



Order Instituting Investigation into the November ) Investigation 19-11-011  
2019 Submission of San Diego Gas & Electric )  
Company's Risk Assessment and Mitigation Phase. )

**RISK ASSESSMENT MITGATION PHASE**

**WORKPAPERS TO**

**CHAPTER SDG&E-4**

**ELECTRIC INFRASTRUCTURE INTEGRITY**

**November 27, 2019**

<b>Reliability</b>	<b>Total</b>	<b>Non HFTD</b>	<b>Natural Units</b>
SAIFI Outages	0.5	60%	0.3
SAIDI Minutes	50	60%	30
	5 year historical average from internal reliability database		
<b>Safety</b>			
Safety Incident Rate	0.3		
Safety Impact	1		
	5 year historical average from internal data		
<b>Financial</b>			
Incident rate	1200		
Financial Impact \$M	0.005		
	Based on \$5,000 per distribution incident		

<b>Chapter</b>	<b>SDG&amp;E-4</b>
<b>Risk</b>	<b>Electric Infrastructure Integrity</b>

Single Point

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M) 2022	Cost Forecast (Capital, \$M)			Pre-Mitigation Single Point		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE Single Point	Post-Mitigation Single Point	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)		LORE	CORE
				SDG&E-4-C2	Overhead 4kV Modernization and System Hardening (non-HFTD)	50	0.00	2.75		3.89	14.13	1200		3.10	1.32%
SDG&E-4-C3-T1	Distribution Switch Replacement Program - OH	50	0.00	0.31	0.31	0.31	1200	3.10	0.00%	0.02%	0.02%	16.80	1199.76	3.10	
SDG&E-4-C3-T2	T2 - OH Distribution Switch - Tie switches (gang or hookstick) in continuation district one	50	0.00	0.08	0.08	0.08	1200	3.10	0.00%	0.00%	0.00%	11.81	1199.96	3.10	
SDG&E-4-C3-T3	T3 - OH Distribution Switch - Switches in contamination district one with large customer count that could benefit from SCADA	50	0.00	0.11	0.11	0.11	1200	3.10	0.00%	0.01%	0.00%	20.46	1199.89	3.10	
SDG&E-4-C7	Tee Modernization Program - UG	35	0.00	1.83	1.83	1.83	1200	3.10	0.00%	0.13%	0.15%	16.06	1198.38	3.10	
SDG&E-4-C8	Replacement of Live Front Equipment - UG (Secondary budget) (Transformers)	50	0.01	0.49	0.49	0.49	1200	3.10	0.06%	0.00%	0.01%	8.44	1199.96	3.10	
SDG&E-4-C9	DOE Switch Replacement - UG	50	0.00	3.95	3.95	3.95	1200	3.10	0.00%	0.11%	0.00%	7.00	1198.67	3.10	
SDG&E-4-C10	Vegetation Management	1	11.41	0.00	0.00	0.00	1200	3.10	58.63%	14.35%	8.77%	65.50	1027.85	2.85	
