

NEED/OPPORTUNITY STATEMENT (NOS)



Darlington Pt Secondary Systems Renewal

NOS 000000001253 revision 2.0

Ellipse Project no.: P0005329

TRIM file: [TRIM No]

Project Reason: Capability - Asset Replacement for end of life condition

Project Category: Prescribed - Replacement

Approvals

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Endorsed	Mark Jones	Secondary Systems and Communications Asset Manager
Approved	Lance Wee	M/Asset Strategy
Date submitted for approval	10 November 2016	

Change history

Revision	Date	Amendment
0	29 April 2016	Initial issue
1	11 October 2016	Update to 2016/17 dollars
2	10 November 2016	Update to format

1. Background

Darlington Point 330/220/132kV Substation comprises 1x 330kV feeder, 1 x 220kV feeder, 2x 330/220/33kV transformers, 2x 330/132/11kV transformers and 5x 132kV feeders. The site was established in 1988, and the secondary systems assets have install dates between 1988 and 2010. Additionally, Darlington Point supplies a single transmission line which feeds Balranald, Buronga, and Broken Hill substations as well as the Victorian Interconnector 0X1 to Red Cliffs.

Darlington Point Substation is a customer connection point supplying Essential Energy's 132kV network in the Riverina agricultural irrigation area inclusive of Leeton which is the centre of the rice growing district in NSW. The site will remain a connection point to Essential Energy into the foreseeable future as outlined in the load forecasts of the 2015 Annual Planning Report.

2. Need/opportunity

In accordance with TransGrid's Renewal and Maintenance Strategies for Automation¹ and Metering Systems², Table 1 shows the assets at Darlington Point Substation that have been identified for replacement by 2023.

Table 1 – Identified asset replacements at Darlington Point Substation from 2014-2023

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 602 – Replacement of RADSB Protection Relays	2	25% of all transformer protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Limited internal support available ongoing repair and maintenance
Need ID 605 - Replacement of Quadramho (SHPM) Protection Relays	1	25% of all 330/220kV line/feeder protections on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Relays known to become trapped in a logic loop, rendering the relay non-auto and initiating the "Relay Inoperative Alarm"
Need ID 606 - Replacement of THR Protection Relays	1	25% of all 330/220kV line/feeder protections on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Inaccurate measurement of fault angles due to deteriorated internal components

¹ Refer SSA Strategy - Renewal and Maintenance - Automation Systems

² Refer SSA Strategy - Renewal and Maintenance - Metering Systems

Need Description	Quantity of Assets to be addressed	% of Services at Site	Need Driver
Need ID 621 – Replacement of DB Series Protection Relays	6	75% of all transformer protection relays on site	<ul style="list-style-type: none"> > Component obsolescence resulting in a lack of spares and no manufacturer support > Faulty harmonic bias circuitry due to component failure > Internal wiring connection problems
Need ID 610 - Replacement of EDM I MkIII Meters	2	50% of all market Meters on site	<ul style="list-style-type: none"> > Microprocessor Energy Meters failing as they approach 15 years of life > Component obsolescence resulting in a lack of spares and no manufacturer support

Additionally, condition assessments for all these individual asset types have been completed³.

The risk cost associated with all secondary systems at Darlington Point is \$2.4m per annum. The most significant element of concern is the reliability consequence associated with a protection system failing to operate during a genuine fault due to the malfunction of the protection relays identified for replacement above. This hazard can result in a number of different outcomes including load shedding, explosive failure of associated primary assets, offloading generation or in the most extreme case, disconnection of the local region. There is an agricultural load at the site with a forecast 20MW as the average of the summer and winter loads in the Annual Report and an estimated 8 hours to recover the site and load after a hazardous event. There is an additional load at risk of 306MW which covers Balranald, Buronga and Broken Hill Substations and OX1 Victorian Interconnector to Red Cliffs. These have been included as they are all supplied from a single 220kV transmission line out of Darlington Point. The risk costs are based on 2015/16 probabilities of failure taken as a trend of existing defect rates of applicable asset types derived from the condition assessments. These probabilities are forecast to continue increasing over the coming years, with the consequence of failure also likely to escalate due to TransGrid's means of mitigating and repairing these failures being almost exhausted.

There is additional risk identified from market meters (which considers repair and potential litigation costs).

