Supplemental Appendix to Accompany

"On the Role of Maximum Demand Charges in the Presence of Distributed Generation Resources"

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Section I of this Supplemental Appendix compares the outcomes at the solutions to problems [RP-n] (where maximum demand charges are not feasible) and [RP] (where maximum demand charges are feasible) as parameters are changed from their levels in the baseline setting. Section II presents additional detail to supplement the findings presented in Tables 3 – 6 in the paper.

I. Outcomes as Selected Parameters in the Baseline Setting Change.

The following tables identify the changes that arise at the solutions to problems [RP-n] and [RP] as selected parameters depart from their levels in the baseline setting. In each instance, parameters other than the one identified in the title of the table assume their values in the baseline setting.

The following tables consider changes in: (i) the utility's TDM costs associated with DG capacity (γ_G); (ii) the utility's capacity-related TDM costs (γ_m); (iii) the welfare weights that the regulator assigns to consumers G and N (w_G and w_N); and (iv) the utility's mid-peak and peak period marginal costs of procuring electricity ($\underline{c}_1$ and $\overline{c}_1$).

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Contemporaneous Peak Demands when γ_G is Increased from 5.05 to 15.05

Measure	[RP]	[RP-n]	Absolute Difference	% Change
Key Variables				
p	35.16	129.68	-94.52	-72.89
D	183.29	0.00	183.29	N/A
R	807,342.02	739,473.95	67,868.07	9.18
k_G	611.63	332.33	279.30	84.04
m	21,634.53	23,174.36	$-1,539.83$	-6.64
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	63.92	58.61	5.31	9.06
$E\{C_2'(\cdot)\}$	93.92	105.76	-11.84	-11.20
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,124,411.20	1,212,986.44	$-88,575.24$	-7.30
$\gamma_m m + \gamma_G K_G$	3,287,269.47	3,516,380.67	$-229,111.20$	-6.52
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,706.48	4,959.79	746.69	15.05
$E\{x_{N1}(\cdot)\}$	7,045.75	6,122.53	923.22	15.08
$E\{x_{N2}(\cdot)\}$	9,155.02	10,464.40	$-1,309.38$	-12.51
$E\{x_{G0}(\cdot)\}$	1,004.35	872.93	131.42	15.06
$E\{x_{G1}(\cdot)\}$	1,240.05	1,077.57	162.48	15.08
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,087.33	994.58	92.75	9.33
$E\{x_{G2}(\cdot)\}$	1,611.29	1,841.74	-230.45	-12.51
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,258.95	1,650.30	-391.35	-23.71
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,261,664.31	2,200,119.71	61,544.60	2.80
$E\{u_{N1}(\cdot)\}$	2,930,289.86	2,854,194.76	76,095.10	2.67
$E\{u_{N2}(\cdot)\}$	4,999,322.72	5,227,245.56	$-227,922.84$	-4.36
$E\{u_{G0}(\cdot)\}$	398,056.65	387,224.77	10,831.88	2.80
$E\{u_{G1}(\cdot)\}$	515,730.43	502,337.67	13,392.76	2.67
$E\{u_{G2}(\cdot)\}$	879,881.24	919,995.86	$-40,114.62$	-4.36
Expected Welfare				
$E\{U_N\}$	6,935,519.61	6,747,863.73	187,655.88	2.78
$E\{U_G\}$	573,846.99	583,744.66	$-9,897.67$	-1.70
$E\{U_G\} + E\{U_N\}$	7,509,366.61	7,331,608.39	177,758.22	2.42

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when γ_G is Increased from 5.05 to 15.05

Measure	[RP]	[RP-n]	Absolute Difference	% Change
Key Variables				
p	51.89	126.54	-74.65	-58.99
D	165.84	0.00	165.84	N/A
R	620,015.75	685,174.47	$-65,158.72$	-9.51
k_G	95.73	290.56	-194.83	-67.05
m	20,838.00	22,054.65	$-1,216.65$	-5.52
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	61.51	58.88	2.63	4.47
$E\{C_2'(\cdot)\}$	98.15	106.24	-8.09	-7.61
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,140,868.68	1,206,312.30	$-65,443.62$	-5.43
$\gamma_m m + \gamma_G K_G$	3,158,815.13	3,346,093.64	$-187,278.51$	-5.60
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,574.34	4,984.59	589.75	11.83
$E\{x_{N1}(\cdot)\}$	6,882.37	6,153.20	729.17	11.85
$E\{x_{N2}(\cdot)\}$	9,165.73	10,510.71	$-1,344.98$	-12.80
$E\{x_{G0}(\cdot)\}$	981.09	877.29	103.80	11.83
$E\{x_{G1}(\cdot)\}$	1,398.57	1,635.28	-236.71	-14.48
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,374.66	1,562.73	-188.07	-12.03
$E\{x_{G2}(\cdot)\}$	1,353.42	1,225.08	128.34	10.48
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,298.27	1,057.70	240.57	22.74
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,255,912.49	2,203,297.62	52,614.87	2.39
$E\{u_{N1}(\cdot)\}$	2,923,178.18	2,858,124.00	65,054.18	2.28
$E\{u_{N2}(\cdot)\}$	5,001,658.05	5,233,178.69	$-231,520.64$	-4.42
$E\{u_{G0}(\cdot)\}$	397,044.33	387,784.08	9,260.25	2.39
$E\{u_{G1}(\cdot)\}$	718,831.70	759,579.54	$-40,747.84$	-5.36
$E\{u_{G2}(\cdot)\}$	621,403.58	609,954.03	11,449.55	1.88
Expected Welfare				
$E\{U_N\}$	6,918,667.38	6,869,978.62	48,688.76	0.71
$E\{U_G\}$	692,086.82	603,555.48	88,531.34	14.67
$E\{U_G\} + E\{U_N\}$	7,610,754.20	7,473,534.10	137,220.10	1.84

