10 Climate and Air Quality

10.1 Introduction

This Chapter provides an assessment of the potential impacts to air and climate arising from the proposed modifications to the West Offaly Power (WOP) Station and associated ash disposal facility (ADF) to facilitate the continued operation of these facilities and phased transition of that station to exclusive firing with biomass. As the existing development is subject to the condition that all existing activity ceases in December 2020 the potential impacts of the continued operation of WOP station and the ADF will also be assessed. This will subsequently be referred to as the 'proposed development'.

The proposed development will be wholly located within the footprint of the WOP station and within the landfill footprint which was subject to EIA in 2001. The proposed development proposes continued operation of the existing generating station with transitioning from peat fuel to biomass commencing in 2020 with no peat being utilised at the station by the end of 2027 as per the description set out in Chapter 4.

Both peat and biomass fly ash will be removed from the flue gas emission from the station and disposed of in the WOP ADF. The ADF will contain fly ash and bottom ash which is generated as a result of peat and biomass combustion at WOP and by the end 2027 from biomass combustion only.

In addition, this chapter will consider the induced indirect environmental impacts associated with WOP Station and the supply of peat fuel to WOP Station and cumulative impacts, with regard to Climate and Air Quality.

10.2 Methodology

The approach to the assessment of Climate and Air Quality comprised a desk based review of publicly available documentation relating to climate change as well as data and documentation relating to the EPA IE Licence P0611-02 and Landfill Operational Plan relating to WOP ADF.

As well as considering the relevant EPA guidance, as used in the preparation of this EIAR, the following sources and publications were utilised in the preparation of this chapter:

- Met Éireann Data;
- West Offaly Power Station IE Licence & Amendments;
- West Offaly Power Station Annual Environmental Reports (2015, 2016 and 2017);
- Clean Air for Europe (CAFE) Directive (2008/50/E C) and the Air Quality Fourth Daughter Directive (2004/107/EC).
- Air Quality Standards Regulations 2011 (S.I. No. 180/2011)
- Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58/2009).
- EPA Air Quality in Ireland Report 2017, Indicators of Air Quality
- European Environment Agency – Air Quality in Europe -2017 Report

- Community Climate Change Consortium for Ireland (http://www.c4i.ie/); and
- A Summary of Climate Change for Ireland, 1981 – 2010.
- Climate Action and Low Carbon Development Act 2015
- Climate Change Advisory Council, Annual Review Report, 2018
- National Mitigation Plan, July 2017
- National Adaptation Framework (NAF), 2018
- National Climate Change Adaptation Framework, 2012
- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).
- COMMISSION IMPLEMENTING DECISION (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants
- Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
- Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814

If the WOP Station were to close in 2020 then there would no longer be any emissions to the atmosphere as currently occurs under its IE Licence. There would be no air quality impacts from the plant and the air quality baseline would reflect this fact. The proposed project will see the continued operation of the WOP Station with continued emissions from the plant to the atmosphere. It is important therefore to determine the impact arising from these emissions which would continue to be licenced by the EPA.

Air dispersion modelling of the key parameters from the emission stacks was carried out by AWN Consulting Limited to identify potential impacts arising from the licenced emission. The air dispersion model considered the worst case maximum allowable limit values for relevant parameters as set out in the EU Commission's implementing decision establishing best available techniques and emission limit values of July 2017.

10.3 Study Area

Climate and climate change is a global issue and greenhouse gas emissions to the atmosphere add to the total concentrations of these gases, particularly carbon dioxide, contributing to climate change. Emissions to the atmosphere occur from the existing WOP Station from operational activities and will also arise from the proposed development (transitioning from peat to biomass and extending the ADF site) during construction, operation and decommissioning. These are quantified and assessed in this Chapter. In addition, as greenhouse gas emissions also occur from the peat supply bogs serving WOP these have also been included in the study.

WOP Station licenced emissions also have the potential to impact on local air quality including at residential and commercial premises and on the general ecology of the area.

The assessment of air quality impacts extends out to a 20km radius study area from the WOP Station site.

10.4 Receiving Environment

10.4.1 Climate Change

Ireland's climate is influenced primarily by the Atlantic Ocean with the warm North Atlantic Drift having a marked influence on sea temperatures. As a result Ireland does not experience extremes of temperature as experienced by many other countries at similar latitude. The maritime influence is strongest near the Atlantic coasts and decreases with distance inland. Winters tend to be cool and windy, while summers, are mostly mild and less windy. Typically air temperatures inland normally reach 18 to 20℃ during summer days, and about 8℃ during wintertime (refer to https://www.met.ie/climate-ireland/climate-of-ireland.asp).

The WOP Station and ADF are located in the Midlands, which comprises mainly a flat landscape with extensive bog and peatlands dominated by the River Shannon system.

The nearest meteorological station is Birr, County Offaly - although this has not been in operation since 2009. However, Met Éireann provides an historical record of meteorological parameters for the period 1979 – 2008 for this station, (https://www.met.ie/climate-ireland/1981-2010/birr.htmll). This in line with the requirements of the World Meteorological Organization (WMO), which recommends that climate averages are computed over a 30 year period of consecutive records. The period of 30 years is considered long enough to smooth out year to year variations. Met Éireann reference 1981 to 2010 as the baseline period for day-to-day weather and climate comparisons. The current WMO global baseline period for use in climate change research is 1961-1990. In summary, mean daily minimum temperature at this station is 6.10C with a mean of daily maxes of 13.50C and an overall mean temperature of 9.80C. An absolute maximum temperature of 30.80C has been recorded in this period and an absolute minimum of -14.60C. Mean daily sunshine duration is 3.2 hours with a maximum recorded of 15.7 hours.

The total mean annual rainfall over the period is 845.7 mm with the greatest daily total at 59.1 mm.

Wind speeds are mainly in a south-westerly direction with a mean monthly wind speed of 6.7 knots (12.4 km/hour) and a maximum gust of 59.2 knots (109.6 km/hour) recorded.

Met Éireann also operate a climatological station at Gurteen, which is just south of Shannonbridge. The average rainfall from records at this station for the period 2015 to 2017 inclusive is given as 966.8 mm and mean temperature as 9.70C for the same period.

10.4.2 Climate Change Projections

10.4.2.1 UN Intergovernmental Panel on Climate Change (IPCC)

The UN Intergovernmental Panel on Climate Change (IPCC) evaluates climate change science by assessing peer reviewed research on climate change. It publishes assessment

reports every 5–7 years. The latest report, Assessment Report 5 (AR5), uses new Representative Concentration Pathways (RCP) scenarios to predict climate change, which are focused on radiative forcing – the change in the balance between incoming and outgoing radiation via the atmosphere caused primarily by changes in atmospheric composition – rather than being linked to any specific combination of socioeconomic and technological development scenarios. These scenarios explicitly include climate mitigation. There are four such scenarios in AR5 named with reference to a range of radiative forcing values for the year 2100 or after i.e. 2.6, 4.5, 6.0, and 8.5 W/m2, respectively.

- RCP2.6 (low),
- RCP4.5 (medium-low),
- RCP6.0 (medium-high) and
- RCP8.5 (high),

The fifth assessment report (AR5) published during 2013 and 2014 gave the following main findings.[1]

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.

Atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years.

Human influence on the climate system is clear. It is extremely likely (95-100% probability) that human influence was the dominant cause of global warming between 1951-2010.

Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

Global surface temperature change for the end of the 21st century is projected to be likely to exceed 1.5 ℃ relative to the period 1850 to 1900 in all but the lowest scenario considered, and likely to exceed 2℃ for the two high scenarios considered.

10.4.2.2 Climate Change and Ireland

Global warming, and the management of emissions with the potential to contribute to global warming, is increasingly important on a national and international basis. Global warming has numerous potential implications for Ireland's environment.

Met Éireann indicates that the average air temperature has risen by approximately 0.8℃ in the last 100 years, with much of the warming occurring towards the end of the 20th century, and all seasons are warmer. This has manifested as seasonal changes with the start of the

[1] Intergovernmental Panel on Climate Change (IPCC) 2013: available at https://www.ipcc.ch/

growing season for certain species, now up to 10 days earlier with an observed decrease in the number of days with frost and increase in the number of warm days (days over 20°C).

All seasons are projected to be significantly warmer (1 to 1.5°C) by mid-century, this will lead to a further increase in the length of the growing season, with a knock-on effect on natural ecosystems which have evolved gradually to suit our climatic conditions.

Met Éireann records indicate that over the last 30 years or so rainfall amounts have increased by approximately 5%, and there is some evidence of an increase in the number of days with heavy rain in the west and northwest. Due to greater uncertainty in the prediction of rainfall, climate projections indicate that overall rainfall amounts in Ireland might decrease slightly; summers are likely to become drier while winters may be wetter especially in the west and north.

Met Éireann state that changes in the Irish climate regime will be incrementally small and barely noticeable on a year to year basis, and will occur against the background of natural climate variability. Declining Arctic sea ice may also affect regional weather patterns which could result in periods of colder weather for Ireland. The probability of occurrence of extreme weather events is expected to increase.

The Met Éireann led study *Ireland's Climate: the road ahead* (2013) carried out global climate model simulations as part of Ireland's contribution to the science underpinning the IPCCs AR5. The Irish study modelled projections for climate change in Ireland indicated the following:

The observed warming over the period 1981-2010 is expected to continue with an increase of ~1.5 degrees in mean temperatures by mid-century; the strongest signals are in winter and summer. Highest daytime temperatures are projected to rise by up to 2 degrees in summer and lowest night time temperatures to rise by up to 2-3 degrees in winter.

Milder winters will, on average, reduce the cold related mortality rates among the elderly and frail but this may be offset by increases due to heat stress during summer.

Winters are expected to become wetter with increases of up to 14% in precipitation by mid-century with summers becoming drier (up to 20% reduction in precipitation). The frequency of heavy rainfall events during winter may increase by up to 20%.

Changes in precipitation are likely to have significant impacts on river catchment hydrology, such as increased flow and level during higher rainfall events and prolonged periods of low water level in drier summers.

An overall increase (0-8%) in the energy content of the wind for the future winter months and a decrease (4-14%) during the summer months.

A small decrease in mean wave heights is expected around Ireland by the end of the century, while in winter and spring, storm wave heights are likely to increase.

Expected increases in temperature will further affect the ecology such as that of Irish butterflies, in particular.

Chapter 7 of the Met Éireann led study considers some additional potential impacts of a warmer climate on Irish Wildlife stating that:

"Spring warming in recent years has had a significant impact on Irish wildlife by advancing the timing of key phenological phases of a wide range of organisms, including trees, birds and insects."

Global modelling was carried out by Met Éireann and the Irish Centre for High-End Computing (ICHEC) as partners in the international EC-Earth consortium (https://www.met.ie/climate/climate-change),

The EC-Earth and other global models were downscaled (dynamically or statistically modelled onto a finer scale with a resolution as low as 4km) to provide information at a regional level for Ireland. The models were used to predict the climate change impacts for the mid-century period 2041-2060 based on medium-to-low (RCP 4.5) and high emission scenarios (RCP 8.5).

The following climate change impacts, (https://www.met.ie/climate/climate-change) are projected for Ireland:

Temperature Changes:

An increase of 1–1.6°C in mean annual temperatures, with the largest increases seen in the east of the country. Warming is enhanced for the extremes (i.e. hot or cold days), with highest daytime temperatures projected to rise by 0.7–2.6°C in summer and lowest night-time temperatures to rise by 1.1–3°C in winter.

Averaged over the whole country, the number of frost days (days when the minimum temperature is less than 0°C) is projected to decrease by 50% for the medium-low emission scenario and 62% for the high-emission scenario.

An average increase in the length of the growing season by mid-century of 35 and 40 days per year for the medium-low emission and high-emission scenarios, respectively[2, 3].

Milder winters will, on average, reduce the cold related mortality rates among the elderly and frail but this may be offset by increases due to heat stress in the warmer summers[4].

Rainfall Projections for Ireland

Simulations show significant projected decreases in mean annual, spring and summer precipitation amounts by mid-century with projected decreases largest for summer, with reductions ranging from 0% to 13% and from 3% to 20% for the medium-to-low and high emission scenarios, respectively.

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[2] Nolan, P. 2015. EPA Report: Ensemble of Regional Climate Model Projections for Ireland. EPA climate change research report no. 159. EPA: Wexford.
[3] O'Sullivan, J., Sweeney, C., Nolan, P. and Gleeson, E., 2015. A high-resolution, multi-model analysis of Irish temperatures for the mid-21st century. International Journal of Climatology. doi: 10.1002/joc.4419.
[4] Gleeson, E., McGrath, R. & M, Treanor, eds. 2013. Ireland's climate: the road ahead. Dublin, Ireland: Met Éireann [Online

The frequencies of heavy precipitation events show notable increases of approximately 20% during the winter and autumn months.

The number of extended dry periods is projected to increase substantially by mid-century during autumn and summer.

The projected increases in dry periods are largest for summer, with values ranging from 12% to 40% for both emission scenarios.

Sea Level Rise

Globally sea levels have been rising at an average rate of approximately 3 mm per year between 1980 and 2010. Sea level is projected to continue to rise at this rate or greater.

All major cities in Ireland are in coastal locations subject to tides, any significant rise in sea levels will have major economic, social and environmental impacts. Rising sea levels around Ireland would result in increased coastal erosion, flooding and damage to property and infrastructure.

Wind Energy and Storm Tracks:

Studies have shown significant projected decreases in the energy content of the wind for the spring, summer and autumn seasons, with the projected decreases largest for summer and no significant trend in winter.

The overall number of North Atlantic cyclones is projected to decrease by approximately 10%.

The paths of extreme storms will extend further south, bringing an increase in extreme storm activity over Ireland, although the number of individual storms is projected to be quite small [2].

Changes in nature

Changes in the climate will bring changes in the behaviour of species.

A spring warming in recent years has seen and advance in the timing of key phenological phases of a wide range of organisms, including trees, birds and insects.

The pace of future change will cause stress to ecosystems which are unable to adapt quickly.

10.4.2.3 Key drivers of climate change

Increased atmospheric levels of greenhouse gases are now widely recognised as the leading cause of climate change. This is borne out by the most recent findings of the Inter-Governmental Panel on Climate Change's (IPCC) Assessment Report 5 (AR5).

The most important long lived greenhouse gases are CO_2, N_2O, and Methane (CH_4). CO_2 arises from a range of sources including the combustion of fossil fuels. According to the

EPA, agriculture remains the single largest contributor to overall greenhouse gas emissions in Ireland[5] (2016 data), at 32.3% of the total followed by energy industries at 20.4% and by transport at 20%, see **Table 10-1** and **Figure 10-1**.

Table 10-1: Ireland's Final Greenhouse Gas Emissions, 2016[6]

1990-2016_Submission 2018 FINAL	2016	% Share 2016	% Change 1990-2016
Energy Industries	12556.70	**20.4%**	**9.8%**
Residential	6046.55	**9.8%**	**-19.6%**
Manufacturing Combustion	4554.61	**7.4%**	**15.0%**
Commercial Services	994.45	**1.6%**	**-8.2%**
Public Services	873.32	**1.4%**	**-24.8%**
Transport	12293.95	**20.0%**	**139.3%**
Industrial Processes	2149.91	**3.5%**	**-34.3%**
F-Gases	1267.30	**2.1%**	**3496.9%**
Agriculture	19851.31	**32.3%**	**-2.4%**
Waste	957.72	**1.6%**	**-38.1%**

[5] EPA Ireland's Final Greenhouse Gas Emissions in 2015, Key Highlights, 13th April 2017

[6] EPA Ireland's Final Greenhouse Gas Emissions in 2015, Key Highlights, April 2018

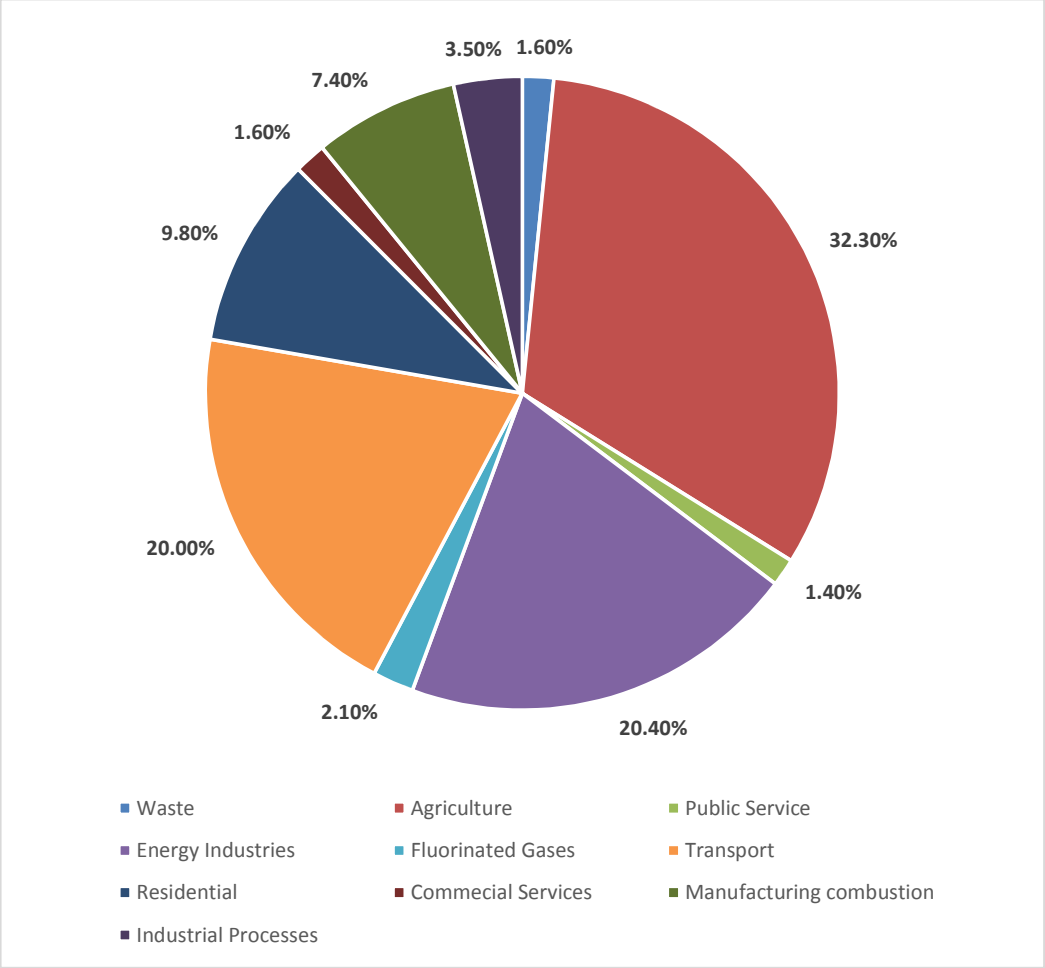

Figure 10-1: Ireland Greenhouse Gas Emission 2016*

*http://www.epa.ie/pubs/reports/air/airemissions/ghgemissions/

10.4.3 Climate Change Advisory Council

The Climate Change Advisory Council (CCAC) is an independent advisory body established under the Climate Action and Low Carbon Development Act of 2015 and tasked with assessing and advising on how Ireland is making the transition to a low carbon, climate resilient and environmentally sustainable economy by 2050. It is tasked with reviewing national climate policy, progress on the achievement of the national transition objective and progress towards international targets. A key task is to conduct an annual review of progress made over the previous year in reducing greenhouse gas emissions and furthering the transition by 2050.