SDG&E-4-C14	Field SCADA RTU Replacement	20	0.00	1.05	1.05	1.05	1200	3.10	0.00%	0.19%	0.00%	26.65	1197.68	3.10	
SDG&E-4-C15	Distribution Circuit Reliability (RAT) (previously "System performance improvement")	50	0.00	1.00	1.00	1.00	1200	3.10	0.00%	0.16%	0.00%	40.25	1198.07	3.10	
SDG&E-4-C19-T1	Underground Cable Replacement Program - Proactive	45	0.01	0.58	5.58	5.58	1200	3.10	0.00%	0.17%	0.04%	10.39	1197.93	3.10	
SDG&E-4-C19-T2	T2 - UG Cable Replacement - Unjacketed - Branch	45	0.09	4.32	4.32	4.32	1200	3.10	0.00%	0.45%	0.42%	25.32	1194.56	3.10	
SDG&E-4-M1	Overhead Public Safety (formerly Wire Correction Program) Proactive - OH	50	0.00	6.06	6.06	6.06	1200	3.10	5.17%	0.11%	0.09%	47.54	1198.65	3.07	
SDG&E-4-M2	Live Front Terminator Replacement - Proactive	50	0.00	0.40	0.40	0.40	1200	3.10	0.07%	0.00%	0.00%	12.29	1199.94	3.10	
SDG&E-4-M3-T1	Streamview Bank 30 Replacement (99282)	5	0.00	0.21	0.00	0.00	1200	3.10	0.00%	0.06%	7.26%	225.33	1199.31	3.09	
SDG&E-4-M3-T2	Pacific Beach 12kV circuit breaker replacement (99282)	50	0.00	0.09	0.00	0.00	1200	3.10	0.00%	0.01%	0.07%	82.20	1199.91	3.10	
SDG&E-4-M3-T3	Ash 12kV cap replacement (99282) Re-Build	50	0.00	0.21	0.00	0.00	1200	3.10	0.00%	0.00%	0.02%	12.20	1199.97	3.10	
SDG&E-4-M3-T4	Downtown "New"	50	0.00	1.09	1.45	33.40	1200	3.10	0.00%	1.33%	0.00%	21.36	1184.00	3.11	
SDG&E-4-M4-T1	San Ysidro Breaker Replacements	30	0.00	1.36	0.00	0.00	1200	3.10	0.00%	0.01%	0.04%	3.55	1199.92	3.10	
SDG&E-4-M4-T2	Murray Breaker Replacements	30	0.00	0.61	0.00	0.00	1200	3.10	0.00%	0.01%	0.09%	16.53	1199.84	3.10	
SDG&E-4-A1	ALTERNATIVE: Customer Owned E-Structure Reconfigure	50	0.00	0.28	0.28	0.28	1200	3.10	0.00%	0.00%	0.00%	1.50	1199.98	3.10	
SDG&E-4-A2	ALTERNATIVE: Relay Replacement Investment Plan (ABB)	43	0.00	0.97	0.97	0.97	1200	3.10	0.00%	0.01%	0.02%	3.15	1199.85	3.10	
SDG&E-4-A3-T1	Alternative: Modernize OH switches	50	0.00	11.15	11.15	11.15	1200	3.10	0.00%	0.14%	0.00%	3.14	1198.32	3.10	
SDG&E-4-A3-T2	Alternative: Modernize UG switches	50	0.00	5.56	5.56	5.56	1200	3.10	0.00%	0.04%	0.00%	1.75	1199.53	3.10	
SDG&E-4-A4	Alternative: Avian protection	50	0.00	6.12	6.12	6.12	1200	3.10	0.00%	0.06%	0.07%	2.53	1199.29	3.10	