Outcomes at the Solutions to [RP] and [RP-n] the Setting with Contemporaneous Peak Demands when γ_m Declines from 151.52 to 106.06

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	115.41	38.77	-76.64	-66.41
D	0.00	148.62	148.62	N/A
R	389,699.89	446,824.86	57,124.97	14.66
k_G	212.82	439.29	226.47	106.41
m	23,421.88	22,173.32	$-1,248.56$	-5.33
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	59.63	63.93	4.30	7.21
$E\{C_2'(\cdot)\}$	107.96	98.36	-9.60	-8.89
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,261,115.65	1,185,127.17	$-75,988.48$	-6.03
$\gamma_m m + \gamma_G K_G$	2,485,199.61	2,353,920.26	$-131,279.35$	-5.28
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,072.52	5,677.97	605.45	11.94
$E\{x_{N1}(\cdot)\}$	6,261.92	7,010.52	748.60	11.95
$E\{x_{N2}(\cdot)\}$	10,674.88	9,613.17	$-1,061.71$	-9.95
$E\{x_{G0}(\cdot)\}$	892.77	999.33	106.56	11.94
$E\{x_{G1}(\cdot)\}$	1,102.10	1,233.85	131.75	11.95
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,048.96	1,124.16	75.20	7.17
$E\{x_{G2}(\cdot)\}$	1,878.78	1,691.92	-186.86	-9.95
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,756.19	1,438.87	-317.32	-18.07
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,213,935.19	2,260,610.67	46,675.48	2.11
$E\{u_{N1}(\cdot)\}$	2,871,276.52	2,928,987.11	57,710.59	2.01
$E\{u_{N2}(\cdot)\}$	5,253,038.95	5,092,293.06	$-160,745.89$	-3.06
$E\{u_{G0}(\cdot)\}$	389,656.30	397,871.21	8,214.91	2.11
$E\{u_{G1}(\cdot)\}$	505,344.06	515,501.14	10,157.08	2.01
$E\{u_{G2}(\cdot)\}$	924,535.52	896,244.10	$-28,291.42$	-3.06
Expected Welfare				
$E\{U_N\}$	7,408,418.01	7,541,638.12	133,220.11	1.80
$E\{U_G\}$	985,004.23	968,660.99	$-16,343.24$	-1.66
$E\{U_G\} + E\{U_N\}$	8,393,422.24	8,510,299.11	116,876.87	1.39

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when γ_m Declines from 151.52 to 106.06

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	112.86	53.77	-59.09	-52.36
D	0.00	131.26	131.26	N/A
R	354,293.51	303,861.08	$-50,432.43$	-14.23
k_G	181.75	27.54	-154.21	-84.85
m	22,280.01	21,317.04	-962.97	-4.32
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	59.84	61.92	2.08	3.48
$E\{C_2'(\cdot)\}$	108.35	101.95	-6.40	-5.91
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,251,618.62	1,197,523.49	$-54,095.13$	-4.32
$\gamma_m m + \gamma_G K_G$	2,363,935.45	2,261,024.29	$-102,911.16$	-4.35
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,092.70	5,559.48	466.78	9.17
$E\{x_{N1}(\cdot)\}$	6,286.87	6,864.00	577.13	9.18
$E\{x_{N2}(\cdot)\}$	10,712.54	9,648.00	$-1,064.54$	-9.94
$E\{x_{G0}(\cdot)\}$	896.32	978.47	82.15	9.17
$E\{x_{G1}(\cdot)\}$	1,670.81	1,483.45	-187.36	-11.21
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,625.42	1,476.57	-148.85	-9.16
$E\{x_{G2}(\cdot)\}$	1,248.61	1,350.19	101.58	8.14
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,143.91	1,334.32	190.41	16.65
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,216,237.83	2,255,127.44	38,889.61	1.75
$E\{u_{N1}(\cdot)\}$	2,874,123.56	2,922,207.52	48,083.96	1.67
$E\{u_{N2}(\cdot)\}$	5,257,337.97	5,098,778.60	$-158,559.37$	-3.02
$E\{u_{G0}(\cdot)\}$	390,061.56	396,906.16	6,844.60	1.75
$E\{u_{G1}(\cdot)\}$	763,831.60	735,925.00	$-27,906.60$	-3.65
$E\{u_{G2}(\cdot)\}$	612,769.95	621,232.74	8,462.79	1.38
Expected Welfare				
$E\{U_N\}$	7,500,136.60	7,519,006.13	18,869.53	0.25
$E\{U_G\}$	983,448.89	1,050,537.08	67,088.19	6.82
$E\{U_G\} + E\{U_N\}$	8,483,585.49	8,569,543.21	85,957.72	1.01

