






Massachusetts DG Collaborative

http://www.masstech.org/policy/dgcollab

Thursday, Feb 9th
DG Interconnection Standards

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Massachusetts DG Collaborative

- Proceeding: D.T.E. 02-38, Massachusetts Department of Telecommunications And Energy (DTE), began in 2002
- Topics assigned to DG Collaborative:
  1. Uniform Interconnection Tariff:
     - 3/03 -- Collaborative Report, followed by proposed tariff
       - » Facilitated by Raab Associates
     - 4/04 -- DTE-approved tariffs became effective
     - 5/05 -- Small changes filed in 2005 Annual Report
     - 6/06 -- Final changes due to DTE
  2. Role of DG in Distribution Company Planning

Uniform Interconnection Tariff – 2005 Annual Report

- May 31, 2005 -- submitted to the Massachusetts DTE – see: http://www.masstech.org/renewableenergy/public_policy/DG/2005_annualreport.htm
- December 27, 2005 -- DTE issued Order 02-38-C – see: http://www.masstech.org/renewableenergy/public_policy/DG/resources/02-38-C_DTE-order.pdf
    - Approved the "Revised Model Interconnection Standard Tariff" with the changes to the Interconnection process proposed in the Collaborative's May 2005 Report, except for the indemnification language opposed by DCAM -- see: http://www.masstech.org/renewableenergy/public_policy/DG/resources/02-38-C_Att-A_Tariff.doc

Uniform Interconnection Tariff – 2006 Final Report

- Final Report is due June 2006
- Goals:
  - Improve effectiveness and efficiency of interconnection process
    - » File any proposed final changes to Interconnection Tariff
  - Identify any changes to interconnection for networks, or other next steps on remaining technical issues:
    - » Current tariff limits interconnection on networks
    - » Network interconnection has become a separate, controversial issue, with its own "Technical Working Group"
- MTC engaging a mediator for the final negotiations ("Phase 4")
- New parties interested in DG in Massachusetts welcome to join now
  - Next 3 meeting dates: 2/15, 3/15, 4/26

Interconnection on Spot Networks: Current Activities

Massachusetts DG Collaborative 2005/2006 Work Plan Network Interconnection Working Group

The Network Interconnection Working Group has identified objectives and scope of deliverables for next year.

Objectives:

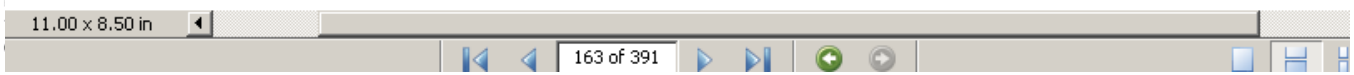
1. Address Tariff issues/concerns for radial interconnection
2. Address Tariff issues/concerns for network interconnection
3. Identify candidate inverter-based pilot projects in Massachusetts. (The criteria for these pilots have not yet been thoroughly discussed by the DG Collaborative.
4. Participate in activities that monitor existing DG installations in the United States
5. Collect additional data from the Williams Building Pilot (spot network interconnection)
6. Monitor industry activities
7. Review applications for network interconnection in Massachusetts
8. Assess potential Network Interconnection Application Guidelines in Massachusetts

Principal Deliverables:

1. Report to DTE that includes conclusions and recommendations to DTE on network interconnection
2. Network proposals for final Tariff (only if 1/25/06 Plenary decides to develop network standards).

Supporting Research and Reports:

