

# Capability Statement




**Power Systems &  
Grid Connection  
Services**

## Company Overview

Clean Technology Partners (CTP) is a specialist engineering consultant to the renewables and energy storage industry.

Established in 2011, CTP has provided engineering services for many gigawatts of clean energy and energy storage projects through all stages of the project lifecycle. After 11 years, Clean Technology Partners has built a reputation as a respected company in the sector. We have taken more than one thousand clean energy projects from concept to completion.

We pride ourselves on our client commitment and ability to find solutions to difficult problems. We have a diverse and experienced team of engineers and project managers to consistently deliver great results for our clients. CTP provides engineering services across three main categories.

 <p><b>Power System Studies</b> PSS/E, PSCAD, PSS Sincal, PowerFactory</p>	 <p><b>Technical Advisory</b> Owners &amp; Lenders Engineer, Due Diligence, Feasibility</p>	 <p><b>Detailed Design</b> Electrical, Control, Structural, Civil</p>
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CTP has performed power system studies for renewables projects since 2013 and has been growing its expertise and experience ever since. Over that time, we have invested heavily in software, knowledge and capability to deliver our services. A feature of our work is the ability to draw on the experience of our 3 core engineering service areas to ensure results found in the power system modelling are achievable in the real world and are delivered with a full appreciation of critical project success factors and stakeholder requirements.

Advanced python scripting and automation techniques are a feature of our work; to be able to handle the large amounts of data and multiple scenarios demanded by the NSPs. For instance, CTP has already developed a full set of scripts for the recent released Dynamic Model Acceptance Test requirements from AEMO.

Studies are conducted in the following software packages;

- PSS/E
- PSCAD
- PSS Sincal
- DIgSILENT PowerFactory

CTP can generate high quality power system studies and analysis as required by clients, NSPs, AEMO and for off-grid projects where site specific requirements need development. CTP has experience performing power system studies for a range of technologies and combination including solar PV, wind, energy storage and synchronous generators.

### **Steady State Analysis**

According to TNSP/DNSP/AEMO requirements for grid connection studies  
System Strength evaluations  
Congestion Studies  
Fault current contribution/evaluation  
Load Flow / Thermal loading  
Voltage control/profile  
Reactive Power Capability  
Contingency Analysis  
PV/QV Analysis

### **Dynamic / Transient Stability Analysis**

According to TNSP/DNSP/AEMO/NER (S5.2.5) requirements for grid connection studies  
NEM wide planning studies  
Event investigation studies

### **Protection Studies**

Protection Settings & Co-ordination reports  
Desensitisation Study

### **Power Quality Studies**

According to TNSP/DNSP/AEMO/NER (S5.2.5) requirements for grid connection evaluations  
Harmonics and Filter Design  
Audio Frequency Injection  
Flicker

### **Corporate Social Responsibility**

CTP is a business that seeks to have a positive impact on its stakeholders and the planet.

This led to us becoming a certified B-Corporation in Nov 2019.

Certified B Corporations are businesses that meet the highest standards of verified social and environmental performance, public transparency, and legal accountability to balance profit and purpose. B Corps are accelerating a global culture shift to redefine success in business and build a more inclusive and sustainable economy. <https://bcorporation.net/>

### **Arc-Flash Studies**

Analysis of operator PPE and clearance for grid requirements

### **Earthing Studies**

Substation & Inverter Station Earthing Design  
Renewable / Energy Storage Field Earthing Design  
Lightning Protection System Design

### **HV Substations**

HV cable sizing based on installation and site conditions  
Concept primary & secondary designs for connection stations ( $\geq 66\text{kV}$ )  
Detailed primary & secondary designs for connection stations ( $\leq 33\text{kV}$ )

*Also see CTP's pre-engineering connection station solution ( $\leq 33\text{kV}$ ) "e-Cube":*  
[www.clean-tech.com.au/utility/utility-products/](http://www.clean-tech.com.au/utility/utility-products/)

### **Construction and Commissioning**

R1 package – incl power system and detailed design elements, as required  
Commissioning management & plan – plant & R2  
R2 – hold point test simulations and troubleshooting  
*Also see CTP Tech Advisory & Design Capability*



## Relevant Project Experience

A selection of example projects below illustrates relevant work that has been completed by Clean Technology Partners, showcasing experience in Power System studies, R1 registration and R2 testing. **Please note this information is confidential and is not to be shared with third parties.**

### 1. NSW Solar Farm (107 MWp PV), NSW (Essential Energy)

Status: **R0 Complete (5.3.4a letter received)**

Scope of Works: Concept Design & Model set-up, Steady-State Studies to Essential Energy Requirements (Thermal Studies, Steady-State Voltage Studies & Voltage Fluctuation Studies), GPS System Studies and Grid Connection Application documentation resulting in AEMO acceptance of performance standards and AEMO Issue of the 5.3.4A Letter.

### 2. VIC Battery & Solar Park (115MW Li-Ion BESS + 27MW Solar), VIC (United Energy)

Status: **R0 studies underway**

Scope of works: Concept Design (Site Plan, HV, AC, SLD, Protection, Battery System Concept Design). Steady State studies, Connection Application Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Dynamic Model Acceptance Testing and Benchmarking.

### 3. VIC Solar Farm (300MW), VIC (AEMO)

Status: **R0 studies underway**

Scope of works: Feasibility (site constraints, concept design, equipment selection, energy yield), Steady State studies. Connection Application Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Dynamic Model Acceptance Testing and Benchmarking.

### 4. VIC Wind Farm (45MW), VIC (Powercor)

Status: **R0 studies underway**

Scope of works: Steady State Studies, Grid Connection Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Model Acceptance Testing and Benchmarking), AEMO/NSP Negotiations, Troubleshooting with the OEM.

