Fire Risk Assessment

Project	Ballincor Wind Farm
Report Title	Battery Energy Storage System (BESS) Fire Risk Assessment
Our Ref	JG/1471/R1 Issue 1

Fire Risk Assessment

Project: Ballincor Wind Farm

Client: RWE Renewables Ireland.

Report No. JG/1471/R1
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Checked	GM					
Approved	GM					

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed Battery Energy Storage System (BESS) is part of the Ballincor Wind Farm and will be located at Ballincor, Co Tipperary.

The Project shall also consist of the design and supply of transformers, battery storage cells, inverter and associated systems.

1.2 WHAT IS A BATTERY ENERGY STORAGE SYSTEM?

The purpose of the BESS facility is to offer system services to the Irish power system under EirGrid's DS3 system. EirGrid summarize their DS3 programme as:

"Delivering a Secure Sustainable Electricity System, DS3 programme seeks to address the challenge of integrating world-leading levels of renewable generation onto our power system".

Conventional power plants normally provide these services, but as the Irish grid moves towards a power system with high levels of wind power and solar power generation, the conventional power plants are not utilised as much for energy generation and so aren't available to provide the ancillary services (which are a by-product of energy generation).

It is possible to turn conventional plants on for ancillary services alone, but this is expensive and increases emissions. It also displaces wind and solar power that could otherwise meet the demand needed. A better solution is to procure the necessary ancillary services from stand-alone devices dedicated to providing the particular ancillary services required.

The BESS facility has, at its core, a Lithium-ion battery energy storage system (LI BESS). BESS facilities of this type are already used in several countries including Britain, Germany, Australia and the United States. They are predominantly used to provide fast acting frequency and reserve grid services helping to ensure the safety and stability of the electricity system. The operation of the BESS is remote, in that a control interface is made available to EirGrid, who will draw on the battery energy reserves as it requires.

1.3 SITE SPECIFIC INFORMATION

The proposed BESS development comprises of the following infrastructural elements:

- 1 no. control building.
- 90 no. battery energy storage containers.
- 15 no. MV inverter containers.
- 1 no. Auxiliary transformer.
- Plinths and ancillary equipment.
- Underground electrical and communications cabling.
- Security lighting, CCTV and communications mast.
- 2 no. storage container.
- Switchgear Room.
- 1 no. COSH container.
- New internal access roads and hardstanding areas for car parking.
- Access gates and security fencing.
- Surface water drainage system.
- Water storage tank.
- All associated ancillary site development and vegetation clearance works including landscaping and hedgerow reinstatement.

Figure 1: Ballincor Battery Energy Storage System (BESS) Site Layout

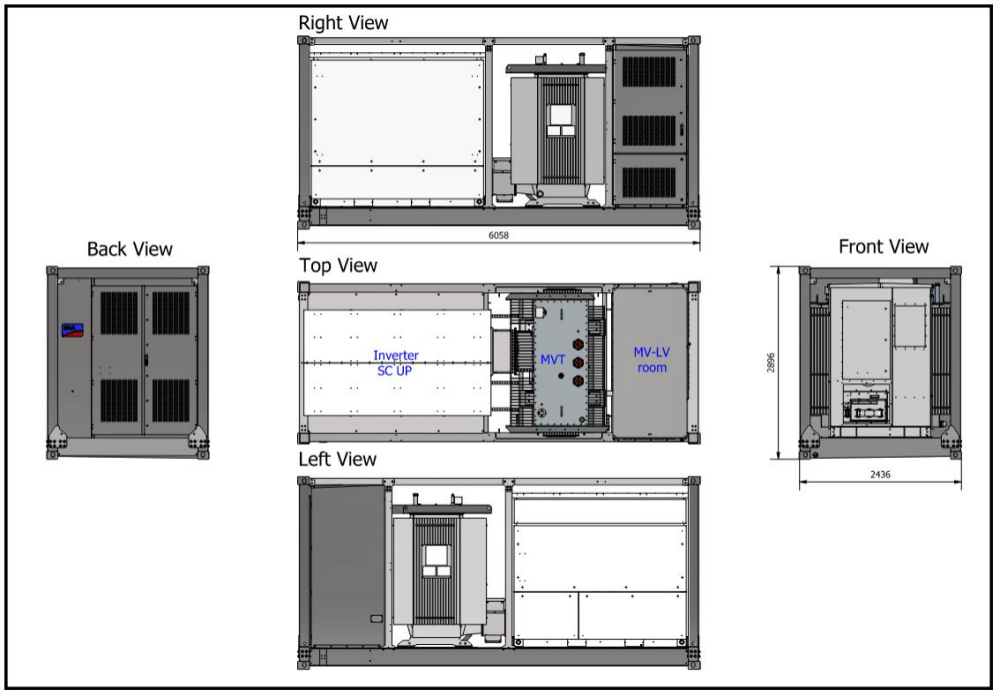

Figure 2: BESS Facility Components

BESS Containers & Ancillary Equipment - Specifications

The following specifications will be required by the client as part of the overall facility design:

- Adequate measures for fire detection and warning shall be implemented as part of the facility's construction and operational design. The design, installation, servicing and maintenance of the proposed fire detection and alarm system implemented on site shall conform to the requirements set out in I.S 3218: 2013+A1:2019 Code of practice for fire detection and alarm systems for buildings – system design, installation, commissioning, servicing and maintenance & amendment 1:2019.

- Adequate safety signage shall be installed on site in accordance with Safety, Health and Welfare at Work (General Application) Regulations 2007 Chapter 1 of Part 7: Safety Signs at Places of Work as amended.

- Emergency lighting and emergency egress must also be addressed in the facilities detailed design and provided in accordance with IS. 3217 code requirements. Technical Guidance e.g. BS 9999: 2017 and BS5588, also give much relevant guidance on fire risk.

- In terms of the layout of the battery technology, batteries will be placed on a battery rack and sealed within a container where they will be monitored and controlled for performance, temperature, and other safety factors.

- In the event of a fault, the system will shut down. The containers are sealed, fireproofed and house all the necessary control and safety systems to ensure optimum performance of its safety measures.

- The facility will be connected to a 24 hour in-house operational controller who will receive real-time signals advising of any battery faults, heat, smoke or fire alarms.

The proposed facility shall include the following minimum safety measures:

- The battery technology shall be Lithium Ion

    - All cells certified to stringent UL1642 lithium-ion cell safety standards.
    - All cells pass UN38.3 transportation safety test standards.

- The battery management system (BMS) shall be capable of detecting problems using cell and module voltage measurements and select temperature measurements within the batteries. Automatic disconnect of the batteries will occur if any unusual parameters are measured.

- The BMS shall maintain strict control of charging and discharging of the batteries. Voltage, current, temperature and state of charge are all measured and controlled to ensure safe charging and discharging to prevent electrical abuse of the system.

- Cells shall be kept at an optimal operating temperature and will not exceed safe temperature ranges.

- An automatic trigger system will be incorporated to foldback power if safe temperature ranges are exceeded.

- A fire suppression system shall be incorporated into the facility's design. The system shall include the following elements at a minimum:

    - Battery storage containers shall have dedicated fire detection and suppression system.
    - The system shall include ionization smoke sensors and heat sensors to detect presence of a fire.
    - The system shall include strobe light/horn to provide indication of smoke and fire detection for personnel inside the container, and external warning lights for personnel outside the container.
    - The system shall use a solid aerosol fire suppression agent in the containers to suppress fire.

- The fire extinguishing agent to be used by the fire suppression system shall have zero ozone depletion potential and shall be thermally and chemically stable when stored. Fire extinguishing agent shall be Novec 1230 or equivalent.

- Regular visual inspections and testing of battery system equipment shall be incorporated into the project's operation and maintenance schedule as per manufacturers requirements.

- Fire safety measures and equipment in the facility must be kept in effective working order. This includes all fixtures and fittings such as fire doors, fire detection and alarm systems, fire-fighting equipment, notices and emergency lighting. Regular checks, periodic servicing and maintenance must be carried out, whatever the size of the workplace. Any defects should be put right as quickly as possible.

- A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of fire-fighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on site at all times.

- The system shall include an abort switch that can be operated at any time with overriding manual abort system.

Battery Energy Storage Systems (BESS)

The BESS containers will comprise of high-quality galvanised metal. The design and layout of the battery storage unit ensures that in the extremely rare instance of a fire occurring within an individual container, the internal fire suppression technology will ensure the isolation of the fire within the fireproof container. Extinguished contaminates will be contained within the specific container that can be removed and disposed of at a later stage. The internal fire suppression technology is considered robust in nature and will act as the first response in the event of a fire incident. The fire detection and alarm system will conform with the requirements of I.S 3218: 2013+A1:2019 Code of practice for fire detection and alarm systems for buildings – system design, installation, commissioning, servicing and maintenance & amendment 1:2019.

During operation, the battery facility, when exporting to grid, discharges a direct current that is transferred to the inverter stations from where it is converted to an alternating current. It is then 'stepped up' by the transformer stations to the required voltage for export to the transmission network. The reverse process happens when the battery is importing from the transmission network. This power will be used to balance the transmission system.

The battery facility encompasses no moving parts or obtrusive features during operation; it is in essence a static development that quietly and efficiently will import or export energy to the transmission grid when needed.

The battery container enclosures proposed in this development are fitted out with racks of battery modules and control systems including communications and controls equipment, to provide system status, with input and output routed into a control building which contains telecommunications equipment and switchgear. Each container is to be fitted with a Fire Suppression System.

Each container will sit on concrete foundation plinths. Outwards opening doors provide external access to the system.

MV Inverter Container with built-in HVAC Units

Size and specification of inverters are subject to engineering design and review. The following description is based on Inverter Stations used in recent projects.

Model: Freemaq PCSK (Frame 2)
Size: 3.7m (W) x 2.2m (L) x 2.2m (H)
Grid Support Functions: Peak shaving, ramp rate control, frequency regulation
Control System: Power Plant Controller or SCADA (supervisory control & data acquisition)
Monitoring System: Freesun app

- Built in WIFI
    - Remote connectivity to smart devices

HVAC System: iCOOL3 air cooling system

- IP55 protection
- Reduced need for dust filters & cooling systems
    - Reduced fire risk

The final unit will likely be a turnkey unit ready for connection to the battery container and MV power distribution wiring. Units will be sited on concrete pads or piers, open skids or may be integrated into full container solutions.

Figure 3: Fluence TX Inverter Station

Access Track

The overall site area is 1.4 hectares. Access to the BESS site is via L1071 and R492.

Access will allow for the construction of the development and future maintenance of the plant and equipment, which is likely to involve limited but regular maintenance visits by small vehicles such as vans. The road will be constructed to allow for the passage of articulated vehicles and fire tender appliances.

Fencing & Gates

Appropriate security to the site during operation will be required to protect the public from exposure to the dangers of electrical equipment. Accordingly, a security fence will be installed around the site in which the electrical equipment and other site infrastructure are located. The proposed development will be secured by a fence around the perimeter, with one access point, via 2 sets of gates providing access to the facility. Appropriate safety signage will be displayed on the fencing and gates.

CCTV

CCTV will be co-located within the compound. Installed lighting would be both located and shielded to minimise light emissions beyond the perimeter of the site. CCTV cameras to be installed covering the entire BESS compound and a contract will be placed with monitoring company. CCTV will only be active after handover.

On & Off-Site Electricity Cabling

The batteries generate Direct Current (DC) electricity. DC cabling will run underground between container and the inverter for each container. At the inverter stations, the DC current will be converted to Alternating Current (AC) by carefully specified inverters, which would then be relayed on to the on-site substation which forms the starting point of connection to the transmission network, again using cabling to the final Point of Connection (PoC).

Underground onsite cables will be laid in a trench within the access tracks at a depth of no greater than 500mm, specifically dug for this purpose and reinstated once construction of the battery storage facility is completed. The specification for the cable trench is in accordance with EirGrid requirements.

