

**2016 Risk Assessment Mitigation Phase
Investigation 16-10-015
Workpapers to
Major Disturbance to Electrical Service
(e.g., Blackout)
(Chapter SDG&E-5-WP)**

January 2017



2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (O&M)

Line No.	Mitigation	Project/Program	Project/Program Description	Status	Recorded (Directs, 2015 \$000)					Forecast Range (Directs, 2015 \$000)						Forecast Methodology
					2011	2012	2013	2014	2015	2017 Low	2017 High	2018 Low	2018 High	2019 Low	2019 High	
1	Modernization of Grid Control Centers	Transmission Energy Management System (EMS) Modernization Project	Upgrade antiquated EMS visualization tool and control room. Tool will help improve situational awareness and prevent potential human errors	P						\$ 170	\$ 188	\$ 69	\$ 77	\$ -	\$ -	Zero-Based
2	Modernization of Grid Control Centers Subtotal				-	-	-	-	-	170	188	69	77	-	-	
3	Advance Readiness	Operation Planning	Development and coordination of operating plans needed for advance readiness. Develop seasonal plans to ensure the safe and reliable operation of the Bulk Electric System throughout the year used as the basis for developing mitigation strategies (i.e. Safety Net)	B	-	-	-	-	1,029	978	1,080	978	1,080	978	1,080	Zero-Based
4	Advance Readiness Subtotal				-	-	-	-	1,029	978	1,080	978	1,080	978	1,080	
5	Monitoring and Control of the Bulk Electric System	Real-time Operation	All activities associated with the support and implementation of real time actions to ensure the safe and reliable operation of the SDG&E Electrical Transmission Grid and interconnections to prevent system collapse, separation, overloads, and/or equipment damage and most importantly, shall ensure the safety of personnel and the public in general	B	-	-	-	-	1,575	1,496	1,654	1,496	1,654	1,496	1,654	Zero-Based
6	Monitoring and Control of the Bulk Electric System Subtotal				-	-	-	-	1,575	1,496	1,654	1,496	1,654	1,496	1,654	
7	TOTAL				\$ -	\$ -	\$ -	\$ -	\$ 2,604	\$ 2,644	\$ 2,922	\$ 2,543	\$ 2,811	\$ 2,474	\$ 2,734	

Notes:

- Baseline (B) and Proposed (P).
- Numbers in risk chapter tables may differ due to rounding.
- The purpose of Risk Assessment Mitigation Phase (RAMP) is not to request funding. Any funding requests will be made in the General Rate Case (GRC). The forecasts for mitigations are not for funding purposes, but are rather to provide a range for the future GRC filing. This range will be refined with supporting testimony in the GRC.

2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (Capital)

