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Modelling Crematorium Emissions in Wales

CDS Green Agenda - Research

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All data provided within this report are approximations based on extensive industry research

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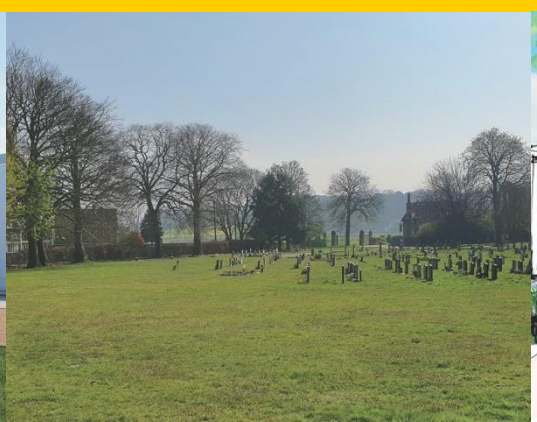

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Welsh Crematorium Emissions Breakdown

Parameter	Amount / unit	Reference
Number of Crematoriums in Wales	**17**	*Pharos 2019 Statistical Issue*
Number of Cremations in Wales (2019)	**24,602**	*Pharos 2019 Statistical Issue*
Average Cremations in Wales per Crematorium (2019)	(24,602 / 17) = **1,447**	*Pharos 2019 Statistical Issue*
Percentage of Crematoriums in Wales which are gas fuelled	**100%**	*n/a*
Average carbon dioxide (CO_2) emissions from a single gas cremation	**245kg**	*(Based on average 32m^3 of gas / cremation + the carbon in the body and coffin)*
Average NOx emissions from a single gas cremation	**500g (absence of Selective Catalytic Reduction assumed)**	*Pharos Summer 2019 (Tony Brookes Article, page 30)*

Total Welsh Crematorium Emissions

Cremations (2019)	CO_2 Gas Cremation (kg)	CO_2 Gas Cremation (T)	NO_x Gas Cremation (kg)
24,602	**6,027,490**	**6,027**	**12,301**

Offsetting the carbon emissions from Welsh Crematoria

Source	Pollutant	Hectares of tree seedlings (Greenhouse Gas Equivalencies Calculator, US, EPA, 2020)	Hectares of mature trees required (Greenhouse Gas Equivalencies Calculator, US, EPA, 2020)
Single Cremation	245kg of CO_2	**1.6 hectares**	**0.13 hectares**
Average Welsh Crematorium (Based on average number of cremations)	354, 558 kg of CO_2	**2,369 hectares**	**187 hectares**
Wales	6,027,490kg of CO_2	**40,330 hectares**	**3,185 hectares**

