Application of System Dynamics To an Integrated Economic and Environmental Policy Assessment

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An integrated system dynamics policy model was developed for a state level economic activity, population, energy demand, supply, and price with realistic feedback mechanisms. Environmental impacts and influences on technical and economic efficiency were also modeled. The model and its use to perform a joint analysis of several interacting policies, including electric and gas utility least cost planning and the construction of an interstate natural gas pipeline are described. A number of interesting results from a variety of perspectives are presented. These include an evaluation of the economic development; air quality and energy efficiency impacts of the pipeline proposal; their sensitivity to fuel prices; and some novel observed feedback relationships between energy price and air quality. The lessons learned in model development, implementation and utilization in both policy and regulatory arenas are discussed. The benefits of fully integrating economic and environmental impacts for policy modeling are evaluated.

1. Introduction

In 1989, the Vermont Department of Public Service ("DPS") began its regulatory and policy review of a proposed Canada to Massachusetts natural gas pipeline passing the length of Vermont. Proposed under the federal "open season" competition for serving the Northeast U.S., this Champlain Pipeline project ("CPL") was the subject of vast media attention and public controversy in Vermont. Grassroots organizations formed to oppose it on various environmental, safety and "NIMBY" (Not In My Back Yard) grounds, while business, industrial and local economic development interests lobbied for it. Concerns were raised about environmental damage from construction and right of way maintenance, explosions, compression stations and the secondary growth consequences of both construction investments and the availability of gas. The benefits of competition and diversity in fuel markets and the reduced air emissions of gas relative to oil- or coal-fired electric generation were put forward. Mass meetings were held around the state, newsletters founded and speeches made. One of the most intriguing questions raised was whether a new fuel source (presumably relatively cheap and convenient) would short circuit vigorous attempts at energy conservation.

In this contentious atmosphere, it fell to DPS as public advocate under Vermont law to assess the need for the gas and its economic and environmental impacts. Recent heightening of environmental debate in Vermont and in its regulatory proceedings, including a year long generic investigation on least cost planning then underway at the state's Public Service Board, and the challenge of considering feedback between regulated and unregulated fuel markets led DPS to choose ENERGY 2020, an integrated system dynamics model of a regional energy economy, for this purpose. (VTDPS 1989) ENERGY 2020 simulates the energy supply and demand dynamics of a region under many varied external and policy conditions. (Backus 1987) Able to dynamically simulate the supply, pricing and demand for a full set of fuel choices, it was well suited to this need.[1] A state level dynamic macroeconomic model for Vermont from Regional Economic Models, Inc. ("REMI") was linked with ENERGY 2020 to capture the influence of energy availability and price on state economic performance and vice versa.

The DPS study focused on the economic, energy efficiency and air quality impacts of expanded availability of gas.[2] The study's purpose was to objectively assess the worth of the pipeline to Vermont in a manner that would satisfy concerned interests, stand up under adversarial cross examination in state and federal regulatory hearings, and deal with the impacts in an interactive and credible way.[3] The administration had actively intervened during the establishment of the open season competition to ensure that a Vermont pipeline project would receive fair consideration. Hence, objectivity and clarity of assumptions and methodology became key requirements.

2. Overview of ENERGY 2020 and Project Modeling

A full implementation of ENERGY 2020 requires the specification of three regional energy market components: the economy, energy demand, and energy supply. The model represents regional demand in residential, commercial and industrial sectors, each further disaggregated. In the version used here, 23 sectors are used: Residential, Commercial, 2-digit Manufacturing SIC's, Agriculture, and Mining. The REMI model dynamically provides economic information to ENERGY 2020, most importantly, local inflation rates and investments in new (energy using) buildings and equipment. ENERGY 2020, in turn, provides REMI with energy prices and utility construction expenditures.

