4 Alternatives

4.1 Introduction

4.1.1 The EIA Regulations require an ES to include *"(d) a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment"* In accordance with the EIA Regulations, this chapter describes the reasonable alternatives to the Development studied by the Appellant and provides an indication of the main reasons for the choice made taking into account the significant effects of the Development where appropriate.

4.1.2 Sunrise Renewables Ltd were the original promoter of the biomass plant project and the applicant for the planning application that led to the 2010 Permission which was granted at appeal. Sunrise Renewables (Barry) Ltd were the applicant for the planning application that led to the 2015 Permission.

4.1.3 The Appellant acquired the Site in November 2015 following the grant of the 2015 Permission. For completeness, and in line with the intent of the EIA Regulations, this chapter considers the reasonable alternatives considered by Sunrise Renewables Ltd, Sunrise Renewables (Barry) Ltd and the Appellant.

4.1.4 This chapter has been prepared by Quod, drawing on documents that supported the 2010 Permission, 2015 Permission and Permit application in 2017 with additional input from the wider Project Team.

4.1.5 The chapter outlines the main design objectives of the Facility and the alternatives considered including:

- Alternative sites;
- 'Do Nothing' alternative scenarios;
- Alternative site layout and building design;
- Alternative stack height;
- Alternative access; and
- Alternative technology.

4.2 Alternative Sites

4.2.1 The granting of the 2010 Permission and the 2015 Permission (as outlined in Chapter 1: Introduction) established and re-established the principle of renewable energy development (in the form of waste wood combustion) on the Site and as such, it continues to fulfil the requirements of the Appellant.

4.2.2 As the 2015 Permission was commenced and the Development constructed, the Appellant has not given any further consideration to alternative sites.

4.3 'Do Nothing' Alternative Scenarios

4.3.1 Potential 'Do Nothing' alternative scenarios to the operational Development could have included:

- An undeveloped Site (left in Pre-Construction condition);
- Demolition of the Development with restoration of the Site to its Pre-Construction baseline condition; and
- Continued existence of the Development at the Site but it remains non-operational.

4.3.2 These potential alternative scenarios were not considered as reasonable alternatives by the Appellant as the Development has already been constructed. As such they have not been studied further by the Appellant and therefore are not discussed further.

4.3.3 The Development processes waste wood which would otherwise require treatment or disposal via other means. The most likely fate of the wood to be processed is combustion in a biomass plant elsewhere, or landfill. Use of waste wood in an alternative biomass plant elsewhere would result in comparable greenhouse gas emissions to those of the Development (as set out in Chapter 7 of this ES). These emissions may be higher or lower than those of the Development depending on the transport distance travelled.

4.3.4 If the wood was sent to landfill instead of the Facility, then a portion of the carbon in the wood (known as the Decomposable Degradable Organic Carbon (DDOC)) content would break down anaerobically, forming landfill gas. Landfill gas is a mixture of carbon dioxide and methane. Some of this could be captured and used to generate energy, however, a portion would inevitably be lost to the atmosphere. Methane is a particularly potent greenhouse gas, with a Global Warming Potential (GWP) 28-36 times higher than carbon dioxide over 100 years[1]. If the wood were to be disposed in landfill as an alternative to use as fuel feedstock for the Development, additional Greenhouse Gas (GHG) emissions would occur.

4.4 Design Objectives

4.4.1 The following objectives for the Energy from Waste (EfW) process technology for the Development were set out by the Appellant's team in the Permit application:

- To provide an Advanced Thermal Technology (ATT) facility that can produce energy from waste using gasification;
- To achieve significantly lower levels of emissions when compared with conventional EfW technologies;
- To achieve a high degree of plant availability and reliability;
- To offer a cost effective and financially low risk solution for the generation of renewable power; and

- To utilise conventional unit operation techniques and technologies which meet the above aims and are established as Best Available Techniques (BAT)[i].

4.5 Alternative Site Layout and Building Design

4.5.1 Figure 4.1 shows the layout of the 2010 Permission which comprised a single building for the energy plant (60m long x 45m wide) with a total footprint of 2,700m^2. The building was a steel portal frame structure with a ridge height of 14.08m.

4.5.2 The approved layout of the 2015 Permission (shown in Figure 4.2) comprises three, functionally interconnected buildings, with ancillary external structures and stack. The revised layout comprises two buildings that are lower than the building height approved under the 2010 Permission and one that is higher. The average building height of the 2010 Permission was 14m (Figure 4.3) while the average building height of the 2015 layout was 16.3m (Figure 4.4).

4.5.3 The revised layout of the 2015 Permission allowed for separate structures to accommodate the functions of the selected plant technology. The result of the changes from the 2010 Permission was a net 7.5% reduction in the building footprint on-Site from 2,700m^2 to 2,497m^2.