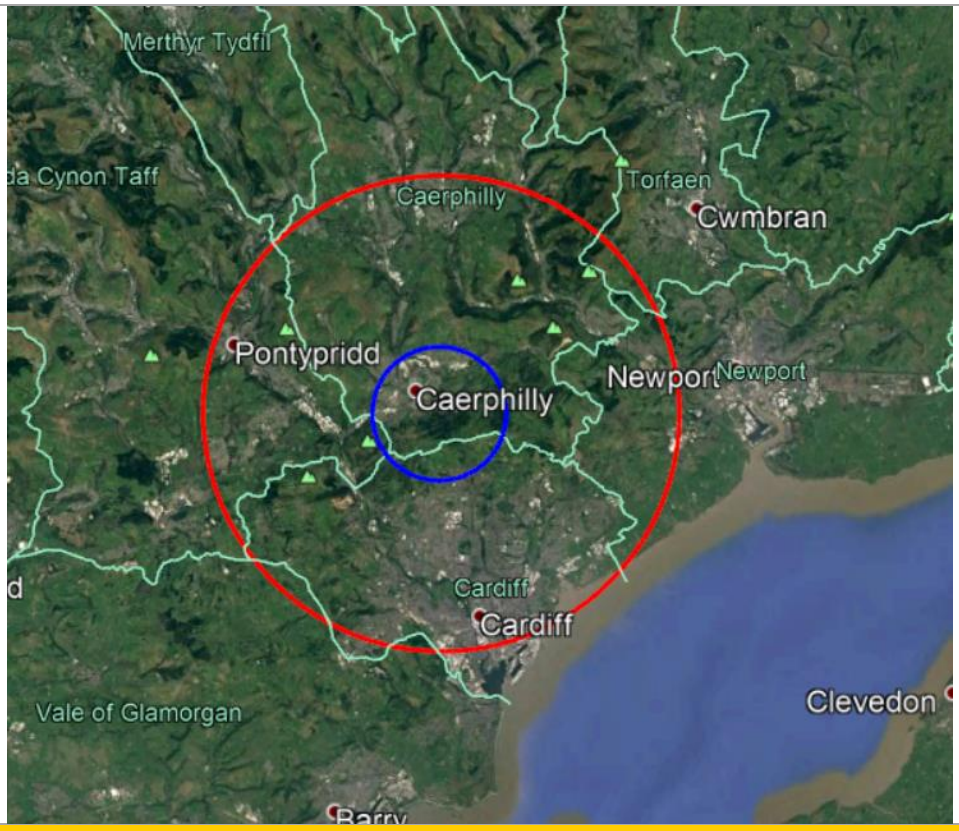

Figure 1. Acreage of trees required to sequester Welsh crematorium emissions (Red- Tree Seedlings, Blue- Mature Trees)

Electric Cremation

The UK is taking a holistic approach to reducing carbon emissions: "New standards set forth by Philip Hammond will bring an end to the installation of gas boilers in any new build domestic properties from 2025"

In the Netherlands, the government have banned any installation of a conventional gas cremator, all cremators must either be electric or a gas cremator which have the capacity to either add hydrogen or completely switch to hydrogen gas.

Hydrogen gas is a potential option for the future for cremation; however, the technology is not in its current state financially viable or efficient, as the infrastructure is not in place to facilitate its usage.

Electric cremators are manufactured both in the Netherlands and in Germany where they have been installed in a number of crematoriums across Europe. The UK should now recognise that this technology can transform the cremation industry and move forward with the green revolution.

The CDS Group have conducted a public survey which identified that 75% of the respondents of the survey would travel further to a crematorium with an electric cremator than one with a conventional gas cremator.

Electric cremators carry out the same principle process as gas cremation but using an alternative source of energy. The most desirable method would be to run the electric cremator off of a green energy tariff thereby ensuring all energy used in the process will be powered by renewable energy.

The efficiency of an electric cremation is due to its process, the cremator uses the most energy within its first 3 days to reach optimal temperature, thereafter the cremator remains at a constant temperature, using minimal electricity. This differs from gas cremation as the chamber has to constantly pump gas through to maintain temperature.

The energy present in the body and the coffin fuel the process, resulting in significantly lower energy usage. The reliable continuous measurement of O_2, temperatures and low pressures, ensures a constant cremation process. Keeping the cremator at constant temperature will extend the life of the fireproof masonry resulting in less maintenance and downtime. As a result, maintenance costs are kept are lower than conventional gas cremation.

There is a requirement in the UK for all crematoria to meet 'Process Guidance Notice 5/1 (12)' (PG5), this document sets out the requirement for a cremation equipment to meet certain criteria. The electric cremator meets all the requirements and statutory guidance set out in PG5 and generally surpasses many other European legislations too.

A crematorium using an electric cremator would not require a gas connection; the heat supplied to the building will mainly be supplied by the heat exchange from the cremator. Any requirements for additional heat within the crematorium building itself could be provided using renewable electric heating such as ground source or air source heat pumps powered by a green energy tariff to further reduce the carbon emission associated with the building.

In comparison to a gas cremator, an electric cremator run on a green energy tariff reduces the associated carbon emissions from the fuel source by 100%. The remaining carbon emissions, which apply to both gas cremations and electric cremations are from the body and the coffin which are calculated to be around 45kg of carbon, dependant on the choice of coffin and size of the body. Therefore, in total the carbon emissions from an electric cremator versus a gas cremator are decreased by over 80%, assuming energy is supplied by renewable resources through on site production or through a green energy tariff.

