Appendix A: Lead Representatives and Alternates

Table A.1 Lead Representatives and Alternates

Organization	Representative	Alternate	Second Alternate
Acadia Center	Ellen Hawes		
City of Lebanon, New Hampshire	Clifton Below		
Conservation Law Foundation-New Hampshire	Melissa Birchard	Tom Irwin	
Energy Freedom Coalition of America	Todd Griset	Peter Brown	
Eversource Energy	Eric Chung	Matthew Fossum	
Liberty Utilities	Heather Tebbetts	Chris Brouillard	Michael Sheehan
New Hampshire Department of Environmental Services	Chris Skoglund	Joseph Fontaine	Rebecca Ohler
New Hampshire Legal Assistance	Dennis Labbe.	Stephen Tower	
New Hampshire Office of Energy and Planning	Rick Minard	Kerry Holmes	Deandra Perruccio
New Hampshire Office of Consumer Advocate	Donald Kreis	James Brennan	
New Hampshire Public Utilities Commission Staff (ex officio)	Tom Frantz	Les Stachow	Jim Cunnningham
NH Sustainable Energy Assn./Northeast Clean Energy Council/	Kate Epsen	Janet Gail Besser	Brianna Brand
Northeast Energy Efficiency Partnerships	Natalie Treat	Brian Buckley	
Patricia Martin, Retired Engineer	Patricia Martin		
RESA / Direct Energy	Marc Hanks	Dan Allegretti	
Revolution Energy	Clay Mitchell	Henry Herndon	
The Jordan Institute	Laura Richardson		
Unitil Energy Systems Inc.	Justin Eisfeller	Kevin Sprague	Gary Epler

Appendix B: Discovery Responses

The information presented in the tables below was provided by Eversource, Unitil, and Liberty in response to discovery requests that were included as Attachment B in the Commission's Order on Scope and Process in this Investigation into Grid Modernization, IR 15-296, April 1, 2016.

Table B.1 T&D Components That Are Automated

	Feeders			Substations			Capacitors		
	Total	Automated	Percent	Total	Automated	Percent	Total	Automated	Percent
Eversource	464	170	**37%**	173	102	**59%**	983	628	**64%**
Unitil	100	97	**97%**	30	28	**94%**	129	51	**40%**
Liberty	41	17	**17%**	15	10	**67%**	128	6	**5%**

Table B.2 T&D Components That Measure Minimum Load

	Feeders			Substations			Line section		
	Total	Min load	Percent	Total	Min load	Percent	Total	Min load	Percent
Eversource	464	252*	54%	173	102	59%	Not reported		
Unitil	System not configured to record			System not configured to record			System not configured to record		
Liberty	41	28	68%	15	5	33%	15	0	0%

*Number of fully automated feeders (170) and Source Automation only (82). Source automation can only be measured at source.

Table B.3 Substations That Are Capable of Reverse Power Flow

	Substation transformers	Substation regulation	Feeder regulation
Eversource	8 known locations have reverse power flows due to larger Non-Utility Generator coming on line. Ultimately, each site could be made to accept reverse power, but scope of upgrades unknown till interconnection study is done.		For pole top regulators 48%
Unitil	No substation transformers designed for reverse power flow	No substation regulators designed for reverse power flow	No feeder/circuit regulators capable of reverse power flow. Sub-transmission systems designed for reverse power flow.
Liberty	No substation transformers capable of reverse power flow	27%	75%

Table B.4 Type and Location of Network System Enablers - Eversource

Eversource		
Capability	**System Location**	**Notes**
Fault Detection, Isolation, Restoration (FDIR)	Distribution System and Substations	329 SCADA controlled substation breakers and 550 SCADA controlled pole top units capable of detecting faults. Some designed to trip while all others can be manually switched through SCADA to pick up load. A Distribution Management System (DMS) pilot installed in 2010 will be upgraded later in 2016. Expansion to the rest of the ESNH system is planned in future years to allow full automation for all existing SCADA controlled breaker and pole top units and any new units.
Automated Feeder Reconfiguration	Distribution System and Substations	FDIR devices continuously monitor the system, alerting operators of loading concerns and faults. A DMS pilot installed in 2010 will be upgraded later in 2016. Expansion to the rest of the ESNH system is planned in future years. to allow full automation for all existing SCADA controlled breaker and pole top units and any new units installed.
Integrated Volt/VAR Control, Conservation Voltage Reduction	Transmission, Distribution and Substations	65 substation capacitor banks controlled via SCADA. 14 pole top distribution capacitors controlled via SCADA. 563 distribution pole mounted capacitors that are controlled remotely via time, voltage, temperature or VAR controls. No CVR.
Remote Monitoring & Diagnostics (equipment conditions)	Transmission, Distribution and Substations	At major Transmission and Distribution Substations, alarms alert operators for various abnormal conditions.
Remote Monitoring & Diagnostics (system conditions)	Transmission, Distribution and Substations	All remotely controlled pole mounted reclosers and switches monitor the system providing voltage, current, power factor and fault indication.

