Demand-Side Transmission and Distribution Capacity from Energy-Efficiency Resources: Vermont's Evolving Approach

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Vermont Energy Investment Corporation (VEIC)

- non-profit organization
- 85 full-time employees
- $17 million annual budget
- Mission: reduce the economic, social and environmental costs of energy consumption through the promotion of cost-effective energy efficiency and renewable energy technologies
- Efficiency Vermont contract
- Energy-Efficiency and Renewable Energy Consulting in 20+ States and 8 Countries

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Vermont's Regulatory Setting

Overview

- Statewide transmission utility (VELCO)
- Least-cost planning obligation for transmission and distribution utilities
- Distributed utility planning collaboratives

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Vermont's Regulatory Setting

Statewide transmission utility

- Vermont Electric Power Company - VELCO
- Owned by the 22 Distribution Utilities in Vermont
- "Northwest Vermont area faces serve reliability problems". VELCO proposes Northwest Reliability Project (NRP)

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Vermont's Regulatory Setting

T&D Least-cost planning obligation

- Section 248 of the V.S.A. 30
- "is required to meet the need for present and future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measures and energy-efficiency and load management measures"

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Vermont's Regulatory Setting

Distributed Utility Planning Collaboratives

- Docket 5980 Memorandum of Understanding
  - Signed by all of Vermont's 22 distribution utilities
  - Created Efficiency Vermont
  - Requires the distribution utilities to pursue Distributed Utility Planning
  - Efficiency Vermont is obligated to fulfill DU collaborative requests for targeted efficiency

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Integrating Efficiency: Transmission & Distribution Planning

Transmission Planning

- Client: VELCO
- Performed an assessment of economically deliverable transmission capacity from targeted energy-efficiency

Distribution Planning

- Client: VT Distributed Utility Planning Collaborative
- Developed an area-specific energy-efficiency scoping tool

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Integrating Efficiency: Transmission Planning (VELCO)

Approach

- Large capital investment over a decade
- Promoting market-proven technologies and implementation strategies
- Supported by sustained marketing and generous financial incentives

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Integrating Efficiency: Transmission Planning (VELCO)

Summary of Analysis

- Based on 2002 Vermont Statewide Potential Study
  - included all of Vermont
  - included all sectors and all markets
  - included all measures
  - used penetration rates for 50/50 prediction
- VEIC and Optimal Energy, Inc. conducted both the Statewide and VELCO studies

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Integrating Efficiency: Transmission Planning (VELCO)

Summary of Analysis (con't.)

- Limited the measures to Northwest Vermont
- Excluded measures:
  - with limited peak demand impact
  - that require regional coordination
  - that rely on emerging technologies
  - not cost-effective (based on societal test)
- Lowered penetration rates to increase degree of confidence in results

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Integrating Efficiency: Transmission Planning (VELCO)

Summary of Residential Analysis

- Built up from end-use disaggregations
- 3 Markets: retail, retrofit and new construction
- 36 technologies, 2 building types, 70 measures
- Data Sources:
  - US EPA ENERGY STAR® Programs
  - Vermont DPS Residential Energy Assessment
  - US EIA Residential Energy Consumption Survey (RECS)
  - Vermont DSM program experience

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Integrating Efficiency: Transmission Planning (VELCO)

Summary of C&I Analysis

- Disaggregated sales forecast into building types and end-uses
- 4 Markets: Renovation, Replacement, Retrofit and New Construction
- 11 Building Types, 9 End-Uses
- Primary Data Sources:
  - Utility sales data by SIC
  - RER hourly load shapes
  - US EIA Commercial Energy Consumption Survey

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Integrating Efficiency: Transmission Planning (VELCO)

Energy Efficiency Findings

- Inner and Metro Region
- Includes Efficiency Vermont program savings
- 97 Summer MW saved economically by 2012
- $268 million in net societal benefits[1]
- ($3,007)/kW or ($250)/kW-yr net transmission cost

[1]**Does not include transmission benefits**

Note: all dollar values are in 2003 dollars

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Integrating Efficiency: Transmission Planning (VELCO)