4.5.4 Other differences between the buildings/structures approved under the 2010 Permission compared to the 2015 Permission are as follows:

- Turbine, Welfare and Ancillary Building – reduced in height and incorporates switchgear, the main control room and a turbine room (to replace the formerly proposed piston engines);
- Main Process Building – gasification equipment is entirely enclosed within a bespoke structure. This was installed to substantially improve containment of the process as a whole. It resulted in an approximate 9m increase in the height due to the enclosure;
- External Air Cooler Condenser (ACC) Unit – installed on steel stilts proposed adjacent to the Turbine, Welfare and Ancillary Building;
- External equipment – two externally located silos to store ash residue from the combustion process to enable ease of access. The Flue Gas Treatment (FGT) exhausting to the chimney stack was installed to be external to the buildings; and
- Chimney Stack – the stack was relocated approximately 20m south east relative to its position in the 2010 Permission. To meet emissions requirements, the height of the stack as consented in the 2010 Permission was increased (discussed further below).

4.5.5 The 2015 Permission proposed that the finish of the structures was as per the 2010 Permission, i.e. steel portal frame construction, surfaced with micro profile or box cladding to all external elevations. The colour and specification of the panels were to be agreed with VoGC prior to construction. The neutral colour and specifications were subsequently reviewed and agreed with VoGC in 2016 as part of an application to discharge Planning Conditions 5, 7, 12, 15 and 16 which set out the specific design controls as part of the 2015

i BAT means the available techniques which are the best for preventing or minimising emissions and impacts on the environment.

Permission. No alternative elevational treatments of the buildings were therefore considered by the Appellant.

4.5.6 The building elevations approved as part of the 2010 Permission and 2015 Permission are shown in Figures 4.1 and 4.2 respectively and approved drawings from the 2015 Permission are provided in Appendix 5.1. Figure 4.5 shows the elevation of the Development based on drawings of the As Built Facility completed in March 2022.

4.5.7 The layout and building design within 2015 Permission were taken forward and implemented due to the functional requirements to accommodate the proposed plant technology.

4.5.8 The Permit requires the implementation of a Fire Prevention Plan. This has necessitated the installation of a fire water tank, pump house and kiosk. Minor consequential adjustments to the layout of the Development have been implemented together with other changes resulting from the detailed design phase albeit the Development remains substantially in accordance with the 2015 Permission. This ES considers as-built Development in its totality.

4.5.9 All structures/buildings associated with the Development are described in further detail in Chapter 5: Description of Development.

Figure 4.1: Approved Layout (2010 Permission)