Table B.5 Type & Location of Network System Enablers - Unitil

Unitil		
Capability	**System Location**	**Notes**
Fault Detection, Isolation, Restoration (FDIR)	None	
Automated Feeder Reconfiguration	Distribution/Substation	2 locations
Integrated Volt/VAR Control, Conservation Voltage Reduction	None	
Remote Monitoring & Diagnostics (equipment conditions)	Substation	4 substations with GE and Weidman transformer hydrogen monitoring systems; SCADA system monitors e.g. communications, pressure, oil temps. Etc.
Remote Monitoring & Diagnostics (system conditions)	Distribution/Substation	AMI system provides system voltage, loads, outage and health information. SCADA sustem monitors e.g. communications, pressure, frequency, oil temps. Etc.

Table B.6 Type and Location of Network System Enablers - Liberty

Liberty		
Capability	**System Location**	**Notes**
Fault Detection, Isolation, Restoration (FDIR)	Distribution Line Sections	Fault Indicators and Grid Sentry Line Sensors
Automated Feeder Reconfiguration	Distribution Line Sections	5 Loop Schemes
Integrated Volt/VAR Control, Conservation Voltage Reduction	None	None
Remote Monitoring & Diagnostics (equipment conditions)	None	None
Remote Monitoring & Diagnostics (system conditions)	Substation	Remote monitoring in 68% of breakers

Table B.7 Number of Customers for Each Rate Offering

	Eversource			Unitil			Liberty		
	Residential	Gen. Service	Outdoor lighting	Residential	Gen. Service	Outdoor lighting	Residential	Gen. Service	Outdoor lighting
Flat energy rates	426,576	-	953	-	724	-	-	7,239	
Inclining block rates	-	-	-	65,237	-	-	35,435	-	-
Declining block rates	-	75,517	-	-	-	-	-	-	-
Seasonal Rate	-	-	-	-	-	-	-	-	-
Time-of-use rates	38	159	-	-	-	-	1,420		-
Critical peak pricing	-	-	-	-	-	-	-	-	-
Peak-time rebates	-	-	-	-	-	-	-	-	-
Total no. of customers:	426,614	75,676	953	65,237	11,181	1,706	35,877	6,436	685

Table B.8 Customer Options for Each Rate Offering

<table>
<tr><th rowspan="2"></th><th colspan="3">Eversource</th><th colspan="3">Unitil</th><th colspan="3">Liberty</th></tr>
<tr><th>Residential</th><th>Gen. Service</th><th>Outdoor lighting</th><th>Residential</th><th>Gen. Service</th><th>Outdoor lighting</th><th>Residential</th><th>Gen. Service</th><th>Outdoor lighting</th></tr>
<tr><td>Flat energy rates</td><td rowspan="7">May opt-out to take service under Residential Time-of-day (TOD) or GS. Residential TOD opt-in.</td><td rowspan="7">Mandatory for Primary, Large GS. Opt-in for GS TOD. GS with approved applications may opt-out to take service under GS TOD</td><td rowspan="7">Mandatory</td><td rowspan="7">Mandatory for inclining block rates; n/a for others</td><td rowspan="7">Mandatory for flat energy rates; n/a for others</td><td rowspan="7">-</td><td rowspan="7">Mandatory except TOU opt-in rate for residential customers</td><td rowspan="7" colspan="2">Mandatory</td></tr>
<tr><td>Inclining block rates</td></tr>
<tr><td>Declining block rates</td></tr>
<tr><td>Seasonal Rate</td></tr>
<tr><td>Time-of-use rates</td></tr>
<tr><td>Critical peak pricing</td></tr>
<tr><td>Peak-time rebates</td></tr>
</table>

