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The Connection Between Environment Regulation and Energy Prices: Electricity Pricing Experiencing in the U.S.

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INTRODUCTION

The purpose of this paper is to urge that any comprehensive regional ecological policy pursued by the International Institute-Association on Regional Ecological Problems (IIAREP) incorporate an energy pricing policy component because energy prices directly affect the environment. In simplistic term, the higher is the price for energy products, the lower is the demand for those products and the more likely it is that there will be a reduction in harmful emissions and discharges all along the energy fuel cycle. This paper suggests that meaningful environmental policy should not be treated separately from energy pricing. Environmental policy makers must become intimately familiar with specific energy pricing mechanisms and scientists must begin to record and quantify the environmental effects of pricing policy throughout the energy fuel cycle. The paper uses the electric pricing experience in the U.S. to illustrate these propositions. By examining specific electric pricing mechanisms in the U.S., one can conclude that environmental effects are present in electric power transactions, but those environmental effects unfortunately are not fully reflected, as they should be, in the pricing of electric transactions. In turn, this requires environmental regulations to deal with those effects

This paper further suggests that an appropriate and necessary subject of reasearch for IIAREP, that will be established at L'vov State University, should be to conduct a detailed examination of the specific environmental effects of specific energy pricing policies in recommending environmental regulation. At a time when some governments in the Carpathian region are considering, at once, the quality of the region's environment, the institution of market-based economies, and the privatization of industries, a unique opportunity may exist to identify as a matter of regional environment policy the true environmental costs imposed by government energy pricing policies and to reflect those costs in energy transactions.

ENVIRONMENTAL REGULATION AND ENERGY POLICY ARE LINKED

The broad, theoretical premise for acknowledging that energy pricing and the environment are connected has surfaced, of course, with the articulation of the concept of sustainable development. Since the completion in 1987 of Our Common Future, the report of the World Commission on Environment and Development sanctioned by the United Nation, the notion that a healthy energy industry depends on sustaining healthy local, regional and global environments is now accepted as one of the cornerstones of the concept of sustainable development. As one energy expert has put it: "environmental policy is driving energy policy". Canadian Prime Minister Brian Mulroney made a similar point at a September 1989 Montreal energy meeting: *Environmental sensitivity and economic growth, fueled by energy, go hand in hand . . We no longer have the luxury to have one without the other.*

The choices of sources of energy and the way in which they are used and priced along the fuel cycle from production to end use obviously have an impact on the environment. In the production and use of electricity, of course, those impacts include global warming, air pollution, acid rain (all caused in part by the burning of fossil fuels), and radiation from nuclear power plant wastes and discharges.

As a general matter, the more electricity one produces by traditional means (coal, natural gas, oil and uranium), the more likely it is both that the environment will be adversely affected and that specific environmental regulations will be needed to address those effects. The future electic pricing policies of nations or regions will play a critical role in stimulating efficiency, in encouraging conservation, and in developing alternate sources of electric production all of which have a beneficial effect on the environment. More broadly, the fluctuations in the world price of oil over the past twenty years and the corresponding changes in supply and demand for oil and oil products, including electricity, provide a ready confirmation that energy prices generally influence both the environment and the conservation and use of energy.

Thus, a nation or region, when it selects an energy pricing policy, necessarily also has shaped its environment policy which must be addressed by treaties, laws and regulations. The implication is that long term meaningful environmental regulation, which is not merely reactive, should begin first to quantify and reflect the environmental effects embedded in energy pricing policies and, second, to adopt pricing policies that accurately reflect those environmental effects.

Accepting the twin premises that world electric demand will increase in the future, and that increased demand, production and use of electricity from traditional sources will pose a corresponding increased burden on the environment, one

is led to conclude that, if the consuming public is to behave rationally in response to electric prices, electric pricing policy should reflect true environmental costs and that environmental policy should consider fully the effect of electric prices. Expressed more broadly and in the language of an economist, energy policy makers unfortunately tend to treat environmental effects as an externality (although a significant externality) rather than as an embedded transaction cost in energy purchases and sales.

GOVERNMENT AUTHORITY OVER ELECTRIC PRICES IN THE U.S.

