Division Manual: Embedded Generator Major Network Connection Costing Guideline CEOM7817

For questions regarding or permission to release this Policy, please contact Essential Energy's Chief Risk and Compliance Officer.

If working from a printed copy of this document, check Policy Alerts and the Policy Library regularly for updates.

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 COMMERCIAL-IN-CONFIDENCE



CONTENTS

1.0	PURPOSE						
2.0	ACTIONS						
2.1	Preli	ninary Design Cost Variances	3				
2.2	Туріс	al Voltage Level for Connections	3				
2.3	Proje	ct Costs Considerations	4				
2.	3.1 F	Potential Cost Implications	4				
	2.3.1.1	Land & Routes	4				
	2.3.1.2	Environmental	4				
	2.3.1.3	Network Earthing	4				
	2.3.1.4	Operations Planning	4				
	2.3.1.5	Telecommunication	4				
	2.3.1.6	Load Control	4				
	2.3.1.7	Protection	5				
	2.3.1.8	SCADA	5				
	2.3.1.9	Substation Design	. 5				
	2.3.1.10	Overhead Mains Design	. 5				
2.	3.2 0	Contestable (Connection Applicant) Scope	. 6				
	2.3.2.1	General	6				
	2.3.2.2	Network Performance Analysis	. 6				
	2.3.2.3	Subtransmission and Distribution Construction	. 6				
	2.3.2.4	Protection	6				
	2.3.2.5	SCADA	. 6				
	2.3.2.6	Telecommunication	7				
	2.3.2.7	Metering	7				
	2.3.2.8	Power Quality	7				
	2.3.2.9	Earthing	7				
	2.3.2.10	Commissioning	7				
	2.3.2.11	Land and Routes	7				
2.	3.3 §	Special Protection Scheme (SPS)	8				
2.4	Desig	gn References	10				
2.	4.1 (General	10				
2.	4.2 5	Substation Design	10				
2.	4.3 I	lains Design	11				
2.	4.4 F	Protection, SCADA and Telecommunication	11				
2.	4.5 N	Netering	12				
2.	4.6 N	letwork Earthing	12				
2.5		estability of Services					
2.6	Cont	estable Works Design Certification	12				

2.	7 Ris	sks	13
	2.7.1	Construction	13
	2.7.2	Environment	13
	2.7.3	Equipment	13
	2.7.4	Legal	13
	2.7.5	Network	13
	2.7.6	Safety	13
2.	8 Ty	pical Connection Arrangements	14
	2.8.1	Option 1: Additional Feeder Bay in Zone Substation	14
	2.8.2	Option 2: New 3 Way Switching to Existing Sub-transmission line	15
	2.8.3	Option 3: Direct Connection to Zone Substation (<5MW)	16
	2.8.4	Option 4: Ancillary Works in Zone Substation	17
	2.8.5	Option 5: HV "T" or Recloser Interface Connection	17
3.0	AUT	HORITIES AND RESPONSIBILITIES	18
4.0	DEFI	NITIONS	18
5.0	REFI	ERENCES	20
6.0	REC	ORDKEEPING	21
7.0	REV	SIONS	21

1.0 PURPOSE

To provide high level connection options, general arrangements and non-contestable cost estimates for a HV embedded generator connection enquiry greater than 30kW into the Essential Energy (EE) network.

During the connection enquiry stage of a new HV embedded generator, potential connection applicant's require high level connection options for various sized generators. This includes but is not limited to different connection options at various voltages and typical non-contestable project costs.

2.0 ACTIONS

2.1 Preliminary Design Cost Variances

The project cost estimates provided in this document are for the HV connection of typical largescale embedded generator connections based on EE's historical data. Due to the large scale of these projects multiple factors can affect the final installation cost and create large variations from these indicative figures.

Historically, high speed telecommunication and protection/SCADA requirements have significant cost implications which cannot be determined at the enquiry stage of the connection. These cost implications will not be clear until further analysis and completion of detailed studies/detailed design for each individual connection.

Consideration should be given to the existing generation or any facilities under development that may severely limit the available generation capacity in that region of the NEM.

This guideline is provided for information purposes only, a detailed list of requirements will be included as part of the Contestable Works Design Information Pack which is to be requested via the Connection Applicant's ASP to the EE Contestable Works team. All costs associated with the engagement of an ASP are the responsibility of the Connection Applicant.

2.2 Typical Voltage Level for Connections

The maximum generator output for each network connection voltage is provided in Table 1 below. Consideration may be granted by EE in special circumstances to permit higher generator outputs at each voltage level where capacity is available in the network. The Connection Applicant should consider that implementing generator levels above the typical maximum generator output can result in substantial network augmentation costs.

Network Connection Voltage	Maximum Generator Output
11/22kV	5MW
33kV	20MW
66kV	40MW
132kV	100MW

Table 6.0.1: Typical voltage levels for embedded generator connections

2.3 **Project Costs Considerations**

2.3.1 Potential Cost Implications

The following items can have connection cost implications beyond the typical high-level figures provided in a typical connection arrangement. Investigation into these considerations should be carried out as part of the connection enquiry.

2.3.1.1 Land & Routes

- Are there existing easements that need to be considered?
- Is the existing line within the road reserve or on Council controlled land?
- What customer consultation will be required along any new routes?
- Is customer consultation required?
- Is the line protected under the Electricity Supply Act (1995)?

2.3.1.2 Environmental

- Is a REF and/or EIA checklist required?
- Is a site survey available/required?
- Is a geotechnical report available/required?
- Is the new route or are adjacent properties heavily vegetated?

2.3.1.3 Network Earthing

- Does an earthing report exist for the site? Is one required?
- For further consideration go to EE Document External Network Connection Earth System Design & Test Requirements, Version 1.1 via this <u>link.</u>

2.3.1.4 Operations Planning

• Detail network constraints and outage requirements.

2.3.1.5 Telecommunication

- Is high speed protection required?
- What new/augmentation equipment will be required (protocol, hardware type, location, installation requirements).
- Is a communications tower/antenna required?

2.3.1.6 Load Control

- Will existing FI plants be impacted by the new connection?
- Will the Connection Applicant need to install reactors?
- Will FI network studies need to be done?
- Is a bulk relay upgrade to devices more suited to a daytime loss of signal a possibility?

2.3.1.7 Protection

- Detail new /augmentation equipment details: -
 - Installation of new or upgrading of existing RTU's?
 - Installation of new line differential protection scheme?
 - Installation of a new distance protection scheme?
 - High speed inter-tripping?
 - Is a Special Protection Scheme (SPS) or runback required?

2.3.1.8 SCADA

- Detail new/augmentation equipment requirements (protocol, equipment details, location etc.).
- Are there sufficient I/O and AC inputs to complete the project? If not, consider combining alarms/indicators.
- Will the new equipment be commissioned with integration to the SCADA RTU located in the SCADA cabinet within the control building?

2.3.1.9 Substation Design

- Is a survey available (2D/3D)?
- Is a geotechnical report available?
- Briefly detail the availability/format/condition of existing drawings in ProjectWise.
- Detail work completed by Subtransmission Development during the preliminary stage (transformer modelling, lightning study, security fence assessment) and where it has been stored (i.e. *Project Information* folder in ProjectWise).

2.3.1.10 Overhead Mains Design

- What is the design temperature?
- Confirm load capability.
- Complete a comprehensive detail design package.
- Is survey data available? Where is it located?
- Have spans been modelled?
- Have photos been reviewed?
- Wind return period for pole strength assessment: ** Years?
- Wind region to be used in design calculations: Zone *?
- Wind return period for pole changes/replacements: ** Years?
- Ground clearance assessment temperature: **°C?
- Conductor design temperatures: -
 - Uplift: -*°C?
 - Sustained: **°C?

2.3.2 Contestable (Connection Applicant) Scope

The full extent of works considered to be contestable and thus the responsibility of the Connection Applicant includes but may not be limited to the following.