Each of the sectors chooses among alternative fuels (natural gas, LPG, oil, wood, solar, coal, and electricity) to satisfy specific end-uses (space and water heating, cooking, drying, refrigeration, lighting, air conditioning, and miscellaneous electromotive). Cogeneration by fuel-type can be explicitly simulated by sector. Changes in energy efficiency are simulated either explicitly measure-by-measure or implicitly through a consumer-preference

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[1] Due to time constraints, the model was supplied with exogenous prices for electricity, gas and other fuels. Normally, the model simulates these variables, taking as its exogenous inputs projected wellhead and minemouth prices.

[2] Only portions of Vermont's three northwestern counties now have natural gas service.

[3] A static companion analysis of town by town market potential was also conducted to provide another perspective on need.

model. Fig. 1 shows the ENERGY 2020 structure configured for use with exogenous fuel cost data.

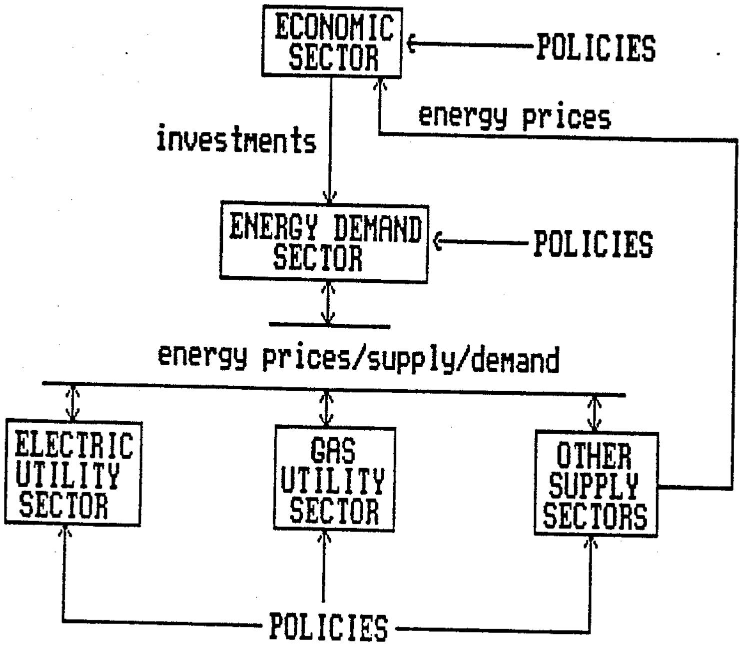

Figure 1. ENERGY 2020 Overview

History of ENERGY 2020

Energy 2020 combines the formalism of engineering and financial modeling with the statistical rigor of econometric models. The demand sector causally extends the approaches taken in advanced econometric models for the residential, commercial, and industrial sectors. (EPRI 1982; Jackson 1982; Reister 1982) The supply sector causally extends the approaches used in recent production costing and financial models. (DFI 1984; EPRI 1988) The crucial characteristic, however, is the feedback simulation which uses the System Dynamics methodology founded in engineering control theory. The National Electric Reliability Council recently noted that the biggest problem with previous analyses was the neglect of price feedback. (Nelson 1989)

The model's current version is the culmination of a development process that started in 1976 at Dartmouth College with an early version (FOSSIL1) written in DYNAMO under primary sponsorship by the U.S. Department of Energy (Backus 1977), continued through the 1979 FOSSIL2 version used to formulate National Energy Plan II (DOE 1981) and currently being used to analyze environmental impacts for the National Energy Strategy Plan. An advanced causal demand version (DEMAND81) was developed at Purdue University for national energy demand policy analysis and adapted for state level use by the Vermont DPS. (Backus 1981, Steinhurst 1984)

The first microcomputer-based integrated energy model to use the new demand concepts and a detailed electric supply sector was Integrated Planning Model written in PROMULA. (Backus 1982) The electric utility portion of the model was originally based on the approach that became the CPAM model used at the Bonneville Power Administration. (Ford 1986) After testing, this model evolved into ENERGY 2020 as used here. ENERGY 2020 is used regularly by utilities and state agencies in many jurisdictions, including Vermont, Illinois, and Massachusetts. In 1988, the American Public Power Association chose ENERGY 2020 as the basis for its least-cost planning project. Recently, California Energy Commission evaluated 26 energy models and selected ENERGY 2020 as the best model for analyses in the 3 to 30-year time horizon.