Table B.9 Customer Participation in Energy Efficiency Programs, 2006 To 2015

No. of customers	Eversource		Unitil		Liberty	
	Residential	C&I	Residential	Gen. Service	Residential	Non-residential
2006	61,490	1,042	11,295	93	4,297	144
2007	77,143	972	10,883	110	5,194	87
2008	87,328	917	11,819	80	22,537	112
2009	71,216	1,187	9,456	100	14,064	83
2010	94,020	944	11,196	26	17,465	85
2011	79,194	862	9,887	77	19,386	118
2012	83,489	1,017	10,180	54	7,464	131
2013	80,714	1,252	10,498	81	20,622	47
2014	100,827	1,512	6,611	95	18,201	275
2015	94,840	987	8,295	95	22,317	176

Table B.10 Customer Participation in Demand Response Programs, 2006 To 2015

No. of customers	Eversource		Unitil		Liberty	
	Residential	C&I	Residential	Gen. Service	Residential	Non-residential
2006	3,279	157	-	-	-	-
2007	3,319	136	-	-	-	-
2008	3,166	231	-	-	-	-
2009	3,303	251	-	-	-	-
2010	3,554	269	-	-	-	-
2011	3,614	229	-	-	-	-
2012	3,659	220	-	-	-	-
2013	3,675	219	-	-	-	-
2014	3,669	217	-	-	-	-
2015	3,620	211	-	-	-	-

Table B.11 Behind-The-Meter Technologies Installed

No. of customers	Eversource			Unitil			Liberty		
	Residential	Gen. Service	Total	Residential	Gen. Service	Total	Residential	Non-residential	Total
Photovoltaics	2,407	266	2,673	389*	39*	428*	272	24	296
CHP	1	14	15	0	1	1	0	2	2
Other DR	34	33	67	2**	7**	9**	N/A	N/A	N/A
Plug-in electric vehicles	Unable to determine	Unable to determine	Unable to determine	N/A	N/A	N/A	N/A	N/A	N/A
Batteries or other storage devices	Unable to determine	Unable to determine	Unable to determine	N/A	N/A	N/A	N/A	N/A	N/A
Total no. of customers:	426,614	75,676	502,290	65,237	11,181	76,418	35,877	6,436	42,313

** Data response by Unitil gives installations by fuel type. Unitil's "Solar" category is assumed to be PV.*
*** Other DR is the summation of Wind, Hydro, Gas, Wood and Biomass installations provided by Unitil*

Table B.12a Annual Installation Schedule of Current Meters - Liberty

The table below provides an annual schedule of the installation date of all of our current meters. Liberty Utilities converted the majority of the meter population to AMR in 2002. Of the approximately 43,000 meters, 3,000 are manually read and approximately 385 are interval meters probed monthly for hourly reads. Since 2002, the Company has introduced an AMR meter for customers with a demand of 20 KW – 200 KW. These meters are read using a probe wireless technology, or analog phone line.

Year	No. meters installed in year	No. AMR meters installed	No. of AMI meter
2002		Conversion year - majority of meters	0
Total current meters	43,333	40,254	0

Table B12.b Annual Installation Schedule of Current Meters - Unitil

Year	UES Total	Notes
2005	158	Decision to AMI System was made, we started purchasing AMI meters even though the system wasn't in place.
2006	2,953	AMI project started in 3rd quarter of 2006
2007	49,786	AMI project replaced whole system
2008	3,116	These meter sets reflect URV replacement problem, not all new meter sets.
2009	1,782	These meter sets reflect URV replacement problem, not all new meter sets.
2010	3,983	These meter sets reflect URV replacement problem, not all new meter sets.
2011	2,188	These meter sets reflect URV replacement problem, not all new meter sets.
2012	2,268	These meter sets reflect URV replacement problem, not all new meter sets.
2013	3,178	These meter sets reflect URV replacement problem, not all new meter sets.
2014	2,567	These meter sets reflect URV replacement problem, not all new meter sets.
2015	4,013	These meter sets reflect URV replacement problem, not all new meter sets and PLX meter additions in Seacoast.
2016	1,029	These meter sets reflect URV replacement problem, not all new meter sets and PLX meter additions in Seacoast.
Total	**77,021**	