In its Annual Review Report 2018[7], the CCAC summarised the progress made to date and highlighted key issues in the Executive Summary as follows:

- *Irish greenhouse gas emissions are rising rather than falling. Ireland is completely off course in terms of achieving its 2020 and 2030 emissions reduction targets. Without urgent action that leads to tangible and substantial reductions in greenhouse gas emissions, Ireland is unlikely to deliver on national, EU and international obligations and will drift further from a pathway that is consistent with transition to a low-carbon economy and society.*
- *The Council welcomes the National Planning Framework and the National Development Plan as potentially significant contributions to transition; however, their robust implementation and monitoring will be key to achieving progress in the transition to a low-carbon, climate-resilient and sustainable economy and society.*
- *The Council welcomes the commitment to end the burning of coal at Moneypoint by 2025. However, the Council is concerned that planned support for biomass co-fired with peat has the effect of supporting the continued burning of peat for electricity generation, thus contributing to higher emissions. There is an urgent need to bring coherence to this aspect of energy policy and climate change policy by closing peat-fired generation as soon as possible.*
- *The Council recommends that the carbon tax be raised to €30 per tonne in Budget 2019 as an essential component of achieving decarbonisation, rising to €80 per tonne by 2030.*
- *The current carbon price level in the EU Emissions Trading System is insufficient to achieve climate targets and objectives, including the decarbonisation of electricity generation. Analysis suggests that the best way to achieve the ending of the burning of coal at Moneypoint by 2025 would be to introduce a carbon price floor in Ireland alongside other European countries. The government should actively work with other European countries towards this goal.*

The proposed development has as one of its objectives the target of contributing to achieving low carbon energy generation which will be achieved by the end of 2027. The transition period proposed, between 2020 and end 2027, requiring the burning of peat and release of greenhouse gases is necessary for reasons set out in Chapter 3, alternatives to the project. There would be an immediate gain in GHG reduction with the immediate closure of WOP but there would be no long term gain in terms of developing a dispatchable

[7] Climate Change Advisory Council, Annual Review Report 2018. http://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiZ3LvKl8LdAhXBe8AKHTArC0oQFjAAegQIABAC&url=http%3A%2F%2Fwww.climatecouncil.ie%2Fmedia%2FCCAC_AnnualReview2018.pdf&usg=AOvVaw0j9IPfC2ReAeCE8brw7S9k

renewable electricity generating station which would contribute significantly to Ireland's renewable energy generation targets and to meeting the objectives of the national mitigation plan. Peat fuel use at WOP would reduce from 2020 and finally cease by the end of 2027 well within the target date of 2030. Based on the commercial realities of co-firing on biomass, level of financial support, supply chain development timeline, which would foster an indigenous biomass industry and need to ensure a just transition period for socio economic reasons 2027 is a realistic achievable year for cessation of peat burn and transition to 100% biomass utilisation at WOP.

10.4.3.1 Irelands Greenhouse Gas Emission Projections 2017 - 2035

The issue of increasing greenhouse gas emissions in the Annual Review 2018 was raised with reference to the EPA's Report "Ireland's Greenhouse Gas Emission Projections, 2017-2035, May 2018[8]". This provides an updated summary of Ireland's total projected GHG emissions to 2035 and progress towards achieving the 2020 targets. It states the following:

- *"Latest EPA greenhouse gas emissions projections indicate an overall increase in greenhouse gas emissions from most sectors. The projected growth in emissions is largely underpinned by projected strong economic growth and relatively low fuel prices leading to increasing energy demand over the period.*
- *The positive impact on emissions of existing and planned policies and measures is tempered by the strong economic outlook and associated increase in energy demand.*
- *Ireland is not projected to meet 2020 emissions reduction targets and is not on the right trajectory to meet longer term EU and national emission reduction commitments.*
- *Fossil fuels such as coal and peat continue to be key contributors to emissions from the power generation sector and the extent of their use will be a key determinant in influencing future emissions trends from this sector.*
- *A strong growth in emissions projections from the transport sector is attributed to a rise in fuel consumption particularly for diesel cars and diesel freight up to 2025. A projected accelerated deployment of electric vehicles between 2025 and 2030 does however result in a projected decline in emissions during this period.*
- *Agriculture emissions are projected to continue to grow steadily over the period. This is based on an updated outlook which sees an increase in animal numbers particularly for the dairy herd.*
- *The gap between the two scenarios – With Existing Measures and With Additional Measures – is narrowing over the period to 2020 indicating that mitigation options in the short-term are largely established.*

[8] Report "Ireland's Greenhouse Gas Emission Projections, 2017-2035, May 2018

- *These projections do not consider the impact of policies and measures that form part of the recently announced National Development Plan or the full impact of policies and measures included in the National Mitigation Plan. It is anticipated that additional impact will be provided to the EPA by relevant Government Departments and Agencies and included in the 2019 Emissions Projections."*

Under the "With Existing Measures", total emissions are projected to increase by 1.0% to 2020 and 4% to 2030. Under the "With Additional Measures" scenario emissions are estimated to increase by 2% by 2020 and decrease by 1% by 2030, see **Figure 10-2** and **Figure 10-3**. The report states that Ireland is not on the right long-term trajectory in meeting national 2050 targets in the electricity generation, built environment and transport sectors. Primarily the increases are driven by increased economic activity. With respect to energy industries, which includes electricity generation, the report identifies that under the "With Additional Measures" scenario, which should see a reduction in CO2 emissions overall, there is a projected higher CO_2 emission to 2025 with a subsequent reduction resulting from the proposed co-firing of peat and biomass supported by REFIT 3 (an additional measure) and the phasing out of peat. Reference is made to the ending of the Public Service Obligation (PSO) for the WOP and Lough Ree Power (LRP) midland peat stations with consequently, peat used for electricity generation significantly reducing. Thereafter, the report assumes that "the fuel type used for electricity generation is influenced by fuel price and in this case gas largely replaces peat as one of the main fuels used for power generation leading to lower emissions".

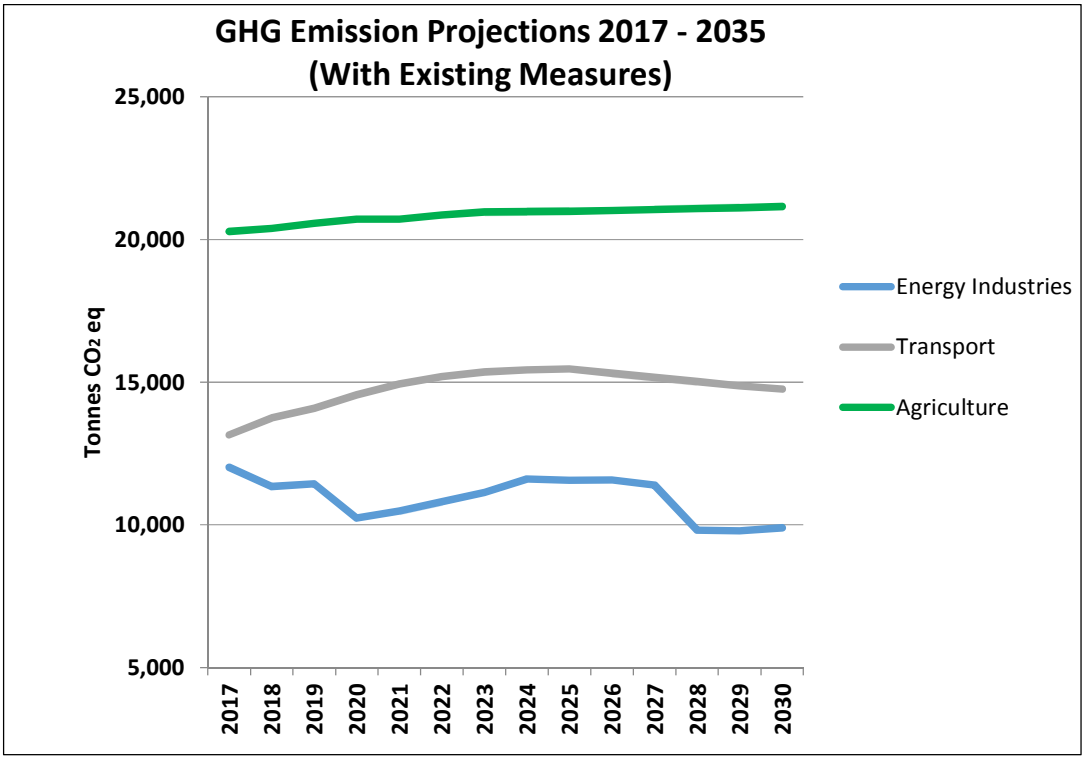

Figure 10-2: GHG Emission Projections 2017-2035 (with existing measures)

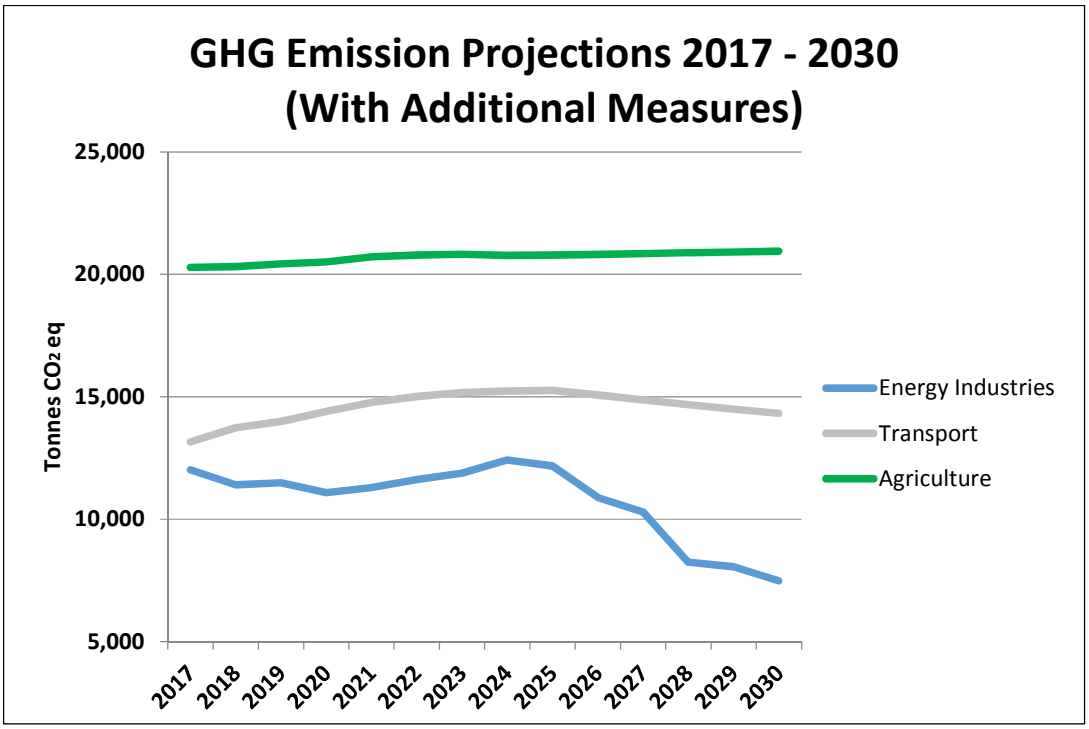

Figure 10-3: GHG Emission Projections 2017-2030 (with additional measures)

It should be noted however that:

- future peat combustion as proposed in co-firing will not receive any financial support from the Government (there will be no PSO to support peat combustion) and hence firing on peat will occur in a competitive market (against gas fired power generation plants for example) in much the same way envisioned in the EPA report.
- Peat combustion at WOP will be phased out completely by the end of 2027 in line with EU emission reduction targets for the energy sector.
- Immediate cessation of peat combustion in 2020 will not automatically reduce GHG emissions at EU level as these are controlled under the EU Emission Trading Scheme (ETS). This scheme requires the purchase of a carbon allowance for every tonne of CO2 emitted. The purchases are from a defined annual allowance for the EU which is reducing year on year in line with the EU Climate Policy. Hence allowances not taken up by the peat plants for example would likely be taken up by another fossil fuel powered energy generator in the EU assuming all allowances are fully utilised. Additionally the price of carbon under the ETS has already increased significantly with the introduction of the Market Stability Reserve (MSR) in January 2019, which will see significant cuts in the available carbon allowances making fossil fuel combustion for energy generation purposes costlier.
- Under the With Existing Measures scenario, total energy industries emissions are projected to decrease by 18% over the period 2017- 2020 to 10.2 Mt CO2eq and decrease by 21% over the period 2017-2030 to 9.9 Mt CO2eq.

- Under the With Additional Measures scenario, total energy industries emissions are projected to decrease by 12% over the period 2017 – 2020 to 11 Mt CO2eq and decrease by 40% over the period 2017-2030 to 7.4 Mt CO2eq

Under EU Rules, biomass is considered carbon neutral. Generation of electricity from biomass fuel is seen as an additional measure to reduce Ireland's Greenhouse Gas emissions going forward to 2035 and West Offaly Power on its own or in combination with LRP Station operating in similar fashion has the potential to contribute significantly to this reduction using sustainable biomass.

The EPA report also referred to the possible indirect impact of co-firing biomass at the midland peat stations on the Renewable Heat Initiative through competition for available biomass. This is unlikely to occur to any significant extent due to the nature of competitive pricing and affordability of biomass in the Irish market. Combined heat and power (CHP) plants will be more distributed, with shorter transport distances and greater affordability for biomass hence the supply to these types of facilities is unlikely to be affected.

10.4.4 Climate Action and Low Carbon Development Act

Ireland's Climate Action and Low Carbon Development Act 2015 provides the statutory basis for the national transition objective laid out in the national policy position underpinning climate change policy in Ireland.

As stated by the DCCAE

"*As provided for in the 2015 Act, in order to pursue and achieve the national transition objective, the Minister for Communications, Climate Action and Environment must make and submit to Government a series of successive National Mitigation Plans (NMPs) and National Adaptation Frameworks (NAFs). When considering these plans and frameworks, Government must ensure that the national transition objective is achieved by the implementation of measures that are cost-effective. The Act provides that the first NMP must be submitted to Government no later than 10 June 2017 and that the first NAF must be submitted to Government no later than 10 December 2017*".

Section 15 (1) of the Act provides that a relevant body shall, in the performance of its functions, have regard to—

a) the most recent approved national mitigation plan,
b) the most recent approved national adaptation framework and approved sectoral adaptation plans,
c) the furtherance of the national transition objective, and
d) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.

The first **National Mitigation Plan (NMP), 2017** set out the context for transitioning to a low carbon, climate resilient and environmentally sustainable economy by 2050. It was adopted pursuant to the Climate Action and Low Carbon Development Act, 2015.

The NMP set out the central roles of the key Departments responsible for key sectors including electricity generation, the built environment, transport and agriculture; as well as a range of other Government Departments.