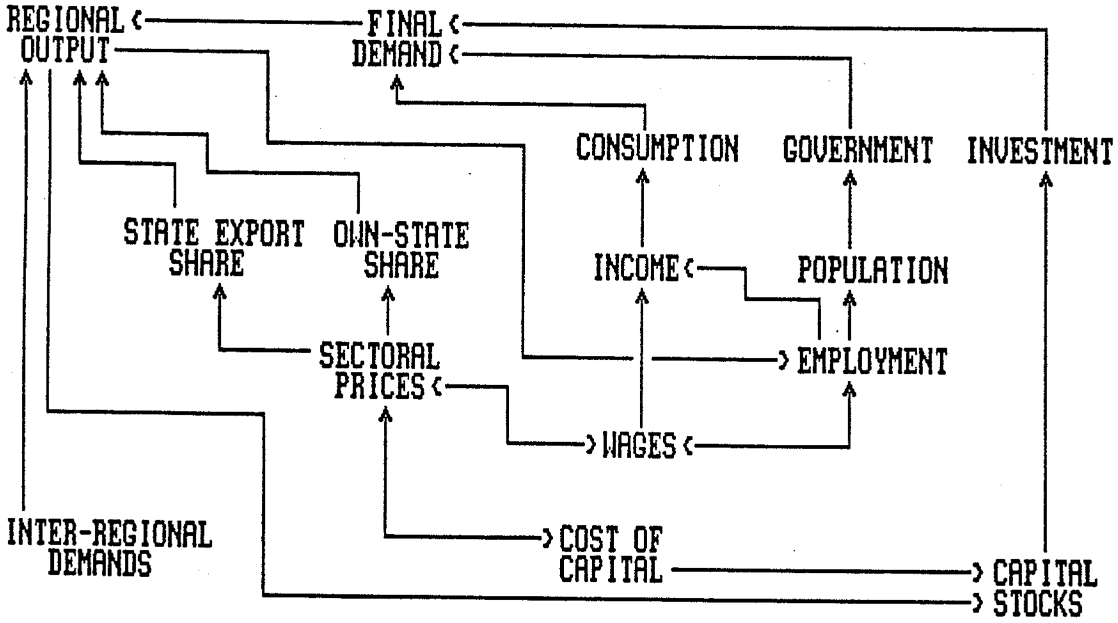

Figure 2. Economy Sector Structure

Macroeconomic Simulation

The REMI model is an econometric model that simulates changes in inter-regional trade interactions. (Treyz 1981) It models business and population migration, use and supply of goods and services, and employment and business growth, accounting for competitiveness and regional demand for products.

Calculated economic growth is fed to ENERGY 2020 to simulate new (energy-using) investments such as homes, factories, stores, equipment, and appliances. In turn, ENERGY 2020 sends energy prices and energy related construction expenditures to REMI to simulate the local impacts of energy industry expansion and capture the change in competitiveness due to energy costs, allowing testing of various policy effects on employment and economic growth, successfully incorporating this linkage between energy and the local economy for, it is believed, the first time. (See Fig. 2.)

Energy Demand Simulation

The demand sector of ENERGY 2020 disaggregates the three residential, commercial and industrial sectors into sub-sectors, each with its own energy end-use variables. Multiple end-uses (including transportation and feed stocks) and multiple fuels are detailed, as are cogeneration, fungible demands and resales. (See Fig. 3.)