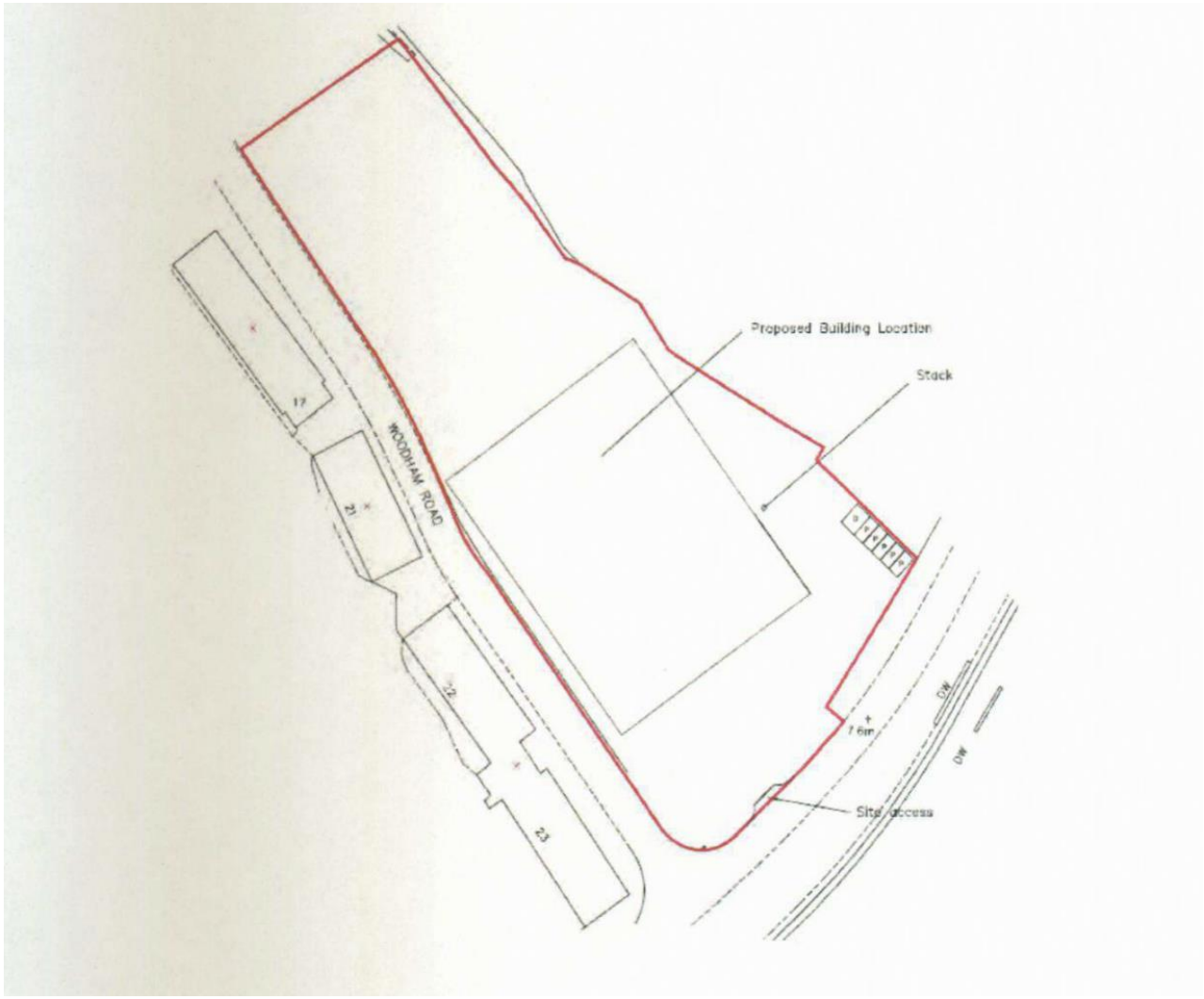


Figure 4.2: Approved Layout (2015 Permission) (drawing Ref: E1627-2104 Rev A)

