 to 7 do not apply to a producer who sells a commodity directly to a consumer or processor outside of the state, or to a person who sells a commodity for use as seeds.

Sec. 7. (17.708) (PENALTIES.)

A person may not sell to another and a person may not purchase from another an agricultural commodity listed in section 2, subdivision 5 for less than the minimum price most recently set by the commissioner. A violation of sections 2 to 7 is a gross misdemeanor.

Sec. _. (FEES TO DEFRAY ADMINISTRATIVE COSTS.)

Subdivision 1. (CHECKOFF FEES.) For the purpose of providing funds to defray the expenses incurred by the commissioner in administering the provisions of this act, the commissioner shall establish a checkoff fee in an amount equal to one-tenth of one percent of the local market value at the first point of sale of the production of each agricultural commodity for which a minimum price is in effect.

Subd. 2. (PAYMENT.) The commissioner shall establish the procedure for the timely payment of the checkoff fee by the producer and publish legal notice of such procedure not later than 90 days after enactment of this act. The procedure shall also be clearly outlined in the notice of the establishment of any minimum price published by the commissioner under the provisions of section 3, subdivision 6. The procedure must be fair, reasonable and the checkoff fee shall be deducted by the first purchaser at the time of sale. The first purchaser shall submit to the commissioner any checkoff fees so deducted once every 30 days in accordance with the procedure established by the commissioner.

Subd. 3. (MINIMUM PRICE FUND.) All monies collected as fees shall be paid into the state treasury and then credited to the minimum price fund of the commissioner, which fund is hereby created and annually appropriated to carry out the purposes of this act. Interest, if any, received on deposits of these monies shall be credited to the fund, and there shall be paid into this fund any sum provided by the Legislature for the purpose of carrying out the provisions of this act.

Subd. 4. (MINIMUM PRICE FUND LIMITS.) In any year during which monies credited to the minimum price fund exceed projected administrative costs by $2 million, the commissioner shall discontinue checkoff fees the following year and thereafter until the monies credited to the minimum price fund fall below $500,000, at which time the commissioner shall give notice that the checkoff fees shall be re-established the following year.

Sec. _. (APPROPRIATION.)

Subdivision 1. (APPROPRIATION.) There is hereby appropriated out of any monies in the general fund of the state treasury, not otherwise appropriated,

the sum of $100,000 or so much thereof as may be necessary, to the commissioner for the purpose of administering this act, for the period beginning on the date when the minimum price of an agricultural commodity becomes effective under section 3, subdivision 2 and ending on June 30, 1985. The funds appropriated pursuant to this section shall be reimbursed to the general fund with interest at the legal rate no later than July 1, 1985.

Sec. _. (EFFECTIVE DATE.)

This act is effective the day following final enactment.

VII.

STATE SUPPORT OF FEDERAL LEGISLATION RE AGRICULTURE, INTERNATIONAL TRADE, ETC.

TASK FORCE REPORT

Recommendations of the Governor's Advisory Commission on Agriprocessing

State Action on Federal Agricultural Policy

I. Introduction

Providing long-term growth opportunities for farm income and agricultural jobs will require the cooperative efforts of Minnesota's government officials, producers, and agri-business people. Together, these groups could take effective action on the multitude of Federal issues that arise each year affecting farm income and agricultural jobs.

Recognizing the immense potential impact of the Federal government on Minnesota Agriculture, the State, in cooperation with the private sector, can take the lead in formulating and implementing new strategies for growth by providing a procedure for developing positions on federal issues, and programs to successfully advocate those positions in Washington, D.C.

To have maximum impact on Federal policy makers, Minnesota Agriculture positions must be: specific; well thought out and well researched; broadly supported within the State's agriculture community; and prioritized (to insure maximum return on invested time and funds).

To increase the probability that Minnesota Agriculture positions will be adopted at the Federal level requires establishing a concerted, on-going program of aggressive advocacy.

