Northeast Energy Efficiency Partnerships

Energy Efficiency as a T&D Resource: Lessons from Recent U.S. Efforts to Use Geographically Targeted Efficiency Programs to Defer T&D Investments

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EXECUTIVE SUMMARY

Introduction. This product of the Northeast Energy Efficiency Partnerships (NEEP) Regional Evaluation, Measurement, and Verification Forum (EM&V Forum) was developed to help inform Forum sponsors about the role efficiency and other non-wires alternative resources can play in deferring utility transmission and distribution (T&D) system investments. Reducing the need for capital investments in T&D is a benefit that accrues to all consumers whether or not they participate in efficiency programs. The authors from Energy Futures Group (EFG) prepared this report with input and assistance from the EM&V Forum's Geotargeting Project Sub-Committee and many other professionals with experience with this topic. The report includes background on the concept of deferring T&D and its importance, case studies from ten jurisdictions around the country describing where geographically targeted efficiency has been employed, insights and lessons learned from these examples, and a set of policy recommendations to advance the use of non-wires alternatives (NWAs) to traditional transmission and distribution (T&D) investments.

Objective. The aim of this report is to document and update information about experiences with geographically targeted efficiency, highlight important new developments in the field, explore the role that analytical tools can play, and suggest high level policy recommendations that could address the needs of EM&V Forum members, based on insights obtained from the examples that are reviewed. The study focuses on electric system T&D deferral primarily because, to date, this is where most efforts have been focused. However, the conclusions drawn from this analysis are also applicable to natural gas infrastructure. The EM&V Forum presents this analysis to its members in order to support utility resource planners, efficiency program designers and implementers, policy makers and utility regulators in ensuring quality and affordable service for rate-payers in the region.

Methodology. This report builds on a Regulatory Assistance Project (RAP) report from February 2012. It includes original material from the RAP report as well as new case studies and updates to some of the cases,

where appropriate. The case study analyses include information on how, when, where and why NWA projects were designed and implemented, as well as the associated benefits and challenges. Interviews with key individuals involved in these projects supplemented secondary sources. Case studies include projects from the following institutions: Bonneville Power Administration, Pacific Gas and Electric, Central Maine Power, Indiana Michigan Power, NV Energy, Consolidated Edison, Long Island Power Authority, Portland General Electric, National Grid, Green Mountain Power, and Efficiency Vermont.

Findings. In order to put the potential for energy efficiency as a NWA into historic context, the authors estimate that the total national T&D investments made by private and public utilities across the country averaged around $45 billion per year (in 2012 $) over the last decade. Furthermore, that level is expected to continue or increase and represents roughly 60% of forecast utility capital investment. While only certain T&D investments can be deferred through NWAs, the opportunity is significant and the savings potential for utilities and customers is large. The effectiveness of efficiency as an alternative to T&D investment depends on the nature of the loads that are being deferred, and both the mix of energy efficiency programs and the level of savings (e.g. savings/year) being achieved. Although this report focuses mostly on how efficiency can *actively*, i.e. intentionally, defer specific *electric* infrastructure investments, many efficiency programs can *passively* defer investments by reducing peak loads even when they are not being implemented to defer specific construction projects. Natural gas efficiency programs are also likely to have potential to both passively and actively defer gas T&D investments. The EM&V Forum is planning more study of the viability of gas in actively deferring T&D investments.

Case Studies. The use of efficiency for targeted T&D deferrals is not yet widespread but is growing, as exemplified by cases from 1990's through the present. The table at the end of this summary presents highlights of cases covered in the report.

Cross-Cutting Observations and Lessons Learned. The cases presented in this analysis offer a number of insights that are useful for future planning efforts:

1. **Geographically Targeted Energy Efficiency Can Defer Some T&D Investments**

   Case study projects from New York, California, Vermont, and Oregon all achieved enough savings to delay T&D investments for some amount of time. First year experience in Maine and Rhode Island indicate they are on track to delay investments.

2. **T&D Deferrals Can be Very Cost Effective**

   Limited data on cost-effectiveness were available. However, it appears that geographically targeted energy efficiency programs can be much less costly than the traditional T&D infrastructure upgrades (see ConEd and Central Maine Power case studies).

3. **There Is Significant Value to the "Modular" Nature of Efficiency and Other NWAs**

The modularity of energy efficiency and other NWAs allows more control in ramp-up and ramp-down of effort, unlike T&D investments which require much larger individual commitments. Modularity buys the opportunity to fine tune forecasts of the magnitude of T&D needs. This benefit was one of the biggest advantages in NWAs found by ConEd, for example.

