Electric Utility Site Selection:
Making Explicit Environmental Choices

by Sanford V. Berg and David Denslow

November 15, 1990

(Very Rough -- portions appropriate for
Public Utilities Fortnightly, other sections for
Land Economics, *Utilities Policy*, or *Energy and the Environments*)

ABSTRACT

Compliance with environmental regulations is not likely to be the only environmental hurdle in the electric utility siting process. Even if all current regulations are met, intervenor groups can delay the site certification process. This study suggests methodological and procedural improvements to current practice. To illustrate points, the study draws from one utility's approach to the problem, wherein a community-based Siting Task Force was established to evaluate alternative locations--balancing economic costs and environmental impacts (air, water, ecology, and land use). The group found that current engineering practice could lead to discarding preferred sites. We suggest procedures for improving the decision-making process in this important area. In addition, we discuss the role of community values and possible environmental offsets in the selection process.

Berg and Denslow are Professors of Economics in the College of Business, University of Florida, Gainesville, FL 32611. Berg is also Executive Director of the Public Utility Research Center and Denslow is Acting Director of the Bureau of Economic and Business Research.

Sara Stack and Sze-yueh Wang served ably as research assistants for our study. Our conclusions do not necessarily represent those of affiliated organizations nor the TECO Siting Task Force (of which we were but two members).

Electric Utility Site Selection: Making Explicit Environmental Choices

Energy price increases induced by the Gulf Crisis and citizen concerns over global warming will both promote closer examination of electric utility demand-side options. However, even with aggressive conservation programs, the higher incomes associated with economic growth will ultimately require supply- side responses. Given the length of the planning process, many electric utilities will be initiating site selection procedures in the near future. System planners will give attention to distances from load centers, transmission routes (and line losses), and a host of technical considerations. Among the most important considerations, and the most difficult to deal with conceptually, is the identification and amelioration of environmental impacts.

To the extent that current practice does not incorporate best practice, utilities would do well to select procedures which will minimize the costs of meeting all environmental constraints. Some of these constraints are established by federal, state and local laws. Other constraints are political in nature--reflecting the NIMBY syndrome (NIMBY--"not in my back yard"), wherein legal constraints are met, but the siting process can be halted by local opposition (either based on widely-held environmental concerns or on opportunistic behavior by a vocal minority). Thus, the siting procedures adopted by utilities need to be both technically sound and politically acceptable. Since a public utility is particularly vulnerable to rate case intervention, maintaining good public relations is essential if investors are to be given the opportunity to obtain a reasonable rate of return.

Here, public relations is not viewed as sponsoring some cosmetic television blitz to make customers feel favorably disposed towards the utility. Rather, it is an integral managerial function of communicating with opinion leaders and the citizenry so that the consequences of various siting options are widely known. Communication is a two-way process. Given the likelihood of legal challenges if the final site does not have relatively widespread support, utility executives would be derelict in their duties if affected parties are not included in the planning process. Does this reflect a diminution of managerial prerogatives, compared with the past? Yes. Is there any way to proceed in the future without citizen input? No.

This study focuses on methodological and political issues associated with electricity generating plant sites, illustrating points with examples from one citizens' advisory group. We believe that insights gleaned from that experience are fairly generalizable, and that the gains to improved environmental/economic trade-offs can be substantial. After reviewing key technical issues and critiquing aspects of current practice, we discuss institutional changes which could strengthen citizen input and improve utility procedures.

Technical Trade-offs and Social Values: A Case Study

Tampa Electric Company (TECO) faced substantial community opposition to the company's preferred site for its next generating plant. TECO's service territory was representative of Florida's population and economic growth--requiring new base load (coal) capacity by 2004 and new combined cycle capacity for intermediate loads. From the company's standpoint, the issue was not when, but where to locate the new facilities. However, the local press denounced the proposed site (Port Manatee on Tampa Bay) and local environmentalists questioned the need for capacity as well as the specific Port Manatee site. It looked like siting controversy could create a political backlash. This lead to the formation of a citizens' advisory group which would provide broader participation in the site selection process than is typical of most industrial decisions.