At present, the absence of a program for identifying--and more importantly, prioritizing--issues on which Minnesota Agriculture can agree makes concerted government-producer-business action very difficult. At present, there is no procedure for coordinating Federal activity by individuals, associations, or firms concerned about Minnesota Agriculture.

The discussion and recommendations that follow suggest one way for Minnesota Agriculture to develop and advocate positions at the Federal level.

II. Identifying and Prioritizing Issues

A. The State Legislative Concurrent Resolution

A powerful, but underutilized, tool exists for formalizing "Minnesota Positions" on agricultural issues: the Legislative Concurrent Resolution.

The Concurrent Resolution is a vehicle whereby the State Legislature formally advises the President, a Federal Agency, and/or the Congress on Federal policy questions.

Embodying Minnesota Agriculture positions in a Concurrent Resolution would be an excellent means of insuring that those positions were: broadly supported and well thought out and researched (committee hearings provide the forum for debate of the pros and cons); and, specific and prioritized (as refined in hearings).

Nevertheless, there are several factors which limit the usefulness of the concurrent resolution process: 1) It is unavailable when the State

Legislature is not in session; 2) It appears to have had minimal impact on policy decisions in Washington, D.C.; 3. As a practical matter, legislators and their staff may not have adequate time or expertise to develop the research so necessary to setting priorities among positions.

B. Governor's Agriculture Policy Advisory Commission.

The establishment of a Governor's Agriculture Policy Advisory Commission (hereinafter "Commission") is recommended to address the shortcomings of the Concurrent Resolution: limited availability; limited impact on Washington; and, limited Legislative resources.

Commission membership would represent a broad cross-section of participants in Minnesota's agricultural economy: producers; ag-transport; ag-processors; ag-financers; State executive and legislative personnel.

The Commission would be responsible for providing the Legislature with a draft Concurrent Resolution (say in late January of each year, and from time-to-time thereafter as necessary) that:

1. Identified specific Federal legislative or regulatory proposals which have a proportionately greater impact (positive or negative) on Minnesota's economy than on other states (reactive);

2. Identified specific proposals for Federal policy initiatives (legislative or regulatory) which would positively impact Minnesota's economy; and,

3. Prioritized all identified proposals for action.

In effect, the Commission would provide legislators a document that seeks to sort out the relative priorities among the multitude of agriculture issues appropriate for consideration at the Federal level.

For example, while we might all agree that Federal policy affecting soil conservation; production levels; government commodity procurement; raw commodity and value added exports, are important to Minnesota Agriculture, we don't have a good sense for priorities among these broad topics. Nor, for that matter, do we have good reason for recommending that any of these topics be afforded a higher priority than, say, the topic of agricultural transportation. The likelihood of Federal action on any specific proposal under one of these braod topics, the costs and benefits of specific proposals, are both factors that ought to carry the most weight in the prioritization process.

A Commission would provide the sort of issue identification, specification and prioritization, on an on-going basis, that current legislative and executive branch budget constraints may well preclude.

III. Advocacy of Minnesota Agriculture Positions

Translation of "Minnesota Agriculture Positions" into Federal policy requires more activity than mere transmission of a Concurrent Resolution to Congress, or occasional testimony before Congressional committees or Federal agencies. A

broad-based, well directed, continuing advocacy is called for, but does not currently exist.

A. State Public Sector Leadership

Minnesota's elected and appointed leadership should provide visible evidence of their commitment to the agriculture economy by setting as their objective the attainment of leadership positions on national or multi-state agricultural-related associations.

Active participation by Minnesotans on such groups: increases the audience that is sensitized to our concerns; increases the likelihood of gaining additional allies for "Minnesota Positions"; and provides a valuable source of intelligence for Commission priority setting.

Specifically:

1. Service on, with the objective of chairing, the Agriculture Committee of the National Governors Assn. would be useful and highly visible evidence of commitment from Governor Perpich. Minnesota has gone unrepresented on this Committee for too long.

2. Similar opportunities ought to be exploited by Commissioner Nichols, Senate and House Leadership, and Senate and House Agriculture Committee chairmen with the Council of State Governments, National Conference of State Legislatures, regional state consortiums, and other relevant organizations.