2.3.2.1 General

- Design and construction of: -
 - Embedded Generation Substation (owned and operated by Connection Applicant).
 - Embedded Generation Connection Point (EE standard construction gifted asset).
 - Auxiliary 415VAC supply (No1) from EE distribution network (gifted to EE).
- All necessary approvals that are to be gained from other relevant authorities that may affect the substation/switchyard and line works.
- Provide SiD documentation.

2.3.2.2 Network Performance Analysis

- Voltage regulation.
- Fault level and sensitivity.
- Stability and harmonics.
- Protection analysis.
- Earthing analysis.
- Operational parameters.
- FI impact study and analysis.

2.3.2.3 Subtransmission and Distribution Construction

- The embedded generator shall be connected as a high voltage customer/generator/developer.
- Where possible the connection point will be located adjacent to the Connection Applicant's substation site at the embedded generation site.
- Any transfer of gifted assets and energisation of the embedded generator shall follow the successful commissioning and sign-off.

Note: Works inside existing EE substations are considered non-contestable and shall be designed, constructed, and commissioned by EE.

2.3.2.4 Protection

- Installation and pre-commissioning of embedded generation protection relays, protection panel and embedded generation substation.
- Protection schemes and settings shall be implemented such that the performance of existing protection schemes are not adversely impacted.

2.3.2.5 SCADA

- It is the Connection Applicant's responsibility to contact the AEMO and negotiate their requirements regarding the data to be transferred from the Embedded Generation site.
- Installation of a SCADA scheme for the solar connection point (gifted to EE) in line with EE standards and existing infrastructure.
- Refer to CEOS7902 for design guidelines.
- All SCADA equipment shall be submitted to and approved by EE Specialist Engineering Manager prior to procurement.

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 6 of 21 **COMMERCIAL-IN-CONFIDENCE**

- Before the Connection Applicant's RTU's can be connected to the EE SCADA network, the Connection Applicant must make available their RTU's with a technician for bench testing of the DNP compatibility with POF.
- EE is responsible for providing a SCADA communication path to AEMO from power generators within its network. An AEMO monitored site requires duplicate RTU's.
- In order to guarantee continuity across EE's footprint, EE will provide a comprehensive list of SCADA equipment requirements associated with the connection.

2.3.2.6 Telecommunication

- Design, construct and test all agreed contestable telecommunications works.
- For sites requiring duplicated communications paths, these paths are also required to be diverse with the exception of communications towers located at the sending/receiving ends of diverse paths.

2.3.2.7 Metering

• Procurement, installation and commissioning of metering equipment in accordance with regulatory requirements (located outside of EE infrastructure).

2.3.2.8 Power Quality

• Installation of a PQM (A-Eberle PQI-DA smart) in the solar SS at the point of common coupling.

2.3.2.9 Earthing

- Prepare and submit earthing designs for any embedded generation substation and embedded generation SS sites.
- Construct earthing system.
- Submit earthing system test reports for approval by EE prior to connection.

2.3.2.10 Commissioning

- Provide installation test documentation to EE for review.
- Provide pre-commissioning documentation to EE for review.
- Provide access to EE for commissioning of gifted assets and embedded generation substation data network equipment.

2.3.2.11 Land and Routes

- Acquisition of land and easements: -
 - Where existing lines are being altered then easements will be required, with widths as per the EE Code of Practice document CEOP8046 Easement Requirements.
 - Easement widths will need to cater for all anchor guy requirements.
 - If any SS site is to be gifted to EE, it is to become Freehold Title in favour of EE including a "right of access", in favour of EE.
 - This access is to be maintained by the Connection Applicant as per the applicable memorandum:
 - CEOF9097A Terms of Easement for Overhead Powerlines.
 - CEOF9097B Terms of Easement for Underground Powerlines.
 - CEOF9097C Terms of Easement for Multi-Purpose Electrical Installation.

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 7 of 21 **COMMERCIAL-IN-CONFIDENCE**

2.3.3 Special Protection Scheme (SPS)

In order to maintain a safe and reliable power supply for all of EE's customers and help protect the existing network assets from overload or unplanned outages, a SPS may need to be implemented as part of the new network connection. A SPS works in real time with the assistance of high-speed communications over multiple sites to monitor the network loads and react by adjusting generation input to within a safe operating level.

A SPS system is implemented separate from any existing or proposed SCADA and Protection systems.

Based on the requirements for the new connection and the existing network conditions the SPS required to protect the network may vary from one of or a combination of the following, a complex multi-site system, a more simplistic Transformer Overload Scheme (TOLS) or Line Overload Scheme (LOLS).

The following conditions all contribute to and may initiate the requirement for a SPS to be implemented:

- Connection type, generator size and operating protocol.
- Feeder voltage and conductor type/size.
- Existing generator connections within the wider network area.
- Existing ZS equipment and capacity.
- TransGrid feeder and equipment capacity.

Typical costs for the implementation of a SPS (EE works only) are illustrated in Table 7.3.1, 7.3.2 and 7.3.3 below:

Connection	Non-Contestable Works	Potential Additional	Estimated Non-
Voltage		Contestable Works	Contestable Cost
All	 ZS design, materials, construction & commissioning. Supply materials, install & commission EE specified TOLS equipment at Solar Farm site. 	 Additional or upgraded communications bearers. Solar Farm TOLS cabinet. 	\$200k - \$600k

Table 7.3.1 Typical TOLS Costs

Table 7.3.2 Typical LOLS Costs

Connection Voltage	Non-Contestable Works		Potential Additional Contestable Works	Estimated Non- Contestable Cost
All	 ZS design, materials, construction & commissioning. Supply materials, install & commission EE specified LOLS equipment at Solar Farm site. 	•	Independent high- speed communications bearers (OPGW, ADSS, microwave). Solar Farm LOLS cabinet.	\$250k - \$1Million

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 8 of 21 **COMMERCIAL-IN-CONFIDENCE**

Connection	Non-Contestable Works	Potential Additional	Estimated Non-
Voltage		Contestable Works	Contestable Cost
All	 ZS design, materials, construction & commissioning for all effected EE ZS's. Supply materials, install & commission EE specified SPS equipment at Solar Farm site. 	 Independent high- speed communications bearers (OPGW, ADSS, microwave) between all affected sites. Solar Farm SPS cabinet. 	\$500k – \$2.5Million

Table 7.3.3 Typical SPS Costs

Notes:

- Costs and typical requirements described in the tables above are indicative only. Detailed analysis during the connection process may result in substantial impacts / costs outside of the ranges indicated.
- Overall cost of the SPS is closely related to the Solar Farm location, size, wide area impact to EE's network and beyond.
- Reduction to the maximum output of the network connection may result in a less complicated SPS or a SPS no longer being a requirement.

2.4 Design References

Refer to CEOP2015 for a list of design reference documents relating to HV assets which are to be owned by EE on completion and HV assets which are to be owned and operated by others. Design and construction shall be to Australian Standards, as a minimum and EE standard for all gifted assets. Supply and construction of any proposed embedded generation substation and embedded generation SS, all-inclusive, will be fully funded by the Connection Applicant. EE HV connection documentation is available <u>here.</u>

2.4.1 General

All electricity works shall be designed to be safe for the electrical conditions likely to be experienced during service and the physical environment in which they will operate. Electrical distribution and transmission design are specialist engineering field and it is the responsibility of the Connection Applicant to confirm that the ASP3 and ASP1, contracted to carry out works, are suitably qualified and experienced.

