TAXES, AGRICULTURE AND CLIMATE CHANGE

By John Bailey and David Morris

November 1998

ILSR
INSTITUTE FOR LOCAL SELF-RELIANCE

The Institute for Local Self-Reliance (ILSR) is a nonprofit research and educational organization that provides technical assistance and information on environmentally sound economic development strategies. Since 1974, ILSR has worked with citizen groups, governments and private businesses in developing policies that extract the maximum value from local resources.

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Summary

In 1998 the Minnesota legislature debated a bill that would have generated a $1.3 billion tax shift –lowering local property taxes and raising energy taxes. A $50 per ton tax on carbon emissions would raise the average cost of energy by 15-25 percent, while the elimination of the state education property tax levy would have, on average, reduced local property taxes by about the same percentage.

This report examines the impact of this ecological tax shift on Minnesota's agricultural sector. Overall, the net impact is beneficial for Minnesota farmers that are growing crops. On a statewide level, the carbon tax raises costs to farmers by about $59.1 million while the property tax reduction lowers costs by $92 million. The benefit varies by crop and by farm size. Soybean farmers do better than corn farmers, large farmers do better than small farmers.

The report also examined the potential for farmers to reduce their energy use through improved efficiency. Over the past few decades, through fuel switching (diesel for gasoline) and through improved crop yields, farmers have been reducing their energy use per bushel grown by 3-5 percent per year. Thus their average efficiency improvements would offset the carbon tax itself very quickly. There are also several untapped areas for significant improvement. These include upgrading the efficiency of equipment like grain dryers and switching to conservation tillage.

If a carbon tax were imposed, it is likely that some system would be developed for paying enterprises that extract carbon from the atmosphere and store it. The science and policy of carbon sequestration is still in its infancy. A recent estimate, however, found that on the national level farmers could adopt soil management techniques that could sequester 75-208 million metric tons of carbon a year, more than offsetting the 66-80 million metric tons of carbon equivalent (MMTCE) they now generate by burning fossil fuels.

Analyzing the impact of the tax shift on Minnesota's agricultural processors is much harder, in part because it is difficult to evaluate the property tax reduction impact. Overall it appears that the net impact of the tax shift would be negative. Many processors would likely pay more than they would get back. However, the ecological tax shift bill provides for a substantial exemption from the tax impact for energy intensive industries and also offers low-cost financing for industries to upgrade their equipment to reduce their pollution. Business might well end up benefiting from the tax shift if they take advantage of the efficiency improvement opportunities. Perhaps the

the largest one would be on-site power generation in high-efficiency, natural gas-fired power plants where the waste heat is used in the facility.

While most farmers and processing enterprises could benefit from an ecological tax shift, the sugar beet farmer and processing industry would bear a significant negative impact. Special provisions might be made for this sector.

Introduction

In 1998 the Minnesota legislature debated *The Economic Efficiency and Pollution Reduction Act of 1998* (EEPRA).[1] The bill created a $1.3 billion tax shift by imposing a $50 per ton of carbon released pollution tax on the burning of fossil fuels and using that additional revenue to eliminate the state General Education Property Tax levy. The carbon tax would, on average, raise the price of energy by 25 percent and the elimination of the state education tax levy on local property would, on average, reduce property taxes by about 25 percent as well.

This paper is one of a series developed by the Institute for Local Self-Reliance to analyze the impact of an ecological tax shift on Minnesota.[2] A previous paper by University of Minnesota Department of Applied Economic's researchers Barry Ryan and Douglas Tiffany estimated the gross impact of the carbon tax on Minnesota agriculture.[3] This paper adds to that analysis information from the tax reduction side of the equation, and draws conclusions about the net impact of an ecological tax shift on Minnesota's farmers and agricultural processors.

Minnesota's Agricultural Sector

Until health and medical services recently surpassed it in size, agriculture has been Minnesota's largest single economic sector. Even today, agricultural activities comprise almost one quarter of the state's economy (see Wilbur Maki analysis mentioned in the Northwest Area Foundation Report).

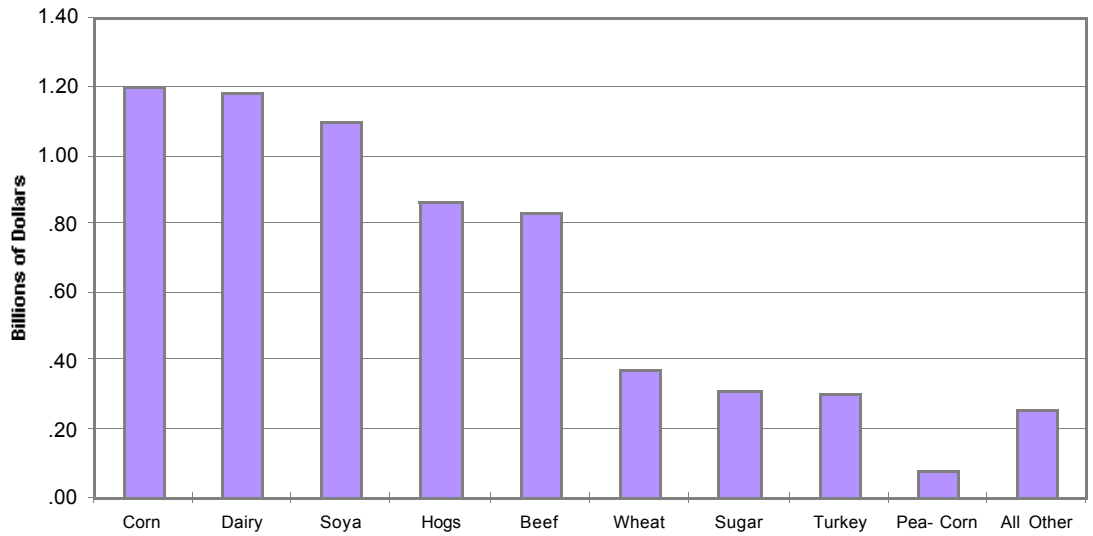
In 1997, Minnesota ranked number one in the nation for sugarbeet production and sweet corn/green peas for processing. Minnesota was among the top five states for production of corn, soybeans, spring wheat, hogs, turkeys, and cheese and other minor crops. Total farm marketing receipts for 1995 were about $7 billion. The table and chart below presents a breakdown of the production level and value of the state's dominant commodities.