B. Use of Existing Private Sector Communication Networks

The effectiveness of grass-roots communications to Congress has been amply demonstrated. The State (through the Commission) should provide communication request/alerts, and status reports on "Minnesota Agriculture Positions" to the agri-business and producer communities. In return, participating businesses and associations would forward the information and/or request to resident members of their existing grass-roots networks, and forward an appropriate request for assistance to their Washington offices.

C. Washington Office

It has been years since the State of Minnesota employed a lobbyist in Washington. Many Minnesota corporations and trade associations have long recognized the need for full-time representation in Washington on issues of critical importance. The cost/effectiveness of a Washington office should be seriously reconsidered--especially in light of the favorable determination made by 35 other states who employ a Washington representative.

D. Making Better Use of the Minnesota Congressional Delegation

Minnesota's existing resources in Washington--our Congressmen and Senators--can be more effectively utilized on behalf of "Minnesota Agriculture Positions". Heightened recognition of the importance of the agricultural economy in all 8 Congressional Districts should increase the priority afforded "Minnesota Agriculture Positions" by Congressmen.

Additionally, the ability to determine quickly and accurately the "Minnesota Agriculture Position" should improve the efficiency of Congressional advocacy of those positions.

Specifically:

1. To emphasize both the importance and content of "Minnesota Agriculture Positions" the Governor should host--at least semi-annually--an agriculture retreat for the entire Minnesota delegation.

2. Irrespective of Congressional committee assignment, the commitment of each Congressman and Senator to actively assist in the implementation of "Minnesota Agriculture Positions" should be obtained by the Governor.

E. Insuring Continuous Advocacy

As noted earlier, Federal issues of import to Minnesota's agriculture economy can be expected to arise when the State Legislature is recessed.

In order to insure a capability to respond to Federal issues year-round, the Commission should be given two additional responsibilities:

1. Identification and direct communication to Federal personnel of policy positions on behalf of Minnesota Agriculture when necessary because the State Legislature is not in session.

2. General direction and coordination of the Federal advocacy program outlined above.

VIII.

DAIRY PROCESSING AND RESEARCH

TASK FORCE REPORT

GOVERNOR'S ADVISORY COMMISSION ON AGRI-PROCESSING

DAIRY PROCESSING AND RESEARCH TASK FORCE

1. Casein Conversion - If the federal government would support a program to convert existing government-owned inventories of nonfat dry milk to casein, the state could provide low-cost loans and tax incentives to organizations to build facilities and equipment with appropriate conversion equipment.

2. Ultra-Filtration/Reverse Osmosis - The hauling costs of milk being used for manufacturing could be reduced substantially with a respective improvement in farmers' revenues through the use of new technology which would eliminate a significant portion of the water in milk at the farm level. This technology, known as membrane technology, uses specialized membranes to separate the water from the valuable milk solids that are in milk. The reduced cost of hauling or transporting these concentrated solids to the milk manufacturing plants would provide an economic benefit to the dairy industry and particularly the dairy farmer.

3. Whey Proteins - Whey proteins are a relatively low-valued and priced component of milk and result as a by-product of basic cheese production. Research into the utilization of whey proteins as a base in flavored or recreational drinks would substantially increase the value of the whey protein and provide a significant nutritional benefit to those that would be normally drinking soda-types of soft drinks.

4. Dairy-related Research Projects/University of Minnesota -

a. Developing and/or evaluating genetic engineering technology directed at increasing milk production, increasing the more valuable milk components, and improving culturing of commercial milk products such as cheese, yogurt and so forth.

b. Economic research and computer modeling for hauling systems related to picking up milk on farms and delivering it to production or milk-utilization facilities.

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IX.

RAILROAD BONDING REPORT

RAILROAD BONDING

MN/DOT has drafted a Bill (copy attached) for introduction into the upcoming session of the Minnesota Legislature which, if passed, would provide the next step in making bonds available for rail service improvement now that Constitutional Amendment No. 4 has been adopted. The Bill essentially broadens the purposes to which existing funding authorization can be put and amends existing law to facilitate the use of funds by regional rail authorities.

