3 Phase Recloser Replacement Strategy

SGNW0014

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Abstract:

Ergon Energy's recloser replacement strategy (for regulatory period: 2015 - 2019) will improve public and operator safety and network reliability Network faults on lines and substations are continuously monitored and must be cleared within legislative time frames in order to protect plant and the public.

This strategy recommends the replacement of remaining oil insulated 3 phase reclosers currently in service in the Ergon Energy 11kV, 22kV and 33kV distribution network and enable a planned approach for replacing a small population of existing oil insulated reclosers with vacuum & SF6 electronic reclosers and introduce the capabilities of SCADA communications and remote access.

This strategy excludes SWER reclosers and does not overlap with other recloser strategies such as the ACR remote communications strategy which recommends implementation of SCADA on a large number of reclosers.

Keywords:

Recloser, replacement, strategy

3 Phase Recloser Replacement Strategy

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Revision history

Revision date	Version number	Author	Description of change/revision
11/11/2013	0.1	Scott Loader	First draft
11/06/2014	1.0	Scott Loader	Updated document with recent budget costings as of June 2014
13/06/2014	1.1	Scott Loader	Updated document references and statistical tables
22/09/2014	1.4	Scott Loader	Alignment with SharePoint version history

Document approvals

Name	Position title	Signature	Date
Jason Hall	GM Engineering Standards & Technology		

Stakeholders / distribution list

Name	Title	Role
Nigel O'Neil	Protection Engineering Manager	Endorsement
Leon Powell	Senior Engineer Refurbishment	Endorsement
Ken Lewis	Engineering Manager Maintenance & Refurbishment	Endorsement

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Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802

3 Phase Recloser Replacement Strategy

1 Overview

1.1 Purpose and scope

This strategy covers the replacement of remaining oil insulated 3 phase reclosers currently in service in the Ergon Energy 11kV, 22kV and 33kV distribution network. These reclosers are only equipped with basic protection functions and not capable of SCADA communications, remote engineering access or SEF capability. This strategy will enable a planned approach for replacing a small population of existing oil insulated reclosers with vacuum & SF6 electronic reclosers having SCADA communications and remote access capability.

This strategy complements other strategies for rolling out SCADA on existing reclosers by implementing an independent and accelerated replacement program for 3 phase reclosers. Other strategies may also require upgrades or even replacement of some existing reclosers in order to implement SCADA.

This strategy excludes SWER reclosers and does not overlap with other recloser strategies such as the ACR remote communications strategy which recommends implementation of SCADA on a large number of reclosers.

2 References

2.1 Ergon Energy controlled documents

Document number or location (if applicable)	Document name	Document type
AER CARIN data templates T2.2_21Mar14	2014 AER REPEX Model	Model
Sharepoint	Management Plan Protection and Control	Management Plan
AER data room	Protection Strategy	Strategy
SharePoint	Protection Relay Replacement Engineering Report	Engineering Report
SGNW0011	(*Future Strategy*) Recloser Monitoring Strategy	Strategy
AER data room	Protection Review Rectification Strategy	Strategy
SGNW0025	(*Future Strategy*) ACR Remote Communications Strategy	Strategy
AER data room	Sensitive Earth Faults SEF Protection Strategy	Strategy
AER data room	SWER Network Management Strategy	Strategy
STNW1004	Standard for Auto Reclose	Standard

STWN1002	Standard for Substation Protection	Standard

2.2 Other documents

Nil

3 Legislation, regulations, rules, and codes

This document refers to the following: Nil

4 Definitions, acronyms, and abbreviations

4.1 Definitions

For the purposes of this strategy, the following definitions apply:

Term	Definition
Engineering access	The ability to remotely communicate to a recloser in order to download or upload information into the recloser
Live line work clearance (LLWC)	A feature of the smart recloser which allows adjustment of protection and control settings for enhanced safety of live line workers on the section of line protected by the recloser
Recloser	A switching device capable of detecting and clearing a fault followed by automatic reclose attempts to restore supply
Uplift Factor	A loading factor to the standard estimate which includes travel and accommodation but excludes overhead costs

4.2 Acronyms and abbreviations

The following abbreviations and acronyms appear in this strategy.

Term, abbreviation or acronym	Definition
ACR	Automatic Circuit Recloser, or simply called a recloser
Ellipse	Ergon Energy's Asset Management system inclusive of the Assets Register
OCC	Operations control centre
SCADA	Supervisory control and data acquisition
SEF	Sensitive earth fault protection
SWER	Single wire earth return

5 Recloser standards

5.1 3 Phase reclosers

Prior to around 1980, 3 phase recloser technology used in the Ergon Energy Network was based on oil as the insulating and interrupting medium. This technology was superseded around 1980 with the introduction of vacuum interruption technology; improved insulation, and basic electronic protection and control capability. Since around 1990, Ergon Energy has been purchasing smart reclosers which are based on vacuum technology, SF6 or epoxy based insulation and microprocessor driven protection and control unit capable of SCADA communications and sensitive earth fault protection. These are known as smart reclosers, and adopted as the current standard for 3 phase reclosers.