Table 1: Commodity Yields and/or Acreage Planted, 1995

	Acreage	Yield
Corn	6.7 million acres	732 million bushels
Soybean	5.9 million acres	235 million bushels
Spring Wheat	2.25 million acres	71.8 million bushels
Dairy	-	94.1 million cwt
Swine Farrow	-	1 million litter
Swine Finish	-	7.08 million head
Beef Calf	-	.42 million head
Beef Cattle	-	.53 million head
Turkeys	-	40.5 million head
Sugarbeet	0.43 million acres	7.43 million tons
Canning Peas	0.09 million acres	117,054 tons
Sweet Corn	0.13 million acres	773,180 tons

Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.

Chart 1: Minnesota Farm Marketing Reciepts 1995



Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.
Note: The marketing reciepts for corn, soybeans, and wheat totaled $2.65 billion. However, farm production values for these crops totaled about $4.0 billion, reflecting their use as an on-farm feed and/or farm storage or maketing decisions.

For most crops energy expenses are a small portion of overall production costs. The table below with data for the Midwest reveals that for corn production energy expenditures are 5.8 to 7.3 percent of total cash costs, about half the cost of seed or

chemicals and less than a quarter the cost of fertilizer. Looking at Minnesota specific data for various crops shown in Table 4, we see that energy costs for various crops are between 3.0 percent and 8.2 percent of total production cash expenses. The highest percentage is for sugarbeets and the low end is for beef calves.

Table 2: Cash Costs per Acre for Corn, North Central Region 1991, 1993, 1995

Cash Expenses	1991 $ per acre	1993 $ per acre	1995 $ per acre
Fertilizer, lime, and gypsum	$45.26	$43.47	$54.82
Chemicals	$22.94	$24.63	$26.59
Seed	$21.42	$22.38	$23.80
Taxes and insurance	$18.21	$18.22	$19.63
Interest	$15.49	$10.90	$15.26
Repairs	$12.15	$12.74	$14.91
General farm overhead	$9.65	$8.32	$11.55
Fuel, lube, and electricity	$12.58	$11.05	$11.26
Custom Operations	$8.80	$8.27	$8.97
Hired Labor	$5.99	$6.05	$6.47
Other variable cash	$0.00	$0.00	$0.00
Total	**$172.49**	**$166.03**	**$193.26**

Source: *Minnesota Agricultural Statistics 1998*, USDA and MN Dept. of Agriculture, 1998. North Central region includes Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, and Ohio

Impact of EEPRA

Energy Cost Increase

After a five year phase-in, EEPRA will raise the cost of major fuels for farmers by 10-20 percent. The cost of coal used for industrial purposes is raised by about 73 percent.

Table 3: Tax Rate by Fuel Type and Percent Increase With $50 per ton Carbon Tax

Fuel Type	Tax Rate/unit	Ag Sector Price (1995 $/unit)	Percent Increase from Carbon Tax
Diesel	$0.15 per gallon	$0.76 per gallon	19.7%
Gasoline	$0.132 per gallon	$0.68 per gallon	19.4%
LP Gas	$0.08 per gallon	$0.69 per gallon	11.6%
Natural Gas	$0.81 per Mcf	$4.80 per Mcf	16.9%
Electricity	$0.0123 per kWh	$0.063 per kWh	19.5%
Coal	$25.18 per ton	$34.40 per ton	73.2%

Note: The tax rate for electricity is determined from statewide energy data and includes nuclear power generation. About 65 percent of the electricity generated in Minnesota comes from coal-fired power plants, about 30 percent from nuclear, and the remaining 5 percent split between natural gas and hydro. About 20 percent of our electricity is imported from outside Minnesota.