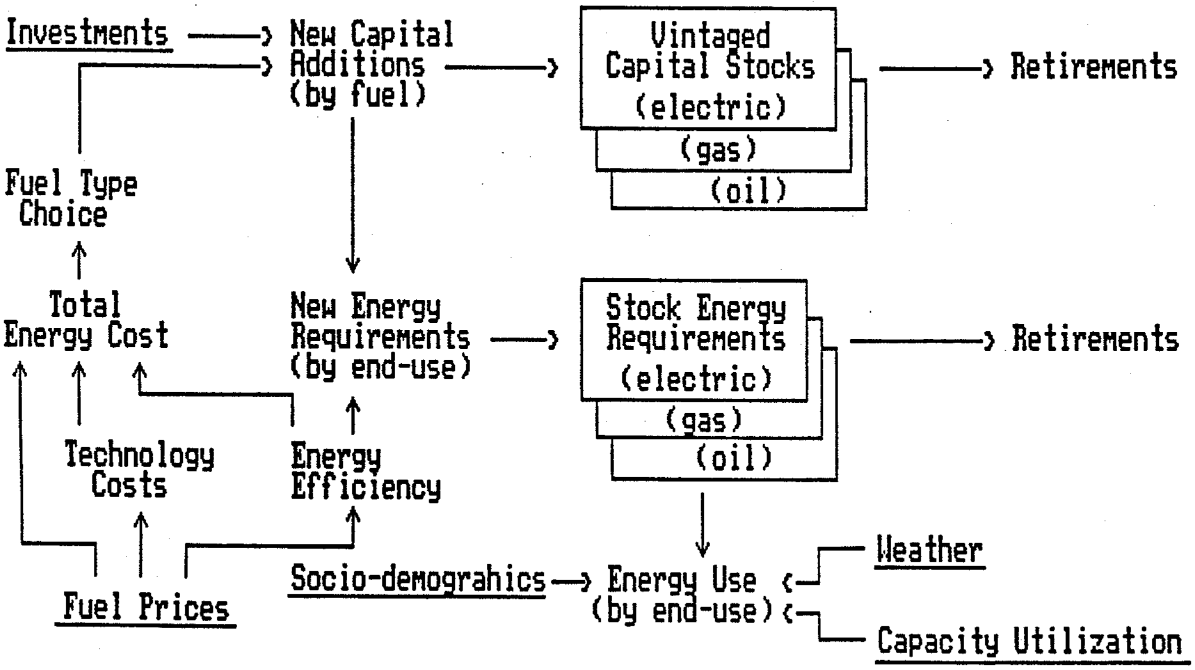

Figure 3. Demand Structure Overview

In ENERGY 2020, energy demand is a consequence of using capital stock in the production of output. For example, the industrial sector produces goods (as determined by demands supplied from REMI) in factories which require energy for production, the commercial sector requires buildings to provide services, and the residential sector needs housing to provide labor, with consequent energy demand for heating, cooling, and appliances.

The amount of energy used in a building is based on energy efficiencies. The energy efficiency of a structure or end use device and the conversion efficiency of its fuel use determine how much energy is used. The energy efficiency of the structure or end use is called the capital stock or process energy efficiency and is primarily technological (e. g., insulation), but can also be associated with control or life-style changes (e. g., operating a house or factory more frugally). Conversion (often, thermal) efficiency associated with air conditioning, electromotive devices, furnaces, and appliances is called the device efficiency.

Energy-using capital stock (buildings and equipment) flows from installation to retirement through three age classes or vintages, yielding embodied energy requirements that result in energy demand when combined with capital utilization level. Consumers determine which fuel and technology to use for new investments by trading off lifetime fuel costs for increased efficiency and concomitant increased capital costs dependent on perceived price, risk, access to capital, laws/regulations, and other imperfect information. Investments add new devices with their own marginal efficiencies to the capital stock flow, changing the average stock efficiency at a rate dependent on economic growth. New technologies (from codes or research & development) also affect the new investment decision by increasing the efficiency of using a particular fuel and may be modeled. Increased market share for a given fuel due to relative shifts in its efficiency and, hence, life cycle operating cost relative to other fuels may increase demand despite the efficiency improvement.