Low Alternative

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M) 2022	Cost Forecast (Capital, \$M)			Pre-Mitigation Low Alternative		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE Low Alternative	Post-Mitigation Low Alternative	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)		LORE	CORE
				SDG&E-4-C2	Overhead 4kV Modernization and System Hardening (non-HFTD)	50	0.00	2.75		3.89	14.13	1200		2.65	1.32%
SDG&E-4-C3-T1	Distribution Switch Replacement Program - OH	50	0.00	0.31	0.31	0.31	1200	2.65	0.00%	0.02%	0.02%	16.80	1199.76	2.65	
SDG&E-4-C3-T2	T2 - OH Distribution Switch - Tie switches (gang or hookstick) in continuation district one	50	0.00	0.08	0.08	0.08	1200	2.65	0.00%	0.00%	0.00%	11.81	1199.96	2.65	
SDG&E-4-C3-T3	T3 - OH Distribution Switch - Switches in contamination district one with large customer count that could benefit from SCADA	50	0.00	0.11	0.11	0.11	1200	2.65	0.00%	0.01%	0.00%	20.46	1199.89	2.65	
SDG&E-4-C7	Tee Modernization Program - UG	35	0.00	1.83	1.83	1.83	1200	2.65	0.00%	0.13%	0.15%	16.06	1198.38	2.65	
SDG&E-4-C8	Replacement of Live Front Equipment - UG (Secondary budget) (Transformers)	50	0.01	0.49	0.49	0.49	1200	2.65	0.06%	0.00%	0.01%	2.63	1199.96	2.65	
SDG&E-4-C9	DOE Switch Replacement - UG	50	0.00	3.95	3.95	3.95	1200	2.65	0.00%	0.11%	0.00%	7.00	1198.67	2.65	
SDG&E-4-C10	Vegetation Management	1	11.41	0.00	0.00	0.00	1200	2.65	58.63%	14.35%	8.77%	39.34	1027.85	2.63	
SDG&E-4-C14	Field SCADA RTU Replacement	20	0.00	1.05	1.05	1.05	1200	2.65	0.00%	0.19%	0.00%	26.65	1197.68	2.65	
SDG&E-4-C15	Distribution Circuit Reliability (RAT) (previously "System performance improvement")	50	0.00	1.00	1.00	1.00	1200	2.65	0.00%	0.16%	0.00%	40.25	1198.07	2.65	
SDG&E-4-C19-T1	Underground Cable Replacement Program - Proactive	45	0.01	0.58	5.58	5.58	1200	2.65	0.00%	0.17%	0.04%	10.39	1197.93	2.65	
SDG&E-4-C19-T2	T2 - UG Cable Replacement - Unjacketed - Branch	45	0.09	4.32	4.32	4.32	1200	2.65	0.00%	0.45%	0.42%	25.32	1194.56	2.65	
SDG&E-4-M1	Overhead Public Safety (formerly Wire Correction Program) Proactive - OH	50	0.00	6.06	6.06	6.06	1200	2.65	5.17%	0.11%	0.09%	9.09	1198.65	2.65	
SDG&E-4-M2	Live Front Terminator Replacement - Proactive	50	0.00	0.40	0.40	0.40	1200	2.65	0.07%	0.00%	0.00%	4.15	1199.94	2.65	
SDG&E-4-M3-T1	Streamview Bank 30 Replacement (99282)	5	0.00	0.21	0.00	0.00	1200	2.65	0.00%	0.06%	7.26%	225.33	1199.31	2.64	
SDG&E-4-M3-T2	Pacific Beach 12kV circuit breaker replacement (99282)	50	0.00	0.09	0.00	0.00	1200	2.65	0.00%	0.01%	0.07%	82.20	1199.91	2.65	
SDG&E-4-M3-T3	Ash 12kV cap replacement (99282) Re-Build	50	0.00	0.21	0.00	0.00	1200	2.65	0.00%	0.00%	0.02%	12.20	1199.97	2.65	
SDG&E-4-M3-T4	Downtown "New"	50	0.00	1.09	1.45	33.40	1200	2.65	0.00%	1.33%	0.00%	21.36	1184.00	2.65	
SDG&E-4-M4-T1	San Ysidro Breaker Replacements	30	0.00	1.36	0.00	0.00	1200	2.65	0.00%	0.01%	0.04%	3.55	1199.92	2.65	
SDG&E-4-M4-T2	Murray Breaker Replacements	30	0.00	0.61	0.00	0.00	1200	2.65	0.00%	0.01%	0.09%	16.53	1199.84	2.65	
SDG&E-4-A1	ALTERNATIVE: Customer Owned E-Structure Reconfigure	50	0.00	0.28	0.28	0.28	1200	2.65	0.00%	0.00%	0.00%	1.28	1199.98	2.65	
SDG&E-4-A2	ALTERNATIVE: Relay Replacement Investment Plan (ABB)	43	0.00	0.97	0.97	0.97	1200	2.65	0.00%	0.01%	0.02%	3.15	1199.85	2.65	
SDG&E-4-A3-T1	Alternative: Modernize OH switches	50	0.00	11.15	11.15	11.15	1200	2.65	0.00%	0.14%	0.00%	3.14	1198.32	2.65	
SDG&E-4-A3-T2	Alternative: Modernize UG switches	50	0.00	5.56	5.56	5.56	1200	2.65	0.00%	0.04%	0.00%	1.75	1199.53	2.65	
SDG&E-4-A4	Alternative: Avian protection	50	0.00	6.12	6.12	6.12	1200	2.65	0.00%	0.06%	0.07%	2.53	1199.29	2.65	