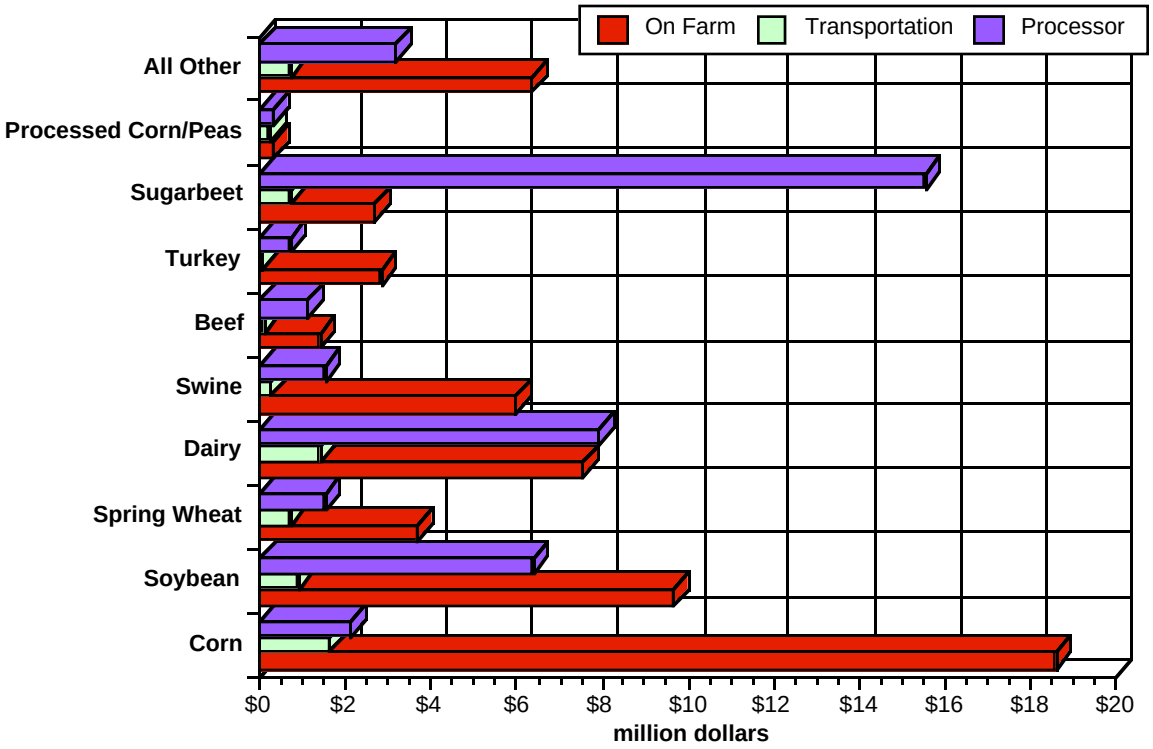
Table 4: 1995 On Farm Energy Expenses and Percent Increase Under EEPRA

Commodity	Energy Expenses ($/unit)	Total Cash Expenses ($/unit)	Energy Costs as Percentage of Cash Expenses (%)	Tax Impact ($/unit)	Percent Increase in Energy Cost
Corn	$17.62 per acre	$258.44 per acre	6.8%	$2.77 per acre	15.7%
Soybean	$8.93 per acre	$177.61 per acre	5.0%	$1.64 per acre	18.4%
Spring Wheat	$8.95 per acre	$148.37 per acre	6.0%	$1.64 per acre	18.3%
Dairy	$0.44 per cwt	$12.70 per cwt	3.4%	$0.08 per cwt	18.2%
Swine Farrow	$20.06 per litter	-	-	$3.66 per litter	18.2%
Swine Finish	$1.81 per head	-	-	$0.33 per head	18.2%
Beef Calf	$10.24 per head	$345.41 per head	3.0%	$1.87 per head	18.3%
Beef Cattle	$6.57 per head	-	-	$1.20 per head	18.3%
Turkeys	$0.40 per head	-	-	$0.07 per head	17.5%
Sugarbeet	$34.26 per acre	$419.95 per acre	8.2%	$6.29 per acre	18.4%
Canning Peas	$5.72 per acre	$151.35 per acre	3.8%	$1.05 per acre	18.4%
Sweet Corn	$8.66 per acre	$216.37 per acre	4.0%	$1.60 per acre	18.5%

Sources: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998*; Southwestern Minnesota Farm Business Management Association 1995 Annual Report, Staff Paper P96-4*, Department of Applied Economics, University of Minnesota, March 1996. *Minnesota Agricultural Statistics 1998*, USDA and MN Dept. of Agriculture, 1998.

Chart 2 shows the collective impact of the carbon tax on farmers, transporters and processors.

Chart 2 : Summary by Sector and Commodity of Tax Impact (million dollars)



Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.

Chart 3 shows that diesel fuel and electricity are the primary energy components for crop production. In some cases these two energy sources comprise 90 percent of total energy consumption. Corn is the exception with its significant consumption of LP gas for drying grain. On the livestock production side, we find that dairy farms are electricity-intensive, swine and beef farms use electricity and diesel fairly evenly, and turkey farms rely on natural gas.

Agricultural manufacturers use mostly electricity and natural gas, except for the sugarbeet industry in Minnesota which uses twice as much coal as natural gas and electricity combined. Dairy processors are using nearly 4.5 times more natural gas than electricity while corn and soybean processors use twice as much natural gas as electricity.

