# NER Direct Applicant Self-Assessment

## Professional Engineer

ENGINEERS AUSTRALIA

| DETAILS | |
|---|---|
| Name: | EA ID Number: |
| Area/s of Engineering Requested | |
| **GIVE A BRIEF SUMMARY HOW YOU THINK YOU MEET THE ELEMENT OF COMPETENCE.** | |

**DEAL WITH ETHICAL ISSUES**

As an engineering consultant at GHD, I led the Owner's Engineering role for the Nauru Microgrid Project, funded by the Asian Development Bank (ADB) through the Rural Development Fund. The project was delivered by a Chinese consortium that had limited knowledge of Australian standards and no prior experience with projects requiring such strict compliance. During my site inspections for milestone payments, I discovered several non-compliances with Australian standards and deviations from the approved design.

I raised these issues with the Contractor's head, but they attempted to manipulate the interpretation of the standards to demonstrate compliance. They also offered me incentives to overlook the non-compliances, citing their lack of familiarity with Australian regulations. I immediately recognized the ethical implications of this situation and the potential risks to safety and project integrity. I firmly refused the offer and made it clear that bribery is unacceptable and contrary to professional ethics.

I reported the incident to the Project Director and the ethics committee, ensuring the matter was documented and handled transparently. I also informed the client, who was aware of similar issues in the past, to maintain full accountability. A Non-Conformance Report (NCR) was filed against the contractor, and formal corrective actions were initiated.

The contractor subsequently addressed all non-compliances and brought the work up to acceptable standards. Additionally, the contracting company agreed to train its employees on the requirements of working on ADB-funded projects and adhering to Australian regulations. This experience highlighted the importance of maintaining professional integrity and ensuring compliance in international engineering projects.

## PRACTISE COMPETENTLY

During my role as a Senior Renewable Energy Engineer at GHD, I worked extensively on utility-scale Solar and Battery Energy Storage System (BESS) projects across the APAC region. BESS was a rapidly emerging technology in the Australian market, with limited expertise available at the time. To stay at the forefront of industry advancements, I prioritized continuous learning by participating in various training programs and staying updated on regulatory changes. One of the critical areas I focused on understood the UL9540 and UL9540A standards, which define the requirements for fire safety and performance evaluation in BESS installations. These standards are complex and often misinterpreted, so I undertook internal training to ensure I had a comprehensive understanding of their application.

Another key area of focus was the updated fire safety guidelines released by the Country Fire Authority (CFA) in Victoria, which became a benchmark for BESS fire safety compliance across Australia. I engaged directly with CFA representatives to interpret these guidelines, particularly regarding fire water requirements and thermal runaway mitigation. This knowledge was essential for designing safe and compliant BESS systems.

I applied this knowledge extensively in the Latrobe Valley BESS project, a 100 MW/200 MWh system in Victoria. Using the expertise I gained, I reviewed thermal runaway testing data provided by the contractor to ensure compliance with UL9540A requirements. I also integrated the CFA's updated fire water storage and suppression requirements into the project design, ensuring adherence to regulatory standards. Furthermore, I prepared detailed design documentation, including Inspection Test Plans (ITPs) and Testing and Commissioning Plans, that incorporated these advanced safety standards.

In addition to regulatory compliance, I used tools such as CYMCAP and HomerPro to optimize the technical and economic aspects of the project. I applied my knowledge to develop accurate energy yield assessments and ensure that the BESS design met the client’s performance and reliability expectations.

## DEVELOP SAFE AND SUSTAINABLE SOLUTION

During my work on a utility-scale Battery Energy Storage System (BESS) project for a mining operation in Western Australia, safety was a top priority, especially when addressing the risks associated with thermal runaway in the battery systems. I participated in Safety in Design (SiD) workshops where we identified the potential risks of overheating in the battery units, which could lead to fires. I worked closely with fire safety experts to develop a solution to prevent this risk. Together, we decided to integrate an automated fire suppression system into the design. I proposed installing temperature sensors inside the battery enclosures to monitor any rise in temperature. If overheating occurred, the system would trigger a water deluge to cool the batteries and prevent thermal runaway.

I also ensured that the design complied with fire safety standards such as UL9540 and UL9540A, which are specific to energy storage systems. I reviewed the design specifications to make sure that all electrical and fire safety requirements were met. Alongside fire safety, I focused on minimizing electrical hazards by recommending the appropriate overcurrent protection and integrating a battery management system (BMS) to monitor the overall health of the batteries.

In addition to safety, I also concentrated on making the project more sustainable. I optimized the layout of the BESS to reduce land disturbance, ensuring minimal impact on the surrounding vegetation and wildlife. I worked with the environmental team to preserve as much natural land as possible and reduce the project's footprint. For the materials used in the project, I recommended the use of aluminum for battery enclosures, which is fully recyclable at the end of its life, minimizing waste. I also specified the use of copper cables made from recycled materials to further reduce the environmental impact.

I made sure that the design also considered the future decommissioning of the system. I worked with the project team to ensure that all components could be easily disassembled and recycled when the BESS reached the end of its lifecycle. I created a detailed plan for the decommissioning process, which included guidelines for the safe disposal of batteries and other materials, in line with environmental standards.