Any assets that are gifted to EE must, at minimum, comply to all relevant EE procedures, guidelines, manuals and standards:

- All designs are to be carried out by an ASP3 accredited in transmission line and substation design.
- All designs to comply with relevant EE standards, templates and requirements.
- In absence of applicable EE standards, the minimum requirements will be as per the following:
 - AS/NZS 3000 Australian and New Zealand Wiring Rules.
 - NSW Service and Installation Rules 2018.
 - National Electricity Rules.
 - AS 3007 Electrical Installations.
 - Electricity Supply Act 1995.
 - AS/NZS 7000 Overhead Line Design.
 - AS 2067 Substations and High Voltage installations exceeding 1kV AC.
- All electricity works shall be designed to be safe for the electrical conditions likely to be experienced during service and the physical environment in which they will operate.

2.4.2 Substation Design

- All Substation and SS design shall comply with the following standards:
 - CEOP8032 Transmission and Zone Substations: Design Guidelines.
 - CEOM7052 Zone Substation Design Services: Drawing Guidelines.
 - CEOM5113.01 High Voltage AC Transmission, Sub-transmission and Zone Substation earthing.
 - AS 2067: Power installations exceeding 1kV AC.
- EE's CAD workspace guidelines and drawing templates are available upon request.
- To confirm the solar SS design, the following "concept" details are to be provided: -
- Single Line diagram.
 - General Arrangement plan view.
 - Site plan.
 - Protection Single Line Diagram.
 - Phasing diagram if available.
 - SCADA schedule preliminary.
 - Building floor plans.
 - Earthing design.
 - SiD report.
- EE's approval of this "concept" design package is required before final designs can commence.

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 10 of 21 **COMMERCIAL-IN-CONFIDENCE**

- All equipment and materials used for construction in the solar SS are required to be approved by the relevant EE manager.
- The intention is the No1 auxiliary 415VAC supply for the solar SS (EE asset) shall be supplied from the essential services board within the embedded generation substation with the back-up AC supply from the EE distribution network.
- A separate application to EE will be required for the connection to the distribution network.

2.4.3 Mains Design

- Design criteria and conditions as set by this document, and the following EE standards, which are to be incorporated into the design submitted for approval as per the following:
 - CEOM7081 Sub-transmission Overhead Design Manual.
 - CEOM7082 Sub-transmission Construction Manual.
 - CEOM7080 Sub-transmission Lines Drawings Standards.
 - CEOP8042 Asset Identification and Operational Labels.
 - CEOM7097 Overhead Design Manual.
 - CEOM7098 Distribution Underground Design and Construction Manual.
 - CEOM7001 Asset Management and Engineering: Network Mains Design Construction Drawing Requirements.
 - CEOM7199 Underground Construction Manual.
- After determination of the line route and before design approval can be given the ASP3 designer is to submit a conceptual design to EE for comment and approval. Once the conceptual detail has been approved by EE, a final design may be completed and submitted to EE for approval.
- The design is to be undertaken using PLS-Cad or PowerLines Pro design software.
- In absence of relevant EE standards, the minimum design requirements will be as per Australian Standard AS/NZS 7000:2010 "Overhead Line Design Detailed procedures.
- The conceptual design is to include: -
 - Route plans.
 - Line schedule.
 - Line profile.
 - PLS-Cad "bak" file or PowerLines Pro "power" file.
 - Design criteria report.

2.4.4 Protection, SCADA and Telecommunication

- All protection, control and communication designs shall comply with the following standards:
 - CEOP8002 Protection Guidelines.
 - CEOP8032 Control and Protection Panels.
 - CEOS7902 Design Guidelines for SCADA and DSA.
 - CEOP8082 Design Guidelines for Load Control.
 - CEOP8012 Generation Connection: Protection Guidelines.
 - CEOM7621.01 Technology Guideline (Telecommunications and Infrastructure).
 - CEOM7210 Operational Manual Radio Sites: Construction.
 - IEC 61000 Electromagnetic Compatibility.
 - AS/NZS 3000 Wiring Rules.
 - Telecommunications Cabling Provider Rules 2014.
 - AS/CA S009:2013 Installation Requirements for Customer Cabling (Wiring Rules).
 - NER Chapter 5 (Network Connection, Planning and Expansion), particularly control characteristics (clause S5.25), communication facilities (clause S5.2.6) and interlocking and synchronising arrangement.

2.4.5 Metering

- All metering designs shall comply with the following standards:
 - CEOP8032 Control and Protection Panels.
 - Embedded Generation Connection Agreement.
 - CEOP8079 HV Metering.
 - IEC 60255 Electrical Relays.
 - IEC 61000 Electromagnetic Compatibility.
 - AS/NZS 3000 Wiring Rules.
 - National Electricity Rules.
- Metering must comply with, the requirements set by AEMO, NER "Chapter 7– Metering" and NEM "Metrology Procedure".
- Revenue metering will be undertaken at the connection voltage and be located as close as practicably possible to the connection point.
- Power Quality metering will be undertaken at the connection voltage and be located within the embedded generation SS control room.

2.4.6 Network Earthing

- An earthing analysis and design are to be undertaken for the substation and SS site and connection to the EE network. A report is to be submitted to EE for review and approval.
- The link to the existing OPGW on the feeder shall be non-conductive.
- The earthing system is to be constructed in accordance with EE standards and tested as part of the commissioning process.
- The following EE standard is to be incorporated into the design detail: -
 - CEOM5113.01 High Voltage AC Transmission, Sub-transmission and Zone Substation earthing.
 - CERM2456 External Network Connection Earth System Design & Test Requirements.

2.5 Contestability of Services

Refer to document: - CEOP2015 – General Terms and Conditions for Contestable Work

2.6 Contestable Works Design Certification

Refer to document: - CEOP2015 – General Terms and Conditions for Contestable Work

Please Note:

- All compliant submissions to Contestable Works will be subject to a 28-day turnaround period.
- Any resubmissions due to non-compliance or omissions shall result in a new 28-day turnaround period.

2.7 Risks

All projects have inherent risks, any potential risks should be identified and mitigated if possible, early in the project timeline. Consider the following questions for each identified project risk:

- What is the risk?
- What is the mitigation? (i.e. measures implemented or contingency allowed).
- What is the justification? (i.e. if a risk is mitigated through an action determined by EE or, it has been deemed 'acceptable', this then provides the reasoning for the decision).

A list of typical risks in example categories are listed below:

2.7.1 Construction

• Asbestos present in building.

2.7.2 Environment

• Asbestos present in building.

2.7.3 Equipment

• Unknown lead time/cost of non-standard major plant.

2.7.4 Legal

• Development dependent upon council approvals.

2.7.5 Network

• No back-up supplies available during installation or maintenance of a transformer.

2.7.6 Safety

• Site entry is off the main highway which is single lane and has no shoulder.

2.8 Typical Connection Arrangements

2.8.1 Option 1: Additional Feeder Bay in Zone Substation

OPTION	VOLTAGES	TELECOMMUNICATION	ESTIMATED COST RANGE (based on previous projects)	NON CONTESTABLE COST RANGE INCLUDES	POTENTIAL ADDIT
1 - Additional Feeder Bay Outdoor ZS	66-132kV	Duplicate paths available	\$2 Million - \$3 Million	All design inside ZS, CB & Fdr bay equipment, Prot/Control Panels, SCADA modifications.	RTU upgrade, telecommunications, extra busbar additions, TX u

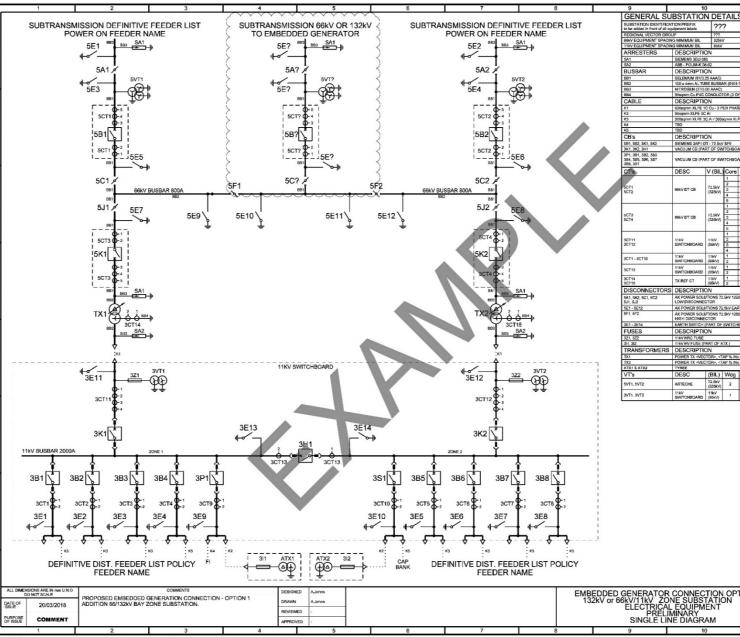


Figure 10.1.1: Example SLD of an Additional Feeder Bay Connection

Division Manual: Embedded Generator Major Network Connection Costing Guideline CEOM7817

DITIONAL CONTESTABLE WORKS COSTS

tra land acquisition, bench extension, additional road access, TX upgrade or Solar Farm substation works.