Chart 3: Summary of Statewide On-Farm Energy Use in Trillion Btus, 1995

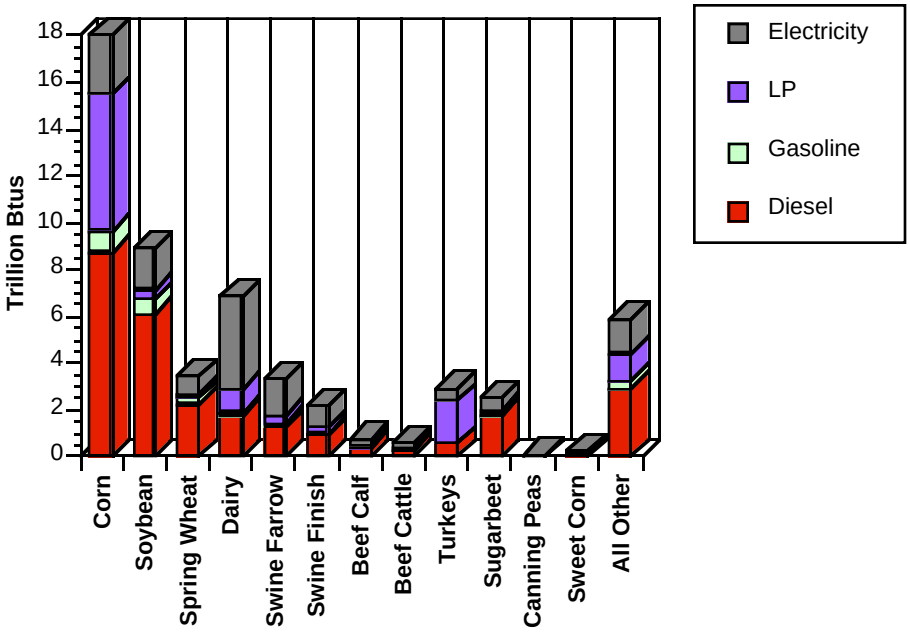
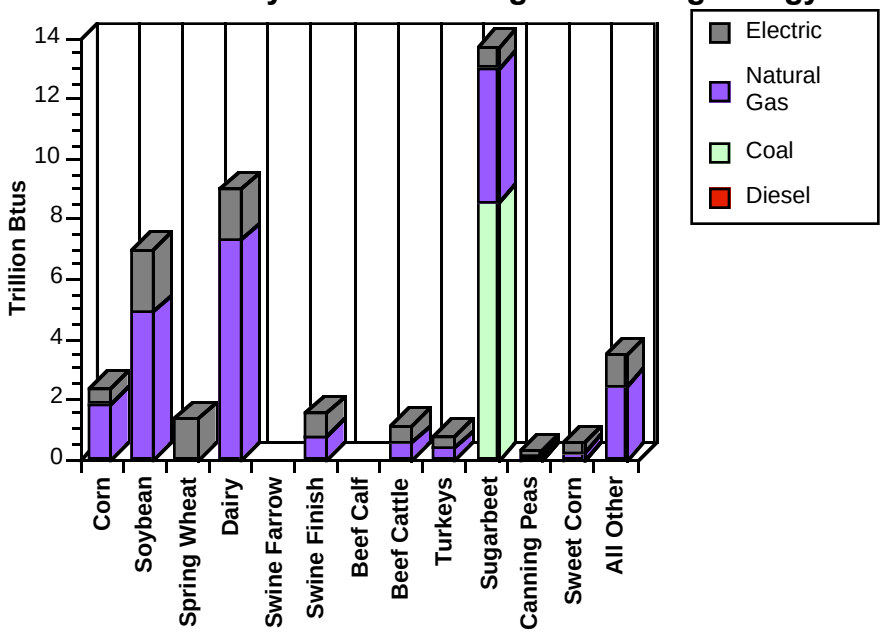


Chart 4: Summary of Statewide Ag Processing Energy Use \in Trillion Btus, 1995



Property Tax Decrease

EEPRA would reduce property taxes by eliminating the general education levy portion of local property taxes that is used to fund school districts. An analysis of EEPRA completed by the Minnesota House of Representatives Research Department concluded that this would lower property taxes statewide by about 25.9 percent.

Currently, funding for schools is primarily raised locally through property taxes.[4] The general education levy typically makes up about 60 percent of the school districts' total levy.

Current Education Funding

Total ($5.6 billion) = Local Property Taxes ($2.3 billion) + State General Fund ($3.3 billion)

Education Funding After EEPRA

Total ($5.6 billion) = Local Property Taxes ($1.1 billion) + State General Fund ($4.5 billion)

Since Minnesota's property tax system has dozens of different class tax rates depending on what type of property is being assessed, each property owner will receive a different effective tax reduction.[5] For example, House Research estimates that agricultural land and seasonal recreation property will receive reductions of 32-35 percent, due to their concentrations in rural areas where the general education levy makes up a greater portion of the overall tax burden. In contrast, residential homestead property will see tax reductions of about 22 percent.

The state class tax rates for agricultural land and buildings, used to determine the tax capacity of a given property, are composed of three separate tiers. The first tier is for for farms with values under $115,000 and the other two tiers are for farms that are valued more than $150,000. Here is the breakdown:

Agricultural Land & Buildings Class Rates

	1998	1999
Homestead:		
< $115,000	0.40%	0.35%
> $115,000:		
<320 acres	0.90%	0.80%
>320 acres	1.40%	1.25%

As a result of this tax structure, larger (more valuable) farms pay higher taxes per acre than smaller farms. Thus, for taxes payable in 1999, an average-sized farm of 343 acres with a value of $377,000 ($1,100 per acre) would have a tax capacity of about $4700 or $13.70 per acre.[6] An 80 acre farm valued at $88,000 would have a tax capacity of $308 or $3.85 per acre. Since the property tax reduction in EEPRA results in a straight percentage reduction, it would benefit larger farms more than small farms. If the property tax reduction for agricultural land is 32-35 percent, the average sized farm of 323 acres would receive a property tax decrease of $1,508 to $1,650, about $4.40 to $4.80 per acre. An 80 acre farm would receive a tax reduction of about $100 or $1.25 per acre.

Net Impact of EEPRA for On-Farm Production

House Research estimates the total property tax reduction for agricultural land and buildings under EEPRA will be about $92 million[7]. Tiffany and Ryan estimate the on

farm energy tax increase will be about $59 million. Thus farmers in Minnesota would receive a net benefit from EEPRA of about $32 million.