High Alternative

ID	Activity	Project Life In Years	Cost Forecast (O&M, \$M ) 2022	Cost Forecast (Capital, \$M)			Post-Mitigation High Alternative		% risk reduction (use if % risk addressed not available) (%)	% Risk Reduction			RSE	Post-Mitigation	
				2020	2021	2022	LORE	CORE		Safety	Reliability	Financial (\$M)		High Alternative	LORE
SDG&E-4-C2	Overhead 4kV Modernization and System Hardening (non-HFTD)	50	0.00	2.75	3.89	14.13	1200	3.85		1.32%	0.09%	0.07%	26.65	1198.97	3.83
SDG&E-4-C3-T1	Distribution Switch Replacement Program - OH	50	0.00	0.31	0.31	0.31	1200	3.85		0.00%	0.02%	0.02%	16.80	1199.76	3.85
SDG&E-4-C3-T2	T2 - OH Distribution Switch - Tie switches (gang or hookstick) in continuation district one	50	0.00	0.08	0.08	0.08	1200	3.85		0.00%	0.00%	0.00%	11.81	1199.96	3.85
SDG&E-4-C3-T3	T3 - OH Distribution Switch - Switches in contamination district one with large customer count that could benefit from SCADA	50	0.00	0.11	0.11	0.11	1200	3.85		0.00%	0.01%	0.00%	20.46	1199.89	3.85
SDG&E-4-C7	Tee Modernization Program - UG	35	0.00	1.83	1.83	1.83	1200	3.85		0.00%	0.13%	0.15%	16.06	1198.38	3.85
SDG&E-4-C8	Replacement of Live Front Equipment - UG (Secondary budget) (Transformers)	50	0.01	0.49	0.49	0.49	1200	3.85		0.06%	0.00%	0.01%	18.13	1199.96	3.85
SDG&E-4-C9	DOE Switch Replacement - UG	50	0.00	3.95	3.95	3.95	1200	3.85		0.00%	0.11%	0.00%	7.00	1198.67	3.85
SDG&E-4-C10	Vegetation Management	1	11.41	0.00	0.00	0.00	1200	3.85		58.63%	14.35%	8.77%	109.10	1027.85	3.21
SDG&E-4-C14	Field SCADA RTU Replacement	20	0.00	1.05	1.05	1.05	1200	3.85		0.00%	0.19%	0.00%	26.65	1197.68	3.85
SDG&E-4-C15	Distribution Circuit Reliability (RAT) [previously "System performance improvement"]	50	0.00	1.00	1.00	1.00	1200	3.85		0.00%	0.16%	0.00%	40.25	1198.07	3.85
SDG&E-4-C19-T1	Underground Cable Replacement Program - Proactive	45	0.01	0.58	5.58	5.58	1200	3.85		0.00%	0.17%	0.04%	10.39	1197.93	3.85
SDG&E-4-C19-T2	T2 - UG Cable Replacement - Unjacketed - Branch	45	0.09	4.32	4.32	4.32	1200	3.85		0.00%	0.45%	0.42%	25.32	1194.56	3.86
SDG&E-4-M1	Overhead Public Safety (formerly Wire Correction Program) Proactive - OH	50	0.00	6.06	6.06	6.06	1200	3.85		5.17%	0.11%	0.09%	111.63	1198.65	3.79
SDG&E-4-M2	Live Front Terminator Replacement - Proactive	50	0.00	0.40	0.40	0.40	1200	3.85		0.07%	0.00%	0.00%	25.85	1199.94	3.85
SDG&E-4-M3-T1	Streamview Bank 30 Replacement (99282)	5	0.00	0.21	0.00	0.00	1200	3.85		0.00%	0.06%	7.26%	225.33	1199.31	3.84
SDG&E-4-M3-T2	Pacific Beach 12kV circuit breaker replacement (99282)	50	0.00	0.09	0.00	0.00	1200	3.85		0.00%	0.01%	0.07%	82.20	1199.91	3.85
SDG&E-4-M3-T3	Ash 12kV cap replacement (99282) Re-Build	50	0.00	0.21	0.00	0.00	1200	3.85		0.00%	0.00%	0.02%	12.20	1199.97	3.85
SDG&E-4-M3-T4	Downtown "New"	50	0.00	1.09	1.45	33.40	1200	3.85		0.00%	1.33%	0.00%	21.36	1184.00	3.87
SDG&E-4-M4-T1	San Ysidro Breaker Replacements	30	0.00	1.36	0.00	0.00	1200	3.85		0.00%	0.01%	0.04%	3.55	1199.92	3.85
SDG&E-4-M4-T2	Murray Breaker Replacements	30	0.00	0.61	0.00	0.00	1200	3.85		0.00%	0.01%	0.09%	16.53	1199.84	3.85
SDG&E-4-A1	ALTERNATIVE: Customer Owned E-Structure Reconfigure	50	0.00	0.28	0.28	0.28	1200	3.85		0.00%	0.00%	0.00%	1.86	1199.98	3.85
SDG&E-4-A2	ALTERNATIVE: Relay Replacement Investment Plan (ABB)	43	0.00	0.97	0.97	0.97	1200	3.85		0.00%	0.01%	0.02%	3.15	1199.85	3.85
SDG&E-4-A3-T1	Alternative: Modernize OH switches	50	0.00	11.15	11.15	11.15	1200	3.85		0.00%	0.14%	0.00%	3.14	1198.32	3.85
SDG&E-4-A3-T2	Alternative: Modernize UG switches	50	0.00	5.56	5.56	5.56	1200	3.85		0.00%	0.04%	0.00%	1.75	1199.53	3.85
SDG&E-4-A4	Alternative: Avian protection	50	0.00	6.12	6.12	6.12	1200	3.85		0.00%	0.06%	0.07%	2.53	1199.29	3.85