Set V (BL) 1 (%c) 2-HR RATING Set 1%v BBA (3 5%) S6A PIS 0.6 1%v BBA (3 5%) S6A PIS 0.6 1%v BBA (3 5%) S6A PIS 0.6 1%v FINA S6A PIS 0.6 1%v FINA FINA S6A PIS 0.6 1%v FINA FINA FINA S6A PIS 0.6 1%v FINA	_								_
THREE PHASE PHASE TO CONTRACT # BVV BUSAR TYP TYP TIVE BUSAR TYP TYP TVV BUSAR TYP TYP TVV BUSAR TYP TYP BVV BUSAR TYP TYP TVV BUSAR TYP TYP BVV BUSAR TYP TVP TVV BUSAR TYP TVP TVV BUSAR TYP TVP TVV BUSAR TYP TVP TVV BUSAR TVP TVP TVV BUSAR Stock Exbo TOP TVV BUSAR Stock Exbo TOP	Ť				0 //				1
TIVE BUSBAR T7 T7 W (BL) 1 (Bc) CONTRACT # Web/L - 30000 Web/L - 30000	.0	PROJECTEL		OLILEVEL					
V (BL) I (Bc) CONTRACT # 2000 CONTRACT # 2001 CONTRACT # 2001 CONTRACT # 2002 Status 2003 Contract # 2004 I (Bc) 2005 I (Bc) 2006 I (Bc) 2007 I (Bc) 2008 I (Bc) 2009 I (Bc) 2000 I (Bc) 2001 I (Bc) 2002 I (Bc) 2003 I (Bc) 2004 I (Bc) 2005 I (Bc) 20		65kV BUSBAR	_		221	1	272	0 Datin	
BeV	_	11kV BUSBAR			771	2	777		
BeV									
THO - 36208 V (BL) 10(8c) - - 277 V (BL) 1000 - - 277 V (BL) 10(8c) - - 277 V (BL) 10(8c) - - 277 V (BL) 10(8c) - - 38 TW BBA (204) 368 - 1820 BBA (204) 180 BBA (204) 180 1820 BBA (204) 180 BBA (204) 180 1800 BBA (204) BBA (204) BBA (204) 180 1800 CLASS Station INC BBA (201) BBA (204) 1800					1(sc)		RACT #	^
V (BL) I (Isc.) CONTRACT # 2000 2000 - 2000 - 271 Y (BL) I (Isc.) 244R RATING 2000 - 280 Y (BL) I (Isc.) 244R RATING 244R RATING 244R RATING 281 Y (BL) I (Isc.) 244R RATING 244R RATING 244R RATING 282 Y (BL) I (Isc.) CONTRACT # 244R RATING 245R (1350) 245R (1360) 2	_							-	
Integ 1906 Image: Constraint of the second	_				10	sc)	CONT	RACT #	1
Print BUDA - V (BL) 1 (%c) 21-RR RATINO BE 1 V0 BENA (200) 21-RR RATINO BE 1 V0 FILE (200) 21-RR RATINO PR 35 0.0 1 V0 FILE (200) 1 V0 PR 35 0.0 1 V0 FILE (200) 1 V0 PR 35 0.0 1 V0 FILE (200) 1 V0 PR 36 0.0 1 V0 SEA (200) 1 V0 PR 36 0.0 1 V0 SEA (200) 1 D0 PR 36 0.0 0 PR 5000 2 2 2 2 0 0 1 1 V0 SEA (200) PR 37 0.0 0 PR 5000 2 2 2 0 0 1 1 V0 SEA (200) 1 V0 SEA (200) 0 PR 5000 2 2 2 0 0 1 1 V0 SEA (200) 1 V0 SEA (200) 0 PR 5000 2 2 2 0 0 1 1 V0 SEA (200) 1 V0 SEA (200) 0 PR 5000 2 2 0 0 0 1 1 V0 SEA (200) 1 V0 SEA (200) 0 PR 5000 2 2 0 0 0 1 1 V0 SEA (200) 1 V0 SEA (200) 0 SEA (200) 1 V0 SEA (200)				· \/	100	0A	-		
PT L - SI Twy U(BL) 1 (Bo) 204 RATING SI Twy BIBA (13 NO) 205 A PIS 05 D Twy BIBA (13 NO) 205 A PIS 05 D Twy BIBA (13 NO) 205 A PIS 05 D Twy BIBA (13 NO) 205 A PIS 05 D Twy BIBA (13 NO) 205 A V (BL) 1 (Bo) CONTRACT # 205 A PIS 05 D TWY (BW) 2050 (25M) TB0 ME0) TWY (BW) 2050 (25M) TB0 100 (25M) ME0) TWY (BW) 2050 (25M) TB0 100 (25M) ME0) TWY (BW) 2050 (25M) TB0 100 (25M) ME00 CLASS FUNC 100 (25M) 100 (25M) 10000002020101 0.1 (250002 (25g)(00) 100 (25M) 100 (25M) 10000002020101 0.1 (25M) (25g)(00) 100 (25M) 100 (25M) 1000000020101 0.1 (25M) (25g)(00) 100 (25M) (25M) 100 (25M)	1-T6	1	+						
SE THV IMPA (1000) Contract (1000) PE 50 Cu THV IMPA (1000) CARA PE 20 CU THV (1000) CARA (2000) CARA PE 20 CU THV (1000) R000, 2000 (2000) THV PARDID CLASS FUNC PUNC 100000002021/201 0.11950002 200001 IMPE (1000) R000 THV 100000002021/201 0.11950002 200001 IMPE (1000) R000 PHOT THV 100000002021/201 0.11950002 200001 IMPE (1000) R000 PHOT THV 1000000002021/201 0.11950002 200001 IMPE (1000) R000 PHOT THV 1000000002021/201 0.11950002 200001 IMPE (1000) R000 10000000001/01 0.1950002 200001 IMPE (1000) R000 10000000001/01 0.1950002 200001 IMPE (1000)	OFF)				-				
THO THAC THAL					(sc)	2HR R	ATING	1
PERSOL Tax/ PERSOL CONTRACT # PERSOL CONTRACT # PERSOL	\SE		-1	1kV	355	A (13.1KA)	- 2054		
TWO -	LPE	3C Cu		1kV	475	A (13.1KA)			
V (BL) I (Isc.) CONTRACT # AR0) TAL (ISA) 2000.25AA TBO AR0) TW (ISA) 2000.25AA TBO AR0) TW (ISA) 2000.25AA TBO AR0) TW (ISA) 800.426AU TBO AR0) CLASS FUNC 1000000201100 0.1950002.26g0001 I.N.E.DIST PROT Net 10000000201100 0.1950002.26g0001 I.N.E.DIST PROT Net 10000000201100 0.1950002.26g0001 I.N.E.DIST PROT Net 10000000201100 0.1950002.26g0001 I.N.E.DIST PROT Net 10000000201101 0.1950002.26g0001 I.N.E.DIST PROT Net 10000000201101 0.1950002.26g0001 I.N.E.DIST PROT Net 1000000001101 0.1950002.26g0001 I.N.E.DIP PROT Net 100000000110 0.09570001.30_200001 I.N.E.DIP PROT Net 100000000110 0.09570001.30_200001 I.N.E.DIP PROT Net 100001000011 0.09570001.30_20001 I.N.E.DIP PROT Net 100001000011 0.09570001.30_20001 I.N.E.DIP PROT Net 1000010001 0.0	_		1	1kV					в
TEAM (BAN) TEAM (BAN) <thteam (ban)<="" th=""> TEAM (BAN) TEAM (BA</thteam>	_				10	sc)	CONT	RACT#	1
NRED T1N (1980) 800A (25%) T2D IPATIO CLASS FUNC 0000000011201 0.11950012 26(000) I.N.E. DIF HOT HELE 10000000011201 0.11950012 26(000) I.N.E. DIF HOT HELE 10000000011201 0.11950012 26(000) HOC HERE NO. 1000000001110 0.11950012 26(000) HOC HERE NO. 1000000001110 0.11950012 26(000) HOC HERE NO. 1000000001110 0.11950012 26(000) HOC HERE NO. 100000000111 0.11950012 26(000) HOC HERE NO. 100000000111 0.11950012 26(000) HOC HERE NO. 100000000111 0.11950012 26(000) HOC HERE NO. 10000000011 0.11950012 26(000) HOC HERE NO. 10000000011 0.11950012 26(000) HOC HERE NO. 10000000011 0.11950011 1000000000000000000000000000000			1	2.5kV (325kV)	125	OA (40kA)	061/2011		