There are two longstanding reasons, neither of which address the environment, for state and federal authorities in the U.S. to regulate electric prices. The first reason is that electric service is an essential public service and therefore that service cannot depend solely on the uncertainties and fluctuations of the free market to determine price, supply and demand.

The second reason is that the electric industry is a natural monopoly which prevents the free market from working as it should in the electric industry. The electric industry is a natural monopoly because the large capital expenditures involved in building generation and transmission facilities prevent easy entry into and exit out of electric markets and because enormous economic waste would result in constructing the duplicate generation and transmission facilities generally needed for competition. Thus, natural market forces do not operate effectively to control electric prices. If prices were not regulated by government, natural monopoly utilities would act rationally and extract from largely captive customers with mostly inelastic electric demands as high a price as their monopoly position permits.

Government regulation, by preserving the natural monopoly status of utilities in exchange for government authority to set electric prices, assures that essential electric service will be provided. The resulting governmental electric price regulation in the U.S. attempts both to mimic the prices that would be charged in a competitive, non-monopoly, market and to control the exercise of monopoly power.

The current government authority over electric prices (rates) in the U.S. is divided between state authorities and the Federal Energy Regulatory Commission (FERC). In general, state authority in electric ratemaking (pricing) is confined to intrastate retail electric rates. Federal ratemaking authority extends to interstate wholesale electric sales and interstate transmissions of electricity among utilities.

Privately-owend electric utilities in the U S. are organized as tax-paying companies that usually are financed by the sale of securities (stock and bonds) in the open market. Today, there are roughly 3,500 separate electric systems of which

250 or so (or about 7 per cent) are privately-owend The remainder of the electric systems are government-owend or consumer-owend. The private electric utilities, while small in number, supply about 80 per cent of U.S. electric demand Virtually every major public and private electric utility system in the U.S. is connected, or capable of being connected, with its neighbouring system. There are large interconnected networks of electric systems forming a nearly complete national grid.

Electric supply in the U.S today generally is coordinated and synchronised among many different electric systems and companies Integration of operations is achieved by the physical interconnection of electric facilities, by the efforts of regional electric reliability councils, and by privately-owned utilities pooling their power resources.

U.S. ELECTRIC PRICING POLICIES AFFECT ENVIRONMENT REGULATION

In the U.S., both traditional and innovative electric pricing mechanisms produce a significant effect on the environment and consequently on U.S. environmental laws and regulations needed to react to those effects. The environmental effects produced largely are unquantified and the electric pricing mechanisms used by state and federal authorities generally do not consider the environment. There are three reasons for the exlusion of environmental costs from energy pricing. First, the historical imposition of governmental electric pricing authority in the U.S. preceded by several decades the assertion of governmental environmental protection authority. Second, "electricity" and the "environment" often are viewed by energy policy makers as terms in contradiction or, at best, in an uncomfortable alliance. Third, there is, as yet, no coordinated energy policy in the U.S. that would compel the reflection of environmental effects (costs) in electricity pricing.

RATEMAKING GOALS

Governmental price-setting, or electric ratemaking, in the U.S. has had over time several goals, none of which, until very recently, directly include the reduction of the environmental costs of electric production and use The primary ratemaking goals under which electric rates have been set are as follows:

1. To attract capital. This means that electric prices should be set sufficiently high to attract investors in private utility companies so that utilities may build plants to produce electricity This continues to be a prime goal in electric price-setting. This goal does not take into account the environment

2. To distribute wealth. Government authorities sometimes structure electric prices to subsidize the provision of electricity to the poor (usually through so-called "lifeline" rates), to subsidize residential electric prices by charging large industrial customers higher prices, or even to subsidize industry through higher residential prices in order to attract or retain industry in an electric service territory. Increasingly, this goal has been tempered and shaped by concerns that rates also be equitable and fair. Again the quality of the environment is not addressed by this goal.

3. To promote efficiency. Efficiency as a ratemaking goal traditionally has related to financial and electric supply considerations like reducing the costs of electric service and reducing dependance on foreign fuel sources and not to preserve and protect the environment. Although the environment may coincidentally benefit from this goal, it is somewhat fortuitous and incidental.