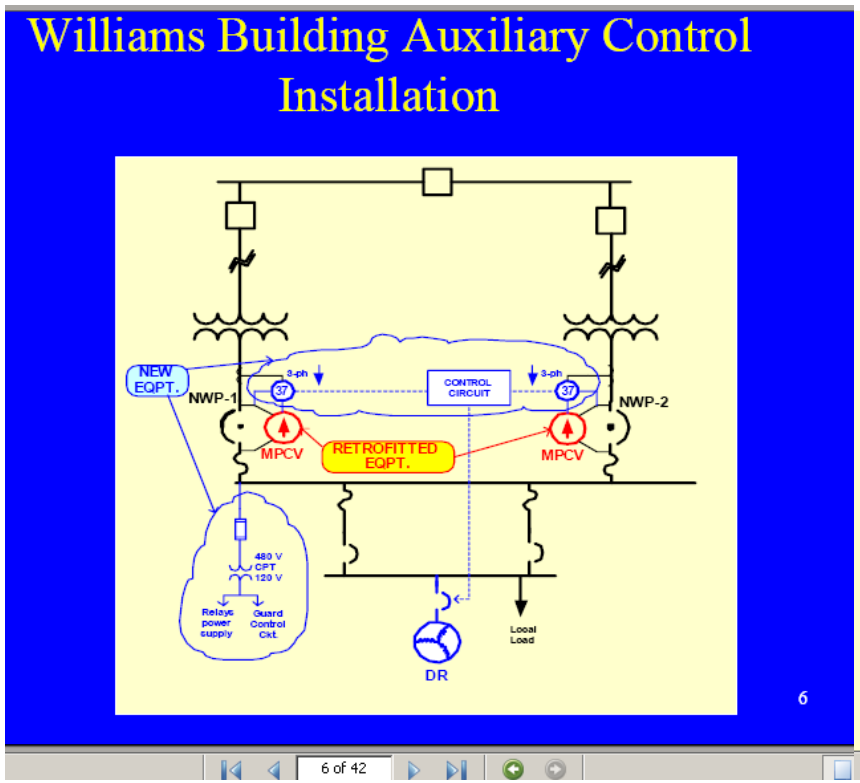
1. Periodic reports on activity outside Massachusetts
2. Network Solutions Technical Report
3. Pilot Project Plan
4. Monitoring of Williams Bldg
5. Reports on Pilot Projects (if any)

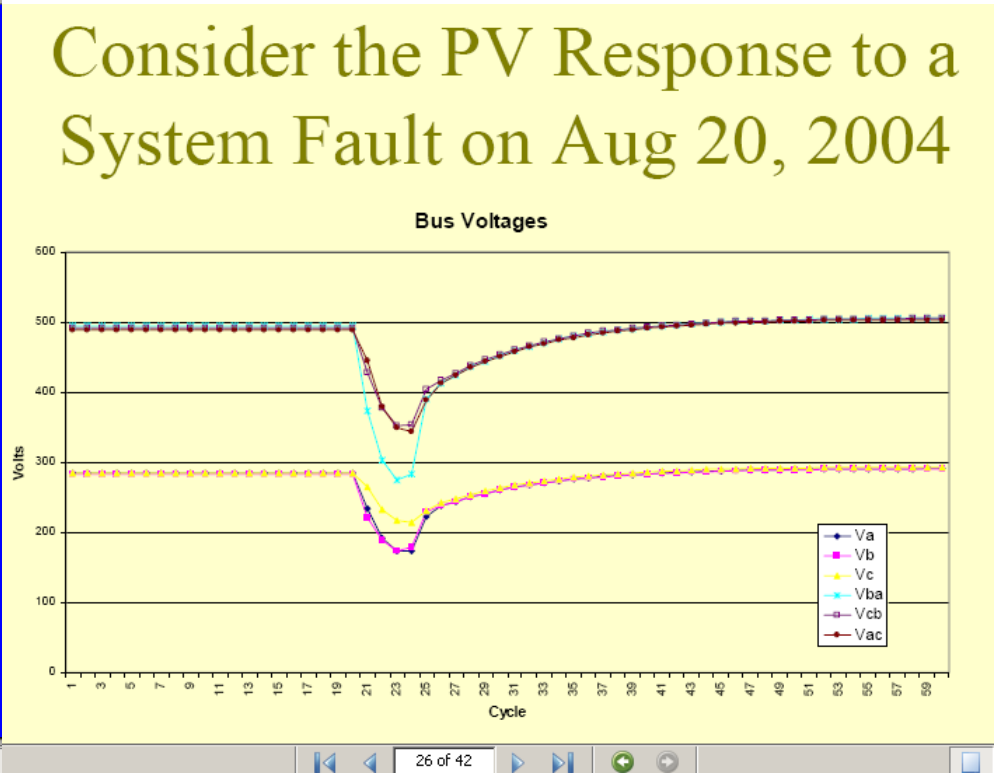


Test Results on Boston Spot Network Interconnection at Williams Building: Presentation by W. E. Feero, P.E., December 16, 2005

- The MTC, the Massachusetts DG Collaborative and the US General Services Administration held a workshop for W.E. Feero to present the results of his analysis of detailed data on the performance of the DG systems interconnected to the NSTAR downtown network at the GSA's Williams Building.
- The findings of a two year monitoring study of the protection performance for the Distributed Generation, DG, installations at the Williams Building was presented. The generation consisted of a 28 kW photovoltaic system and a 75 kW induction generator. The study also included a simulation of the spot network system, the induction generator, and the photovoltaic system's interfacing inverter using the commercially available PSCAD electromagnetic transients program. The simulation allowed the findings of the study to be extended to larger generation installations and to all three generation types: induction, synchronous, and inverter interfaced.