4. Policy Mandates Are Driving Most Deployments of NWAs

In most of the case studies analyzed in this report, the catalyst for the consideration of NWAs as an alternative is some sort of government policy. Internal utility barriers and lack of financial incentives comparable to those available for T&D construction are common reasons why NWAs aren't pursued more frequently without mandates.

5. Cross-Disciplinary Communication and Trust is Essential

It is critical for T&D planners and energy efficiency program administrators to work together and to understand each other's needs. Collaboration via multi-disciplinary teams is one effective strategy exemplified in the ConEd, Vermont, and PG&E case studies.

6. Senior Management Buy-In is Invaluable

Senior management support for cross-disciplinary collaboration and implementation of NWAs is critical if NWAs are to be fully integrated into utility resource planning.

7. Smaller Is Easier

Targeting smaller load reductions that require smaller numbers of customers to participate leads to fewer complexities and a shorter planning process, and is recommended for building a foundation of experience with NWA solutions.

8. Distribution Is Easier Than Transmission

Distribution projects are likely easier to implement than transmission projects because they are usually smaller, have a less complex planning process, and typically involve fewer decision-makers. Project costs are also incurred by local ratepayers in the same way as NWA project costs. In contrast, the socialization of transmission infrastructure costs tends to provide utilities with incentives to invest in traditional "poles and wires" upgrades.

9. Integrating Efficiency with Other Alternatives Will be Increasingly Common and Important

Many of the cases looked at in this report involved pairing energy efficiency with demand response, or distributed generation to meet the reliability needs of the project. The ConEd Brooklyn-Queens project is a striking example, and such multipronged efforts can be expected to grow in the future.

10. "Big Data" and New Analytical Tools Enable More Sophisticated Strategies

Various planning software tools are being developed that will allow more accurate modeling of localized loads and spatial variation in avoided costs to give system planners greater precision in assessing loads and the opportunity for load relief available from NWAs. These will enhance planners' ability to incorporate NWAs in system planning.

11. Impact Assessment Should Focus First on the T&D Reliability Need

Evaluations of NWAs usually focus on whether or not the need for the T&D project was delayed into the future. Deferral of construction is the bottom line for NWAs, and is typically regarded as more important for these projects than specific attribution of savings, which may be considered a secondary indication of success. Process evaluations can also provide valuable insight into what worked and what didn't for specific projects.

Policy Recommendations. The researchers presented four recommendations that policy-makers should consider if they are to effectively address the opportunity for NWAs or, by extension, "non-pipes alternatives" (NPAs) for the natural gas sector.

1. Require Least Cost Approach to Meeting T&D Needs

This requirement is in place in every jurisdiction that routinely assesses the use of NWAs in its planning process. It is needed to help overcome strong institutional and financial barriers to the adoption of NWAs. New York is in the process of overhauling utility regulation so that financial incentives are present that reward minimizing T&D costs for ratepayers; while this is as yet untested, it may be a viable alternative policy strategy.

2. Require Long-Term Forecast of T&D Needs

In order to reduce the incidence of costly T&D investments being made by default because of the lack of time to plan and implement NWAs that would be more cost effective, it is important to have a long-term forecast of T&D needs. The researchers recommend at least a 10 year forecast, but point to Vermont where a 20 year forecast ensures that enough lead time is available to implement NWAs.

3. Establish Screening Criteria for NWA Analyses

Most of the jurisdictions in the case studies have established a set of minimum criteria that triggers a more detailed assessment of NWAs. These criteria enable a more streamlined review process for load-related projects that have the potential to defer investments. The table below provides a summary of the criteria currently in place in a number of jurisdictions examined in the report.