The Plan set out a vision for decarbonising the electricity generation sector noting with respect to peat use as a fuel that (Para. 3.1):

> *'Peat burning generation will gradually be replaced by sustainable biomass.'*

The Plan made a brief reference to the conversion of the peat burning generating stations, including WOP for that purpose, stating:

> *"In the decade beginning in 2021, the new Renewable Electricity Support Scheme (RESS) will incentivise investment in further renewable generation beyond the current target. Peat burning generation will gradually be replaced by sustainable biomass. Benefits for health, well-being, air quality and sustainable development will accrue as we transition away from coal and peat generation. Aside from the converted peat burning stations, the role of biomass will largely be confined to the heating sector."*

The NMP (NMP, Section 3.3) acknowledges the intent of Bord na Móna to co-fire at Edenderry Power Station (EPL) with REFiT3 support, and also to cease harvesting of peat for electricity generation by 2030. It further states that the ESB's stations – WOP and LRP, may also move to co-firing with biomass, availing of REFiT3, stating:

> *"This will contribute significantly to the decarbonisation of electricity and is in keeping with the Energy White Paper."*

The NMP (NMP, Annex 2) sets out the mitigation measures presented in the Environmental Report (ER) prepared as part of the Strategic Environmental Assessment (SEA) of that Plan. It is noted that the SEA is a statutory and systematic process undertaken to aid decision-making in relation to any plan, programme or project to ensure that environmental and other sustainability aspects are considered effectively. An identified mitigation measure in relation to the assessment of alternatives addressed the potential elimination of the peat powered plants, noting that any decision to eliminate these plants should only be taken in the context of a feasibility study that would be prepared within the coming five years – i.e. by 2022:

> *Electricity Generation – Eliminate Peat Powered Plants;*
>
> *Undertake a feasibility study to address the measures required to discontinue the combustion of peat for electricity. All options for discontinuation of these plants should be considered and a multi criteria analysis undertaken to determine the optimum approach. Environmental criteria should be the primary driver for the decision making process. This study should be undertaken within the next five years to inform decision making for the next NMP and provide a clear roadmap for the phased cessation of peat in this sector.*
>
> *Sector response/proposition - Energy: The harvesting of peat for electricity generation is expected to cease by 2030. Currently, one of the three peat-fired electricity generating plants (Edenderry, owned by Bord na Móna) co-fires with biomass at levels in excess of 30%. The two ESB plants, West Offaly and Lough Ree, are technically capable of co-firing with biomass and the owners are currently*

examining the potential for co-firing. The subsidies currently supporting the generation of electricity from peat in these two power stations will cease by end 2019. This will provide a key incentive for the owners of these plants to convert to co-firing. An issue to be overcome is the development of more cost-effective supply chains of biomass.

The completion of additional studies is enshrined elsewhere in the NMP. Action 24 commits to oversight by DCCAE of a review of future peat generation plants in line with Bord na Mona's Sustainability Strategy which was to be completed by 2019 – noting that that Strategy was "to cease harvesting peat for electricity generation by 2030".

Noting these references it is clear that the NMP accepted the on-going operation of the peat stations into the 2020's and did not considered their immediate closure in 2019/ 2020.

The proposed transition period of WOP electricity generation from peat fuel to biomass fuel between 2020 and the end of 2027 is in line with the NMP and reflects the gradual transition as identified in the Plan. The proposed project also advances the date by which peat harvesting for electricity generation at WOP will cease with the generating station firing on biomass only from the end of 2027 well in advance of the 2030 date.

The first statutory **National Adaptation Framework (NAF)**[9] was published in January 2018. It outlines the government and societal approach to climate adaptation setting out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The NAF establishes a context for Government Departments preparing sectoral adaptation plans in relation to identified priority areas, as well as local authority adaptation strategies.

Under the National Adaptation Framework (NAF), Government Departments have to prepare Sectoral Adaptation Plans. Twelve sectors under 7 Government Departments will prepare plans. The deadline for submitting plans to Government is 30 August 2019. The sectors specifically relevant to WOP are;

- Electricity and Gas Networks - Department of Communications, Climate Action and Environment

The **National Climate Change Adaptation Framework (NCCAF)**[10] was published in 2012. This non-statutory document was a first step in developing a comprehensive national policy position within which adaptation measures to address the impacts of climate change could be taken and planned. Climate change adaptation can be defined as the ability of a system

[9] National Adaptation Framework, 19th January 2018, https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/default.aspx

[10] National Climate Change Adaptation Framework, December 2012, https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/National-Climate-Change-Adaptation-Framework.aspx

to adjust to climate change, to minimize potential damage, to take advantage of opportunities, and to cope with the consequences.

Annex IV of the NCCAF sets out an Overview of Challenges for Sectors and Section 3 deals specifically with Energy - focussing on the impacts of climate change on the sector itself.

In February 2018 the DCCAE published the "Climate Change Adaptation Plan for the Electricity and Gas Networks"[11], in the context of the December 2012 National Climate Change Adaptation Framework (NCCAF). This high level Plan outlines the likely effects of climate change on the Irish electricity and gas networks sectors and possible actions to develop resilience to climate change within the sector. It focusses on assessing our vulnerability to key climate variables and the likely impacts of such on our electricity and gas networks, based on our current understanding of climate change and its consequences for Ireland.

With respect to the energy sector that plan (Page 7) sates that this;

> *"is essential to the functioning of the modern economy and is a key enabler to all other economic activities. Disruptions or reductions in the supply of energy can have significant negative impacts on the commercial and social heart of the country. The impacts of such disruptions will be highly dependent on scale and duration.*
>
> *While it is acknowledged that the energy sector can be a contributory element to climate change, the sector is also at risk from climate change impacts with potential consequences for both energy resources and the sustainability of the infrastructure".*

The Plan is high level and does not consider project or location specific measures nor will it influence the development consent for any energy projects. The specific contents of the Adaptation Plan will not, of themselves, have a significant effect on the environment or Natura 2000 sites. It has been determined therefore that neither a Strategic Environmental Assessment (SEA) nor an Appropriate Assessment (AA) will be required at this time.

The Plan acknowledges the necessity to ensure robustness of the energy system and the fact that there are synergies between mitigation planning and adaptation planning (page 11);

> *"Energy related climate adaptation actions and plans must ensure that our evolving energy system remains sufficiently robust to deal with the likely consequences of climate change.*
>
> *It is important to reflect on the interaction (synergies and co-benefits) between mitigation planning and adaptation planning. It is clearly a 'least regrets' option that if mitigation activities succeed in limiting the rise in global temperatures, less*

[11] Climate Change Adaptation Plan for the Electricity and Gas Networks sector, https://www.dccae.gov.ie/en-ie/news-and-media/publications/Pages/Climate-Change-Adaptation-Plan-for-the-Electricity-and-Gas-Networks-sector-0221-5002.aspx

adaptation will be needed to deal with the consequences of climate change. However, due to the slow response time of the climate system, changes are projected to continue and increase over the coming decades. Even if GHG emissions came to an end, some changes, such as sea-level rise, are projected to continue up to and beyond the end of this century".

As set out in the Energy Sector Profile (page 14) the overarching objective of the Government's energy policy is to ensure secure and sustainable supplies of competitively priced energy to all consumers;

"It is important that Ireland's energy supply is resilient to external shocks related to climate events or associated events, and focusses on reducing emissions to support national and international efforts in climate mitigation in line with the Paris Climate Agreement and EU Climate Obligations.

Large energy infrastructure projects typically have long investment cycles, but the ongoing development and renewal of the energy networks is essential to ensure Ireland's energy system is safe and secure and ready to meet demand. A safe, secure energy system is also critical to Ireland's ability to attract inward investment, support domestic investment and retain and create jobs."

Section 3 of the Plan sets out the key climate impacts for the energy sector as follows:

- Flooding / change in precipitation / extreme events
- Temperature rise
- Sea level rise
- Changes in wind energy content

Electricity generating plants are identified as being particularly vulnerable to climate change impacts and in the context of WOP, flooding and temperature rise are the potential impacts of concern due to its geographic location on the Shannon River and requirement for cooling water abstraction for operational purposes. However, a Flood Risk Assessment has been carried out; see Chapter 8, which indicates that the generating station will not be impacted by flooding. The WOP Station must comply with the conditions of its IE Licence with respect to thermal cooling water discharge and the potential impact on the receiving water, (see Chapter 8 also). During extreme weather events, such as prolonged dry spells with low flows and elevated river water temperature, WOP could potentially be required to reduce generating load, thereby reducing thermal load to the river, to ensure that the IE Licence condition is adhered to. When operating fully on biomass as a fuel this could result in a reduction in dispatchable renewable energy generation which would likely need to be met by alternate fossil fuel electricity generation.

An example of this is cited in the Plan on page 31 where

"an extreme heatwave in Poland in the summer of 2015 put additional pressure on the Polish power system, with a lack of water for cooling contributing to blackouts in August 2015."

With respect to changes in wind energy content the plan states (Page 30) that:

Extreme wind events are unlikely to directly affect the operation of a thermal power station. However, damage to transmission assets may indirectly result in a generating station being unable to operate for a period of time.

Increased variability of wind generation will increase requirements for backup generation and/or storage. Changes in wind energy content may lead to increased incidence of wind-farm power unavailability due to wind speeds above the design shutdown levels of wind turbines (typically 25 m/s for current equipment); and may also lead to increased risk of mechanical damage to wind turbines.

This highlights the importance of having robust renewable electricity generating stations such as WOP firing on sustainable biomass on the national grid which will not only compliment wind generation but provide backup when wind is unavailable.

Section 6 of the Plan sets out options for adaptation and addressing the challenge of climate change impacts on the electricity and gas networks with the following suite of general adaptation options referenced:

- Energy sector climate research
- Collaborative research across stakeholder bodies e.g. EPA research on Critical Infrastructure Vulnerability to Climate Change
- Auditing energy infrastructure to identify vulnerabilities and implement optimum adaptation measures
- Effective cooperation and communication between Departments, agencies, state bodies and other stakeholders to ensure that energy infrastructure is prepared for changes to climate; this should include the sharing of information that will assist with adaptation such as climatic data
- Mainstream climate change adaptation into all energy policies
- Climate change to be incorporated into engineering management practices
- Energy infrastructure planners and designers to take climate change projections and impacts into account
- The development of Ireland's abundant, diverse and indigenous renewable energy resources
- Optimal combination of increased energy efficiency and increased use of renewable (low carbon) energy sources

Climate change pressure has been incorporated into the engineering design for the generating station with SUDs incorporated and Flood Risk Assessment undertaken. The development will provide a stimulus to Ireland's growing biomass supply chain, an indigenous renewable energy resource, through creating a market demand for energy crops providing dispatchable renewable low carbon electricity generation to the Irish grid.

The table on page 50 of the electricity and gas network sectors plan sets out an adaptation implementation plan, action 4 of which relates to the diversification of the electricity generation portfolio. This sets a deliverable of increased diversification of the energy fuel mix, including increased use of renewable and indigenous resources. The WOP project as

proposed will see diversification of generation into renewable biomass stimulating the development of an indigenous biomass industry.

Section 3.1 of the Climate Action and Low Carbon Development Act 2015 sets a **national transition objective** as follows:

3. (1) For the purpose of enabling the State to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050 (in this Act referred to as the "national transition objective") the Minister shall make and submit to the Government for approval—

(a) a national mitigation plan, and

(b) a national adaptation framework.

(2) When considering a plan or framework, referred to in subsection (1), for approval, the Government shall endeavour to achieve the national transition objective within the period to which the objective relates and shall, in endeavouring to achieve that objective, ensure that such objective is achieved by the implementation of measures that are cost effective and shall, for that purpose, have regard to—

a) the ultimate objective specified in Article 2 of the United Nations Framework Convention on Climate Change done at New York on 9 May 1992 and any mitigation commitment entered into by the European Union in response or otherwise in relation to that objective,
b) the policy of the Government on climate change,
c) climate justice,
d) any existing obligation of the State under the law of the European Union or any international agreement referred to in section 2, and
e) the most recent national greenhouse gas emissions inventory and projection of future greenhouse gas emissions, prepared by the Agency.

The proposed project will achieve a low carbon electricity generation dispatchable renewable electricity generating station fully operational on biomass only by the end of 2027. This will contribute significantly to achieving the **national transitional objective** of a low carbon, climate resilient and environmentally sustainable economy.

The proposed project will contribute to meeting the objective of **mitigating the greenhouse gas emissions and adapting to the effects of climate change** in the State. In the short term, between 2020 to end 2027 greenhouse gases from the combustion of the peat co-firing element will continue to be emitted from the generating station but these will reduce to zero at the end of 2027. Thereafter, electricity generated by the station from sustainable biomass will be counted as zero carbon for the biomass element under the EU ETS scheme. From the end of 2027 WOP will be a low carbon renewable energy generating station displacing electricity generation from fossil fuel on the grid and reducing greenhouse gas emissions. This mitigating effect will also reduce the pressure to adapt to the effects of climate change.

10.4.5 Air Quality Standards

To protect human health, vegetation and ecosystems, EU Directives have been adopted which set down air quality standards for a wide variety of pollutants. The current standards are contained in the CAFE Directive (2008/50/EC) (European Parliament (EP) and Council of Europe (CEU), 2008) and the Fourth Daughter Directive (2004/107/EC). These Directives also include rules on how Member States should monitor, assess and manage ambient air quality.

The CAFE Directive is an amalgamation of the Air Quality Framework Directive and its subsequent first, second and third daughter Directives.

The CAFE Directive was transposed into Irish legislation by the *Air Quality Standards Regulations 2011* (S.I. No. 180/2011). It replaces the *Air Quality Standards Regulations 2002* (S.I. No. 271/2002), the *Ozone in Ambient Air Regulations 2004* (S.I. No. 53/2004) and S.I. No. 33/1999 *Environmental Protection Agency Act, 1992 (Ambient Air Quality Assessment and Management) Regulations 1999*. The Fourth Daughter Directive was transposed by the *Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009* (S.I. No. 58/2009).

EU legislation on air quality (CAFE) requires that Member States divide their territory into zones for assessment and management purposes. Ireland is divided into four such zones (refer to Figure 9-2 in the Air Quality Standards Regulations (2015). The zones were amended on 1st January 2013 to take account of population counts from the 2011 CSO Census and to align with the coal restricted areas in the 2012 Regulations (S.I. No. 326 of 2012). Zone A is the Dublin conurbation, Zone B is the Cork conurbation, Zone C other cities and large towns comprising Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, and Balbriggan. Zone D, principally rural, is the remaining area of Ireland. WOP Station and ADF is located in Zone D.

In conjunction with individual local authorities, the EPA undertakes ambient air quality monitoring at specific locations throughout the country in the urban and rural environment. It prepares an Air Quality Report based on data from 30 monitoring stations and a number of mobile air quality monitoring units. The EPA as the National Reference Laboratory for Air, coordinates and manages the monitoring network. Monitoring stations are located across the country. The EPA provides real time air quality data on its website (www.epa.ie/air/quality/).

Air quality standards have been developed and incorporated into Irish statute in order to protect both human health and the ambient environment. These standards are based on International agreements, which identify performance standards and limit the generation of air quality pollutants at a regional, national and global level.

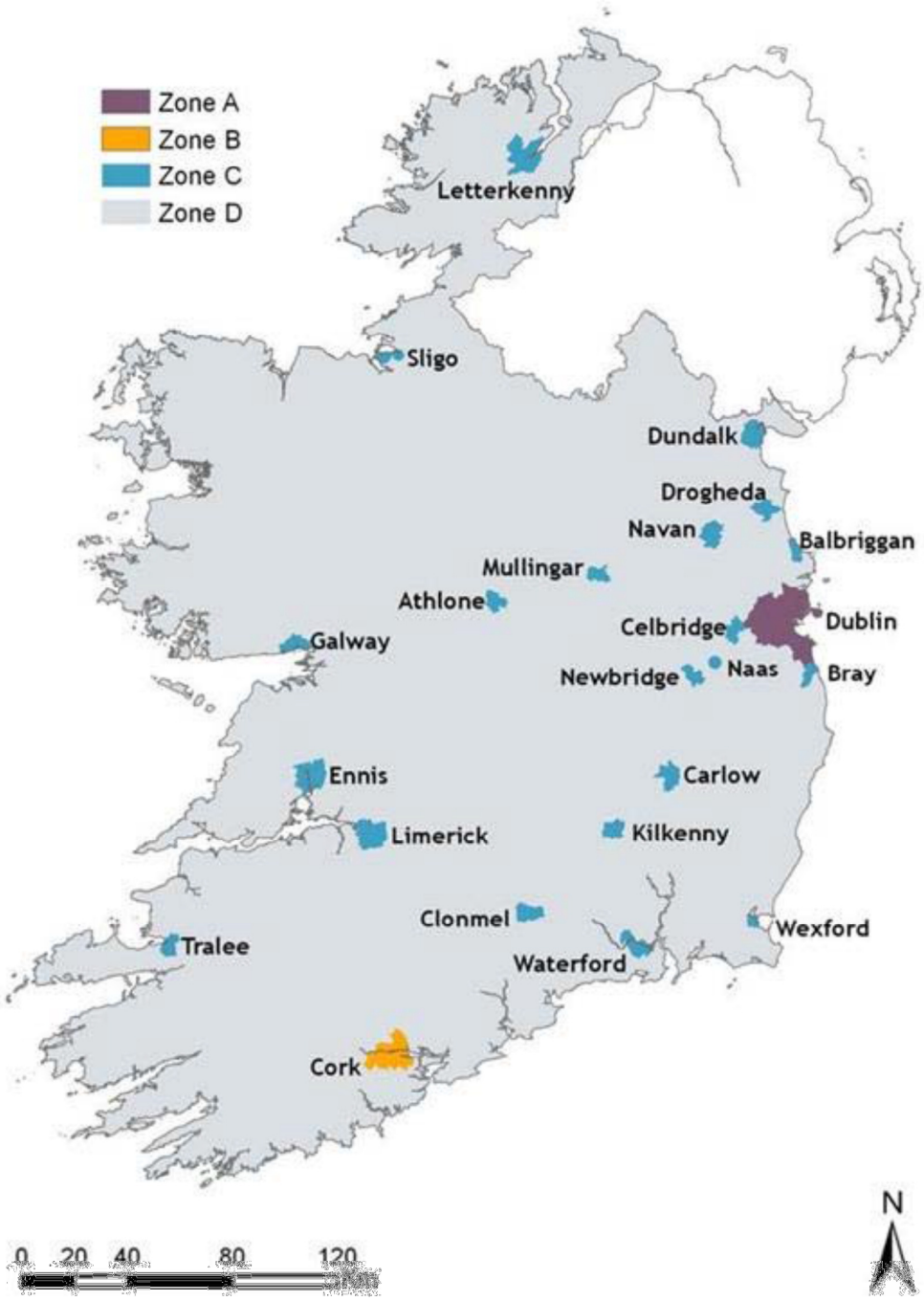

Figure 10-4 Air Quality Zones in Ireland

(Source: Air Quality in Ireland 2015, EPA)

10.4.5.1 EPA Air Quality Zone

WOP and the ADF are located in the air quality management area Zone D as defined by the EPA in accordance with EU air quality legislation. Background air quality data for Zone D was obtained from the EPA report on Air Quality in Ireland 2016– Indicators of Ambient Air Quality (2016) and air quality bulletins as published periodically by the EPA and assessed against the Air Quality Standards Regulations 2011 (S.I. No. 180/2011) which transpose the requirements of the Clean Air for Europe (CAFE) Directive (2008/50/EC).