Test Results on Boston Spot Network Interconnection at Williams Building





- Results available at: http://www.masstech.org/renewableenergy/public_policy/DG/meetings/2005_Dec16_network-test.htm

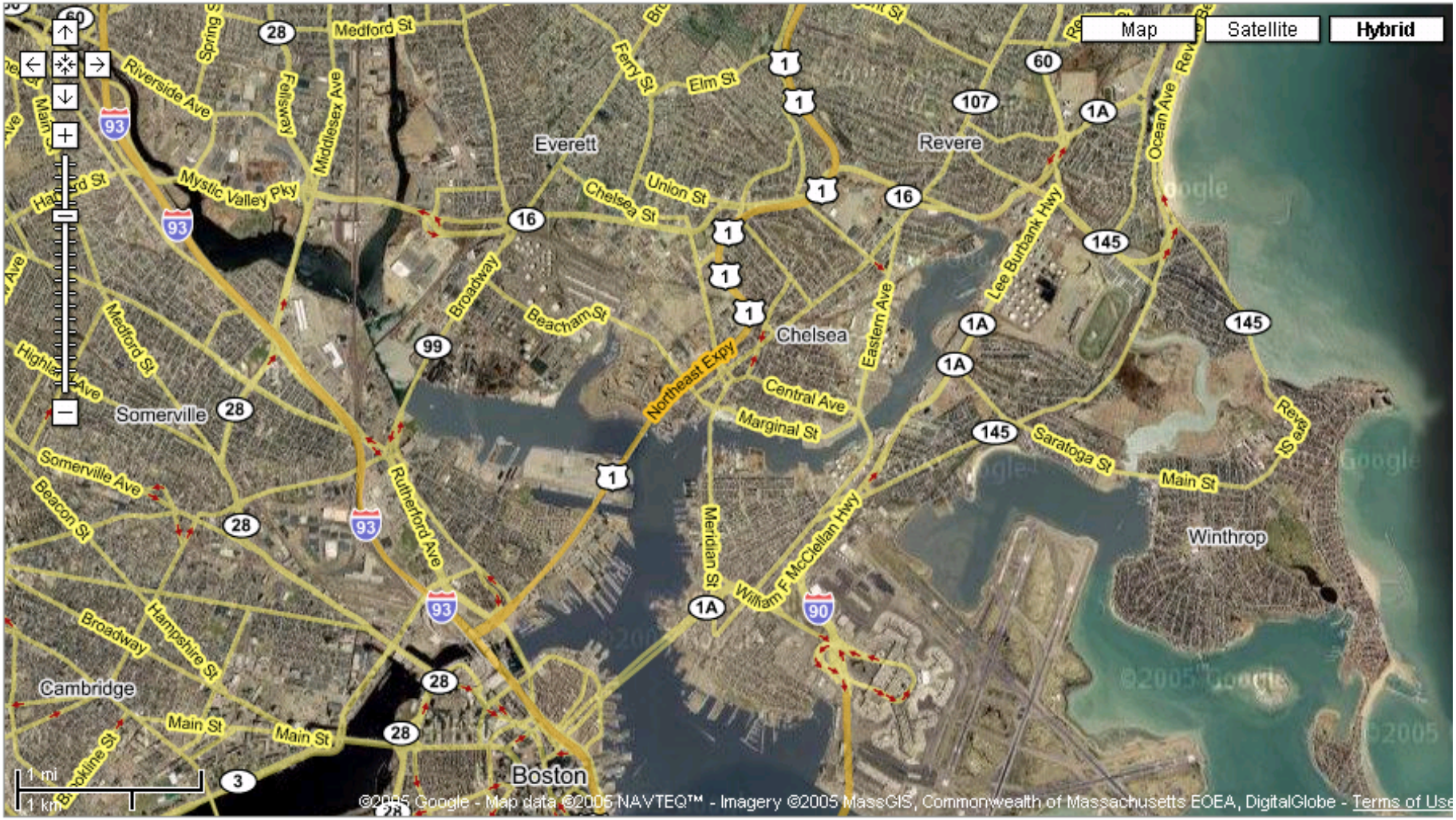
Role of DG in Distribution Company Planning