Table 5 shows the net impact per acre of EEPRA for selected crops. In this calculation we have assumed an average 32 percent reduction in property taxes and used an across-the-board figure of $3.05 per acre for the value of this reduction.[8]

Table 5: Net Impact per Acre of EEPRA for On-farm Production of Six Crops

Commodity	Acreage	Tax Impact ($/unit)	Property Tax Reduction ($/unit)	Net Benefit/Loss ($/unit)	Total Benefit/(Loss)
Corn	6.7 million acres	$2.77 per acre	$3.05 per acre	$0.28 per acre	**$1.88 million**
Soybean	5.9 million acres	$1.64 per acre	$3.05 per acre	$1.41 per acre	**$8.32 million**
Spring Wheat	2.25 million acres	$1.64 per acre	$3.05 per acre	$1.41 per acre	**$3.17 million**
Sugarbeet	0.43 million acres	$6.29 per acre	$3.05 per acre	($3.24 per acre)	**($1.39 million)**
Canning Peas	0.09 million acres	$1.05 per acre	$3.05 per acre	$2.00 per acre	**$0.18 million**
Sweet Corn	0.13 million acres	$1.60 per acre	$3.05 per acre	$1.45 per acre	**$0.19 million**

Table 5 reveals that five out of the six crops will see a net benefit from EEPRA without increasing their energy efficiency or productivity. Sugarbeet production is the exception.

Using data for an average-sized farm, we can illustrate the subtle differences of the net impacts of EEPRA depending on the the type of crop being produced. A 343 acre farm planted in corn will see energy expenses rise by $950 and property taxes decline by about $1,046, resulting in a net benefit from EEPRA of $96. If the farm was 100 percent soybeans, the 343 acre farm would see increased energy costs of $563 and a net benefit of about $483 once the property tax reduction is considered.

Net Impact to Transport and Processors

It is difficult to estimate the net effect of EEPRA on agricultural transport businesses and processors. The energy use and tax impacts on these sectors can be estimated fairly accurately but the overall property tax reductions are embedded within $431 million in property tax reductions for commercial/industrial property under EEPRA.[9] Data on property taxes paid by individual sectors of agricultural processor (eg. grain milling, ethanol production, sugar processing) is not readily available.

As for the transport companies, if we assume that they will pass their entire $6.89 million tax increase under EEPRA back to the on-farm sector the on-farm sector's overall net benefit will drop to $25 million.

EEPRA contains several provisions that are useful to energy-intensive industries like agricultural processing. It provides for up to a 75 percent exemption from the tax

increase (and the tax reduction as well) and provides low-cost financing for businesses to improve their energy efficiency. In 1997, ILSR analyzed the effects of EEPRA on businesses in Minnesota and the potential for energy efficiency[10]. We concluded that for almost all industrial sectors, the net impact of the tax shift could be offset with very small and cost-effective investments in energy efficiency.

This is not true of all individual business sectors. For example, one case study performed by ILSR was of a Minnesota ethanol plant. The cost of energy under EEPRA increased by about $585,000 while the property tax reduction was about $59,000 for a net negative impact of $526,000 or about 3.5 cents per gallon of ethanol produced. With the 75 percent exemption the net negative impact would be lowered to about $130,000. This would still raise the cost of ethanol by about 0.9 cents per gallon.

It is important to note, with regard to this case, that while EEPRA raises the net cost of producing ethanol by about a penny a gallon, it raises the market price of ethanol's competing fuel -gasoline -by a far greater amount, 13 cents a gallon.

It is also useful to note that ethanol plants that rely on natural gas rather than coal, capture and utilize their waste heat, improve their product yields and adopt other energy saving techniques, will be able to avoid much of the negative impact of the tax shift.

In our analysis of the impact of the tax shift on energy-intensive industries we noted that the taconite industry was the single industry that would likely be unable to improve energy efficiencies to offset the burden of EEPRA's tax shift even with a 75 percent exemption.[11] Similarly in the agricultural processing sector, the sugar beet industry may need special attention. Minnesota is the largest beet-producing region in the United States. Over 2,680 growers produce 7.5 million tons of beets on 425,000 acres. There are four sugarbeet processing facilities in Crookston, Grand Forks, Moorhead and Renville.[12] The sugarbeet processors would bear a major portion of the impact of the proposed tax increase– $15 million or 38 percent of the entire increased energy cost for agricultural processors. Total property taxes for sugar beet processors are modest, perhaps $1.4 million.[13] Thus to completely offset this impact with a property tax reduction would require sugarbeet processors to pay property taxes in excess of $58 million which is not the case in Minnesota. Even with a 75 percent tax exemption, the net loss to sugarbeet processors would be more than $3 million.

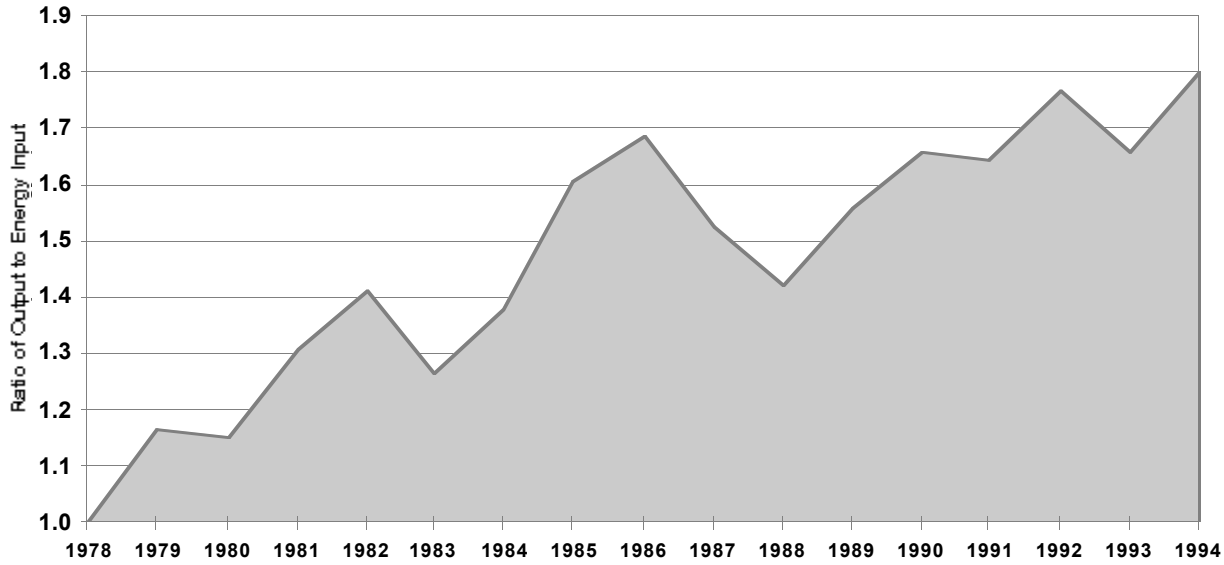
Efficiency Potential In Agriculture Sector