4 To conserve electricity. As with the ratemaking goal of efficiency mentioned immediately above, conservation, as a pricing mechanism, originally was meant to encourage utilities to save money by, for example, avoiding adding new, expensive electric capacity Traditional conservation goals in ratemaking are not primarily to protect or enhance the environment. Indeed, the ratemaking goal of conservation actually could result in increased environmental impacts For example, if a utility were to conserve expensive oil, by burning instead less expensive high sulfur coal, the goal of oil conservation might be achieved at the expense of increasing harmful air emissions to the environment. Recently, this ratemaking goal has been used in a new way to foster conservation by the ultimate end user (consumer) of electricity. This shift in conservation goals from the electric utility-producer to the end-user could have a significant beneficial effect on the environment because less electricity will have to be produced and used.

5. To encourage demand for electricity. Traditionally, this has mean keeping electric prices low enough to encourage increases in demand for electricity by consumers. This goal for many years was a mainstay consideration in ratemaking and served the growth energy policy of the U.S. In recent years, however, with the increased emphasis on the goals of achieving efficiency in electric operations and conserving the energy resources used by electric consumers, this ratemaking goal is no longer a prime consideration in ratemaking. Of course, this goal does not consider the environment.

SPECIFIC ELECTRIC PRICING MECHANISMS

Against the landscape of the U.S. electric industry, and the government pricing authority over that industry, one can identify several specific traditional, and new,

pricing mechanisms and observe that they have direct and indirect effects both on electric production and on the environment.

"RATE BASE" FORMULA PRICING OF ELECTRICITY

This traditional pricing mechanism has been used by both state and federal rate-making authorities. It rewards an electric utility with revenues in direct proportion to an increase in the utility's capital investment in electric generation and transmission facilities The formula is as follows:

$$R = O + (V - D)r$$

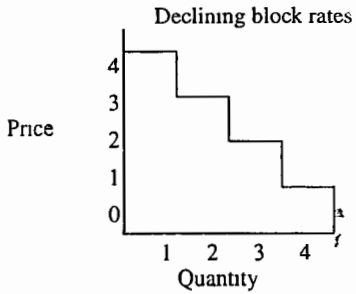
R – is the total revenue desired
O – is the operating expenses
V – is the value of utility's property *D* is depreciation
r – is the rate of return (profit margin expressed as a percentage)
(V – D) – is the rate base

Here, the percentage of profit margin, *r* (the rate of return), is multiplied by the rate base, *(V – D),* which is added to operating expenses, *O*, to arrive at the total revenue, *R*, that a pricing authority approves for a utility. Thus, all other factors being equal, the larger a utility's rate base (capital expenditure in electric facilities) the more total revenue it will enjoy because that rate base is multiplied by the rate of return. This pricing mechanism rewards a utility for building more electric plants. A utility that increases its revenues by expanding its rate base must encourage its customers to use more electricity or it must attract new electric customers to justify its expenditures on new electric plants.

The effect on environmental regulation is indirect but real. The electric facilities added to the rate base to achieve more total revenue produce more emissions into the air and discharges to water. And increased emissions and discharges need changes in environmental regulations or even new regulations to react to those emissions and discharges.

DECLINING BLOCK RATES

This traditional pricing mechanism, no longer in favor in the U.S., serves the rate-making goal (mentioned above) of wealth distribution. This is a non-cost based pricing mechanism that serves a pure growth energy policy by encouraging customers to use more electricity. It effectively rewards increased uses of electricity by customers with a lower price. Graphically, a declining block rate design would appear as follows:



Here, the utility's customers that use the most electricity are rewarded with the lowest price per unit of electricity used. Thus, the customer group that uses the least electricity pays the highest price per unit of electricity used.

Under this pricing mechanism electric users have little or no incentive, to conserve electricity or to use electricity efficiently. This results in increased customer demand for electricity and requires more generation facilities to be built and produces more emissions and discharges to the environment that require a regulatory response.

