DESIGN INFORMATION

TRANSMISSION HV CONNECTION WORKS

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1 PURPOSE

The purpose of this document is to identify generic requirements applicable to the design of Transmission assets which are proposed to be connected to & or associated with Essential Energy's network infrastructure.

Such assets include Substation/Switchyard Primary & Secondaries, Overhead & Underground power line systems.

The contents of this generic design information document (GDI) have been compiled on the basis of certain conditions and restrictions. The designer shall incorporate these requirements within the electrical design prepared for presentation to Essential Energy.

This generic design information document (GDI), in conjunction with the documents listed below, provides the process necessary for design of transmission systems in relation to new HV Connection projects.

- High Voltage Connection Requirements CEOP8079. Available on EE website : www.essentialenergy.com.au
- Transmission & Zone Substations: Design Guidelines – CEOP8032.
- Subtransmission Line design manual CEOM7081.

To proceed with and confirm a connection to the Essential Energy transmission network a Connection Investigation Services Agreement (CISA) is to be established and project specific Design Information (DI) is to be applied for.

2 KEY TERMS & DEFINITIONS

AEMO means Australian Energy Market Operator

ASP means an accredited service provider, being a person or body accredited under part 10 of the Electricity Supply (General) regulation 2001, (NSW).
Accreditation of service providers is administered by the department of Industry & Investment.
A list of ASP's is available on the Industry & Investment website.

ASP3 means a Level 3 service provider accredited to carry out design works.

ASP1 means a Level 1 service provider accredited to carry out construction works.

DI means design information.

EE means Essential Energy.

NER means national electricity rules

The Proponent for the purposes of this document shall mean the applicant/customer/developer requesting the works to be conducted.

3 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.

Transmission design is a specialist engineering field and it is the responsibility of the Proponent to ensure that the ASP3 & ASP1, contracted to carry out works, are suitably qualified and experienced.

3.1 CONNECTION POINT

A critical step within the connection process is the establishment of a connection point.

The connection point is the point of connection of the Proponent's facility to the EE network.

The Connection Point to Essential Energy's Network will be determined by EE & defined in the Connection Agreement.

The determination of the connection point will depend on the agreed connection arrangement after an analysis of the impact upon existing EE assets due to the connection assets to be provided by the proponent and generally are either;

(i) at the landing span/termination structure of a proponent owned connection circuit to an EE owned substation

(ii) the landing span/termination structure of an EE owned connection circuit to a proponent owned substation

(iii) at the take-off point of a proponent owned connection circuit to an EE owned circuit

Connection substation assets which form part of the EE network will be owned by EE.

3.2 PROTECTION, COMMUNICATIONS & SCADA

A conceptual protection report including modelling of the Project facilities fault level contribution needs to be carried out in order to confirm the connection arrangement & the impact upon EE's transmission network.

A conceptual report for SCADA and communications will also be required for Essential Energy for review and comment.

The reports must describe how compliance with the NER will be achieved for SCADA, protection and communication aspects of the Project.

The final and approved reports will be included in the Connection Agreement once acceptable as attachments.

Any preliminary comments and approvals provided by EE shall be addressed in the final report.

3.3 HV METERING

Metering must comply with, and meet the requirements set by AEMO, National Electricity Rules (NER) “Chapter 7– metering” and NEM “Metrology Procedure”.

Metering will be undertaken at the connection voltage and be located as close as practically and effectively possible to the Connection Point.

3.4 ENVIRONMENTAL

It is a requirement that all proposed work must have an appropriate environmental impact assessment carried out in accordance with the Environmental Planning and Assessment Act 1979 (EPA Act) and in accordance with EE Procedural Guideline CECM1000.70 SSHE Manual: Environmental Impact Assessment NSW & EE REF guidelines.

EE, as the determining authority, must ensure that the requirements of the Environmental Planning and Assessment Act 1979 (EPA Act) are satisfied.

The proponent’s ASP3 designer or suitably qualified environmental consultant is to provide EE with an environmental impact assessment (EIA). The EIA must be approved & determined by EE, before design certification is given & approval to commence construction.

It is the responsibility of designer’s to consult the EE policy CECM1000 and its attachments before they commence a project to ensure they are aware of the required environmental procedures.

3.4.1 Vegetation Management (VMP)

A VMP is to be documented & submitted to EE detailing the vegetation clearing requirements for all new substation/switchyard sites and power line routes.

The VGM is to be submitted to & approved by EE prior to design certification.

All clearing for new works is to comply with the following EE’s documents –
CEOP8008 “Vegetation Management Plan”
CEOP2010 “Vegetation Clearing Guidelines for New Power Lines”.
CEOP2021 “Vegetation: Removing Vegetation Near Overhead Power Lines”.