A goal of EEPRA is to create a tax system where economic signals encourage people to reduce pollution. One way to achieve this is to switch to less polluting fuels. Another is to improve energy efficiency per unit produced. The agricultural sector has been moving in this direction for many decades.

The largest gains in efficiency have come from an increase in crop yields and the second largest from the shift to more efficient diesel engines from gasoline engines.[14] For the livestock sectors, better disease control, more efficient feed conversion, and refinements in farm management have each contributed to productivity gains.

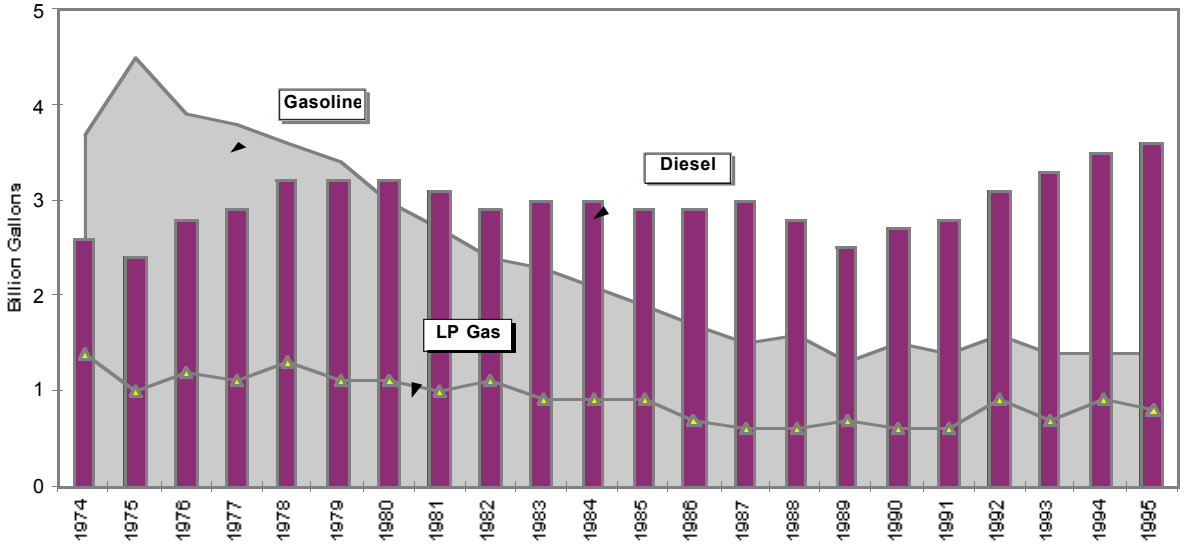
Since 1978 farmers have reduced their energy consumption by 24.3 percent. Per unit of energy applied, farmers in 1994 were producing 80 percent more output from the same amount of energy used as in 1978.[15]

Chart 5: Energy Productivity in U.S. Agriculture 1978-1994



Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.

Chart 6: U.S. Farm Fuel Use 1974-1995



Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.

Energy productivity (outputs over energy inputs) for agriculture has increased an average of 5 percent per year for several decades. Under EEPRA, energy costs will rise by about 15-20 percent. If the current energy productivity trends continue, farmers will have increased their energy productivity by more than 25 percent by the time EEPRA is fully phased in, completely offsetting the tax increases even without considering the property tax reductions. But the potential for even greater energy savings is high. Ryan and Tiffany conclude that, "A continuation of recent trends would bring annual energy savings of 5 percent, but the potential for synergistic savings from the developments outlined above suggest that larger conservation gains are possible."

For example, drying grain at harvest can represent up to 35 percent of the energy used for on-farm corn production. New grain dryers can remove moisture with half the fuel used by older equipment. Industry experts estimate that the average age of most dryers currently in use is 15 to 20 years old. A new dryer can cost in excess of $25,000 but for large farms (greater than 1000 acres) it could pay back the investment in less than 7 years from reduced energy costs.[16]

A significant opportunity for energy savings is the adoption of conservation tillage practices. New management practices, plant varieties, and equipment are ushering in the era of conservation tillage practices. The most radical approach is to leave all of the prior year's crop residue on the field, a practice known as no-till. Studies have shown that no-till saves the equivalent of 3.5 gallons of diesel fuel per acre over conventional tillage practices.[17]

While Minnesota farmers are embracing conservation tillage practices, they have not adopted no-till. Minnesota farmers are on the northern edge of the Corn Belt, and hence face a short growing season. In order to hasten soil warming in the spring, Minnesota farmers keep crop residue levels on the field somewhat below the levels found in no-till. Nevertheless, Minnesota farmers do practice a conservation tillage practice known as mulch till. Though it does not conserve as much energy as no-till, mulch till still can save the equivalent of 2.5 gallons per acre in diesel fuel over conventional practice. A savings of this magnitude would lower energy expenditure by about $1.92 per acre. By using less fuel the farmer would also lower the impact of the carbon tax by $0.29 per acre. Combining these two savings gives a total savings of $2.21 per acre, reducing by nearly 80 percent the $2.77 energy cost increase for a corn farmer by the carbon tax. Once the property tax reduction of $3.05 per acre is taken into account, the mulch till farmer would receive a toal net benefit of almost $2.50 per acre or $900 for an average sized farm per year.