- Distribution Planning Working Group
- Coordination with other projects (MTC Pilots, EPRI):
  - MTC Congestion Relief Pilots
  - EPRI DER Public/Private Partnership
    - Nine Potential Components of a Win-Win Framework
- Economic Analysis by Navigant Consulting (excerpts below)
- 3 Technical Challenges
- Future Activities

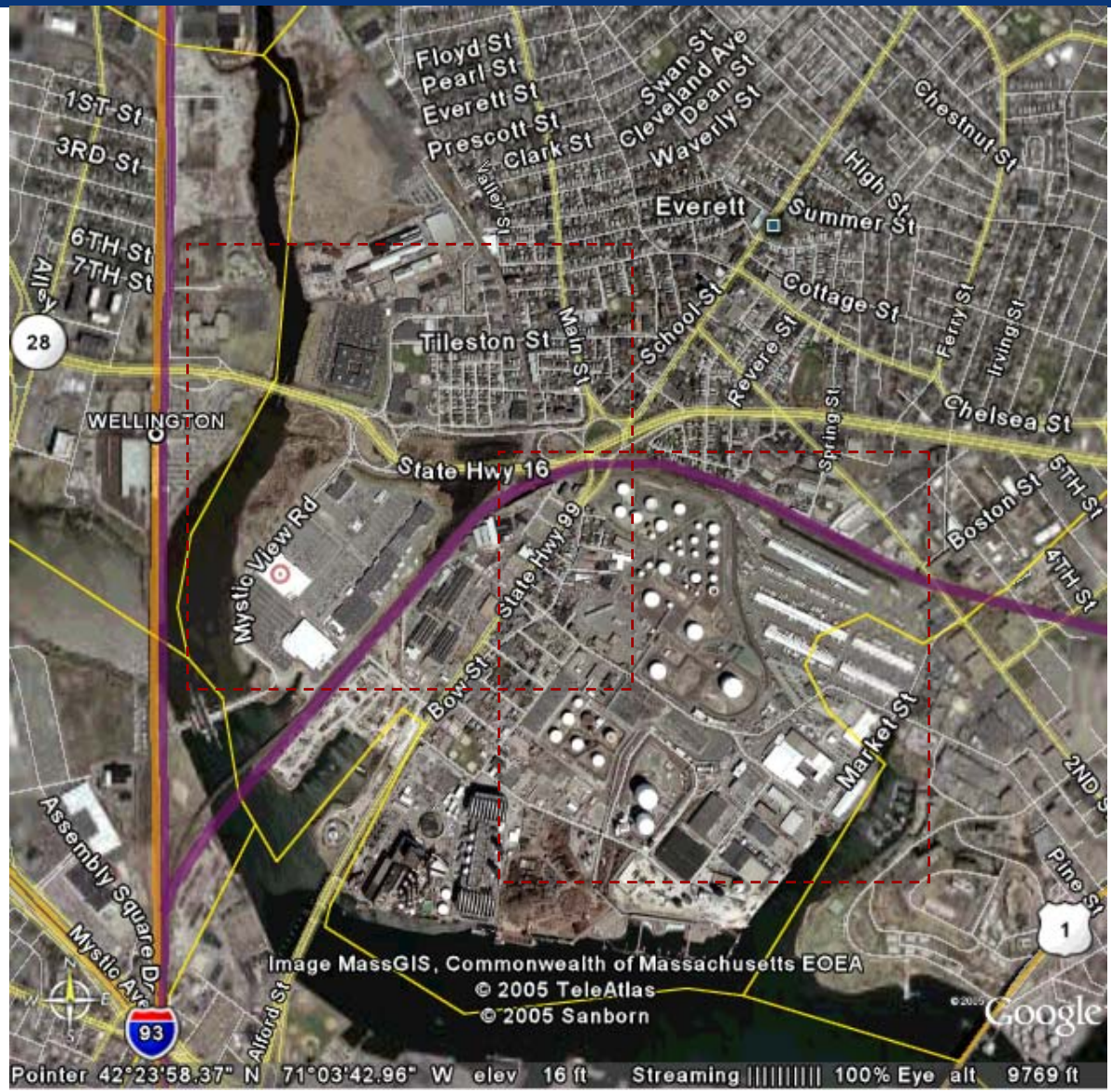
MTC Congestion Relief Pilots

- Partnership:
  - Renewable Energy Trust of the MTC
  - National Grid & other interested distribution companies
- DE Installations:
  - renewable DG and other distributed energy resources
    - demand-response & energy efficiency,
    - storage & other distributed resources
  - collect data on all benefits and costs from such DE (T&D, markets)
- Win/Win Strategies (benefits to both distribution system and host customers)
  - Enhanced "Smart DE" – joint optimization in design and dispatch
  - Modes of Operation
  - Business Models – and potentially rate recommendations