The Task Force represented an institutional innovation: a way to involve representatives of the community and independent experts in utility decision-making.[1] Our motto might have been "We usually like to have choices; we don't always like the choices we have." The process required us to confront the siting problem thoughtfully, to develop weights for environmental values, and to arrive at a consensus decision regarding preferred sites. As the President and CEO of TECO Energy put it, "We are committed to following your recommendations, committed to meeting the demand for power in the growing Tampa Bay area, and committed along with you [the Task Force] to finding the best compromise between the cost we must pass on to our customers and the need to protect our environment."

The issues were complex, requiring a substantial time commitment on the part of citizen-volunteers. The issues were also controversial, requiring mutual respect and a sense of openness among participants. The Task Force drew upon the services of an engineering consulting firm--to provide technical information and to identify specific sites. The group utilized a well-established decision framework:

(1) Define the problem;

(2) Identify key social values and technical parameters, including objectives, options, and organizing concepts;

(3) Analyze the consequences of each option;

(4) Evaluate each option in terms of our objectives;

(5) Choose the best alternative, based on the weights (relative valuations) attached to competing objectives.

---

[1] In September 1989, the TECO Power Plant Siting Task Force had its first meeting. The group was composed of state and community representatives, including the President of the local NAACP, Vice-President of the Greater Tampa Chamber of Commerce, a former Assistant Secretary of the Interior, a former head of the Florida Department of Environmental Regulation, the President of the Florida Audubon Society, the President of the Hillsborough Environmental Coalition (covering most of TECO's service territory), several businessmen, and citizens active in the Sierra Club and similar groups, including 1,000 Friends of Florida. Several members had service on water management boards and planning agencies. Professors of Economics and of Geology also were appointed to the group. Each member brought some specialized expertise to the committee, with everyone recognizing the multidisciplinary nature of the issues at hand. The President of the University of Tampa served as Chairman of the nineteen member Task Force.

The steps correspond to stages in the site selection process. Three broad phases of the study were established to allow the Task Force to gradually narrow the alternatives, so that the final choice would be based on the best information available regarding engineering and environmental constraints. The phases and key inputs from the Task Force are listed in the Siting Flow Diagram.

Phase I: Regional Study Area Screening

The problem facing the Task Force is where to site new generating capacity. One option was not to build, so the group had to determine whether income and consumer growth justified new capacity. The Task Force examined TECO's conservation, load management, and cogeneration programs. After reviewing technical aspects of electricity load forecasts and generation mix, it concluded that TECO's expansion plan was reasonable--that residential, commercial, and industrial customers would require additional electricity production capacity.

Then the Task Force turned to additional organizing concepts to help members understand the environmental factors that needed to be considered. At monthly meetings, the group heard speakers describe air quality constraints, ecological constraints, and land use/sociological constraints. Using regional suitability maps allowed the consulting engineers to screened out geographic areas which were unsuitable--these areas were unlikely to contain sites which could meet current federal, state, and local environmental regulations. The final site had to have a high probability of successfully completing the permitting process.

The technical terms were overwhelming at times. For example, favorite acronyms from the air quality analysis included NAAQS (national ambient air quality standards--primary and secondary), NSPS (new source performance standards), PSD (prevention of significant deterioration), and BACT (best available control technology). The group waded through reports and sought clarifications regarding the meaning of various regulations related to air, ecology, and land use.

General economic suitability was established by identifying the location of existing infrastructure (pipelines, railroad lines, barge transportation, and transmission facilities). These "attractors" reduced the need for additional infrastructure investments and implied lower costs for customers. Another factor was the availability of cooling water sources. Also, land ownership patterns affected the transactions costs of negotiating for site acquisition. Based on the engineering consultants' work, these preliminary study areas yielded about forty sites for consideration in the intermediate screening stage of the study.