This strategy recommends replacement of pre-1990 oil insulated 3 phase reclosers with current Ergon Energy standard 3 phase smart reclosers.

5.2 SWER reclosers

Prior to around 1990, almost all SWER recloser designs were based on low cost, hydraulic type, with oil insulation. A significant population of these reclosers are still in service and considered acceptable for SWER protection in Ergon Energy.

Since around 1990, smart electronic SWER reclosers have been available, and Ergon Energy has installed a few hundred of these units. However, due to high cost of the smart SWER reclosers compared to the oil based units, Ergon has continued to purchase oil based reclosers for standard application. The option to use smart SWER reclosers is available in the construction standards; however, it is currently not used on all SWER applications due to its higher cost.

Replacement of SWER oil based reclosers is not included in the scope of this strategy, however, a staged approach for the replacement of such reclosers is recommended in the future ACR communications strategy. The SWER network management strategy also recommends the use of smart SWER reclosers for specific applications on the SWER network.

6 Recloser population

Smart reclosers are generally well documented in Ellipse and PDS, however, data on some earlier installations involving legacy reclosers may not be reliable as there is a possibility that a small number of these reclosers may have been upgraded but data not updated in Ellipse or PDS. Due to data issues, it is possible that the actual number of legacy reclosers requiring replacement will vary from the estimated quantity in the annex.

7 Options

7.1 Option 1: Replace 3 phase oil recloses with electronic reclosers within 5 years

Replacement reclosers will provide a number of benefits as follows:

- provide greater flexibility of protection settings and improved protection coordination
- permit SCADA communications, and remote engineering access
- significantly reduced operational response times for rural and remote reclosers with SCADA
- provide event logs and alarms for recloser condition monitoring from a remote location

- provide SEF capability (a safety feature)
- provide LLWC capability (a safety feature)
- provide feeder load and voltage for planning purposes
- align with current standards on reclosers

Under this option, each replacement recloser will be equipped with SCADA communications, controlled from the OCC, and capable of remote engineering access.

7.2 Option 2: Replace 3 phase oil reclosers with electronic within 10 years

This option mirrors Option 1 however over a ten year period. This option takes into consideration possible financial and resource restrictions.

In addition, this program shall continue beyond 2019 to address recloser replacements as identified within Option 1 or determined as appropriate to be replace via other sources.

7.3 Option BAU: Continue to operate oil insulated 3 phase reclosers

Not all features and corresponding benefits outlined in Annex A would be realised with oil-insulated reclosers remaining in service. With this option, replacement of such reclosers will not occur unless the recloser fails in service or alternatively replaced under some other program.

8 Recommendation

This strategy recommends Option 1, implementing a five-year program commencing 2015, to replace approximately 20, 3 phase oil insulated reclosers in Ergon Energy's distribution network. It is recommended that this replacement program is rolled out independent of any other recloser replacement strategy.

Annex A Estimated 3 phase reclosers identified for replacement

Table 1: Estimated 3 phase reclosers identified for replacement

Equipment Number	Plant/Serial Number	Recloser Type[1]	Recloser Location
659978	RE93096093	KYLE 22KV OCB	TUNG 22KV TUNGAMULL FDR CB TG-S201
3520296	RE91602639	MACGRW EDISON 11KV OIL	RC CLONCURRY RD No.1 CLONCURRY
3714203	RE92717495	RC GEC 22kV HR (3PHASE GE)	RC James Creek JC2.2WOL.RECL
3724244	RE92931573	MCGRAW EDISON 11KV OIL	RC BROWN & BRYANT No.2 BROWN & BRYANT NO
3735155	RE92151286	RC McGraw Edison 22KV RV	RC Mourilyan School M1.167.2IN2.RECL St
3743238	RE92659959	RC GEC HR (3 PHASE GE)	RC EMERALD CREEK SPUR EC2.2KUR.RECL
3743699	RE92743544	RC REYROLLE - 1204 Dimbulah Rd	RC Boyle Creek BC2.2TAB.RECL
3771745	RE91630153	MCGRAW EDISON 11kV KFE	RC NOLANS NO.1 NOLANS NO.1
3825436	RE92119717	11KV	RC CANEFIBRE NO.1 CANEFIBRE NO.1
3834524	RE92122675	11KV RECLOSER	RC BLUFF RD No.6 BLUFF RD NO.6
5722683	RE93431120	MCGRAW EDISON 11kV KFE	RC Carpentaria Gold 1 Carpentaria Gold 1
649675	RE92432366	MCGRAW EDISON 11KV VCB	PAMP 11KV LEMONTREE FDR CB CB4008
651033	RE92989066	MCGRAW EDISON 11KV OIL	MODA 11KV MONDURAN FDR CB B452
651116	RE93083276	MCGRAW EDISON 11KV OIL	MODA 11KV MONDURAN FDR CB A452
655884	RE92007049	KYLE 11KV VCB	GUML GUML - B252 GUML - B252
3437698	RE92109415	MACGRAW EDISON 11KV VAC/OIL	RC RYAN RD RECLOSER No.1 RYAN RD REC NO.
3439548	RE92159000	MCGRAW EDISON 11KV VAC/OIL	RC BURDEKIN RD NO.3 BURDEKIN RD NO.3
3704364	RE91864509	McGraw Edison 22kV BWV 50A	RC IRVINEBANK SPUR - HERBERTON FDR IR7.2
3720439	RE91749284	11kV OIL RECLOSER CB4158	RC Biddeston Recloser CB4158
3744800	RE92654096	11kV OIL RECLOSER CB4409	RC Grays Gate Recloser CB4409