Since only about a quarter of Minnesota's farmers practice conservative tillage, the widespread adoption of this technique could offer significant savings.

Table 6: Percent of Acreage in Conservation Tillage, 1990 and 1997

		1990	1997
Corn	Minnesota	20.5%	21.4%
	United States	32.1%	41.4%
Soybeans	Minnesota	22.5%	41.2%
	United States	27.2%	51.9%
Small Grains	Minnesota	14.4%	18.6%
	United States	20.8%	31.1%
All Crops	Minnesota	18.4%	26.6%
	United States	26.0%	37.3%

Source: *Minnesota Agricultural Energy Use and the Incidence of a Carbon Tax*, Barry Ryan and Douglas G. Tiffany, University of Minnesota, April 1998.

Many agricultural processing operations also have opportunities for cost-effective energy efficiency investments.

Dairy operations use significant amounts of electricity for collecting, cooling, and holding milk in storage. Ryan and Tiffany concluded, "The installation of adjustable speed drives (ASD) to milking parlor vacuum pumps is one innovation delivering energy savings of 50 percent or more.[18] Regulating vacuum pumps can account for one-third of the dairy's energy use according to a Cornell University study. Additional energy savings can come from installing plate coolers to chill milk before it reaches the bulk storage tank. Depending on the size of the herd, adding these two energy saving devices can cost from $35,000 to $100,000, but the payback is typically within two to three years. Resulting electricity savings may be $10.00 per cow per year from ASD's alone." The $10.00 per cow potential savings represents about 77 percent of increased cost per cow of the carbon tax of about $13.00, without considering the offsetting reduction in property taxes.[19]

Processors have been consistently improving their energy efficiency. Ryan and Tiffany found that some soybean processors use the same amount of energy as they did 15 years ago, but are processing 50 percent more soybeans. This represents a decline in energy use of 33 percent over fifteen years or 2.73 percent compounding savings per year.

Technological advances make it possible for some agricultural processors to install their own high efficiency power generation systems. Soybean crushers, for example are seriously exploring this option. The "waste" heat would be used to heat soybean flakes or for refining soy oil. The excess electricity from the plant could be sold back into the electric power grid.

Carbon Sequestration: A Potential Economic Opportunity for Minnesota Farmers

If there is to be a tax on carbon, policymakers have looked at the question of whether there should also be a tax credit or direct payment for the extraction of carbon from the atmosphere and its storage in the soil. Carbon sequestration in soils increases the amount of organic carbon and reduces carbon dioxide in the atmosphere and also increases the agricultural productivity of the soil. Minnesota farmers and farmers around the world may have a unique ability to be paid as carbon "sinks".

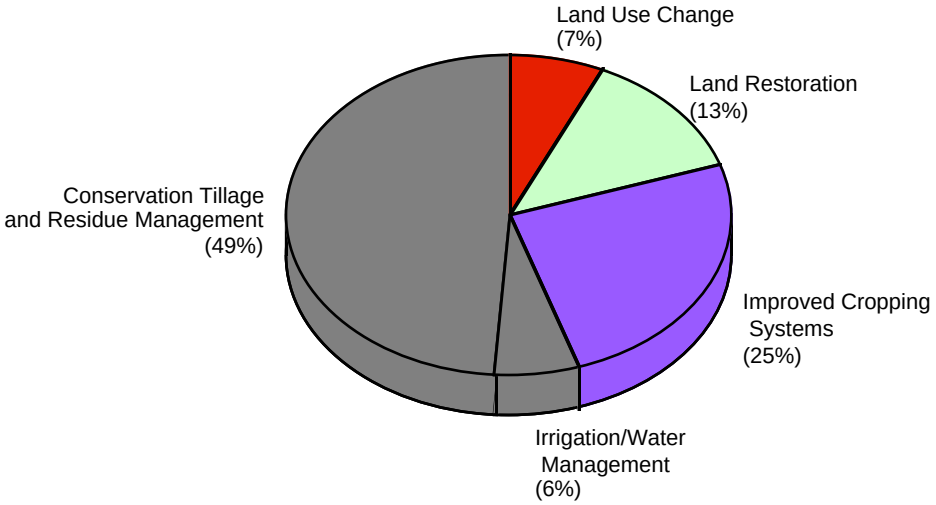
The science and policy rules regarding carbon sequestration are still in their infancy. The international climate change meeting in Kyoto last year did not resolve whether countries will be able to "count" carbon sequestered in the soil toward their greenhouse gas reduction goals but this issue will likely be revisited in future meetings. In May 1998 the International Soil and Water Conservation Society (SWCS) convened a forum in Calgary, Alberta on agriculture's role in reducing greenhouse gases.

Carbon sequestration can occur through reduced-tillage, use of winter cover crops, re-establishment of grasses or other native plants, and improved grazing regimes. In a preliminary paper, SWCS reported that changes in land management practices could store an additional 1,650 million metric tons of carbon in agricultural soils in the U.S. and Canada over the next twenty years.