Phase II: Intermediate Screening

The goal of Phase II was to further narrow the list of potential sites. Now the Task Force was ready for more detailed consideration of site-specific environmental and monetary impacts. First, the group had to define the environmental criteria (objectives) in enough detail to allow specialists to characterize the sites in terms of environmental impacts. Each of the four disciplines consisted of components. Those components (and the weights within each discipline) are listed below:

Air Quality Criteria
- Ambient SO2 air quality standards (using distance-weighted emissions within 50 km radius (4)
- PSD class II increments (using distance-weighted increment consuming emissions within 50 km radius (3)
- Impacts on PSD class I Areas (1)

Ecological Criteria
- Diversity of area systems (4)
- Value of habitat function (4)
- Impact on protected species (5)

Land Use/Socioeconomic Criteria
- Compatibility with existing land use patterns (5)
- Compatibility with planned land use patterns (5)
- Impact on archaeological/historical resources (3)
- Community impact (4)
- Agricultural impact (1)

Water Resources/Geotechnical Criteria
- Advantages for cooling water makeup (5)
- Advantages for cooling water discharge (5)
- Area suitability advantages (3)

The internal (component) weights were intended to capture different priorities for the components for each environmental discipline. For example, in the case of the land use discipline, a site's taking land that was currently being used in agriculture was not given much weight compared to a site's being relatively incompatible with existing or planned land use patterns. Specifically, it had one-fifth the weight of compatibility with current and planned land use patterns, an comprised only one-eighteenth of this discipline.

The Task Force discussed the fourteen components and in some cases revised the scoring systems to be applied to particular components. For example, the group viewed being very close to urban areas and being very close to relatively pristine areas both as negatives. Since each component was being rated on a one to five basis (with five being the most environmentally suitable or acceptable), the scoring system had to provide the highest scores to sites in the mid-range (in terms of distance from both urban and pristine areas). Also, members of the Task Force wanted to make sure that the discrete nature of the scoring did not unduly influence the score of a site that was very close to a boundary radius.

The group recognized that these were rough screening scores that were needed to eliminate the least suitable sites.

Once within-discipline weights were agreed upon, the discipline-specific weights were established. To obtain an overall environmental score (and ranking of sites), some weights had to be applied to the four broad areas. The engineering consultants recommended using pair-wise rankings in which each discipline (general environmental category) was compared with each of the others--in terms of being of equal, less than, or of greater importance. Each Task Force member made the comparisons, and the results were combined into overall discipline weights. The resulting consensus weights were as follows: air (2.15), water (2.92), ecology (2.92), land use/socioeconomics (2.0).

Since the weighting of the fourteen environmental considerations is an extremely complex issue, the Task Force sought additional outside review of the process. We obtained an expert in measurement methodology for multiattribute alternative evaluation. He concluded that the pair-wise comparison approach was capable of providing weights that would allow us to identify the better sites. He suggested the use of sensitivity tests, which (when performed) indicated that the site environmental rankings were relatively insensitive to the discipline weights. Thus, the procedure proved to be a reasonable way for screening preliminary sites and finding the ones with preferred environmental profiles.

An important *caveat* is that the discipline weights may have captured average rather than marginal importance of this area. For example, introductory economic courses often examine the "Water-Demand Paradox." The marginal valuation of water is very low because of its relative abundance, yet the average value is higher--in recognition of the high value for the first few gallons of water (necessary for life). Thus, when the Task Force was asked to come up with relative valuations, members may have considered average rather than marginal values. When we compare exchanging a little more of one environmental amenity for a little less of another--relative marginal valuations are what matter. Thus, the pairwise comparison procedure has potentially serious conceptual flaws.

Once the discipline weights were established, obtaining the environmental site rankings involved scoring the site using its specific features. Similarly, the economic rankings depended on the cost differentials associated with the various sites. The estimates of cost differences were primarily estimated on the basis of distance from infrastructure and the need for coal handling facilities. The engineers identified the most expensive site, and all the others were ranked in terms of the cost savings relative to that site. Thus, the Task Force had four summary indices: the scores (in environmental "points" and dollars saved), and the numerical rank orders of the sites in terms of these scores.