Line No.	Mitigation	Project/Program	Project/Program Description	Status	Recorded (Directs, 2015 \$000)					Forecast Range (Directs, 2015 \$000)								
					2011	2012	2013	2014	2015	2017 Low	2017 High	2018 Low	2018 High	2019 Low	2019 High	2017-2019 Low (Sum)	2017-2019 High (Sum)	Forecast Methodology
1	Upgrades and Installation of New Transmission Facilities	10-year transmission plan Studies	Develop 10-year transmission plan in cooperation with California Independent System Operator (CAISO) and other stakeholders to ensure reliability standards are met including prevention of blackout	P	\$ -	\$ -	\$ -	\$ -	\$ 495	\$ 446	\$ 545	\$ 446	\$ 545	\$ 446	\$ 545	\$ 1,338	\$ 1,635	Zero-Based
2		San Luis Rey Synchronous Condensers	Installation of dynamic volt-ampere reactive (VAR) sources to quickly respond to voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	11,673	60,491	20,680	25,276	-	-	-	-	20,680	25,276	Zero-Based
3		San Onofre Synchronous Condenser	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	5	127	24,916	18,605	22,739	-	-	-	-	18,605	22,739	Zero-Based
4		Miguel Synchronous Condensers	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	237	4,281	18,215	22,263	-	-	-	-	18,215	22,263	Zero-Based
5		Suncrest Static Var Compensator	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	433	156	90	110	-	-	-	-	90	110	Zero-Based
6		TL23071: Sycamore Canyon - Penasquitos 230 kV Line	Construction of a new 13.84mi overhead and 2.94mi Under Ground 230 kV Line from Sycamore Canyon to Penasquitos	P	-	-	-	5,281	6,803	44,739	54,681	-	-	-	-	44,739	54,681	Zero-Based
7		South Orange County Reliability Project	Replace distribution equipment, add a 230 kV GIS Switchyard at Capistrano, add 2 new 230 kV circuits from Talega to Capistrano. Tie in Capistrano to SONGS and Escondido	P	-	-	-	6,605	37,999	36,884	45,080	82,514	100,850	97,271	118,887	216,669	264,817	Zero-Based
8		Imperial Valley Flow Control Device - Phase Shifting Transformer Option	Installation of two phase shifting transformers at Imperial Valley	P	-	-	-	-	7,044	34,717	42,431	-	-	-	-	34,717	42,431	Zero-Based
9		2nd Miguel to Bay Blvd 230 kV line	Construction of a new line with 1175 MVA Rating from Miguel to Bay Boulevard	P	-	-	-	-	-	1,999	2,443	3,998	4,886	13,993	17,103	19,990	24,432	Zero-Based
10		New Mission - Penasquitos 230 kV Line	Construction of a new 230 kV line from Mission to Penasquitos	P	-	-	-	-	-	2,088	2,552	3,341	4,083	2,088	2,552	7,517	9,187	Zero-Based
11	Upgrades and Installation of New Transmission Facilities Subtotal				-	-	5	24,356	142,185	178,463	218,120	90,299	110,364	113,798	139,087	382,560	467,571	
12	Modernization of Grid Control Centers	Transmission Energy Management System Modernization Project	Upgrade antiquated EMS visualization tool and control room. Tool will help improve situational awareness and prevent potential human errors	P	-	-	-	29	54	9,883	10,923	4,015	4,437	-	-	13,898	15,360	Zero-Based
13	Modernization of Grid Control Centers Subtotal				-	-	-	29	54	9,883	10,923	4,015	4,437	-	-	13,898	15,360	

2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (Capital)

Line No.	Mitigation	Project/Program	Project/Program Description	Recorded (Directs, 2015 \$000)						Forecast Range (Directs, 2015 \$000)						2017-2019 Low (Sum)	2017-2019 High (Sum)	Forecast Methodology
				Status	2011	2012	2013	2014	2015	2017 Low	2017 High	2018 Low	2018 High	2019 Low	2019 High			
14	Monitoring and Control of the Bulk Electric System	Real-time Operation	All activities associated with the support and implementation of real time actions to ensure the safe and reliable operation of the SDG&E Electrical Transmission Grid and interconnections to prevent system collapse, separation, overloads, and/or equipment damage and most importantly, shall ensure the safety of personnel and the public in general	B	-	-	-	-	1,575	1,496	1,654	1,496	1,654	1,496	1,654	4,488	4,962	Zero-Based
15		Synchrophasor Project	Phasor Measurement Units (PMU) installed for the Synchrophasor project help provide a better indication of the electric grid stresses and could be used to trigger wide area corrective actions to maintain grid reliability	B	-	-	-	-	1,679	1,601	1,769	1,601	1,769	1,601	1,769	4,803	5,307	Zero-Based
16		Energy Management System Maintenance	Activities associated with the maintenance of the Energy Management System (EMS). Operators and Engineers use the EMS system to monitor, control, and study the power system to maintain system voltage, stability and reliability	B	-	-	-	-	1,669	950	1,050	950	1,050	950	1,050	2,850	3,150	Zero-Based
17	Monitoring and Control of the Bulk Electric System Subtotal				-	-	-	-	4,923	4,047	4,473	4,047	4,473	4,047	4,473	12,141	13,419	
18	TOTAL				\$ -	\$ -	\$ 5	\$ 24,385	\$ 147,162	\$ 192,393	\$ 233,516	\$ 98,361	\$ 119,274	\$ 117,845	\$ 143,560	\$ 408,599	\$ 496,350	

Notes:

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2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (GRC Total - O&M)