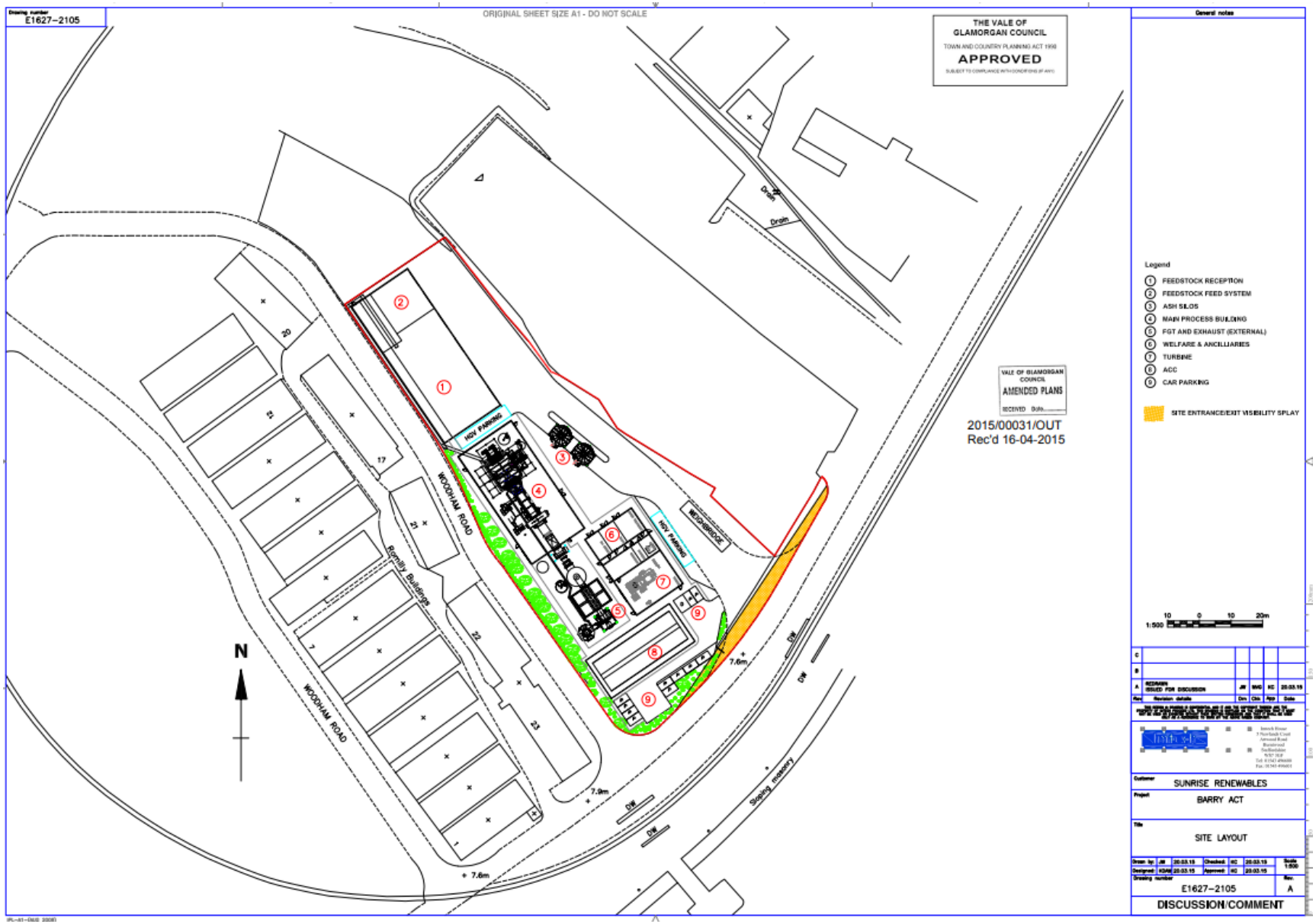
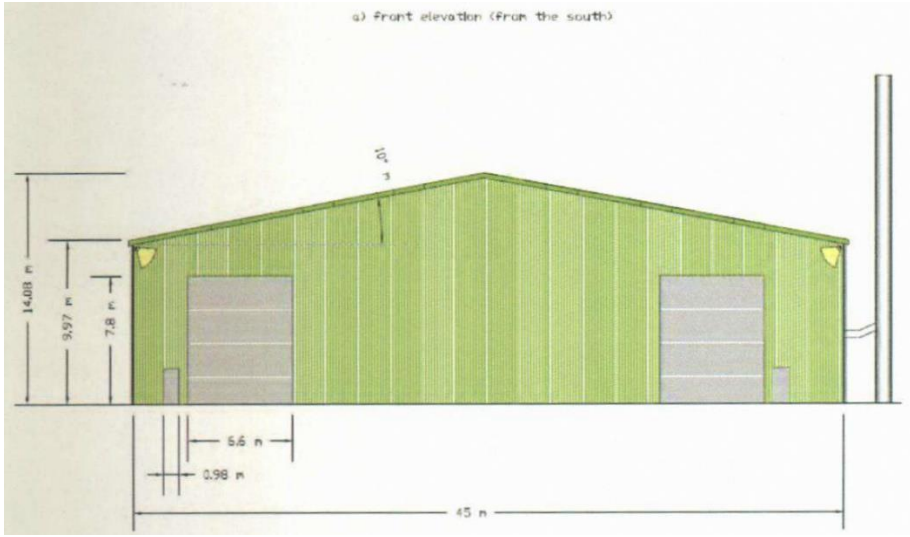
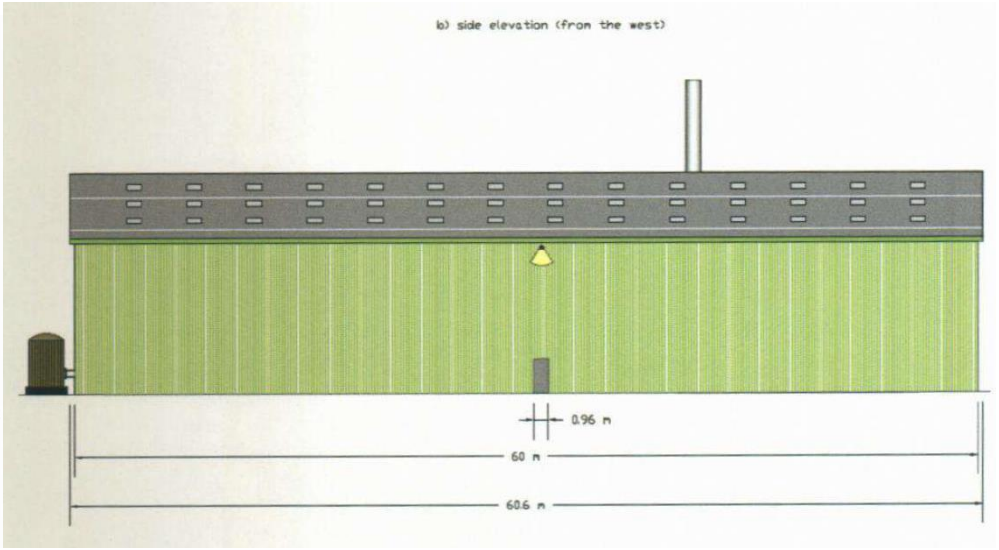
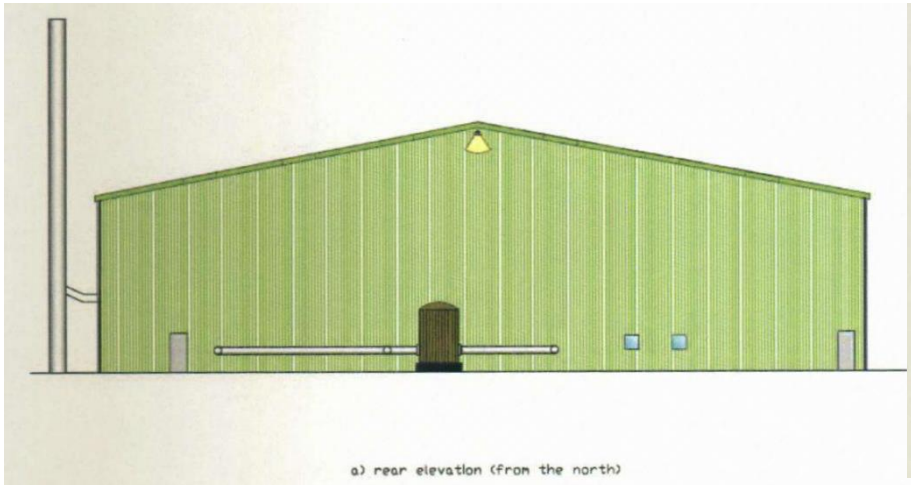