**SSDG&E-4-C2: 4 kV Modernization and System Hardening Program - Distribution**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life				
			Total		Scope	Effectiveness	Risk Addressed						
Safety	% Scope		1%	<i>Fraction of miles in scope</i> High <i>Risk associated with these overhead wires</i>	Based on planned work	SME Estimate	Safety: attributed risk with a frequency multiplier of 2 Reliability/financial: attributed risk with a 2% adjustment that accounts for UG cable incidental replacements		50				
	% Effectiveness		95%							1.318%			
	% Risk Addressed		128%										
Reliability	% Scope		1%	<i>Fraction of miles in scope</i> High <i>Risk associated with these overhead wires</i>									
	% Effectiveness		95%							0.086%			
	% Risk Addressed		7%										
Financial	% Scope		1%	<i>Fraction of miles in scope</i> High <i>Risk associated with these overhead wires</i>								Company reliability data	
	% Effectiveness		95%							0.072%			
	% Risk Addressed		6%										

**SDG&E-4-C3-T1: Hook Stick Switches and Solid Blades in Contamination District One**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life	
		Total		Scope	Effectiveness	Risk Addressed			
Safety	% Scope	1%	0%	Identified by SDGE	SME Estimate	Safety: secondary impact not assessed Reliability: attributed risk adjusted 2x for frequency and 2x for consequence, per SME input, financial only adjusted for frequency		50	
	% Effectiveness	95%							<i>Fraction of switches in scope</i>
	% Risk Addressed	0%							<i>High</i> <i>No direct impact on safety</i>
Reliability	% Scope	1%	0.02%						
	% Effectiveness	95%							<i>Fraction of switches in scope</i>
	% Risk Addressed	3%							<i>High</i> <i>Average of SAIDI and SAIFI impact</i>
Financial	% Scope	1%	0.02%				Company reliability data		
	% Effectiveness	95%							<i>Fraction of switches in scope</i>
	% Risk Addressed	3%							<i>High</i> <i>Proportional to SAIFI impact</i>

**SDG&E-4-C3-T2: Tie Switches (Gang or Hook Stick) in Contamination District One**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life
		Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	0.08%	0.00000%	<i>Fraction of switches in scope</i>	Identified by SDGE	SME Estimate	Safety: secondary impact not assessed Reliability: attributed risk adjusted 2x for frequency and 3x for multi-phase installation, per SME input, financial only adjusted for frequency	50
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	0%		<i>No direct impact on safety</i>				
Reliability	% Scope	0.08%	0.004%	<i>Fraction of switches in scope</i>				
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	5%		<i>Average of SAIDI and SAIFI impact</i>				
Financial	% Scope	0.08%	0.002%	<i>Fraction of switches in scope</i>			Company reliability data	
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	3%		<i>Proportional to SAIFI impact</i>				

**SDG&E-4-C3-T3: Switches in Contamination District One with large customer count that could benefit from SCADA**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
					Scope	Effectiveness	Risk Addressed		
Safety	% Scope	0.08%	0.00%	<i>Fraction of switches in scope</i>	Identified by SDGE	SME Estimate	Safety: secondary impact not assessed Reliability: dual benefits accounted for, the reliability of the switch and the time savings stemming from the introduction of an upgraded switch Financial: cost per outage		50
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on safety</i>					
Reliability	% Scope	0.08%	0.009%	<i>Fraction of switches in scope</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	12%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	0.08%	0.001%	<i>Fraction of switches in scope</i>				Company reliability data	
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	1%		<i>Proportional to SAIFI impact</i>					



