CLIMATE CHANGE RISK & ADAPTATION ASSESSMENTS

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Summary

This Best Practice Guidance for ADBA is prepared by SLR Consulting. It provides an overview of how to conduct a climate change risk assessment and supporting adaptation plan for anaerobic digestion (AD) plants and biogas industry sites.

The Regulatory Position

The environmental regulators for England and Wales, the Environment Agency (EA) and National Resources Wales (NRW) respectively, now require environmental permit holders to include a climate change risk assessment and adaptation plan within their environmental management system.[1]

This requirement applies to both existing permit holders and to those applying for new environmental permits. If your permit was issued before April 2023, you should complete a climate change adaptation risk assessment by 1 April 2024, and be prepared to complete a supporting adaptation plan to manage your risks shortly after. Most existing or planned AD plants will need to comply with this regulation.

Climate Impacts for the Biogas Industry

Like all UK industries, the biogas industry is impacted by natural hazards, with weather-related impacts such as flooding and lightning strikes resulting in damage to sites and a risk to the health and safety of on-site personnel and nearby receptors.

The latest Intergovernmental Panel on Climate Change (IPCC) AR6 Synthesis report[2], published in 2023, states that global surface temperatures have reached "1.1°C above 1850–1900 levels in 2011–2020". Under stated policies as of 2020, it is anticipated to rise to around 3.2°C by 2100.

At a regional level, the 2021 UK Climate Change Risk Assessment (CCRA3)[3] highlights the following:

- All UK energy-related infrastructure is at risk from the impacts of climate change, especially due to the changing frequency and intensity of surface water and coastal flooding[4].
- Both high and low temperatures, snow, ice, high winds, and lightning can all cause disruption to the energy network. The future risks from wind and lightning are more uncertain than for other climate hazards.
- The potential for reduced water availability in the future could reduce the output of thermal power generators and potentially biomass and gas power output.
- Agricultural productivity could be at impacted under future climate scenarios. This could be as a direct result of more extreme weather, or indirectly due to a greater number of pests, pathogens and invasive non-native species (INNS)[5].

Climate change impacts affecting the biogas industry may vary considerably geographically and between sites. Therefore, it is important for site managers to understand the climate change impacts specific to each site, and how climate will impact the sites' activities on nearby receptors during its' operational lifetime. In doing so, site managers can adequately respond to, and manage or mitigate against the impact of identified climate change risks through the development of a climate change adaptation plan.

1 **EA 'A changing climate' guidance update, April 2023**
2 **IPCC AR6 Synthesis Report 2023**
3 **2021 UK CCRA3 Report**
4 **CCRA3 Energy Sector Briefing**
5 **CCRA3 Agriculture and Food Sector Briefing**

Conducting a Climate Change Risk Assessment

The steps outlined below describe the process for conducting a climate change risk assessment.

Step 1: Identify Potential Risks

To start, site managers should scope out potential risks that could impact their site, and potential risks that the site could create for nearby receptors, due to changes in the climate. Site managers should consider a broad range of climate variables in their risk identification exercise. When considering potential risks, sites should consider risks that could impact the site both today and at future time horizons, e.g., 2050, up to the operational lifespan of the asset. Sites should also consider which nearby receptors could be impacted e.g., local watercourses, residential areas, designated sites and transportation networks.

Table 1 sets out different climate variables and the potential impacts that they could have on the site and nearby receptors.

Step 2: Climate Change Risk Assessment

Once potential climate impacts have been identified, site managers should conduct a climate change risk assessment. A best practice climate change risk assessment will consider the impacts associated with multiple forward-

TABLE 1 CLIMATE CHANGE VARIABLES AND ASSOCIATED IMPACTS (SLR)

Climate Change Variable	Example Impact to Site	Example Impact a Site Could Create
Summer Daily Maximum Temperature	Increased water usage. Issues with cooling biogas for condensate removal.	Increased odour generation from site.
Winter Daily Minimum Temperature	Freezing of condensate in biogas lines or chiller – potential restrictions leading to the use of flare or pressure relief valves	
Winter Daily Maximum Temperature	Lower demand for gas in the network. Potential for lower manure supply – cattle grazing in fields for more of the year.	
Daily Extreme Rainfall	Flooding in bunds and potential damage to equipment. Need to process water through digesters, reducing feeding capacity.	Increased risk of contamination from surface water discharge.
Average Winter Rainfall	Potential for increased site surface water flooding leading to access issues for operators. Need to process water through digesters reducing feeding capacity.	Increased risk of contamination from surface water.
Drier Summers	Potential limit to abstraction from boreholes for dilution. Less rainwater for feedstock dilution – more digestate recycling needed.	Increased risk of contamination from surface water discharge.
River Flow	Insufficient river flow for abstraction for site use.	River flows unable to accept discharge flow due to low dilution.
Sea Level Rise	Potential risk of flooding at coastal sites.	Increased risk of contamination from surface water discharge.
Storms (incl. lightning strikes & high winds)	Increased risk of lightning strikes. High winds causing damage to membrane roof.	

looking climate change scenarios, as recommended by the ISO 14090 standard. For compliance purposes, the environmental regulators only require organisations to consider a scenario that assumes a 4°C rise by 2100 and a 2°C rise by 2050, equivalent to an RCP8.5 or SSP5-8.5 scenario (see Table 2).

When considering which climate scenarios to use, site managers should opt for the latest available data, where possible, to future-proof their risk assessments. Currently, the latest climate data available is the Coupled Model Intercomparison Project Phase 6 (CMIP6) dataset; a multi-model set of globally simulated climate data. Sites may alternatively opt for the earlier Phase 5 dataset, CMIP5, which has informed the widely available UK specific, UK Climate Projections 2018 (UKCP18) dataset.