Figure 4.3 Approved Elevations (2010 Permission)







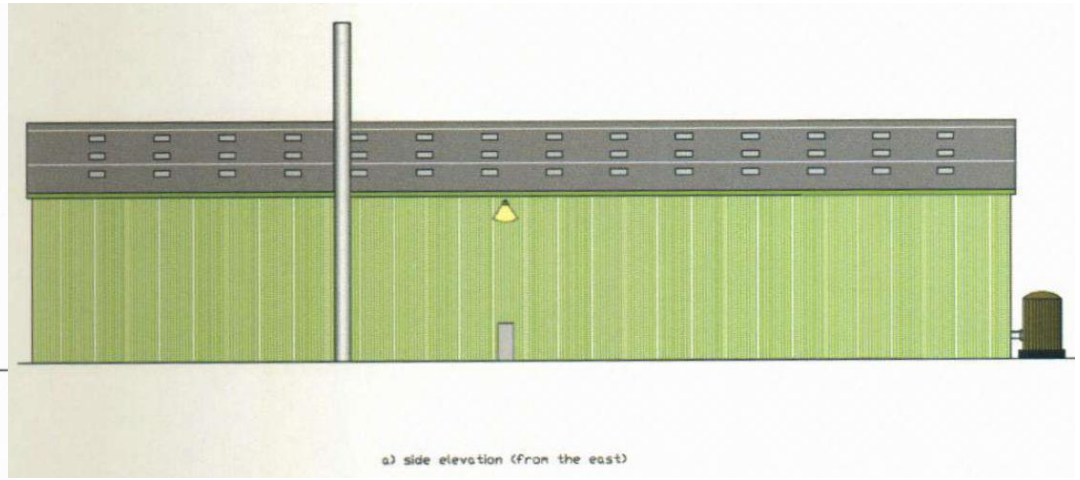
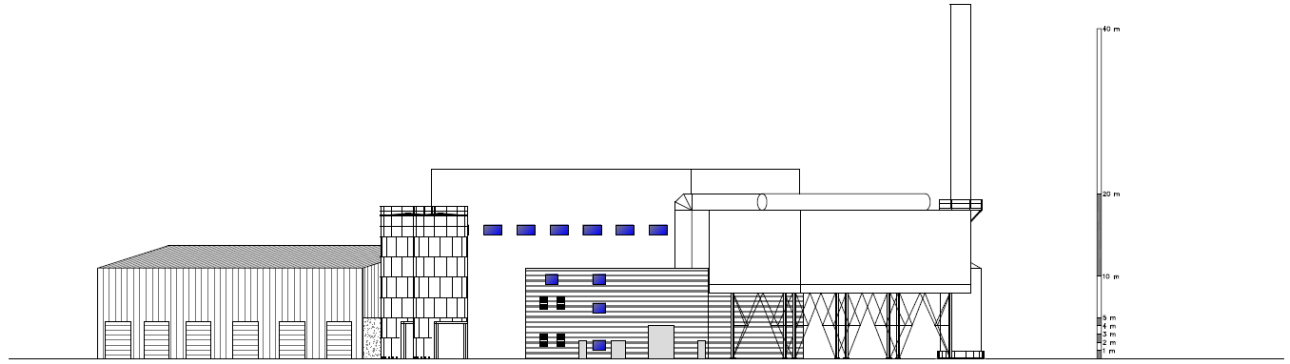
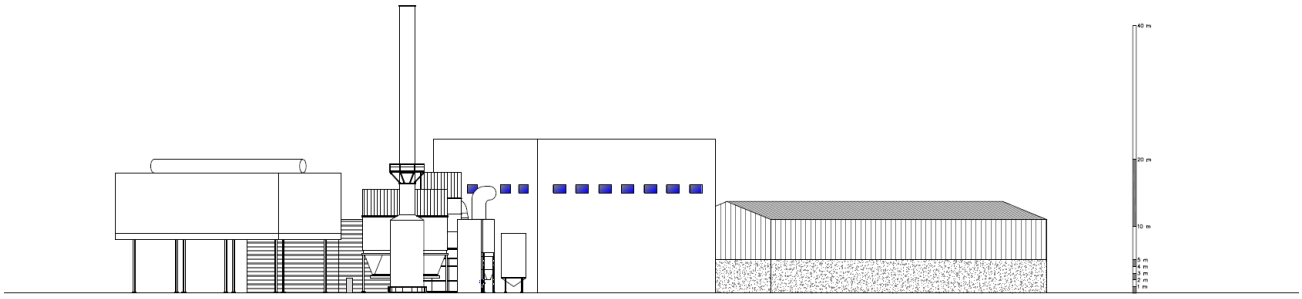