Table B12.c Annual Installation Schedule of Current Meters - Eversource

	Eversource						
	AMR meters		Remotely read meters		Manually read meters		Total
Purchase years	C&I	Residential	C&I	Residential	C&I	Residential	
2016	5,646	4,220	1	0	0	0	9,867
2015	45,090	238,967	28	0	25	0	284,110
2014	23,460	219,928	8	0	107	0	243,503
2013	875	8,128	10	0	83	9	9,105
2012	458	3,494	6	0	208	14	4,180
2011	468	3,242	58	0	714	1	4,483
2010	292	1,768	43	0	261	2	2,366
2009	19	106	34	0	291	15	465
2008	30	445	10	0	337	6	828
2007	104	392	1	0	141	10	648
2006	13	75	2	0	320	10	420
2005	77	413	5	0	148	4	647
2004	228	1,356	7	0	339	20	1,950
2003	314	2,473	4	0	138	3	2,932
2002	227	1,173	2	0	148	114	1,664
2001	123	700	11	0	58	8	900
2000	130	731	5	0	458	9	1,333
1999 and earlier	9	105	0	0	363	339	816
TOTALS	77,563	487,716	235	0	4,139	564	570,217

Table B.13 Utility Metering Age and Cost Recovery Assumptions

	Eversource	Unitil	Liberty
Average meter age (years)	2	All meters: 20 Electronic endpoint meters: 7.5	Does not have data on meter life of the meters retrofitted to accomodate the AMR technology
Average book life (years)	35	20	19
Average assumed operating life (years)	20 to 25	Avg meter: 40 Endpoint: 20	19
Average expected life remaining (years)	18 to 23	12.5 (based on age of endpoints)	6 to 18

Table B.14 Current Practice for Meter Replacement

	Current practice for replacing meters	Replacement schedule?
Eversource	Meters that fail and under warranty: returned to manufacturer for correction/replacement. Replacement meters are replaced with like meters (AMR meters)	When warranty period expires, testing programs used to determing replacement schedule that may be needed.
Unitil	Replace meters with like meters.	Upgrading or installing ~500/year in one division with PLX enabled meters
Liberty	Failed AMR replaced with another AMR meter. Non-AMR meters replaced with AMR meter only when an AMR is available, otherwise a Non-AMR meter. AMR meters are replaced/exchanged for following reasons: Failed equipment, Access issues (Non-AMR to AMR), Regulated Sample Program.	-

Table B.15 Options When Meter Fails or Requires Replacement

	Options available & selected	Reason
Eversource	Meter exchange, thereby replacing the entire meter	Lowest cost option; quickest resolution for any potential billing issues with the least service interruption for customers
Unitil	If AMI endpoint fails on a mechanical meter, Company replaces the endpoint; if mechanical meter fails, meter replaced with an electronic meter with built-in endpoint; if electronic meter fails, replaced with meter with and electronic meter with a built in endpoint. Purchasing separate endpoints will not be available after 2017.	
Liberty	Failed AMR meters replaced w/ another AMR meter; Non-AMR meters replaced w/ AMR meter if AMR meter is available, otherwise replaced with Non-AMR meter.	Company's policy is to replace entire meter when any part of the meter fails

Table B.16 Meter Replacements

	Type of meter chosen and why	Functions the replacement meter offers
Eversource	Two primary decision points in deciding what type of meter replacement: (a) Does it meet requirements for billing the specific customer where it is to be installed; (b) Does it comply with the requirements of the reading system used to collect billing data	None provided
Unitil	If AMI endpoint fails on a mechanical meter, endpoint replaced; if mechanical meter fails, meter replaced w/ an electronic meter w/ built-in endpoint; if electronic meter fails, replaced w/ meter with an electronic meter w/ a built in endpoint. Purchasing separate endpoints will not be available after 2017.	New meters can measure voltage by default; if a PLX meter is installed it also offers interval metering capability.
Liberty	If a meter fails, it is replaced with an AMR meter unless interval data is required.	None provided