The first section of the Bill expands the uses to which State rail rehabilitation funds can be used. It specifically permits the use of State rehabilitation funds to pay a portion of the cost of acquiring a rail line by a regional rail authority. Because many rehabilitation projects involve abandoned lines or lines to be abandoned which must first be acquired before rehabilitation can begin, the ability to use State funds for acquisition costs becomes very important. Under current law, State funding assistance is not available for acquisitions by regional rail authorities.

Sections 3 through 6 amend existing laws relating to regional rail authorities. The Bill would permit any municipality, rather than only counties, to form a regional rail authority. This provision is responsive to the desires of several municipalities for the establishment of regional rail authorities, but who have been unable to convince their counties to do so.

Section 7 of the Bill is perhaps the most important. In 1980 the Legislature authorized the sale of $13.5 Million of bonds for acquisitions by the State rail bank. The Bill expands this language and provides that bonding money may also be available for rail rehabilitation purposes. The Bill does not request additional funds nor does it request additional bonding authority.

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A bill for an act

relating to transportation; authorizing the commissioner to expend money for railroad acquisition by a regional railroad authority; modifying the regional railroad authority act to allow municipalities to form regional railroad authorities; allowing the expenditure of certain state funds for railroad improvement and acquisition; providing an aircraft base price for taxation purposes; amending Minnesota Statutes 1982, sections 222.50, subdivision 7; 360.531, subdivision 4; 398A.02; 398A.03; 398A.04, subdivisions 8 and 9; and Laws 1980, chapter 610, section 1, as amended.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

Section 1. Minnesota Statutes 1982, section 222.50, subdivision 7, is amended to read:

Subd. 7. The commissioner may expend money from the rail service improvement account for the following purposes:

(a) To pay interest adjustments on loans guaranteed under the state rail user loan guarantee program;

(b) To pay a portion of the costs of capital improvement projects designed to improve rail service including construction or improvement of short segments of rail line such as side track, team track and connections between existing lines, and construction and improvement of loading, unloading, storage and transfer facilities of a rail user;

(c) To acquire, maintain, manage and dispose of railroad right-of-way pursuant to subdivision 8 and the state rail bank

program;

(d) To provide for aerial photography survey of proposed and abandoned railroad tracks for the purpose of recording and reestablishing by analytical triangulation the existing alignment of the inplace track;

(e) To pay a portion of the costs of acquiring a rail line by a regional railroad authority established pursuant to chapter 398A.

All money derived by the commissioner from the disposition of railroad right-of-way or of any other property acquired pursuant to sections 222.46 to 222.62 shall be deposited in the ~~state rail bank~~ service improvement account.

Sec. 2. Minnesota Statutes 1982, section 360.531, subdivision 4, is amended to read:

Subd. 4. [BASE PRICE FOR TAXATION.] For the purpose of fixing a base price for taxation from which depreciation in value at a fixed percent per annum can be counted, such price is defined as follows:

(1) The base price for taxation of an aircraft ~~of which a similar or corresponding model was being manufactured on August 1 preceding the fiscal year for which the tax is levied~~ shall be the manufacturer's list price ~~of such similar or corresponding model in effect on such August 1~~.

(2) ~~The base price for taxation of an aircraft of which no similar or corresponding model was manufactured until after such August 1 shall be the manufacturer's list price at the factory when the aircraft taxed was first manufactured.~~

~~(3)~~ The commissioner shall have authority to fix the base value for taxation purposes of any aircraft of which no such similar or corresponding model has been manufactured ~~since a time prior to such August 1~~, and of any rebuilt or foreign aircraft, any aircraft on which a record of the list price is not available ~~in his office~~, or any military aircraft converted for civilian use, using as a basis for such valuation the list price ~~on such August 1~~ of aircraft with comparable performance characteristics, and taking into consideration the age and

condition of the aircraft.