Everett MA Pilot Area – Location Outside Boston



Everett MA Pilot Area



EPRI DER Public/Private Partnership

- Phase 2 of multi-state project: 2006 - 2007
- Goal: create incentives for electricity providers to proactively integrate DER.
- For further information:
  - see the proposal entitled "Creating and Demonstrating Incentives for Electricity Providers to Integrate Distributed Energy Resources (DER)," recently submitted by Massachusetts DOER to the State Technologies Advancement Collaborative (STAC), posted at:

    http://www.masstech.org/renewableenergy/public_policy/DG/resources/DistributionPlanning_Win-Win_Resources.htm
  - contact EPRI or DOER for information on participation.
- Pilot projects in CA and MA, including:
  - Congestion Relief Pilot: MTC and National Grid (see below)

Nine Potential Components of a Win-Win Framework

Incentives to DER Host Customers:

- Customer-Specific Distributed Resource Contracts
- Targetted Distributed Resource Credits
- Transitional Distributed Resource Credits

Rate Redesign:

- Real-Time Pricing
- Redesign of Demand, Energy and Fixed Rate Components

Treatment of Utilities and Nonparticipating Ratepayers:

- Tracking/Balancing Accounts
- Shared Savings or Other Targeted Incentives
- Revenue-based PBR
- Adding DER Costs to Rate Base

Links to reference materials:

http://www.masstech.org/renewableenergy/public_policy/DG/resources/DistributionPlanning_Win-Win_Resources.htm

Attachment B (accompanying the January 31, 2006 letter to Massachusetts DTE and the January 2006 Interim Report on DG and Distribution Deferral by the Distribution Planning Work Group)

Distributed Generation and Distribution Planning:

An Economic Analysis for the Massachusetts DG Collaborative

January 20, 2006

Prepared by Navigant Consulting, Inc.

under contract to the

Massachusetts Technology Collaborative

posted at:

