TASK FORCE AND WORKING GROUP ON ENERGY INFRASTRUCTURE AND THE PROTECTION OF LONG ISLAND SOUND

Integrating Conservation and Load Management Resources In Electric Transmission Planning: Challenges and Opportunities for Connecticut

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OVERVIEW

I. Background
II. Influence of load growth on future transmission capacity need and cost
III. Prospects for lowering load growth with enhanced C&LM investments
IV. Economics of acquiring transmission capacity from additional C&LM resources
V. Optimizing Connecticut's portfolio of new transmission capacity and multiple non-transmission alternatives

I. BACKGROUND

I am an economist by training with 23 years' experience in planning and assessing efficiency and renewable investments as energy resources and business opportunities.

Since 2001 I have been leading teams assessing economically achievable potential for electricity savings from energy efficiency investments in Vermont, New York, and Maine.

We have also been working on two projects integrating distributed resources into transmission and distribution planning in Vermont.

I. BACKGROUND (con't)

- **New York State Energy Research and Development Authority:** Estimating potential contributions by efficiency and renewable resources toward state's energy requirements and greenhouse-gas emission targets (in draft)
- **Northwestern Vermont Electric Reliability Project:** Assessing economically deliverable transmission capacity from energy-efficiency on behalf of state's transmission utility (in draft)
- **Vermont Distributed Utility Planning collaboratives:** Developing DSM scoping tool for assessing potential contribution by energy-efficiency toward deferring need for distribution investments (in progress since 2000)

I. BACKGROUND (con't)

- **Maine Public Advocate:** Estimated economically achievable potential for electricity savings from energy-efficiency investments (October 2002)

- **Efficiency Vermont:** Served as program planning leader and senior policy advisor for statewide energy-efficiency utility (2000-present)

- **Connecticut Office of Consumer Counsel:** submitted prefiled testimony in Siting Council Docket No. 217 regarding prospects for relying on distributed resources to further reduce need for adding transmission capacity in southwestern Connecticut (March 2002)

II. INFLUENCE OF LOAD GROWTH ON FUTURE TRANSMISSION CAPACITY NEED AND COST

The influence of load growth on transmission requirements is not news to Connecticut

27 years ago, the Power Facility Evaluation Council (the CSC's predecessor)…

- Found that decelerated load growth due to the energy crisis of 1973-4 and its aftermath had postponed the need for adding transmission capacity to serve southwestern Connecticut. (Docket No. 5 February 1975)

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

- Recognized the potential for demand-reducing efforts to postpone the need for additional transmission capacity

20 years ago, the Siting Council found that "recent decreases in load growth ...will result in considerable delay in the requirement for a 345 kV loop into the southwestern area...." (Connecticut Siting Council, Findings in Docket No. 26, October 8, 1982)

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Future peak demand growth directly affects both

- Magnitude and
- Timing of future transmission capacity need

More rapid demand growth

- Increases the amount of total capacity needed at any given time in the future
- Accelerates the need for expanding existing capacity

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Lower demand growth postpones

- Critical need date = time by which higher loads on existing capacity push[es] reliability below minimum acceptable threshold
- Transmission capacity additions otherwise needed to avert reliability problems

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Each year the project is put off avoids the annual carrying charges associated with return **ON** and **OF** capital associated with the investment.

- The proposed Bethel-Norwalk line is estimated to cost approximately $131million,
- The anticipated Middletown-Norwalk line is estimated to cost about $400 million,
- For a total cost of $531 million
- Those were 2001 estimates. Including related facilities, "The total project is estimated to be in excess of $600 million." (Regional Transmission Expansion Plan, RTEP02, Approved by the ISO-NE Board of Directors, November 7, 2002, p. 57)

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Deferring this investment by one year would

- Reduce the present value of transmission revenue requirements by approximately $60 million

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Proposed transmission solutions usually come in stages

- Early stage to address existing or imminent reliability problems
- Later stages to address future reliability or cost problems arising from future load growth

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

Embarking on campaigns now to lower future load growth

- Often cannot influence timing of early-stage, near-term additions (within 2 years)
- Usually can alter later stage investments'
  - Size
  - Configuration
  - Timing

II. LOAD GROWTH AND TRANSMISSION CAPACITY NEED (con't)

A. Additional Savings From Connecticut's Current C&LM Portfolio

B. Potential Estimates in California and Vermont

C. Estimating Potential For Additional Savings in Connecticut

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT

A. Additional Savings From Connecticut's Current C&LM Portfolio

Connecticut is among the nation's leaders in energy efficiency programs in terms of

- Scope
- Design
- Scale

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

SCOPE:

Programs target all major lost-opportunity and discretionary retrofit markets.