Sec. 3. Minnesota Statutes 1982, section 398A.02, is amended to read:

398A.02 [PURPOSE.]

The purpose of the regional railroad authorities act is to provide a means whereby ~~counties~~ one or more municipalities, with state and federal aids as may be available, may provide for the preservation and improvement of local rail service for agriculture, industry, or passenger traffic when determined to be practicable and necessary for the public welfare, particularly in the case of abandonment of local rail lines.

Sec. 4. Minnesota Statutes 1982, section 398A.03, is amended to read:

398A.03 [ORGANIZATION OF AUTHORITY.]

Subdivision 1. [ORGANIZATION RESOLUTION.] A regional railroad authority may be organized by resolution or joint resolution adopted by the governing body or bodies of one or more ~~counties~~ municipalities, providing and stating:

(a) That the authority is organized under the regional railroad authorities act as a political subdivision and local government unit of Minnesota, to exercise thereunder part of the sovereign power of the state;

(b) The name of the authority, including the words "regional railroad authority";

(c) The ~~county or counties~~ municipality or municipalities adopting the organization resolution;

(d) The number of commissioners of the authority, not less than five; the number to be appointed by the governing body of each ~~county~~ municipality; and the names and addresses of the first board of commissioners;

(e) The ~~municipality~~ city and county in which the registered office of the authority is to be situated;

(f) That neither the state of Minnesota, the ~~county or counties~~ municipality or municipalities, nor any other political subdivision is liable for obligations of the authority; and

(g) Any other provision for regulating the business of the

authority determined by the governing body or bodies adopting the resolution.

Subd. 2. [HEARING.] Before final adoption of an organization resolution, the governing body of each ~~county~~ municipality named in it shall provide for a public hearing upon notice published in ~~the official county~~ a newspaper of general circulation in the municipality or municipalities and mailed to the governing body of each ~~municipality~~ city or town in the county named in the resolution, at least 30 days before the hearing. The hearing may be adjourned from time to time, to a time and place publicly announced at the hearing, or to a time and place fixed by notice published in ~~the official county~~ a newspaper of general circulation in the municipality or municipalities at least ten days before the adjourned session. Joint hearing sessions may be held by the governing bodies of all ~~counties~~ municipalities named, at any convenient public place within any of the ~~counties~~ municipalities. The resolution may be amended by the governing body or bodies at or after any hearing session at which the amended resolution is proposed and made available to interested citizens. It shall not become effective until adopted in identical form by the governing bodies of all ~~counties~~ municipalities named in the resolution.

Subd. 3. [CERTIFICATE OF INCORPORATION.] A copy of the organization resolution, certified by the recording officer of each ~~county~~ municipality adopting it, shall be filed with the secretary of state, who shall issue a certificate of incorporation if the resolution conforms to the requirements of this section, stating in the certificate the name of the authority and the date of its incorporation, which shall be the date of acceptance for filing. The certificate of incorporation shall be conclusive evidence of the valid organization and existence of the authority.

Subd. 4. [AMENDMENT.] The organization resolution may be amended by resolution or joint resolution of the governing bodies of all ~~counties~~ municipalities named in the resolution prior to amendment and the governing body of any additional

~~county~~ municipality named in the amendment. Each amendment shall be adopted at or after hearing upon notice as required for the organization resolution. No amendment releasing a ~~county~~ municipality from its obligations as a party named in the resolution shall be effective unless all covenants, agreements, mortgage liens, and other security given for bonds of the authority have been discharged and satisfied by payment or otherwise in accordance with their terms. All other amendments shall take effect upon filing with the secretary of state and issuance of an amended certificate of incorporation in the same manner as provided for the organization resolution.

Subd. 5. [BOARD OF COMMISSIONERS.] All powers granted to an authority shall be exercised by its board of commissioners. Commissioners shall be appointed and vacancies in their office shall be filled by the governing body of each ~~county~~ municipality named in the organization resolution, in accordance with the provisions of that resolution. The term of each commissioner shall be one year, or the remainder of the one year term for which a vacancy is filled, and until a successor is appointed. Commissioners shall receive no compensation for services but shall be reimbursed for necessary expenses incurred in the performance of their duties.