Combustion emissions from WOP comprise mainly Carbon Dioxide (CO_2), Carbon Monoxide (CO), oxides of nitrogen (NOx), oxides of sulphur (SOx) dust with very low quantities of Hydrochloric Acid (HCl) Hydrofluoric Acid (HF) and Mercury (Hg). The station also releases non methane volatile organic carbons (NMVOC,) from fuel storage. Ash is not a source of gas or odour therefore there are no air emissions emitted from the ADF. Gaseous emissions from WOP Station and dust from the transportation and handling of ash are discussed in this chapter. Cumulative impacts with LRP Station and EPL as well as indirect climate impacts from WOP Station and the fuel source used at the plant are discussed.

10.4.5.2 Dust Deposition Standards and Guidelines

Currently in Ireland there are no statutory limits for dust deposition. Dust particles in the ambient environment is pervasive, however localised increases in dust particles is usually associated with exposure of soil surfaces, usually through human activities associated with agricultural practices or construction. Whether general dust deposition becomes an issue for the general public is a subjective issue and depends on a variety of factors including the sensitivity of nearby locations, the repetitive nature of any dust deposition occurring and the nature of the dust particulate itself. It is because of these variances and the subjectivity of the issue that there are no statutory limits. The focus for dust control and emissions is on minimising the potential for a nuisance occurring in the first instance and implementing good site practices where practicable.

In recent years the TA Luft/VDI 2119/Bergerhoff Method of dust emission monitoring has become the most commonly used method. This method is advocated by the EPA and the Department of Communications, Climate Action & Environment (DCCAE). This method involves determining a mass dust deposition rate per unit area over a given time period, using a direct collection pot to standardise dimensions of either glass or plastic. The system benefits from being a direct collection method i.e. less transferring of material and consequent reduction in sampling errors. This method is defined as an internationally recognised standard and has been adopted by the EPA as the method of choice for licensed facilities.

The TA Luft/VDI 2119 recommended threshold guideline value is 350mg/m²/day. Below this threshold guideline value dust deposition problems are considered less likely. This is the recommended threshold value normally stipulated by local authorities and the EPA in conditions attached to development consent and Waste Licences.

10.4.6 WOP Station emissions to air

Emissions to air from WOP Station are subject to IE Licence P0611-02 limits. The licence sets out emission limit values (ELVs) not to be exceeded and a schedule of monitoring requirements. These requirements are shown in Table 10-2**.**

In addition, the station operates in accordance with its Greenhouse Gas Emission permit No. IE-GHG077-10385-4 issued by the EPA[12]. The Greenhouse Gas Emissions Permit authorises the holder to undertake named activities resulting in emissions of specified greenhouse gases from the listed emission points. It also contains requirements that must be met in respect of such emissions, including monitoring and reporting requirements, refer to:

http://www.epa.ie/pubs/reports/air/etu/permit/electricitysupplyboardghg068.html.

Table 10-2: Emission limit values and monitoring requirements according to P061102 Licence

P0610-02 Schedule	Emission Point Ref. No.	Location	Parameter	ELV	Monitoring
Schedule B	PS-A1	Boiler Stack	Oxides of sulphur Nitrogen oxides (as NO_2) Dust	200 mg/m^3 200 mg/m^3 20* mg/m^3	
Schedule B	PS-A2	Auxiliary Boiler Stack	Oxides of sulphur Nitrogen oxides (as NO_2) Dust	1700 mg/m^3 300 mg/m^3 20* mg/m^3	
Schedule B	Dust Deposition	At locations to be agreed by the agency	Dust	350 mg/m^2/day	
Schedule C	PS-A1	Boiler Stack	Sulphur dioxide Nitrogen oxides (as NO2) Dust	- 	Continuous Continuous Continuous Continuous

[12] EPA, Greenhouse Gas Emission Permit, IE-GHG077-10385-4, ESB West Offaly Power

https://www.google.ie/search?source=hp&ei=v7XEW5qJBI3TkwXW1KXQDQ&q=Greenhouse+Gas+Permit+for+West+Offaly+Power&oq=Greenhouse+Gas+Permit+for+West+Offaly+Power&gs_l=psy-ab.12..33i160k1.28876.38776.0.41428.43.37.0.3.3.0.1139.5493.6j11j7j0j1j7-1.26.0....0...1c.1.64.psy-ab..14.28.5443...0j0i131k1j0i22i30k1j0i22i10i30k1j33i22i29i30k1j33i21k1.0.E_I0t_yBn_8

P0610-02 Schedule	Emission Point Ref. No.	Location	Parameter	ELV	Monitoring
			Oxygen Temperature Pressure Water vapour content		Continuous Continuous Continuous**
Schedule C	PS-A2	Auxiliary Boiler Stack	Carbon monoxide Nitrogen oxides (as NO2) Sulphur dioxide Dust	-	Annually Annually Annually Annually
Schedule C	Ambient monitoring	At locations to be agreed by the agency	Dust	-	Monthly

*Technical Amendment A to Industrial Emissions Licence.

**The continuous measurement of water vapour content shall not be necessary, provided that the sampled exhaust gas is dried before the other parameters are continuously analysed.

10.4.6.1 Large Combustion Plant BAT Requirements

In 2017 the European Commission published its implementing decision (on best available technique (BAT) conclusions under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants (LCP)[13]. This decision sets out new compliance criteria for air quality emission limits from large combustion plant. The limits set out in the Commission decision for large combustion plants firing on peat or biomass are provided in Table 10-3.

[13] Commission Implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants (notified under document C(2017) 5225)

Table 10-3: New emission limit values for large Peat/Biomass combustion plants

Emissions to Air	Yearly average	Daily Average	
Oxides of Sulphur	< 10–70(3) (Higher end 100) mg/Nm^3	< 20–85(5) (Higher end 165) mg/Nm^3	
Nitrogen Oxides (as NO2)	40–150 (Higher end 160)	95–165 (Higher end 200)	
Dust	2-10 mg/Nm^3	2–16 mg/Nm^3	
HCl	1-5 mg/Nm^3	1-12 mg/Nm^3	
HF	<1 mg/Nm^3		
Hg		< 1–5 µg/Nm3	Average over the sampling period

The annual emissions of the licenced pollutants are reported in the station Annual Environmental Reports. A summary of the annual emission data for the years 2015 to 2017 is provided in Table 10-4.

WOP Station has adhered to the emission limits to air over the past three years with minor exceptions. A small number of minor incidents relating to air have been reported during this period. These minor incidents have all been resolved to the satisfaction of the EPA and the likelihood of reoccurrence is considered to be low.

Table 10-4: Annual Emissions to Air for 2015, 2016 and 2017

Parameters	Emissions (kg/annum)		
	2017	2016	2015
Carbon dioxide (CO_2)	1,130,974,590	1,279,368,000	1,106,804,212
Sulphur oxides (SOx/SO_2)	222462.2	191,839	216,597
Particulate matter	4130.9	3,788	5,005
Carbon monoxide (CO)	83382	77,051	80,098
Nitrous oxide (N_2O)	69160	65,479	68,069
Ammonia (NH3)	15054	14,235	14,798
Non-methane volatile organic compounds (NMVOC)	3880	3,673	3,819
Benzene	242	230	239
Polycyclic aromatic hydrocarbons (PAHs)	0.854	1	1
Nitrogen oxides (NOx/NO_2)	653953	712,825	700,557

10.4.7 ADF

The operation of the ADF is controlled under the stations IE Licence. Ash is transported from WOP in covered wagons to prevent dust along the Bord na Móna internal rail system to the landfill site. The ADF is operated in accordance with an agreed Landfill Operational Plan as required by the EPA IE Licence P0611-02. Section 6 of the Landfill Operational Plan deals specifically with dust. In addition the licence, under Condition 6.17 specifies operational controls at the landfill. Continued operation of the ADF will be in accordance with any revision of the IE Licence covering the activity.

10.4.7.1 Dust Deposition

The IE Licence for the site specifies a dust deposition standard of 350mg/m^2/day at locations which have been agreed with the agency. There have been no significant breaches of the dust standard at these location

10.4.8 Ambient Air Quality

Clean air is of particular importance to the Irish population's general health and wellbeing. The benefits of a clean natural environment play an important role in reducing the burden of chronic disease. Ireland is fortunate in having a good quality of air relative to other EU Member States as evidenced by the most recent EPA report A*ir Quality in Ireland 2016 - Key Indicators of Ambient Air Quality*.

The most recent EPA Air Quality report provides an overview of air quality in Ireland for 2016, based on the data obtained from 30 monitoring stations that form the National Ambient Air Quality Monitoring Network as assessed against legislative limits and target values for the protection of health and vegetation/ecosystems. Concentrations observed were also compared to the World Health Organisation (WHO) air quality guideline values. It includes an assessment of the following pollutants: NOx, SO_2, CO, ozone, particulate matter (PM_{10}, $PM_{2.5}$ and black smoke), benzene and VOC, heavy metals and polycyclic aromatic hydrocarbons. The EPA Air Quality Report 2016 highlights the following:

- No levels above the EU limit value were recorded at any of the ambient air quality network monitoring sites in Ireland in 2016
- WHO guideline values were exceeded as follows:
- Ozone at 7 monitoring sites
- Particulate Matter PM_{10} at 11 monitoring sites (24hr WHO guideline)
- Particulate Matter $PM_{2.5}$ at 9 monitoring sites (24hr WHO guideline)
- Particulate Matter $PM_{2.5}$ at 2 monitoring site (annual WHO guideline)
- EEA reference levels were exceeded as follows
- PAH at 4 monitoring sites
- The dioxin survey 2016 shows levels recorded remain consistently low in the Irish Environment.

The report summary indicates a growing understanding of the links between air quality and human health. Although air quality is compliant with EU legislative requirements there are exceedances of the WHO standards which gives cause for concern. The European Environment Agency (EEA) has estimated that air quality from home heating is responsible for 1,510 premature deaths in Ireland in 2014. Transport is also identified as a significant contributor to air emissions with increasing concern over agricultural related emissions.

With respect to large combustion plants such as WOP Station the report in its conclusion acknowledges such emissions are well controlled and regulated under the Industrial Emissions Licencing system enforced by the EPA:

> *"Emissions from large industrial activities are well regulated through the industrial and waste licensing regimes and further downward pressure on emissions will be realised through ongoing implementation of the European Industrial Emissions Directive (IED) and associated Best Available Techniques requirements of the IED."*

Challenges remain in reducing levels of particulate matter predominantly sourced from the burning of fossil fuels in domestic appliances and commercial boilers in Ireland and it is likely that future air quality standards in Europe will reflect those of the World health Organisation (WHO).

A summary of background air quality for the main pollutants such as NOx, SO_2, CO, PM_{10} and $PM_{2.5}$ as assessed by the EPA for Zone D is provided in **Table 10-5** to **Table 10-10**. The appropriate limit values as derived from the EU CAFE Directive (2008/50/EC) and as transposed into Irish legislation [S.I. No. 180/204] are also provided for comparative purposes.

Air quality in Zone D areas is generally very good with low concentrations of pollutants such as NO_2, SO_2, Particulate Matter 10 microns in size ($PM1_0$), Particulate Matter 2.5 microns in size ($PM_{2.5}$) and Carbon Monoxide (CO).

Table 10-5: EPA Air Quality Monitoring Nitrogen Oxides (NOx) Zone D

Limit Threshold Values for NOX as set out in the 2008 CAFE Directive & S.I. No. 180 Of 2011				**Summary Statistics For Hourly NOX Concentrations In Ireland In 2016 µg/m^3**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**		
Human Health	One hour	200 µg/m^3	18 hours per year	**Annual Mean**	Range 3.7 – 17.3[1]
Human health Calendar year 40 µg/m3	Calendar year	40 µg/m^3		**Median**	9.5[2]
Alert	One hour	400 µg/m^3		**Hourly Max**	884[3]
Vegetation	Calendar year	30 µg/m^3			
Upper assessment threshold for human health	Calendar year	32 µg/m^3			

Lower assessment threshold,for human health	Calendar year	26 µg/m^3

1) Reported range of annual Mean values: (Emo Court, Enniscorthy, Castlebar and Kilkitt)
2) Median is the highest reported for the above four stations (Enniscorthy)
3) Highest hourly max reported for Enniscorthy

Table 10-6: **EPA Air Quality Monitoring Sulphur Dioxide (SO_2) Zone D**

Limit Threshold Values for SO2 as set out in the 2008 CAFE Directive & S.I. No. 180 Of 2011				**Summary Statistics For Hourly SO_2 Concentrations In Ireland In 2016 Zone D**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**	**µg/m^3**	
Human Health	One hour	350 µg/m^3			
Human health	One day	125 µg/m^3	3 days per year	**Annual Mean**	1.8 – 2.5[1]
Alert	One hour	500 µg/m^3		**Median**	1.9[2]
Vegetation	Calendar year	20 µg/m^3		**Hourly Max**	43.1[3]
Upper assessment threshold for human health	One day	75 µg/m^3	3 days per year	**Daily Max**	18.5[4]
Lower assessment threshold for human health	One day	50 µg/m^3	3 days per year		

1) Reported range of annual Mean values: Enniscorthy, Kilkitt and Shannon Estuary
2) Highest reported Median for above stations
3) Highest hourly max (Enniscorthy)
4) Highest daily max (Enniscorthy)

Table 10-7: EPA Air Quality Monitoring Carbon Monoxide (CO) Zone D

Limit Threshold Values for CO as set out in the 2008 CAFE Directive & S.I. No. 180 Of 2011				**Summary Statistics For Rolling 8 hour CO Concentrations In Ireland In 2016 Zone D**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**	**mg/m3**	
Human health	8 Hour Average	10 mg/m^3	-	**Annual Mean**	0.6[1]

Upper assessment threshold for human health	8 Hour Average	7 mg/m^3	-	**Median**	0.6[2]
Lower assessment threshold for human health	13 Hour Average	5 mg/m^3	-	**Hourly max**	4.1[3]

1) Enniscorthy only
2) Enniscorthy only
3) Enniscorthy only

Table 10-8: EPA Air Quality Monitoring Ozone Zone D

Air Quality Limit Values for ozone set out in the 2008 CAFE Directive And S.I. No. 180 Of 2011				**Summary Statistics For Rolling 8 hour Ozone Concentrations in Ireland in 2016 Zone D**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**	**µg/m3**	
Human health	Daily maximum 8-hour mean	120 µg/m3	25 days per year averaged over 3 years	**Annual Mean**	Range[1] 49.8 – 71.8
Vegetation	AOT40 accumulated over May-July	18,000 µg/ m3 averaged over 5 years		**Median**	73.3[2]
LTO health	Daily maximum 8-hour mean	120 µg/ m3		**Max. 8 Hour**	124.9[3]
LTO vegetation	AOT40 accumulated over May-July	6,000 (µg/m3).h		**Number of days greater than 120**	1[4]
				Average AOTO40	Range [4] 1372 -7622

1) Reported range of annual Mean values: Kilkitt, Mace Head, Castlebar, Valentia and Emo Court
2) Highest reported Median (Mace Head)
3) Highest reported Max hourly (Kilkitt)
4) Range across all five stations

Table 10-9: EPA Air Quality Monitoring Particulate Matter (PM_{10}) Zone D

Air Quality Limit and Target Values for PM10 as set out by The CAFE Directive And S.I. No. 180 Of 2011				**Summary Statistics For Daily PM10 Concentrations In Ireland In 2016**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**	**µg/m3**	
PM10 limit value	One day	50 µg/m3	Not to be exceeded on more than 35 days per year	**Annual Mean**	Range [1] 8.1 – 17.3
PM10 limit value	Calendar year	40 µg/m3		**Median**	14.6 [2]

Upper assessment threshold	One day	35 µg/m3	Not to be exceeded on more than 35 days per year	**Daily Max**	87.9 [3]
Lower assessment threshold	One day	25 µg/m3	Not to be exceeded on more than 35 days per year	**Number of days greater than 50**	7[4]

1) Reported range for 4 stations Reported range of annual Mean values: Castlebar, Claremorris, Enniscorthy and Kilkitt
2) Highest Median reported (Enniscorthy)
3) Highest daily max (Enniscorthy)
4) Enniscorthy

Table 10-10: EPA Air Quality Monitoring Particulate Matter ($PM_{2.5}$)

Air Quality Limits and Target Values for PM2.5 as set out by The CAFE Directive And S.I. No. 180 Of 2011				**Summary Statistics For Daily PM2.5 Concentrations For Ireland In 2016**	
Objective	**Reference Time Period**	**Limit or Threshold value**	**No. of Allowed Exceedances**	µg/m3	
PM2.5, target value	Calendar year	25 µg/m3	To be met by 1 January 2010	**Annual mean**	**Range** [1] **6 – 12**
PM2.5, limit value	Calendar year	25 µg/m3	To be met by 1 January 2015	**Median**	**10** [2]
PM2.5, limit value2	Calendar year	20 µg/m3	To be met by 1 January 2020	**Daily max**	**56.6** [3]
Upper assessment threshold	Calendar year	17 µg/m3			
Lower assessment threshold	Calendar year	12 µg/m3			
PM2.5 exposure concentration		20 µg/m3	To be met by 1 January 2015		
PM2.5 exposure reduction target	**0 - 20 % Reduction in exposure (depending on the average exposure indicator in the target reference**				

1) Reported range of annual Mean values: Claremorris and Longford
2) Highest Median reported (Longford)
3) Highest daily max reported (Longford)

10.4.8.1 Heavy Metals

Heavy metals (lead, Arsenic, Cadmium and Nickel) concentrations were all below the annual limit or target values in Zone D. Previous EPA Air Quality in Ireland Report (2015 for example) noted that domestic fuel burning emissions in rural areas was the main source of particulate matter and poly-aromatic hydrocarbons (PAH). Trends indicated in the 2017

Report continue to indicate low levels of heavy metals with some concern for PAH. Levels of particulate matter in some smaller towns for example are similar or higher than those in cities, where bituminous coal is banned.