[1] All listed reclosers are non-SWER and in-service (spares and smart recloses omitted)
The list is based on estimated recloser counts from Ellipse and PDS

Annex B Recloser replacement plan summary – Option 1

Table 2: Recloser replacement plan[2]

Replacement year	2015	2016	2017	2018	2019	Total
Replacement quantity	4	4	4	4	4	20
Estimated replacement cost	$202,352	$202,352	$202,352	$202,352	$202,352	$1,011,760

[2] Replacement plans assumes a unit replacement cost of $48,209 per recloser based on the standard Ellipse estimate MIP1051, exclusive of travel, accommodation and overheads.

Annex C Recloser replacement schedule – Option 1

Table 3: Recloser replacement schedule – Option 1[3]

Year	#	Substation Name	Region	Applicable Standard estimate	Standard estimate excluding travel, accommodation and OHs	Include Uplift Factor
2015	1	Tungamull	CA	MIP1019	$48,209	$50,588
	2	Duchess Road	NQ	MIP1019	$48,209	$50,588
	3	Dimbulah	FN	MIP1019	$48,209	$50,588
	4	Charters Towers	NQ	MIP1019	$48,209	$50,588
				2015 total	**$192,836**	**$202,352**
2016	1	Innisfail	FN	MIP1019	$48,209	$50,588
	2	Mareeba	FN	MIP1019	$48,209	$50,588
	3	Mareeba	FN	MIP1019	$48,209	$50,588
	4	Ravenswood	NQ	MIP1019	$48,209	$50,588
				2016 total	**$192,836**	**$202,352**
2017	1	Ayr	NQ	MIP1019	$48,209	$50,588
	2	Millchester	NQ	MIP1019	$48,209	$50,588
	3	Ravenswood	NQ	MIP1019	$48,209	$50,588
	4	Pampas	SW	MIP1019	$48,209	$50,588
				2017 total	**$192,836**	**$202,352**
2018	1	Monduran Dam	WB	MIP1019	$48,209	$50,588
	2	Monduran Dam	WB	MIP1019	$48,209	$50,588
	3	Gumlu	NQ	MIP1019	$48,209	$50,588
	4	Duchess Road	NQ	MIP1019	$48,209	$50,588
				2018 total	**$192,836**	**$202,352**
2019	1	Home Hill	NQ	MIP1019	$48,209	$50,588
	2	Atherton	FN	MIP1019	$48,209	$50,588
	3	Oakey	SW	MIP1019	$48,209	$50,588
	4	Millmerran	SW	MIP1019	$48,209	$50,588
				2019 total	**$192,836**	**$202,352**
				2015-2019 Overall Total	**$964,180**	**$1,011,761**

[3] Replacement plans assumes a unit replacement cost of $48,209 per recloser based on the standard Ellipse estimate MIP1019, exclusive of travel, accommodation and overheads and includes uplift factor.

Annex D Recloser replacement schedule – Option 2

Table 4: Recloser replacement schedule – Option 2[4]

Year	#	Substation Name	Region	Applicable Standard estimate	Standard estimate excluding travel, accommodation and OHs	Include Uplift Factor
2015	1	Tungamull	CA	MIP1019	$48,209	$50,588
	2	Duchess Road	NQ	MIP1019	$48,209	$50,588
				2015 total	**$96,418**	**$101,176**
2016	1	Dimbulah	FN	MIP1019	$48,209	$50,588
	2	Charters Towers	NQ	MIP1019	$48,209	$50,588
				2016 total	**$96,418**	**$101,176**
2017	1	Innisfail	FN	MIP1019	$48,209	$50,588
	2	Mareeba	FN	MIP1019	$48,209	$50,588
				2017 total	**$96,418**	**$101,176**
2018	1	Mareeba	FN	MIP1019	$48,209	$50,588
	2	Ravenswood	NQ	MIP1019	$48,209	$50,588
				2018 total	**$96,418**	**$101,176**
2019	1	Ayr	NQ	MIP1019	$48,209	$50,588
	2	Millchester	NQ	MIP1019	$48,209	$50,588
				2019 total	**$96,418**	**$101,176**
				2015-2019 Overall Total	**$482,090**	**$505,880**

[4] Replacement plans assumes a unit replacement cost of $48,209 per recloser based on the standard Ellipse estimate MIP1019, exclusive of travel, accommodation and overheads and includes uplift factor.

Ergon Energy Corporation Limited ABN 50 087 646 062
Ergon Energy Queensland Pty Ltd ABN 11 121 177 802