				Recorded (Directs, 2015 \$000)								Forecast Range (Directs, 2015 \$000)									
Line No.	Mitigation	Project/Program	Project/Program Description	Status	GRC 2011	GRC 2012	GRC 2013	GRC 2014	GRC 2015	Non-GRC 2015	O&M Total 2015	GRC 2017 Low	GRC 2017 High	GRC 2018 Low	GRC 2018 High	GRC 2019 Low	GRC 2019 High	Non-GRC 2019 Low	Non-GRC 2019 High	O&M Total 2019 Low	O&M Total 2019 High
1	Modernization of Grid Control Centers	Transmission Energy Management System (EMS) Modernization Project	Upgrade antiquated EMS visualization tool and control room. Tool will help improve situational awareness and prevent potential human errors	P							\$ -	\$ 144	\$ 160	\$ 59	\$ 65	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2	Modernization of Grid Control Centers Subtotal				-	-	-	-	-	-	-	144	160	59	65	-	-	-	-	-	-
3	Advance Readiness	Operation Planning	Development and coordination of operating plans needed for advance readiness. Develop seasonal plans to ensure the safe and reliable operation of the Bulk Electric System throughout the year used as the basis for developing mitigation strategies (i.e. Safety Net)	B	-	-	-	-	-	1,029	1,029	-	-	-	-	-	-	978	1,080	978	1,080
4	Advance Readiness Subtotal				-	-	-	-	-	1,029	1,029	-	-	-	-	-	-	978	1,080	978	1,080
5	Monitoring and Control of the Bulk Electric System	Real-time Operation	All activities associated with the support and implementation of real time actions to ensure the safe and reliable operation of the SDG&E Electrical Transmission Grid and interconnections to prevent system collapse, separation, overloads, and/or equipment damage and most importantly, shall ensure the safety of personnel and the public in general	B	-	-	-	-	-	1,575	1,575	-	-	-	-	-	-	1,496	1,654	1,496	1,654
6	Monitoring and Control of the Bulk Electric System Subtotal				-	-	-	-	-	1,575	1,575	-	-	-	-	-	-	1,496	1,654	1,496	1,654
7	TOTAL				\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,604	\$ 2,604	\$ 144	\$ 160	\$ 59	\$ 65	\$ -	\$ -	\$ 2,474	\$ 2,734	\$ 2,474	\$ 2,734

Notes:

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- The purpose of Risk Assessment Mitigation Phase (RAMP) is not to request funding. Any funding requests will be made in the General Rate Case (GRC). The forecasts for mitigations are not for funding purposes, but are rather to provide a range for the future GRC filing. This range will be refined with supporting testimony in the GRC.

2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (GRC Total - Capital)

				Recorded (Directs, 2015 \$000)								Forecast Range (Directs, 2015 \$000)											
Line No.	Mitigation	Project/Program	Project/Program Description	Status	GRC 2011	GRC 2012	GRC 2013	GRC 2014	GRC 2015	Non-GRC 2015	Capital Total 2015	GRC 2017 Low	GRC 2017 High	GRC 2018 Low	GRC 2018 High	GRC 2019 Low	GRC 2019 High	GRC 2017-2019 Low (Sum)	GRC 2017-2019 High (Sum)	Non-GRC 2017-2019 Low	Non-GRC 2017-2019 High	Capital Total 2017-2019 Low	Capital Total 2017-2019 High
1	Upgrades and Installation of New Transmission Facilities	10-year transmission plan Studies	Develop 10-year transmission plan in cooperation with California Independent System Operator (CAISO) and other stakeholders to ensure reliability standards are met including prevention of blackout	P	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 495	\$ 495	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,338	\$ 1,635	\$ 1,338	\$ 1,635
2		San Luis Rey Synchronous Condensers	Installation of dynamic volt-ampere reactive (VAR) sources to quickly respond to voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	-	-	60,491	60,491	-	-	-	-	-	-	-	-	20,680	25,276	20,680	25,276
3		San Onofre Synchronous Condenser	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	-	-	24,916	24,916	-	-	-	-	-	-	-	-	18,605	22,739	18,605	22,739
4		Miguel Synchronous Condensers	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	-	-	4,281	4,281	-	-	-	-	-	-	-	-	18,215	22,263	18,215	22,263
5		Suncrest Static Var Compensator	The addition of synchronous condenser (dynamic) VAR sources will provide system operation with VAR sources/sinks needed to quickly respond to major disturbances that might cause high voltage deviations, low voltages, and possible voltage collapse situations	P	-	-	-	-	-	156	156	-	-	-	-	-	-	-	-	90	110	90	110
6	Upgrades and Installation of New Transmission Facilities Subtotal	TL23071: Sycamore Canyon - Penasquitos 230 kV Line	Construction of a new 13.84mi overhead and 2.94mi Under Ground 230 kV Line from Sycamore Canyon to Penasquitos	P	-	-	-	-	-	6,803	6,803	-	-	-	-	-	-	-	-	44,739	54,681	44,739	54,681
7		South Orange County Reliability Project	Replace distribution equipment, add a 230 kV GIS Switchyard at Capistrano, add 2 new 230 kV circuits from Talega to Capistrano. Tie in Capistrano to SONGS and Escondido	P	-	-	-	-	-	37,999	37,999	-	-	-	-	-	-	-	-	216,669	264,817	216,669	264,817
8		Imperial Valley Flow Control Device - Phase Shifting Transformer Option	Installation of two phase shifting transformers at Imperial Valley	P	-	-	-	-	-	7,044	7,044	-	-	-	-	-	-	-	-	34,717	42,431	34,717	42,431
9		2nd Miguel to Bay Blvd 230 kV line	Construction of a new line with 1175 MVA Rating from Miguel to Bay Boulevard	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19,990	24,432	19,990	24,432
10		New Mission - Penasquitos 230 kV Line	Construction of a new 230 kV line from Mission to Penasquitos	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,517	9,187	7,517	9,187
11					-	-	-	-	-	142,185	142,185	-	-	-	-	-	-	-	-	382,560	467,571	382,560	467,571
12	Modernization of Grid Control Centers	Transmission Energy Management System Modernization Project	Upgrade antiquated EMS visualization tool and control room. Tool will help improve situational awareness and prevent potential human errors	P	-	-	-	25	46	8	54	8,401	9,285	3,412	3,772	-	-	11,813	13,057	2,085	2,303	13,898	15,360
13	Modernization of Grid Control Centers Subtotal				-	-	-	25	46	8	54	8,401	9,285	3,412	3,772	-	-	11,813	13,057	2,085	2,303	13,898	15,360