RATIO CLASS FUNC 100500260/2010 0.1%00002 26(00.1) I.NE DIST MOT Net 100500260/2010 0.4%00002 26(00.1) Net PROT Net 100500260/2010 0.4%400001 32(00.1) Net PROT Net 100500260/2010 0.4%400001 32(00.1) Net PROT Net 20001 0.5%40000000 0.5%400000000000000000000000000000000000	DAR	9	1	1kV (95kV)	200	0A (25kA)	TBD		1
1000500201201 0.0150002201201 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.01570002200000 0.015700022000000 0.015700022000000 0.0157000220000000000000000000000000000000	MR	71	- It	1KV (95KV)	800	A (25kA)	TBD		
1000500201201 0.0150002201201 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.0150002201001 0.01570002200000 0.015700022000000 0.015700022000000 0.0157000220000000000000000000000000000000		1710	_	01.400			F11110	_	Н
100000201/201 0.010000226(00) Mol. Bell Prior Tes. 000000201/201 0.0190000226(00) 1000000201000 000000201/201 0.0190000226(00) 1000000001000 000000201/201 0.0190000226(00) 1000000001000 000000201/201 0.0190000226(00) 100000000000000000 0000000010000 0.009000000000000000000000000000000000		ATTU 00500/250/125/1	_		ms(r)	1-1		PROT Not	
100000201/201 0.010000226(00) Mol. Bell Prior Tes. 000000201/201 0.0190000226(00) 1000000201000 000000201/201 0.0190000226(00) 1000000001000 000000201/201 0.0190000226(00) 1000000001000 000000201/201 0.0190000226(00) 100000000000000000 0000000010000 0.009000000000000000000000000000000000	10	00/500/250/125/1		0.1PX500R2.25	950	1:1	LINE DIST F	ROT No2	
1000000001001 0.11000002.08/001 EAV BEP PROT Tec: 1000000001 1.5000 20000 1.5000 20000 200010000101 0.0107400 20000 1.5000 20000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.00174000 81000 1.5000 1.5000 200010 0.001740001 820000 1.50000 1.50000 200011 0.001740001 820000 1.500000 1.500000 200011 0.001740001 820000 1.5000000 1.5000000 200011 0.001740001 820000 1.50000000 1.50000000 20001100000000000000000000000000000000	12	00/500/300/150/1	_	0.2 10VA@1200	11	11	METERING		
1000000001001 0.11000002.08/001 EAV BEP PROT Tec: 1000000001 1.5000 20000 1.5000 20000 200010000101 0.0107400 20000 1.5000 20000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.00174000 81000 1.5000 1.5000 200010 0.001740001 820000 1.50000 1.50000 200011 0.001740001 820000 1.500000 1.500000 200011 0.001740001 820000 1.5000000 1.5000000 200011 0.001740001 820000 1.50000000 1.50000000 20001100000000000000000000000000000000	10	00/500/250/125/1		0.1PX500R2.25	8 501	0:1	66kV BBP P	ROT No1	
1000000001001 0.11000002.08/001 EAV BEP PROT Tec: 1000000001 1.5000 20000 1.5000 20000 200010000101 0.0107400 20000 1.5000 20000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.00174000 81000 1.5000 1.5000 200010 0.001740001 820000 1.50000 1.50000 200011 0.001740001 820000 1.500000 1.500000 200011 0.001740001 820000 1.5000000 1.5000000 200011 0.001740001 820000 1.50000000 1.50000000 20001100000000000000000000000000000000	10	100/500/250/125/1		0.1PX500R2.25	Q500	2:1	TX DIFF PR	OT No1	6
1000000001001 0.11000002.08/001 EAV BEP PROT Tec: 1000000001 1.5000 20000 1.5000 20000 200010000101 0.0107400 20000 1.5000 20000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.0017400 81000 1.5000 1.5000 200010000101 0.00174000 81000 1.5000 1.5000 200010 0.001740001 820000 1.50000 1.50000 200011 0.001740001 820000 1.500000 1.500000 200011 0.001740001 820000 1.5000000 1.5000000 200011 0.001740001 820000 1.50000000 1.50000000 20001100000000000000000000000000000000	12	100/500/300/150/1		0.2 10VA@1200	11		METERING		
20001 0.099400013.0 (2000) 111/04 BDF APOT 20001000000001 0.099400013.0 (2000) 111/04 BDF APOT 2000100000010 0.099400013.0 (2000) 111/04 BDF APOT 2000100000010 0.099400013.0 (2000) 111/04 BDF APOT 20001 0.0994400013.0 (2000) 110/04 BDF APOT 20001 0.09944000113.0 (2000) 110/04 BDF APOT 20001 110/04 DDF APOT 110/04 BDF APOT 20001 110/04 DDF APOT 110/04 DDF APOT 20001 110/04 DDF APOT 110/04 DDF APOT 20001000000000000000000000000000000000	10			0.1PX500R2.25	2500	2.1	66kV BBP P	ROT No2	
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	10	100/500/250/125/1 100/1	-	0.1PX500R2.25 0.05PX600R13	Contraction (Contraction) Contraction (Co	00:1	66kV BBP P 11kV BBP P	ROT No1 ROT	
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	20	00/1000/500/1	_	1.0 10VA @ 200	0:1		METERING		
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	20	00/1000/500/1	-	0.025PX575R6. 0.025PX575R6.	581	1000:1	TX DIFF PR	OT No2 OT No1	
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	80	8/400/1	_	5VA 10P20@40	0.1		11kV FDR P	RÓT	
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	20	100/1	-	0.05PX600R136 0.05PX600R136	2200 2200	0:1	11kV BBP P 11kV BBP P	ROT	
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	20	100/1		0.05PX600R138	\$200	0:1			1