For substitutable uses, e.g., boiler heat, the consumer must choose a specific type of fuel. The choice is based on perceptions of price. The fraction of the time consumers choose one fuel over another is the fraction of the time they perceive it is less expensive than the alternative. The market shares are modeled via discrete choice theory. (EPRI 1982) For example, if electric and gas dryers have the same perceived life cycle cost, 50% of the population purchasing dryers will buy gas and 50% will buy electric dryers. If the cost of using electric dryers is more expensive than using gas, the market share will shift in favor of the gas dryers. Not all customers, however, will switch to gas even if its average price is less, so market share approaches 0 or 1 only asymptotically. Likewise, the tradeoff between efficiency and other factors (such as capital costs) determines the efficiency of the new capital purchases based on perceived life cycle costs within constraints determined by technology or physics. As in the market share discussion above, this tradeoff process can be simulated in terms of consumer choice theory.

The necessary efficiency tradeoff curves, called consumer-perception curves, were estimated using cross-sectional (historical) data on the way consumers make the tradeoff and implicitly determine efficiency trends. Measure-by-measure or least-cost curves which use engineering calculations and discount rates to show how consumers should or could be made to respond to changing energy prices may be substituted.

Pollution Analysis

ENERGY 2020 determines the pollutant emissions from forecasted fuel-specific energy use in each sector multiplied by the appropriate sector-specific emissions coefficient (pounds of pollutant per BTU). These coefficients are based on the national data contained in (EPA 1982). Aggregate-technology, sector-specific coefficients are used for natural gas, coal, LPG, distillate and residual oil, and wood, giving emissions for SO_x, NO_x, CO_2, CO, volatile organic compounds, and total suspended particulates in tons.

Electric Supply

As noted above, the electric utility submodel of ENERGY 2020 was not used in this analysis. Future electricity prices were assumed to be those projected by NEPOOL for Vermont. (NEPOOL 1988) The use of these projections neither endorsed nor disputed their validity. They were used solely as a representative price projection. The electric utility fuel-use mix is based on a recent Vermont avoided cost study. (VTDPS 1986) When total electricity demand projections from ENERGY 2020 vary from that study combined-cycle gas generation is assumed to be added or displaced.

Electric generation to serve the needs of Vermont customers may or may not be from plants located in Vermont, due to centralized dispatch by NEPOOL. This study, however, addressed the direct pollutant emissions for which Vermont is responsible, regardless of location and, so, used the Vermont own-load generation mix. No attempt was made, however, to calculate emissions from the fuel cycle or from industries using fuels as feedstock.

Fuel Supply

If the CPL were completed, gas availability to Vermont commerce would approximately double, while the population having access would approximately triple. This analysis assumes that the distribution system would be expanded to serve anyone along the CPL route who would, according to the model, demand natural gas. It does so by increasing the fraction of the population allowed to select gas as a policy variable. The actual decision to select gas is then modeled on price and customer preference considerations as explained above.

DOE primary fuel-cost data was used throughout this analysis. (DOE 1989) The base case assumes the DOE base case fuel-cost projections. Low and high scenarios assumed the DOE low and high fuel-cost projections. The use of the DOE data does not indicate, however, that these projections are considered correct or valid. Rather, they reflect a reference projection with a band of expectations applicable to the sensitivity analyses portrayed.

Least-Cost Planning

To simulate least-cost energy policies, the model assumed that all customers of regulated utilities will be offered incentives up to the avoided cost of energy less program overhead costs, assumed to be 30% of avoided costs for the residential sector and 15% for the commercial and industrial sectors.

Electric avoided costs are based on a DPS study. (VTDPS 1986) For this study, avoided gas costs are set to the average gas price. Conservation program costs are assumed to be capitalized by the utilities with no direct cost to the customer, although adding the conservation costs to the rate-base can cause the price of the regulated energy to rise. The fully implemented

ENERGY 2020 model can simulate DSM program financing. This process was approximated here by assuming that rate adjustments for DSM expenditures equalled an annuity earning the rate base rate of return on the program's cost. (This rate adjustment was about half that which would have resulted from expensing DSM costs.) Thus, the net effect for a regulated fuel is a complex interaction of lower demand due to efficiency and the rate impact of DSM incentives offset by the increased market share due to that fuel choice's lower life cycle cost. The DSM programs, as simulated, apply only to new stock and fuel-conversion investments identified as the highest priority concern in Vermont's generic docket as "lost-opportunities." (VTPSB 1988)

3. Scenarios

Results of various analyses used to evaluate the CPL are presented along with alternatives which attempt to include the impact of the above hypothetical least-cost program. The least-cost scenarios assume electric and gas least-cost programs will phase-in over a five year period beginning in 1990 and 1991, respectively. Statewide energy bills, end-use energy-use, primary energy use (with electricity demand transformed to utility fuel needs), economic activity, and pollutant emission projections were developed by fuel and economic sector.