**SDG&E-4-C7: Tee Modernization Program**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
					Scope	Effectiveness	Risk Addressed		
Safety	% Scope	0.40%	0%	<i>Fraction of tees in scope</i>	Identified by SDGE	SME Estimate	Based on an assessment of company data. A reliability adjustment of 3x is included to account for multi-phase installations.		35
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on safety</i>					
Reliability	% Scope	0.4%	0.1%	<i>Fraction of tees in scope</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	35%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	0.4%	0.1%	<i>Fraction of tees in scope</i>			Company reliability data		
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	38%		<i>Proportional to SAIFI impact</i>					

**SDG&E-4-C8: Replacement of Live Front Equipment - Reactive**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	1.3%	0.06%	<i>Fraction of live front transformers in scope</i>	Identified by SDGE	SME Estimate	Based on an assessment of company data, a factor of 2x is used to account for more consequential selections		50
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	5%		<i>Efforts focused on targeting riskier assets</i>					
Reliability	% Scope	N/A	0.004%						
	% Effectiveness	N/A							
	% Risk Addressed	0.004%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0.01%						
	% Effectiveness	N/A							
	% Risk Addressed	0.006%		<i>Proportional to SAIFI impact</i>					

**SDG&E-4-C9: DOE Switch Replacement - Underground**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	71%	0%	<i>Fraction of switches in scope</i>	Identified by SDGE	SME Estimate	There is a time savings during outage restoration		50
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on safety</i>					
Reliability	% Scope	N/A	0.1%	<i>Fraction of switches in scope</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0.12%		<i>SAIDI savings</i>					
Financial	% Scope	N/A	0%	<i>Fraction of switches in scope</i>			Company data		
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on financial risk anticipated</i>					

**SDG&E-4-C10: Vegetation Management**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life
		Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	47%	Percentage of vegetation management areas <i>High</i> Wires-down events related to tree causes	Identified by SDGE	SME Estimate	Safety: proportional to wires-down events All: residual risk assumed to revert to a larger size in the absence of vegetation management, multiplier of 7x used based on historical reliability information		1
	% Effectiveness	99%						
	% Risk Addressed	126%						
Reliability	% Scope	47%	Percentage of vegetation management areas <i>High</i> Average of SAIDI and SAIFI impact					
	% Effectiveness	99%						
	% Risk Addressed	31%						
Financial	% Scope	47%	Percentage of vegetation management areas <i>High</i> Proportional to number of experienced electrical interruptions				Company data	
	% Effectiveness	99%						
	% Risk Addressed	19%						

**SDG&E-4-C14: Field SCADA RTU Replacement**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life
		Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	42%	<i>Fraction of degraded RTUs in field</i> <i>High</i> <i>No direct impact on safety</i>	Identified by SDGE	SME Estimate	Restoration time savings		20
	% Effectiveness	95%						
	% Risk Addressed	0%						
Reliability	% Scope	N/A	<i>Fraction of degraded RTUs in field</i> <i>High</i> <i>SAIDI savings</i>					
	% Effectiveness	95%						
	% Risk Addressed	0.2%						
Financial	% Scope	42%	<i>Fraction of degraded RTUs in field</i> <i>High</i> <i>No direct impact on financial risk</i>				Company data	
	% Effectiveness	95%						
	% Risk Addressed	0%						

**SDG&E-4-C15: Distribution Circuit Reliability**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%	Targeted number of units for improvement	Identified by SDGE	SME Estimate	Up to 45 minutes estimated to be saved per outage		50
	% Effectiveness	N/A		High					
	% Risk Addressed	0%		No direct impact on safety					
Reliability	% Scope	N/A	0.2%	Targeted number of units for improvement					
	% Effectiveness	100%		High effectiveness in reducing associated reliability risk					
	% Risk Addressed	0.2%		Time savings per interruption affecting x customers					
Financial	% Scope	N/A	0%	Targeted number of units for improvement					
	% Effectiveness	N/A		High					
	% Risk Addressed	0%		No direct impact on financial risk					

