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Power Plant Siting and Agricultural Land: Commentary on a Proposed Regulation

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Power Plant Siting and Agricultural Land:

Commentary on a Proposed Regulation*

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The Problem

The state-wide Power Plant Siting Advisory Committee is considering the importance of agricultural land in power plant siting proceedings. Many people perceive that large amounts of agricultural land are being lost to non-agricultural uses, such as residential and commercial developments, and roads and highways. The problem addressed here is whether and to what extent cropland should be considered in the siting of new power plants in Minnesota. Implications will be drawn for the related regulation proposed by the Minnesota Environmental Quality Board (Appendix A).

For the purpose of discussion, I will use projected new power generating capacity over the next 15 years of 2,000 megawatts. A likely division is 60 megawatts near the Twin Cities, 800 added to the existing Sherco Plant, and the remaining, 1,140 somewhere in the remaining portion of the state. However, the exact location of the new plants will not alther the general conclusions of this paper.

The Agricultural Land Situation

Although it appears that large tracts of land are disappearing from agricultural use, it is impossible to show a net loss of cropland by

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looking at the aggregate statistics. In fact, there are a number of variables such as government programs, expected farm prices, and technology, which determine the amount of cropland at any given time.

A look at national data is instructive. Changes in the amount of cropland since 1949 were associated with adjustments in surplus crop production capacity for more than two decades following World War II. An abrupt increase in demand for farm products beginning in 1972 brought forth increased cropland into production (see Table 1). From a low of 333.6 million acres of cropland in 1972, acreage has increased steadily to a total of 376.5 million acres in 1977, a net increase of over 40 million acres during a five year period.

According to a 1979 USDA publication,[1/] a total of 61 million acres in the U.S. was in urban and transportation uses in 1974. Between 1969 and 1974, about 3.8 million acres, or 750,000 acres per year shifted to urban uses. In addition, .5 million acres or 100,000 acres per year were added to rural transportation uses, largely as a result of the interstate system, but partly because of new airports. The USDA extimates that not more than 35-40 percent of the land urbanized earch year is cropland.[2/] If we assume 50 percent of the 3.8 million acres over the 5 year period was cropland, this amounts to 1.9 million acres. Yet over the same period, cropland in the U.S. increased from 332.8 million acres to 361.2 million acres, or 28.4 million acres. The point is that although large quantities of agricultural land indeed shifts to other uses, this amount is dwarfed

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[1/] H. Thomas Frey, Major Use of Land in the United States, 1974, USDA, ESCS, Agricultural Economics Report No. 440.

[2/] Ibid.

Table 1--Cropland used for crops, by region, 48 States, 1949-77[1/]

Year	Northeast	Lake States	Corn Belt	Northern Plains	Appalachian	Southeast	Delta States	Southern Plains	Mountain	Pacific	48 States
					Million acres						
1949	17.2	38.2	78.0	93.9	22.3	20.2	16.6	44.7	34.7	20.8	386.6
1950	17.1	37.5	77.2	93.3	21.1	18.7	15.3	41.7	35.2	20.2	377.3
1951	17.0	37.7	77.4	93.8	21.2	18.7	15.4	43.4	35.9	20.6	381.1
1952	16.9	37.4	77.8	93.8	20.8	19.0	15.1	41.8	36.6	20.8	380.0
1953	16.8	37.6	78.8	94.0	20.6	18.9	14.9	41.3	35.8	20.8	379.5
1954	16.6	37.6	79.4	95.5	20.0	17.6	14.8	41.5	36.2	20.7	379.9
1955	16.4	37.6	79.5	94.6	19.9	17.3	14.3	41.4	36.2	20.5	377.7
1956	15.9	37.4	78.5	92.8	18.9	16.1	13.7	38.9	35.7	20.8	368.7
1957	15.7	36.4	77.2	90.1	17.5	15.1	13.2	37.3	35.2	20.5	358.2
1958	15.5	36.0	76.9	90.4	17.2	13.7	12.5	36.8	35.3	20.5	354.8
1959	15.2	36.7	78.8	90.2	17.4	14.6	13.1	37.6	34.4	20.5	358.5
1960	14.9	35.8	78.4	91.5	17.1	13.3	12.8	37.2	34.1	20.2	355.3
1961	14.4	35.3	71.6	86.9	16.1	12.7	12.8	35.8	33.8	20.1	339.6
1962	14.2	33.3	70.7	85.3	15.4	11.9	12.7	34.4	33.9	19.4	331.2
1963	14.2	34.5	72.5	87.1	15.2	12.1	13.1	34.8	34.0	19.8	337.3
1964	14.0	34.2	72.0	86.2	15.0	11.9	13.5	34.1	33.9	19.9	334.8
1965	13.7	34.1	72.4	87.2	15.1	11.5	13.7	34.0	34.5	19.7	335.9
1966	13.7	33.3	72.7	87.5	15.0	11.0	13.6	32.0	33.8	19.4	332.0
1967	13.4	34.3	76.2	88.2	15.7	12.1	14.9	31.6	34.1	19.7	340.3
1968	12.7	33.7	72.6	86.2	15.5	11.8	16.1	32.5	34.1	19.7	334.9
1969	12.2	31.5	70.7	88.3	14.8	11.5	15.9	33.9	34.9	19.1	332.8
1970	12.5	31.9	71.6	86.9	14.9	11.7	16.4	31.7	34.6	19.5	331.7
1971	12.7	34.2	75.3	88.5	16.2	12.5	16.3	30.7	34.4	19.5	340.3
1972	12.3	32.3	72.8	87.2	15.6	12.1	16.4	29.9	35.0	20.0	333.6
1973	12.6	35.3	79.2	89.9	16.4	12.7	16.5	34.5	34.9	20.0	352.0
1974	12.9	36.6	81.9	90.5	17.1	13.4	16.8	35.1	35.9	21.0	361.2
1975	13.0	37.3	83.0	91.9	17.5	13.8	17.2	35.4	35.9	21.4	366.4
1976	13.1	38.4	84.1	92.2	17.9	14.0	18.4	34.3	36.2	21.5	370.1
1977	13.2	38.9	85.7	94.1	18.5	14.7	19.1	35.4	36.0	20.9	376.5