Subd. 6. [MEETINGS AND ACTIONS.] The board of commissioners shall by resolution establish the time and place or places of its regular meetings and the method and notice required for calling special meetings, all of which shall be open to the public. A majority of the commissioners being present at a meeting, any action may be taken by resolution or motion adopted by recorded vote of a majority of those present, unless a larger majority is required by bylaws adopted by the board.

Subd. 7. [OFFICERS AND EMPLOYEES.] The board of commissioners shall appoint a chairman, vice chairman, secretary, and treasurer from its members, each to serve for a term of one year and until a successor is appointed. The offices of secretary and treasurer may be combined, and deputies

or assistants may be appointed for either office or the combined office, from members of the board or otherwise. The powers and duties of each office shall be determined by the board, which shall require and pay for a surety bond for each officer handling funds. The board shall provide for the keeping of a full and accurate record of all proceedings and of resolutions, regulations, and orders issued or adopted; the state auditor shall, as time and resources permit, annually audit the books of said regional railroad authority. The board may appoint an executive director and other officers, fix their compensation, and delegate to them the powers and duties, as it may determine. It may also employ, or authorize the executive director to employ, all other employees, consultants, and agents needed to perform its duties and exercise its powers. Chapter 353 shall apply to all salaried employees.

Sec. 5. Minnesota Statutes 1982, section 398A.04, subdivision 8, is amended to read:

Subd. 8. [TAXATION.] Before deciding to exercise the power to tax, the authority shall give six weeks published notice in all ~~counties~~ municipalities in the region. If a number of voters in the region equal to five percent of those who voted for candidates for governor at the last gubernatorial election present a petition within nine weeks of the first published notice to the secretary of state requesting that the matter be submitted to popular vote, it shall be submitted at the next general election. The question prepared shall be:

"Shall the regional rail authority have the power to impose a property tax?

Yes .....

No ....."

If a majority of those voting on the question approve or if no petition is presented within the prescribed time the authority may thereafter levy a tax at any annual rate not exceeding four mills on the assessed valuation of all taxable property situated within the ~~county or counties~~ municipality or municipalities named in its organization resolution. Its

recording officer shall file in the office of the county auditor or city or town assessor of each ~~county~~ municipality a certified copy of the board of commissioners' resolution levying the tax, and each county auditor or city or town assessor shall assess and extend upon the tax rolls the portion of the tax that bears the same ratio to the whole amount that the assessed valuation of taxable property in that ~~county~~ municipality bears to the assessed value of taxable property in all ~~counties~~ municipalities named in the organization resolution. Collections of the tax shall be remitted by ~~each county~~ the treasurer of each municipality to the treasurer of the authority.

Sec. 6. Minnesota Statutes 1982, section 398A.04, subdivision 9, is amended to read:

Subd. 9. [MUNICIPAL AGREEMENTS.] The authority may enter into agreements with the ~~county or counties~~ municipality or municipalities named in the organization agreement, or with other municipalities situated in the counties named in the resolution, respecting the matters referred to in section 398A.06.

Sec. 7. Laws 1980, chapter 610, section 1, as amended by Laws 1981, chapter 338, section 8, is amended to read:

Section 1. [RAILROAD ASSISTANCE; APPROPRIATION.]

The sum of $13,500,000 is appropriated from the state transportation fund to the rail service improvement account in the special revenue fund to be expended by the commissioner of transportation for the ~~acquisition and betterment of public land and buildings and public improvements of a capital nature determined to be needed for preservation in the state rail bank~~ in the manner and for the purposes specified in Minnesota Statutes, sections ~~222.50, subdivision 7, clause (c) and 222.63~~ 222.49 to 222.63.

Sec. 8. [EFFECTIVE DATE.]

Sections 1 to 7 are effective the day following final enactment.