A reduction in annual carbon emissions by an estimated 80% would decrease the total CO_2 emissions associated with the 17 Welsh Crematorium from 6,027 tonnes per annum to 1,107 tonnes per annum. To reduce the carbon emissions down even further, consideration should be given to the choice of coffin, as a more environmentally friendly coffin could help to further offset the reductions in emissions.

The level of NO_x resulting from an electric cremator vs a gas cremator are more than halved, with less than200g produced in comparison to an average of 500g from a average gas cremator. The electric cremator also has the capacity to add Selective Catalytic Reduction (SCR), similar to a denox machine on a gas cremator, which would further decrease the NO_x emissions.

Gas vs Electric - Environmental Impacts Breakdown (Per Annum)

Gas Cremator			
	Cremations	**CO_2 (kg)**	**NO_x (kg)**
Single Cremation	1	245	0.5
Welsh Cremations	24,602	6,027,490	12,301
Electric Cremator			
	Cremations	**CO_2 (kg)**	**NO_x (kg)**
Single Cremation	1	45	0.2
Welsh Cremations	24,602	1,107,090	4,920

Gas vs Electric - Environmental Impacts in Context (Per Annum)

Source	Pollutant	Private vehicle (equivalent mileage)
GAS CREMATOR		
Single Cremation	0.5kg of NO_x	**2,280 miles**
Single Cremation	245 kg of CO_2	**1,276 miles**
Wales Total Pollution	12,301kg of NO_x	**56,092,560 miles**
Wales Total Pollution	6,027T of CO_2	**31,391,260 miles**
Total Mileage	**87,483,820 miles**	
ELECTRIC CREMATOR		
Single Cremation	0.2kg of NO_x	**912 miles**
Single Cremation	45kg of CO_2	**234 miles**
Wales Total Pollution	4,920kg of NO_x	**22,437,024 miles**
Wales Total Pollution	1,205T of CO_2	**5,338,649 miles**
Total Mileage	**27,775,673 miles**	
Total Reduction	**-59,710,147 miles (68%)**	

Appendix: Pandemic Situation in Wales and its effect on cremation emissions

A pandemic is defined as “an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people”.

On the 31st of December 2019, the World Health Organisation declared several cases of unusual pneumonia in Wuhan in China, the disease was named COVID-19. By August 2020 over 21,500,000 people are reported to have been infected and over 750,000 deaths have been recorded worldwide. The UK has experienced over 45,000 deaths resultant of COVID-19 and the pandemic is ongoing (October 2020). Pandemics such as COVID-19 cause excess deaths in short periods of time and therefore increase stress on the bereavement industry, especially in worst affected areas. In April 2020, the deaths within that month doubled compared to the previous year. As cremation accounts for approximately 79% of UK deaths, crematoria nationwide have been put under serious pressure.

Deaths Registered Per Month in Wales 2020 (COVID-19) (ONS 2020)				
03-Apr-20	10-Apr-20	17-Apr-20	24-Apr-20	01-May-20
920	928	1,169	1,124	929
Cremations (79% of deaths)				
726	733	923	888	734
Cremation Emissions in Wales (0.245T CO_2 per cremation) 2020				
177.9	179.6	226.1	217.6	179.8
TOTAL Cremation CO_2 Emissions 2020				**981 Tonnes**
Deaths Registered Per Month in Wales in 2019 (Same time period) (ONS 2020)				
05-Apr-19	12-Apr-19	19-Apr-19	26-Apr-19	03-May-19
642	637	580	678	688
Cremations (79% of deaths)				
507	503	458	535	544
Cremation Emissions in Wales (0.245T CO_2 per cremation) 2019				
124.2	123.2	112.2	131.1	133.3
TOTAL Cremation CO_2 Emissions 2019				**624 Tonnes**

In the year 2020 there was a 57% increase in approximate cremation CO_2 emissions in April. The probability of future pandemic situations has elevated, and the emissions associated with cremations must be considered. If the whole of Wales had electric cremation equipment and on a green energy tariff in April 2020; approximately 785 tonnes of carbon would not have been emitted.