Evaluated Scenarios

- NRP - 115 kV and 345 kV transmission lines
- ARC 5 - 120 MW of CT and 74 MW DSM
- 4 other generation scenarios

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Integrating Efficiency: Transmission Planning (VELCO)

Comparison of Integrated Scenarios

- NRP is $66 million (5.4%) greater than ARC 5
  - Present value total societal costs
- NRP is $17 million (1.4%) greater than ARC 5
  - Present value total societal costs adjusted for NEPOOL Transmission Tariff
- VELCO is economically indifferent between scenarios

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Integrating Efficiency: Transmission Planning (VELCO)

Energy Efficiency

- Advantages:
  - Negative Net Costs
  - Can be acquired in small blocks
  - Risk-mitigation: Savings vary with underlying load
- Disadvantages
  - Highly capital intensive
  - May be less certain a resource than transmission lines
  - Requires concerted effort by multiple parties
  - Cost are not currently socialized across power pool

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Integrating Efficiency: Transmission Planning (VELCO)

Transmission Project (NRP)

- Advantages:
  - Does not rely on multiple parties
  - Greater resource certainty
  - Costs are currently socialized across power pool
- Disadvantages
  - Construction delay risk
  - Permitting risk
  - Construction Cost risk
  - Resource is acquired in large blocks

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Integrating Efficiency: Distribution Planning (DUP)

Distributed Utility Planning Collaboratives

- The 22 distribution utilities in Vermont are required to pursue Distributed Utility Planning
- Efficiency Vermont is obligated to fulfill DU collaborative requests for targeted efficiency

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Integrating Efficiency: Distribution Planning (DUP)

Problem

- How to cost-effectively assess the energy-efficiency potential of distribution-constrained area
  - Distribution utilities no longer employ DSM staff in Vermont
  - All distribution-constrained areas are not equal
  - Need ability to quickly assess potential in an area

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Integrating Efficiency: Distribution Planning (DUP)

Solution

- DUP Scoping Tool
  - Quickly assesses if the energy-efficiency potential is large enough to cost-effectively defer distribution upgrades
  - Designed for constrained area of any size
  - Allows the DU to determine if a detailed study of an area is necessary
  - Includes currently planned Efficiency Vermont programs

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Integrating Efficiency: Distribution Planning (DUP)

Summary of DUP Tool

- Based on 2002 Vermont Statewide Potential Study and 2003 VELCO analysis
- VEIC and Optimal Energy, Inc. conducted both the Statewide and VELCO studies

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Integrating Efficiency: Distribution Planning (DUP)

Summary of DUP Tool (con't.)

- Excluded measures:
  - with limited peak demand impact
  - that require regional coordination
  - that rely on emerging technologies
  - not cost-effective (based on societal test)
- Penetration rates increased due to ability to focus marketing efforts in specific area

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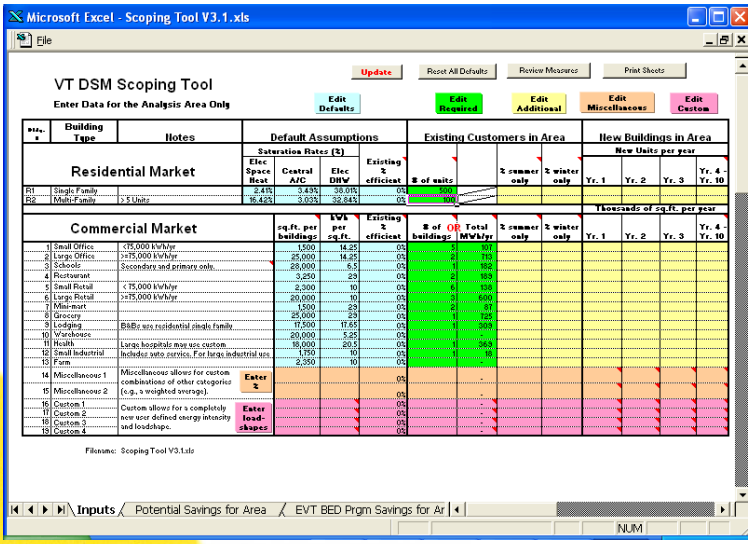
DUP Scoping Tool: Sample Inputs