The group needed a way to combine these disparate scores. Obtaining a composite environmental/economic ranking can be achieved several ways. First, the environmental and economic rankings can be added together, yielding an index of overall ranking. This approach has been used in previous engineering studies, with the early screening process giving extra weight to environmental concerns so that sites that are highly suitable from the environmental standpoint are included in the set of final candidates. Alternatively, a frontier mapping approach retains all four summary indices, allowing decision-makers to evaluate options in a more consistent fashion.

The ranking approach is flawed because it does not take advantage of the full information on the sites, and it violates some fundamental principles of decision theory. A very simple example illustrates the problem with a simplistic absolute ranking methodology. Consider Figure 1 which depicts the cost savings and environmental scores associated with six hypothetical sites. Site A has the lowest economic and highest environmental rankings. Its position on the Figure reflects its actual economic and environmental scores. It has economic savings of $50 million over the highest cost site (not shown), and it has an environmental score of 40 points. Similarly, site C ranks number one in terms of cost savings ($120 million), but is number six in the environmental ranking. How can we compare these sites?

Given the characteristics of the four other sites, the simple summation of the two rankings yields a "tie". If weights were applied to the rankings (say two to one, doubling the environmental ranking), then site A would rate higher than site C. However, if the four other sites had characteristics such as are shown in Figure 2, even a quadrupling of the environmental ranking will not alter the rating: site C "wins".

Yet the characteristics of sites A and C are no different in the two situations. Each is best in one of the two dimensions that we care about. The simple summation of rankings approach violates a fundamental principle of social decision theory--the independence of irrelevant alternatives. Sites B, D, E, and F are irrelevant for a wide range of valuations that we would place on the dimensions that we care about: we want the site to have high environmental scores (low impacts) and high cost savings (relative to alternatives). These examples illustrate why the frontier approach provides a useful characterization of the trade-offs we face.

Valuations of "Frontier" Sites

The Independence of Irrelevant Alternatives principle is also violated by relative ranking schemes. Table 1 contains three sets of point scores for four sites. Only the characteristics of Site D differ in the three cases. In the first column, an irrelevant alternative is dominated by each of the other sites in both dimensions. In the second case, it has a super environmental score, but scores zero on cost (no cost savings). Site C has the highest relative score (1.5, shown in the bottom half of the Table), receiving a 1.0 for the best cost saving and .5 for an environmental score of 20 (one-half the score for Site 1 -- the highest environmental score). However, if Site D offered instead, significant cost savings (180) but zero on the environmental scale, Site C's relative savings would change -- and it would be displaced by Site A as the "top site." Is this an anomaly or could it characterize much of environmental scoring as currently practiced? We believe that especially when weights are applied to the two dimensions to screen out unsuitable sites, that good options may be lost. Thus, the frontier approach does not attempt to collapse the environmental and economic into a single index. Premature elimination of viable sites is an unnecessary cost to rate-payers, and does not achieve environmental objectives.

To see how our values or preferences come into play, let us continue with the example. Figure 3 only depicts sites A, B, and C. Clearly, A is preferred to B, and C is preferred to B. But what about A versus C? We have to turn to relative valuations of the bundles: no simple summation of relative rankings will suffice. If A is preferred to C, indifference curves could be drawn as shown in Figure 4. The curve through point A is above the curve through point C. Higher curves (to the northeast) represent higher levels of overall satisfaction. The decision-maker's satisfaction is constrained by the opportunity set available to him or her. Here, the opportunity set is depicted by the sites that have been identified.

The indifference curves in Figure 4 are drawn to show that the decision-maker is more satisfied at the combination of environmental amenities and cost savings represented by point A than those associated with point C. If another site were suddenly available, with a combination of cost savings and environmental impacts associated with point X, that would be valued as highly as site A. That is, the decision-maker views the slight reduction in the environmental score as being compensated for by the increase in cost savings. Newly discovered site Y would be preferred to site A or site X.