[1/] Cropland used for crops is the sum of the acreage from which one or more crops were harvested plus acreages of crop failure and cultivated summer fallow.

Source: H. Thomas Frey, Major Use of Land in the United States, 1974, USDA, ESCS, Agricultural Economic Report No. 440.

by the amount of land shifting into and out of production because of factors such as farm prices.[3/]

At the regional and state level, the picture appears to be similar. For the three Lake States, cropland declined from 38.2 million acres in 1949 to a low of 31.5 million acres in 1969 (see Table 1). Since then, cropland has increased to 38.9 million acres in 1977, a number greater than in 1949. In Minnesota, there were 20.9 million acres of cropland in 1959, 23.9 million acres in 1974, and an estimated 25.4 million acres in 1979--this in spite of land lost to urban and transportation uses, and other uses (see Table 2).

Note that the estimated change between 1974 and 1979 approximates 1.5 million acres. The increases over the last decade are largely the result of clearing and drainage. It is contended by some that these lands are better left in forests and undrained. However, that is not the issue here. The issue is whether we are in danger of "running out" of farmland, and it appears that we are not.

The general, inescapable conclusion in viewing the data is that one is hard put to find a severe cause for alarm over disappearing farmland as it relates to overall food supply.[4/] There are some real issues over urbanization and land use, which will be discussed shortly. However, disappearance of cropland as it relates to food supply is <u>not</u> the major

[3/] Critics of this proposition might argue that land which is urbanized and used for freeways is of higher quality than that coming into production because of higher prices. However, one can concede this, and still find the argument compelling that urbanization poses no threat to agricultural production in the aggregate.

[4/] There are cases, particularly in California, where unique land suited to specialty crops warrants special protection. Land used for artichokes near Watsonville and grapes in Napa Valley are examples. This special case would not seem to apply to Minnesota.

Table 2: Cropland in Minnesota, Selected years, 1949-1979

Date	Acres
1949	20.9 million
1954	22.3 million
1959	22.5 million
1964	22.7 million
1969	23.4 million
1974	23.9 million
1979*	25.4 million

*U.S. Dept. of Commerce, 1978, Census of Agriculture, Preliminary Report.

Source: Adopted from USDA Agriculture Statistics, 1978.

issue, especially in the context of power plant siting.

Cropland and Power Plants in Perspective

To zero in on the problem at hand, the consideration of cropland in power plant siting, let us review some data, make some simple calculations, and draw some implications with respect to the proposed regulations. It seems to be generally agreed that the developed portion of a power plant uses from 1 to 1.5 acres of land per megawatt of generating capacity. If we use the uppermost figure of 1.5 acres per megawatt, and apply this to the anticipated 2,000 megawatts additional capacity, we arrive at an upper estimate of 3,000 acres of land needed in Minnesota during the next 15 years for power generation. If we compare this to 24 million acres of cropland (as opposed to total land area) we have:

$\frac{3,000}{24,000,000}$ or .01 percent of the total if every acres used for power plants were to be cropland.