SDG&E-4-C19-T1: Underground Cable Replacement Program - Feeder									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	0.3%	0%	<i>Selected miles of underground jacketed feeder cable/total</i>	Identified by SDGE	SME Estimate	Blended reliability impact of two separate projects		45
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on safety</i>					
Reliability	% Scope	0.3%	0.2%	<i>Selected miles of underground jacketed feeder cable/total</i>					45
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	67%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	0.3%	0.04%	<i>Selected miles of underground jacketed feeder cable/total</i>			Company data		45
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	16%		<i>Proportional to number of outages</i>					

SDG&E-4-C19-T2: Underground Cable Replacement Program - Branch									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	3%	0%	<i>Selected miles of underground unjacketed feeder cable/total</i>	Identified by SDGE	SME Estimate	Based on an assessment of company data		45
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0%		<i>No direct impact on safety</i>					
Reliability	% Scope	3%	0.5%	<i>Selected miles of underground unjacketed feeder cable/total</i>					
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	18%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	3%	0.4%	<i>Selected miles of underground unjacketed feeder cable/total</i>			Company data		
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	16%		<i>Proportional to number of outages</i>					



**SDG&E-4-M1: Overhead Public Safety (OPS) program**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life
		Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	16%	5%	<i>Fraction of small wire over freeways and public proximity areas</i>	Identified by SDGE	SME Estimate	Based on an assessment of company data	50
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	34%		<i>Risk associated with wires down</i>				
Reliability	% Scope	2%	0.1%	<i>Targeted miles/total miles</i>				
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	7%		<i>Small wire fraction of associated reliability risk</i>				
Financial	% Scope	2%	0.1%	<i>Targeted miles/total miles</i>			Company data	
	% Effectiveness	95%		<i>High</i>				
	% Risk Addressed	6%		<i>Proportional to number of outages</i>				

**SDG&E-4-M2: Replacement of Live Front Terminator Equipment - Proactive**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
	% Scope	% Effectiveness			% Risk Addressed	Scope	Effectiveness		
Safety	% Scope	1%	0.07%	<i>Fraction of live front terminators</i>	Identified by SDGE	SME Estimate	Safety: 2x multiplier to account for more consequential targeted work Reliability: additional 2% credit given for incidental underground cable replacements		50
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	5%		<i>Terminator associated risk of electrical contact</i>					
Reliability	% Scope	N/A	0.005%	<i>Fraction of live front terminators</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	0.005%		<i>Average of SAIDI and SAIFI Impact</i>					
Financial	% Scope	N/A	0.004%	<i>Fraction of live front terminators</i>			Company data		
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	0.004%		<i>Proportional to number of outages</i>					

SDG&E-4-M3-T1: Streamview Bank 30 Re-build

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life	
	% Scope	% Effectiveness	% Risk Addressed		Scope	Effectiveness	Risk Addressed			
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Financial risk adjusted by higher outage costs experienced in a substation versus the average outage in the distribution system. Effective life shortened to account for very high estimated failure rate due to transformer condition.		5	
	% Effectiveness	N/A								
	% Risk Addressed	N/A								No safety impact
Reliability	% Scope	N/A	0.1%							
	% Effectiveness	22%								High, deflated by sunk/future costs
	% Risk Addressed	0.3%								Average of SAIDI and SAIFI impact
Financial	% Scope	N/A	7%					Company data		
	% Effectiveness	22%								High, deflated by sunk/future costs
	% Risk Addressed	32%								Proportional to SAIFI impact

**SDG&E-4-M3-T2: Pacific Beach 12kV Replacement Re-build**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Financial risk adjusted by higher outage costs experienced in a substation versus the average outage in the distribution system.		50
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.007%						
	% Effectiveness	15%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.05%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0.07%					Company data	
	% Effectiveness	15%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.5%		<i>Proportional to SAIFI impact</i>					

**SDG&E-4-M3-T3: Ash 12 kV Cap Replacement Re-build**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Financial risk adjusted by higher outage costs experienced in a substation versus the average outage in the distribution system.		50
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.002%						
	% Effectiveness	25%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.01%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0.02%				Company data		
	% Effectiveness	25%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.10%		<i>Proportional to SAIFI impact</i>					