1.4 RWE RENEWABLES IRELAND LTD.

The applicant for the proposed development is RWE Renewables Ireland Ltd with a registered address at Unit 5 Desart House, Lower New Street, Kilkenny City, Ireland.

1.5 EMERGENCY ACTION CODE (EAC) - LITHIUM-ION BATTERIES

EACs provide a quick assessment to the emergency services of what actions should be taken during an accident. The fire and police services use the specific characters and numbers to determine which actions may be necessary, during the first few minutes of an incident involving dangerous goods.

The idea behind the EACs is that emergency responders, especially the fire service, carry a small card with them known as the “Hazchem Scale Card” that translates the EACs into immediate action to be taken at the scene of an incident until specialist advice and help can be obtained.

EACs are characterised by a single number (1–4) and either one or two letters (depending on the hazard)

Li-Ion batteries are categorized as being of Hazard Class 9 materials.

Figure 4: Sample identification placard

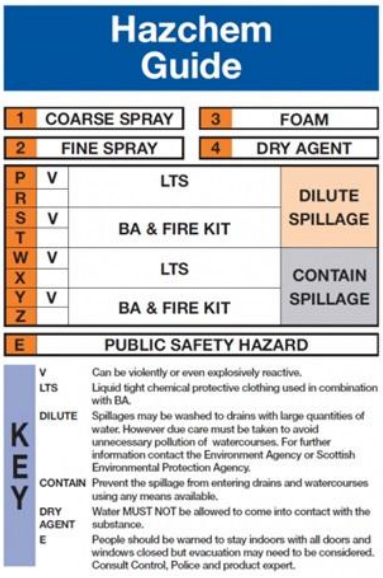

Figure 5: Guide to be carried by Fire Service responders.

Li-Ion Batteries are detailed under Guide 147 and come under the UN Action Code 3481. The appropriate EAC is to be determined on consultation with a HAZNO consultant and appropriate signage erected in locations around the facility that will be immediately visible to Fire Service personnel.

1.6 FIRE SAFETY RISK ASSESSMENT

The purpose of a fire risk assessment / risk management plan is to determine what actions are needed to be taken to prevent a fire from occurring in a premises or facility and equally to determine what actions are required to ensure the safety of people in and around a premises if a fire does occur.

Risk management should be comprehensive and consultative, involving those who will work at the facility (employees and contractors) including analysis of activities and operations at the facility. Risk management should be organisation-wide, supported by organisational management at all levels, underpinned by organisational policy, and integrated into organisational decision-making.

Risk management involves the following:

Risk identification to understand the potential sources of fire including on-site hazards (e.g. electrical faults, operational faults, chemical releases, operational practices/processes, animal management); off-site hazards (e.g. bushfire, grassfire, storm, lightning, flood); and any other operational, financial, or strategic risks that could affect the ability of the organisation or operation to meet objectives.

Risk analysis and risk evaluation involves identifying the nature of risk and its characteristics, and analysis of controls for identified risks based on the hierarchy of controls and informed by industry good practice. Analysis includes evaluation of controls based on assessment of their effectiveness and the practicality of their implementation.

Risk treatment involves the selection and implementation of controls for each identified risk.

Monitoring and review, recording and reporting involves regular and comprehensive review of risks and controls through monitoring of site hazards, risks, systems and processes to ensure that emerging risks are identified; existing risks are effectively controlled; and controls are appropriate and effective. Risk management activities and outcomes are to be communicated across the organisation.

The aims of the fire risk assessment and this report are: -

- To identify of any practices or conditions that could pose significant fire risks to persons occupying the compound.
- To satisfy the requirements of the Fire Services Act with respect to the carrying out of a fire risk assessment.
- To ensure adequate firefighting facilities are provided for use by the fire brigade.
- To assess the environmental impact of the facility in the event of a fire.

1.7 METHODOLOGY

To complete a fire risk assessment, it is necessary to identify the hazards. The risk due to the hazard occurring should then be reviewed and an assessment made of the seriousness of the risk imposed by the hazard.

It is generally sufficient to gauge the risk as high, medium, tolerable or low. Where the risk is considered to be high i.e. that there is a significant possibility of people being seriously injured should a fire break out, action must be taken to reduce the risk to a reasonable level.

The body of the report provides commentary and background to the fire risk assessment methodologies and also the guidance necessary for management to carry out future fire risk assessments.

2.0 STATUTORY PROVISIONS

When assessing the standard of safety in a building in Ireland the following pieces of legislation are relevant:

- The Building Regulations, and
- The Fire Services Act 1981 & 2003

2.1 BUILDING REGULATIONS

Building Regulations apply to all building work carried out in Ireland and are intended to provide for the health and safety of persons in and around a building. For fire safety, Technical Guidance Document B (TGD B) provides guidance on measures to achieve an adequate level of life safety for most building types.

Although TGD B provides fire safety guidance for industrial buildings, the recommendations are generic in nature and cover a wide variety of industrial uses. As such, they do not deal adequately within unique or unusual structures such as that proposed for the lithium-ion energy storage system containers.

However, the TGD B acknowledges its limitations and permits the use of fire safety engineering in buildings. Therefore, where the fire strategy departs from TGD B guidance, the principles of BS 7974 and the recommendations of BS 9999 can be adopted for demonstrating compliance with Building Regulations.

As part of the proposed development it is also proposed to construct the following stand-alone building:

- Switchgear Room

As the building above is considered an occupied building, it will be required to undertake a separate fire safety certificate application for each stand-alone building. They will be required to demonstrate compliance with the relevant sections of Technical Guidance Document B 2024 - Fire Safety – Volume 1 Buildings other than Dwelling Houses.

As the BESS enclosures are non-walkable, it would not be possible for a person to be located within them, and therefore they are exempt from compliance with Building Regulations under ‘Buildings not frequented by people’. However, for the purpose of the Fire Risk Assessment, Building Regulations guidance will be used as the basis of design appraisal to ensure a reasonable standard of safety is achieved.

2.2 FIRE SERVICES ACT

The Fire Services Act 1981 & 2003 are the primary acts in Ireland that govern fire safety in buildings to which the public are admitted. The 1981 Act established the fire authorities and made provision for the organisation of the fire service, training of fire personnel, firefighting and fire safety, and other matters relating to the protection of people and property from fire.

The 2003 amendment expanded the duties of persons in control of premises to make adequate provision for ensuring the safety of persons on their premises. The person in control must proactively promote good fire safety practice and procedures on the premises. It also strengthens the status of advice given by a fire authority or an authorised person and substantially strengthens their inspection powers.

An authorised fire officer may serve on the owner/occupier of a premise a closure notice having immediate effect if he/she is of the opinion that a serious risk is posed to the safety of persons on or in the premises.

2.2.1 Duty of Care

Section 18 of the Fire Services Acts 1981 & 2003 (as amended) declares that: -

It shall be the duty of every person having control over premises to which this section applies to: -

a) Take all reasonable measures to guard against the outbreak of fire on such premises,

b) *Provide reasonable fire safety measures for such premises and prepare and provide appropriate fire safety procedures for ensuring the safety or persons on such premises,*
c) *Ensure that the fire safety measures and procedures referred to in paragraph (b) are applied at all times, and*
d) *Ensure, as far as is reasonably practicable, the safety of persons on the premises in the event of an outbreak of fire whether such outbreak has occurred or not.*

This duty of care is placed on every person having control over the premises to ensure that adequate fire safety provisions are made available – the absence of which could deem it to be a 'potentially dangerous building' under Section 19 of the Fire Services Act.

Section 8 of the Safety, Health and Welfare at work Act 2005 places a general duty of care on employers in respect of workplace health and safety: -

"Every employer shall ensure, so far as is reasonably practicable, the safety, health and welfare at work of his or her employees".

3.0 MEANS OF ESCAPE

3.1 OCCUPANCY

The site will contain 1-2 members of staff during normal operations. Anyone accessing the site including external contractors will be inducted beforehand. The occupant capacity of the Switchgear Room has been calculated below.

Location	Area (m^2)	Usage	Occupant Load Factor (m^2/person) (1)	Estimated Occupancy (persons)
Switchgear Room	215	Plant	30	8
			TOTAL	**8**

Note 1: Occupant Load Factors are taken from TGB B 2024.

3.1.1 BESS Enclosures

By design, it is not physically possible for personnel to enter a BESS enclosure. Each enclosure will be accessed for the purposes of carrying out maintenance activities via the external front doors on each enclosure. Therefore, there will be no occupants within the BESS enclosures.

3.2 EXIT CAPACITY

3.2.1 BESS Enclosures

As noted above, there will be no occupants within the BESS enclosures.

3.2.4 Switchgear Room

The Switchgear Room exit doors will be required to achieve a minimum of 800mm clear opening width.

3.3 TRAVEL DISTANCES

TGD B recommends that travel distances within Industrial Buildings should not exceed 18m in a single direction or 45m where alternatives are available. Greater limitations are placed on rooms which are designated as Places of Special Fire Hazard as follows:

- Escape in a single direction – 9m.
- Escape in more than one direction – 18m.

Building Regulations guidance classifies the following as rooms as Places of Special Fire Hazard:

- *'Oil-filled transformer and switchgear rooms, boiler rooms, storage space for fuel or other highly flammable substances and rooms housing a fixed internal combustion engine'.*

Under Building Regulations TGDB guidance, the containers would not be classified as a place of special fire risk. As no occupants will be able to enter the containers and their escape route away from these containers will be fully external, travel distances would not be applicable.

3.4 INNER ROOMS

Where inner rooms are provided, the following conditions of TGD B are required to be satisfied:

- The occupancy of each inner room is less than 20.
- The inner rooms are not bedrooms.
- The escape routes do not pass through more than one outer room.
- Travel distance from any point in the inner room to the exit from the access room is within the above recommended limits.

- The access room is not a place of special fire risk.
- The access room will be fitted with automatic fire detection.

3.5 EVACUATION

All buildings within the facility will adopt a simultaneous evacuation strategy. BESS enclosures will not be accessible and therefore evacuation from them is not a consideration.

4.0 FIRE SAFETY RISK ASSESSMENT

4.1 SUMMARY

There are five main steps in the fire risk assessment process: -

1. Identify fire hazards.
2. Identify people at risk.
3. Evaluate, remove, reduce and protect from risk.
4. Record, plan, inform, instruct & train.
5. Review of fire safety risk assessment.

Generally, it should be possible for a person who is not a fire-specialist to complete a fire risk assessment. People who work day to day in a premise will be most familiar with the layout and are often instinctively aware of when they feel unsafe. 'Fire Prevention' is often a case of applying common sense and remaining vigilant and observant with respect to the fire hazards around us.

Although, based on its size and layout, the Ballincor BESS Facility would not be considered a complex facility, the complexity of the inverter stations and the presence of high DC current and Lithium-Ion battery cells may warrant it being considered as a complex facility. RWE Renewables Ireland however would be aware of the fire safety systems that are to be provided and the way in which they are expected to interact.

4.2 STEP 1 - IDENTIFICATION OF FIRE HAZARDS

For a fire to occur it needs a source of fuel and an ignition source. If these hazards can be minimised or reduced, then the risks to people and business are minimized. In order to do this the hazards in the facility must be identified.

It is important to reduce the possibility of ignition sources and fuel coming together i.e. fire prevention. This is the first line of defence. If hazardous materials are used, alternative feasible options which are less hazardous but can serve the same purpose should be explored and considered.

4.2.1 Identify Sources of Ignition

All workplaces contain heat and ignition sources. Some will be obvious such as cooking equipment or open flames (hot works). Others may be less obvious such as heat from chemical processes or electrical equipment.

The following are typical sources of ignition found in buildings / facilities:

- Smokers' materials:
  Cigarettes matches etc.
  It is recommended that the BESS facility be a non-smoking site.