10.4.8.2 European Environment Agency Air Quality in Europe Report 2017

In addition the European Environment Agency – Air Quality in Europe – 2017 Report identified air pollution as the single largest health risk in Europe but also indicates that air quality in Ireland is substantially better than the European average. The EEA report presents an updated overview and analysis of air quality in Europe from 2000 to 2015 and reviews the progress made towards meeting the European air quality standards. It indicates that Ireland complied with the air quality European limit values including PM10 and $PM_{2.5}$ and the stricter WHO limits for the latter also, during the observation period. The Report also indicates that premature deaths across Europe arise from air pollution with an estimated 1,660 premature deaths occurring in Ireland from existing levels of $PM_{2.5}$ (1,480), Nitrogen Dioxide (160) and Ozone (20) with predictions based on the lowest concentrations used to calculate the health impacts of a pollutant in a baseline scenario (the counterfactual concentration (C_0).

10.5 Impacts of the Development

This assessment considers the likely significant effects on the environment arising in relation to Climate and Air Quality, including the secondary, cumulative, transboundary, short term, medium term and long term permanent and temporary, positive and negative effects of the project.

10.5.1 Construction Phase Impacts

10.5.1.1 WOP Station Construction Phase Climate Impacts

Although it is intended to have just in time delivery of biomass to the station for operating purposes the assessment includes the proposed biomass storage areas (Slab A, Slab B and the pellet silo) as these will be constructed at the site. These could either be constructed simultaneously or in sequence. The construction will require site preparation and excavation, the delivery of construction raw materials, fill material and steel and concrete for slab development, see Construction Methodology in **Appendix 4.2**. This will entail earth moving and road deliveries using HGVs and concrete lorries. Construction of the proposed slabs will require excavation and earth moving to form pre construction levels and piling or gravity foundations using typical equipment such as a piling rig (likely to be a Continuous Flight Auger type) , excavators, JCBs, cranes and concrete pumps. Construction is estimated to take place within a twelve month period.

Greenhouse gases will be emitted from diesel fuel used by HGVs in delivering materials to site and also from construction equipment used on site. An estimate of the fuel used and associated CO_2 emissions for both the ground baring or piled foundation option is provided in Table 10-11. Conversion factors are based on SEAI conversion factors for diesel fuel density, net calorific value and CO2 emission factor based on fuel type[14].

Although the quantity of GHGs emitted will be low and not significant they will contribute to the total GHG emissions from Ireland but will occur only once. The construction impact will therefore be negative, not significant and of short duration.

Table 10-11: Estimated construction fuel use and CO_2 emission

	Ground baring foundation	Piling Foundations
Estimated total Fuel Usage (litres)	114,336	127,652
Tonnes of CO_2	307	343

The development of biomass storage slab B will also require the clearance of a 0.25 ha of oak-dominated woodland. This habitat was artificially planted following the development of WOP Station and the decommissioning of Shannonbridge Power Station. The loss of this plantation will give to a loss of carbon sequestration and is considered to be a slight negative and long term impact on climate change.

10.5.1.2 WOP Station Impacts of Climate on the Development

Predicted climate change, as identified by Met Eireann, and its potential impacts on the proposed development have been assessed in terms of temperature, rainfall, wind and storm events, sea state and nature, see **Table 10-12** below. Existing baseline data has been derived from the Met Eireann long term record for the eastern part of the country (Casement Aerodrome 1981 to 2010, (see https://www.met.ie/climate/available-data/historical-data) with additional information relating to major weather events (https://www.met.ie/climate/major-weather-events) and supplemented by more recent Met Eireann reports.

The key potential impacts of climate change on the proposed development relate to temperature and precipitation changes which could alter the hydrology and thermal condition of the River Shannon at the location where the stations thermal cooling water load discharges. Higher water temperatures, particularly during periods of low river water flow, could reduce the thermal assimilative capacity of the river leading to an increased thermal plume footprint. However, aquatic ecological surveys undertaken during periods of low flow

[14] SEAI conversion factors: https://www.seai.ie/resources/seai-statistics/conversion-factors/

have indicated that whilst an impact occurs within the thermal plume footprint the river status, as expected, quickly recovers outside of this and the water body is not significantly affected, (see **Chapter 8** –Aquatic Ecology).

Although heavy rainfall events are frequent across the country, climate predictions indicate these events could occur with greater frequency. The principal impact that can occur on the WOP Station from increased frequency of rainfall events is flood risk. A Flood Risk Assessment for the development has been prepared and included in **Appendix 8-2**. As per the 2009 Planning Guidelines climate change has been factored into consideration for flood risk assessments. The flood risk assessment concluded that there is no significant risk of flooding to the new works and existing infrastructure at WOP Station.

Table 10-12: Predicted climate change impacts on the proposed development

Existing Climate		Climate change predicted impact	Predicted potential impacts on the development
Temperature	• Maximum Temperature 31.00℃ (Casement aerodrome 1981- 2010). Highest air temperature recorded in the 20th Century: 32.5℃ at Boora, Co. Offaly on 29th June 1976 • Mean Temperature 9.7℃ and Mean Daily summer temperature 19.1℃ (Casement aerodrome 1981- 2010) • Mean daily winter temperatures 2.2℃ and Lowest air temperature -15.7℃ (Casement Aerodrome 1981 -2010). Lowest air temperature recorded in the 20th century: -18.8℃ at Lullymore, Co. Kildare on 2nd January 1979 • Major events recorded by Met Eireann: 2010 Severe cold snap, 2009/2010 coldest winter in almost 50 years, 2006 Warmest summer since peak in 1995.	• Projected changes of 1–1.6℃ in mean annual temperatures, with the largest increases seen in the east of the country. Warming is enhanced for the extremes (i.e. hot or cold days), with highest daytime temperatures projected to rise by 0.7–2.6℃ in summer and lowest night-time temperatures to rise by 1.1–3℃ in winter. • Averaged over the whole country, the number of frost days (days when the minimum temperature is less than 0℃) is projected to decrease by 50% for the medium-low emission scenario and 62% for the high-emission scenario. • An average increase in the length of the growing season by mid-century of 35 and 40 days per year for the medium-low emission and high-emission scenarios, respectively • Milder winters will, on average, reduce the cold related mortality rates among the elderly and frail with potential offsetting due to heat stress in the warmer summers	• Increasing air temperature will potentially lead to increasing Shannon River temperatures particularly in summer peak periods. Although the thermal energy load from the station's thermal cooling water will not increase, the overall water temperature within the thermal plume footprint could increase with impacts on aquatic ecology. • Increases in the length of growing season could potentially increase biomass supply to WOP Station as forest would mature quicker and pass through their lifecycle more rapidly

	Existing Climate	Climate change predicted impact	Predicted potential impacts on the development
Precipitation	• Highest mean monthly 81.6 (October), Highest daily 97.5 mm, Mean daily winter total 188mm • Average number of winter days with over 0.2mm precipitation: 47 • Average number of days with over 0.2mm precipitation: 43 • Major events recorded by Met Eireann: 2018 Storm Emma -Heavy snow across the country.2011 Heavy rainfall Dublin area, 2009 heavy rain and severe flooding in many parts of the country, 2008 heavy rain and flooding 2003, flooding, 2002 severe flooding,	• Met Eireann simulations show significant projected decreases in mean annual, spring and summer precipitation amounts by mid-century with projected decreases largest for summer, with reductions ranging from 0% to 13% and from 3% to 20% for the medium-to-low and high emission scenarios, respectively. • The frequencies of heavy precipitation events show notable increases of approximately 20% during the winter and autumn months. • The number of extended dry periods is projected to increase substantially by mid century during autumn and summer	• Reducing mean annual spring and summer precipitation would result in reduced flows in the River Shannon, This in turn could reduce the capacity of the Shannon River to absorb the thermal cooling water load from the generating station with a potential for reduced operational capacity and output of renewable energy. • Increased rainfall will give rise to increased flows in the Shannon River with potential for increased risk of flooding of both the station and the ADF site. However, Flood Risk Assessments have been prepared for both locations which indicate that this potential is very low. • The volume of leachate from the active ash cells in the ADF could increase due to periods of intense rainfall. However, the leachate treatment system and lagoons associated with the ADF has been designed to allow for climate change potential impacts.

	Existing Climate	Climate change predicted impact	Predicted potential impacts on the development
Sea Level Rise	• Major events recorded by Met Eireann Coastal flooding 2002	• Globally sea levels have been rising at an average rate of approximately 3 mm per year between 1980 and 2010. Sea level is projected to continue to rise at this rate or greater. • All major cities in Ireland are in coastal locations subject to tides, any significant rise in sea levels will have major economic, social and environmental impacts. Rising sea levels around Ireland would result in increased coastal erosion, flooding and damage to property and infrastructure	• The WOP and ADF locations are neither located on the coast, nor are they tidally influenced hence there will be no potential impact from sea level rise.
Wind Energy and Storm Tracks	• Mean wind speed 5.5m/s, maximum gust 42.2 m/s, maximum of mean 10 minute wind speeds 29.3, mean number of says with gales 18.1 (Casement Aerodrome 1981-2010), • Major events recorded by Met Eireann: 2018 Storm Emma, 2018 Storm Eleanor, 2014 Storm Darwin, 2013/2014 Severe Winter storms	• Studies have shown significant projected decreases in the energy content of the wind for the spring, summer and autumn seasons, with the projected decreases largest for summer and no significant trend in winter. • The overall number of North Atlantic cyclones is projected to decrease by approximately 10%.	• With a reduction in wind energy, particularly during the drier spring, summer and autumn months there would be less potential for dust generation from the Station and the ADF site. Although warmer periods could lead to drying out of surfaces with greater potential for dust generation this can be mitigated by ensuring minimum exposed areas and active dust control using water

	Existing Climate	Climate change predicted impact	Predicted potential impacts on the development
		• The paths of extreme storms will extend further south, bringing an increase in extreme storm activity over Ireland, although the number of individual storms is projected to be quite small	bowsers for example. • Major events have the potential to curtail the station's operations. For example, extremely low temperatures could lead to hazardous road conditions reducing the supply of fuel to the station. Similarly heavy snow fall events could seriously disrupt fuel supply for prolonged periods leading to a reduction in energy output.
Changes in nature	• There is limited biodiversity associated with the WOP Station or ADF	• Changes in the climate will bring changes in the behaviour of species. • A spring warming in recent years has seen and advance in the timing of key phenological phases of a wide range of organisms, including trees, birds and insects. • The pace of future change will cause stress to ecosystems which are unable to adapt quickly.	• There will be no significant biodiversity or habitat impacts from climate change on the station or ADF site as these are industrial footprints. • Peat harvesting also occurs from existing industrial peat harvesting industrial footprints with no new bog areas been developed

10.5.1.3 ADF Construction Phase Climate Impacts

The landfill footprint will be developed in cells over the period of operation of the plant. There will be potential for minor temporary short term impacts on climate arising from greenhouse gas emissions from construction equipment but these will be minor and the impacts on climate change during the construction phase will be non-significant

There will be potential for minor temporary short term impacts on air quality arising from construction transport and construction related activity, including those associated with the construction of landfill cells and the importation and deployment of synthetic clay liner. These potential impacts relate to construction and transport vehicle emissions and localised potential for dust generation.

10.5.1.4 ADF Impacts of Climate on the Development

Climate predictions indicate that although heavy rainfall events are frequent across the country these events could occur with greater frequency. The principal impact that can occur on the ADF from increased frequency of rainfall events is flood risk ad increased leachate. A Flood Risk Assessment for the development has been prepared and included in **Appendix 8-2**. As per the 2009 Planning Guidelines climate change has been factored into consideration for flood risk assessments. The flood risk assessment concluded that the site lies outside all flood zones even allowing for climate change effects.

10.5.1.5 WOP Station Construction Air Quality Impact on Human Health

The principle potential impact to air quality and human health during operation will arise form dust generation; spoil storage and vehicle movements from excavation associated with the construction site and construction of the storage slabs and pellet silo. It should be noted however, that the development will occur within an existing industrial site, namely the WOP Station. Dust generated by construction activity can potentially give rise to local nuisance. However, the impact of this will depend largely on climatic factors. For example the potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust also depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations.

The primary air quality issue related to construction is dust potentially arising from the following general construction activities:

- Earth moving and excavation equipment including handling and storage of soils and subsoil material;
- Vehicle movement over hard dry surfaces on the site;
- Vehicle movement over surfaces off site contaminated by muddy materials brought off the site.

Dust deposition is usually highly localised to areas of activity, with dust particles falling to the ground within several hundred metres of the source. Dust emissions do not cause long term or wide spread changes to local air quality.

The majority of the releases are likely to occur during the normal construction working hours. However, in the instance of exposed soil produced from significant earthwork activities, there is potential for short term dust generation to occur 24 hours per day depending on weather conditions.

Particulate matter can remain suspended in the atmosphere for a longer period and can be transported over a wider area than dust, by wind. It is potentially small enough to be drawn into the lung during breathing, which in sensitive members of the public could cause an adverse reaction. However, given the general good air quality in the Zone D area construction route and relatively short duration of construction activity at any one location no significant impact from particulate matter is expected. Typical sources of particulate matter during the construction phase are similar in nature to those that give rise to dust. Particulate matter is also released from the engines of site plant, such as compressors, generators etc. whilst they are running.

10.5.1.6 Impacts on Human Health

Impacts on Human Health could potentially arise from dust generation during the construction of the biomass storage areas and from noise associated with the construction activities. These impacts would be **imperceptible and temporary in nature** and would be confined to the construction sites within the existing generating station footprint. Potential noise impacts are discussed separately in **Chapter 9**.

10.5.1.7 ADF Air Quality Impact on Human Health

Similar to the WOP construction activities impacts on Human Health could potentially arise from dust generation during the construction of the landfill and from noise associated with the construction activities. Potential dust impacts on human health are assessed in 10.5.1.5 Operational Phase as the landfill is an existing facility with ongoing cell construction filling and closure. Potential noise impacts are discussed separately in **Chapter 9**.

10.5.2 Operational Phase Impacts

10.5.2.1 WOP Station Operational Phase Climate Impacts

WOP is a thermal combustion energy generation plant currently fired on peat fuel and which will transition to biomass fuel by the end of 2027. The plant will operate on a daily basis either firing on peat or on biomass. The proposed progressive reduction in peat firing and increasing biomass co-firing with projected annual CO_2 emission reduction is shown in **Table 10-13** and **Figure 10-5**.

Table 10-13: Biomass, Peat and CO_2 Profile to 2035

Year	Maximum Peat (000's ET)	Annual CO_2 (000's Tonnes) /annum	Percentage Biomass energy
2019	1,220	1,279	0
2020	750	673	40.6%
2021	750	671	40.6%
2022	750	671	40.6%
2023	750	671	40.6%
2024	750	673	40.6%
2025	500	450	58.2%
2026	500	450	58.6%
2027	500	450	58.6%
2028 ➡	0	0	100%

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The quantities of peat indicated in **Table 10-13** above equate to the station operating at a level of 40% of its rated capacity being generated by biomass fuel. Depending on biomass availability and level of government support it would be possible to utilise increased quantities of biomass and achieve a 100% capacity factor on biomass fuel alone, with no peat, increasing overall displacement of energy generated from fossil fuels.