Alternative scenarios were chosen to characterize a range of gas contract possibilities and alternative fuel price trajectories. The scenarios are divided into three sets to reflect alternative versions of a pipeline contract, each with a low, base, and high energy price scenario.

The first set (Alternative 1) of pipeline-contract scenarios assumes that half of the starting gas price is a commodity cost growing with the oil price and the other is a fixed (demand or toll) charge. Alternative 2 assumes that the proposed but rejected Vermont Gas Systems, Inc./Western Gas Marketing Limited contract of May 1, 1989 sets prices. Alternative 3 assumes that the price of gas at the border will be the combined cost of tolls in Canada and the wellhead market price of domestic (U.S.) gas as projected by DOE. Alternatives 1, 2 and 3, in that order, provide increasing gas costs. Capital expenditures for the pipeline and associated distribution system are added and capture secondary impacts on economic growth. The CPL construction cost in Vermont used is $170 million (1988$). The cost of the initial distribution system is estimated at approximately $9.5 million.

Industrial oil and LPG users are assumed to have fungible demands for gas and are subject to short-term fuel switching on price. Residential, commercial, and firm industrial gas customers are not assumed to have fungible demand capabilities. Existing residential and commercial oil and LPG users can convert to natural gas, if desired.

The fourteen cases (scenarios) run represent the following combinations of these assumptions, designed to assess the impact of the pipeline, LCP and sensitivity to energy prices. We discuss here only the no pipeline case (Case 1) and the three pipeline scenarios (Cases 3, 5, and 7) under base case energy costs, along with their least-cost counterparts. For results of the low and high energy cost cases (Cases 9 through 14) see (VTDPS 1989).

Scenario Case Identifier Key

Energy Cost	LCP	No Pipeline	Alt. 1	Alt. 2	Alt. 3
Base	No	1	3	5	7
Base	Yes	2	4	6	8
Low	No	--	9	11	13
High	No	--	10	12	14

4. Discussion of Simulations

Absent the pipeline, forecasted residential and industrial electric energy growth is comparable to that estimated previously by the DPS. (VTDPS 1987) Commercial load growth, however, is 1% per year smaller. One cause is that this analysis uses a higher level of aggregation (one versus 14 commercial sub-sectors in the previous DPS report) which masks certain expected trends in subsector end uses such as retail air conditioning. Further, the commercial economic growth supplied endogenously by REMI is lower than the exogenous forecast used in (VTDPS 1987). Reconciling these differences was outside the scope of this effort, but presents no difficulty in principle. In general, because air-conditioning in Vermont is primarily an electric end-use, this consideration had negligible impact on this analysis and its purpose.

Economic activity for the residential sector is reflected as real personal income. For the commercial and industrial sectors, real total sales (not contribution to gross state product) were used, because they properly reflect the goods and services delivered and the required energy for the production process.

The ratio of economic output to total BTUs consumed reflects overall technical energy efficiency. The ratio of economic output to the total energy bill is a reflection of overall economic efficiency of energy use. These ratios are fundamental to economic vitality. With energy conservation, energy demand may actually grow if the reduced cost of using energy (at high efficiency) makes the local economy more competitive and stimulates economic growth. Additionally, energy conservation is not necessarily good (putting aside, for the moment, environmental effects) if its cost so suppresses the economy that the energy reduction is more due to a decline in economic activity than a more efficient use of energy.