- Naked Flames:
  Gas or liquid fuelled equipment
  Not applicable, as the site will contain all electrically powered equipment.

- Vehicle Exhausts.

- Heating Appliances.

- Hot Processes:
  - Construction hot works - Potential during maintenance activities

- Extract fans in Battery Storage Container and Inverter Stations:
  - Debris build-up in ductwork

  Not applicable as site will be a clean environment.

- Heat sources:
  - Battery Cells

- Friction generated heat from mechanical equipment:
  Not applicable to the equipment within the site.

- Static charge from mechanical equipment:
  Not applicable to the equipment within the site.

- Poor electrical installations:
  - Untrained or incompetent workmanship

- Faulty electrical equipment:
  - Faulty wiring and bunched or damaged cabling.

- Spontaneous ignition:
  Oil-soaked rags etc.

Given the quantity of electrical equipment within each battery container, the risk of fire from an electrical fault could be considered moderate.

The individual battery cells could also be considered to be a moderate fire risk. Causes of lithium ion battery fires are:

- Manufacturing defects
  - Foreign objects causing short circuits within cells.
- Physical abuse
  - Space restriction causing pressurization and short circuit of cells.
- Electrical abuse
  - Over charging of battery cells

4.2.2 Identify Sources of Fuel

These are divided into two main groups: -

- Low combustible fuels such as paper, wood, cardboard, etc.
- Highly combustible fuels such as rubber, solvents, etc.

The following are typical sources of fuel found in buildings / facilities:

- Flammable liquid-based products:
  - Paints, varnishes etc.

  Not applicable as no flammable goods will be stored within the Battery Storage Containers or other structures.

- Flammable liquids and solvents:
  - Alcohol, spirits etc.

  Not applicable as no flammable goods will be stored within the Battery Storage Containers or other structures.

- Transformer Oils:
  Transformer oils may be present on site.

- Flammable gases:
  - LPG, refrigerants etc.

  Not applicable as no flammable gases will be used on site.

- Flammable chemicals:
  - Chemical hazards found in Inverters, etc, i.e. dielectric fluid, lithium, transformer oil, sulfuric acid, Edisol XT & sulfuric hexaflouride.

  Not applicable as no flammable chemicals will be used on site.

- Stored goods or Racked Storage.
  Not applicable as no stored goods or racked storage will be present on site.

- Foodstuffs
  - Oils, sugars etc.

  No foodstuffs will be stored within the Battery Storage containers, Inverter Stations or other structures.

- Plastics & rubber:
  - Furniture, equipment etc. - Electrical equipment within the Battery Storage containers, Inverter Stations or other structures.

  No plastics & rubber will be stored within the Battery Storage containers, Inverter Stations or other structures.

- Paper products:
  - Stationary etc.

  Not applicable as no paper products will be stored within the Battery Storage containers, Inverter Stations or other structures.

- Packaging materials:
  Not applicable as no packaging materials will be stored within the Battery Storage containers ,Inverter Stations or other structures.

- Textiles:
  Furniture
  Not applicable as no furniture will be stored within the Battery Storage Containers, Inverter Stations or other structures.

The Battery Storage Containers will be primarily of metal construction as are the internal battery storage racks. Potential fuel sources would be limited to electrical cabling and some plastic or rubber parts of mechanical equipment. Transformer and substation buildings would likely be of concrete or block construction and would contain a limited fire load. Therefore, the fuel load and combustibility of the finished container (not including battery cells) and transformer and substation buildings would be considered to be relatively low.

The individual battery cells are designed with safety and stability as paramount. All cells will be certified to UL1642 lithium-ion cell safety standards and all cells must pass the UN 38.3 transportation safety test standards. The cells are encased in protective metal casings and are held securely in specially designed racks to avoid accidental damage and to allow for monitoring and control of individual battery cells.

The Inverter Stations will be steel framed insulated containers with a concrete foundation. The internal components of the containers are primarily of metal construction. Potential fuel sources would be limited to electrical cabling and some plastic or rubber parts of mechanical equipment.

The substation buildings containing ESB & MV switch rooms etc would contain a limited fire load. All transformers will be located externally. Therefore, the fuel load and combustibility of the inverter units and other buildings would be considered to be relatively low.

4.2.3 Identify Sources of Oxygen

The primary source of oxygen in this facility is that which is contained in the internal atmosphere within the containers. This is supplied through the container ventilation system and would not be considered to be above or below the concentration of oxygen normally found in air.

Additional sources of oxygen can be found in materials used or stored in premises such as:

- some chemicals (oxidising materials), which can provide a fire with additional oxygen and so help it burn. These chemicals should be identified on their container (and Control of Substances Hazardous to Health data sheet) by the manufacturer or supplier who can advise as to their safe use and storage

- oxygen supplies from cylinder storage and piped systems, e.g. oxygen used in welding processes; and

- pyrotechnics (fireworks), which contain oxidising materials and need to be treated with great care

It is not considered that the above would be present in any quantity likely to present a specific fire risk within the BESS Facility.

4.3 STEP 2 - IDENTIFICATION OF PEOPLE AT RISK IN THE BUILDING

4.3.1 Staff

The facility is to be mostly unmanned other than for regular inspection and maintenance duties. This will generally be carried out by a small number of RWE Renewables Ireland Ltd employees who will be familiar and trained in all site-specific fire safety issues and procedures. Occasional large-scale maintenance operations may require higher numbers of staff to be located in the facility however all staff will be required to undergo a site induction and be provided with the appropriate site safety and fire safety information.

Staff numbers have been confirmed as follows:

- Construction: 20 persons.
- Normal Operation: 1-2 persons.
- Preventative Maintenance: 1-2 persons.
- Reactive Maintenance: 1-2 persons.

Maintenance of the Substation will comprise of the following activities:

- Supplementary scrub and hedgerow cutting if and where necessary.
- Maintenance of drainage features.
- Replacement of any damaged electrical components (rare) and servicing visits to ensure that all electrical infrastructure is working properly (typically twice a year).

The operational phase of the development is anticipated to have negligible trip generation potential with maintenance only deployed by LGV if the facility is performing sub-optimally and for monthly maintenance, with additional visits required to attend to remedial issues when necessary. In addition to maintenance visits, the batteries when in operation will be visually inspected twice a year. The operational access point will use the same entrance to the site as during the construction period.

Maintenance of the battery facility will comprise of the following activities:

- Reading of the electricity meter; and
- Replacement of any damaged electrical components (rare) and servicing visits to ensure that all electrical infrastructure is working properly (typically twice a year).

As there will be no waste produced during the operational phase of the battery facility, no on-site waste storage or waste collection is required during the operational phase.

4.3.2 Fire Fighting Personnel

There will be close liaison with the fire services pre the facility becoming Operational with a site visit being arranged and a Pre-Incident Plan (PIP) to be devised subsequent to same. Through the PIP process, personnel will be made familiar with the plant and processes before an incident occurs.

Emergency procedures will be determined with the site staff and the fire service. The procedures should be documented for reference both during an incident and during training sessions.

The RWE Renewables Ireland Ltd 'Authorised Person' should be consulted before any entry to the facility is attempted.

4.4 STEP 3 – EVALUATE THE RISK

4.4.1 Evaluate the risk of a fire occurring

The following are potential causes of fire in the BESS facility:

- Risk 1: Poor electrical installations / faulty electrical equipment. The primary cause of fire in buildings is as a result of electrical faults in equipment due to either poor installation, inappropriate use or inadequate maintenance.
- Risk 2: Overheating Lithium-Ion battery cell causing a fire in a rack.
- Risk 3: Fire involving a Transformer.
- Risk 4: Fire involving a Substation.

4.4.2 Evaluate the risk to people.

In the event of a fire the following risks to people may be present:

- Occupants within any occupiable structures may be exposed to risks from fire, smoke and potentially explosion.
- Occupants in the facility but not within an occupiable structure may be exposed to risks from a container fire and the potential for spread of the fire to more than the container of fire origin. The containers are described as fireproof and made from non-combustible materials therefore the risk of horizontal fire spread could be considered to be low however, the reactive nature of the Li-Ion battery cells could increase this risk to medium.
- The battery storage containers are proposed to be located away from the other structures on the site therefore, in the very unlikely event of the failure of the monitoring systems and the fire detection and suppression systems, the risk of spread of fire from container to container and also from container to adjacent (non-container) structures would be considered as low.
- Persons may be exposed to the effects of toxic gasses released from the burning Lithium-Ion battery cells.
    - The following are to be considered as risks to humans:
        - Contact with battery electrolyte may be irritating to skin, eyes and mucous membranes.
        - Fire will produce irritating, corrosive and/or toxic gases.
        - Burning batteries may produce toxic hydrogen fluoride gas.
        - Fumes may cause dizziness or suffocation.
- DC arcs can be difficult to extinguish and pose a risk to fire-fighters attempting to suppress the fire. Arc flash labels should be present on all devices where arc flashes may occur.
- If a fire damages the DC cables, for example by burning off insulation, then there will be risk of electric shock from the exposed DC conductors, in particular to fire-fighters.
- Not all Fire fighters are not used to dealing with DC and may not be familiar with specific techniques in dealing with such fires.
- The battery equipment contains stored electrical energy, even when disconnected. As such, care should be taken to not directly touch the battery equipment during the event or during overhaul operations. A subject matter expert should advise on how to handle stranded energy remaining in any of the damaged battery equipment.
- If the structure is metal, or steel frame, then an accidental short may result in parts of the module being “live”.
- Lithium-ion batteries, under normal operating conditions, do not produce any gases. However, under abnormal failure conditions, such batteries can rapidly evolve flammable/explosive gases.
- The Fire Suppression Agent used at this facility is Novec 1230. When discharged in the event of a fire, the by products are known to cause eye and skin irritation and potential toxicity risks.
- While clean agents are proven highly effective at extinguishing non-battery fires, explosive conditions may still develop when fire is not present as batteries continue to off-gas until cool.

4.4.3 Evaluate the risk to the environment.

In the event of a fire the following risks to the environment may be present:

- Release of toxic smoke into the air.

- Concerns have been raised regarding the presence of heavy metals within some industrial level electrical equipment, and whether such metals can be or are released during a fire. Therefore, while such risks are considered to be low, caution is needed in dealing with fire damaged components and residues since a variety of heavy metals and other toxins may be present.

- Battery electrolyte spillage will not reach ground or water level as it will be contained within the container.

4.5 STEP 3 - REMOVE OR REDUCE THE HAZARD

The following hazards have been identified:

4.5.1 Sources of Ignition:

Hazard 1: Poor electrical installations / faulty electrical equipment.

Mitigating measure:

All electrical equipment will be new and installed to all relevant standards by appropriately trained personnel. Procedures must be put in place to ensure all equipment is subject to regular testing and maintenance. Ensure that the premises and any equipment provided in connection with firefighting, fire detection and warning, or emergency escape routes and exits are covered by a suitable system of maintenance and are maintained by a competent person in an efficient state, in efficient working order and in good repair. All electrical installations will comply with the National Rules for Electrical Installations (IS: 10101).

Hazard 2: Overheating Lithium-Ion battery cell.

The risk is that the typical Li-ion battery fire growth can involve a potential explosion/ejection that involves a rapid temperature increase within the battery, potentially causing damage to adjacent battery cells thus allowing the fire to develop within a container.

The consequence of this would be a full container fire with the potential to spread to multiple containers within the facility.

Mitigating measure:

The facility is protected with a SCADA (Supervisory Control & Data Acquisition) multiple layer safety system that provides monitoring and control of all aspects of the battery storage system from individual battery cell up to full system control.

The system monitors key components in the system and ensures operation within set parameters, with access to voltage, current, temperature, and multiple types of fault detection. Operation outside of normal conditions for voltage, current and temperature will cause the system to fold back power or under severe conditions cease operation immediately to prevent hazard.