In accordance with TransGrid's Renewal and Maintenance Strategy for Secondary Systems Site Installations⁴, the opportunity exists to address these risks by performing a full secondary system replacement at Darlington Point. This opportunity is due to the high concentration of the secondary system assets required to be addressed. It is expected that this would provide additional benefits for the organisation including:

- > Moving from a centralised Alarm and Control platform to a distributed control architecture that improves operational control and reliability while reducing the consequence of equipment failure
- > Upgrading Auto Reclose facilities to allow better control, indication and fault analysis than what is currently available at the site
- > Upgrading Transformer Control facilities to allow better control, indication and fault analysis than what is currently available at the site

³ Refer NACA-SSAP - Protection, NACA-SSAM - Metering

⁴ Refer SSA Strategy - Renewal and Maintenance - Secondary Systems Site Installations

3. Related Needs/opportunities

The following related Needs contain works for Darlington Point that could be fulfilled by completing a Secondary Systems Replacement:

- > Need ID 602 – Replacement of RADSB Protection Relays
- > Need ID 605 – Replacement of Quadramho (SHPM) Protection Relays
- > Need ID 606 – Replacement of THR Protection Relays
- > Need ID 621 – Replacement of DB Series Protection Relays
- > Need ID 610 – Replacement of EDM I MKIII Meters

4. Recommendation

It is recommended that options be considered to address the identified Need/opportunity.

Attachment 1 – Risk costs summary

Summary of results is attached below. Refer to supporting document in PDGS for full risk assessment.

Current Option Assessment - Risk Summary

Project Name: Darlington Point DNT Secondary Systems Renewal

Option Name: 1253 - Base Case

Option Assessment Name: 1253 - Base Case - Assessment 1

Rev Reset Period: Next (2018-23)



Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr 1)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Peo)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Battery and Charger System	2	Battery	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.12	Failure	\$0.24	9.00%	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Battery	Unplanned Outage - HV (Battery and Charger System)	\$0.11	Failure	\$0.22	9.00%	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Uncontrolled Electrical Contact / Discharge (Battery and Charger System)	\$0.12	Failure	\$0.24	9.00%	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Battery and Charger System	2	Charger	Unplanned Outage - HV (Battery and Charger System)	\$0.11	Failure	\$0.22	9.00%	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Controls	7	Bay Controller	Unplanned Outage - HV (Controls)	\$0.16	Failure	\$1.15	4.00%	\$0.05	\$0.03	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Controls	7	Control Cabling	Unplanned Outage - HV (Controls)	\$0.16	Failure	\$1.15	4.00%	\$0.05	\$0.03	\$0.02	\$0.02	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.84	Failure	\$1.69	31.00%	\$0.52	\$0.06	\$0.45	\$0.01	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage AC Supply)	\$0.98	Failure	\$1.96	31.00%	\$0.61	\$0.16	\$0.45	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage AC Supply)	\$0.84	Failure	\$1.69	3.00%	\$0.05	\$0.01	\$0.04	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage AC Supply	2	AC Low Voltage Cable	Unplanned Outage - HV (Low Voltage AC Supply)	\$0.98	Failure	\$1.96	3.00%	\$0.06	\$0.02	\$0.04	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	\$0.12	Failure	\$0.24	2.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Board/Panel/Box	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.11	Failure	\$0.22	2.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Low Voltage DC Supply	2	DC Low Voltage Cable	Uncontrolled Electrical Contact / Discharge (Low Voltage DC Supply)	\$0.12	Failure	\$0.24	2.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Major Component	No.	Minor Component	Sel. Hazardous Event	LoC x CoF (\$M)	Failure Mechanism	NoxLoC xCoF (\$M)	PoF (Yr ⁻¹)	Total Risk (\$M)	Risk (\$M) (Rel)	Risk (\$M) (Op)	Risk (\$M) (Fin)	Risk (\$M) (Pco)	Risk (\$M) (Env)	Risk (\$M) (Rep)
Low Voltage DC Supply	2	DC Low Voltage Cable	Unplanned Outage - HV (Low Voltage DC Supply)	\$0.11	Failure	\$0.22	2.00%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Metering	4	Meter	Failed Compliance Obligations (Metering)	\$0.11	Failure	\$0.45	3.50%	\$0.02			\$0.02			
Protection >=220kV	10	Protection	Unplanned Outage - HV (Protection >=220kV)	\$0.21	Failure	\$2.06	3.22%	\$0.07	\$0.03	\$0.03	\$0.03	\$0.00	\$0.00	\$0.00
Protection >=220kV	10	Protection Relay	Explosive Failure of Asset (Protection >=220kV)	\$2.43	Failure	\$24.25	3.22%	\$0.78	\$0.73	\$0.03	\$0.03	\$0.00	\$0.00	\$0.02
Protection <=132kV	6	Protection	Unplanned Outage - HV (Protection <=132kV)	\$0.21	Failure	\$1.24	1.02%	\$0.01	\$0.01	\$0.01	\$0.01	\$0.00	\$0.00	\$0.00
Protection <=132kV	6	Protection Relay	Explosive Failure of Asset (Protection <=132kV)	\$1.41	Failure	\$8.44	1.02%	\$0.09	\$0.08	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
				\$9.27		\$47.90		\$2.40	\$1.22	\$1.12	\$0.02	\$0.01	\$0.01	\$0.03
Total VCR Risk:				\$1.14				Total ENS Risk:	\$0.03					