## IDENTIFY, ASSESS AND MANAGE RISKS

During my involvement in a large-scale solar and Battery Energy Storage System (BESS) project, I encountered a technical risk related to the design of the electrical protection system. While reviewing the design, I identified a critical issue with the coordination of overcurrent protection devices between the solar inverters, BESS, and the grid connection point. The protection devices were not properly coordinated, creating a risk that the BESS could continue to operate during fault conditions, which posed a significant safety risk to both personnel and equipment.

I performed a detailed root cause analysis and discovered that the protection settings for the inverters were too slow to clear faults effectively. The settings for the inverters' overcurrent protection relays were not optimized to quickly detect fault conditions. In the event of a fault, such as a short circuit, the inverters failed to isolate the faulty section fast enough. This delay meant that the fault would persist longer than safe, which could lead to equipment damage, fire hazards, or even pose a danger to site personnel.

As a Project Manager, I emphasized revisiting the risk register throughout the project's lifecycle. I ensured that the risk ratings and mitigation strategies were updated as the project evolved, especially when critical issues like this were identified. To address the protection coordination risk, I proposed specific adjustments to the protection device settings. I recommended reducing the time delay on the inverter protection settings to allow for faster fault detection and response. I worked with the protection team to fine-tune the settings on the overcurrent protection relays to ensure that faults were detected more quickly, triggering isolation within milliseconds rather than allowing for extended fault conditions. Additionally, I suggested incorporating fault detection algorithms that provided more granular sensitivity to different fault types, particularly low-voltage and high-current conditions, ensuring quicker and more precise isolation.

I also identified that the protection coordination between the inverters, BESS, and the grid connection needed improvement. The original design had relied on generic coordination settings, which led to a lack of synchrony between the protection devices. To resolve this, I collaborated with the protection engineering team to develop a tailored coordination scheme. This included adjusting the relay settings to ensure that in the event of a fault, the protection devices would operate in the correct sequence, with the inverters isolating first, followed by the BESS, and finally, the grid protection devices. This scheme would ensure faster isolation of the fault, reducing the risk of further damage or safety hazards.

I also participated in several HAZOP workshops during the project development, where operational and construction risks were thoroughly analyzed and discussed. These workshops were crucial in identifying potential safety hazards and allowed me to ensure that all risks were accounted for in the project's risk management framework. By adhering to robust risk management processes, I helped create an environment where safety was a top priority. Tools for reporting risks or near-miss incidents, both in projects and on-site, were extremely effective in identifying and addressing risks proactively. I encouraged my teams to utilize these tools, ensuring a culture of safety and risk awareness throughout the project.

After proposing these adjustments, I updated the protection design and documented the changes in the project's risk register. I ensured the construction team was aware of the updated design and provided detailed documentation for the new protection relay settings. During the commissioning phase, I worked closely with the team to verify that the new protection settings were correctly implemented and tested. I conducted several fault injection tests to validate that the protection devices could now detect and isolate faults within the required time frames, ensuring no extended fault conditions and mitigating any safety risks associated with prolonged faults.

# LOCAL ENGINEERING KNOWLEDGE

During a recent large-scale utility solar and Battery Energy Storage System (BESS) project in Australia, I encountered the need to apply local engineering knowledge, particularly in relation to the use of Australian engineering standards and guidelines. This project was located in Victoria, and one of the critical activities involved designing the electrical protection system for the integration of solar and BESS with the grid. The challenge was ensuring compliance with the relevant Australian standards, while also meeting the specific safety and performance requirements set out by the local authorities and clients.

To begin with, I focused on familiarizing myself with the standards applicable to electrical protection systems in renewable energy projects. For this project, the primary standards I used were AS/NZS 3000:2018 (the Australian/New Zealand Wiring Rules), AS 60079 (for electrical equipment in explosive atmospheres), and AS 2067:2016 (substations—design, construction, and operation). These standards provided comprehensive guidelines on the installation, operation, and maintenance of electrical systems in Australia, ensuring both safety and compliance with local regulations.

As I reviewed the design for the electrical protection system, I identified areas where the coordination between the inverters, BESS, and grid connection needed to be improved. To ensure compliance with AS/NZS 3000, I worked closely with the electrical protection engineers to apply the principles outlined in the standards. This involved using the recommended fault protection and isolation protocols to prevent any overcurrent or fault conditions from affecting the safety of the system. I also worked with contractors to ensure that all wiring and electrical components met the safety and operational standards laid out in AS/NZS 3000.

Additionally, I collaborated with suppliers to ensure that the protection relays and other electrical equipment conformed to the Australian standards. As part of my due diligence, I conducted Australian Standards Compliance Assessments for the BESS OEMs involved in the project, comparing their products against Australian standards and ensuring that they met the necessary performance and safety requirements. I also liaised with independent consultants to assess the overall design for alignment with Australian grid connection guidelines, including the National Electricity Rules (NER) and the Clean Energy Council (CEC) guidelines for connecting renewable energy systems to the grid.

Throughout the project, I regularly sought input from various experts, including the electrical protection engineers, contractors, and suppliers, to ensure that our approach was aligned with the latest standards and best practices. I applied engineering knowledge contributed by other team members to refine the protection coordination, incorporating their insights into the final design. I also made sure that all design modifications and improvements were documented and reflected in the risk register, adhering to the local risk management framework.