### 5. Glenrowan West Solar Farm (149 MWp PV), VIC (Ausnet)

Status: **Operational**

Scope of Works: Responsible for all commissioning activities including management of internal resources as well as client and external stakeholder liaison. Support all phases of commissioning – PCU & DC circuit energisation, prepare commissioning plan, R2 Hold Point Testing and coordinate with multiple different parties including NSP, owner, key subcontractors and AEMO. Key member of R2 commissioning team, directing onsite testing activities and with key responsibility for timeliness and accuracy of data from site and troubleshooting of site issues such as intermittent PPC crashing / reboot, compliance to new AEMO comms failure requirements, grid oscillations and SCADA and PPC behaviour under backup battery & genset cutover.

### 6. Ferguson Wind Farm (10.8 MW), VIC (Powercor)

Status: **Operational**

Scope of works: Steady State Studies, Grid Connection Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Model Acceptance Testing and Benchmarking), AEMO/NSP Negotiations, Troubleshooting with the OEM, R2 package updates.

## 7. Maryrorough and Baking Board Solar Farms (2 X solar farms, total 54.4MWp), QLD (Ergon)

Status: **Operational**

Scope of Works: Owner's Engineering Services & Project Management, supported owner and contractor to complete the R2 package, including PSSE/PSCAD models & RUGs, hold point pre-simulations, problem solving of emergent issues, submission of final report and post hold point of system events for GPS compliance.



## 8. Waste-to-Energy (20MW) – VIC (Powercor)

**Client:** Confidential

**Scope of works:** EPC Contract Technical Schedule, Steady State Studies (Steady State Load Flows, Fixed Tap Load Flows, Fault Level Studies, Contingency Load Flows), DMAT, Dynamic Modelling in PSSE and PSCAD (Connection Studies Report, RUG, Benchmarking Report, Voltage Control), Power Quality Study, AEMO/NSP Negotiations

## 9. NSW Solar Farm (19 MWp PV), NSW (Essential Energy)

Status: **R0 Complete (5.3.4a letter received)**

Scope of Works: Power System Modelling and Report to Essential Energy Requirements, PSS/e and PSCAD benchmarking, AEMO Negotiations and Studies, resulting in AEMO acceptance of performance standards and AEMO Issue of the 5.3.4A Letter.

## 10. Diapur Wind Farm (7.4 MW), VIC (Powercor)

Status: **Operational**

Scope of works: Steady State Studies, Grid Connection Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Model Acceptance Testing and Benchmarking), AEMO/NSP Negotiations, Troubleshooting with the OEM, R2 package updates.





**11. Yarraberb Solar Farm (44MW; Jan 2020 – February 2021)**

Status: **R0 studies complete**

Scope: Dynamic Modelling and Generator Performance Compliance Assessment, AEMO Model Testing and Validation, Detailed Power System Studies, R1 package creation, PSS/E and PSCAD benchmarking studies, Power Quality studies.

**12. Kentucky Solar & Battery Farm 4.95 MW Solar + 10 MWh DC Coupled Li-Ion BESS, NSW (Essential Energy)**

Status: **Connection Application Package Complete**

Scope of works: Concept & Detailed Design (Electrical & Control – Construction Issue Drawings). Steady State, dynamic and power quality studies to EE standard CEOP8079. Additional EE network studies and documentation for DC coupled BESS, including CAS and PMA checklist.

**13. 7 x 4.95 MW Solar Farms, NSW (Essential Energy)**

Status: **Various**

Scope of works: Steady State, dynamic and power quality studies to EE standard CEOP8079. Voltage control strategy, CAS, PMA checklist and PSCAD model with RUG.

**14. Grid Capacity and Connection Options for Waste To Energy Project (20MW) - VIC (United Energy)**

Client: **Confidential**

Scope of works: Connection Options (Connection Options Assessment, Concept Design (Site General Arrangement), MV Single Line Diagram), Grid Capacity (Review NSP data pack and model set up, Grid capacity modelling and assessment), Power Systems Modelling (Steady State Studies, DMAT, Generator Performance Assessment, Power Quality Study, AEMO/NSP Negotiations)

**15. Essential Energy – Professional Technical Services Panel**

Scope of works: support Essential Energy to complete network modelling and analysis work for a variety of Connection Planning projects.

**16. S.A. Power Networks / Enerven – Professional Technical Services Panel**

Scope of works: support SAPN to complete network modelling and analysis work for a variety of Connection Planning projects and Enerven on a range of technical advisory and detailed design engagements.

**17. Lord Howe Island Microgrid (1.1 MW PV, 4MWh BESS, 1MVA diesel gensets), NSW (Off-grid)**

Status: **Operating**

Scope of works: Electrical and power system studies for a complex remote power system that involves multiple sources of power, including the entire island network being powered solely by solar and battery power for significant periods of the day. Studies included - model development in DIgSILENT PowerFactory, Load Flow Study, Fault Studies, Protection Study, Dynamic Studies, Power Quality Study, Earthing Study & Design and Black-Start Study.

**18. Grid connected hybrid (4MW gas engines + 3.5MW Solar Farm), VIC (Powercor)**

Status: **R0 studies underway**

Scope of works: Load Flow Studies, Owner's engineering, Generator Integration Investigation, Site Inspections, Concept Designs, CAPEX estimate. Grid Connection Study Package (PSSE and PSCAD Dynamic Modelling (NEM/SMIB), Power Quality, Model Acceptance Testing and Benchmarking). Includes developing PSSE AVR models for older synchronous generators on the site where no models could be sourced from the manufacturer.