994 72.84/(28/4) 1150-(31.84) 000/07/12.24 RTH SWITCH 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 31.94 000/07/12.24 954 72.84/(28/4) 1100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 72.84/(28/4) 100-(31.84) 080/07/12.24 954 116/(18/6) 54 100 116/(18/16/16/16/18/10/10/10/10/10/10/10/10/10/10/10/10/10/	20	00/1000/500/1	_	0.025PX575R6.	5@10 5@10	100.1	No1 TX REP No2 TX REP	PROT	D
594 72.54V (223A) 135A 0652912.23 CTI I SWITCH 72.64V (226A) 31.56A 0652912.23 59A 72.64V (226A) 31.56A 0652912.23 59A 72.64V (226A) 131.66A 0652912.23 59A 72.64V (226A) 1316A 0652912.23 59A 126A (2126A) 180 180 50A 180 180 180 50A 110V (360A) 5A 180 50A 110V (360A) 5A 180 50A 110V (360A) 5A 180 50AV(312) 50395MA 180 180 50AV(312) 50395MA 180 180 6.0040120-, 50395MA 180 180 6.0040120-, 50395MA 180 180 780 1100/10 1203010 1303010 1140/10 20340P (5044) 180.7 1901 1303010 1140/10 20340P (5044) 180.7 1901 1303010 1140/13 1466	a	00/1002000/1	T I	(BIL)	10	sc)	CONT	RACT #	
RTI SMITCH 72.8v (228/v) 91.8A 0505072.2 99A 72.8v (228/v) 1300.4) 0605072.2 90AD 72.8v (228/v) 1300.4) 0605072.2 90AD V (9LL) 1 (90.5) 0607072.2 90AD V (9LL) 90.90071 100 90AD V (9LL) 90.90071 102.0017 90AD 90AD 90.90071 102.017 90AD 90AD NO 1 (90071 102.017 110.0V/2 100.072 100.072 100.071 91.90071 100.072 100.072 100.072	50A	_							1
BOARD Case (current) Case (current) Code (current) TRO V (BL) 1 (Bc) CONTRACT # Introv (BEO) BO (BEO) BO (BEO) BO (BEO) Introv (Current) BO (BEO) BO (BEO) BEO (BEO) Introv (Current) BO (BEO) BO (BEO) BO (BEO) Introv (Current) BO (BEO) BO (BEO) BO (BEO) Introv (State) Current) BO (BEO) BO (BEO) Introv (State) Introv (State) BO (BEO) BO (BEO) BO (BEO) Introv (State) BEAN (State)<	DT.	ENTELL				,			
BOARD Case (current) Case (current) Code (current) TRO V (BL) 1 (Bc) CONTRACT # Introv (BEO) BO (BEO) BO (BEO) BO (BEO) Introv (Current) BO (BEO) BO (BEO) BEO (BEO) Introv (Current) BO (BEO) BO (BEO) BO (BEO) Introv (Current) BO (BEO) BO (BEO) BO (BEO) Introv (State) Current) BO (BEO) BO (BEO) Introv (State) Introv (State) BO (BEO) BO (BEO) BO (BEO) Introv (State) BEAN (State)<	50A	Sveron							1
V (BL) 1 (16c) CONTRACT # 1140 (360) 64 180 1140 (360) 64 64 1140 (360) 64 64 1140 (360) 64 64 1140 (360) 64 64 1140 (360) 64 64 1140 (360) 110 64 1140 (360) 110 100 1140 (360) 110 100 1140 (360) 110 100 1140 (360) 110 100 1150 (360) 110 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100 1150 (30) 1100 1100			_					24	Н
TINO (1960) PA TID TINO (1960) PA TID TID VI (BL) PONMER (2010) CONTRACT # CONTRACT # RATIO CLASS FUNC CONTRACT # RATIO CLASS FUNC CONTRACT # RW:0:3 119/04, COORD defitiv 2016/04, TID CONTRACT # RW:0:3 119/04, COORD defitiv 2016/04, TID TID RW:0:3 119/04, COORD defitiv 100 2 FIOL 100/100 TID TINON SITURY CASS FUNC CONTRACT # TINON SITURY UNEXPECTIVE TID FUNC TINON SITURY 1MSP (60/4) NO 1 PROT TID F TINON SITURY UNEXPECTIVE ESSENTIAL F UNEXPECTIVE ESSENTIAL F F	nbu	(AD)					CONT	RACT#	1
THAT BA EX.# 2010 0.00MTAP,-COOLNAL definitiv 20060A TEO RATIO CLASS SECOND 0.00MTAP,-COOLNAL definitiv 20060A TEO RATIO CLASS NO IPROT 10000 CLASS NO IPROT 110000 CLASS NO IPROT 110000 CLASS NO IPROT 1110000 TEO NO IPROT 11100000 MSP (SCNA) NO IPROT 11100000 MSP (SCNA) NO IPROT 11100000 Exercical Comp. Exercical Comp. 111000000 SUPERSCES ESSERTIAL 111000000 SEAVING NUMER SIT VISION			11	1KV (95KV)	БA	,	TBD		1
ENGUIRA-COOLING-BOTIW 2095MA TR0 E RATIO CLASS EVANC EEEEMAS RATIO CLASS EVANC EEEMAS TION NO1 EEEATIG EVANC EEEEMAS TION NO1 EEEATIG EEEATIG EEEATIG SUPERSCHART IMSP (SOUR) NO 1 PROT TR0	_		1	1kV	SA DC		EE #2100	10 DAOT #	
ENTION NO1 ENTION OF CONTRACT # FUNC CONTRACT # INO 27801 1202010 ENTION NO1 ENTITION NO1 <thenthere< th=""> ENTITION NO1 <th< td=""><td>ic N</td><td>ONTAP: «COOLIN</td><td></td><td></td><td>207</td><td>WYER MANA</td><td>TRD</td><td>RACI #</td><td>_</td></th<></thenthere<>	ic N	ONTAP: «COOLIN			207	WYER MANA	TRD	RACI #	_
RATIO CLASS FUNC CONTRACT # MKVPS:1100/16 02000 M0 PROT 1302010 1150/16 100 PROT 1302010 1 1150/16 100 PROT 150010 1 1150/16 100 PROT 150010 1 1150/16 100010 1 1 1150/16 100010 1 1 1150/16 100010 1 1 1150/16 100010 1 1 1150/16 100010 1 1 1150/17 100010 1 1 1 1150/17 100010 1 1 1 1150/17 100010 1 1 1 1150/17 100010 1 1 1 1 1150/17 100010 1 1 1 1 1150/17 100010 1 1 1 1 1 1150/17 100010 1 1 1<	ic.N	OMTAP>, <coolin< td=""><td>G> 6</td><td>6/11kV</td><td>207</td><td>30MVA</td><td></td><td></td><td>5</td></coolin<>	G> 6	6/11kV	207	30MVA			5
TION No1 <u>CBA29</u> (SOVA) <u>NO PPOT</u> <u>1122013 <u>1122013 <u>1122013 <u>1122013 </u> <u>I122013 <u>1122013 </u> <u>I122013 <u>1122013 </u> <u>I122013 </u> <u>I122013 </u> <u>I122013 </u> <u>I122013 I122013 I122013 <u>I122013 I122013 I12201 I1220 I12201 I12201 I1220 I12201 I12201 I12201 I12201 I12201 I1220 I12201 I1</u></u></u></u></u></u></u></u></u></u></u></u></u>	1 c				63k			BACT #	
			-		_	NO 1 PRO	T	RAUI #	1
	6	6kVA3:110VA3	0.2%	M2P (50VA)		ND 2 PRO	132/2010		
	1	1kV/\3:110V/\3	1868	SP (SCVA)		NO 1 PRO	T TBD		Н
									F
SUPERSEDES. DRAWING NUMBER SHIT VER									G
2222300 74 A	ודי	ON No1		SUPERSEDES	NG N	UMBER	SHT	VER	н
			_	1 44		900	14	A	L