To align with best practice, site managers should choose downscaled climate change projections from these datasets i.e., recalibrated projections for regional or local use. If a more detailed assessment or scenario analysis is required, site managers are recommended to seek external support from climate change experts who will be able to support with processing and interpreting climate data.

Table 2 outlines both the CMIP5 and CMIP6 datasets, the scenarios available within CMIP5 (and UKCP18) and the comparable scenarios in CMIP6 that result in a similar amount of warming by 2100. Note that scenarios in bold are those recommended to provide a high, medium, low view of future climate conditions.

Preparing A Climate Change Adaptation Plan

Once potentially material risks to the site or nearby receptors have been identified under different climate change scenarios and time horizons, it is then the responsibility of the site manager to ensure that these risks are managed to limit the impact of them to the site and nearby receptors. The detail in the final plan should be commensurate with the level of climate risk identified in the risk assessment.

Under EA and NRW requirements, site managers are responsible for identifying and establishing risk management controls, along with monitoring procedures. These should be put into place at the site and incorporated into the management system tied to the applicable environmental permit. The identified actions therefore must be specific to the individual site and the identified risks.

TABLE 2 CMIP5 AND CMIP6 CLIMATE SCENARIOS

CMIP5	CMIP6	Approximate Associated Warming °C in 2100 (based on CMIP6[6])	Future Warming Scenario Use Case
RCP*2.6	SSP**1-2.6	1.3 – 2.4	Low
RCP4.5	SSP2-4.5	2.1 – 3.5	Medium
RCP6.0	SSP3-7.0 (OR SSP4-6.0***)	2.8 – 4.6	
RCP8.5	SSP5-8.5	3.3 – 5.7	High

Dataset providers:
CMIP5: **UKCP18 User Interface**, **CEDA Archive**
CMIP6: **WCRP CMIP6 Archive**

Additional notes:

***RCP = Representative Concentration Pathway**, the number of each scenario denotes the associated radiative forcing potential of each scenario at 2100.

****SSP = Shared Socioeconomic Pathway**, the first number of each scenario denotes the socioeconomic pathway, i.e. plausible policy, economic growth, technological development pathways . There are five SSP scenarios in total. The second number refers to the associated radiative forcing that aligns with the RCP scenarios.[7]

*****SSP4-6.0 is known as "tier 2" scenario** which an additional scenario of interest and is not commonly used. It is therefore recommended that the SSP3-7.0 is used instead if a further high emissions scenario is required.[8]

6 **PCC AR6 Report – Summary for Policymakers**

7 O'Neill, B.C., Kriegler, E., Riahi, K. *et al.* A new scenario framework for climate change research: the concept of shared socioeconomic pathways. *Climatic Change* **122**, 387–400 (2014). **https://doi.org/10.1007/s10584-013-0905-2**

8 **Government of Canada CMIP6 and Shared Socio-economic Pathways overview**

To prepare a climate change adaptation plan site managers should consider the following, in line with the ISO 14090 standard:

Identify Risk Controls
For each material risk or risk category, site managers should consider the options available for minimising the impact of each risk, or minimising exposure to the risk. Multiple options may be available for each risk at this stage, and site managers should understand the economic, environmental and social costs or benefits associated with each of the proposed measures, in addition to the timeline over which they are effective. As part of this exercise, it may be necessary to seek input from other stakeholders both on and off site.

Prioritise Actions
From the controls identified, site managers should evaluate and select the preferred measures noting any assumptions that have informed the prioritisation. Where possible, low- or no-regret actions, such as nature-based solutions, should be prioritised over hard engineering solutions or non-reversible actions to avoid lock-in. For example, actions delivering multiple benefits that address several climate impacts or offer longer-term resilience may be prioritised over actions that are costly, or only help to manage one climate impact.

The EA and NRW recommend adopting a dynamic planning approach to allow for flexibility in the implementation of adaptation actions. In a dynamic planning approach, different future adaptation scenarios are modelled with pre-determined decision and trigger points for implementing each control measure in a phased manner according to their prioritisation. Such an approach limits the need for upfront capital expenditure and facilitates a more measured approach to climate change adaptation and investment. To facilitate a dynamic planning approach, site managers should have a robust monitoring programme in place (see *Monitor and Review* below.) with Key Risk Indicators (KRIs) to inform decision and trigger points.

Develop a Plan
In developing the Climate Change Risk and Adaptation Action Plan, the site manager should set out clear objectives for the plan. Each adaptation action or climate risk control within the plan should have a clear owner, timescale for implementation and justification for inclusion. Where possible, the plan should align with existing business continuity, or site safety plans employed by the company and/or site. In some cases, existing plans may be adjusted to incorporate specific climate risks and their management actions. However, best practice guidance says adaptation plans should be site specific.

Monitor and Review
An adaptation plan is a working document that should be reviewed regularly and updated accordingly. Monitoring the effectiveness of the implemented adaptation actions is key to understanding whether the plan has achieved its objectives. As part of this, all climate related incidents or near misses at or from the site should be recorded. If following a dynamic planning approach, monitoring plays a vital role in the implementation of the adaptation plan itself.

The site manager or risk owner is responsible for conducting regular reviews of the plan. The timing of these reviews is best determined by the site manager; however, best practice guidance recommends the plan is reviewed at least annually, with a full reassessment at least every 4 years. More frequent reviews may be necessary if multiple incidents or near-misses occur, or if new climate information becomes available.

For further information on conducting a climate change risk and adaptation assessment, please refer to ISO14090 or the following guidance:

EA Guidance for Climate Change: risk assessment and adaptation planning in your management system

Biowaste: examples for your adapting to climate change risk assessment

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