A somewhat unique, subtle response occurs in modeling pollutant emissions for Vermont. For all practical purposes, new (future) electric space heating in Vermont is projected to be negligible in most areas due to regulatory constraints. Therefore, relative to electricity, gas can only displace new residential and commercial electric hot water heaters, ranges, and dryers. Other than for hot water heating, the shift from electricity in new construction is minimal. A significant shift to natural gas occurs at the expense of oil and biomass. The reduction in oil and biomass usage does improve statewide energy efficiency, but the efficiency and cost savings are not as great as they would have been if electricity were the dominantly displaced fuel.

The least cost program analyzed here is a bounding case scenario focusing on maximum energy-use reduction. Complete participation was assumed and no mechanism was incorporated to limit free-riders and partial consumer compliance. Hence, the model allowed investments that might not normally occur in an actual DSM program. Further, the avoided cost of electricity is not always higher than the average cost. This means that the "no-losers" rule is violated and, although the least-cost program saves energy and money at the societal level, non-participants may perceive a net increase in the cost of using electricity and gas. This cost perception causes a shift back to the oil and biomass fuels which do not have the DSM program nor DSM-related energy cost impacts. Finally, certain "inconsistencies" occur after the year 2000 when there is little reason to believe that the NEPCOL electric price projections and DPS avoided costs are self-consistent. Given the purpose of these "least-cost" scenarios to show improved energy efficiency and not cost efficiency, the "later-year" secondary cost impacts are not relevant to this analysis.

A simulated shift to biomass caused by least-cost programs appears to imply increased CO2 production, but is misleading. In a well-managed forestry program, the tree stock is maintained, and CO2 released by fuel wood corresponds over time to the CO2 fixed and converted by the growing forest, which is not reflected here.

In the long-term there are negligible differences across the scenarios due to direct CPL construction expenditures, with much of the construction materials and labor coming from outside of Vermont. The local construction industry does obtain a share of the project ($30 to $50 million dollars), which, due to low unemployment in Vermont, raises wages (and local inflation), increases local industry costs and temporarily reduces competitiveness. This reduction is felt by the state economy as a slight reduction in overall economic growth.

5. Results

Several tables summarize the results of this analysis. The no-pipeline case (1) is compared to the three pipeline cases (3, 5 and 7). Table 1 shows the real (1989$) savings in the statewide energy bill for the years 2000 and 2010. In all but the highest price case there are significant (expected) savings exceeding $50 million in the year 2010. The high gas costs implicit in Case 7 reflects an unlikely extreme case presented here for completeness and comparison purposes only.

Table 1. Statewide Energy Bill ($M/Yr)

	Case1	Case3	Case5	Case7
2000	707	684	683	708
2010	940	877	888	961

The total statewide primary energy-use is reduced in all scenarios as illustrated in Table 2. Biomass, oil, and electricity are displaced for more efficient gas use. The reduced energy use in Case 7 is more the consequence of price-induced conservation in the existing natural gas market than the availability of new gas.

Table 2. Statewide Energy Use (TBTU/YR)

	Case1	Case3	Case5	Case7
2000	69.3	68.6	68.8	65.7
2010	78.2	76.8	76.7	71.4

In general, residential and industrial economic growth shown in Table 3 is only sightly improved by the pipeline because of reduced energy bills. The high cost scenario has a minor negative impact on the economy while the other price scenarios have a minor positive impact.

Table 3. Sectoral Economic Activity in Year 2010 ($M)

	Case1	Case3	Case5	Case7
Residential	6347	6362	6359	6333
Commercial	8432	8444	8442	8421
Industrial	6152	6176	6147	6133

In all price scenarios, less energy is used to produce a unit of economic output as illustrated in Table 4. While the change is minor, combined with the preceding result, it shows that the pipeline has a positive impact on energy efficiency without negative economic effects.

Table 4. Economic Output per BTU for Year 2000

	Case1	Case3	Case5	Case7
Residential	100	104	104	103
Commercial	340	346	346	349
Industrial	152	152	152	152

If energy is assigned a value equal to its economic price, then a measure of economic energy efficiency can be produced. This measure indicates how a more diverse energy path improves the economic (competitive) position of the State. Table 5 shows that in all but the high price scenario, economic competitiveness improves.