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Contemporaneous Peak Demands when w_N Increases from 1.0 to 1.1

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	113.69	13.77	-99.92	-87.89
D	0.00	192.71	192.71	N/A
R	944,974.89	1,033,109.88	88,134.99	9.33
k_G	198.39	487.48	289.09	145.72
m	23,451.77	21,842.27	$-1,609.50$	-6.86
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	59.75	65.37	5.62	9.41
$E\{C_2'(\cdot)\}$	108.23	95.87	-12.36	-11.42
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,266,984.69	1,173,104.69	$-93,880.00$	-7.41
$\gamma_m m + \gamma_G K_G$	3,554,413.32	3,312,002.05	$-242,411.27$	-6.82
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,086.13	5,875.50	789.37	15.52
$E\{x_{N1}(\cdot)\}$	6,278.75	7,254.74	975.99	15.54
$E\{x_{N2}(\cdot)\}$	10,700.29	9,331.67	$-1,368.62$	-12.79
$E\{x_{G0}(\cdot)\}$	895.17	1,034.10	138.93	15.52
$E\{x_{G1}(\cdot)\}$	1,105.06	1,276.83	171.77	15.54
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,055.52	1,155.11	99.59	9.44
$E\{x_{G2}(\cdot)\}$	1,883.26	1,642.38	-240.88	-12.79
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,768.97	1,361.56	-407.41	-23.03
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,215,494.24	2,265,799.91	50,305.67	2.27
$E\{u_{N1}(\cdot)\}$	2,873,204.17	2,935,403.20	62,199.03	2.16
$E\{u_{N2}(\cdot)\}$	5,255,949.69	5,036,854.25	$-219,095.44$	-4.17
$E\{u_{G0}(\cdot)\}$	389,930.69	398,784.52	8,853.83	2.27
$E\{u_{G1}(\cdot)\}$	505,683.33	516,630.38	10,947.05	2.16
$E\{u_{G2}(\cdot)\}$	925,047.82	886,486.82	$-38,561.00$	-4.17
Expected Welfare				
$E\{U_N\}$	6,891,108.90	7,097,341.04	206,232.14	2.99
$E\{U_G\}$	436,118.75	409,567.62	$-26,551.13$	-6.09
$E\{U_G\} + E\{U_N\}$	7,327,227.65	7,506,908.66	179,681.01	2.45

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when w_N Increases from 1.0 to 1.1

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	110.17	35.53	-74.64	-67.75
D	0.00	165.97	165.97	N/A
R	896,495.98	832,471.37	$-64{,}024.61$	-7.14
k_G	160.39	0.00	-160.39	-100.00
m	22,324.25	21,105.42	$-1{,}218.83$	-5.46
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	60.02	62.61	2.59	4.32
$E\{C_2'(\cdot)\}$	108.77	100.51	-8.26	-7.59
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,260,604.24	1,190,201.22	$-70{,}403.02$	-5.58
$\gamma_m m + \gamma_G K_G$	3,383,380.63	3,197,893.52	$-185{,}487.11$	-5.48
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,113.92	5,703.56	589.64	11.53
$E\{x_{N1}(\cdot)\}$	6,313.11	7,042.15	729.04	11.55
$E\{x_{N2}(\cdot)\}$	10,752.17	9,405.03	$-1{,}347.14$	-12.53
$E\{x_{G0}(\cdot)\}$	900.06	1,003.83	103.77	11.53
$E\{x_{G1}(\cdot)\}$	1,677.78	1,440.68	-237.10	-14.13
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,637.73	1,440.68	-197.05	-12.03
$E\{x_{G2}(\cdot)\}$	1,253.23	1,381.54	128.31	10.24
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,160.83	1,381.54	220.71	19.01
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,218,604.66	2,261,561.35	42,956.69	1.94
$E\{u_{N1}(\cdot)\}$	2,877,049.96	2,930,162.56	53,112.60	1.85
$E\{u_{N2}(\cdot)\}$	5,261,756.83	5,051,819.22	$-209{,}937.61$	-3.99
$E\{u_{G0}(\cdot)\}$	390,478.13	398,038.53	7,560.40	1.94
$E\{u_{G1}(\cdot)\}$	764,609.32	727,660.11	$-36{,}949.21$	-4.83
$E\{u_{G2}(\cdot)\}$	613,285.00	622,632.83	9,347.83	1.52
Expected Welfare				
$E\{U_N\}$	7,017,404.33	7,062,988.65	45,584.32	0.65
$E\{U_G\}$	451,138.94	540,791.21	89,652.27	19.87
$E\{U_G\} + E\{U_N\}$	7,468,543.27	7,603,779.86	135,236.59	1.81

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Contemporaneous Peak Demands when w_G Increases from 1.0 to 1.1