The conclusion must be that the construction of power plants poses no significant threat to cropland in Minnesota when used in the proportions cited above.

What is the effect of the regulation which stipulates a limitation of 320 acres for the plant site and 320 acres for the make-up water storage reservoir and cooling pond site? If the 640 acres for a 400 megawatt plant is optimal from the point of view of the utility, the regulation has no effect on the utility. If the utility desires to build a larger plant, and is constrained to a given amount of land, either of two things would happen: 1) the utility would substitute capital for land to attain the desired capacity, or 2) the utility would build a greater number of smaller capacity plants, thereby using a greater number of smaller sized parcels of land.

The utility must take into account the cost of land as well as other factors of production, including cost of transportation, inputs such as coal, and cost of transmitting electricity. Thus the utility has the usual incentives of any producer to consider technical options and resource prices in production. The utility will very likely consider the possible problems of land acquisition and possible adverse public relations in its decision process.

Note that the proposed regulation poses no limitations on land acquisition inside municipalities. The higher value of this land would presumably give the utility incentive to economize on its use. The same incentive exists outside the municipality as well, "prime" farmland being more costly to the utility, all else equal, than lower grade land. But again, the utility has other costs to consider. In addition, society has "external costs" such as pollution, noise, and transportation disruptions to consider; costs which are external to the producer.

Farmland taken up by the site, then, is one factor or source of costs of producing electricity. It appears that power generation poses no threat to Minnesota cropland in the aggregate. The effect of the proposed regulation is, at best, zero and at worst, may cause the utility to use a less than optimum combination of resources in production. Further, it may focus the attention of society away from more pressing problems associated with production and distribution of electricity.

The Issues of Substance

While it is rather easy to conclude that power plants pose no significant threat to Minnesota cropland, in the eyes of this observer, there are a number of issues which are significant. To not attempt to offer

constructive insights on these issues would be to hand in an incomplete assignment.

The topics of power plants and agricultural land have associated with them a legacy of heated, emotional controversy. And, as so often happens in public controversy, emotion and energy are dissipated on non-productive lines of argument. What are the salient issues? These, I submit, are related to the general areas of size and location of power plants, external costs, compensation to damaged parties, land use planning, and the role of government in our economy, particularly with respect to regulating industry. I offer for your consideration the following thoughts on each of these.

Location of Power Plants. Power generating plants are unpopular and generally unwanted, especially by those proximate to the proposed location, although their product, electricity, is very much in demand. Among the perceived disamenities of a power plant (let us confine ourselves to fossil Fueled plants) are possible air pollution, unsightly structures, noise and disruptions in transportation because of coal trains, and possible reduced value of adjacent lands. These concerns are legitimate and real, and such issues should be addressed specifically and directly with respect to location of power plants.

Size of Power Plants. If a power plant is unwanted, a large power plant is even more unwelcome. There is some controversy regarding the optimal size of plant. Should there be a few large plants, or larger numbers of smaller plants dispersed over a greater geographical area? The proposed ruel of the PPSAC is to limit the plant to 320 acres for the developed portion of the site and 320 acres for the makeup water storage site and the cooling pond site. If the capacity of the plant is related

to the land requirement (1 megawatt to 1.5 acres) the limitation on land use tends to limit the size of the plant. The word "tends" is used because in most production situations, resources are somewhat substitutable. Capital might be substituted for land in this case to build a plant with larger capacity.

Either way, however, the results are somewhat perverse. If the intent of the land use regulation is to limit the size of plant in terms of generating capacity, the purpose could be partially circumvented by the substitution of capital for land. If the unintended effect is to limit size of the plant, particularly if it is less than an optimal size of plant, the utility either must substitute capital for land to increase plant capacity, or must produce at a less than optimal size. Either way, costs of production are raised, and the consumer will incur higher costs for electricity.

The point is that size of plant should be based on a number of considerations. The real question is "How can we produce a given amount of electricity at minimum cost, taking all costs--capital, land, labor, and non-market costs, such as air pollution--into consideration?" An arbitrary limit on land for a power plant may limit the options of the utility for minimizing costs of production.