Table 1: Criteria for Requiring Detailed Assessment of Non-Wires Solutions

	Must Be Load Related	Minimum Years Before Need	Maximum Load Reduction Required	Minimum T&D Project Cost	Source
Transmission					
Vermont	Yes	1 to 3 4 to 5 6 to 10	15% 20% 25%	$2.5 Million	Regulatory policy
Maine	Yes			>69 kV or >$20 Million	Legislative standard
Rhode Island	Yes	3	20%	$ 1 Million	Regulatory policy
Pacific Northwest (BPA)	Yes	5		$3 Million	Internal planning criteria
Distribution					
PG&E (California)	Yes	3	2 MW		Internal planning criteria
Rhode Island	Yes	3	20%	$ 1 Million	Regulatory policy
Vermont	Yes		25%	$0.3 Million	Regulatory policy

4. Promote Equitable Cost Allocation for NTAs

Investments in traditional transmission resources can be spread across regional rate-payers. For example, a large majority of the cost of a transmission investment in Maine can ultimately be borne by ratepayers in the other five states that are part of the New England grid. For NWAs there is no comparable way of socializing investment costs even when they would effectively address reliability concerns at a lower price. Legislation is being seen in some states (e.g. Maine and Vermont) requiring state officials to advocate for equal treatment of transmission and non-transmission planning and cost allocation in negotiations with and proceedings before their independent system operators, the Federal Energy Regulatory Commission (FERC) and other bodies.

See the full report here.

Summary of Geo-targeting Non-Wires Alternatives (NWA) Case Studies						
Who? (Page in Report)	**Challenges**	**Goals**	**When?**	**Measures Installed**	**Benefits Achieved**	**Regulatory Environment (Vertically Integrated or Restructured?)**
Bonneville Power Authority Puget Sound Region, Washington (Pg. 15)	Puget Sound area was heavily reliant on peak power being transmitted through lines going over the cascade mountain range. There were reliability concerns over one of the lines failing.	Increase system reliability in the area without building new transmission lines over the mountains.	Early 1990s - Present	Voltage support (series capacitors to avoid building new transmission) and increased deployment of efficiency programs.	Delayed the construction of new transmission lines, no new lines have been built to date.	V.I.
Bonneville Power Authority Puget Sound Region, Washington (Pg. 16)	One of the three underwater cables providing power to the San Juan Islands was accidentally severed.	Implement demand side reductions to keep the load on the remaining cables at an acceptable level until a new cable is installed.	Program ran for 5 years	Demand response.	Successfully managed loads on the remaining cables until a new one was installed.	V.I.
PG&E CA (Pg. 16)	A growing community of 25,000 homes and 300 businesses increased demand to warrant building a new substation.	Determine if the need for this substation could be delayed through intensive energy efficiency investments.	1991-1993	Mainly residential retrofit programs. Free low cost measures initially (CFLs, Showerheads etc.) Follow-up for air sealing, duct sealing, AC replacement if needed.	2.3 MW of peak demand savings at a cost of about $3,900 per kW. Delayed building the substation for at least two years.	R

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PG&E CA (Pg. 17 & 43)	Passage of Assembly Bill 327 in October 2013 required utilities to assess the locational benefits and costs of distributed resources (including efficiency), identify economically optimal locations for them, and put in place plans for their deployment.	To target distribution substation level projects that can be deferred by reducing load growth.	2013-Present	Four projects are being proposed after a rigorous set of selection criteria was developed to find the projects with the greatest chance for success. These projects are still in the proposal stage as of the writing of this report.	Still in the proposal process. PG&E is working on organizational changes to help address the divide between system planners and EE program planners.	R
Central Maine Power Boothbay Area, ME (Pg. 18 & 35)	Central Maine Power proposed a large investment to modernize transmission infrastructure, the project was challenged and it was proposed that some of the investment be in NWAs.	To use a pilot program to see if a hybrid approach (some T&D investment and some NWA investment) could be used to meet the energy needs of the region.	2008-Present	Third party administrator, GridSolar, released RFPs for efficiency, demand response, solar, back-up generators, and battery storage. All had been implemented in 2013 except one contractor who had difficulty with financing, a second RFP was issued to fill this gap.	1203 kW of NTA resources were deployed and operational by summer 2014. An additional 500 kW of battery storage unit is currently expected to be operational by the end of 2014. $17.6 million cheaper than the pure transmission solution (about 1/3 of the cost).	R