Table 5. Economic Output per Energy $ for Year 2000

	Case1	Case3	Case5	Case7
Residential	29.3	30.5	30.6	29.5
Commercial	88.0	88.8	90.0	86.6
Industrial	60.9	62.5	62.6	59.3

Finally, as displayed in Table 6, the pipeline has a significant positive impact on air pollution. Less electric generation and oil/biomass usage improves pollution emissions.

Table 6. Pollution Emissions in Year 2000 (Tons/Year)

	Case1	Case3	Case5	Case7
SOX	13.8	12.1	12.0	12.7
NOX	9.3	8.7	8.7	8.8
CO2	5640	5360	5360	5390

In conclusion, in the worst (high price) scenario, analysis indicates that the pipeline has, for all practical purposes, neutral implications. In all the other price scenarios, the pipeline appears to provides a significant economic competitiveness and environmental benefit to the state.

6. Use of Model and Study in Policy Making

The implementation of ENERGY 2020 used in this study was limited in several ways. It was deliberately pruned back in some areas, particularly electric generation dispatch, generation expansion and pricing in order to save development time, to meet regulatory deadlines and because recent proxy inputs were readily available, while interactions with the model sectors of most interest were believed to be minor. Some obviously valuable extensions were not implemented, such as monetization of environmental impacts and substate regional modeling, again primarily due to time constraints. Despite these limitations, "clients" at DPS report that useful results were obtained and, interestingly, attribute at least a part of the value to some unique system dynamics characteristics of the modeling methodology.

Legal and engineering staff at DPS responsible for project definition and policy formulation, but not involved with the actual modeling, were interviewed on several aspects of user satisfaction. The primary benefits reported were fundamentally related to the choice of system dynamics modeling. Chief among these was the explicit accounting for economic feedbacks and a concrete assessment of net environmental impacts, with the latter of most interest to advocacy groups and the public. One informant stated he was "excited about how far [the model] went to meet concerns of the 'rational opposition,'" meaning those interest groups concerned with policy and environmental questions, as opposed to local "zoning" and siting issues.[4] Findings were used in press releases, meetings with environmental groups, legislators and regional planning commissions. A DPS attorney reported a marked lowering of hostility and more positive, respectful questioning at public meetings, even those hosted by entities opposing CPL. Technical and legal personnel were also comforted by the model's ability to readily supply sensitivity analyses and updates, particularly in view of the project's lurching, "hurry up and wait" regulatory pace.

On the other side of the ledger, in addition to the model restrictions mentioned above, the complexity of the feedback model was seen as a barrier to its acceptance. While the implementors hold that the model is totally transparent in that all feedback relationships are visible in the model code, informants felt that the sheer volume of such relationships and, consequently, the amount of output, plus the regulatory community's unfamiliarity with system dynamics terminology and concepts rendered it effectively a black box. Staff interviewed looked forward to using the model in a revived regulatory review of CPL.

7. Implications for the Future

This project raised many issues relative to future needs for reflecting environmental and least-cost considerations in the decision making process. Since this effort, the Massachusetts Department of Energy Resources modified ENERGY 2020 to allow environmental dispatch of electrical generation. The Illinois Department of Energy and Natural Resources modified their model to add externality costs and regulatory preferences to the dispatch and fuel choice decision. The selection of DSM versus new supply for "utility capacity expansion" based on least cost principles is under development at the Central Maine Power Company. Finally, DOE, the American Public Power Association, and EPRI are proposing enhancements to the HYPERSENS sensitivity/confidence analysis component of ENERGY 2020 to allow users to find those policies that best meet desired objectives balanced with the requirement that policies be robust to uncertain future conditions. These advances bode well for the analysis of critical issues confronting energy policy makers.

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[4] It should be noted, however, that these benefits were realized only in public discussion and policy debates, not in the regulatory arena. Although the study was filed as an exhibit in the Vermont certificate of public good docket on the CPL (Vt. P.S.B. Docket 5300), proceedings were suspended, both in Vermont and at FERC at the pipeline's request soon thereafter, pending reorganization under new ownership and securing of new gas supply contracts.

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