SCADA systems would typically have some, or all, of the following features:

1. Battery Management System (BMS) within each individual storage rack
    - Continuous monitoring of each rack
    - Communication with the main Control Rack to alert/isolate if unsafe conditions are detected.
    - Monitoring of:
        - voltage,
        - current and
        - temperature

    to ensure all are within pre-set safe operational ranges. Readings outside these ranges will trigger action at either cell, module, rack, container or system level depending on severity.

2. Each rack has independent air flow control to maintain proper air temperature for the batteries in each rack to prevent overheating of individual battery cells that could potentially lead to a fire event.

Integrated on-board fire detection and suppression system that will automatically activate upon detection of smoke and heat will also be included in each container.

Suppression systems may be activated by either smoke or thermal detection within the containers. The suppression system uses a gaseous, clean firefighting agent (Novec 1230) that removes heat from the fire thus suppressing fire growth. The concentration of the fire suppression agents were specified specifically to combat fires involving lithium ion battery cells.

4.5.2 Sources of Fuel:

Hazard 1: Plastics & rubber from electrical equipment.

Mitigating measure:
Equipment is largely of metal construction however small quantities of plastic and rubber will be present. It is not considered that the quantities would be present in quantities that would be considered a high fire risk.

Hazard 2: Lithium-Ion battery cells

Mitigating measure:
Individual battery cells are contained in metal casings and groups of cells are contained in protective metal cased modules. The facility has a full monitoring, control and suppression system installed as detailed above.

Hazard 3: Flammable chemicals in Battery Storage containers, Inverter Stations and other structures.

Mitigating measure:
The chemicals contained within the Battery Storage containers and Inverter Stations are common to all such buildings. These containers and buildings are subject to the usual construction, maintenance and safety procedures that apply to all buildings that deal with the production of electricity.

The ancillary transformers in the battery storage containers are Dry Type transformers containing no volatile liquids and pose a low fire or explosion risk. The battery transformers are oil filled transformers (ONAN – Oil Natural – Air Natural) where the oil temperature is controlled by convection of heat to the external environment.

4.5.3 Sources of Oxygen:

Hazard 1: Ventilation system.

Mitigating measure:
The ventilation system and cooling fans will be connected to the fire detection system and will automatically shut off in the event of an alarm activation.

Hazard 2: Atmospheric Oxygen.

Mitigating measure:
The level of atmospheric oxygen would not be above or below the concentration of oxygen normally found in air and would therefore not constitute an above normal level of risk from fire.

4.6 TRANSFORMER SPECIFIC FIRE RISKS

Hazard:

- Electrocution.
- Burning transformers (or oil-filled switch gear) may explode and spray burning oil over a considerable distance.
- Explosive gases including hydrogen, acetylene and methane.
- Transformer may not be bunded leading to fire spread to other transformers.
- Burning transformers may cause ionisation of the air causing electricity to flash from phase to phase, phase to earth or adjacent structures or equipment.
- Residual Charges sufficiently powerful to cause electrocution.
- Highly toxic PCBs (mainly commercial or industrial premises).

Mitigating measure:

- PPE as appropriate.
- Ensure isolation and earthing of the affected transformer.
- Water or foam should **NEVER** be sprayed on any electrical apparatus which has not been declared to be isolated by an authorised person.
- Firefighting attack to be made only when the extinguishing media has been established and there are sufficient stocks to sustain the operation.
- Fire fight from a distance.
- Take advantage of available protection.
- Lay and maintain a foam blanket around the transformer, if not bunded (to contain burning oil). Note - Transformers will be bunded.
- If PCBs released contact EPA.
- Operation of local fixed installation system, if not automatic.

4.7 SUBSTATION SPECIFIC FIRE RISKS

Hazard:

- Electrocution.
- Injured people may carry a residual charge of several thousand volts.

Mitigating measure:

- PPE as appropriate.
- Do **NOT** enter sub-station unless assurance has been received by authorised person from RWE Renewables Ireland Ltd that this can be safely done.

Until such authorisation is given firefighters must **NOT**

- Climb equipment.
- Use ladders.
- Do not direct any jet or spray above ground or beyond any fitted safety screens.
- Water or foam should **NEVER** be sprayed on any electrical apparatus which has not been declared to be isolated by an authorised person.
- Rescue should not be carried out unless assurance has been received by an authorised person from RWE Renewables Ireland Ltd that this can be safely done.

4.8 BESS CONTAINER SPECIFIC FIRE RISK

See Appendix H for a specific fire risk assessment for the BESS containers:

- Risk 1: Fire involving battery cells.
- Risk 2: Non-battery fire in a container.
- Risk 3: Explosive atmosphere in a container.
- Risk 4: Fire external to battery container.

4.9 REMOVE OR REDUCE THE RISK TO PEOPLE & ENVIRONMENT

The risk to staff in the BESS facility is **considered tolerable** as:

- The facility including any occupiable structures is to be fitted with emergency lighting in accordance with IS 3217: 2013 + A1:2017 and I.S. EN 1838: 2013.

- The containers are largely constructed of metal and materials of low combustibility therefore the risk of fire spreading from one structure to another adjacent structure would be considered as low.

- A monitoring system will be in operation at all times to ensure all equipment is operating within appropriate parameters.

- A fire detection system and suppression system is to be installed within each container should the monitoring system fail to address any issues. The alarm system is to be installed in accordance with I.S 3218: 2013+A1:2019 Code of practice for fire detection and alarm systems for buildings – system design, installation, commissioning, servicing and maintenance & amendment 1:2019.

- All staff will receive appropriate training regarding fire safety issues and procedures.

The risk to residents in surrounding areas is **considered tolerable** as:

- A monitoring system will be in operation at all times to ensure all equipment is operating within appropriate parameters.

- A fire detection and suppression system is to be installed in each Battery Storage Container should the monitoring system fail to address any issues

The risk to attending fire service personnel is **considered tolerable** as:

- An emergency action plan will be drawn up involving the local fire service and any other relevant bodies. These members of the local authority and fire service will be brought on site and given an induction on all relevant systems with respect to fires involving Lithium-Ion battery units, disconnecting from the grid, associated DC fire risks and evacuation procedures.

- The fire service will not be expected to enter the facility or to attempt to suppress a fire until such time as all equipment has been electrically isolated by an authorised person from RWE Renewables.

- The RWE Renewable 'Authorised Person' should be consulted before any entry to the facility is attempted.

The risk to the local environment and wildlife habitat **are considered tolerable** as:

- The remote and onsite monitoring systems will reduce the likelihood of a fire occurring within the facility and the fire detection & suppression systems will restrict the growth and development of a fire to the container / structure of origin. The overall risk of fire ignition within the facility is considered low therefore the likelihood of the resulting release of toxic smoke or other harmful by products of a fire in an industrial electrical facility is also considered as low.

- The design and layout of the battery storage unit ensures that in the extremely rare instance of a fire occurring within an individual container, the internal fire suppression technology will ensure the isolation of the fire within the fireproof container. Firewater or extinguished contaminates will be contained within the specific container that can be removed and disposed of at a later stage.

- Due to the nature of the facility, i.e. high voltage electricity storage, traditional firefighting methods, i.e. fire hose and water, would not be applied in the Substation facility therefore the issue of firefighting water runoff would not be considered an issue. Some firefighting water may be used around the boundaries of the site to prevent fire spread to adjacent vegetation however, this water would not have come into contact with the potential hazards contained within the electrical containers or structures and would therefore not pose a hazard to the local environment.

4.10 MONITORING, DETECTION, SUPPRESSION & WARNING

4.10.1 Monitoring

The BESS facility will be protected with a SCADA (supervisory control & data acquisition) multiple layer safety system that will provide monitoring and control of all aspects of the facility including the battery storage system from individual battery cell up to full system control.

The site will be monitored 24x7 by the Support Team. When an alarm is detected, the following will happen:

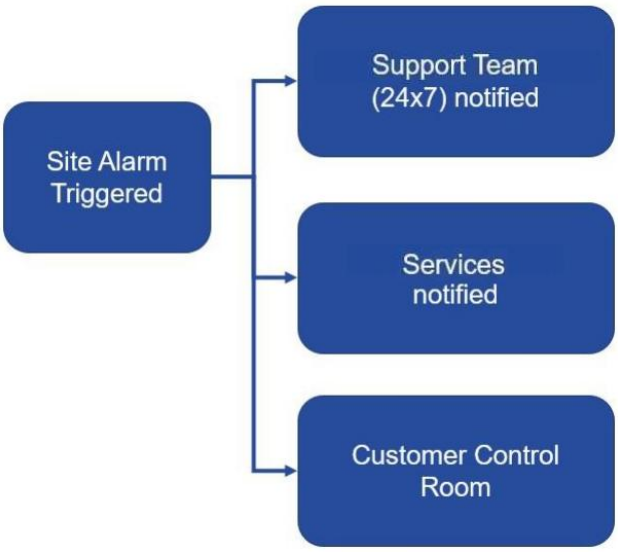

Figure 6: Cause & Effect

A SCADA system monitors key components in the system and ensures operation within set parameters, with access to voltage, current, temperature, and multiple types of fault detection. Operation outside of normal conditions for voltage, current and temperature will cause the system to fold back power or under severe conditions cease operation immediately to prevent hazard.

Each storage rack will have an individual Battery Management System (BMS) that will provide continuous monitoring of each rack and will communicate with the main Control Rack to alert/isolate if unsafe conditions are detected. The BMS monitors voltage, current and temperature to ensure all are within pre-set safe operational ranges. Readings outside these ranges will trigger action at either cell, module, rack, container or system level depending on severity.

Each rack has independent air flow control to maintain proper air temperature for the batteries in each rack to prevent overheating of individual battery cells that could potentially lead to a fire event.

Each zone (group of battery racks and a Control Rack) has a DC isolation switch for manual disconnect of the zone.

4.10.2 Detection & Suppression

The fire detection and alarm system will comply with I.S 3218: 2013+A1:2019 Code of practice for fire detection and alarm systems for buildings – system design, installation, commissioning, servicing and maintenance & amendment 1:2019.

Each Battery container is equipped with smoke detectors, heat detection and a suppression system, addressed to a fire alarm panel. In addition, each container has an emergency stop button and a manual override for the deployment of the NOVEC system. Further, the controls container hosts a sitewide emergency stop as well as status on each system through indicator lights. Details of this system are shown below.

In the event of failure of the safety measures in the system, an integrated on-board fire detection and suppression system that will automatically activate upon detection of smoke and heat will be provided in each container. The system contains optical smoke sensors heat sensors to detect the presence of a fire.

The suppression system operates on a double knock principle and uses a gaseous, clean firefighting agent (Sigma XT) that removes heat from the fire thus suppressing fire growth. The concentration of the fire suppression agents has been determined specifically to combat fires involving lithium-ion battery cells.

The fire extinguishing system will operate on a double knock principle, being fully automatic with a manual override and manual discharge facility.

The Siemens Fire Panels used are FC724 in each OCTE, one FC722 as Master Fire Panel, incorporating the following:

1. Twin red “Fires” indicating LED’s.
2. Audible alarm and twin amber “Fault” indicating LED’s.
3. Twin “Auto / Manual” indicating LED’s.
4. Audible alarm and twin red gas release imminent LED’s per protected area
5. Audible alarm and twin red gas released LED’s per protected area. Gas released shall be signalled from pressure switches within the cylinder assemblies.
6. “Auto/Manual” key switch per protected zone
7. “Gas Disable” switch per protected zone.
8. Manually operated “Gas Release” facility

The Stat-X System is configured to discharge upon the receipt of a signal from the Siemens suppressant control panel. On the receipt of the signal from the control panel the solenoid will energise and release the suppressant held within Stat-X cylinders to flood the protected area with the correct design concentration of suppressant.