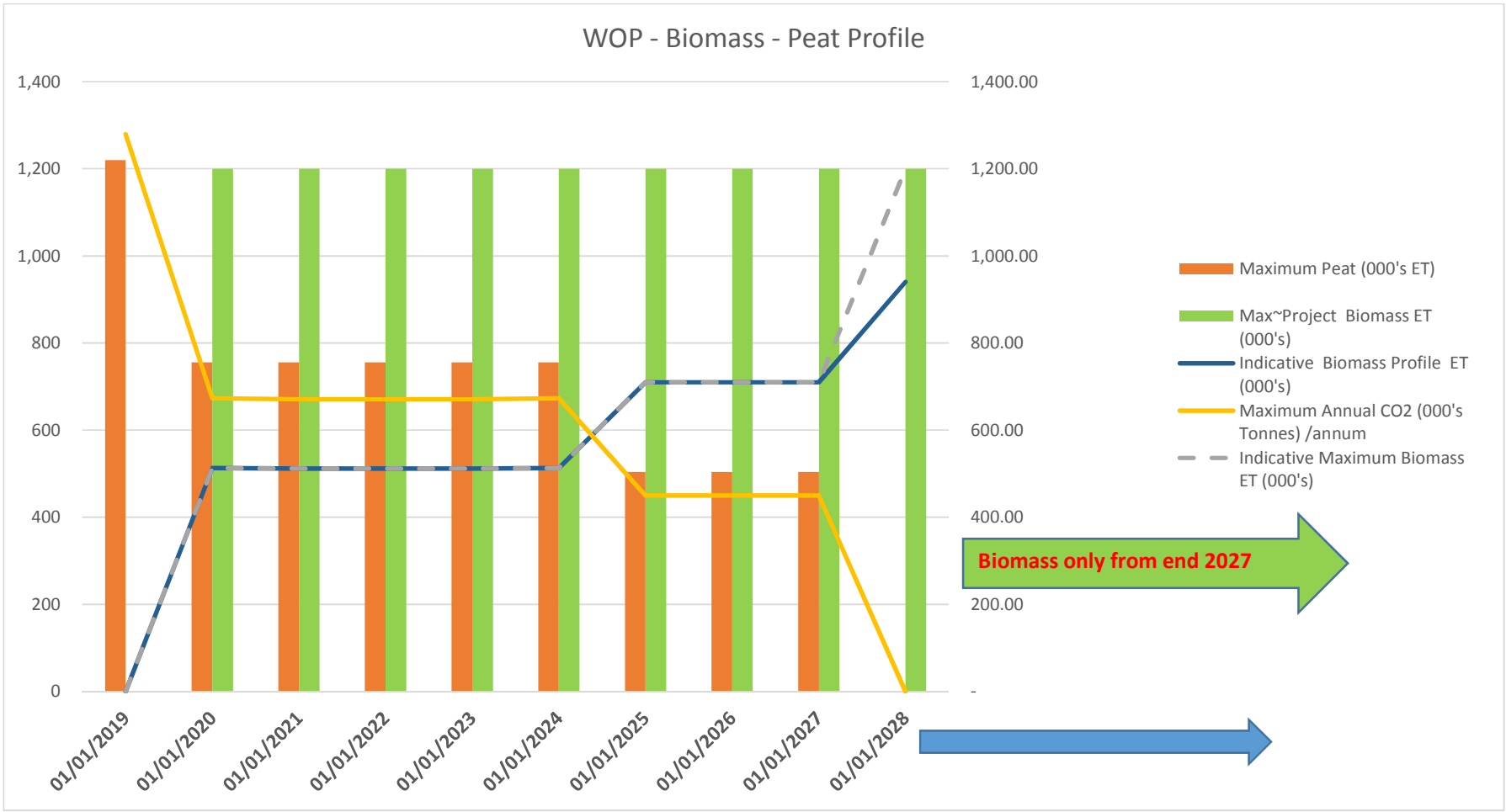

Figure 10-5: Biomass, Peat and CO_2 Profile

The Sustainable Energy Authority of Ireland Statistical Support Unit provides the following emission factors for milled peat (https://www.seai.ie/resources/seai-statistics/conversion-factors/), see **Table 10-14**

Table 10-14: SEAI Statistical Unit Emission Factors

Fuel	Calorific Value		Emission Factors	
	NCV (toe/t)	NCV (MJ/t)	TCO_2/TJ (NCV)	gCO_2/kWhth (NCV)
Milled Peat	0.186	7,787.00	116.7	420

The emission factors are provided in terms of Net Calorific Value. Energy production at WOP from milled peat with an average emission of 420 gCO2/kWh NCV and operating at a nett thermal efficiency of 36% will produce 1,192 gCO_2/kWh of electricity generated or 1.192 tCO_2/MWhe.

Carbon dioxide emissions from WOP are fully accounted for under the EU Emission Trading Scheme and at the end of each year a Greenhouse Gas Certificate must be provided to the EPA setting out the total tonnage emitted and the allowances purchased under the GHG ETS scheme matching these emissions. Data is transmitted to the EU which in turn prepares and submits a national inventory report (NIR) to the United Nations Framework Convention on Climate Change (UNFCC) secretariat. The NIRs contain detailed descriptive and numerical information and the common reporting format tables contain all greenhouse gas (GHG) emissions and removals, implied emission factors and activity data, see https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018.

The use of sustainable biomass fuel for energy generation purposes is considered to be carbon neutral under both the UN and European Union emission inventory guidelines. Biomass material sources are considered to be neutral as carbon emissions arising from their combustion are reabsorbed back into the re-growing crop and so may be considered to be part of the global cycle of biogenic carbon and have no overall effect on the amount of atmospheric carbon dioxide in circulation. However, it is important that the biomass fuel meets sustainability criteria that demonstrate this. In terms of the energy sector and EU ETS biomass fuels are regarded as contributing zero CO_2. There is no net increase in CO_2, the main greenhouse gas contributing to climate change, in the atmosphere arising from CO_2 emissions from sustainable biomass.

In the period 2020 to end 2027 WOP Station will continue to emit CO_2 and NOx from the combustion of fossil fuels co-firing with biomass. The emissions of these greenhouse gases are significant and negative in terms of climate change impact but will be reducing and for a short defined time period 2020 to end 2027. Post 2027 WOP will fire on biomass alone, which is certified as zero carbon under the EU ETS scheme. The impact post 2027 can therefore be considered to be **positive, significant and medium term** in nature.

10.5.2.2 ADF Operational Phase Climate Impacts

Operational phase climate impacts will arise due to GHG emissions from fuel combustion associated with plant utilised at the ADF site. However, the level of activity is low and the impact of these emissions will be insignificant but will be medium term in nature as they are associated with the operational life of the ADF.

10.5.2.3 WOP Station Operational Phase Impacts on Air Quality

Emissions to air from WOP are licensed by the EPA (IE Licence P0611-02 and as per Technical Amendment A) which sets emission limits based on the EU Industrial Emissions Directive (EU Directive 2010/75/EC). The licence sets out emission limit values (ELVs) not to be exceeded and a schedule of monitoring requirements for the boiler stacks (PS-A1 and PS-A2). The ELVs are shown in **Table 10-15**.

Greenhouse gas emissions from WOP are accounted for under the European Union Emission Trading Scheme.

Table 10-15: Emission limit values according to IE Licence P0611-02

P0611-02 Schedule	Emission Point Ref. No.	Location	Parameter	ELV
Schedule B	PS-A1	Boiler Stack	Oxides of sulphur Nitrogen oxides (as NO_2) Dust	200 mg/m^3 200 mg/m^3 20* mg/m^3
Schedule B	PS-A2	Auxiliary Boiler Stack	Oxides of sulphur Nitrogen oxides (as NO_2) Dust	1700 mg/m^3 300 mg/m^3 20* mg/m^3
Schedule B	Dust Deposition	At locations to be agreed by the agency	Dust	350 mg/m^2/day

*Technical Amendment B to Industrial Emissions Licence.

WOP Station has adhered to the emission limits to air over the past three years with minor exceptions. A small number of minor incidents relating to air have been reported during this period. These include breaches of ELVs and monitoring equipment functioning which were addressed under existing procedures for such incidents. The incidents have all been resolved and the likelihood of reoccurrence is considered to be low.

The IE Licence requires the station to prepare and submit and Annual Environmental Report (AER) to the EPA summarising emission data. The AER Reports are publicly available on the EPA website (http://www.epa.ie/licensing/). Data relating to air emissions from the main boiler stack (PS-A1) have been extracted from the reports for the period 2015 - 2017 and presented in **Table 10-4** above.

Continuous monitoring of the stack emission is in place and allows early detection of any equipment failure which can give rise to fugitive emissions. These are therefore, rapidly identified, noted to the EPA and addressed immediately limiting any potential impact.

Although minor breaches in the ELVs have occurred these have not significantly impacted air quality in the vicinity of the plant.

Under the proposed development licensed emissions of SO_2, NO_x, and dust will continue until plant closure. In addition to the current ELVs set out in **Table 10-15** above a maximum flow volume of 567,000 Nm^3 per hour is allowed for PS-A1 (maximum per day of 13,600,000 Nm^3 per day) and 15,500 Nm^3 per hour for PS-A2.

10.5.2.4 Air Quality Modelling of WOP air emission

Modelling of the impact of air emissions on the receiving environment has been undertaken by AWN Consulting. The contribution of both current licenced and proposed BAT emissions from the facility to off-site levels of release substances was assessed and the location and maximum of the worst-case ground level concentrations for each compound identified.

The proposed BAT emission limit values are set out in the EU Commission decision on BAT conclusions[15]. These emission limit values will likely be introduced by the EPA into a future IE Licence for the station. Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulatory model AERMOD (Version 16216r) and the methodology outlined in the policy and technical guidance notes, LAQM.PG(16) and LAQM.TG(16), issued by UK Department for Environment, Food and Rural Affairs(1-5). The assessment of air quality is carried out using a phased approach as recommended by the UK Department for Environment, Food and Rural Affairs (2). The dispersion modelling study consisted of the following components:

- Review of emissions data and other relevant information needed for the modelling study;
- Summary of background NO_2, SO_2, PM_{10}/$PM_{2.5}$, hydrogen chloride, hydrogen fluoride and mercury concentrations;
- Dispersion modelling of released substances under the following scenarios:
- Permitted emission concentrations of pollutants as per existing IED Licence P0611-02 (hereafter Maximum Existing Scenario).
- Permitted emission concentrations of pollutants as per proposed BAT limit values which will be implemented as part of the plants transition to exclusive firing with biomass (hereafter Maximum Proposed Scenario).
- Sensitivity Scenario assessment of cumulative impact in event of simultaneous emissions from PS-A1 (Main Stack) and PS-A2 (Auxiliary Boiler).

[15] • COMMISSION IMPLEMENTING DECISION (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants

- Presentation of predicted ground level concentrations of released substances;
- Review of traffic related impacts on sensitive receptors with respect to ambient air quality limit values ; and
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

Air quality impacts from traffic and transport were also assessed using the DMRB Traffic Model.

The report on modelled outputs is provided in **Appendix 10.1**

The modelling results for the plant operation demonstrate that ambient pollutant concentrations (including background) are well below the applicable air quality limit values at all off-site receptors.

The station operating in compliance with its current IE Licence emission limits or in compliance with the requirements of the new BAT conclusions will have **an imperceptible impact on the receiving environment over the medium term.**

The results of the air dispersion modelling study with respect to traffic emissions indicate that the impacts of the WOP facility on air quality are predicted to be **imperceptible with respect to the operational phase local air quality assessment for the long and short term**.

The plant will primarily operate on a just in time delivery basis for biomass. Deliveries of biomass and peat by road transport typically use moving floor vehicles to deliver biomass to the underground belt transfer system in the enclosed lorry unloader building. The potential for dust release or wind-blown biomass from delivery operations is very low and any impact would be **imperceptible and temporary in nature**.

There is potential for wind blow of externally stored biomass material and during delivery of biomass to these storage areas. However, woodchip biomass particulate size is typically in the range of 3mm-63mm and is unlikely to give rise to significant wind blow issues. The biomass storage slab A has been designed to allow for a dust screen to be mounted on top of the retaining wall to prevent any wind-blown dust exiting the area should this be required. The potential impact from wind-blown biomass will be localised and will not be significant but would exist in the medium term. Storage Slab B also has alpha block walls to prevent dust and hence Storage Slab B will be unlikely to give rise to significant impact in the area. In addition the existing building to the south-west of the Biomass Slab B will also provide a wind break preventing wind blow of biomass from this location.

Transportation of ash from the station could also generate airborne dust but transport occurs in covered wagons and ash is dampened down to minimise dust release. The impact from this operation would be **slight negative, localised, occur during the lifetime of the plant and not significant**.

Pellet deliveries will be delivered directly to an enclosed hopper at the pellet unloading and transfer facility to the closed storage hopper. The potential for dust release from the delivery

and storage of pellets will be low and any impact will be imperceptible and of short duration also.

Air emissions from WOP Station will continue to be controlled under the IE licence as issued by the EPA. The impact can therefore be stated to have a likely **slight negative impact in the medium term**.

10.5.2.5 ADF Air Quality Impacts

The principle potential impact to air quality and human health during operation will arise from dust generation, which could give rise to potential impact on localised air quality for brief periods. It should be noted however, that the ADF is in a remote location with very limited potential for impact on human beings due to the absence of housing in the general area. The ADF will be developed on a cell by cell basis as required during the operational phase. Generally as one cell is in operation, closed and subsequently capped the next cell will be in construction. During the construction and capping of the cells, there will be site preparation and construction activities, both of which have the potential to generate dust. Dust generated by construction activity can give rise to local nuisance. However, the impact of this will depend largely on climatic factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust also depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The ADF is in a remote location with limited potential to impact on sensitive receptors.

Transportation of ash by rail can also give rise to localised dust impacts from fugitive emissions, particularly during unloading operations and cell filling.

The primary air quality issue related to construction is dust potentially arising from the following general construction activities:

- Earth moving and excavation equipment including handling and storage of soils and subsoil material, geo-synthetic liner, drainage and capping material;
- Vehicle movement over hard dry surfaces on the site;
- Vehicle movement over surfaces off site contaminated by muddy materials brought off the site, and
- Transport of ash materials by rail to the ADF and placing and compacting ash in the cell structures within the ADF.

Dust deposition is usually highly localised, typically occurring during normal construction working hours and confined to areas of activity, with dust particles falling to the ground within several hundred metres of the source. Dust emissions do not cause long term or wide spread changes to local air quality. However, in the instance of exposed soil produced from significant earthwork activities, there is potential for short term dust generation to occur 24 hours per day depending on weather conditions.

Particulate matter can remain suspended in the atmosphere for a longer period and can be transported over a wider area by wind. It is potentially small enough to be drawn into the lung during breathing, which in sensitive members of the public could cause an adverse reaction. However, given the general good air quality in the Zone D area construction route and relatively short duration of construction activity at any one location no significant

impact from particulate matter is expected. Typical sources of particulate matter during the construction phase are similar in nature to those that give rise to dust. Particulate matter is also released from the engines of site plant, such as compressors, generators etc. whilst they are running.

Therefore, occasionally at the ADF, increased and perceptible localised emissions may occur. There may also be occasions when mechanical breakdown of site plant could cause short term releases of excess particulate matter and short term release may also occur during start up. However with good construction and mitigation practices and ensuring compliance with the EPA approved Landfill Operational Plan dust will not impact significantly on air quality.

The potential for dust emissions will exist on site until the landfill is finally decommissioned, and capping is completed. The operational impact of the ADF is therefore considered to be imperceptible and medium term and confined to the general area of the ADF site itself.

Potential noise impacts are assessed in Chapter 9 of this EIAR.

10.5.3 Decommissioning Phase

10.5.3.1 WOP Station Decommissioning Impacts

The WOP Station will be decommissioned in accordance with the EPA approved DMP/CRAMP. Subsequently the station may undergo demolition to a brown field status in line with planning permission requirements.

There will be minor greenhouse gas emissions associated with fuel combustion used by the decommissioning and demolition equipment and transport of waste materials from the site.

Potential impacts could occur to air from demolition activities which would be similar in nature to those during the construction phase. Dust and Noise will be the key potential impacts which could occur to air.

The stations DMP identified that some asbestos waste material may still remain on site and the excavation and disposal of this could result in air borne asbestos with potential to impact on human beings in the area if not properly controlled and managed.

Waste generated from the decommissioning process will be removed form site and either recycled or disposed of by licenced waste contractors.

10.5.3.2 ADF Decommissioning Impacts

The ADF will be decommissioned in accordance with the EPA approved CRAMP. All open cells will be capped with an impermeable barrier, a drainage layer, and a final peat capping layer and subsequently revegetated. There will be no potential from the atmospheric emissions once the closure and restoration is concluded.