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

DESIGN:

Program designs are aggressive,

- Paying most if not all incremental costs of efficiency in new construction or replacement
- Buying down customer retrofit costs so that they yield paybacks of 2 years or less, depending on customer type

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

SCALE:

- Total C&LM spending in 2001 was $77 million
- Savings from all program operations in 2002 are projected to be 67 MW

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

BUT: Evidence is strong that Connecticut could increase savings substantially

- Over-subscription of current programs at current funding levels
- Studies of potential in other states indicate Connecticut could increase several-fold the current pace of cost-effective efficiency resource acquisition

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

Connecticut could increase savings even further by

- Expanding program eligibility to more customers and efficiency technologies
- Intensifying marketing to achieve near-universal participation
- Increasing incentives for targeted efficiency measures and/or customers
- Strengthening delivery services to make it easier for customers to choose and install efficiency technologies

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

B. Potential Estimates in California and Vermont

- California
- Vermont

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

California potential estimates

- Xenergy recently completed a study entitled "California's Secret Energy Surplus: The Potential for Energy Efficiency" (September 2002)
- Estimated maximum economically achievable electricity savings beyond business as usual
- "Business as usual" in California involves $2 billion annually for all efficiency program spending,
- Achieving 1,788 MW from 2002 through 2011

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

- Xenergy estimated that California could
  - acquire over four times as much peak demand savings
  - by spending 3.3 times as much in program costs
- Maximum achievable savings would cut projected load growth in half

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

Vermont potential study results

- Optimal estimated maximum achievable potential for Vermont (May 2002)
- We found that peak demand savings could be increased tenfold if Vermont pursued all achievable savings

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

C. Estimating Potential For Additional Savings in Connecticut

- No detailed analysis has yet been done of how much additional efficiency savings Connecticut could realize
- I estimate that Connecticut could increase savings over currently planned efforts by pursuing the strategies listed here

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

- Over the next 5 years, I estimate that enhancing current programs could achieve
  - 121 MW in cumulative annual peak load reductions by 2007 in southwestern Connecticut
  - 55 MW of which would be realized in the Norwalk-Stamford area.

III. PROSPECTS FOR LOWERING LOAD GROWTH WITH ENHANCED C&LM INVESTMENT (con't)

- These figures correspond roughly to a 75% increase in the current pace of savings
- When Connecticut conducts its own potential study, you should expect to find results
  - In the range found in California and Vermont

IV. ECONOMICS OF C&LM TRANSMISSION CAPACITY RESOURCES

A. Current Practice In Connecticut For Assessing C&LM Economics

B. Assessing Costs Of Demand-Side Transmission Resources

IV. ECONOMICS OF C&LM TRANSMISSION CAPACITY RESOURCES

A. Current Practice In Connecticut For Assessing C&LM Economics

Increasingly in today's changing electric industry structure C&LM cost-effectiveness analysis projects and compares

- Total resource benefits
- Total resource costs

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Net benefits = Benefits – Costs

- Present worth of net benefits = direct measures of economic value to Connecticut from C&LM investments
- Represents the size of the stimulus to Connecticut's economy
- The greater the positive difference between benefits and costs, the greater the economic development impact of C&LM

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Benefit/Cost ratio:

- C&LM investments are economically worthwhile if BCR>1

Connecticut's current C&LM investments appear highly cost-effective, i.e.

- Projected resource benefits far exceed total C&LM costs
- Total Program benefits have been estimated by C&LP at about 2.0, twice total program costs

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Resource Benefits consist of avoided electricity costs and avoided non-electric resource costs

Electricity benefits consist of avoided costs for

- Energy generation
- Generating capacity
- Distribution capacity
- Transmission capacity

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Some efficiency technologies also include non-electric/environmental benefits, such as avoided

- Natural gas
- Oil
- Water

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

B. Assessing Costs Of Demand-Side Transmission Resources

To compare alternative resources with transmission capacity, costs must be stated in comparable terms

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Example: Generation alternatives to transmission capacity

The net cost of transmission capacity from generation alternatives ($/kW or $/kW-yr) =

- Generator capacity payments or capital costs, MINUS
- Value of energy output sold into the market (net of fuel costs), divided by
- Peak capacity contribution from generating source

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

C&LM should be handled the same way as generation alternatives to transmission capacity:

- Net cost of C&LM transmission capacity =
- Total resource costs (as in traditional C&LM cost-effectiveness analysis) MINUS
- Present value of all non-transmission resource benefits (avoided energy and generation and distribution capacity), divided by
- Peak capacity provided by peak demand reduction

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

- Consequently, the net cost per kW of transmission capacity from C&LM is NEGATIVE
- Whenever the sum of non-transmission benefits EXCEED total resource costs of C&LM

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

This somewhat startling finding is consistent

- With the high benefit-cost ratio found for Connecticut C&LM programs, and
- The relatively high combined value of avoided energy and generation and distribution capacity costs compared with avoided transmission costs

