Submission by Amazon Data Services Ireland Ltd. (ADSIL) to the Environmental Protection Agency regarding conditions 7.2.1 and 7.2.2 of IED permits: P1171-01; P1170-01; P1172-01; P1173-01; P1177-01; P1192-01; P1184-01; P1186-01

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Background

In 2023 **Amazon Data Services Ireland Ltd** (ADSIL), the Irish entity of Amazon Web Services (AWS), which is part of the Amazon.com, Inc group of companies) was granted IED permits by the Environmental Protection Agency (EPA) for eight separate facilities in Dublin. Each permit contained a condition (7.2.1) stipulating that the licensee (ADSIL) should undertake a study to "identify opportunities to increase the use of solar power, biofuels and other renewable energy options including energy storage". The following condition (7.2.2) within the respective permits directed that the licensee should submit a report on the study to the EPA on the options to decrease or offset the use of fossil fuel energy.

This submission has been prepared by ADSIL to meet compliance with conditions 7.2.1 and 7.2.2.

Following obtainment of IED permits, ADSIL convened a multi-disciplinary team to address the requirements of the relevant conditions referenced above. That team included members from various parts of the ADSIL organisation, including specialists in sustainability, energy, infrastructure, operations and engineering. A review was subsequently compiled that examined the feasibility to increase the usage, at the facilities in question, of: on-site solar power; on-site wind energy; on-site energy storage systems; and on-site deployment of sustainable biofuels.

The findings of this study are summarized below.

Overall ADSIL approach to renewable energy use, both globally and in Ireland

It may be helpful to first set out the broader ADSIL approach to renewable energy use.

ADSIL remains resolutely committed to building a sustainable business for its customers and the planet. In 2019, Amazon co-founded The Climate Pledge, a commitment to reach net zero carbon emissions by 2040, ten years ahead of the Paris Agreement. As part of that commitment, Amazon is on a path to powering its operations with 100% renewable energy by 2025, five years ahead of the original 2030 target. In 2022, 90% of the electricity consumed by Amazon was attributable to renewable energy sources. Currently in Ireland (and other parts of EMEA) operational power requirements have exceeded this target and achieved 100% renewable energy. In Ireland, we also procure green tariffs for energy supply. This means all energy consumption within all 8 campuses under the IEDs is offset with renewable generation. Amazon is the largest corporate purchaser of renewable energy globally for the 4th year running and has announced over 500 renewable energy projects across 27 countries, including Ireland, generating 77,000 GWh of clean energy annually which is the equivalent amount of electricity needed to power 19.7 million European homes each year.

ADSIL's focus on sustainability and climate – which is consistent with the Irish Government's own climate goals of achieving 80% renewable energy usage by 2030 – is equally evident in its significant investment in Irish infrastructure. ADSIL has already announced funding three wind

projects (total 229MW capacity) in Ireland; two of which are now fully operational, delivering clean energy to the Irish grid. ADSIL is also supporting the new district heating scheme in Tallaght by providing excess heat from a nearby data centre. The system will initially heat 47,000 m^2 of public sector buildings, 3000m^2 of commercial space, and 135 affordable rental apartments. This is projected to save 1,500 tonnes of carbon per annum during the first phase, the equivalent of a 60% reduction in carbon emissions.

These renewable wind and district heating projects have been achieved through collaboration and partnerships with government, renewable energy developers, and local utilities. They reflect the company's continued commitment to sustainability, both in Ireland and internationally.

On-site use of sustainable biofuels

ADSIL have significant experience of deploying on-site sustainable fuels in Ireland. In January 2023, it started the transition to the use of hydrotreated vegetable oil (HVO) to power backup generators at all its sites, including those in receipt of the IED permits. HVO is a biofuel made from cooking oil, or vegetable, plant and residue oils. It can reduce greenhouse gas emissions by up to 90% over the fuel's lifecycle when compared with fossil diesel. An added benefit of HVO is that it's proven to be more compatible with industrial machinery than biodiesel as no modifications to fuel systems are required. This versatility has allowed ADSIL to fill the tanks of its backup generators with HVO without material operational changes.

The transition to HVO use at the sites in question is well underway. To date, in fact, nearly 600,000 litres of HVO have been purchased for ADSIL infrastructure in Ireland, which will achieve carbon savings of approximately 1,370 metric tonnes of CO_2 per annum.