10.5.4 Transboundary Impacts

Transboundary air pollutant emissions in Ireland were reported annually to the European Commission under the National Emissions Ceiling Directive and to the UNECE under the

Convention on Long-Range Transboundary Air Pollution. These pollutants are responsible for long-range transboundary air pollution such as acidification, eutrophication and ground-level ozone pollution. The Directive (EU) 2016/2284 (new National Emissions Ceilings Directive) on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (old NEC Directive) entered into force on the 31st of December 2016. It requires the submission of an emission inventory by 15th February 2017 and every year thereafter. This new legislative act harmonises the reporting obligations to the European Union under the Convention on Long Range Transboundary Air Pollution (CLRTAP).

The EPA now reports data on five key air pollutants, nitrogen oxides (NOx), sulphur dioxide (SO_2), non-methane volatile organic compounds (NMVOCs), ammonia (NH_3) and particulate matter of 2.5 microns or less ($PM_{2.5}$) to the European Commission as required under the new legislation. Mandatory reporting of Carbon Monoxide (CO), the heavy metals Cadmium (Cd), Mercury (Hg) and Lead (Pb), persistent organic pollutants (POPs -Polyaromatic Hydrocarbons (PAHs), dioxins/furans, Polychlorinated biphenyls (PCBs), Hexachlorobenzene (HCB)), $PM_{2.5}$ and PM_{10} is required annually.

The most recent inventory emission submitted to the European Commission by the EPA [16] indicates that emissions of three of the five main air pollutants increased - ammonia, nitrogen oxides and non-methane volatile organic compounds. The report summarises the emission inventory as follows:

- Ireland exceeded its emission ceilings for nitrogen oxides (NOx) and non-methane volatile organic compounds (NMVOCs) for all years since 2010 and the emission ceiling for ammonia (NH3) in 2016.
- 2016 is the first year for which the EPA has reported an exceedance for ammonia, although the EPA's Air Pollutant projections have indicated for some time that it was likely to occur if animal numbers continued to rise.
- As was the case for the 2015 Inventory, Ireland will seek to use the flexibilities allowed in Article 5(1) of the Directive, as national total emissions of NOx and NMVOC are non-compliant with reduction commitments due to updating inventories in accordance with scientific knowledge.
- Emissions of sulphur dioxide (SO_2) continue to decrease. These were well below the required EU emission limits, substantially due to the use of lower sulphur content fuels in electricity generation and transport.

[16] EPA, Ireland's Transboundary Gas Emissions. 1990-2016, March 2018

- Particulate matter ($PM_{2.5}$) emissions declined in 2016. Future emissions will depend largely on the quantity and quality of solid fuel used in the residential and commercial sectors.

The submission also shows Ireland exceeding its 2010 NOx and VOC ceilings for all years since 2010, see **Table 10-16**. VOC emissions are above the national emission ceiling primarily due to the inclusion of a new source category (emissions from manure management in agriculture). NOx emissions have been consistently above the national emission ceiling.

The emissions of SO_2 from industrial sources decreased by 92 % from 1990 while the emissions in the transport sector decreased by 96.7 %. Total SO_2 emissions in 2010, and all subsequent years, are compliant with the 2010 ceiling. Power stations are one of the principal sources of SO_2 emissions, contributing 27 % to the total in 2016. Emissions in the power generation sector sectors have decreased by 96.4 % since 1990.

The principal source of NOx emissions comes from the transport sector, which mainly consists of road transport, contributing approximately 41 % of the total in 2016 with agriculture the second largest at 29.6 %. Power generation contributed 7.5 %, in the same period. NOx emissions in Ireland have decreased by 38.7 % between 1990 and 2016. An increase in NOx emissions in recent times, leading to levels in excess of the national emission ceiling limits, is attributed to transport, industry and agricultural sources.

The agriculture sector accounts for virtually all (99 %) of ammonia emissions in Ireland. Grasslands ultimately receive the bulk of the 40 million tonnes (Mt) of animal manures produced annually in Ireland along with approximately 300,000 tonnes of nitrogen in fertilisers. A proportion of the nitrogen in these inputs is volatilised into the air as ammonia.

The main sources of VOC emissions in Ireland are from manure management in agriculture and solvent use, which combined produce 83.3 % of the annual total in 2016. Emissions from stationary combustion of fossil fuels across all sectors; power stations, residential, commercial and agriculture account for 11.27 % of national total VOC emissions. Transport emissions account for almost 4.9 % of national total emissions of VOC, mainly from exhaust and fugitive releases from gasoline vehicles.

Table 10-16: Ireland's Transboundary Gas Emissions 2016 (in '000 tonnes)

	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling
kt	SO_2		NOx		VOC		NH_3	
2010	28.257	42	82.395	65	91	55	108.9	116
2011	26.68	42	73.399	65	88.724	55	104.873	116
2012	25.191	42	75.873	65	88.204	55	105.905	116
2013	25.393	42	76.542	65	90.001	55	107.758	116
2014	16.891	42	104.142	65	106.114	55	108.312	116

	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling	National Total Emission	National Emission Ceiling
2015	15.004	42	104.393	65	106.403	55	111.121	116
2016	13.766	42	107.300	65	108.25	55	116.700	116

Direct transboundary impacts are associated with emissions of SO_2, NO_x, VOC and NH_3 from WOP Station. Quantities of transboundary pollutants are reported annually to the EPA in the stations Annual Environmental Report; these are provided in **Table 10-17**.

In terms of potential transboundary gas emissions from the ADF there is only minor potential for such impacts from the ash disposal area itself principally from sulphur oxides and NOx from the combustion of fossil fuel related to the ash transport and landfilling activities.

Table 10-17: WOP Station- Transboundary Gas Emissions 2017[17]

Transboundary Gas	Tonnes/annum
Sulphur Oxides (SOx/SO_2)	222.46
Nitrogen oxides (NOx/NO_2 tonnes)	653.99
Ammonia (NH_3 tonnes)	15.03
Carbon Monoxide (CO tonnes)	81.38
Nitrous Oxide (N_2O tonnes)	69.17
Non-methane volatile organic compounds (NMVOC tonnes)	3.88
Particulate Matter (PM_{10})	4.13

WOP Station operates in accordance with its IE Licence which sets emission limits for SOx, NOx and particulate matter and is subject to the EU Commissions Best Available Techniques requirements which will continue to tighten emission limits through IE Licence reviews and amendments implemented by the EPA. The transition to biomass is also likely to see a reduction of SOx and NOx from the combustion of biomass fuel as opposed to peat.

[17] Annual Environmental Report, 2017, (www.epa.ie)

Indirect emissions of transboundary gases also occur from peat harvesting operations and transport of the peat with the peat supply bogs releasing an estimated 12.6 tonnes of nitrous oxide annually.

10.5.5 Indirect Impact - Peat Supply to WOP

Greenhouse gas emissions from the peatlands used to supply peat to WOP Station are counted under land use change and forestry emissions (IPC Sector 5). The peat supply bogs do not function as active carbon sinks as they have been drained and are bare of vegetation. Emissions of greenhouse gases CO_2, CH_4 and N_2O can arise from the active peat production surface areas and milled peat stockpiles through the oxidative loss of carbon.

Estimates of greenhouse gas losses have been made based on the area extent of peat bogs serving WOP and using the IPCC Supplementary Guideline for Wetlands (Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Intergovernmental Panel on Climate Change, 2013[18], Tier 1) emissions for boreal zone (i.e. sub-arctic) and temperate wetlands in peat production as follows:

- Carbon dioxide 2.8 tonnes CO_2-C/ha/yr.
- Methane - peat surface 0.0061 tonnes CH_4 /ha/yr.
- Methane – ditches 0.542 tonnes CH_4 /ha/yr.
- Nitrous oxide 0.00094 tonnes N_2O /ha/yr.

Using these values and gross production surface area ranging from circa 13,390 ha down to 12,997, which reflects the reducing supply of peat to WOP, the estimated annual greenhouse gas emissions between 2020 and 2028 are estimated to range as follows: 133,231 to 137,474 tonnes of CO_2, 797 to 799 tonnes of CH_4 and 12.2 to 12.6 tonnes of N_2O.

It should be noted that this is a worst case scenario where the total licenced area of the peat bogs has been used rather than the actual peat extraction areas. As some of the bogs provide peat to other electricity generating stations the percentage area serving WOP has been used in the calculations.

An estimate of greenhouse gas emissions from stockpiles of milled peat serving WOP, based on the projected maximum peat usage by WOP as set out in **Chapter 4** (Table 4-2) and assuming 1.5 years of stockpile for each supply year, has been made using measurements of CO_2, CH_4 and N_2O from uncovered milled peat stockpiles in Finland

[18] IPCC 2014, 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds). Published: IPCC, Switzerland.

(annual total CO_2-equivalent emission of 15.772 kg CO_2eq/m2/yr.)[19]. This indicates emissions of circa 65,180 tonnes of CO_2eq in 2020, reducing to 45,453 tonnes of CO_2eq in 2027 with contributions from this source reducing to zero at the end of 2027.

10.5.5.1 Peat production, loading and transport

Gas oil is used to provide motive power for peat harvesting, loading and transportation by narrow gauge railway or by road. An estimated 2.12 million litres of gas oil is used annually in tractors, hydraulic excavators, locomotives and road vehicles to transport the peat to WOP Station. Based on SEAI[20] published net calorific emission values for gasoil of 10.161 kWh/l of and 0.000264 tonnes of CO_2/kWh an estimated 5,687 tonnes of CO_2 would be emitted per annum when peat was supplying 100% of the stations fuel requirement. This is estimated to reduce immediately to 3,412 tonnes per annum in the period 2020 to the end of 2024, with a further reduction to 2,354 tonnes/annum in the period 2025 to end 2027.

The peat harvesting and delivery to WOP Station will reduce during the period 2020 to 2027 and then will cease altogether. Emissions from fuel use arising from harvesting and delivery of peat will therefore reduce to zero during this period. However, greenhouse gas losses will continue from the peat supply bog bare peat areas whereas milled peat will no longer be stockpiled.

Some of these supply bogs also supply the ESB LRP Station and the Bord na Móna's EPL hence the emissions from the supply bogs themselves do not arise solely from their use associated with WOP. It is intended that an application similar to WOP will be made to transition LRP to co-firing with biomass with a similar transition period to biomass only operation. Hence peat could be supplied to both WOP and LRP from the same supply bog. EPL is scheduled to close in 2023 under its current planning. Long term options for the use of the peat supply bogs are in consideration by Bord na Móna and include options such as site use for renewable energy (wind and solar) and rehabilitation.

There is also potential for peat dust generation during the harvesting and stockpiling operations, which if uncontrolled could give rise to nuisance outside the peat harvesting areas. However, Bord na Móna operates their harvesting operations under their environmental management system which included for dust control measures using best industry practice.

[19] Alm, J. et al. Emission factors and their uncertainty for the exchange of CO2, CH4 and N2O in Finnish managed peatlands. Boreal Environmental Research 12: 191-209, Helsinki, 2007

[20] Martin Howley and Mary Holland, Energy Policy Statistical Support Unit, Energy-Related Emissions in Ireland, CO_2 emissions from fuel combustion 2016 Report, SEAI

10.5.6 Impacts from Biomass supply

Carbon dioxide emissions associated with the combustion of sustainable biomass are treated as zero under the EU ETS scheme, due to the reabsorption by the re-growing biomass. However there will still be, greenhouse gas emissions associated with the biomass supply chain.

Currently there are no Irish standards for Biomass Sustainability and there is no global definition of sustainability for this type of material. However, the REDII, recently agreed at EU Commission and Parliament level, provides sustainability criteria to which ESB will adhere. ESB is committed to ensuring its sustainability programme is fully compliant with these REDII criteria, in as far they are relevant to this project.

Historically, the Renewable Energy Directive (2009/28/EC) introduced sustainability criteria for biofuels and bio-liquids and set out a methodology for calculating the greenhouse gas impact of biofuels and bio-liquids only and their fossil fuel comparators. In 2010 the European Commission published a report on the sustainability requirements for solid and gaseous biomass. However, the Commission indicated that it did not, at that stage, propose any binding sustainability criteria at the EU level. However, the report did provide an annex setting out a methodology for calculating the greenhouse gas impact of solid and gaseous biomass used in electricity, heating and cooling. Typical' and 'default' values for a limited range of biomass supply chains were also included.

The Commission subsequently invited Member States to use an updated GHG emission accounting methodology presented in a Staff Working Document produced in 2014 and the report of the Joint Research Centre (JRC). The Staff Working Document covered:

(i) the role of biomass in achieving the EU renewable energy targets;

(ii) the promotion of sustainable biomass production and use; and

(iii) an updated EU approach to assessing GHG savings associated with the use of biomass. And the related GHG emission default values that are contained in the JRC report.

The Commission indicated that assessment of GHG savings, arising from the use of solid biomass as a fuel for energy production, should be carried out with reference to a Fossil Fuel Comparator (FFC). For renewable electricity produced from biomass, the FFC is 183 gCO2 eq. /MJ. This is equivalent to fossil fuel emissions of 660 kgCO2 eq. /MWhe.

Biomass can come from many sources with significant variation in the supply chain. Energy used in the supply chain may have a significant effect on the carbon emissions attributable to bioenergy, for example where fossil fuel energy is used in harvesting, transport and conversion processes such as in chipping of wood or in pellet production and subsequent delivery to WOP Station. The magnitude and significance of these emissions will vary depending on the source of biomass and the processes involved. The EU Commission's

GHG savings targets are underpinned by the typical and default emission values developed by the European Commission's in-house science service, the Joint Research Centre (JRC). The JRC published updated calculations for input values and GHG emissions for solid and gaseous bioenergy pathways in 2017[21] which was updated to Version 2, to take account of the proposals for the revised Renewable Energy Directive (RED II) contained in COM (2016) 767. Its report provides updated typical and default GHG emission values for biomass coming from different sources, including forest systems producing woodchip, pellets, and briquettes, from industrial residues and from agricultural biomass systems. Typical and default GHG values are provided in tables extracted from the JRC report and provided in **Appendix 10.2**

Under the recast Renewable Energy Directive (RED II) changes are proposed which extend the existing EU sustainability criteria for bioenergy to cover biomass and biogas for heating and cooling and electricity generation. The agreed greenhouse gas savings are at least 70 % for electricity, heating and cooling production from biomass fuels used in installations starting operation after 1 January 2021 and 80 % for installations starting operation after 1 January 2026". As the RED is currently drafted this would apply to solid biomass projects such as WOP.

The primary changes proposed under the recast RED of relevance to WOP are as follows:

- Article 26 of RED extends the existing EU sustainability criteria for bioenergy to cover biomass and biogas for heating and cooling and electricity generation.
- A new risk-based sustainability criterion for forest biomass is introduced, as well as LULUCF requirement for carbon accounting of carbon impacts of forest biomass used in energy generation.
- at least 70 % for electricity, heating and cooling production from biomass fuels used in installations starting operation after 1 January 2021 and 80 % for installations starting operation after 1 January 2026".
- A new Annex VI is added to include a common greenhouse gas accounting methodology for biomass fuels for heat and power, including default values.
- In Annex IX the feedstocks (mainly for advanced biofuels) which should be considered for meeting the new fuel-suppliers' obligation target are listed. New to the list in Part B is molasses. Every two years the Commission shall evaluate the feedstocks allowing for the possibility to add but not remove feedstocks from the list.
- A minimum market obligation of 6.8% "low-emission and renewable fuel" by 2030 is placed on all fuel suppliers (currently part of the Fuel Quality Directive).

[21] Giuntoli J, Agostini A, Edwards R, Marelli L et al., Joint Research Centre Report EUR 27215 EN, Solid and gaseous bioenergy pathways: input values and GHG emissions. Calculated according to the methodology set in COM(2016) 767, EU 27215 EN, doi; 10.2790/27486

- The introduction of national databases for traceability of fuels and to mitigate the risk of fraud.

The recast RED II Directive also proposes Rules for calculating the greenhouse gas impact of biomass fuels and their fossil fuel comparators in Annex VI of the Directive. The typical and default values of greenhouse gas emission savings for biomass are as per the JRC report and provided in **Appendix 10.2**.

ESB will appoint an independent company to operate a certifiable sustainability programme. The certification programme will provide life cycle analysis of the carbon emissions for biomass utilised by the station, which will allow calculation of the achieved GHG emission displacement based on the EU Fossil Fuel Comparator.

10.5.7 Do Nothing

The WOP Station and ADF would cease to operate on the expiration of the existing planning permission in December 2020. All deliveries of peat fuel would cease and no peat harvesting associated with deliveries to WOP Station would continue. The station would be decommissioned and demolition would take place in accordance with its DMP and existing planning permission requirements generating minor greenhouse gas emissions and dust emissions during this process. The ADF would be closed in accordance with its CRAMP.

There would be no significant air emissions once the plant closure occurs. However, the potential to displace CO_2 emission from other fossil fuel based energy generation plant would not exist and no addition would be made to the percentage of nationally renewable energy generation.

Alternative energy production, likely from a fossil fuel generator, could be required to meet demand which would lead to greenhouse gas emissions being generated elsewhere.

10.6 Mitigation

10.6.1 Construction phase

10.6.1.1 WOP and ADF construction mitigation of Climate Change

Best practice in engineering construction, such as CIRIA Guidance, will be followed to ensure minimum GHG emissions to atmosphere during construction. This will include efficient use of resources, materials, transport and equipment use and minimising waste generation.