Recent research suggests that improved management of U.S. cropland can lead to 75 - 208 million metric tons of carbon sequestration per year. Currently, greenhouse gas emissions from the agriculture sector are estimated to be 66 million metric tons of carbon equivalent (MMTCE)[20] to 80 MMTCE. Thus the agricultural sector has the potential to offset completely its own greenhouse gas emissions and become a carbon sponge for emissions from other sectors.[21]

If the U.S. imposed a $50 per ton carbon tax to meet some of the obligations under the Kyoto Protocol, the total value of carbon sequestration for agriculture is between $3.25 and $10.4 billion. The range of carbon sequestration potential for U.S. agricultural land is 75-208 million metric tons per year.[22] In 1996 the cropland area in the U.S. totaled 293.2 million acres resulting in a carbon sequestration value of between $11 and $35 per acre per year.

Chart 7: Carbon Sequestration Potential of Different Components of Improved Management of U.S. Croplands



Source: *The Potential of U.S. Cropland to Sequester Carbon and Mitigate the Greenhouse Effect*, R. Lal, J.M. Kimble, R.F. Follet, C.V. Cole, Ann Arbor Press, 1998.

FOOTNOTES

[1] H.F. 1190, S.F. 1110

[2] The Ecological Tax Reform-Project Resources at http://www.me3.org/projects/greentax/ includes these reports:
Improving the Efficiency of Minnesota's Industries, David Morris and Ann Robertson, Institute for Local Self-Reliance, November 1997; *The Minnesota Ecological Tax Shift: Impact Analysis on Individual Businesses*, David Morris, Alyson Schiller, and John Bailey, Institute for Local Self-Reliance, February 1997; *Carbon Taxes With Tax Reductions in Minnesota*, Steve Bernow, Mark Fulmer, Irene Peters, Michael Ruth, and Daniel Smith, Tellus Institute, February 1997; *Tax Pollution, Not Families and Businesses* - Summary of EEPRA 1998, February 1998;
The Effect of the Minnesota Ecological Tax Shift on Low Income Households, John Bailey and David Morris, Institute for Local Self-Reliance, March 1997; *Green Taxes*, Institute for Local Self-Reliance, July 1994.

[3] *Minnesota's Agricultural Energy Use and the Incidence of a Carbon Tax*. April 1998. Prepared by Doug Tiffany and Barry Ryan, University of Minnesota Applied Economics Department, for Minnesotans for an Energy Efficient Economy.

[4] Supplemental revenue is often raised by establishing an excess property tax levy through a local referendum.

[5] Calculation of property taxes in Minnesota is essentially a two step process. The state determines the class tax rate which is first applied to the assessed value of all property in a given taxing district (eg. school district, county, township) to determine the tax district's tax capacity. Once taxing district's budgets are determined they are divided by the tax district's tax capacity to determine a local tax rate. For each property all of the local tax rates are added together and multiplied by the individual property's tax capacity to get the gross taxes payable. Once credits are subtracted a net tax payable is determined. The local tax rates vary around the state from 80% to 130%.

[6] see footnote 6.

[7] House Research Department.

[8] There are about 29.8 million acres of agricultural land in Minnesota subject to property taxes. This land is valued at $24.9 billion ($836 per acre) and subject to about $284.5 million in property taxes or $9.55 per acre, House Research Department.

[9] House Research Department.

[10] *The Minnesota Ecological Tax Shift: Impact Analysis on Individual Businesses*, David Morris, Alyson Schiller and John Bailey, Institute for Local Self-Reliance, February 1997.

[11] See Morris, David and Ann Robertson, *Improving the Efficiency of Minnesota's Industries*, Institute for Local Self-Reliance, November 1997. We recommended that for taconite a carbon tax could replace the existing $2.10 tax based on the per ton of taconite produced. This would impose no additional tax burden on the industry while at the same time providing it economic signals that would encourage reduced pollution.

[12] Lord, Ron, *The Beet Sugar Industry of Minnesota and North Dakota: Current Situation and Prospects*, Sugar and Sweetener Situation and Outlook, Economic Research Service, United States Department of Agriculture, September 1994.

[13] A check of one facility revealed a property tax bill of $360,750 in 1998.(Conversation with the Polk County Assessor and Treasurer, October 1998.) Assuming that other plants pay similar taxes, the total property taxes for sugarbeet processors is in the range of $1,440,000.

[14] USDA. ERS. Natural Resources and Environment Division. "Farm Fuel and Ethanol." *AREI Updates*. Number 16; December 1996.

[15] Tiffany, Ryan.

[16] There are 29,000 farms larger than 1000 acres in Minnesota, about one-third the total. Smaller farms would require a larger payback, assuming that a grain dryer was used by a single farmer on a single farm

[17] Conservation Technology Information Center. "Crop Residue Management." West Lafayette, Indiana. 1997.

[18] Kuber, C. "Pumping Savings out of Thin Air." *Dairy Today*. January 1996.

[19] Leake, L. L. "Saving Kilowatts and Cash." *Dairy Today*. August 1997. From data contained in the Southwestern Minnesota Farm Business Management Association 1995 Annual Report (Staff Paper P96-4, Department of Applied Economics, University of Minnesota, March 1996) we used an average production per cow of 171 cwt per year. With annual production in the state at 94.1 million cwt we arrived at a figure of 550,000 head for dairy.

[20] Lal, et. al. define million metric tons of carbon equivalent (MMTCE) as follows: The term MMTCE is based on the conversion of all gases to equivalent global warming potential (ratio of global warming of greenhouse gas to carbon dioxide) expressed on a weight basis.

[21] Potential carbon sequestration includes 7 percent from land conversion (e.g., CRP and conservation buffers), 13 percent from restoration of degraded soils, 25 percent from improved cropping systems, and 49 percent from conservation tillage techniques. *The Potential of U.S. Cropland to Sequester Carbon and Mitigate the Greenhouse Effect*, R. Lal, J.M. Kimble, R.F. Follet, C.V. Cole, Ann Arbor Press, 1998.

[22] *Ibid*.