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	148.40	57.28	-91.12	-61.40
D	0.00	177.66	177.66	N/A
R	510,628.88	562,470.21	51,841.33	10.15
k_G	489.12	763.90	274.78	56.18
m	22,849.62	21,348.71	$-1,500.91$	-6.57
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	57.29	62.40	5.11	8.92
$E\{C_2'(\cdot)\}$	102.87	91.32	-11.55	-11.23
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,151,156.56	1,066,882.29	$-84,274.27$	-7.32
$\gamma_m m + \gamma_G K_G$	3,464,644.94	3,238,614.72	$-226,030.22$	-6.52
Expected Demand				
$E\{x_{N0}(\cdot)\}$	4,811.88	5,531.80	719.92	14.96
$E\{x_{N1}(\cdot)\}$	5,939.66	6,829.79	890.13	14.99
$E\{x_{N2}(\cdot)\}$	10,188.26	8,911.98	$-1,276.28$	-12.53
$E\{x_{G0}(\cdot)\}$	846.90	973.60	126.70	14.96
$E\{x_{G1}(\cdot)\}$	1,045.38	1,202.04	156.66	14.99
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	923.25	1,011.30	88.05	9.54
$E\{x_{G2}(\cdot)\}$	1,793.14	1,568.51	-224.63	-12.53
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,511.38	1,128.46	-382.92	-25.34
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,179,554.57	2,253,591.03	74,036.46	3.40
$E\{u_{N1}(\cdot)\}$	2,828,767.58	2,920,307.87	91,540.29	3.24
$E\{u_{N2}(\cdot)\}$	5,188,850.59	4,944,225.53	$-244,625.06$	-4.71
$E\{u_{G0}(\cdot)\}$	383,605.29	396,635.75	13,030.46	3.40
$E\{u_{G1}(\cdot)\}$	497,862.48	513,973.60	16,111.12	3.24
$E\{u_{G2}(\cdot)\}$	913,238.31	870,184.08	$-43,054.23$	-4.71
Expected Welfare				
$E\{U_N\}$	6,578,991.22	6,753,899.70	174,908.48	2.66
$E\{U_G\}$	748,940.99	753,981.65	5,040.66	0.67
$E\{U_G\} + E\{U_N\}$	7,402,826.31	7,583,279.52	180,453.21	2.44

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when w_G Increases from 1.0 to 1.1

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	145.47	71.84	-73.63	-50.62
D	0.00	163.19	163.19	N/A
R	453,301.93	388,854.83	$-64{,}447.10$	-14.22
k_G	441.09	248.01	-193.08	-43.77
m	21,742.90	20,548.52	$-1{,}194.38$	-5.49
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	57.57	60.16	2.59	4.50
$E\{C_2'(\cdot)\}$	103.32	95.38	-7.94	-7.68
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,144,908.99	1,083,423.01	$-61{,}485.98$	-5.37
$\gamma_m m + \gamma_G K_G$	3,296,711.62	3,114,764.18	$-181{,}947.44$	-5.52
Expected Demand				
$E\{x_{N0}(\cdot)\}$	4,835.04	5,416.71	581.67	12.03
$E\{x_{N1}(\cdot)\}$	5,968.30	6,687.49	719.19	12.05
$E\{x_{N2}(\cdot)\}$	10,231.50	8,910.55	$-1{,}320.95$	-12.91
$E\{x_{G0}(\cdot)\}$	850.97	953.35	102.38	12.03
$E\{x_{G1}(\cdot)\}$	1,586.14	1,353.65	-232.49	-14.66
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,476.00	1,291.73	-184.27	-12.48
$E\{x_{G2}(\cdot)\}$	1,192.54	1,319.12	126.58	10.61
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	938.45	1,176.25	237.80	25.34
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,182,957.83	2,246,160.80	63,202.97	2.90
$E\{u_{N1}(\cdot)\}$	2,832,975.44	2,911,120.97	78,145.53	2.76
$E\{u_{N2}(\cdot)\}$	5,195,204.45	4,943,888.94	$-251{,}315.51$	-4.84
$E\{u_{G0}(\cdot)\}$	384,204.26	395,328.02	11,123.76	2.90
$E\{u_{G1}(\cdot)\}$	752,896.04	708,664.29	$-44{,}231.75$	-5.87
$E\{u_{G2}(\cdot)\}$	605,527.87	619,281.51	13,753.64	2.27
Expected Welfare				
$E\{U_N\}$	6,697,848.37	6,748,434.85	50,586.48	0.76
$E\{U_G\}$	771,413.97	856,197.56	84,783.59	10.99
$E\{U_G\} + E\{U_N\}$	7,546,403.74	7,690,252.17	143,848.43	1.91

Now suppose the utility's mid-peak and peak period marginal procurement costs increase by 30%, so $\underline{c}_1 + \overline{c}_1 \overline{X}_1 = 75.14$ and $\underline{c}_2 + \overline{c}_2 \overline{X}_2 = 122.98$.

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Contemporaneous Peak Demands when the Utility's Mid-Peak and Peak Period Marginal Procurement Costs Increase by 30%