10.6.1.2 WOP and ADF construction mitigation of Air Quality

The potential for dust during construction depends on a number of factors, most notably the prevalent weather conditions. While a need for significant active dust control during construction is not foreseen, good practice site management measures will be implemented as necessary and will include as a minimum the following:

- A water bowser will be available to spray work areas, especially during periods of excavations works coinciding with dry periods of weather. This will prevent dust migration offsite to sensitive receptor areas.
- Use of appropriately covered trucks during delivery of materials to the site to minimise the potential for fugitive emissions
- Stockpiled material during the construction phase will be sprayed during periods of dry weather in order to suppress dust migration from the site.
- Wheel wash facilities exist at the WOP and ADF site and will be used for construction related traffic as required and
- Use of mechanical road sweeper at the entrance from the public road.
- Dust suppression by water spray on access tracks as required.
- Control of vehicle speeds within the WOP and ADF site.
- Regular inspection of public roads outside the WOP and ADF site for cleanliness and cleaning as necessary.
- Regular inspection and maintenance of the concrete batching plant equipment and dust control equipment.

The dust minimisation measures will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

10.6.2 Operational Phase

10.6.2.1 WOP and ADF operational mitigation of Climate Change

The transition of WOP Station to biomass fuel, which is considered as zero carbon, in the period 2020 to 2027 is in line with the national and EU Climate change mitigation strategy leading to a reduction in GHG emissions to the atmosphere.

Biomass will be sourced from certifiable sustainable sources with independent auditing to confirm the level of GHG savings achieved.

The station will operate in accordance with its IE Licence which in turn requires the implementation of best available techniques (BAT) to minimise emissions from the station and to ensure it operates in the most efficient manner possible. The station operated at an efficiency level of 36.1% (AER 2017) which is well within the BAT requirement range for stations of this type.

Good engineering practice will be followed in the ongoing operation of the ADF to minimise the fuel use and release of GHG to the atmosphere.

10.6.2.2 WOP and ADF operation mitigation of Air Quality

The main potential for impact relates to dust emissions during the operational phase of the project. The main mitigation is the implementation in full of the requirements of the Sites IE Licence with respect to management of the facility and landfill.

The WOP Station site will operate strictly in accordance with the EPA IE Licence Conditions which reflect the requirements of the EU Commission in terms of best available techniques being employed to ensure plant operational efficiency, emission control and monitoring systems. Annual plant performance will continue to be reported to the EPA in the form of an Annual Environmental Report.

To mitigate against biomass wind blow the biomass storage areas permanent retaining wall at Slab A has been designed to accommodate a dust screen which will be put in place should monitoring indicate that wind-blown dust becomes an issue.

A water bowser will be available to spray biomass storage areas, especially during dry weather periods to minimise biomass mobility. This will prevent dust migration offsite to sensitive receptor areas

At the ADF the requirements for the landfill management are set out in IE Licence Condition 3.16. The development of the landfill is strictly controlled by the EPA through the licence with prior approval of specified engineering works required before implementation. This includes the requirement to develop and implement a Landfill Operational Plan to the satisfaction of the EPA for all active, closed and restored landfill cells and landfilling activities at the installation.

The key Mitigation set out in the Landfill Operational Plan with respect to dust control is as follows:

- 15 – 18% moisture will be added to the ash as it is dispensed from the ash silo at the WOP Station into the ash wagons, and
- The ash wagons are covered with hydraulically controlled lids as can be seen from **Plate 1.** The ash wagon lids will remain closed at all times during transportation of ash from LRP to the ADF.

Plate 1: Ash wagon of a rail bogey with two ash buckets and a hydraulically controlled lid

- A further 15% of moisture is added to the ash as it is deposited and levelled in the cell at the ADF. This water / leachate will be deployed using a tractor and slurry tanker.
- Water / Leachate will be sprayed on the deposited ash at regular intervals to prevent dust during dry summer weather.

Water / Leachate required for dust suppression will be sourced from the following:

- The leachate collected in the monitoring manhole may be spread over the ash.
- A recirculation pump (ITT Flygt N3127180 487 Impeller 5.9kW motor) has been installed in the leachate lagoon. This pump is capable of recirculating leachate from the lagoon to the cell through 450m of 4" lay flat hose. Leachate is also removed from the lagoon by tanker and recirculated over uncapped cells as a dust suppression method.

The Landfill Operational Plan also sets out procedures for operation during adverse weather conditions. The landfill will be developed on a cell by cell basis with each cell being capped by an impermeable barrier layer, a drainage layer and soil layer within two years of the cell being filled.

The final closure of the landfill will be in accordance with the Closure, Restoration and Aftercare Management Plan prepared in accordance with Condition 10. 2 of the IE Licence and approved by the EPA.

The measures described in the Landfill Operational Plan are 'good practice' measures and are designed to ensure that the construction activities do not generate excessive dust or particulate material release. Employment of such measures will ensure that no significant dust effects occur during project construction, operation or decommissioning and closure.

Indirect releases of dust from the peat supply bogs are controlled under their respective EPA IPC conditions. Bord na Móna operate the peat harvesting sites under their EMS system with best industry practice used to control dust emissions from their harvesting, storage and transport operations.

10.6.3 Mitigation of greenhouse gas and transboundary emissions

The indirect impacts of greenhouse and transboundary gases SO_2, NOx, VOCs and NH_3 are controlled under the IE licence issued by the EPA to WOP and under the IPC licences to Bord na Móna for their peat harvesting operations. These set emission limit values which must be complied with and which are derived from the European Commission's publications on Best Available Techniques to limit emissions from large combustion plants and for other land use activities.

Emissions of CO_2 are controlled under the European Emission Trading Scheme (ETS). Carbon emissions from WOP Station are accounted for in the pan EU Emissions Trading Scheme (ETS). The ETS is a cap and trade scheme, established in 2005, that restricts CO_2 emissions from the major emitting sectors in Europe. It was established under Directive 2003/87/EC and its amendments and is implemented in Ireland under S.I. 490 of 2012 and amendments and S.I. No. 261 of 2010 and amendments. It is a mandatory requirement for power generators such as West Offaly Power to participate in the scheme.

Under the ETS scheme WOP operates under a GHG emission permit (IE-GHG077-10385-4), issued by the Environmental Protection Agency, which allows it to operate and emit CO_2 surrendering a certificate for each tonne of CO_2 emitted. The total number of carbon credits in the scheme is set at EU level and is set at a level which aims to reduce CO_2 emissions progressively to 43% below 2005 levels by 2030 in line with the EU Council 2030 climate and energy policy framework. With the ETS, the EU has predetermined how many credits

are available for each year and so this establishes how much carbon can be emitted across the EU in any year while maintaining a trajectory to the overall target of the scheme.

Peat harvesting areas will be rehabilitated post harvesting by Bord na Móna as required by the IPC Licences under which they operate. This will lead to a reduction in emissions in the long term from the harvesting areas once rehabilitation is implemented. Rehabilitation and rewetting of drained peatland is recognised widely (especially by EPA funded research such as the Framework for the restoration of degraded peatlands[22] the Carbon Restore Project[23] and the EPA Research Report No. 228[24]) as 'low hanging' fruit in terms of reducing carbon emissions by changes in land use.

Bog rehabilitation could also be feasible on sites where renewable energy developments such as wind and solar may be feasible depending on the site. This would have the added benefit of not only generating renewable energy but also acting as an active carbon sink arising from rehabilitation of degraded sites.

10.7 Difficulties Encountered in Compiling Information

No difficulties were encountered in compiling the information presented in this Chapter.

10.8 Residual Impacts

In terms of dust no significant impacts are predicted following the implementation of good construction practice and implementing the mitigation measures set out in **Section 10.6** above.

During adverse weather condition some residual impacts will occur, dependent on wind speed and turbulence during construction and operation, however, it is likely that the impact will be localised in the area immediately surrounding the source and will be of short duration.

WOP Station will continue to emit GHGs on a reducing scale in the period 2020-2027. From the end of 2027 electricity generated by the station from sustainable biomass will be counted as zero carbon for the biomass element under the EU ETS scheme. From the end of 2027 WOP will be a low carbon renewable energy generating station displacing electricity

[22] EPA Research, Climate, Water , Sustainability http://erc.epa.ie/droplet/modalFull.php?cid=17931

[23] EPA Carbon Restore: The Potential of Restored Irish Peatlands for Carbon Uptake and Storage http://erc.epa.ie/safer/iso19115/displayISO19115.jsp?isoID=280

[24] Gerard Kiely, Paul Leahy, Philip McVeigh, Ciaran Lewis, Matteo Sottocornola, Anna Laine and Ann-Kristin Koehler, EPA Research Report No. 228 Peat, GHG - Survey of GHG Emission an Sink Potential of Blanket Peatlands

generation from fossil fuel on the grid and reducing greenhouse gas emissions. This is considered to be a **positive, significant and medium term** impact.

Peat supply to WOP for energy generation will cease at the end of 2027. Following rehabilitation of the peat supply bogs serving WOP, greenhouse gases from this activity will significantly reduce.

10.9 Cumulative Impact

Potentially cumulative impacts could occur from simultaneous construction of the WOP biomass storage facilities and the development of the ADF cells. Both these developments will cumulatively release GHGs from fuel combusted by construction and transport equipment. Dust could potentially be generated at both sites during construction. However, given the distance of the WOP ADF site to the WOP Station (5.5 km) a cumulative dust impact will be imperceptible. Similarly, during the operational phase controlled emissions will occur from the WOP Station to air and from the ongoing development activities at the ADF site. Again, given the separation distance and the emission control and monitoring system in place at WOP cumulative impacts will be imperceptible. Greenhouse gas emissions and transboundary emissions are cumulatively produced by other fossil fuel power generation plants including LRP Station and EPL and other sectors. Ireland's greenhouse gas emissions in 2016 are shown in **Figure 10-6** below.

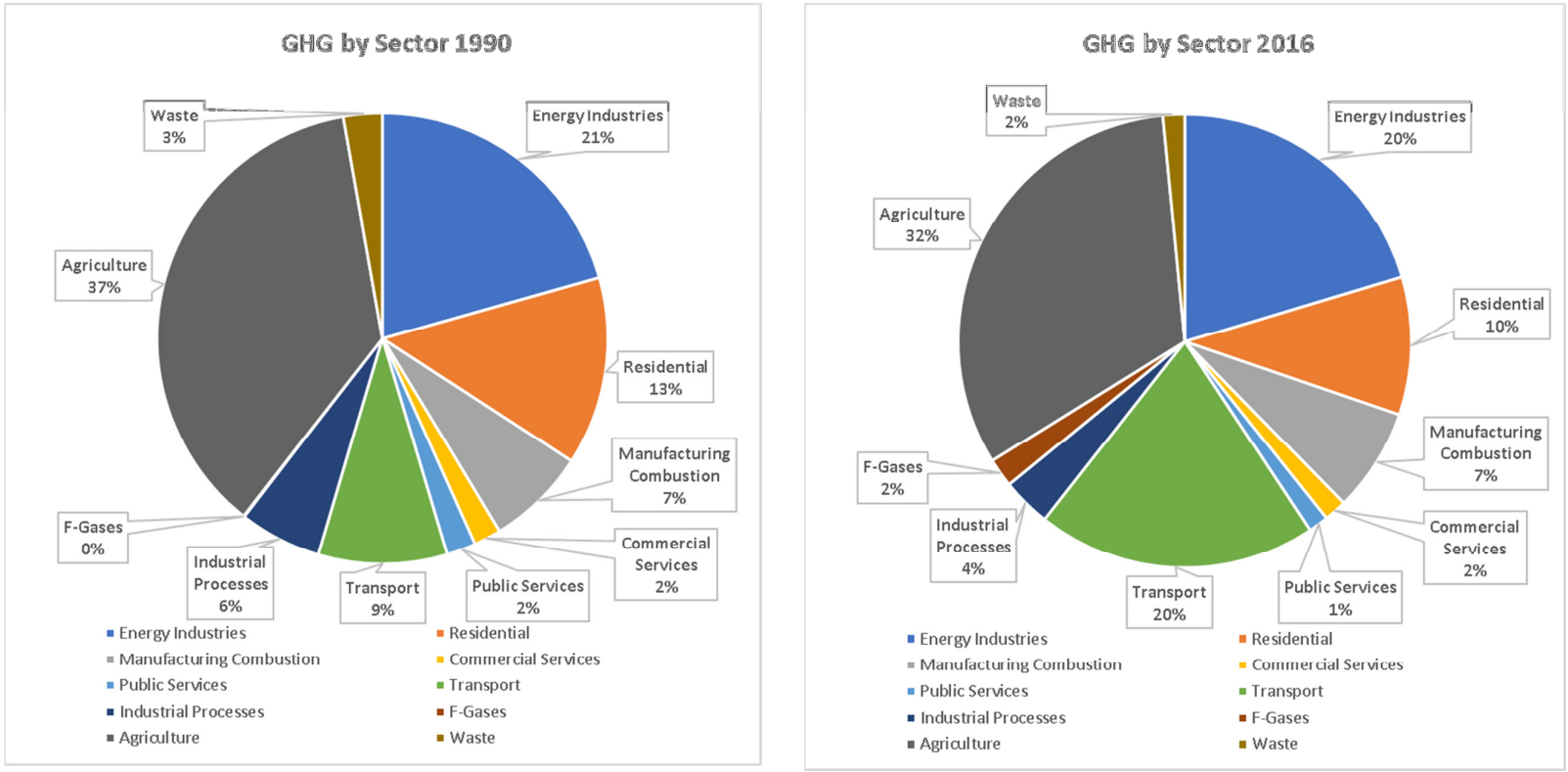

Figure 10-6: Cumulative Greenhouse Gas emissions 1990 - 2016[25]

[25] EPA November 2017, Ireland's Provisional Greenhouse Gas Emissions 2016, November 2017

A separate planning application will be submitted to Longford County Council to transition LRP Station away from peat and to co-firing with biomass also. LRP is a 100MWe generating station. The peat utilisation and associated CO_2 reduction profile is similar to that of WOP, with peat fuel being completely phased out by the end of 2027. The cumulative reduction in CO_2 which would arise from both plants transitioning to biomass is provided in **Table 10-18.**

Table 10-18: Cumulative CO_2 reduction from WOP and LRP

Year	Peat (000's ET)	Annual CO2 (000's Tonnes) /annum	Percentage Biomass energy	Biomass ET (000's)
2019	2,100	1,911	0	0
2020	1,260	1,148	40.6%	870
2021	1,260	1,143	40.6%	868
2022	1,260	1,143	40.6%	868
2023	1,260	1,143	40.6%	868
2024	1,260	1,148	40.6%	870
2025	840	771	58.6%	1,194
2026	840	771	58.6%	1,194
2027	840	771	58.6%	1,194
2028	0	0	100%	

In the period between 2020 and end 2027 significant quantities of CO_2 would continue to be emitted from the generating stations which would be a significant long term negative impact on climate change but such emissions would be within the EU GHG emission reduction goal to 2030. However, cumulatively, at the end of 2027 there would be a significant reduction in CO_2 emissions arising from both plants firing on biomass alone and displacing fossil fuel energy generation. This would have a significant positive impact on climate change in the long term.

EPL is an existing thermal energy generating stations co-firing on biomass and peat and operated by Bord na Móna at Ballykilleen, Edenderry, County Offaly. A peaking plant (Cushaling Power Limited) is also located on the site. The site is licenced by the EPA (IE Licence P0482-04) and all emissions are controlled under this licence to ensure no significant air quality impacts from dust, sulphur oxides or nitrogen oxides occur. Emissions to air are provided in the sites AER 2017 report as follows; 548,330 tonnes of CO_2, 787 tonnes of NO_2, 933 tonnes of SO_x and 43 tonnes of dust. These emissions would be cumulative with WOP and LRP.

EPL operates with support for biomass under REFiT3 with electricity produced from the biomass fuel counted as carbon neutral. When WOP, LRP and EPL are firing on biomass there will be a significant cumulative GHG emissions saving. This will continue until the end of 2023 when the current planning permission for EPL expires.

Lumcloon Energy Ltd. is a privately owned planning approved lithium Ion battery storage facility located adjacent to West Offaly Power on a greenfield site. The facility will be used to store available excess electricity from the grid, mainly from renewable generation and to discharge it rapidly back into the grid when required. The battery storage units will be housed in a warehouse type building. There would be potential for minor negative impacts during the construction phase of this facility through excavation and earth moving with emissions of greenhouse gases from delivery and construction equipment. This would be cumulative with the proposed development. There would be a positive benefit to renewable energy overall during the operational phase of the facility.

Cumulative air quality impacts in the form of dust from peat harvesting activities associated with the peat supply bogs for WOP could also occur. Some of the peat supply bogs providing peat to WOP also supply peat to LRP and EPL and potential cumulative dust emissions from harvesting and stockpiling operations could therefore occur. To mitigate against this Bord na Móna operate their peat harvesting in accordance with their IPC Licences which include dust control measures and dust deposition standards. The indirect impacts, greenhouse gas emissions and dust, described in Section 10.5.5 above which arise from the bare peat areas, stockpiles and associated drainage will also occur cumulatively with the peat supply bogs providing peat to LRP, EPL and the commercial horticultural bogs and other peat harvesting industries. These cumulative impacts will continue until such time as peat harvesting and stockpiling no longer occurs and the supply bog areas are rehabilitated as per their respective IPC Licences where applicable.

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