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Modeling Energy Efficiency in the Load Forecast Chad Burnett IURC Contemporary Issues Technical Conference

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Accounting for DSM in Load Forecast

The purpose or effect of the Company's DSM/EE programs is to <u>accelerate the</u> <u>adoption of energy efficient technology</u> to enable our customers to be more efficient consumers of energy.



Cooling EE/DSM Program Example



Residential Lighting Example

• I&M's DSM programs in IN accelerated the adoption of energy efficient lighting faster than Kingsport, where there were no utility sponsored energy efficiency programs.





^{3 |} Economic Forecasting



Economics of Low Hanging Fruit

- The Law of Diminishing Returns
- Price of Substitutes









Measure What Matters With Meters

- The way DSM program savings are measured is different than the way loads are metered and modeled in the load forecast.
- Full deployment of AMI technology could dramatically improve the measurement accuracy of DSM program savings and allow for consistent measurement across jurisdictions.





Multiple Ways to Model DSM in the Load Forecast

- The Brattle Group¹ has identified 6 different approaches used across the industry to model DSM impacts in energy sales forecasts.
 - 1. DSM Already Embedded in Sales Data No post-regression adjustment needed
 - 2. Historical DSM Embedded in Sales Data Adjust for incremental DSM in forecast
 - 3. Reconstruct Historical sales as if no DSM and do post-regression adjustment
 - 4. Include DSM activities as a right-hand side variable in econometric models
 - 5. Hybrid Model (SAE) that embeds end-use features in econometric models
 - 6. <u>Combination of approaches identified above</u>
- I&M's approach is most like #6- Combination of Approaches #5 and #2- Itron's
 SAE combined with a Supplemental Efficiency Adjustment (formerly called degradation)

 ¹ 'Estimating the Impact of DSM on Energy Sales Forecasts: A Survey of Utility Practices' by Z. Wang, A. Faruqui, and J. Hall. The Brattle Group. 2017 http://files.brattle.com/files/5648_estimating_the_impact_of_dsm_on_energy_sales_forecasts.pdf
 Economic Forecasting



SAE Load Forecast By End Use

 The SAE model provides the ability to dissect the load forecast by enduse type.





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Survey of Peer Utilities (Work in Progress)

	Utility A	Utility B	Utility C	I&M		
Itron SAE Models?	Yes	Yes, Itron develops forecast	No (traditional econometric model)	Yes		
DSM Optimized?	Constant Target	Optimized	Constant Target	Optimized		
DSM Model Approach	Regress DSM as independent variable	Regress DSM as independent variable	Model programs base on measure life. Assume no savings after measure life expires	Supplemental Efficiency Adjustment Matrix based on measure life		
Adjusting DSM savings in Load Forecast?	DSM coefficient used to discount future DSM savings in forecast	DSM coefficient used to discount future DSM savings in forecast	Not using SAE so load forecast does not already account for energy efficiency. As a result, no adjustment needed for future DSM savings.	Supplemental Efficiency Adjustment used in conjunction with SAE model to prevent double counting EE		



DSM as Independent Variable?

- Some utilities are including historical DSM savings as an independent variable in the model to determine the appropriate % to discount (or adjust down) future DSM savings to avoid double counting energy efficiency in the load forecast.
- I&M tried this approach, but the DSM variable was not statistically significant.
- Instead, <u>I&M uses a Supplemental Efficiency</u> <u>Adjustment matrix to adjust the DSM savings</u> <u>amounts</u> in the load forecast.

Variable	T-Stat	P-Value
Residential Vars. XHeat	30.034	0.00%
ResidentialVars.XCool	29.456	0.00%
ResidentialVars.XOther	79.723	0.00%
BinaryVars.Jan	1.189	23.57%
BinaryVars.Feb	-6.501	0.00%
BinaryVars.Mar	-6.187	0.00%
BinaryVars.Apr	-7.443	0.00%
BinaryVars.May	-6.407	0.00%
BinaryVars.Jun	-3.537	0.05%
BinaryVars.Jul	2.188	2.96%
BinaryVars.Aug	4.229	0.00%
BinaryVars.Sep	3.422	0.07%
BinaryVars.Oct	-2.453	1.48%
BinaryVars.Nov	-4.705	0.00%
BinaryVars.JanD06on	6.240	0.00%
BinaryVars.FebD06on	6.077	0.00%
BinaryVars.may13on	-7.248	0.00%
BinaryVars.d1112	-4.953	0.00%
BinaryVars.d2020on	2.538	1.17%
dsmusage.dsmusage	-0 406	68 54%

Not statistically significant



Supplemental Efficiency Adjustment

- Each program is mapped to an end-use and measure life.
- The savings are degraded over time in a matrix to recognize the efficiencies already included in the load forecast.

I&M India	ina											
	Residential Li	ighting										
5/10	900,000	19,899,654	15,515,989	15,306,274	19,651,372	15,067,351	15,169,832	11,939,913	1,070,007	609,626	-	-
	<u>2008</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	2022	2023	2024	2025
2008	900,000											
2009	688,574											
2010	440,204											
2011	207,749											
2012	49,670											
2013												
2014												
2015		19,899,654										
2016		15,224,867	15,515,989									
2017		9,733,237	13,818,033	15,306,274								
2018		4,593,477	11,871,004	13,631,267	19,651,372							
2019		1,098,246	9,759,036	11,710,554	17,500,870	15,067,351						
2020			7,589,116	9,627,132	15,034,911	13,418,490	15,169,832					
2021			5,485,731	7,486,541	12,360,053	11,527,759	13,509,757	11,939,913				
2022			3,581,587	5,411,585	9,611,798	9,476,858	11,606,165	10,633,296	1,070,007			
2023			2,003,944	3,533,178	6,947,809	7,369,680	9,541,315	9,135,012	952,914	609,626		
2024			856,315	1,976,859	4,536,165	5,327,113	7,419,806	7,509,804	818,643	542,913	-	
2025			195,335	844,741	2,538,043	3,478,027	5,363,346	5,840,001	672,999	466,414	-	-
2026				192,695	1,084,543	1,946,001	3,501,682	4,221,397	523,358	383,434	-	-
2027					247,396	831,555	1,959,237	2,756,114	378,305	298,178	-	-
2028						189,687	837,211	1,542,081	246,992	215,535	-	-
2029							190,977	658,954	138, 195	140,721	-	-
2030								150,315	59,053	78,735	-	-
2031				Total to Subtract from LF			69,099,327		13,471	33,645	-	-
2032				Total Savings w/ no adjustment			151,698,321			7,675	-	-
			Supplen	mental Efficiency Adjustment Impact			46%				-	-



Consistent Load Forecast For Multiple Uses

- I&M's methodology has proven to produce accurate and reliable results that are useful for planning and setting rates.
- I&M uses the same load forecast in it's financial planning as it uses it rate cases, rider and fuel filings, and the Integrated Resource Plan.
- The only difference is that the IRP load forecast is the long-term DSM assumptions.
 - Financial forecast assumes long-term DSM assumptions consistent with the most recently completed IRP.
 - IRP load forecast includes Commission approved DSM programs in the near term, but solves for the optimal DSM levels in the long-term.