All vegetation management works shall be the responsibility of the proponent. This work must not commence until the consent of all affected landowners & Government bodies has been obtained & the EIA has been determined.

3.4.2 Construction Environmental Management Plan (CEMP)

The Proponent must develop a CEMP to be used for the practical construction of the Electricity Works, especially a transmission line prior to construction works commencement.

The CEMP must address and comply with:

All approvals which apply to the construction and operation of the assets.
Mitigation measures identified in the environmental impact assessment.
Landowner & affected authority requirements.
All other environmental requirements issued by Essential Energy or any relevant statutory authority to the Connection Applicant from time to time.

3.5 OTHER AUTHORITY REQUIREMENTS

All necessary approvals are to be gained from other relevant authorities that may be affected by proposed substation/switchyard & power line works.

It is the designer's responsibility to consult and obtain approvals, as necessary, from the relevant authority affected by proposed works.

Local Councils and the RMS have specific requirements in respect to works carried out on road reserves under their control. The Electricity Supply Act (NSW) has specific requirements regarding works on public roads and reserves. Section 45 of the Act requires that notice of proposed works must be given to the Local Councils and they must be given up to 40 days to comment.

Specific authority applications must be undertaken for any works impacting upon Rail property, waterways, Transgrid assets & aircraft landing facilities.

The environmental review process may also highlight the need to consider & obtain approvals from authorities such as Crown Lands, National Parks & State forests.

3.6 MATERIALS

All materials used for construction works are required to be approved EE.

Approved materials are listed on EE's approved inventory listing. The approved material inventory list is available on the EE website – www.essentialenergy.com.au

Any material item proposed to be used which does not appear on EE's approved inventory list is to be assessed, approved by EE and conform to EE's technical requirements.

The Proponent/ASP will be responsible to supply all materials for use in there project. Surplus materials will be the property of the Proponent.

All materials recovered from the existing network are to be returned to EE.

Materials may be purchased from EE, if available, including standard poles.

Enquiries for purchase and availability of EE approved material items may be made to:-

EE External Sales Officer
Ph : 0268834596
Email : jennie.buxton@essentialenergy.com.au

3.7 LAND ACCESS INVESTIGATION AGREEMENT (LAIA)

Where Electricity Works are to be constructed or installed, Essential Energy will seek to enter into an LAIA with the Proponent.

It is the proponent's responsibility to obtain land tenure over any new construction works deemed to be EE asset. Freehold title is required over substation/switchyard sites & registered easements in favour of EE over power line routes through any properties that are affected by power line works.

The proponent is responsible for all costs resulting from the establishment of freehold title & or registered easements including compensation to land holders, stamp duty, valuation for stamp duty purposes, all legal fees including EE legal fees, solicitors, surveyors and registration fees.

3.7.1 Substation / Switching Station Freehold Title

All substation/switching station sites owned & operated by EE are to be covered by freehold title.

The proponent is responsible to do all things necessary to transfer land title to EE. To ensure the transfer is legally binding, the consideration should be $1.

Land owned by a third party (ie not the proponent) should be transferred to the proponent & then to EE.

If subdivision of land is required a determination as to whether a process of "Plan of Subdivision" or "Plan of Acquisition" is applicable. A "Plan of Subdivision" will require local Council approval.

All sites will require legal access to EE either by public roadway or "right of access" is acquired & registered in favour of EE.

3.7.2 Transmission Line Easement

All transmission line assets owned & operated by EE are to be covered by an easement.

Minimum easement requirements particular to EE are detailed in the EE's code of practise document CEOP8046 "Easement Requirements". These requirements may vary depending upon site conditions. Actual easement widths and requirements are to be confirmed and agreed by EE.

The proponent's solicitor must advise that easements, over all lands impacted by proposed works, have been settled or a formal deed of agreement, from the landowner & the proponent, has been obtained.

Suitable documentation and / or plans indicating easement creation are to be submitted to EE prior to certification.

EE's standard recitals have been registered with the Land & Property Information (LPI). Wordings other than the standard recitals as registered with the Land & Property Information (LPI) will not be accepted by EE.

EE does not procure easements over roadways, apart from crown lands. Where transmission lines traverse roadways easements are not acquired over adjacent lands unless conductors cross such lands under still air conditions or the zoning building setback requirements are impacted upon by the conductors under blow-out conditions.

The proponent or their representatives must not enter private land holdings without consent from the landowner. If landowner consent becomes difficult EE may issue an "authority to enter" advise to access existing line easements.

A landowner database is to be submitted with the design submission for certification. The database is to include the name, contact details, postal address & specific site conditions if any.