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	150.19	46.79	-103.40	-68.85
D	0.00	197.69	197.69	N/A
R	617,467.93	702,793.74	85,325.81	13.82
k_G	504.05	793.09	289.04	57.34
m	22,818.70	21,183.18	$-1,635.52$	-7.17
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	74.20	82.80	8.60	11.59
$E\{C_2'(\cdot)\}$	134.08	116.67	-17.41	-12.98
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,400,569.86	1,283,098.75	$-117,471.11$	-8.39
$\gamma_m m + \gamma_G K_G$	3,460,034.57	3,213,680.69	$-246,353.88$	-7.12
Expected Demand				
$E\{x_{N0}(\cdot)\}$	4,797.80	5,614.66	816.86	17.03
$E\{x_{N1}(\cdot)\}$	5,922.25	6,932.23	1,009.98	17.05
$E\{x_{N2}(\cdot)\}$	10,161.96	8,771.22	$-1,390.74$	-13.69
$E\{x_{G0}(\cdot)\}$	844.42	988.19	143.77	17.03
$E\{x_{G1}(\cdot)\}$	1,042.32	1,220.07	177.75	17.05
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	916.45	1,022.04	105.59	11.52
$E\{x_{G2}(\cdot)\}$	1,788.51	1,543.74	-244.77	-13.69
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,498.15	1,086.87	-411.28	-27.45
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,177,451.72	2,257,901.87	80,450.15	3.69
$E\{u_{N1}(\cdot)\}$	2,826,167.57	2,925,637.89	99,470.32	3.52
$E\{u_{N2}(\cdot)\}$	5,184,924.59	4,910,484.60	$-274,439.99$	-5.29
$E\{u_{G0}(\cdot)\}$	383,235.19	397,394.46	14,159.27	3.69
$E\{u_{G1}(\cdot)\}$	497,404.88	514,911.68	17,506.80	3.52
$E\{u_{G2}(\cdot)\}$	912,547.33	864,245.65	$-48,301.68$	-5.29
Expected Welfare				
$E\{U_N\}$	6,434,869.63	6,659,809.64	224,940.01	3.50
$E\{U_G\}$	636,271.30	624,036.46	$-12,234.84$	-1.92
$E\{U_G\} + E\{U_N\}$	7,071,140.93	7,283,846.10	212,705.17	3.01

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when the Utility's Mid-Peak and Peak Period Marginal Procurement Costs Increase by 30%

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	146.84	65.95	-80.89	-55.09
D	0.00	177.49	177.49	N/A
R	564,087.49	503,745.48	$-60,342.01$	-10.70
k_G	451.99	235.52	-216.47	-47.89
m	21,720.33	20,434.68	$-1,285.65$	-5.92
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	74.65	78.91	4.26	5.71
$E\{C_2'(\cdot)\}$	134.79	122.98	-11.81	-8.76
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,394,160.47	1,306,182.97	$-87,977.50$	-6.31
$\gamma_m m + \gamma_G K_G$	3,293,346.18	3,097,452.02	$-195,894.16$	-5.95
Expected Demand				
$E\{x_{N0}(\cdot)\}$	4,824.22	5,463.28	639.06	13.25
$E\{x_{N1}(\cdot)\}$	5,954.91	6,745.07	790.16	13.27
$E\{x_{N2}(\cdot)\}$	10,211.28	8,786.57	$-1,424.71$	-13.95
$E\{x_{G0}(\cdot)\}$	849.07	961.54	112.47	13.25
$E\{x_{G1}(\cdot)\}$	1,582.58	1,331.83	-250.75	-15.84
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,469.72	1,273.03	-196.69	-13.38
$E\{x_{G2}(\cdot)\}$	1,190.18	1,329.25	139.07	11.68
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	929.81	1,193.58	263.77	28.37
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,181,375.07	2,249,369.31	67,994.24	3.12
$E\{u_{N1}(\cdot)\}$	2,831,018.47	2,915,088.04	84,069.57	2.97
$E\{u_{N2}(\cdot)\}$	5,192,249.43	4,914,229.81	$-278,019.62$	-5.35
$E\{u_{G0}(\cdot)\}$	383,925.70	395,892.72	11,967.02	3.12
$E\{u_{G1}(\cdot)\}$	752,375.95	703,444.25	$-48,931.70$	-6.50
$E\{u_{G2}(\cdot)\}$	605,183.45	619,979.71	14,796.26	2.44
Expected Welfare				
$E\{U_N\}$	6,558,259.23	6,630,828.60	72,569.37	1.11
$E\{U_G\}$	656,163.77	743,157.07	86,993.30	13.26
$E\{U_G\} + E\{U_N\}$	7,214,423.00	7,373,985.67	159,562.67	2.21

Now suppose the utility's mid-peak and peak period marginal procurement costs decrease by 30%, so $\underline{c}_1 + \overline{c}_1 \overline{X}_1 = 40.46$ and $\underline{c}_2 + \overline{c}_2 \overline{X}_2 = 66.22$.

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Contemporaneous Peak Demands when the Utility's Mid-Peak and Peak Period Marginal Procurement Costs Decrease by 30%