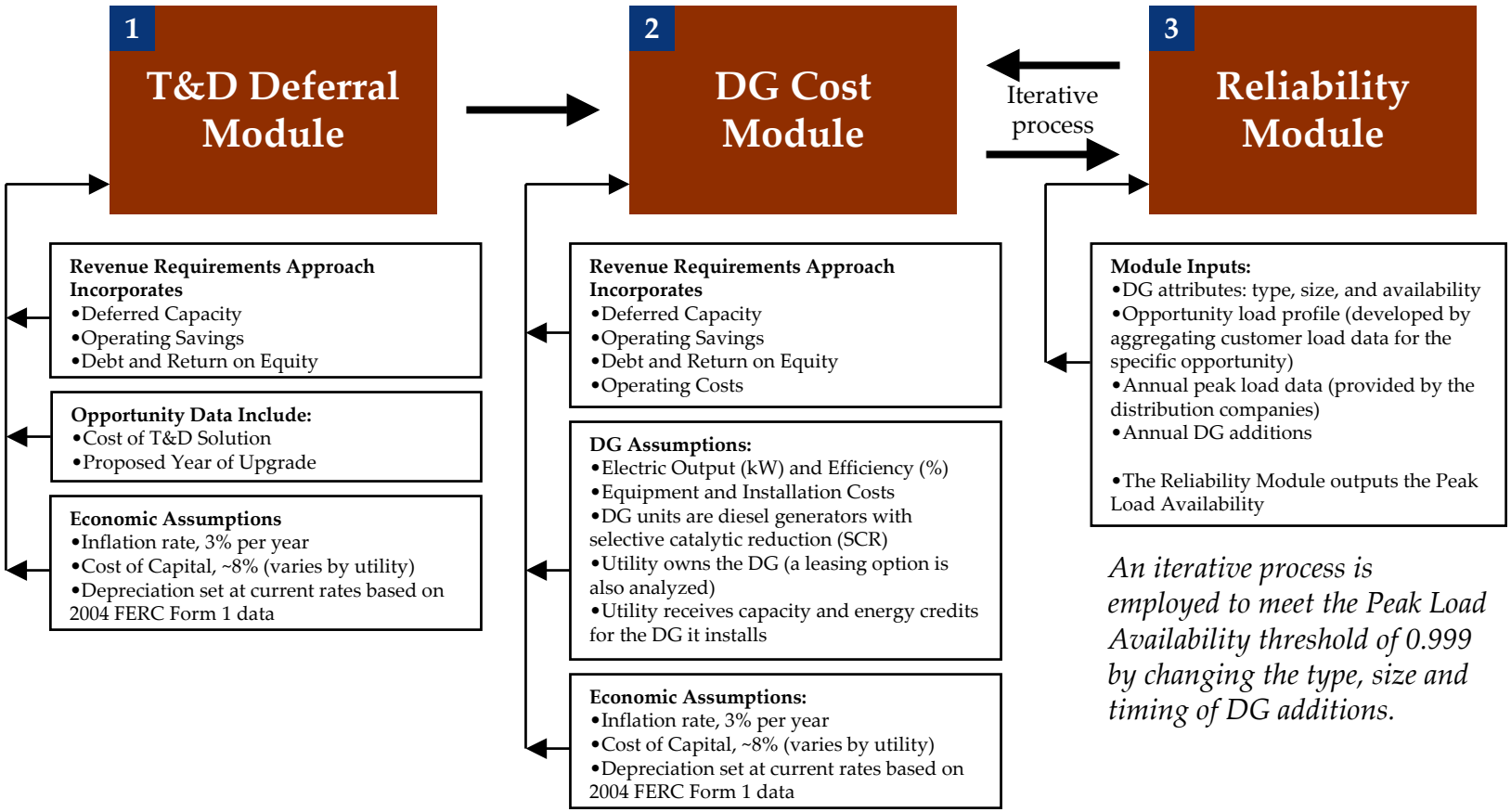
NAVIGANT CONSULTING

Each Massachusetts Electric Distribution Company provided details about a proposed distribution upgrade[1] and customer information for two locations within their distribution system.[2, 3]

Opportunity Name	Electric Distribution Company	Load Zone	Gas Distribution Company	Opportunity Type[4]	Date of Proposed Upgrade[5]	Current Rating (MW)	Traditional Solution Rating (MW)	Traditional Solution Cost	2006 Load (MW)	Average Annual Load Growth
NGRID Norwell	MECO	SEMA	Commonwealth Gas (NSTAR Gas)	New Substation Transformer, Growth	2009	28	50	$900,000	26.5	2.50%
NGRID Worcester	MECO	WCMA	Bay State Gas	New Substation Transformer, Contingency and Growth	2006	19.1	60	$2,100,000	23.2	1.40%
FG&E Lunenberg	FG&E	WCMA	Fitchburg Gas and Electric	Distribution Line Construction & Load Transfer, Contingency	2007	16.0	15.98	$603,000	15.6	2.96%
FG&E Leominster	FG&E	WCMA	Boston Gas (KeySpan)	Distribution Line Reconstruction, Condition	Est. 2006	N/A	N/A	$250,000	0.05	0.00%
NSTAR Woburn	BECO	NEMA	Boston Gas (KeySpan)	Transfer load to alternate circuit, Growth	2006	2	3	$60,000	2.1	1.00%
NSTAR Framingham	BECO	NEMA	Commonwealth Gas (NSTAR Gas)	Tie line, contingency	2007	121.6	126.6	$530,000	119.0	0.55%
WMECO Substation	WMECO	WCMA	None	New Substation Transformer, Projected Contingency Overload and Growth	2010	35.4	73.9	$2,300,000	34.1	1.12%
WMECO Circuit	WMECO	WCMA	None	New Distribution Circuit, Projected Contingency Overload, Reliability and Growth	2009	20.7	46.5	$500,000	19.3	2.36%

1. "Utility Distribution Planning Situations Analysis," March 9, 2005. Available at: http://www.masstech.org/renewableenergy/public_policy/DG/resources/Collab_2005Collab05_03_09_DP_UtilityList.xls
2. "Data from utilities on customer load in the 8 opportunity areas," Available at: http://www.masstech.org/renewableenergy/public_policy/DG/resources/Collab2005_2005-08-16_All-Customers-in-DG-situations_draft.xls
3. "These opportunities are examples of regions in the Company's distribution system that would face constraints in the future. The objective was for each Distribution Company to present two opportunities in order to capture a range of possible distribution planning scenarios that would help facilitate the discussion of the [Distribution Planning] Working Group." Massachusetts Distributed Generation Collaborative 2005 Annual Report. May 31, 2005. Available at: http://www.masstech.org/renewableenergy/public_policy/DG/2005_annualreport.htm
4. There are two general types of opportunities – contingency and growth. Contingency - new equipment is needed to provide back-up when an existing device fails or is unavailable. Growth - New equipment is needed when existing equipment is overloaded due to increased load growth.
5. This date corresponds to the first year of capacity shortfall after 2006.