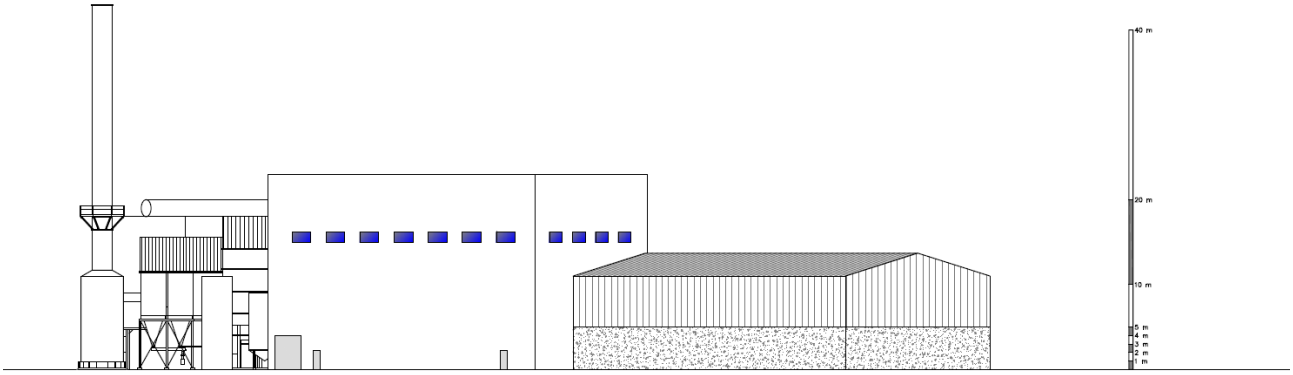
Figure 4.4: Approved Elevations (2015 Permission)