2016 Risk Assessment Mitigation Phase
SDGE-05-WP
Risk: Major Disturbance to Electrical Service (e.g., Blackout) (GRC Total - Capital)

Line No.	Mitigation	Project/Program	Project/Program Description	Recorded (Directs, 2015 \$000)						Non-GRC 2015	Capital Total 2015	Forecast Range (Directs, 2015 \$000)										Capital Total 2017-2019 Low	Capital Total 2017-2019 High
				Status	GRC 2011	GRC 2012	GRC 2013	GRC 2014	GRC 2015			GRC 2017 Low	GRC 2017 High	GRC 2018 Low	GRC 2018 High	GRC 2019 Low	GRC 2019 High	GRC 2017-2019 Low (Sum)	GRC 2017-2019 High (Sum)	Non-GRC 2017-2019 Low	Non-GRC 2017-2019 High		
12	Monitoring and Control of the Bulk Electric System	Real-time Operation	All activities associated with the support and implementation of real time actions to ensure the safe and reliable operation of the SDG&E Electrical Transmission Grid and interconnections to prevent system collapse, separation, overloads, and/or equipment damage and most importantly, shall ensure the safety of personnel and the public in general	B	-	-	-	-	-	1,575	1,575	-	-	-	-	-	-	-	-	4,488	4,962	4,488	4,962
13		Synchrophasor Project	Phasor Measurement Units (PMU) installed for the Synchrophasor project help provide a better indication of the electric grid stresses and could be used to trigger wide area corrective actions to maintain grid reliability	B	-	-	-	-	-	1,679	1,679	-	-	-	-	-	-	-	-	4,803	5,307	4,803	5,307
14		Energy Management System Maintenance	Activities associated with the maintenance of the Energy Management System (EMS). Operators and Engineers use the EMS system to monitor, control, and study the power system to maintain system voltage, stability and reliability	B	-	-	-	-	-	1,669	1,669	-	-	-	-	-	-	-	-	2,850	3,150	2,850	3,150
15	Monitoring and Control of the Bulk Electric System Subtotal				-	-	-	-	-	4,923	4,923	-	-	-	-	-	-	-	-	12,141	13,419	12,141	13,419
16	TOTAL				\$ -	\$ -	\$ -	\$ 25	\$ 46	\$ 147,116	\$ 147,162	\$ 8,401	\$ 9,285	\$ 3,412	\$ 3,772	\$ -	\$ -	\$ 11,813	\$ 13,057	\$ 396,786	\$ 483,293	\$ 408,599	\$ 496,350

Notes:

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