For each opportunity, NCI repeats the 3-step process to determine when and how much DG must be installed to defer the proposed T&D upgrade.



On an annual basis the cost of the DG solution is compared to the deferral savings. When the annual cost of the DG solution is greater than the annual savings of the T&D deferral, the deferral period ends.

For every customer, or group of customers, Navigant repeats a three step process to determine the aggregate annual DG potential for an opportunity.

1 T&D Deferral Module

Revenue Requirements Approach Incorporates
- Deferred Capacity
- Operating Savings
- Debt and Return on Equity

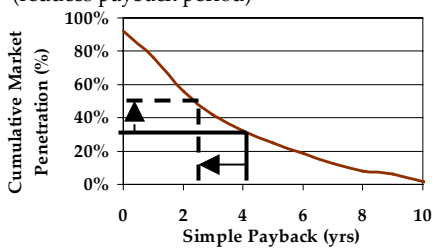
Opportunity Data Include:
- Cost of T&D Solution
- Proposed Year of Upgrade

Economic Assumptions
- Inflation rate, 3% per year
- Cost of Capital, ~8% (varies by utility)
- Depreciation set at current rates based on 2004 FERC Form 1 data

- Calculate a one-time incentive payment for installing DG, EE or committing to a DR program.
- Determine NPV of the deferral savings over the deferral period; divide by the capacity shortfall multiplied by 1.5.
- This factor (1.5) is intended to cover the reliability needs.

2 Status Quo Model

Energy Cost Savings Module:
- Incorporate a one-time incentive payment based on opportunity and length of deferral (reduces payback period)



- Include DR with a 2 yr simple payback

Market Penetration Module:
- Same assumptions as compared to the Status Quo scenario.

Market Adoption Module:
- There is a more rapid adoption (as compared to the Status Quo scenario) of DG, EE and DR through market transformation efforts.
  - Customers now adopt DG within 5 years
  - Customers now adopt EE within 2 years
  - Customers now adopt DR within 2 years

3 Reliability Module

Module Inputs:
- DER attributes: type, size, and availability
- Opportunity load profile (developed by aggregating customer load data for the specific opportunity)
- Annual peak load data (provided by the distribution companies)
- Annual DER additions

- The Reliability Module outputs the Peak Load Availability

In the Active Customer scenario, customer incentives are also assumed, varying with the cost of the upgrade and the shortfall size.

- Using a similar approach as in Active Utility scenario, deferral savings are calculated using a revenue requirements approach.
- Larger cost upgrades with small shortfalls have the largest incentive payments.
- The size of the incentive payment varies by the deferral period target. Target deferral periods of 2 and 3 years were tested.
- A simplifying assumption was used that provided the entire value of the deferral to customers, and the incentive is a one-time payment provided in the first year.
- The incentive is available equally for DG, EE and DR.
- This incentive payment increased the customers' likelihood to install DG, EE and DR, since payback periods will be reduced.

Active Customer Incentives		
Opportunity	**2 yr Deferral ($/kW)**	**3 yr Deferral ($/kW)**
NGRID Norwell	120	110
NGRID Worcester	100	140
FG&E Lunenberg	200	160
FG&E Leominster	1100	1600
NSTAR Woburn	180	200
NSTAR Framingham	76	64
WMECO Substation	520	480
WMECO Circuit	140	110

The most attractive ownership option varies by the characteristics of the planning opportunity.

Deferral Periods		
Opportunity	**Active Utility Scenario**	**Active Customer Scenario (3 yr)**
NGRID Norwell	1 yr	1 yr
NGRID Worcester	0 yr	0 yr
FG&E Lunenberg	2 yr	2 yr
FG&E Leominster	10 yr	N/A
NSTAR Woburn	1 yr	0 yr
NSTAR Framingham	0 yr	9+ yr
WMECO Substation	6 yr	3 yr
WMECO Circuit	2 yr	2 yr

Key Drivers for DG/Distribution Planning Attractiveness

- **Cost of Upgrade versus Shortfall** is a key driver. Opportunities that require large investments for a relatively small shortfall tend to be more attractive. This is a bigger driver for the Active Utility scenario. It is less of an impact for the Customer scenarios, even though it drives drive the size of the incentive.
- **Customer Characteristics** are important for the Customer scenarios. The better opportunities (i.e. with lower weighted average paybacks) have large C&I customers with good thermal demand and access to natural gas.
- **Shortfall as a Percentage of Load** is important for the Customer scenarios. The more customer load and smaller the shortfall the more opportunities there are for DG to meet the capacity needs. Opportunities with a small shortfall as a percentage of load tend to have a greater probability that customer resources can offset the shortfall.
- **Timing for the Upgrade** is an important driver for the Customer Case. The NGIRD Worcester and NSTAR Woburn opportunities start with a capacity shortfall in 2006. This makes it difficult for DG to ramp up to meet the shortfall. In the Active Utility scenario, DG may be installed more quickly.
- **Load Growth** is an important driver for both cases. Opportunities with slower load growth tend to be more attractive.

