National Grid 2-1

Request:

For the Rhode Island Division of Public Utilities and Carriers' (the Division) proposed weather-normalized transmission peak demand forecast discussed on pages 32 and 33, and as supported in Division Exhibit 4 in Docket No. 4770:

a. Please provide the functional form and variables included in the Division's model.

b. Please provide the underlying model input data used to produce the Division's forecast. For any data that was derived from other data, for example actual and weather-normalized HDDs and CDDs, please provide the calculation of those values.

c. Please provide the model outputs for the Division's forecast. Please include the predicted values for all historical and future observations, as well as the residuals for each historical observation.

d. For each model, please provide all estimated coefficients, standard errors, and goodness-of-fit statistics (such as adjusted R-squared values). Please provide the results of any tests performed to validate the statistical strength of the included explanatory variables, such as T-stats and/or p-values, for each.

e. For each observation in each model, please provide any diagnostic statistical test outputs performed (such as R-Student, Cook's D, leverage, etc.). Discuss how any outliers and other influential observations were addressed. Finally, please provide the results of any additional diagnostic tests, such as those for multicollinearity.

f. Did the Division test any alternative models? If so, please provide items a, b, c, d and e above for all such models.

Response:

a. The functional form of the Division's model is: Transmission Peak ~ CDD + HDD + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.6697. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	Estimated Coefficient	Standard Error	T-Value	P-Value
Intercept	154,553.053	59,724.887	2.588	0.03606
CDD	41.806	10.227	4.088	0.00464
HDD	1.780	3.966	0.449	0.66717
Year	-71.050	29.819	-2.383	0.04869

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results. The VIFs for these variables are low enough such that multicollinearity is not a concern.

Variable	Tolerance	VIF
CDD	0.848	1.18
HDD	0.809	1.24
Year	0.940	1.06

f. Yes, the Division tested five alternative models. Items a, b, c, d, and e are repeated for each alternative model below.

Alternative Model #1

a. The functional form of the Division's model is: Transmission Peak ~ Weighted Temperature-Humidity Index (WTHI) + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.04859. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	Estimated Coefficient	Standard Error	T-Value	P-Value
Intercept	152,399.927	99,145.140	1.537	0.163
WTHI	5.918	6.753	0.876	0.406
Year	-68.527	49.264	-1.391	0.202

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results.

Variable	Tolerance	VIF
WTHI	0.993	1.01
Year	0.993	1.01

Alternative Model #2

a. The functional form of the Division's model is: Transmission Peak ~ Temperature-Humidity Index (THI) + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.1248. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	Estimated Coefficient	Standard Error	T-Value	P-Value
Intercept	153,017.072	94,949.756	1.612	0.146
THI	6.610	5.341	1.238	0.251
Year	-70.789	47.320	-1.496	0.173

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results.

Variable	**Tolerance**	**VIF**
THI	0.990	1.01
Year	0.990	1.01

Alternative Model #3

a. The functional form of the Division's model is: Transmission Peak ~ CDD + HDD + Average Humidity + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.6354. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	**Estimated Coefficient**	**Standard Error**	**T-Value**	**P-Value**
Intercept	198,335.048	97,790.862	2.028	0.08889
CDD	44.791	11.900	3.764	0.00935
HDD	4.990	6.900	0.723	0.49676
Average Humidity	2.065	3.537	0.584	0.58065
Year	-93.978	50.241	-1.871	0.11060

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results.

Variable	**Tolerance**	**VIF**
CDD	0.691	1.45

HDD	0.295	3.39
Average Humidity	0.272	3.67
Year	0.366	2.73

Alternative Model #4

a. The functional form of the Division's model is: Transmission Peak ~ Maximum Temperature + Minimum Temperature + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.3005. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	**Estimated Coefficient**	**Standard Error**	**T-Value**	**P-Value**
Intercept	117,498.831	86,415.426	1.360	0.2161
Maximum Temperature	13.125	6.755	1.943	0.0931
Minimum Temperature	-7.499	7.807	-0.961	0.3688
Year	-53.747	42.733	-1.258	0.2488

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results.

Variable	**Tolerance**	**VIF**
Maximum Temperature	0.328	3.05
Minimum Temperature	0.327	3.06

Year	0.970	1.03

Alternative Model #5

a. The functional form of the Division's model is: Transmission Peak ~ Maximum Temperature + Minimum Temperature + Average Humidity + Year.

b. Please see attachment NG 2-1(b) Transmission Peak Model Inputs.xlsx.

c. Please see attachment NG 2-1(c) Transmission Peak Model Outputs.xlsx.

d. The Adjusted R-squared of the model is 0.2788. Please see the table below for the estimated coefficients, standard errors, T-values, and P-values.