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	111.17	25.00	-86.17	-77.51
D	0.00	169.71	169.71	N/A
R	832,267.07	881,932.74	49,665.67	5.97
k_G	177.29	447.15	269.86	152.21
m	23,495.46	22,046.46	$-1,449.00$	-6.17
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	41.57	44.09	2.52	6.06
$E\{C_2'(\cdot)\}$	74.80	67.96	-6.84	-9.14
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	982,707.08	924,913.29	$-57,793.79$	-5.88
$\gamma_m m + \gamma_G K_G$	3,560,928.01	3,342,738.23	$-218,189.78$	-6.13
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,106.04	5,786.76	680.72	13.33
$E\{x_{N1}(\cdot)\}$	6,303.36	7,145.02	841.66	13.35
$E\{x_{N2}(\cdot)\}$	10,737.45	9,505.30	$-1,232.15$	-11.48
$E\{x_{G0}(\cdot)\}$	898.67	1,018.48	119.81	13.33
$E\{x_{G1}(\cdot)\}$	1,109.39	1,257.52	148.13	13.35
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,065.12	1,145.87	80.75	7.58
$E\{x_{G2}(\cdot)\}$	1,889.80	1,672.94	-216.86	-11.48
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,787.67	1,415.36	-372.31	-20.83
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,217,731.92	2,264,079.56	46,347.64	2.09
$E\{u_{N1}(\cdot)\}$	2,875,970.89	2,933,276.12	57,305.23	1.99
$E\{u_{N2}(\cdot)\}$	5,260,127.43	5,071,684.80	$-188,442.63$	-3.58
$E\{u_{G0}(\cdot)\}$	390,324.53	398,481.74	8,157.21	2.09
$E\{u_{G1}(\cdot)\}$	506,170.27	516,256.01	10,085.74	1.99
$E\{u_{G2}(\cdot)\}$	925,783.10	892,617.03	$-33,166.07$	-3.58
Expected Welfare				
$E\{U_N\}$	7,059,509.79	7,213,017.60	153,507.81	2.17
$E\{U_G\}$	558,237.80	552,638.25	$-5,599.55$	-1.00
$E\{U_G\} + E\{U_N\}$	7,617,747.59	7,765,655.85	147,908.26	1.94

Outcomes at the Solutions to [RP] and [RP-n] in the Setting with Divergent Peak Demands when the Utility's Mid-Peak and Peak Period Marginal Procurement Costs Decrease by 30%

Measure	[RP-n]	[RP]	Absolute Difference	% Change
Key Variables				
p	108.13	41.35	-66.78	-61.76
D	0.00	150.30	150.30	N/A
R	778,716.29	710,773.27	$-67,943.02$	-8.73
k_G	144.17	0.00	-144.17	-100.00
m	22,357.84	21,240.83	$-1,117.01$	-5.00
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	41.70	42.89	1.19	2.85
$E\{C_2'(\cdot)\}$	75.08	70.45	-4.63	-6.17
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	977,110.68	935,114.48	$-41,996.20$	-4.30
$\gamma_m m + \gamma_G K_G$	3,388,388.35	3,218,410.98	$-169,977.37$	-5.02
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,130.04	5,657.63	527.59	10.28
$E\{x_{N1}(\cdot)\}$	6,333.03	6,985.36	652.33	10.30
$E\{x_{N2}(\cdot)\}$	10,782.25	9,550.43	$-1,231.82$	-11.42
$E\{x_{G0}(\cdot)\}$	902.89	995.75	92.86	10.28
$E\{x_{G1}(\cdot)\}$	1,683.07	1,466.27	-216.80	-12.88
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,647.08	1,466.27	-180.81	-10.98
$E\{x_{G2}(\cdot)\}$	1,256.73	1,371.54	114.81	9.14
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,173.68	1,371.54	197.86	16.86
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,220,363.48	2,259,795.73	39,432.25	1.78
$E\{u_{N1}(\cdot)\}$	2,879,224.61	2,927,979.50	48,754.89	1.69
$E\{u_{N2}(\cdot)\}$	5,265,040.54	5,080,402.83	$-184,637.71$	-3.51
$E\{u_{G0}(\cdot)\}$	390,787.68	397,727.78	6,940.10	1.78
$E\{u_{G1}(\cdot)\}$	765,187.25	732,690.85	$-32,496.40$	-4.25
$E\{u_{G2}(\cdot)\}$	613,667.74	622,248.61	8,580.87	1.40
Expected Welfare				
$E\{U_N\}$	7,180,490.13	7,204,317.53	23,827.40	0.33
$E\{U_G\}$	576,488.19	663,002.33	86,514.14	15.01
$E\{U_G\} + E\{U_N\}$	7,756,978.32	7,867,319.86	110,341.54	1.42

II. Additional Detail for Tables 3 – 6.

Table 3. Comparing the Solutions to [RP] and [RP*t*-n] in the Setting with Divergent Peak Demands when $\gamma_G = 45.05$ and $\beta_1 = 70$