The following is the procedure for activation of the fire suppression system:

Each Container will be provided with an independent, thermally activated suppression system containing an auxiliary contact to provide information to the fire panel upon release.

4.10.3 Battery Energy Storage System Emergency Stop System

An Emergency Stop System will be installed around the site with Emergency Stop Buttons located inside and outside of the Control House. The Balance of Plant is described below:

Site Control Stop

The Control House has one Fast-Stop push button in the Control Room on site. Pushing the Site E-Stop does the following:

- opens the AC Disconnect on the AC/DC inverters (Power Conversion Systems)
- opens contactors in each Battery Rack Protection Module
- opens the MV breaker of each core

Figure 7: Typical Stop button

Container Control Stop
The containers will be provided with Fast Stop Pushbuttons.

4.10.4 General Lithium-Ion Safety

The battery energy storage system should incorporate the following general Li-ion safety features:

- Functional Safety System
  - All battery management systems (BMS) can detect problems using cell and module voltage measurements and select temperature measurements within the batteries. Automatic disconnect of the batteries will occur if any unusual parameters are measured.

- Electrical Abuse Prevention
  - The BMS maintains strict control of charging and discharging of the batteries. Voltage, current, temperature and state of charge are all measured and controlled to ensure safe charging and discharging.

- Physical Abuse Prevention
  - Energy storage racks are designed without the ultra-high space limitations of a mobile phone. Mechanical stability is designed into every module.

- Thermal Abuse Prevention
  - Sophisticated thermal management systems maintain cells at optimal temperature and will automatically trigger foldback of power if safe temperature ranges are exceeded.

- Automatic Fire Detection and Suppression
  - Built-in automated system will react and extinguish incipient fires before they can develop.

4.11 FIRE BRIGADE SITE FAMILIARISATION AND EXERCISES

Consultation with Tipperary Fire Service will be initiated at their earliest possible convenience to ensure that both parties are fully aware of the risks associated with firefighting in a BESS facility and the limitations and assumptions of both parties in the event of a fire in the facility.

Prior to commissioning the facility, operators should offer a familiarisation visit and explanation of emergency service procedures to Tipperary Fire Service and other emergency services. Information in relation to the specific hazards and fire suppression requirements of the site should be provided during this visit.

4.12 FIREFIGHTING WATER SUPPLY

Given the level of monitoring, detection and suppression contained within the various elements of the facility, the risk of fire ignition in the facility is considered as low. In the event of a fire ignition within the facility, traditional firefighting methods, i.e. water based, would not be suitable for fighting a fire in a BESS facility.

It is proposed to provide an underground tank onsite for firefighting water supply.

Firefighting activities at the facility would likely be limited to prevention of fire spread beyond the boundaries of the facility.

4.13 PROVISION OF EMERGENCY INFORMATION

Emergency information signs will be provided at entry to the site, an emergency information book will be stored onsite consisting of:

- A description of the premises, its infrastructure and operations.
- Site plans that include the layout of the entire site, including buildings, internal roads, infrastructure, fire protection systems and equipment, dangerous goods storage areas, drains and isolation valves, neighbours and the direction of north.
- Up-to-date contact details for site personnel, regulatory authorities and site neighbours.
- A manifest of dangerous goods.
- Safety data sheets for all dangerous goods stored on-site.
- Procedures for management of emergencies, including evacuation, containment of spills and leaks, and fire procedures.

4.14 TRAINING FOR FACILITY STAFF

Staff operating and/or working in this facility are required to be trained and aware of:

- Site and operational risks and hazards.
- Site emergency management roles, responsibilities and arrangements.
- The use of any firefighting equipment where there is an expectation for staff to undertake first aid firefighting.
- The storage, handling and emergency procedures for dangerous goods on-site.
- The location of first-aid facilities and application of first aid equipment.

4.15 ESCAPE ROUTES

Assembly points for occupants within the facility will be identified as part of the fire safety and evacuation plan.

4.16 EMERGENCY LIGHTING

The facility is to be fitted with emergency lighting in accordance with IS 3217: 2023 to adequately indicate and illuminate all escape routes, and so that all firefighting equipment and call points can be easily seen. The emergency lighting signs will be maintained in all windowless accommodation.

4.17 SIGNS & NOTICES

Exit signage and safety notice signage will be provided in accordance with BS 5499: Part 4, 2013 throughout the facility and within each occupiable structure to identify clearly the location and direction of the means of escape.

In addition, signs will be provided to indicate the position of all first aid firefighting equipment and fire alarm call points.

- Exit signs shall be provided throughout the facility indicating exit routes.
- Appropriate signage shall be installed within the containers to identify areas of high risk or where hazards are present.
- An Emergency Action Code card (if applicable) and signage shall be provided in appropriate locations to provide information to Fire Service personnel on the appropriate actions to be taken to fight the fire.

4.18 TESTING AND MAINTENANCE

New fire safety systems should be installed by a competent person. Equipment, devices or facilities that are provided in the facility for the safety of people, such as fire alarms, fire extinguishers, lighting, signs, fire exits and fire doors, must be kept in effective working order. Regular checks, periodic servicing and maintenance shall be carried out and any defects are put right as quickly as possible. All maintenance shall be carried out by a competent person. Where contractors are used, third party certification may be required to demonstrate a reasonable assurance of quality of work and competence can be achieved.

In addition to the above please note the following checks which will be put in place as appropriate. As the site will be generally unmanned, where daily or weekly checks are specified these checks should be carried out during the times when personnel are on site and are to be incorporated into the monthly tests and checks as appropriate:

- **Daily Checks**
  - Remove bolts, padlocks and security devices from fire exits ensure that doors on escape routes swing freely and close fully,
  - Check escape routes to ensure they are clear from obstructions and combustible materials, and in a good state of repair.
  - Check the fire alarm panel to ensure the system is active and fully operational.
  - Where practicable, visually check that emergency lighting units are in good repair and apparently working.
  - Check that all safety signs and notices are legible.
- **Weekly Tests and Checks**
  - Test fire detection and warning systems and manually operated warning devices weekly following the manufacturer's or installer's instructions.
  - Check the batteries of safety torches.
  - Check that fire extinguishers and hose reels are correctly located and in apparent working order.
- **Monthly Tests and Checks**
  - Test all emergency lighting systems and safety torches to make sure they have enough charge and illumination according to the manufacturer's or supplier's instructions. This should be at an appropriate time when, following the test, they will not be immediately required.
  - Check that escape doors are in good working order and closing correctly and that the frames and seals are intact.
- **Six-monthly Tests and Checks**
  - A competent person will test and maintain the fire-detection and warning system as per the requirements of IS 3218 2013.
- **Annual Tests and Checks**
  - The emergency lighting and all firefighting equipment, fire alarms and suppression systems will be tested and maintained by a competent person.

4.19 STEP 4 - RECORD, PLAN, INFORM, INSTRUCT & TRAIN

4.19.1 Record the Significant Findings & Actions Taken

As per the requirements of this risk assessment RWE Renewables Ireland Ltd will record the significant findings of this fire risk assessment and the actions that will be taken to address any findings of the risk assessment when constructed.

Significant findings should include details of:

- The fire hazards you have identified.
- The actions you have taken or will take to remove or reduce the chance of a fire occurring (preventive measures)
- Persons who may be at risk, particularly those especially at risk
- The actions you have taken or will take to reduce the risk to people from the spread of fire and smoke (protective measures)
- The actions people need to take in case of fire, including details of any persons nominated to carry out a particular function (your emergency plan); and
- The information, instruction and training you have identified that people need and how it will be given.

You may also wish to record discussions you have had with staff or staff representatives (including trade unions).

In more complex premises, it is best to keep a dedicated record including details of significant findings, any action taken, a copy of the emergency plan, maintenance of fire-protection equipment and training.

You must be able to satisfy the enforcing authority, if called upon to do so, that you have carried out a suitable and sufficient fire risk assessment. Keeping records will help you do this and will also form the basis of your subsequent reviews. If you keep records, you do not need to record all the details, only those that are significant and the action you have taken.

4.19.2 Emergency Management Plan

An emergency management plan is required to help deal with any fire situation. The purpose of an emergency management plan is to ensure that the people in your facility know what to do if there is a fire and that the facility can be safely evacuated. If you or your organisation employ five or more people, then details of your emergency plan must be recorded. Even if it is not required, it is good practice to keep a record.

Your emergency plan should be based on the outcome of your Fire Risk Assessment and be available for your employees, their representatives (where appointed) and the enforcing authority.
An emergency evacuation plan will be provided for the containers and substation building and will contain details of immediate actions upon detection of a fire (manually or automatically), container evacuation procedure, system shutdown procedures (if manual required), fire service notification procedures,location of Fire Assembly Point should site be occupied by more than one person.

An Emergency Action Plan for a major incident should be drawn up in consultation with the local Fire Service, the HAS and any other relevant local authorities. This should include consideration for incidents involving a manned facility and an unmanned facility.

The emergency management plan is to include:

- Emergency prevention, preparedness and mitigation activities.
- Activities for preparing for, and prevention of emergencies (e.g. training and maintenance).

- Control and coordination arrangements for emergency response (e.g. evacuation procedures, emergency assembly areas and procedures for response to hazards).
- The agreed roles and responsibilities of on-site personnel (e.g. equipment isolation, fire brigade liaison, evacuation management).
- Facility description, including infrastructure details, activities and operating hours.
- A site plan containing infrastructure (BESS containers, inverters, generators etc), site entrances, exits and internal roads; fire services (water tanks, fire hydrants, fire hose reels); and neighbouring properties.
- Up-to-date contact details of site personnel and any relevant off-site personnel who could provide technical support during an emergency.
- A manifest of dangerous goods if required.
- Emergency procedures for credible hazards and risks, including fire.
- Procedures for notifying the emergency services.
- Procedures for evacuating personnel.
- A fire management plan includes all of the fire mitigation measures that will be implemented to reduce the risk of fire, established through a risk management process. A fire management plan may specifically address:
    - Risk management measures specific to fire (as above).
    - A fuel (vegetation) reduction and maintenance plan/procedure.

The fire management plan should form part of the emergency management plan; where the hazards/risks and controls are identified and implemented to ensure fire risk is managed so far as is reasonably practicable, and the activities associated with fuel reduction and maintenance are captured in the organisation's standard operating procedures.

4.19.3 Emergency Shutdown

In the case of a fire event the system will send an alarm signal through the Energy Management System, which will notify the 24/7 monitoring team, and the system will automatically shut down to reach a safe state. There will also be two manual shut downs at two levels:

1) Locally by pressing the emergency stop button (LOCAL EMERGENCY STOP) located inside and at each entrance of the container concerned (in this case, it will be the only one to be disconnected),
2) or globally by pressing another emergency stop push button (GLOBAL EMERGENCY STOP).

These emergency stop buttons disconnect the containers from the medium voltage supply, preventing risks of electrical shock, as well as disconnection of the inverters. The global stop button disconnects all of the containers.

As the batteries will be disconnected directly there is no discharging of the system. The system will be disconnected at its then existing state of charge (SoC). In general, the batteries will be operated on average below a SoC of 80% which results in a reduced risk compared to them being at 100% SoC.

4.19.4 Waste Disposal Plan

A waste disposal plan shall also be developed to consider how toxic by-products resulting from a fire incident should be disposed of.

4.20 INFORM, INSTRUCT, CO-OPERATE AND CO-ORDINATE

RWE Renewables Ireland Ltd must give clear and relevant information and appropriate instructions to all people working in the facility, such as contractors, about how to prevent fires and what they should do in the event of a fire.

4.20.1 Information and instruction

All staff should be given information and instruction as soon as possible after they are appointed and regularly after that. Make sure you include staff who work outside normal working hours, such as cleaners or maintenance staff.

All other relevant persons should be given information about the fire safety arrangements as soon as possible, e.g. contractors when they start work.