Thus, the theory of social choice suggests that we apply our values to the opportunity set (as reflected in the site frontier) and select the site yielding the greatest satisfaction (or least dissatisfaction). In the above instance, if A is preferred to C, then it would be selected. However, what if the decision-maker preferred site C to site A? Figure 5 depicts indifference curves consistent with this valuation. Note that again, a site with the characteristics of site X is equally preferred to site C for this decision-maker. Or, as economists put it, the decision-maker is indifferent between the two sites (and their associated combinations of environmental and economic impacts). The bundles of attributes are viewed as equivalent from the standpoint of meeting the decision-maker's overall objectives.

An option like site X could be created if some of the monetary savings from C were used to enhance other environmental objectives. For example, 10,000 acres of wetlands might be purchased with $35 million. This new option could be the basis for a compromise that met the objectives of decision-makers with preferences like those in Figure 4 and other decision-makers with preferences like those in Figure 5. Of course, we do not really know what proportion of the population has which kinds of preferences, nor what the preferences might be in the future. Nevertheless, we are still faced with making a social choice, balancing environmental and economic objectives.

A key question is how to appraise the environmental benefits associated with the $35 million purchase of environmentally sensitive land. This question was an important one for the Task Force. The entire environmental scoring process required the group to combine disparate objectives related to air, water, ecology, and land use. From the very start, the Task Force was unable to avoid choosing from among competing objectives.

Implicit in the weights were our relative valuations of different dimensions of the environment. For example, within the ecology discipline, consider two hypothetical sites, with identical scores in each of the fourteen components except those within ecology (detailed definitions of the rating scheme appended). Let one site have a three on system diversity and a two on habitat function, and the other have the opposite. Since diversity and function were given equal weights within the ecology discipline, these two sites would have the same environmental score: they would be equivalent from the environmental standpoint if the third component of the ecological discipline (protected species) were the same. However, if one of the sites had a two in the area of protected species and the other a three, the more suitable site would have a score 1.2 points higher than the other.

In addition, had the only difference between the two sites been in the areas of diversity and protected species (with ratings of two and three, versus three and two), the one with a higher rating in the area of protected species would have the higher ecological (and therefore environmental ranking) because the Task Force gave it greater weight within the ecological discipline. The Task Force applied weights to competing environmental objectives throughout the process.

As a final application of the relative values framework, consider a situation where two decision-makers must agree on a preferred site. Assume they do not have identical preferences. Even if one of the decision-makers' preferences are like those depicted in Figure 6, an option like Y could still be mutually beneficial (assuming that the other decision-maker does value cost savings). Note that such a flat preference structure is somewhat unusual: the decision-maker characterized in Figure 6 would have to be indifferent between points B and C, indifferent to a $70 million saving to utility rate-payers.

Let us turn from competing objectives and hypotheticals to the choice set facing the Task Force. Based on our recommendations, the group supplemented the ranking methodology with the frontier approach, so we retained a diverse set of sites. The group finally faced five to ten alternative sites for the base load (coal) plant. Since this unit has the greatest environmental and cost implications, it made sense to focus on the major alternatives: Polk 7 and Hillsborough 7 (Port Manatee). Several other Polk sites--11, 13, 14--had some cost advantages over Polk 7 and other Polk sites had higher environmental scores than Hillsborough 7). Narrowing the choice to two at this stage would have allowed us to focus on the key characteristics of the sites. The additional information and detailed consideration of the two sites should have helped us clarify our own valuations (or preferences). Our understanding of the nature of the environmental impacts is a key determinant of our views regarding the two options (and possible compromise options).

Another reason to consider only two sites, HIL-7 and PLK-7, was that evaluating more than two forced the group to use unfamiliar methodologies that, though standard practice in plant siting studies, confused the group. The Task Force lacked the time to master them, so that they can become tools we can use easily and appropriately. Instead engineering procedures had a tendency to befuddle members, reducing citizen control of the decision.

Further limitations of the pairwise approach

We can illustrate this through a look at the pairwise comparison procedure used to construct environmental scores in Phase III. To start with a simple case, suppose that the group judges sites on only two environmental criteria, water and ecology. Suppose further that assigned water and ecology are equal weights. Consider only two sites, H and P. If H dominates P on water, and P dominates H on ecology, then they tie, using a pairwise comparison:

	Water	Ecology	Dummy	Total
H	1	0	1	2
P	0	1	1	2

Now suppose we introduce a third possible site, C, that loses to both H and P on water, beats H on ecology, and loses to P on ecology. Now the pairwise comparison yields:

	Water	Ecology	Dummy	Total
H	2	0	1	3
P	1	2	1	4
C	0	1	1	2

Though nothing has changed in the relationship between H and P, now P beats H instead of tying.