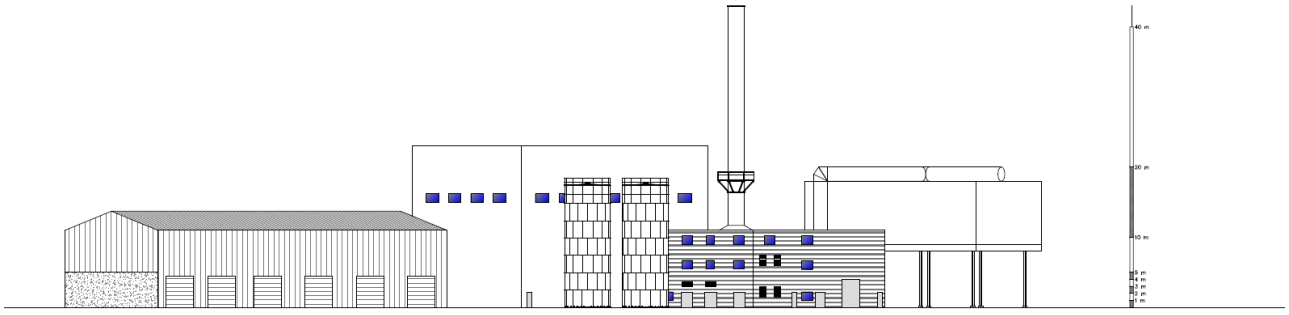
SECTION A-A



SECTION B-B

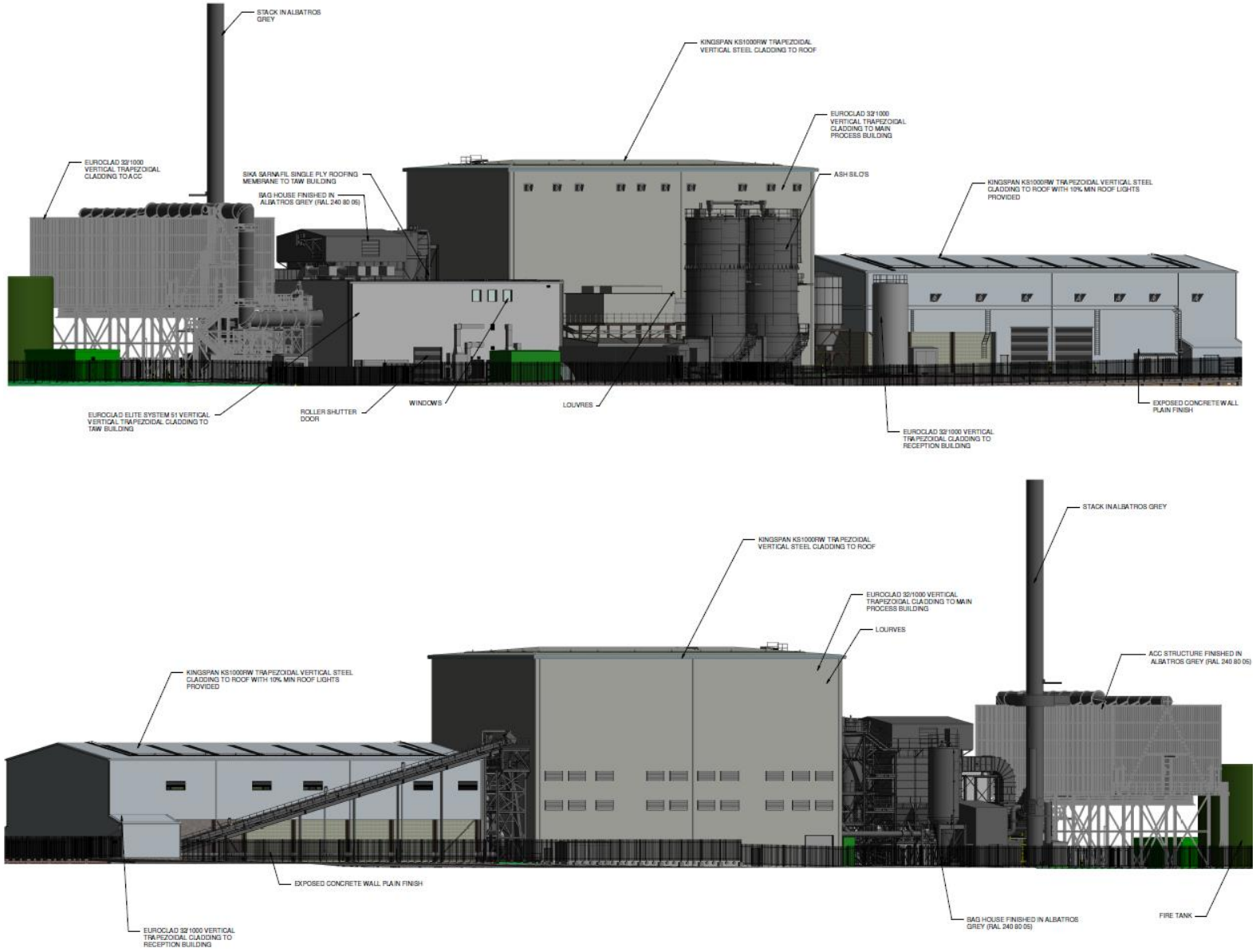


SECTION C-C



SECTION D-D

Figure 4.5: Surveyed Elevations of the As Built Facility (East and West Elevations) based on GHD drawings, March 2022



4.6 Alternative Stack Height

4.6.1 As part of the 2010 Permission, the height and diameter of the flue stack were 20m and 1.0m, respectively.

4.6.2 Detailed air quality dispersion modelling undertaken as part of the 2015 planning application was used to determine the appropriate height for the stack in compliance with the requirements of the IED. The modelling determined that an increase in stack height (from 20m in the 2010 Permission to 43m), and diameter (from 1.0m in the 2010 Permission to 1.6m) was required to ensure the predicted maximum off-Site process concentrations would remain within the relevant air quality emission limit values for all pollutants considered.

4.6.3 With the increased stack height and diameter, the air quality impacts were assessed in the air quality assessment that informed the 2015 Permission as negligible.

4.6.4 A stack height explanation was subsequently provided to NRW as part of the Permit application in 2017. NRW were satisfied with the stack height justification in their Permit Decision Document (Appendix 1.2) and the height consented under the 2015 Permission, and the stack was subsequently constructed in line with this.

4.6.5 As part of this ES, an up-to-date air quality assessment and Human Health Risk Assessment have been undertaken (Chapter 9: Air Quality). These assessments support the previous conclusions that the as built stack height is appropriate.

4.7 Alternative Access

4.7.1 The Site is accessed via a single access/egress point on David Davies Road via Cory Way. This remains unchanged from the 2010 Permission. No alternative vehicular access points or routes have been considered by the Appellant.

4.7.2 The 2019 VES and 2021 VES make reference to benefits of the Site's dockside location for access via seaport as a potential alternative route for supply of fuel feedstock to reduce vehicular movements and journey times / distances. However, this is not being taken forward by the Appellant due to the location of the existing fuelwood contract within South Wales and a number of other reasons, including:

- Transportation using seaport would require several modes of transport to fulfil the journey which could lead to increased inefficiencies, e.g. the nearest unloading point in Barry Docks is still some distance from the Site so further transportation would be required to deliver feedstock to Site;
- Unloading could result in additional environmental effects, e.g. noise, vibration; and
- More infrastructure would be required to facilitate this transition of delivery of feedstock.