Measure	[RP]	[RP*t*-n]	Absolute Difference	% Change
Key Variables				
p_0	36.33	21.45	14.88	69.37
p_1	36.33	47.14	−10.81	−22.93
p_2	36.33	192.64	−156.31	−81.14
D	173.39	0.00	173.39	N/A
R	790,588.65	935,992.37	−145,403.72	−15.53
k_G	312.47	963.11	−650.64	−67.56
m	20,982.98	20,966.11	16.87	0.08
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	62.09	62.83	−0.74	−1.18
$E\{C_2'(\cdot)\}$	98.30	95.42	2.88	3.02
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,153,307.33	1,128,388.50	24,918.83	2.21
$\gamma_m m + \gamma_G K_G$	3,198,730.30	3,236,545.97	−37,815.67	−1.17
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,697.28	5,814.82	−117.54	−2.02
$E\{x_{N1}(\cdot)\}$	7,034.38	6,928.83	105.55	1.52
$E\{x_{N2}(\cdot)\}$	9,283.95	9,535.80	−251.85	−2.64
$E\{x_{G0}(\cdot)\}$	1,002.73	1,023.42	−20.69	−2.02
$E\{x_{G1}(\cdot)\}$	1,419.37	1,841.41	−422.04	−22.92
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,341.35	1,600.93	−259.58	−16.21
$E\{x_{G2}(\cdot)\}$	1,380.17	1,111.45	268.72	24.18
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,200.17	556.64	643.53	115.61
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,261,335.45	2,264,731.39	−3,395.94	−0.15
$E\{u_{N1}(\cdot)\}$	2,929,883.24	2,925,478.42	4,404.82	0.15
$E\{u_{N2}(\cdot)\}$	5,026,925.25	5,077,591.56	−50,666.31	−1.00
$E\{u_{G0}(\cdot)\}$	397,998.77	398,596.46	−597.69	−0.15
$E\{u_{G1}(\cdot)\}$	723,278.75	777,479.70	−54,200.95	−6.97
$E\{u_{G2}(\cdot)\}$	622,583.67	591,819.30	30,764.37	5.20
Expected Welfare				
$E\{U_N\}$	7,018,027.34	7,043,504.18	−25,476.84	−0.36
$E\{U_G\}$	572,748.21	544,292.30	28,455.91	5.23
$E\{U_G\} + E\{U_N\}$	7,590,775.55	7,587,796.48	2,979.07	0.04

Table 4. Comparing the Solutions to [RP*t*] and [RP*t*-n] in the Baseline Setting with Divergent Peak Demands

Measure	[RP*t*-n]	[RPt]	Absolute Difference	% Change
Key Variables				
p_0	21.45	21.45	0.00	0.00
p_1	61.29	52.50	−8.79	−14.34
p_2	219.13	191.60	−27.53	−12.56
D	0.00	36.41	36.41	N/A
λ	1.00	1.00	0.00	0.00
R	696,211.71	670,939.97	−25,271.74	−3.63
k_G	647.30	560.93	−86.37	−13.34
m	20,529.80	20,446.28	−83.52	−0.41
Expected Costs				
$E\{C_0'(\cdot)\}$	21.45	21.45	0.00	0.00
$E\{C_1'(\cdot)\}$	62.37	62.54	0.17	0.27
$E\{C_2'(\cdot)\}$	93.56	93.31	−0.25	−0.27
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,097,948.15	1,096,991.23	−956.92	−0.09
$\gamma_m m + \gamma_G K_G$	3,113,943.53	3,100,853.03	−13,090.50	−0.42
Expected Demand				
$E\{x_{N0}(\cdot)\}$	5,814.82	5,814.82	0.00	0.00
$E\{x_{N1}(\cdot)\}$	6,790.53	6,876.47	85.94	1.27
$E\{x_{N2}(\cdot)\}$	9,145.03	9,014.17	−130.86	−1.43
$E\{x_{G0}(\cdot)\}$	1,023.42	1,023.42	0.00	0.00
$E\{x_{G1}(\cdot)\}$	1,804.66	1,732.98	−71.68	−3.97
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,643.03	1,592.92	−50.11	−3.05
$E\{x_{G2}(\cdot)\}$	1,065.91	1,113.25	47.34	4.44
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	693.03	790.12	97.09	14.01
Gross Expected Utility				
$E\{u_{N0}(\cdot)\}$	2,264,731.39	2,264,731.39	0.00	0.00
$E\{u_{N1}(\cdot)\}$	2,917,980.54	2,922,870.26	4,889.72	0.17
$E\{u_{N2}(\cdot)\}$	4,997,137.47	4,967,881.01	−29,256.46	−0.59
$E\{u_{G0}(\cdot)\}$	398,596.46	398,596.46	0.00	0.00
$E\{u_{G1}(\cdot)\}$	775,487.06	770,103.79	−5,383.27	−0.69
$E\{u_{G2}(\cdot)\}$	582,441.84	592,164.64	9,722.80	1.67
Expected Welfare				
$E\{U_N\}$	6,938,695.89	6,943,536.47	4,840.58	0.07
$E\{U_G\}$	715,925.47	716,942.44	1,016.97	0.14
$E\{U_G\} + E\{U_N\}$	7,654,621.35	7,660,478.91	5,857.56	0.08

Table 5. Comparing the Solutions to [RP] and [RP*t*-n] in the Baseline Setting with Divergent Peak Demands when γ_G is increased to 15.05