The information and instructions provided must be in a form that can be used and understood. The information and instruction you give should be based on your emergency plan and must include:

• The significant findings from your fire risk assessment.

• The measures that you have put in place to reduce the risk.

• What staff should do if there is a fire.

• The identity of people you have nominated with responsibilities for fire safety; and

• Any special arrangements for serious and imminent danger to persons from fire.

Information & Instruction should include showing staff the fire-protection arrangements, including the designated escape routes, the location and operation of the fire-warning system and any other fire-safety equipment provided, such as fire extinguishers. Fire action notices can complement this information and, where used, should be posted in prominent locations.

Due to the level of the consequences of a fire in an Inverter Storage container or substation building, it must be ensured that written instructions are given to people who have been nominated to carry out a designated safety task, such as calling the fire and rescue service or checking that exit doors are available for use at the start of each working day.

4.20.2 Co-operation and Co-ordination

Any third-party contractors or maintenance contractors will be inducted to site and will be made aware of all safety and fire safety procedures.

Close co-operation between RWE Renewables Ireland Ltd and any relevant party such as external contractors, the fire brigade and the relevant local authority in the event of a fire. Information to be co-ordinated will include site specific information, fire detection and suppression system information and local area evacuation plan (if required) should a fire occur that is not contained by the fire suppression system.

4.20.3 Fire safety training

RWE Renewables must provide adequate fire safety training for all staff and temporary visitors/contractors. The type of training should be specific to the requirements for a grid Stabilisation facility and should:

- Take account of the findings of the fire risk assessment.
- Explain site specific emergency procedures.
- Take account of the work activity and explain the duties and responsibilities of staff.
- Take place during normal working hours and be repeated periodically where appropriate.

- Be easily understandable by staff and other people who may be present.
- Be tested by fire drills.

RWE Renewables Ireland Ltd developed staff training should include the following:

- What to do on discovering a fire.
- How to raise the alarm and what happens then.
- What to do upon hearing the fire alarm.
- The procedures for alerting contractors and visitors including, where appropriate, directing them to exits.
- The arrangements for calling the fire and rescue service.
- The evacuation procedures for all staff to reach an assembly point at a place of total safety.
- The location and, when appropriate, the use of firefighting equipment.
- Where appropriate, how to stop machines and processes and isolate power supplies in the event of a fire.
- The safe use of and risks from storing or working with highly flammable and explosive substances.
- The importance of general fire safety, which includes good housekeeping.

4.21 DOCUMENTATION

Generally, all relevant documents should be held in the **Fire Safety Manual** for the facility. Day to day log sheets that are filled out by security/service staff may, for convenience, be kept in a folder in a control room or other designated location, but their whereabouts should be recorded in the Fire Safety Manual.

The four most important documents within the manual will be:

- The Fire Strategy/Fire Safety Certificate documentation.
- The Fire Management Plan or Evacuation Plan.
- Logbook.
- Fire Risk Assessment.

4.21.1 Fire Strategy

The Fire Strategy will include:

- An assessment of the number of people likely to be in the building and the required capacity of the escape routes.
- The operation of the fire alarm system – this should incorporate a simple cause and effect table.
- The operation of other fire safety systems e.g. suppression – this should incorporate a simple cause and effect table.
- The access facilities provided for the fire service including the location of the nearest water supplies.

4.21.2 Fire Evacuation Plan

The aim of the evacuation plan is to ensure that in the event of fire, the workforce (including contractors and casual employees) is sufficiently familiar with the action they should take. This is to allow the occupants to be safely evacuated to a location where they will not be in danger. The employer is responsible for preparing the plan.

The plan includes the action to be taken by staff in the event of fire, the evacuation procedure, and the arrangements for calling the fire brigade. Due to the toxic nature of smoke produced from a fire involving an electricity generating facility an evacuation plan may be required for occupants of the surrounding area.

Notices giving clear and concise instructions of the routine to be followed in case of fire must be prominently displayed. The notice includes the method of raising an alarm in the case of fire and the location of an assembly point to which staff should report to when escaping from the facility.
All people regularly employed in a workplace should be aware of the risk of fire, particularly if they work with hot processes or use highly flammable substances. They also need to know the action to be taken in case of fire, including: -

- How to warn others of the fire.
- The location and use of escape routes.
- Assisting or directing visitors or members of the public from the workplace.
- The location of a nominated assembly point(s).

The Fire Management/Evacuation Plan should be a formal, concise document that will be easily understood by all employees. It will be closely linked to the fire alarm cause and effect table. Each member of RWE Renewables Ireland Ltd staff within the building should be familiar with their role as defined by the evacuation plan.

4.21.3 Fire Safety Log Book

This should be used to record all fire safety tests that are carried out by both RWE Renewables Ireland Ltd personnel and outside contractors.

Records should include:

- Automatic Fire Detection and Alarm.
- Emergency lighting.
- Active fire suppression systems.
- Electrical installations.
- Portable Appliance Test's (PAT's).
- Fire Extinguishers.
- Fire incident records.
- Staff training.
- Escape route checks.

The Log Book should include the frequency and method of testing i.e. Annually/Outside contractor or Weekly/progressively from individual fire alarm call point by staff/security.

The Log Book should be held in the Fire Safety Manual and should be completed and reviewed to ensure all records are up to date. If any records for testing and maintenance are kept in another location, this should be stated in the Fire Safety Manual.

4.21.4 Fire Risk Assessment

The latest copy of the BESS Facility Fire Risk Assessment should be kept in the fire safety manual. The results of the assessment and specifically a record of any action taken should also be kept with the Fire Risk Assessment so that it is available for inspection by officers from Tipperary Fire Service or the relevant local authority.

4.22 STEP 5 - REVIEW OF FIRE RISK ASSESSMENT

One of the most important aspects of the Fire Risk Assessment is a review of the fire safety documentation kept on the premises. This must be immediately available for scrutiny by the enforcing authority.

The fire safety risk assessment should be repeated: -

- At regular intervals** to: -
- Ensure continued compliance and good practice.
- Ensure previously identified bad practice and breaches of the Fire Services Act have been resolved.
- Where there has been a change in working practices.
- Following any fire.
- Where there is a significant change in the structure or use of the building.
- Where there have been significant changes linked to the business cycle.

** We recommend that in order to comply with legislation, the assessment be repeated at least annually.

5.0 FINDINGS AND THE ACTION PLAN

The findings of the fire risk assessment have to be formally recorded. The recorded information should include the following: -

- The date the assessment was made.
- The person completing the assessment.
- The person to whom the findings are to be reported.
- The hazards that have been identified.
- The name, location and occupation of any staff member at risk.
- The risks that have been identified.
- The mitigating factors of the risks.
- The further actions needed to be taken (including by whom and when).
- Any areas that need to be reviewed prior to next fire risk assessment.
- The conclusions arising from the assessment.

6.0 AUDIT

A biennial audit of fire safety procedures for the building should be carried out to:

- Ensure the provisions of this fire safety manual have been implemented;
- Review equipment to ensure that maintenance procedures are being followed;
- Check that the as-built drawings have been kept up-to-date and reflect any changes to compartmentation, escape routes, etc.

As a result of this audit the safety procedures and Fire Strategy may need to be amended to take account of the following:

- Experience and knowledge gained over the previous 2-year period;
- Changes in personnel
- Changes in operations or use of parts of the building
- The findings and recommendations of the yearly (or most recent) Fire Risk Assessment.

The Fire Safety Management Strategy will cross reference to the Health and Safety Policy for the Ballincor Battery Energy Storage System.

7.0 CONCLUSION

While the risks associated with a fire involving Lithium-Ion battery modules and associated electrical equipment cannot be completely eliminated, the level of monitoring and controls proposed for this facility provide a level of safety that reduces the potential for the outbreak of a fire to a level that would be considered to be as **tolerable** as is reasonably practicable.

Should the monitoring and control system fail to detect and avoid ignition of one of the Li-Ion battery cells the fire detection and suppression system installed in each container will provide the maximum level of protection against fire growth and escalation to a multiple battery cell fire.

The design and construction features of the individual containers allow for quick egress to a place of relative safety.
These features include multiple exits, short travel distances, emergency lighting and construction from products of limited combustibility.

In the event of an electrical anomaly within the BESS containers, Inverter Stations or other structures, the control systems detailed throughout this Fire Risk Assessment will provide measures to reduce the chance of fire ignition. Should a fire develop within a structure, the fireproof construction and limited combustibility of the structure and its contents should reduce the risk of fire spread to adjacent units, surrounding vegetation or adjacent properties.

Due to the probable low fire growth and spread, any firefighting activities required to control a fire would likely cause minimal environmental damage through firefighting water runoff into the local ecological and water systems.

The following standalone building will achieve full compliance with the relevant sections of Technical Guidance Document B 2024 - Fire Safety – Volume 1 Buildings other than Dwelling Houses.

- Switchgear Room

It is our opinion, based on the information and advice provided by our client for the purposes of carrying out this Fire Risk Assessment, that Ballincor BESS facility would be considered a **tolerable** fire risk. This will be dependent on all measures including training, controls & monitoring and the fire detection system, being implemented, installed and maintained to the standards detailed in this Fire Risk Assessment and to the manufacturer and EirGrid specific guidelines.

8.0 INFORMATION, LIMITATIONS AND ASSUMPTIONS

The information limitations and assumptions used in the preparation of this report are noted below:

This report is based on information and documentation provided by RWE Renewables Ireland Ltd.

Other Limitations

Complying with the recommendations of this report will not guarantee that a fire will not occur.

The design of mechanical and electrical systems such as fire alarm and suppression system are a specialist area. Fire Strategy recommendations are given in this report; however, the design and specifications must be developed at the appropriate stage in consultation with the specialist designers of these systems.

This report has been prepared for the sole benefit, use and information of RWE Renewables Ireland Ltd and the liability of Jeremy Gardner Associates Ireland Ltd. t/a Jensen Hughes, its directors and employees in respect of the information contained in the report will not extend to any third party.

APPENDIX A – SITE PLAN

ISO A1 594mm x 841mm

Project Management Initials:
Designer: JC
Checked: DB
Approved: DB

38.5m
5m
LC
LM
DU/DE
VT
CB
CT/VT
3m
2m
2m
2m
FCL 46.35 m
FIRE WALL
SUMP PUMP
5A
NER
TANK
LM
RG
MH
IPP Compound Palisade Fence Tie in Point.
121.9m
Palisade Fence
Overflow Parking/ Laydown Areas
FOR SUBSTATION TIE IN DETAILS SEE DRAWING 05867-DR-501
82m
10.7m
3.5m
RWGT
AJ
3.8m
BESS Switchgear Building
SWITCH GEAR ROOM
CONTROL ROOM
OFFICE
SCADA ROOM
WC
HALL
MESSROOM
STOREROOM
20.1m
RWHT
Customer MV Switchgear Building
FFL 46.50 m
SWITCH GEAR ROOM
CONTROL ROOM
OFFICE
STOREROOM
HALL
MESSROOM
WC
20.1m
FCL 46.35 m
MATCH IN EXISTING
FWHT
EARTHING/AUX. TRANSFORMERS
Space to allow future grid support equipment
LC
Soakaway
Oil Seperation
Waste Mgmt. Area
COSHH Container
Auxiliary Transformer
Waste Mgmt Area
COSHH Container
Storage Containers
1
2
FCL 46.35 m
LC
Palisade Fence
36.5m
IPP Compound Palisade Fence Tie in Point.
13.2m
Palisade Fence
2.5m
BESS COMPOUND
Palisade Fence
85.9m
Palisade Fence
122.4m
ACCESS ROAD
Farm Access Track (Unsurfaced)
P
FCL 46.35 m
LC

BESS COMPOUND LAYOUT PLAN

Scale: 1:250

1:250
5m 0 5m 10m 15m 20m 25m

Map Series:
Prime Data Vector

ITM Centre Point Co-ordinate:
X,Y = 603171.5483, 699974.5702

Tailte Éireann Licence No.
CYAL50492393

tli GROUP

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Hampshire,
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PROJECT

Ballincor Wind Farm
110kV Substation

CLIENT

RWE

CONSULTANTS

TOBIN
CONSULTING ENGINEERS

NOTES: -

- This drawing is to be used only for the purpose of the planning application and is subject to detailed design.