AVERAGE COST RATEMAKING

This traditional electric pricing mechanism determines the price paid by each customer on the basis of a utility's total average costs as follows:

$$\frac{\text{total quantity of electricity}}{\text{total cost of production}} = \text{average cost}$$

The effect of average cost ratemaking is that the prices a specific customer pays bear little direct relationship to that customer's electric use. For example, under average cost ratemaking, if a new large industrial customer locates in a utility's service territory and a new electric plant must be built to serve that industry, the costs of the new plant are not borne by that large industrial customer alone. Rather, the costs of the new plant are added to the pile of existing productions costs and a new average cost is reached which is spread throughout all customer classes. Existing customers, who may be conserving electricity, will be forced to help pay for the new plant in the form of a new and higher average cost based electric rate even though those customers are not responsible for the new plant being built. This discourages customers from conserving electricity and may result in increased electric plant emissions and discharges. In turn, this requires environmental regulation.

TIME-OF-DAY PRICING

This innovative pricing mechanism charges electric customers different rates at different times of the day in direct relation to the utility's varying costs to generate electricity throughout the day. That is, an electric utility's costs of electric production vary significantly depending on the hour of the day. At peak times (for example, 6.00 P.M.) a utility must use all of its generating facilities, including the most inefficient plants, to meet the peak demand of its customers. The cost to produce electricity at peak hours far exceeds the cost to make electricity at non-peak hours, like 3:00 A.M., when only the most efficient electric plants need to run. Time-of-day pricing matches a customer's rates with the actual costs to produce the electricity used by that customer at a given time. Thus, a customer may save money by using electricity at the least expensive time of the day. In this way, a utility may be able to operate its least efficient plants less and its most efficient plants more. This results in more efficient utility operations and in a reduction in emissions and discharges to the environment. Customers, responding to time-of-day pricing, enjoy lower prices and efficiency and conservation are encouraged. Similar pricing techniques can be applied to seasonal costs as well. This pricing mechanism may reduce or even eliminate the need for certain environmental regulations. One prerequisite for adoption of time-of-day pricing is the ability to meter each customer's electric use.

CONSERVATION RATES

This innovative pricing mechanism rewards electric consumers for using less electricity and rewards the utility for efficient operations. This mechanism attempts to overcome the natural and understandable reluctance of private utilities to reduce electric use because lost electric sales reduce profits. Conservation rates achieve this by permitting the utility to recoup a percentage of the profit it would have earned on the electricity it otherwise would have generated or purchased to serve its customers. The customer benefits by paying lower electric rates that reflect the cost savings to the utility of avoiding building new plants and of avoiding the associated environmental costs. Significantly, the New York Public Service Commission recently approved a conservation pricing mechanism that includes a valuation of avoided environmental impacts in using less electricity. Those benefits of avoiding environmental impacts by not building new power plants are shared by the utility and its customers. This represents one of the first tangible evidences that U.S. electric pricing authorities directly and openly recognize that the benefits to the environment are relevant in setting electric prices. This, of course, does not

mean necessarily that the costs to the environment will be reflected in electric prices — a much more difficult problem However, this is an important step in that direction.

CONCLUSION

If the concept of sustainable development is to endure and continue to have relevance in environmental and energy policy making, environmental policy makers must begin to translate the articulation of a connection between environmental regulation and energy prices into quantifiable cost data. An ecological research institute, such as IIAREP, might undertake that task in two steps. The first step, addressed in this paper, is to identify specific energy pricing mechanisms and their potential effects on the environment The second step is to begin to quantify, in specific terms, the environmental effects induced by specific governmental energy pricing policies throughout the fuel cycle from production to end use. Without that scientific data, it is likely that the historical exclusion of some relevant environmental costs in energy pricing policy will continue for the foreseeable future. In turn, this means that environmental regulation will continue to address the effects of energy pricing only in a reactive, after-the-fact, way.

If energy end users are to respond rationally to the burdens imposed on the environment by their energy appetites, then energy prices ought to reflect directly the true costs of those effects. That is, the end user, who demands energy in the first instance and sets in motion the energy fuel cycle that produces environmental costs, should also pay. Perhaps it is time that environmental regulation be based not only on the common law and international law principle that "the polluter pays", but also on the principle that, to the extent possible, "the consumer pays".