	[RP]			[RP*t*-n]
Key Variables			**Key Variables**	
p	35.16		p_0	21.46
			p_1	59.12
			p_2	216.19
D	183.29		D	0
R	807,342.02		R	767,096.47
k_G	611.63		k_G	661.66
m	21,634.53		m	21,665.15
Expected Costs			**Expected Costs**	
$E\{C_0'(\cdot)\}$	21.45		$E\{C_0'(\cdot)\}$	21.45
$E\{C_1'(\cdot)\}$	63.92		$E\{C_1'(\cdot)\}$	62.42
$E\{C_2'(\cdot)\}$	93.92		$E\{C_2'(\cdot)\}$	93.94
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,124,411.20		$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,109,077.54
$\gamma_m m + \gamma_G K_G$	3,287,269.47		$\gamma_m m + \gamma_G K_G$	3,292,661.56
Expected Demand			**Expected Demand**	
$E\{x_{N0}(\cdot)\}$	5,706.48		$E\{x_{N0}(\cdot)\}$	5,814.78
$E\{x_{N1}(\cdot)\}$	7,045.75		$E\{x_{N1}(\cdot)\}$	6,811.79
$E\{x_{N2}(\cdot)\}$	9,155.02		$E\{x_{N2}(\cdot)\}$	9,181.06
$E\{x_{G0}(\cdot)\}$	1,004.35		$E\{x_{G0}(\cdot)\}$	1,023.41
$E\{x_{G1}(\cdot)\}$	1,240.05		$E\{x_{G1}(\cdot)\}$	1,198.87
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,087.33		$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,033.66
$E\{x_{G2}(\cdot)\}$	1,611.29		$E\{x_{G2}(\cdot)\}$	1,615.87
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,258.95		$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,234.72
Gross Expected Utility			**Gross Expected Utility**	
$E\{u_{N0}(\cdot)\}$	2,261,664.31		$E\{u_{N0}(\cdot)\}$	2,264,730.37
$E\{u_{N1}(\cdot)\}$	2,930,289.86		$E\{u_{N1}(\cdot)\}$	2,919,260.26
$E\{u_{N2}(\cdot)\}$	4,999,322.72		$E\{u_{N2}(\cdot)\}$	5,004,987.42
$E\{u_{G0}(\cdot)\}$	398,056.65		$E\{u_{G0}(\cdot)\}$	398,596.28
$E\{u_{G1}(\cdot)\}$	515,730.43		$E\{u_{G1}(\cdot)\}$	513,789.21
$E\{u_{G2}(\cdot)\}$	879,881.24		$E\{u_{G2}(\cdot)\}$	880,878.23
Expected Welfare			**Net Expected Utility**	
$E\{U_N\}$	6,935,519.61		Non-DG	6,904,955.56
$E\{U_G\}$	573,846.99		DG	604,791.33
$E\{U_G\} + E\{U_N\}$	7,509,366.61		Aggregate	7,509,746.89

Table 6. Comparing the Solutions to [RP] and [RP*t*-n] in the Baseline Setting with Divergent Peak Demands when γ_m is Reduced to 106.06

	[RP]			[RP*t*-n]
Key Variables			**Key Variables**	
p	53.77		p_0	21.45
			p_1	61.52
			p_2	185.83
D	131.26		D	0.00
R	303,861.08		R	391,670.09
k_G	27.54		k_G	463.12
m	21,317.04		m	21,078.19
Expected Costs			**Expected Costs**	
$E\{C_0'(\cdot)\}$	21.45		$E\{C_0'(\cdot)\}$	21.45
$E\{C_1'(\cdot)\}$	61.92		$E\{C_1'(\cdot)\}$	62.58
$E\{C_2'(\cdot)\}$	101.95		$E\{C_2'(\cdot)\}$	98.36
$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,197,523.49		$\sum_{t=0}^{2} E\{C_t(\cdot)\}$	1,163,480.24
$\gamma_m m + \gamma_G K_G$	2,261,024.29		$\gamma_m m + \gamma_G K_G$	2,237,891.56
Expected Demand			**Expected Demand**	
$E\{x_{N0}(\cdot)\}$	5,559.48		$E\{x_{N0}(\cdot)\}$	5,814.82
$E\{x_{N1}(\cdot)\}$	6,864.00		$E\{x_{N1}(\cdot)\}$	6,788.35
$E\{x_{N2}(\cdot)\}$	9,648.00		$E\{x_{N2}(\cdot)\}$	9,636.18
$E\{x_{G0}(\cdot)\}$	978.47		$E\{x_{G0}(\cdot)\}$	1,023.42
$E\{x_{G1}(\cdot)\}$	1,483.45		$E\{x_{G1}(\cdot)\}$	1,804.08
$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,476.57		$E\{x_{G1}(\cdot)\} - \theta_1^E k_G$	1,688.44
$E\{x_{G2}(\cdot)\}$	1,350.19		$E\{x_{G2}(\cdot)\}$	1,123.15
$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	1,334.32		$E\{x_{G2}(\cdot)\} - \theta_2^E k_G$	856.37
Gross Expected Utility			**Gross Expected Utility**	
$E\{u_{N0}(\cdot)\}$	2,255,127.44		$E\{u_{N0}(\cdot)\}$	2,264,731.39
$E\{u_{N1}(\cdot)\}$	2,922,207.52		$E\{u_{N1}(\cdot)\}$	2,917,846.76
$E\{u_{N2}(\cdot)\}$	5,098,778.60		$E\{u_{N2}(\cdot)\}$	5,096,587.37
$E\{u_{G0}(\cdot)\}$	396,906.16		$E\{u_{G0}(\cdot)\}$	398,596.46
$E\{u_{G1}(\cdot)\}$	735,925.00		$E\{u_{G1}(\cdot)\}$	775,451.51
$E\{u_{G2}(\cdot)\}$	621,232.74		$E\{u_{G2}(\cdot)\}$	594,033.39
Expected Welfare			**Net Expected Utility**	
$E\{U_N\}$	7,519,006.13		Non-DG	7,554,427.72
$E\{U_G\}$	1,050,537.08		DG	1,045,892.77
$E\{U_G\} + E\{U_N\}$	8,569,543.21		Aggregate	8,600,320.49