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Indiana & Michigan (I&M) Niles, Michigan (Pg. 18)	Peak load forecasts show the need to invest in an upgrade at a substation in Niles.	Currently developing a pilot project to use more aggressive efficiency investments to postpone the transformer upgrade.	2014-Present	Increased rebates for current efficiency programs and more aggressive customer outreach and marketing efforts.	Project still in proposal process as of the writing of this report.	R
NV Energy Carson City Area, NV (Pg. 19)	Rural area outside the city faced with rising electricity demand. NV Energy would have to run a costly local station more frequently or construct a 30 mile transmission line from a more efficient station.	Meet the growing demand without building a new transmission line or running up fuel costs at the local power station.	2008-Present	A second refrigerator collection and recycling program (paired with new CFL distributions) and the commercial retrofit program brought most demand side savings. NV Energy staff also re-conductored the existing transmission line to increase capacity.	NV Energy has not had to re-visit the need for additional T&D investments in the area or increase the run time of the local power station.	R
ConEdison New York City Metro Area, NY (Pg. 20 & 27)	Growth in demand was causing a number of distribution networks to approach their peak capacity. Many of the distribution lines are underground in this region, making investment costs much higher.	Defer infrastructure upgrades through locally-targeted end use efficiency, distributed generation, fuel-switching and other demand-side investments	2003-2010	ESCOs were open to bid for any measures to provide permanent load reduction. All implemented projects were efficiency measures.	Provided 40 MW of peak load reduction. Saved $75 million when just compared to potential T&D costs and a total of over $300 million long term savings.	R

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ConEdison Brooklyn & Queens, NY (Pg. 29)	Summer heat wave showed the need for system reinforcement for sub-transmission feeders to keep up with forecasted supply constraints.	Meet this demand with customer side solutions, load transfers, and the installation of new capacitors to delay building a new substation.	2014-Present	$200 M in customer-side and utilty- side investments, along with undisclosed costs associated with load transfers, new capacitors, and upgrades at two other substations.	Still in the proposal stage, predicted to delay the construction of the new substation until 2026 (from 2017).	R
Long Island Power Authority (LIPA) Far Rockaway Region, NY (Pg. 21)	Transmission upgrades are needed for peak load relief.	To meet 25 MW of guaranteed capacity relief through NWAs.	2014-Present	RFPs have been submitted for new generation, energy storage, and demand response.	Still in the proposal process as of the writing of this report.	R
Long Island Power Authority (LIPA) South Fork Region, NY (Pg. 21)	Approximately 20 MW of coincident peak capacity is needed by 2018, with more potentially required in later years.	To help defer a $294 Million capital investment in (primarily) new underground transmission cables and substation upgrades over the next eight years.	2014-2022	RFPs for a combination of storage, solar, and at least 13 MW of guaranteed load relief.	Still in the proposal process as of the writing of this report.	R

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Portland General Electric (PGE) Portland, OR (Pg. 22)	Downtown Portland required distribution system upgrades. Peak summer loads had the greatest effect on demand increases.	Successfully defer investments for one to three years.	1993	Targeted marketing for commercial buildings that needed significant demand reductions. ESCOs were contracted and used a two-tiered pricing system for areas outside of the targeted marketing.	The ESCOs contracted by PGE reduced load through efficiency measures by nearly 25% in just one year. System planners built the infrastructure anyways, were unsure if savings would be persistent.	R
National Grid Tiverton/Little Compton, RI (Pg. 23)	Towns of Tiverton and Little Compton were projected to need a $2.9 Million feeder project in 2014.	Delay the project four years until 2018.	2014-Present	Targeted marketing of state efficiency programs. Strong focus on summer peak load reductions. Demand response (Wi-Fi thermostats for homes with central AC, plug load control devices for window AC units).	NGrid reported to regulators that the program so far has reduced loads enough to put off the feeder for one year.	R
Green Mountain Power Mad River Valley, VT (Pg. 24)	Sugarbush ski resort announced plans to add 15 MW of load to demand with the construction of a new hotel, conference center, and snow making equipment which would have overburdened existing infrastructure.	To accommodate the construction of these new facilities without adding any new T&D equipment using C&I and residential efficiency programs.	1995	Large C&I retrofit program, small C&I retrofit program, residential retrofit program focusing on electric heat and hot water, and a new residential construction program.	Program came very close to achieving savings goals.	V.I.

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Efficiency Vermont Northern Chittenden County, Newport, St. Albans, and the "Southern Loop," VT (Pg. 25 & 48)	The passage of Act 61 made NWAs to T&D investments a primary goal in establishing annual budgets. These four regions were targeted because of the potential for significant reductions in T&D investments.	Efficiency VT was given savings goals that were 7 to 10 times higher than what had previously been accomplished in the regions.	2007-2009	Efficiency Vermont initiated intensive account management of large commercial and industrial customers, launched a small commercial direct install program, and locally increased marketing and promotion of CFLs.	Program participation and savings per participant were higher than standard state-wide program but fell short of summer and winter peak reduction goals. Still, it has not been required to schedule system upgrades in 3 of the 4 regions.	V.I.