4.7.3 However, subject to further assessment, this is an opportunity that could be brought forward should circumstances change in the future subject to appropriate environmental assessment.

4.7.4 Environmental effects associated with feedstock deliveries to the Site via the dock have therefore not been considered further within this ES.

4.8 Alternative Technology

ATT

4.8.1 There are a number of potentially suitable Advanced Thermal Treatment (ATT)[ii] technologies which have been considered for the Development. Although all of the technologies reviewed are capable of treating waste wood, the majority have been rejected on the grounds of environmental impact, operational cost or efficiency.

4.8.2 ATT has been selected for the Development as it has a number of advantages over traditional incineration processes including:

- It is viable at smaller unit sizes;
- There is much less visual impact, as ATT processes tend to be smaller and require shorter exhaust stacks (44m compared to 60-100m for conventional incinerators);
- ATT is modular and therefore more flexible to changes in quantity or quality of feedstock; and
- ATT is more suited to pre-sorted or processed wastes such as waste wood.

4.8.3 As a consequence of the above, less flue gas treatment is required. Hence, fewer raw materials are used resulting in the production of fewer residues. ATT was therefore taken forward by the Appellant for use in the Development.

4.8.4 The system detailed in the 2010 Permission included pyrolysis plant which could have processed up to 72,000 tonnes of wood per annum (approximately 216 tonnes per day). The system proposed by the 2010 Permission was manufactured by Prestige Thermal Equipment and would have produced an average net output of 9MW.

4.8.5 In seeking to optimise the efficiency and output potential of the plant, Sunrise Renewables (Barry) Limited (the 2015 Permission applicant), reviewed the choice of available technology. They chose to replace the pyrolysis system (included in the 2010 Permission) with an alternative gasification system manufactured by Outotec, a globally established manufacturer. The Outotec technology was selected for the Development as it has higher efficiency, has an increased electrical output (9MWe to 10MWe) and is considered to be more versatile.

4.8.6 The Outotec technology which has been installed at the Development enables syngas to be produced through a fluidised bed gasification process. The Outotec equipment produces syngas through a fluidized-bed process while the Prestige Thermal Equipment produced syngas through a pyrolysis process. Both technologies are forms of ‘gasification’. The general sequence of the gasification process is described in Chapter 5: Description of the Development.

ii Advanced Thermal Treatment (ATT) technology: A generic term used to describe an EfW technology that does not combust the residual waste but instead transforms it into a gas (synthesis gas or syngas), which in turn is combusted to generate high temperature steam which generates renewable electricity via a turbine. ATT primarily uses Gasification and/or Pyrolysis processes.

4.8.7 Gasification combined with a heat recovery boiler and associated steam turbine generation was selected for the Development as the BAT due to the following main reasons:

- Environmental advantages over incineration and other technologies in terms of lower mass flow of air pollutants, lower water use and smaller footprint;
- Lower operating costs than conventional incineration due to lower air flows, smaller boilers and less fouling / maintenance;
- Reliable technology with numerous global reference sites; and
- Gasification recognised by UK government as being a preferred technology as opposed to traditional 'Mass Burn' moving grate combustion processes.

4.8.8 NRW's detailed assessment of the BAT in relation to combustion technology is detailed in Section 6 of the Permit Decision document (Appendix 1.2). As part of this assessment, NRW evaluated the combustion efficiency and energy utilisation of different design options for the Facility, including consideration of the Global Warming Potential and persistent organic pollutants. Following their own assessment, NRW were satisfied that the operating and abatement techniques being employed are BAT for co-incinerating waste wood.

Flue Gas Clean-up Technologies

4.8.9 The prime function of FGT is to reduce the concentration of pollutants in the exhaust gas as far as practicable. FGT is the predominant solution for modern flue gas facilities. FGT and pollution control at the Development consists of:

- the injection of urea for the reduction of NO_x;
- lime injection for acid gas neutralisation; and
- activated carbon powder injection for absorption and removal of heavy metals, dioxins, Volatile Organic Compounds (VOCs) and other substances.

4.8.10 Cleaned flue gas is released to atmosphere via the 43m high stack. Emissions from the stack are monitored in accordance with requirements of the Permit (see Chapter 9: Air Quality for further details) and for process control purposes. The flue gas cleaning system also incorporates a baghouse system, designed to remove submicron dust particles within anticipated emission limit values of the IED.

4.8.11 Alternative scrubbing techniques were considered for use at the Development, however dry FGT was selected over wet scrubbing systems due to its:

- Proven ability to meet stringent emission limits;
- Small physical footprint;
- Lower parasitic loads (electrical);
- Flexible operation with regards to temperature and capacity;
- Easy stabilisation of dry residues;
- Simplicity of design and operation; and
- Low investment cost.

References

[1] Intergovernmental Panel on Climate Change (IPPC), (2014). *Fifth Assessment Report.*