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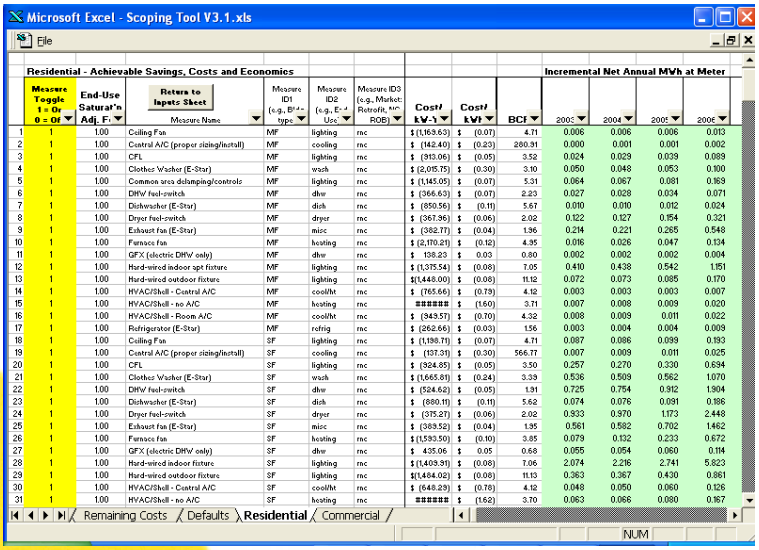
DUP Scoping Tool: Sample Measures



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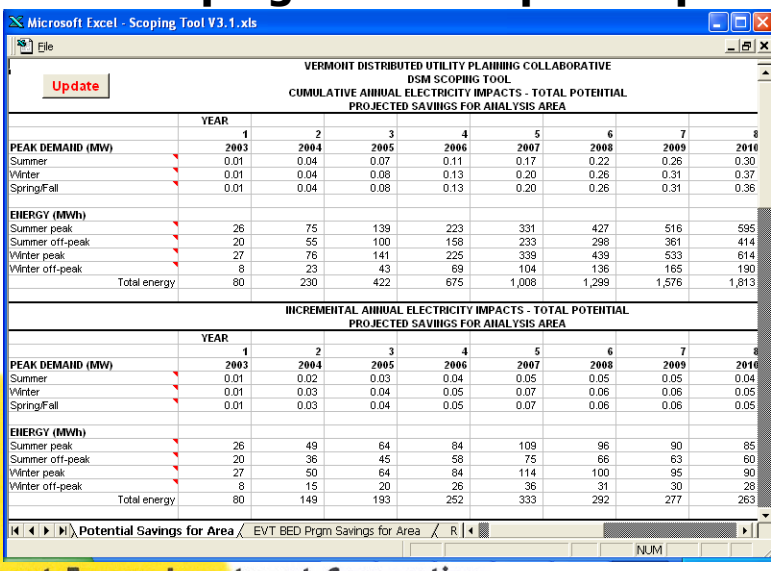
DUP Scoping Tool: Sample Outputs



Microsoft Excel - Scoping Tool V3.1.xls

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Update

VERMONT DISTRIBUTED UTILITY PLANNING COLLABORATIVE
DSM SCOPING TOOL
CUMULATIVE ANNUAL ELECTRICITY IMPACTS - TOTAL POTENTIAL
PROJECTED SAVINGS FOR ANALYSIS AREA

	YEAR							
	1	2	3	4	5	6	7	8
PEAK DEMAND (MW)	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Summer	0.01	0.04	0.07	0.11	0.17	0.22	0.26	0.30
Winter	0.01	0.04	0.08	0.13	0.20	0.26	0.31	0.37
Spring/Fall	0.01	0.04	0.08	0.13	0.20	0.26	0.31	0.36
ENERGY (MWh)								
Summer peak	26	75	139	223	331	427	516	595
Summer off-peak	20	55	100	158	233	298	361	414
Winter peak	27	76	141	225	339	439	533	614
Winter off-peak	8	23	43	69	104	136	165	190
Total energy	80	230	422	675	1,008	1,299	1,576	1,813