2.8.2 Option 2: New 3 Way Switching to Existing Sub-transmission line

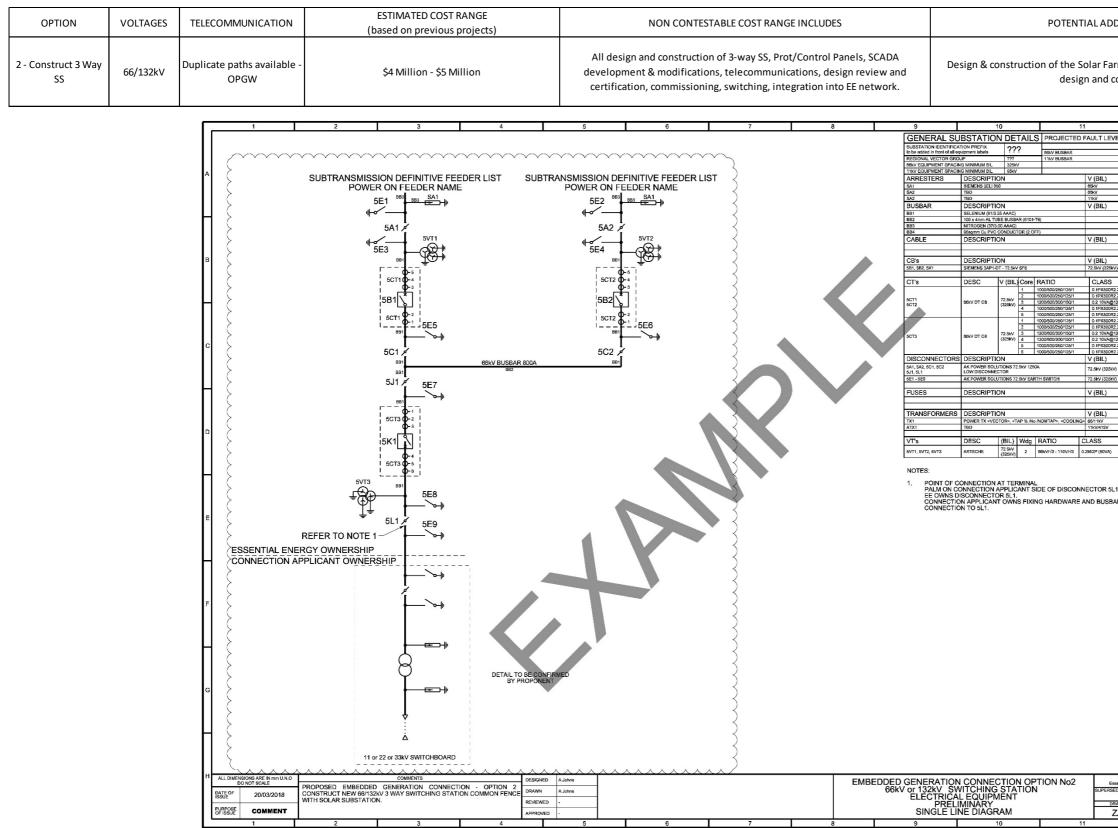


Figure 10.2.1: Example SLD of 3-Way SS Connection

Division Manual: Embedded Generator Major Network Connection Costing Guideline CEOM7817

POTENTIAL ADDITIONAL CONTESTABLE WORKS COSTS

Design & construction of the Solar Farm Substation, fees and land acquisition, all network studies, design and construction of all auxiliary supplies.

		12	-
			r I
/EL		ATED <date>)</date>	
	THREE PHASE	PHASE TO EARTH	
-	777 777	222	
			A
	I (Isc)	CONTRACT #	$^{\circ}$
	-	35/2009	
_			
-	- (Isc)	CONTRACT #	
-	1000A	-	
	2000A		Н
	800A	-	
_	-		
	l (lsc)	2HR RATING	
-			
	I (Isc)	CONTRACT #	в
V)	1250A (40kA)	061/2011A	
<i>.</i>			
		FUNC	
2.25	2500:1 2(500:1	LINE DIST PROT No1	
2.25	g 500:1	LINE DIST PROT No2	
1200	2:1 22:500:1	METERING 66kV BBP PROT No2	Н
2.25	8500:1 8500:1	66kV BBP PROT No1	
2.25	8500:1	TX DIFE PROT No1	
2.25	@500:1	TX DIFF PROT No2 REVENUE METERING	
1200	8500:1 8500:1 8500:1 1:1 8500:1 8500:1	POM & CHECK MET	
2.25	2500:1	66kV BBP PROT No1	с
2.25	2000.1	66kV BBP PROT No1	
	l (Isc)	CONTRACT #	
ŋ	1250A (31.5kA)	005/2012 2a	
	31.5kA	005/2012 25	
ð	e LUNA	30072012 20	
	l (Isc)	CONTRACT #	Н
	,,		
	POWER	CONTRACT #	
_	??MVA	TBD	
-	??kVA	TBD	D
_	FUNC	CONTRACT #	
	NO 1 PRO	-	
	NO 2 PRO	132/2010 DT	
	-		
1			
.1.			
AR			
			Е
			F
			F
			F
			F
			F
			F
			F
			F
			F
			F
			F
			F
**	2013		
sent	2013 Iail Energy		
© ssent	tial Energy	essential	
EDE	tial Energy S:	essential	
EDE	ial Energy S: ING NUMBER	essential serie vez	
EDE	ial Energy S: ING NUMBER	energy	

2.8.3 Option 3: Direct Connection to Zone Substation (<5MW)

OPTION	VOLTAGES	TELECOMMUNICATION	ESTIMATED COST RANG (based on previous proje		NON CON	TESTABLE COST RANGE INCLUE	ES		POTENTIAL ADDI
3 - Additional Indoor CB	11/22kV	Duplicate paths available	\$1.5 Million - \$2.5 Millio	on All de	-	truction & commissioning with , telecommunication and SCAI		RTU upgrade, telecon bu	nmunications, extr usbar additions, TX
		A POV		BB2	5F2 11 5E12 3E14	7 STRANSMISSION DEFINITIVE FEE POWER ON FEEDER NAME 5A2 # 5VT2 5A2 # 5VT2 5A2 # 5VT2 5A2 # 5VT2 5CT2 C+ 5CT2 C+	DER LIST	9ELERUM (91/3 26 AAAC) 100 4 mm, AL TUBE BUBBAR (901) 956mm C. PV COLUCION (20 COLUCIO	BeV BUSBAR 11kV BUSBAR 11kV BUSBAR V (BIL) 66v 86v V (BIL) 66v V (BIL) 5F7 V (BIL) 5F7 SE 11kV FB C Cu 11kV FF J V (BIL) FF J V (BIL) FF J V (BIL) FF J V (BIL) 72, SKV (25KV) 11kV (55KV) RAFD) 11005002051231 11005002051231 1005002051231 10050020501231 10050020501231 <
		ALL DIVENSIONS ARE IN IMP UNO DO NOT SCALE DATE OF 2003/2018		311 ATX1 3CT13	3S1 3CT10 3CT10 3E10 3E10 3E10 3E10 3E5 3CT10 3CT10 3CT10 3E5 3CT10 3CT1	15 6 2 3CT6 6 2 3CT7 6 2 3C 3E6 3E7 3E8 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		GENERALLY RE	

Figure 10.3.1: Example SLD of a Direct Connection to CB

Division Manual: Embedded Generator Major Network Connection Costing Guideline CEOM7817

DDITIONAL CONTESTABLE WORKS COSTS

extra land acquisition, bench extension, additional road access, , TX upgrade or Solar Farm substation works.