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

EXAMPLE: CL&P indicates that benefits exceed costs by a substantial margin in some cases, particularly commercial and industrial programs,

- The reported benefit/cost ratio for the Express Services program is 3.9, i.e.
- Costs are only about a quarter of total benefits (1/3.9), meaning
- As long as non-transmission benefits exceed 1/4th of total electric benefits, the Net cost/kW of transmission capacity will be less than zero

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Using this method I calculated the net cost of transmission capacity provided by CL&P's 2002 C&LM plans:

- Residential programs average a net cost of *negative* $19/kW-yr. of peak demand reduction
- Commercial and industrial programs average minus $37/kW-yr

IV. ECONOMICS OF C&LM TRANSMISSION RESOURCES (con't)

Draft analysis results for Vermont's Northwest Reliability Project corroborate these findings, showing that

- There is a large potential for lowering future demand with more C&LM investment
- At substantially NEGATIVE net resource costs.

V. OPTIMIZING CONNECTICUT'S PORTFOLIO OF NEW TRANSMISSION CAPACITY AND MULTIPLE NON-TRANSMISSION ALTERNATIVES

LEAST-COST PLANNING OBJECTIVE:

Choose the portfolio of transmission and non-transmission resources that minimizes the total costs of providing reliable service to Connecticut electricity consumers

V. PORTFOLIO OPTIMIZATION (con't)

A. CHALLENGES

Today the system has a built-in bias

- Towards transmission
- Against non-transmission alternatives
- Even those such as expanded C&LM with zero or negative resource costs

V. PORTFOLIO OPTIMIZATION (con't)

Under current regulation, nothing can compete economically with transmission because of the socialization of pricing for pool transmission facilities (PTF)

- Most of the costs of PTF are borne by consumers outside Connecticut, whereas
- Connecticut electricity consumers must bear up to 100% of the costs of non-transmission alternatives, PARTICULARLY EXPANDED C&LM

V. PORTFOLIO OPTIMIZATION (con't)

It would be logical today for Connecticut to look at all alternatives to transmission

- If transmission costs are borne solely inside the state, or
- Conversely, if the costs of non-transmission alternatives shared with consumers outside the state in the same way as PTF

V. PORTFOLIO OPTIMIZATION (con't)

It now appears possible that PTF pricing will go eventually go away, perhaps within five years

If Connecticut waits until then, it may well be too late

- To start the 3-5 –year process of acquiring enough additional C&LM resources
- To postpone or alter the need for the next planned transmission facilities

V. PORTFOLIO OPTIMIZATION (con't)

Even without the problem of PTF pricing, deciding how to pay for additional cost-effective C&LM will continue to present a challenge

Transmission capacity value is a relatively small part – on the order of a fifth – of the total electricity resource savings from C&LM including energy, generation capacity, and distribution capacity

V. PORTFOLIO OPTIMIZATION (con't)

B. OPPORTUNITIES

Connecticut has the chance

- to lower its total electric service costs by choosing the least-cost portfolio,
- combining transmission and non-transmission resources including expanded C&LM investment

It is doubtful that the least-cost solution consists entirely of one type of new capacity

V. PORTFOLIO OPTIMIZATION (con't)

Connecticut can find the least-cost solution by developing and comparing competing scenarios,

- Each constructed to furnish the same target reliability performance
- Each involving different amounts of
  - Transmission
  - Generation
  - C&LM, including demand-response initiatives

V. PORTFOLIO OPTIMIZATION (con't)

The gains to Connecticut's economy from pursuing the least-cost portfolio equal the difference between the total resource costs of

- The all-transmission scenario
- The least-cost combination of transmission and non-transmission alternatives

V. PORTFOLIO OPTIMIZATION (con't)

Analysis today can identify the potential economic savings Connecticut could realize

- If five years of expanded DSM with deferred transmission costs less than current plans,
- Then Connecticut will be better off beginning enhanced deployment of C&LM resources now, given the possible end by then of PTF pricing
- Especially since now – long before the demise of PTF pricing -- additional C&LM lowers cost of doing business in Connecticut

V. PORTFOLIO OPTIMIZATION (con't)

Connecticut going forward can look to non-transmission beneficiaries of additional C&LM savings to contribute toward the costs of achieving them:

- Customers in whose facilities C&LM technologies are installed and thus benefit most directly (to whom benefits also include gas, oil, water, and other cost savings)

V. PORTFOLIO OPTIMIZATION (con't)

- Distribution utility customers who together benefit from the distribution peak load reductions from enhanced C&LM and resultant deferral of planned distribution capacity additions
- Electricity consumers generally who collectively benefit from lower retail energy prices resulting from lower aggregate demand due to enhanced C&LM
- Connecticut residents who benefit from energy efficiency and envornmental gains