INCREMENTAL ANNUAL ELECTRICITY IMPACTS - TOTAL POTENTIAL
PROJECTED SAVINGS FOR ANALYSIS AREA

	YEAR							
	1	2	3	4	5	6	7	8
PEAK DEMAND (MW)	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Summer	0.01	0.02	0.03	0.04	0.05	0.05	0.05	0.04
Winter	0.01	0.03	0.04	0.05	0.07	0.06	0.06	0.05
Spring/Fall	0.01	0.03	0.04	0.05	0.07	0.06	0.06	0.05
ENERGY (MWh)								
Summer peak	26	49	64	84	109	96	90	85
Summer off-peak	20	36	45	58	75	66	63	60
Winter peak	27	50	64	84	114	100	95	90
Winter off-peak	8	15	20	26	36	31	30	28
Total energy	80	149	193	252	333	292	277	263

Potential Savings for Area | EVT BED Prgm Savings for Area | R

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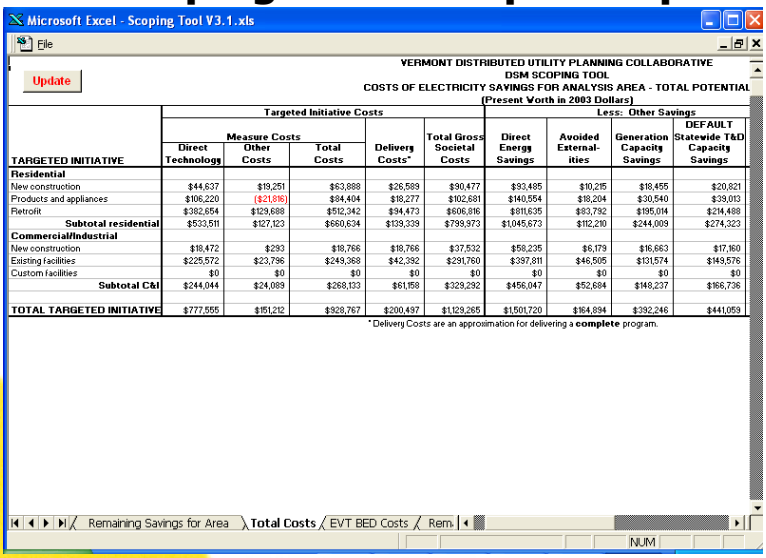
DUP Scoping Tool: Sample Outputs



Microsoft Excel - Scoping Tool V3.1.xls

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VERMONT DISTRIBUTED UTILITY PLANNING COLLABORATIVE
DSM SCOPING TOOL
COSTS OF ELECTRICITY SAVINGS FOR ANALYSIS AREA - TOTAL POTENTIAL
(Present Worth in 2003 Dollars)

	Targeted Initiative Costs					Less: Other Savings			
	Measure Costs								
TARGETED INITIATIVE	Direct Technology	Other Costs	Total Costs	Delivery Costs*	Total Gross Societal Costs	Direct Energy Savings	Avoided External-ities	Generation Capacity Savings	DEFAULT Statewide T&D Capacity Savings
Residential									
New construction	$44,637	$19,251	$63,888	$26,589	$90,477	$93,485	$10,215	$18,455	$20,821
Products and appliances	$106,220	($21,816)	$84,404	$18,277	$102,681	$140,554	$18,204	$30,540	$39,013
Retrofit	$382,654	$129,688	$512,342	$94,473	$606,816	$811,635	$93,792	$195,014	$214,488
Subtotal residential	$533,511	$127,123	$660,634	$139,339	$799,973	$1,045,673	$112,210	$244,009	$274,323
Commercial/Industrial									
New construction	$18,472	$293	$18,766	$18,766	$37,532	$58,235	$6,179	$16,663	$17,160
Existing facilities	$225,572	$23,796	$249,368	$42,392	$291,760	$397,811	$46,505	$131,574	$149,576
Custom facilities	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal C&I	$244,044	$24,089	$268,133	$61,158	$329,292	$456,047	$52,684	$148,237	$166,736
TOTAL TARGETED INITIATIVE	$777,555	$151,212	$928,767	$200,497	$1,129,265	$1,501,720	$164,894	$392,246	$441,059

*Delivery Costs are an approximation for delivering a **complete** program.