				_
EVEL	S (CALCUI	_	12 TED <date>)</date>	
	THREE PHASE		PHASE TO EARTH	
_	??? ???	_	??? ???	
		_		А
	l (Isc)		CONTRACT #	
_		_	35/2009 35/2009	
	I (Isc)		CONTRACT #	
	1000A 2000A	_		Ц
	AGDA			
	l (Isc)		2HR RATING	
_	865A (13.1KA) 185A (10KA)	_	- 205A	
	475A (13.1KA)		520A	в
	-	_	-	Р
	I (Isc)		CONTRACT # 061/2011A	
5KV) V)	1250A (40kA) 2000A (25kA)		051/2011A TBD	
0	800A (25kA)		TBD	
		L c		П
S 0R2.25(@500:1		UNC INE DIST PROT No1	
0R2.25 0R2.25 4@1200	@500:1	l N	INE DIST PROT No1 INE DIST PROT No2 IETERING	
0R2.25	@500:1	6	6kV BBP PROT No2 6kV BBP PROT No1	
0R2.25	@500:1 @500:1	6 T	5kV BBP PROT No1 X DIFF PROT No1	С
0R2.25	@500:1		X DIFF PROT No2	
@1200 0R2.25	@500:1	6	IETERING 6KV BBP PROT No2	
0R2.25	@500:1 @ 2000:1	8	5kV BBP PROT No1 1kV BBP PROT	
Q 200	0:1	N	IETERING	
575R6.5	5 @ 1000:1 5 @ 1000:1	Т	X DIFF PROT No2 X DIFF PROT No1	
20840	5 @ 1000:1 0:1 \$2000:1	1	1kV FDR PROT 1kV BBP PROT	
00R138	3200D:1	1	1kV BBP PROT	
00R138	32000:1 5@1000:1	1 N	1kV BBP PROT	
575R6.	5@1000;1	N	02 TX REF PROT	D
	I (Isc)	_	CONTRACT #	
5KV)	1250A (31.5kA)	1	005/2012 28	
5kV)	31.5kA	_	005/2012 2b	
5kV)	1250A (31.5kA)		005/2012 2a	Ц
	TBD I (Isc)		TBD CONTRACT #	
v)	6A TBD 8A EE #210010			
_	POWER	-	CONTRACT #	
	20/30MVA		TRD	_
_	20/30MVA 63kVA		TBD EE #251493	Е
	FUNC		CONTRACT #	
A)	NO 1 PRO NO 2 PRO	тс тс	132/2010	
,	NO 1 PRO	_	TBD	
				F
				G
)))				
)))))	13			_
sential SEDES	Energy : NG NUMBER	e	ssential energy sHT VER	н
sential SEDES	Energy		ssential energy sHT VER 4/4 A	н

2.8.4 Option 4: Ancillary Works in Zone Substation

OPTION	VOLTAGES	TELECOMMUNICATION	ESTIMATED COST RANGE (based on previous projects)	NON CONTESTABLE COST RANGE INCLUDES	POTENTIAL ADDIT
4 - Ancillary Works in ZS	66/132kV	Duplicate paths available - OPGW	\$200K - \$500K	Telecommunications, SCADA development, design review and certification, commissioning, switching, integration into EE network.	Design & construction of the 3-way SS, supplies, network

2.8.5 Option 5: HV "T" or Recloser Interface Connection

OPTION	VOLTAGES	TELECOMMUNICATION	ESTIMATED COST RANGE (based on previous projects)	NON CONTESTABLE COST RANGE INCLUDES	POTENTIAL ADDI
5 - HV "T"or Recloser Interface Connection	11/33kV	Duplicate paths available	\$200K - \$500K	Review study recommendations, design review of new gifted reclosers and metering TX, Protection coordination, implementation of protection setting changes, earthing design review, PQM installation (including telecommunications paths between PQM and reclosers), commissioning and final testing.	Facilitate network performace analysis, ancillary serv Line easements, land purchases, meterir

Refer to CEOM7114.01 Typical 11-33kV HV Customer Overhead Connection Arrangement and CEOM7114.02 Typical 11-33kV HV Customer Underground Connection Arrangement

DITIONAL CONTESTABLE WORKS COSTS

SS, Solar Farm Substation, subtransmission line, all auxiliary vork studies, fees and land acquisition.

DITIONAL CONTESTABLE WORKS COSTS

sis, design, construction and commissioning of Solar Farm and ervices, metering TX and reclosers. ering, safety in design documentation, test and commissioning documentation.

3.0 AUTHORITIES AND RESPONSIBILITIES

Summarise responsibilities allocated to employees (by job/position title) within the process specified under Actions.

Position / Title	Responsibility		
Manager / Network Design Development (NDD)	The approval of this guideline.		
Team Leader / NDD Major Connections	Updating of this document as required.		
All Major Stakeholders consulted in the major network connection process.	 Reviewing of this document. 		

4.0 **DEFINITIONS**

ADSS

All-Dielectric Self-Supporting (optical fibre cable).

AEMO

Australian Energy Market Operator.

ASP

Accredited Service Provider - A person accredited under a scheme approved by the NSW Department of Trade and Investment.

СВ

Circuit Breaker.

CBF

Circuit Breaker Failure.

Connection Applicant

For the purposes of this document shall mean the customer / generator / developer requesting the works to be conducted.

Contestable Works

Works for which a Connection Applicant may choose the provider of services.

СТ

Current Transformer.

DIP

Design Information Pack.

DNP3

Distributed Network Protocol is the communication protocol used by Essential Energy.

DSR

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 18 of 21 **COMMERCIAL-IN-CONFIDENCE**

Design Safety Report.

EE

Essential Energy.

EIA

Environmental Impact Assessment.

FI

Frequency Injection.

ICCP Inter-Control Centre Protocol.

IED Intelligent Electronic Device.

NATA National Association of Testing Authorities.

NER

National Electricity Rules.

NEM National Energy Market.

Non-Contestable works

Works which Essential Energy deem to be impractical or too great a risk, to allow external parties to undertake.

OPGW

Optical Ground Wire or optical fibre composite overhead ground wire.

POC

Point of Connection, the physical connection between Essential Energy's network and a private network.

POF

PowerOn Fusion, is the network management system used by Essential Energy.

PD

Project Definition.

PQM

Power Quality Meter.

PSA

Protection Settings Advice.

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 19 of 21 **COMMERCIAL-IN-CONFIDENCE**

PV

Photovoltaic.

RBSC

Runback Scheme Controller.

REF

Review of Environmental Factors.

RTU Remote Terminal Unit.

SCADA

Supervisory Control and Data Acquisition.

SiD Safety in Design.

SLD Single Line Diagram.

Switching Station.

VT

Voltage Transformer.

WAN

(Telecommunication) Wide Area Network.

ZS

Zone Substation.

5.0 REFERENCES

Internal

Branch Procedure – Connection Process Guideline – CEOP8079

Branch Procedure - Transmission and Zone Substations: Design Guidelines - CEOP8032

Division Manual - Sub-transmission Line Design Manual – CEOM7081

Branch Manual - Sub-transmission Construction Manual – CEOM7082

<u>Operational Manual - Overhead Construction Manual – CEOM7099</u>

Branch Manual - Asset Management and Engineering Network Mains Design - Construction Drawing Requirements - CEOM7001

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 20 of 21 **COMMERCIAL-IN-CONFIDENCE** Branch Manual - Zone Substation Design Services: Drawing Guidelines – CEOM7052

Branch Manual - Underground Construction Manual - CEOM7199

Division Procedure - General Terms and Conditions for Contestable Works - CEOP2015

Operational Standard - SCADA and DSA Systems - CEOS7902

Essential Energy's HV connection documentation is available here

External

Nil Entry

6.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Type of Record	Storage Location	Retention Period
Nil entry		

* The following retention periods are subject to change e.g. if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Management Team.

7.0 REVISIONS

Issue No.	Section	Details of changes in this revision	Change Risk Impact?
2	2.3.3	Addition of SPS requirements.	Low
	2.4.6	Addition of CERM2456.	
	2.8.2	Updated EE Non contestable scope for construction of 3-way SS.	
	Various	Update references to CEOS7902 – Design Guidelines for SCADA and DSA.	
	2.8.5	Updated reference to Standard O/H and U/G Connection Arrangements	

8 September 2021 – Issue 2 Approved By: Manager Design Development Next review: September 2024 Page 21 of 21 **COMMERCIAL-IN-CONFIDENCE**