ADSIL is aiming to switch entirely to HVO at all its infrastructure sites across Europe, including Ireland. For this to happen an accessible, steady, and sustainable supply of HVO will be required. To support the adoption of HVO, ADSIL is engaged with suppliers who are developing a global supply chain, working with local organisations (e.g., Certa in Ireland) and is investing in the procurement of HVO from renewable sources, with raw materials that are traceable to their origins and not derived from sources that impact highly biodiverse areas.

On-site wind energy

As referenced above, ADSIL has extensive experience working with wind energy developers in Ireland. It was, for example, the first company in the country to announce corporate power purchase agreements (CPPAs). Amazon has committed to offtake 100% of the power from renewable wind projects in Cork, Donegal, and Galway. These projects are projected to add, once fully operational, 229MW of renewable energy to the grid, the equivalent energy to power over

160,000 Irish homes. As with on-site solar, the multi-disciplinary team was able to draw on this wider experience of the deployment of wind energy solutions.

The study determined that conventional utility scale wind turbines (+5 MW scale) are too large for installation at the ADSIL sites in question, all of which are located in or adjacent to commercial or residential areas – large scale turbines require appropriate spacing to minimize turbulence, maintain safe operating distances in case of turbine failure or collapse and as such urban environments are limited in their potential to deploy on-site wind generation. Smaller, building-integrated wind generation technologies were assessed as a potential alternative. Hourly wind speeds from Dublin airport were used as a proxy to model wind potential. The wind profile was compared against the typical power generation curve of a small scale (5kWp) rooftop mounted power generator. This was estimated to have a potential production value of up to 3000kWh/year, assuming a constant and optimal wind direction (losses from suboptimal wind direction and variability of this natural resource were not adjusted for). The multi-disciplinary team determined that up to 100kW capacity of wind turbines could hypothetically be installed at the facilities in question, representing an upper estimate which assumes the building edge is facing the direction of prevailing wind. Even working from these generous assumptions, it was determined that such systems – provided planning permission could be obtained for them – would only produce a negligible amount of the facility's annual energy use. As such, development of on-site wind energy has been determined to be unfeasible. The assessment concluded that investment in off-site projects is more productive, efficient and scalable.

Accordingly, on account of this low-energy generation potential and intermittency challenge, on-site wind was determined not to constitute a viable substantial or mitigating power source for the eight sites subject to the IED permits. ADSIL will continue to track on-site wind technology innovations in the event that technological advancements allow for more effective usage of such on-site solutions.

On-site solar power

ADSIL and Amazon have significant experience in harnessing solar power to reduce emissions, wherever possible. In Europe alone, Amazon has 80 on-site solar projects, with investment strategy driven by local solar radiance conditions and relative economics versus consuming offsite power.

Solar photovoltaic (PV) systems have already been installed within buildings in five of the eight IED sites, providing power for office areas and car charging ports. The multi-disciplinary team, drawing on AWS' wider solar experience, examined the potential to enhance on-site solar power usage at the facilities in question. The study determined that the respective ADSIL facilities could accommodate photovoltaic (PV) capacity. However, solar power potential in the Dublin area is limited due to the high geographic latitude and adverse local weather patterns. Moreover, PV systems would contribute a negligible percentage of a typical facility's energy consumption. The

intermittent generation profile of rooftop PV also means that the power generated would not replace the need to connect to the national electricity grid given the intermittency and scale of solar resource. The focus therefore is initially, on investing in energy efficiency measures on-site, with energy efficiency audits (IED condition 7.1) to be completed to inform this.

On-site energy storage systems

The multi-disciplinary team evaluated energy storage systems, or batteries, as an alternative to conventional emergency backup generators in a scenario whereby utility power becomes unavailable.

The principal challenge to the deployment of such solutions were determined to be the practical issue of the space required to implement them. On-site energy storage systems, that would be suitable for ADSIL cloud infrastructure, are large and occupy a significant footprint. As the ADSIL facilities are generally located in developed areas, and are not adjacent to greenfield sites with potential for such large-scale energy storage solutions, it was determined that it would not currently be technically and economically feasible to deploy both Back-up Energy Storage Systems (BESS) in addition to emergency back-up generators.

ADSIL will continue to examine the potential for greater use of battery storage systems in future.

Conclusion

ADSIL remains resolutely committed to enhancing energy efficiency of DCs, collaborating with suppliers, energy companies and industry experts to enable transitioning to renewable energy, reducing embodied carbon, and innovating in the design and manufacture of cloud hardware to limit waste. Whilst already making significant emission savings through the use of HVO, ADSIL will continue to invest in new solutions and seek to reduce emissions wherever possible, including all of our sites in Ireland.