A utility anticipating a new site has incentives in terms of politics and public relations, as well as monetary costs, to acquire no more farmland than necessary, given other factor costs. The case for regulation to arbitrarily limit farmland per plant site is very weak. The issue of size of plant should be given direct attention. If there is a case for limiting size, it should be done directly, rather than through the "proxy" of limiting agricultural land for a given site.

Pollution and External Costs. The utility, as any other firm, has incentive to take costs incident on the firm into account. There are other costs which are incident on other segments of society, generally referred to as external or spillover costs, which the firm does not have the same incentive to take into account. These are real costs that are realized by society in general, particularly those adjacent to the facility. Examples of such costs are air pollution, the existence of smoke stacks, and noise and invonvenience caused by the transport of coal to the generating site.

The level of consciousness of industry regarding these problems has undoubtedly risen during the past decade. Nevertheless, these items pose some vexing problems and, in the absence of action by society to the contrary, the hard fact remains that industry has no incentive to account for these costs. The fact that it is difficult to quantify these costs exacerbates the problem. These costs are, nevertheless, real, and must be accounted for by society, which leads to the next set of issues.

Compensation of Damaged Parties

The existence of external costs implies that there are persons and firms realizing damages as a result of the power plant. These damages may be direct or indirect, sometimes easily quantifiable, but more often are difficult or nearly impossible to quantify.

Perhaps the most obvious direct damages are those realized by the landowner who surrenders land on which the power plant is built. However, since the "damage" is obvious and direct, the landowner can be compensated and even be made "better off" in monetary terms.[5/] Less obvious, except.

5/ This is not to imply that psychic values of a homestead or sentimental values, for example, can be evaluated in monetary terms.

to the individual involved, is the farmer whose operation is less efficient because of smaller size or irregularly shaped fields.

The potential "damages" to property and health suffered by victims of pollution are difficult to quantify, and no efficient mechanism exists for compensating them. Other damages may include reduced land values (or values which don't increase as much as they otherwise would have) because of the proximity of the plant, and noise and disruptions because of coal trains.

People who perceive themselves to be potentially on the receiving end of these damages will naturally be opposed to the siting of a new power plant in their proximity. A major challenge is to minimize losses or to compensate in some way persons being damaged by the power plant site.

Land Use Planning. The third issues, land use planning, is again emotionally loaded. Volumes have been written about urban sprawl, the decline of central cities, and the many problems that go with it. Recall that although 900,000 acres of land (about 35% of it cropland) is converted to urban uses annually, this would seem to pose no immediate threat to our food supply or have by itself any significant effect on food prices. The social dynamics of the situation seem to be, however, that people who do not oppose suburban development, can get excited about retention of agricultural land. People who oppose zoning or other general social measures to influence land use, will often get on the bandwagon to retain agricultural land.[6/]

6/ The forces influencing problems of development have been well documented elsewhere. See for example, Philip M. Raup, "An Overview of Land Use Issues," in Proceedings of Minnesota Regional USDA Rural Development Committee Land Use Workshop, December 1975.

Again, however, this skirts the real questions, "In what kind of community do we wish to live?", and "What kinds of rules of the game does society wish to establish for land use?" The demand for open space is legitimate and should be able to stand on its own validity. For some reason, support can be garnered for the retention of agricultural land, but not for open space, a generally pleasing environment, and the measures to influence land use that go with it. Perhaps it can be argued that if the same ends can be achieved under the aegis of retention of agricultural land, so be it! However, we must remind ourselves of the statistical weakness on which this proposition rests.

Government and the Economy

The final set of issues touches in some way all of the above. The facts that there are external costs, that there are damaged parties, and that the firm has little incentive to take these into account, means that society, acting through representative government, has the responsibility of "intervening." Sometimes, critics of government label this as "intervention in the marketplace." This is a fallacious interpretation. A more accurate interpretation is that society is "setting the rules of the game" within which the private sector operates. It is an attempt by society, through representative government, to account for items such as external costs, which in fact are not properly accounted for in the private marketplace.

In particular, because a utility is a "natural monopoly," it is subjected to rules and restraints. Because society is concerned with "fairplay," a reasonable objective is to attempt to minimize inequities or to compensate those suffering them so that the broader society might benefit from the product.

The challenge is to set up the "rules of the game" in such a way as to efficiently produce electricity, but in such a manner that benefits for the general public are not at the expense of others. A broad general philosophy is to let the private sector do what it does best--namely combine the factors of production for efficient operation, but within the limits or constraints set by society. Rational minds can differ on what those limits should be. Differing philosophies and ideologies tend to cloud the issues, and needlessly polarize debate.