**SDG&E-4-M3-T4: New Substation**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life	
			Total		Scope	Effectiveness	Risk Addressed			
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Proportional to the frequency of N-1 conditions experienced at substations benefiting from this asset		50	
	% Effectiveness	N/A								
	% Risk Addressed	N/A								
Reliability	% Scope	N/A	1.33%							
	% Effectiveness	N/A								<i>Sum of N-1 substation contingency scenarios</i>
	% Risk Addressed	N/A								
Financial	% Scope	N/A	0%							
	% Effectiveness	N/A								
	% Risk Addressed	N/A								

**SDG&E-4-M4-T1: San Ysidro Breaker Replacement**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
					Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Financial risk adjusted by higher outage costs experienced in a substation versus the average outage in the distribution system.		30
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.006%						
	% Effectiveness	36%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.02%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0.04%						
	% Effectiveness	36%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.12%		<i>Proportional to SAIFI impact</i>					

**SDG&E-4-M4-T2: Murray Breaker Replacement**

Attribute	Risk Reduction		Total	Formula	Basis			Reference	Project Life
					Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		As determined by SDG&E	Per SME estimate	Financial risk adjusted by higher outage costs experienced in a substation versus the average outage in the distribution system.		30
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.01%						
	% Effectiveness	35%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.04%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0.09%				Company data		
	% Effectiveness	35%		<i>High, deflated by sunk/future costs</i>					
	% Risk Addressed	0.26%		<i>Proportional to SAIFI impact</i>					



**SDG&E-4-A1: Customer Owned E-Structure Reconfigure**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0.001%	<i>Contact risk estimate</i>	Identified by SDGE	SME Estimate	Based on an assessment of company data		50
	% Effectiveness	N/A							
	% Risk Addressed	N/A							
Reliability	% Scope	N/A	0.001%	<i>Reliability risk estimate</i>					
	% Effectiveness	N/A							
	% Risk Addressed	N/A							
Financial	% Scope	N/A	0.001%	<i>Financial risk estimate</i>				Company data	
	% Effectiveness	N/A							
	% Risk Addressed	N/A							

SDG&E-4-A2: ABB Distribution Relay Replacement									
Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
	% Scope	% Effectiveness	Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		Identified by SDGE	SME Estimate	Based on 4 hour outage assumption		43
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No direct impact on safety</i>					
Reliability	% Scope	2%	0.01%	<i>Replacing x relays at risk of failure/total distribution relays</i>					
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	0.7%		<i>Average of the SAIDI and SAIFI impacts</i>					
Financial	% Scope	2%	0.02%	<i>Replacing x relays at risk of failure/total distribution relays</i>			Company data		
	% Effectiveness	100%		<i>High</i>					
	% Risk Addressed	1.4%		<i>Proportional to number of outages</i>					

**SDG&E-4-A3-T2 Modernize OH switches**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		Identified by SDGE	SME Estimate	Estimates based on company data		50
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.1%						
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0.1%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0%				Company reliability data		
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No financial impact</i>					

**SDG&E-4-A3-T2 Modernize underground switches**

Attribute	Risk Reduction			Formula	Basis			Reference	Project Life
			Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	0%		Identified by SDGE	SME Estimate	Estimates based on company data		50
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No safety impact</i>					
Reliability	% Scope	N/A	0.04%						
	% Effectiveness	95%		<i>High</i>					
	% Risk Addressed	0.04%		<i>Average of SAIDI and SAIFI impact</i>					
Financial	% Scope	N/A	0%				Company reliability data		
	% Effectiveness	N/A							
	% Risk Addressed	N/A		<i>No financial impact</i>					

**SDG&E-4-A4: Avian Protection**

Attribute	Risk Reduction		Formula	Basis			Reference	Project Life
		Total		Scope	Effectiveness	Risk Addressed		
Safety	% Scope	N/A	No human safety impact	Identified by SDGE	SME Estimate	Estimates based on company data		50
	% Effectiveness	N/A						
	% Risk Addressed	N/A						
Reliability	% Scope	6%	Fraction of targeted assets					
	% Effectiveness	95%	High					
	% Risk Addressed	1%	Average of SAIDI and SAIFI impact					
Financial	% Scope	6%	Fraction of targeted assets				Company data	
	% Effectiveness	95%	High					
	% Risk Addressed	1%	Proportional to SAIFI impact					