LEGEND: -

- Propose Access Track in Private Land shown thus
- Surface Water Drainage shown thus
- Finished Compound Level shown thus — FCL 46.35m
- Manhole shown thus
- Gully shown thus
- Lighting Column shown thus — LC

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P5	13.11.25	Issued for Planning
P4	07.11.25	Issued for Planning
N1	22.10.25	Issued for Information
P3	13.08.25	Issued for Planning
P2	06.08.25	Issued for Planning
P1	10.07.25	Issued for Planning

PROJECT NUMBER

05-867

SHEET TITLE

BESS Compound Layout Plan

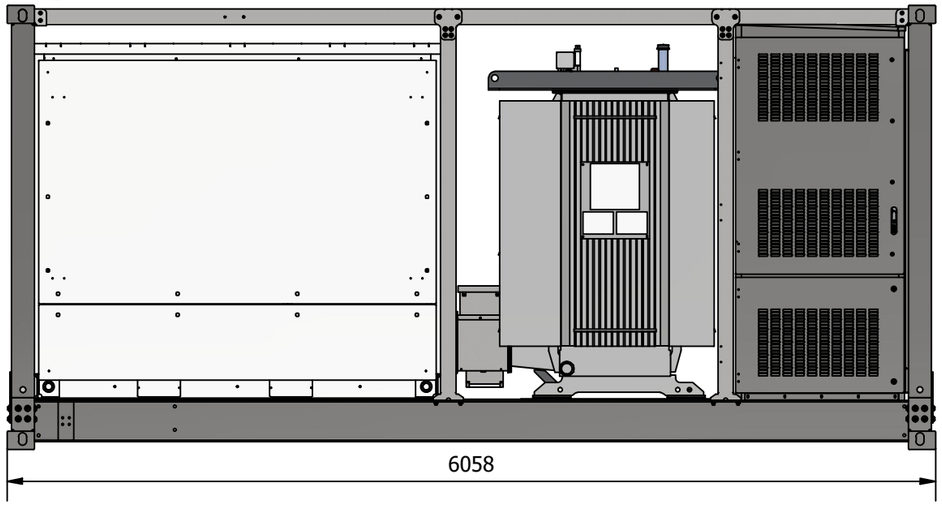
SHEET NUMBER

05867-DR-502

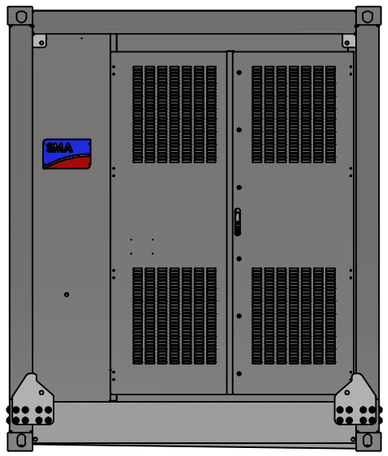
APPENDIX B – EQUIPMENT LAYOUT

Basic closed door configuration

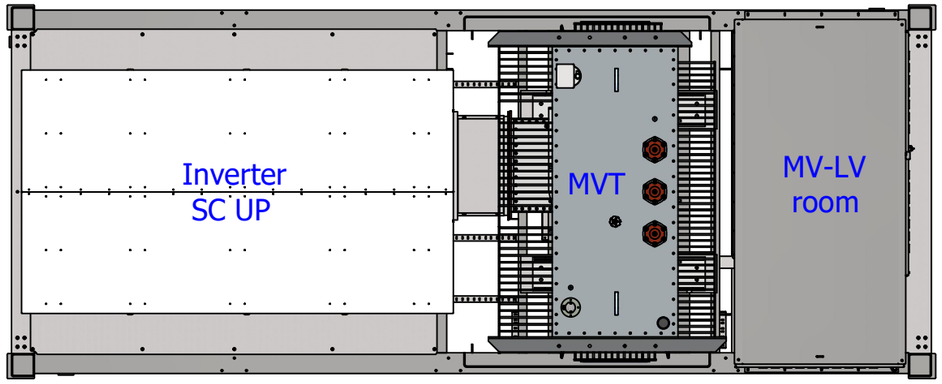
Right View



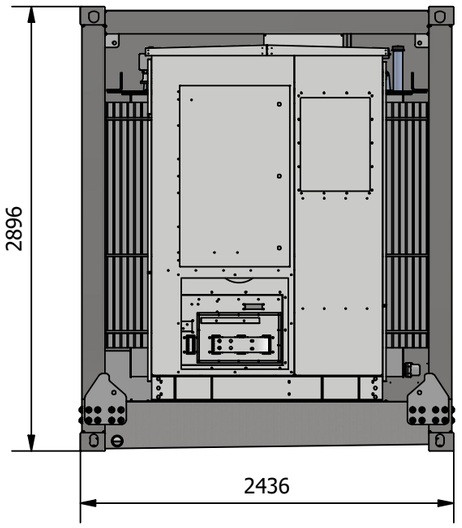
Back View



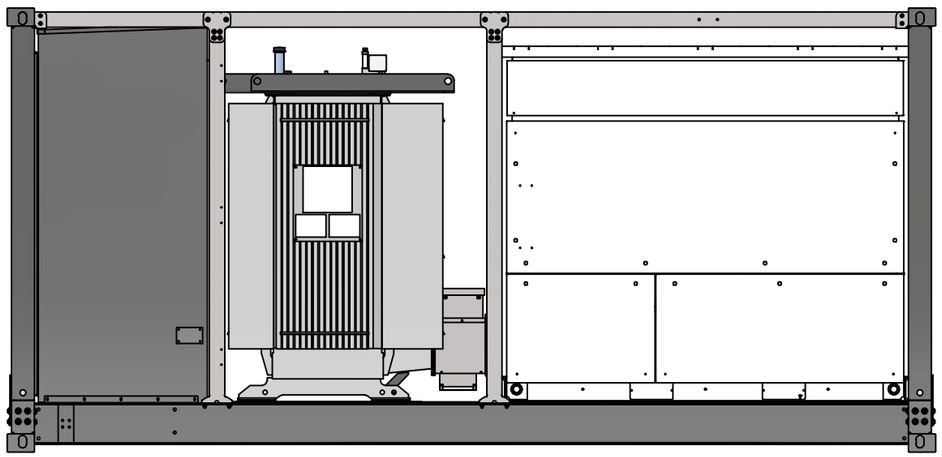
Top View



Front View



Left View



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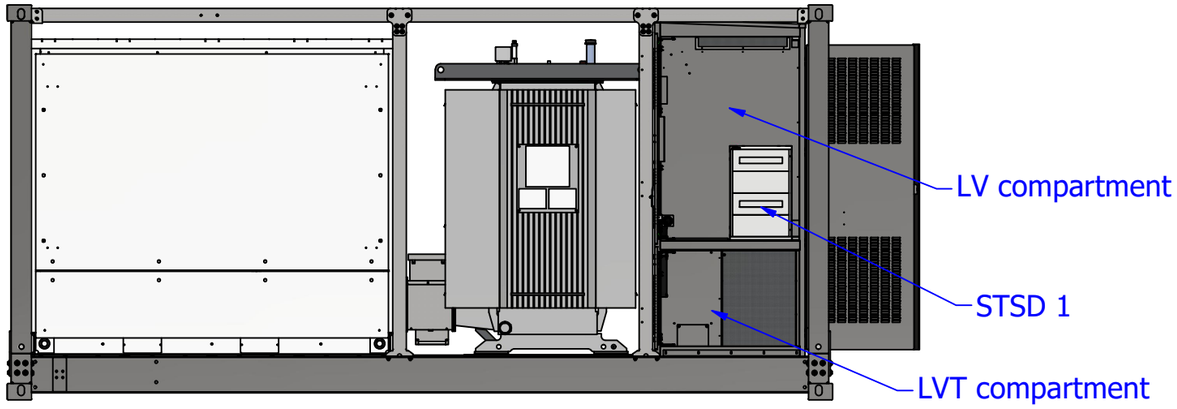
REV	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED			

Basic opened door configuration

Right view



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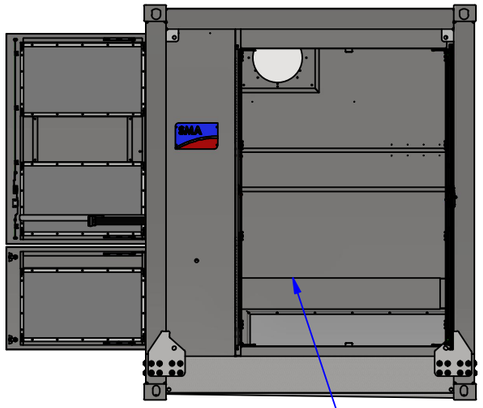
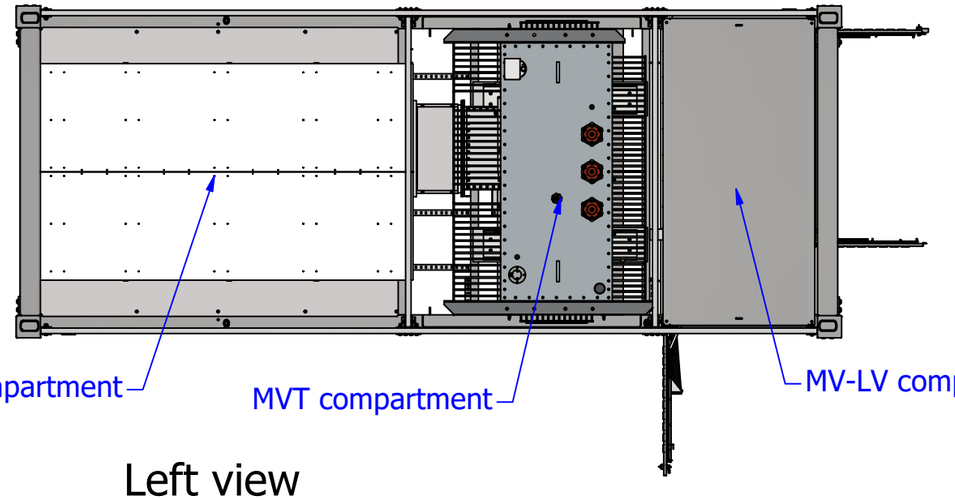
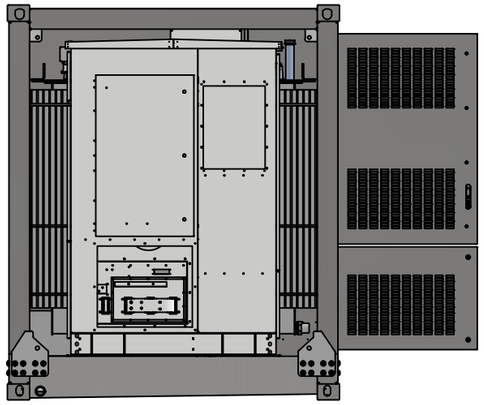