4 DESIGN CRITERIA

4.1 SUBSTATION/SWITCHING STATION DESIGN

4.1.1 Proponent Ownership.

Substation assets constructed by the proponent, to provide connection services only, will remain the property and responsibility of the proponent.

Design & construction will be to Australian Standards as a minimum requirement.

EE communication and SCADA control equipment including panels will be required within the site & associated control room. EE access will be necessary.

Construction of and supply of materials for the proposed Project substation will be fully funded by the proponent.

An earthing analysis & design report is to be undertaken for the substation site to be connected to the EE network. The report will be submitted to EE for review and approval.

The following EE standard is to be incorporated into the earthing design detail :- CEOM7051.23 – "High Voltage a.c. Transmission & Sub Transmission: Earthing Techniques."

4.1.2 EE Ownership.

All designs are to be carried out by an ASP3 to EE standards as detailed in the manuals listed below :-

Transmission & Zone Substations: Design Guidelines	CEOM 7081
Zone Substation Design Services: Drawing Guidelines	CEOM7052

The design package is separated into Five (5) sections:

- Substation Design Scope.
- Civil and Structural Design.

- Building Design.
- Primary System Design.
- Secondary System Design.

EE approval/certification of the preliminary design scope drawings is required before acceptance of further design detail.

The design scope package drawing requirements are:

- Single Line diagram.
- General Arrangement – Plan view.
- Site Plan.
- Protection Single line Diagram.
- Phasing Diagram – if available.
- SCADA schedule – preliminary.
- Building Floor Plans.

A drawing approval register is to be established for all design drawings. EE's standard drawing register spreadsheet template may be issued upon request.

Essential Energy has developed a suite of Template Design Drawings and shall be replicated as required. All the Template designs are to be assessed as suitable for the specific situation. Information and recommendations from the Substation Design scope shall be used to review and complete the design.

4.2 TRANSMISSION LINE DESIGN

4.2.1 Design Standards.

All designs are to be carried out to EE standards, as detailed in the manuals listed below:-

- Subtransmission Line Design Manual CEOM 7081
- Subtransmission Construction Manual CEOM 7082
- Overhead Design Manual CEOM 7097
- Overhead Construction Manual CEOM 7099
- Underground Design Manual CEOM 7098
- Underground Construction Manual CEOM 7199

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."

4.2.2 Drawings & Information.

All drawings will be presented in accordance with EE's Subtranmission Line: Drawing Standard CEOM 7080.

All drawings and information shall be submitted in electronic format. All drawings submitted for EE review are to be presented in "pdf" format.

All final drawing submissions for certification are to be presented in "pdf" and in a format suitable to the MicroStation cad system. The standard format is ".dgn". If other formats are

used it will be up to the ASP to ensure full and complete conversion to microstation compatible file format has occurred.

EE will issue required drawing numbers and advise of suitable title block information requirements.

All other information shall be in digital format suitable for importation into Microsoft Word 2000 or later version. An alternative is to have a PDF file type suitable for Adobe. The software copy shall contain the same information as any hardcopy, ie colour photographs etc.

4.2.3 Design Software.

EE's subtransmission line design software package is "PLS Cadd". EE prefers that designers submit software files and design material compatible with PLS Cadd software.

EE administers & supports standard weather criteria & structure files for the PLS cadd line design programme.

The standard criteria is detailed within the standards manuals & are also available electronically to ASP3 Designers who are engaged in transmission line design involving EE network.

4.2.4 Overhead Design.

The requirements for the design and construction of Transmission lines for use in the EE network are detailed within the EE document CEOM7081 "Subtransmission line design Manual".

This manual forms the basis of, and includes the philosophy and design criteria for, design and construction of Transmission lines within EE.

After determination of a line route & before design certification can be given the ASP3 designer is to submit a conceptual design to EE for comment & approval. Once conceptual detail has been approved by EE a final design may be completed & submitted to EE for certification.

The conceptual design is to include:-

- Route plans.
- Line schedule.
- Line Profile.
- PLS Cadd . "bak" file.
- Design Criteria report.

The following basic conditions shall apply:-

- Overhead lines will be designed to maintain safety clearances to the ground, buildings or structures and other lines under the environmental and electrical service conditions for the line. EE may stipulate or specific site conditions may require greater clearances eg over navigable waters, railways, cultivation etc.

- Maximum design operating temperature for all subtransmission lines will be 85˚C unless notified otherwise by EE.

- Structure placement & conductor stringing will be carried out from a true ground profile as recorded by survey. The ground profile will reflect a true indication of variation in ground level.

- Conductor size and type if not stipulated by EE shall have a current rating suitable for the project loading and comply with the required fault rating and avoid corona.