A regulatory agency has limited ability to administer and to regulate--limited in the sense of resources and "political capital." The agency must direct its attention to matters which it deems most important.[7/] In general, regulations directed toward a specific objective should: 1) be as closely directed toward that aspect as possible; 2) interfere as little as possible with the internal decisions of the firm, while still attaining the objective; and 3) be consistant insofar as possible with efficient resource use.

I offer an agricultural analogy. Suppose that society, through representative government, decides to limit corn production and it tries to do so by limiting the amount of land planted to corn. This tactic violates the above principles because 1) it is directed toward the input (land) as opposed to the output (corn) which is the real objective; 2) as the farmer can substitute capital (fertilizer, chemicals) and labor for land, the objective of limiting output will likely not be achieved to the desired extent; 3) it interferes with the farmer's decisions on how best to produce a given amount of output. The corn which is produced will be

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7/ A regulatory agency obtains its powers from a legislative body, and hence operates within those broad limits. Within those limits, nevertheless, an agency has some amount of discretion to establish rules which have the force of law.

produced at a higher cost than necessary to society because of the limitation on one of the inputs. A more effective and economically efficient approach to achieve limited output would be to directly limit the output of corn, letting the producer decide how best to produce that amount.

A similar analogy can be drawn with respect to pollution control. Society has the right--indeed, the responsibility--to attain environmental goals. To achieve them, it is more efficient from both an administrative and an economic point of view to directly regulate the emmissions of the plant or the automobile, rather than attempt to specify "best practicable technology," or pollution control equipment which must be placed on automobiles. This is not to leave industry "off the hook," but to give the private sector the flexibility and potential for innovation to meet standards which are, quite properly in the judgment of this observer, set by society. Indeed, the more directly the regulation is tied to the ultimate objective, the less chance to "slip around" it by means such as low quality equipment or factor substitution.[8/]

Summary

There exist many legitimate concerns regarding land use, power plants, and related issues. These are public issues fraught with emotion and controversy on which rational minds can differ. The issues are public and affect many people, and must necessarily be subjected to public debate.

The basic conclusion of this paper is that the limitation of use of agricultural land for power plant sitings has little or no defense in the aggregate. The intent of this paper is to focus attention on the more

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[8/] It may be more politically feasible to limit or specify inputs rather than output. This may be precisely because it allows the firm the opportunity to evade the real impact of the regulation, whether this be the case of output of farm products or pollution emmissions. However, it is the eternal goal of economists that what is effective and economically efficient can become politically feasible.

salient issues such as the generally efficient use of all resources in producing electricity, non-market costs such as pollution, compensation of those damaged in the process of production and distribution of electicity, and land use which is in accord with the public interest in general. Issues of controversy are better resolved, and the public better served, by addressing issues directly, and, where regulations are deemed appropriate, to regulate directly, rather than by "proxy."

The PPSAC working in tandem with the utilities is a lauditory approach to resolving these difficult and complex public issues. The establishment of methods to resolve such issues in which affected parties have a voice in the outcome is a major challenge of participatory democracy. This may appear to be a cumbersome and slow moving process. However, I am reminded of a speaker at a recent farm policy forum which I attended. When asked whether the public policy process could ever be made more efficient, he replied, "Yes, if you are willing to surrender your democratic form of government!"

With all its apparent short-run problems and frustrations, the open process of dealing forthrightly with the very real problems of production and distribution of electricity is certainly the preferable way in the long run.

Appendix A:

Proposed changes and additions to existing environmental quality board rules on routing high voltage transmission lines and siting large electric power generating plants:

Agricultural Lands

6 MCAR § 3.072 ("Definitions")

Make the following changes:

P. "Developed portion of plant site" means that general portion of the LEPGP site occupied by structures or other facilities, exclusive of make-up water storage reservoirs or cooling ponds.

Q. "Prime farmland" means those detailed soil survey mapping units that meet the specifications of 7 Code of Federal Regulations 657.5(a) (1978).

6 MCAR §§ 3.074.H.2. ("Criteria for the evaluation of sites.")

Add the following:

d. No LEPGP site shall be selected where the developed portion of the plant site includes more than 320 acres of prime farmland, and no make-up water storage reservoir or cooling pond site shall be selected that includes more than 320 acres of prime farmland. These provisions shall not apply to sites located within municipalities; nor shall they apply to sites located within areas designated for orderly annexation.

Source: Minnesota Environmental Quality Board