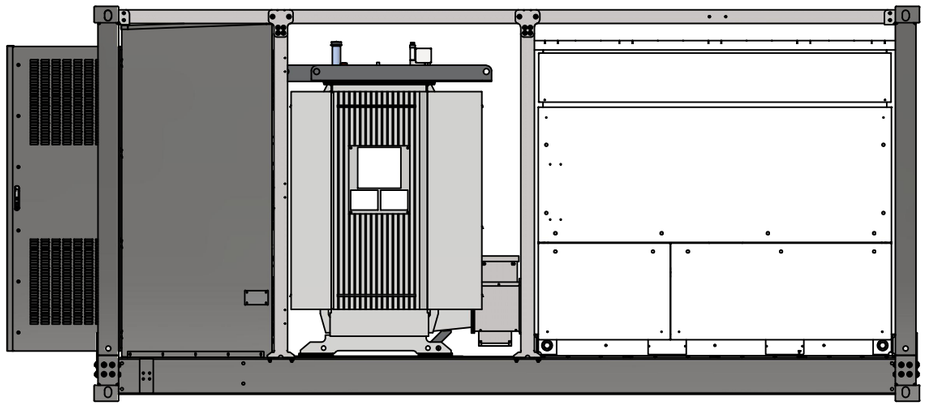
Top view



Front view



Left view



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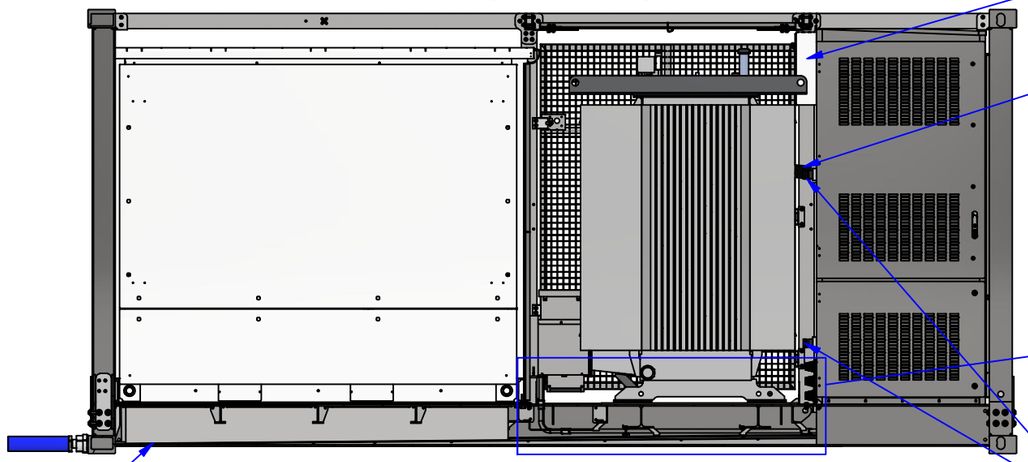
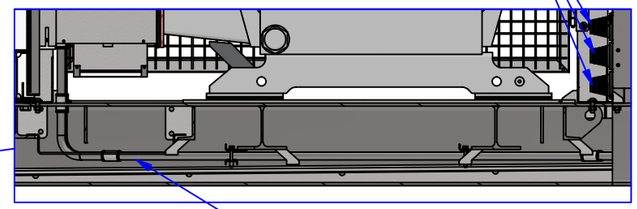
REV	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED			

Super equipped configuration
with closed doors

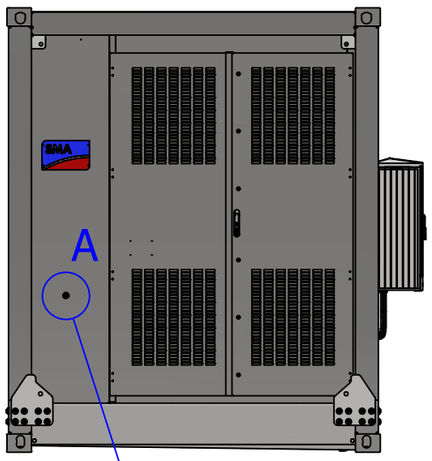
B-B (1 : 40)

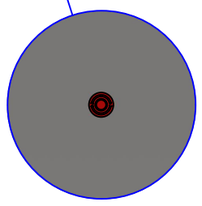


C (1 : 20)



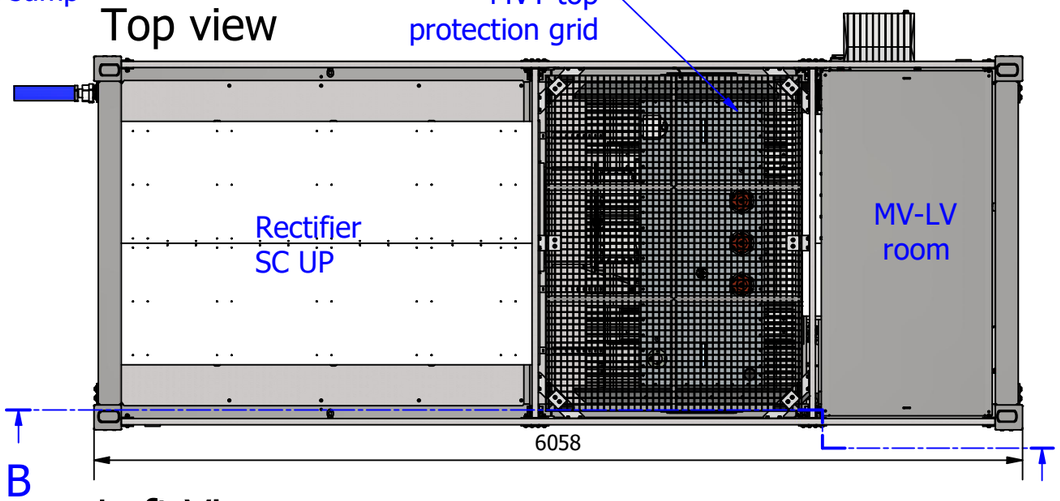
Back view





Fast stop button
A (1 : 10)

Top view



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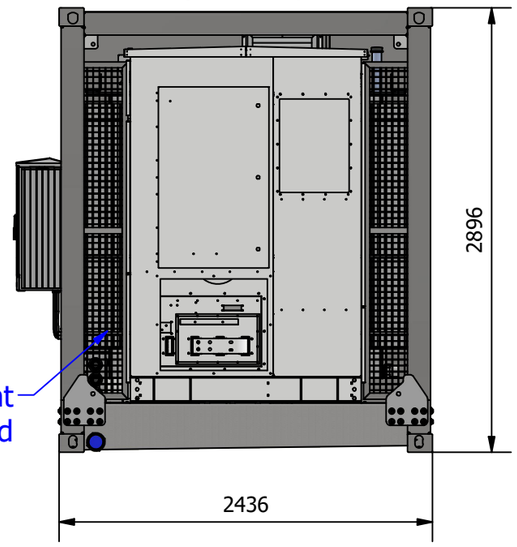
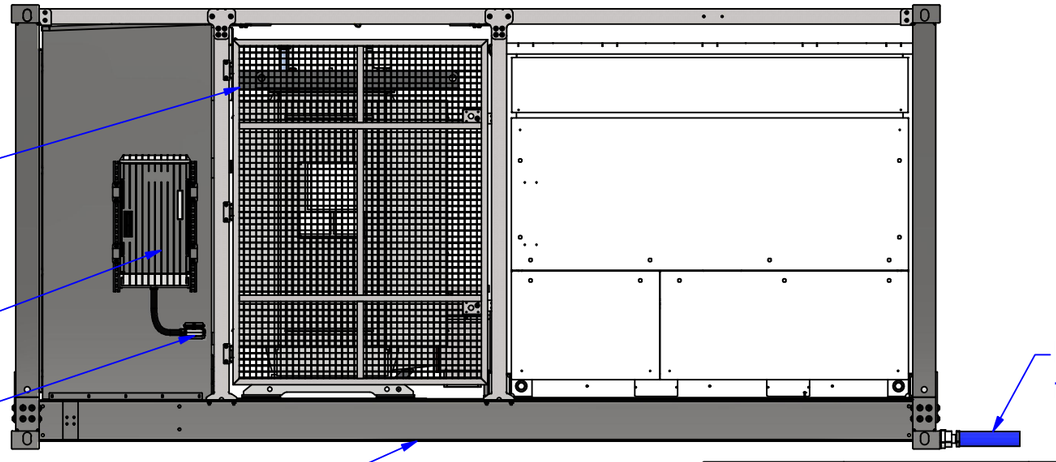


Left View



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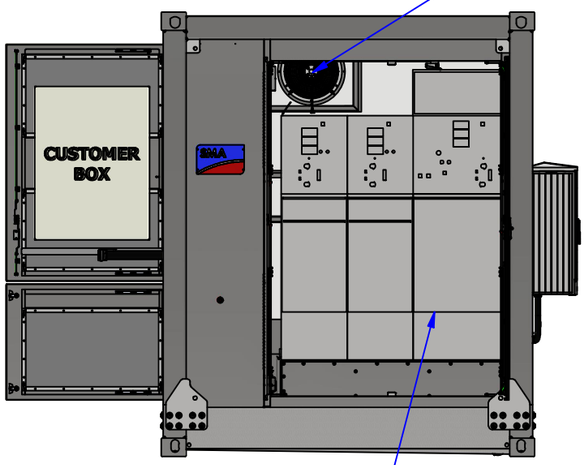
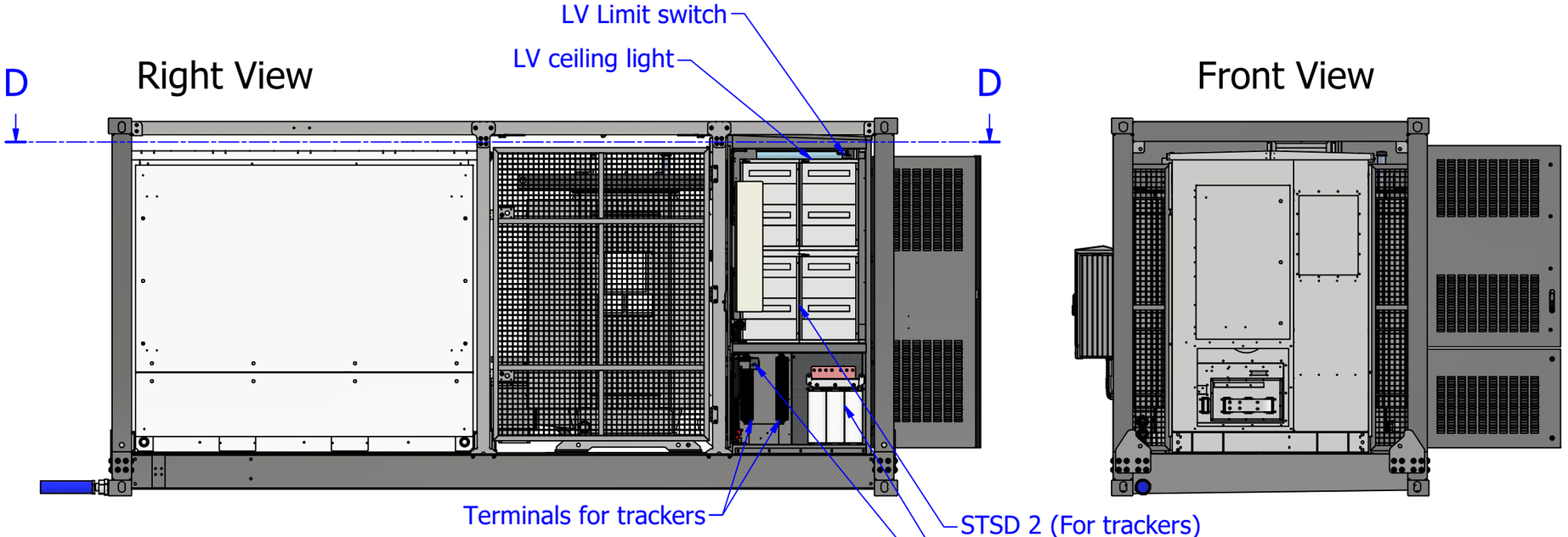
REV	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED			

Super equipped configuration with opened doors

Back View



Right View



Front View

D-D (1 : 40)

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REV	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED			

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