Intuitively, this seems to be irrational decision-making. The inclusion of an irrelevant alternative, C, changes the ranking of H and P. It violates common sense. Digging deeper into the procedure, however, one finds that there is a theoretical rationale for it based on probability distributions. If there are a large number of sites and we make certain strong assumptions about how they array along a continuum of water and ecology values, then we can derive cardinal scores for those values from ordinal rankings.

Digging still deeper, we see that for most of our attributes, those strong assumptions do not apply to our ten or eleven sites. As an extreme instance, for combined cycle plus base load, of the twelve categories look at three: (1) total S02 impacts, (2) PSD impacts, and (3) system diversity. In each of the three, 9 sites score 6.0 and 1 site scores 1. The sites obviously do not fit the assumption that the sites spread smoothly (more precisely, randomly by a rectangular distribution) along continual. Consequently the attempt to derive cardinal numbers from pairwise comparisons between these sites is futile.

Yet no overall environmental score can be constructed <u>without</u> cardinal scores for each of the twelve attributes. The method requires cardinal scores to multiply by the numerical weights. Otherwise there is no way to construct a total score. Thus the method breaks down. To follow standard practice, it must be done. But we should be cautious in letting it guide us.

As a crude test of whether this matters, as opposed to being merely a theoretical quibble, we pit PLK-7 and HIL-7 against each other for CC&BL, pretending the other eight sites do not exist. We use the comparisons provided by the consultants. The result is 15.4 for PLK-7 versus 14.6 for HIL-7 (depicted in Figure 7. This is much closer than the 72.31 versus 59.82 obtained from the pairwise comparisons with ten sites (shown in Figure 8).

We find that the advantage for PLK-7 comes from habitat function, protected species, water discharge, and landmark area. In contrast HIL-7 wins on water make-up, area suitability, and planned land use. It would have been better for the group to look closely at these and other characteristics of the two sites, not at 45 pairwise comparisons on each of 12 attributes, or at 540 comparisons in all, hastily done.

<u>Phase III: Detailed Candidate Study Area Analyses</u>

The Task Force ended up tentatively rejecting the Tampa Bay HIL-7 Site, and another site comparable to PLK-7 was added to the remaining inland sites. The mined-out phosphate pits offered advantages as inland cooling ponds. The costs of the inland alternatives were fairly similar.

As economists, the authors preferred keeping options open, and questioned whether the full environmental consequences of the inland sites were accounted for. The twelve million gallons of fresh water needed daily contrasted sharply with the use of salt water for cooling. Furthermore, the impacts of HIL-7 on the Tampa Bay estuary were minimal, especially in comparison with existing generating units on the Bay -- owned by TECO and by Florida Power Corporation.

Given the importance of the decision, and the strong feelings various stakeholders had regarding possible outcomes, a two-step approach might have been best. The group could have made a "tentative decision," voting up (or down) specific sites. The sites could have had ameliorative land acquisition programs associated with them--creating potential win-win situations discussed earlier. For example, the Hillsborough County Environmental Lands Acquisition and Protection Program (ELAPP) satellite photographs have identified 70,000 acres of environmentally sensitive land in the area, and ELAPP continues to add tracts to its own acquisition program. This Hillsborough agency has identified the need for over $20 million for acquiring available tracts, labeled as Class A sites. Their budget (and funds available from state programs) will determine the scope of such activity in the future.

From our view, ameliorative acquisitions represented a potential offset to concerns over the Port Manatee site (Hillsborough 7). However, we needed information about current programs and the likelihood of future funding levels. If this policy area is one in which the state will be playing an extremely active role in the future, such a state initiative reduces the incremental environmental benefits of set-aside activity associated with power plant siting. On the other hand, a precedent could be set which lead to greater sums going into ameliorative activity in the future.