Variable	**Estimated Coefficient**	**Standard Error**	**T-Value**	**P-Value**
Intercept	48,595.958	117,115.016	0.415	0.6926
Maximum Temperature	13.426	6.867	1.955	0.0984
Minimum Temperature	-4.299	8.708	-0.494	0.6391
Average Humidity	-3.508	3.949	-0.888	0.4086
Year	-19.084	58.356	-0.327	0.7548

e. The Division used variance inflation factors (VIF) to test for multicollinearity. Please see the table below for the VIF results.

Variable	**Tolerance**	**VIF**
Maximum Temperature	0.327	3.06
Minimum Temperature	0.271	3.69
Average Humidity	0.432	2.31
Year	0.536	1.87

Prepared by Tim Woolf

National Grid 2-2

Request:

Referencing Table 16 on page 45 of the Testimony of Tim Woolf and Melissa Whited, the Total Incentive amount for 2020 (high) and 2021 (high) does not match the backup that was provided. Please provide the correct values. If Table 16 represents the correct values, provide updated calculations. Please also update the summary Table 26 on page 63 of the Testimony of Tim Woolf and Melissa Whited, if applicable.

Response:

Table 16 on page 45 contains an error of 1 basis point for 2020 (high) and 2021 (high). The correct values are shown in Exhibit 4 and reproduced below.

Non-Wires Alternatives	2019 (med)	2019 (high)	2020 (med)	2020 (high)	2021 (med)	2021 (high)
Targets (incremental MW)	3	6	3	6	3	6
Incentive for Quantified Benefits (bps)	1	2	2	4	3	6
Incentive for Unquantified Benefits (bps)	1	2	1	2	1	2
Total Incentive (bps)	2	4	3	6	4	8

Prepared by Tim Woolf

National Grid 2-3

Request:

Please provide the following in support of assumptions discussed in Exhibit TW/MW- 3.

a. Documentation for Daymark's capacity model, including explanation of all calculations relevant to avoided capacity costs and any underlying assumptions. Please provide any additional relevant model output and calculations in Excel format with formulae intact.

b. All underlying data, assumptions and calculations in support of the estimated avoided transmission capacity costs from Daymark. Please provide calculations in Excel format with formulae intact.

c. Documentation for Daymark's energy model, including explanation of all calculations relevant to avoided peak hour energy costs and any underlying assumptions. Please provide any additional relevant model output and calculations in Excel format with formulae intact.

d. For each PIM, documentation in support of the assumptions for FCM, transmission, and distribution peak coincidence factors in Table 2.

e. For each PIM other than transmission and FCM peak demand reduction, documentation in support of the assumptions for assumed costs to customer as a percentage of benefits in Table 3.

Response:

Objection: The Division objects to Data Request 2-3 (a) (b) & (c) on the ground that it seeks proprietary, competitively sensitive and confidential information.

Without waiving the foregoing objection, the Division will provide the assumptions and outputs for the capacity and energy models upon the execution of a Confidentiality and Non-Disclosure Agreement by National Grid.

d. For the System Efficiency PIMs, the transmission PIM and FCM PIM were designed to be mutually exclusive. For this reason, the transmission PIM's coincidence factor is set to 100% for transmission and 0% for FCM, and vice versa.

No documentation is available for the coincidence factors for the DER PIMs. These coincidence factors represent approximations based on the technology type and are meant to be illustrative.

Because we intend most of the incentives for these PIMs to be based on a shared savings approach, we expect that more detailed coincidence factors would be developed for the purposes of calculating net benefits and actual incentives to the Company.

e. The costs for the Electric Heat Initiative were derived from the Company's benefit-cost analysis, as provided in Attachment DIV 1-1-3. No documentation is available for the costs assumed for the other PIMs. These cost assumptions are meant to be illustrative. Because we intend most of the incentives for these PIMs to be based on a shared savings approach, we expect that more cost estimates would be developed for the purposes of calculating net benefits and actual incentives to the Company.

Prepared by Tim Woolf

National Grid 2-4

Request:

Please provide all supporting data to support Witness Gregory Booth's estimate that the Company's proposed annual rate allowance of $700,000 should be reduced by at least 30% (page 19- 20).

Response:

National Grid proposes hiring additional engineers and analysts to manage a System Data Portal. Specifically, the Company indicates that two distribution engineers and one analyst are required to manage what is essentially a software package. The proposed FTEs are not designing or building the software, but managing inputs and outputs. The software is used to upload distributed generation attributes and calculate available capacity or constraints on circuits. Circuit maps with specific information are then made available to the public. In my opinion, the Company has overstated the number of required personnel to manage the software. Reducing National Grid's proposed resources by one distribution engineer at $110,000 annually with 45% for benefits and an additional 30% for Company overheads amounts to a $207,350 per year, or 30% of the Company's proposed $690,000 budget.

Prepared by Gregory L. Booth, PE