Remaining Savings for Area | Total Costs | EVT BED Costs | Rem

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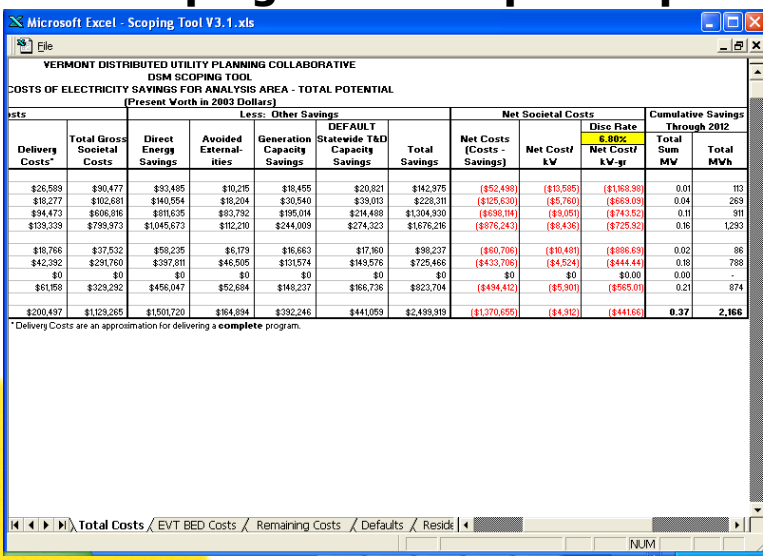
DUP Scoping Tool: Sample Outputs



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VERMONT DISTRIBUTED UTILITY PLANNING COLLABORATIVE
DSM SCOPING TOOL
COSTS OF ELECTRICITY SAVINGS FOR ANALYSIS AREA - TOTAL POTENTIAL
(Present Worth in 2003 Dollars)

sts		Less: Other Savings					Net Societal Costs			Cumulative Savings Through 2012	
					DEFAULT				Disc Rate 6.80%		
Delivery Costs*	Total Gross Societal Costs	Direct Energy Savings	Avoided External-ities	Generation Capacity Savings	Statewide T&D Capacity Savings	Total Savings	Net Costs (Costs - Savings)	Net Cost/ kW	Net Cost/ kW-yr	Total Sum MW	Total MWh
$26,589	$90,477	$93,495	$10,215	$18,455	$20,821	$142,975	($52,498)	($13,585)	($1,998.98)	0.01	113
$18,277	$102,681	$140,554	$18,204	$30,540	$39,013	$228,311	($125,630)	($5,760)	($863.09)	0.04	269
$94,473	$606,816	$811,635	$83,792	$195,014	$214,488	$1,304,930	($698,114)	($9,051)	($743.52)	0.11	911
$139,339	$799,973	$1,045,673	$112,210	$244,009	$274,323	$1,676,216	($876,243)	($8,436)	($725.92)	0.16	1,293
$18,766	$37,532	$59,235	$6,179	$16,663	$17,160	$98,237	($60,706)	($10,481)	($886.69)	0.02	86
$42,392	$291,760	$397,811	$46,505	$131,574	$149,576	$725,466	($433,706)	($4,524)	($444.44)	0.18	788
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0.00	0.00	-
$61,158	$329,292	$456,047	$52,684	$148,237	$166,736	$823,704	($494,412)	($5,901)	($565.01)	0.21	874
$200,497	$1,129,265	$1,501,720	$164,894	$392,246	$441,059	$2,499,919	($1,370,655)	($4,912)	($441.66)	**0.37**	**2,166**

* Delivery Costs are an approximation for delivering a **complete** program.

Total Costs | EVT BED Costs | Remaining Costs | Defaults | Reside

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Integrating Efficiency: Prospects for the Future

Will Energy-Efficiency help mitigate future Transmission and Distribution upgrades in Vermont?

- VELCO is submitting filing this summer proposing constructing of the NRP
- Distribution utilities in Vermont are using the DUP Scoping Tool

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