DG in Distribution Planning: 3 Technical Challenges

		Type of Deficiency	Type of Impact	Summary of Challenge	Potential Solutions
1	**DER Monitoring and Control**	Normal Load Deficiency	Resource availability during heavy load conditions		
		Contingency Based Deficiency	Dispatchability of DG resource in response to contingency		
2	**DG Response During Disturbances**	Normal Load Deficiency	DG response to recloser operation		
		Contingency Based Deficiency	DG availability following a contingency		
3	**Protection System Changes**	Normal Load Deficiency	Relay coordination issues		
		Contingency Based Deficiency	Reverse power flow issues		

DG in Distribution Planning: Future Activities

Economic Analysis:

- Review EE & DR Calculations
- Analyze Hybrid Utility-Customer Scenario
- Refine Category A (incl. losses, ISO market)
- Review "Overhead" Costs to Obtain Benefits of DG
- Review and compare other DER studies
- Estimate Category B Costs & Benefits
- Simplifying/testing worksheet methods for utility application

Technical and Planning Activities:

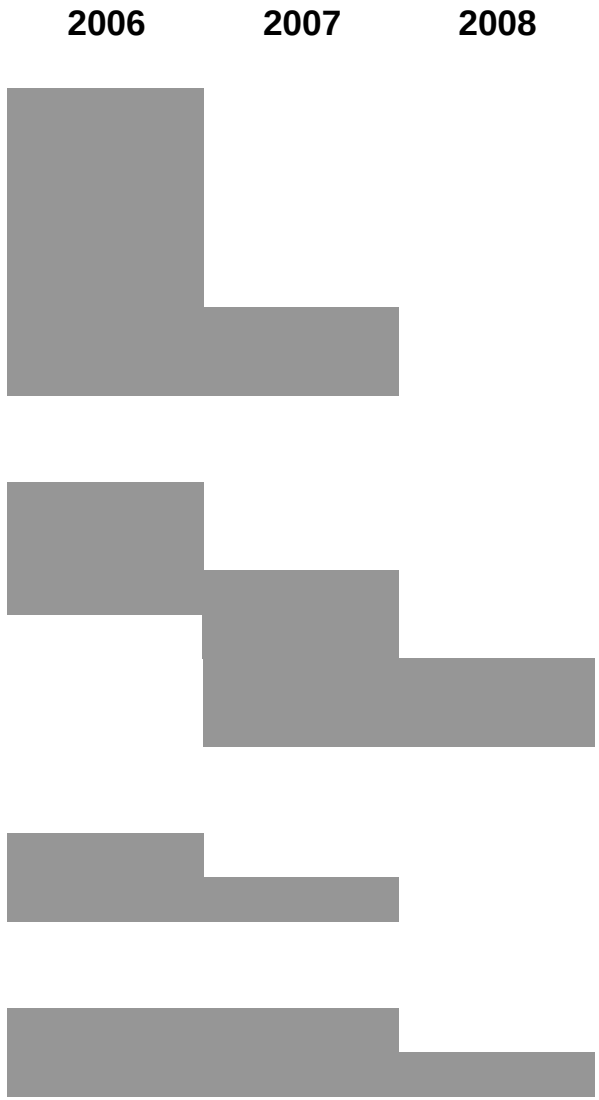
- Charrette on Technical and Contractual Issues
- Development of Screening Methods
- DER modeling and protection system design
- Optimizing DER size, location and mix
- Operator use of DER as system resource
- Development of Other Distribution Planning Methods

Outstanding Tasks from May 2005 Report:

- Analysis of Existing DG for T&D Support
- Statewide DG Economic Assessment

Ongoing Activities (coordination with DG Collaborative):

- EPRI DER/STAC (Win/Win Business, Regulatory Models)
- MTC Congestion Relief Pilot(s)
- Distribution Planning Filings with DTE



Discussion

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