If ameliorative action had been part of a HIL-7 option, the press, other stakeholders, and various public agencies could have reviewed the Task Force's tentative choice. A series of public workshops could have been held to disseminate information and receive comments. Competing values and the consequences of various options could be discussed by concerned groups. Those who have not been deeply involved in the process could have become educated about the issues. In addition, more detailed studies of key environmental impacts could have been performed if the analyses could have an impact on the group's relative valuations of the options. Once all the information was in, a final vote could have been taken.

A key advantage of the ameliorative land acquisition option was that it would have forced Task Force members and the community to recognize that there are trade-offs within the environmental category. Instead of an environmental score/cost saving frontier, we might have considered wetlands set aside vs. other environmental impacts. Unfortunately, no constituency spoke for the option. Special interest environmentalist had already taken positions against HIL-7: they were never faced with the choice *within* the categories of environmental amenities. Perhaps we did not have time to fully examine the options. Since this is an innovative approach to obtaining a compromise solution, the features of such a program would have needed to be carefully examined by all participants. What would be the time pattern of utility outlays for land acquisition? Would it be better to have the program under the control of ELAPP or a private group, like the Nature Conservancy? If \$20 million investment in preserving environmentally sensitive land is unacceptable, would \$40 million be an acceptable match--to environmental groups? to rate-payers? to regulators? Could funds be used for developing and operating parks? Could funds be utilized for environmental education and research?

Concluding Comments

The case of TECO provides a very stark contrast between siting options: salt water vs. inland. However, we believe that the principles enunciated here are relevant for addressing utility siting policies in areas where the alternative sites seem more homogeneous. With the new 1990 Clean Air legislation, SO2 trades will complicate the picture for utility executives. The customers can decide to pay a higher price for electricity (as they pay for expensive environmental controls) or a lower price for electricity (involving some controls plus the purchase of emission rights). Utilities and the local citizenry will have to achieve mutual agreement on the best strategy, otherwise, the political uproar can be very damaging.

Furthermore, the issues associated with water, ecology, and land use are no less complicated. Using some of the economic savings to achieve other environmental amenities is one way to transform a zero-sum game into a win-win situation from the standpoint of the utility customers and environmentalists. If utilities do not accept some leadership responsibility for stewardship programs that benefit customers and citizens, others favoring a win-lose scenario will take the initiative. We have no doubt who the losers will be.[2]

One interesting sidelight to the TECO situation was the local vote taken on continuing the Hillsborough County Environmental Lands Acquisition and Protection Program (ELAPP).

xxxxxx
xxxx need information on vote
xx

If the voters okayed the extension, that serves as a ratification of decision to go inland. Citizens are willing to pay for environmental amenities. If, however, ELAPP was turned down, then the Task Force's decision is unreflective of the voting citizenry. Of course, the values of the environmentalist might still be the "correct" ones, if voters were not myopic or uninformed of the issues at stake. Nevertheless, a failure of ELAPP would be somewhat problematic.

[2] Tomain (1990) contrasts the traditional electric utility perspective with utopian environmentalists' viewpoints, and finds both wanting. Reconciliation is not simple, but energy strategies and environmental strategies are obviously interrelated. Environmental protection and economic development might be viewed as complementary processes--requiring that the types of trade-offs described here be articulated carefully.

REFERENCES

Hamilton, Michael Seymour, (1984), "Regulation of Power Plant Siting: Decision Making in the Public Interest," Ph.D. Dissertation, Colorado State University.

Hartog, J. A., E. Hinloopen, and R. Nijkamp (1989), "A Sensitivity Analysis of Multicriteria Choice Methods: An application on the Basis of the Optimal Site Selection for a Nuclear Power Plant," *Energy Economics*, October, 293-300.

Markandya, A., (1990), "Environmental Costs and Power Systems Planning," *Utilities Policy*, Vol. 1, No. 1, October, 13-27.

Joseph P. Tomain (1990), "Electricity and the Environment," *Public Utilities Fortnightly*, July 5, 34-36.