Table B.17 Number of Customers with Following Meter Capabilities

			Eversource*			
			AMR & remotely read meters		Manually read meters	
	Liberty	Unitil	Residential	C&I	Residential	C&I
a. Drive-by meter reading	40,254	All AMI	487,716	77,563	0	0
b. Time-of-use register	**1178**	**All**	**40**	**0**	**1**	**345**
c. Reading of interval data	**358**	**2170, currently expanding capabilities**	**1**	**234**	**112**	**1,815**
d. Daily reading at the Company's office	8	All	1	234	0	0
e. On-demand / real-time meter reading	8	All	1	234	0	0
f. Communication to meter from the Company	0	All	0	0	0	0
g. Communication from meter to customer end-use equipment	0	None, but system capable	0	8	16	1,537
h. Remote switch for service connection / disconnection.	0	451, but system capable	11,799	1,011	0	0
i. Power quality reading	0	1903, but system capable	0	0	0	0
j. Outage identification and restoration notification	0	All	0	0	0	0
k. Planning data (snap-shot demand and system reads).	0	All	0	0	0	0

Appendix C: Illustrative Outline for NH Grid Modernization Plans

1) **List of Acronyms used in the plan**
2) **Executive Summary**
   a) Grid modernization vision /strategy (Where will we be in 10 years, and how will the Company get there?)
   b) Recovery window aligned with the plan
   c) 10-year plan updated at similar interval to LCIRP (three years)
   d) Envision GMP will take over LCIRP over time—Combine LCIRP/GMP
   e) Cost causation principles
3) **Introduction**
   a) Purpose of the filing
   b) Regulatory requirements
      i) GMP and cost recovery requirements
      ii) The business case analysis
   c) Grid modernization objectives
   d) Compliance with the filing requirements
4) **Grid Modernization Plan**
   a) Approach
   b) Overview of the plan
      i) Grid modernization roadmap (10-year, high-level project sequence and dependencies
      ii) Five years spending "pre-approved"
   c) Stakeholder engagement
      i) Customer education component prior to engaging the customers
      ii) Involvement in the pre-planning and prioritization and project consideration (input to the plan, not review of the plan)
      iii) Prior to plan submittal, solicit comments on the proposed plan
   d) Role(s) of third parties
   e) Investment plan
   f) Key factors for projects
      i) First five years of plan
      ii) "Pre-approved" spending portion of the plan
      iii) Annual cost recovery filing
   g) Rate recovery assumptions
   h) Project portfolio and business case analysis
      i) Project descriptions
      ii) Projected project costs and benefits; (singular project analysis and/or combined project analysis)
      iii) Impact on metrics and state policy goals
      iv) Alternatives analysis/discussion
      v) Portfolio benefit-to-cost ratio

vi) Grid security and cyber security considerations
vii) Based upon a combination of utility, vendor, and RFP/RFQ estimates
viii) Common business case assumptions:
(1) Common societal assumptions—carbon savings, etc.
(2) Customer avoided cost of reliability
(3) Rate of inflation—Moody's Analytics
(4) Energy forecast (kWh)—Analyses conducted by the ISO-NE. More granular forecasts will be distribution company-specific.
(5) Demand forecast (kW)—Analyses conducted by the ISO-NE. More granular forecasts will be distribution company-specific.
(6) Forecast capacity prices—Third-party consultant to perform this analysis. Analysis conducted will be comparable to the analyses conducted for long-term renewable energy contracts.
(7) Forecast energy prices—Third-party consultant to perform this analysis. Analysis conducted will be comparable to the analyses conducted for long-term renewable energy contracts.
(8) Forecast renewable energy certificates ("RECs")—Third-party consultant to perform this analysis. Analysis conducted will be comparable to the analyses conducted for long-term renewable energy contracts.
(9) Recovery of stranded costs as part of the business case
(10) Methodology for determining discount rate
(11) Time horizon for evaluating investments
(12) Sensitivity analysis—Variables that are best suited for a sensitivity analysis are those for which a small change in an assumption can lead to a large change in the resulting output of a calculation.
ix) Implementation roadmap

i) Additional plan components
i) Marketing, education and outreach for customers
ii) Research development, and deployment (RD&D)
iii) Privacy and customer data access
iv) Program build metrics

j) Financial summary

5) Rates and Regulatory

a) Regulatory/ratemaking framework
i) Proposed rate mechanism
ii) Rate impact by customer class

b) Cost recovery
i) Study costs
ii) Stakeholder engagement costs
iii) Marketing and research costs
iv) Incremental O&M and capital costs

6) Appendix

a) Projects considered

b) Benefit/cost models

c) Revenue requirement and customer bill impact

d) Supplemental studies