- EE approved insulators compliant with applicable Australian Standards are required. Insulators supplied will need to comply with the electrical, mechanical and environmental stresses as determined by site conditions.

- All overhead lines shall incorporate armour rods & vibration damper control on all conductors including the overhead earthwire.

- EE utilises an Optical fibre Ground Wire (OPGW) as a standard for OHEW protection. Extension of an OHEW conductor without optical fibre will require EE approval. OHEW protection is required for the full length of a transmission line.

- All Structures are to be earthed at ground level. Earthing design to be submitted to EE as part of design approval and certification, structure ground earth resistivity levels to be included.

- Typical structure configurations are included within EE's construction manuals and are to be used as the basic requirement within designs.

- All structures are to be designed to the applicable Australian Standards and shall be either prestressed spun concrete or steel. Hardwood timber poles may be used under special circumstances and requires EE approval.

- Foundation design and detail to be included with design plans. Geo tech test results of soil bearing capacity are to be included.

4.2.5 Underground Design.

Underground cables shall be designed and installed to ensure that :-

- Safe operational performance will occur.
- They are able to supply the load currents that they will encounter under in service conditions.
- They have the insulation appropriate for the nominated voltage.
- Are able to handle the prospective short circuit currents which will enable the correct operation of protective devises.
- Have the appropriate separation clearances from other services.

After determination of a cable route & before design certification can be given the ASP3 designer is to submit a conceptual design to EE for comment & approval. Once the conceptual design has been approved by EE a final design may be completed for certification submission to EE.

The conceptual design is to include:-

- Route plans including cable route & overall length, conduit detail & location of other affected services.
- Cable schedule including cable, joint & termination specifications.
- Trench Profile configuration.
- Geotech report including soil thermal rating.
- Cable pulling tension analysis including pulling pit requirements.
- Bonding design including earthing and surge protection arrangements.

All cables crossing roadways and through easements are to be installed in conduits with spare conduits to be installed in the same location.

The cable manufacturers recommended rating, pulling tension and bending radios limitations are to be complied with and included within the cable specification.

Thermal rating of the cable is to be considered as part of the installation process and for calculation of maximum current rating.
Manufactures recommended maximum conductor thermal rating must not be exceeded under any condition.

Thermal rating of backfill used is to be assessed and documented. Minimum backfill requirements are - Fine grained beach or brickeys sand.
95% Compaction at 200mm layers.

5 DESIGN CERTIFICATION

All electrical design and construction plans are to be submitted to EE's Network Quality Assurance Division for certification prior to any construction works being scheduled or commenced and shall be prepared in accordance with EE's requirements & conditions as set by DI and within the Design and Construction Manuals.

Failure to comply with these requirements shall result in rejection of the designs or drawings.

Final design submitted for certification will include but not limited to the following information:-

- Substation location, line Route & design options analysis.
- EIA reports including Vegetation Management Plan.
- Line route, survey, profile drawings & line construction schedules.
- Civil, structural and electrical design detail.
- Geotech and structure foundation detail.
- Conductor & stringing detail.
- Earthing design for substation and lines.
- Material List.
- Detail of all affected Government authority services, compliance with all requirements and correspondence.
- Landowner database including Names, contact and property detail and all correspondence.
- Easement plans and dealings finalised or submitted for registration.
- Hazard and risk assessment report and mitigation controls.

Designs and drawings are to be approved by the ASP designer prior to submission to EE for certification. Each design and drawing shall include the ASP's accreditation detail.

Design certification shall lapse where:

- Construction has not commenced within six (6) months, or
- Construction has been interrupted for more than six (6) months, from the date stated on the design when certified, whichever is the later date.

Where design certification has lapsed the ASP shall review the design and resubmit it for certification.

Should an amendment to the layout occur after a plan has been certified, the amended design shall be lodged with EE for re-certification.

Designs along with all relevant information to be submitted to :-

Mr Darrell Groth
Manager Network Connections
Essential Energy
P.O.Box 718
Queenbeyan, NSW. 2620
Email: networkconnections@essentialenergy.com.au

6 PROJECT MANAGEMENT

At the finalisation & submission of Design Certification between the Proponent & EE a project co-ordinator will be appointed, by EE, to manage design & construction works association between the ASP & EE.

EE's Project Co-ordinator will represent EE's interests & ensure the design & construction works interface is maintained and that the proponent's expectations in respect to timing & completion of such works are achievable and understood by both the proponent & EE.

It is essential that the proponent's expectations in regards to construction completion & works scheduling is submitted to EE for review. EE will review such expectations & comment on the feasibility in relation to network connection.