

OR Annual report 2022

Appendices



Greenhouse gas emissions, global warming potentials and coefficients for calculations

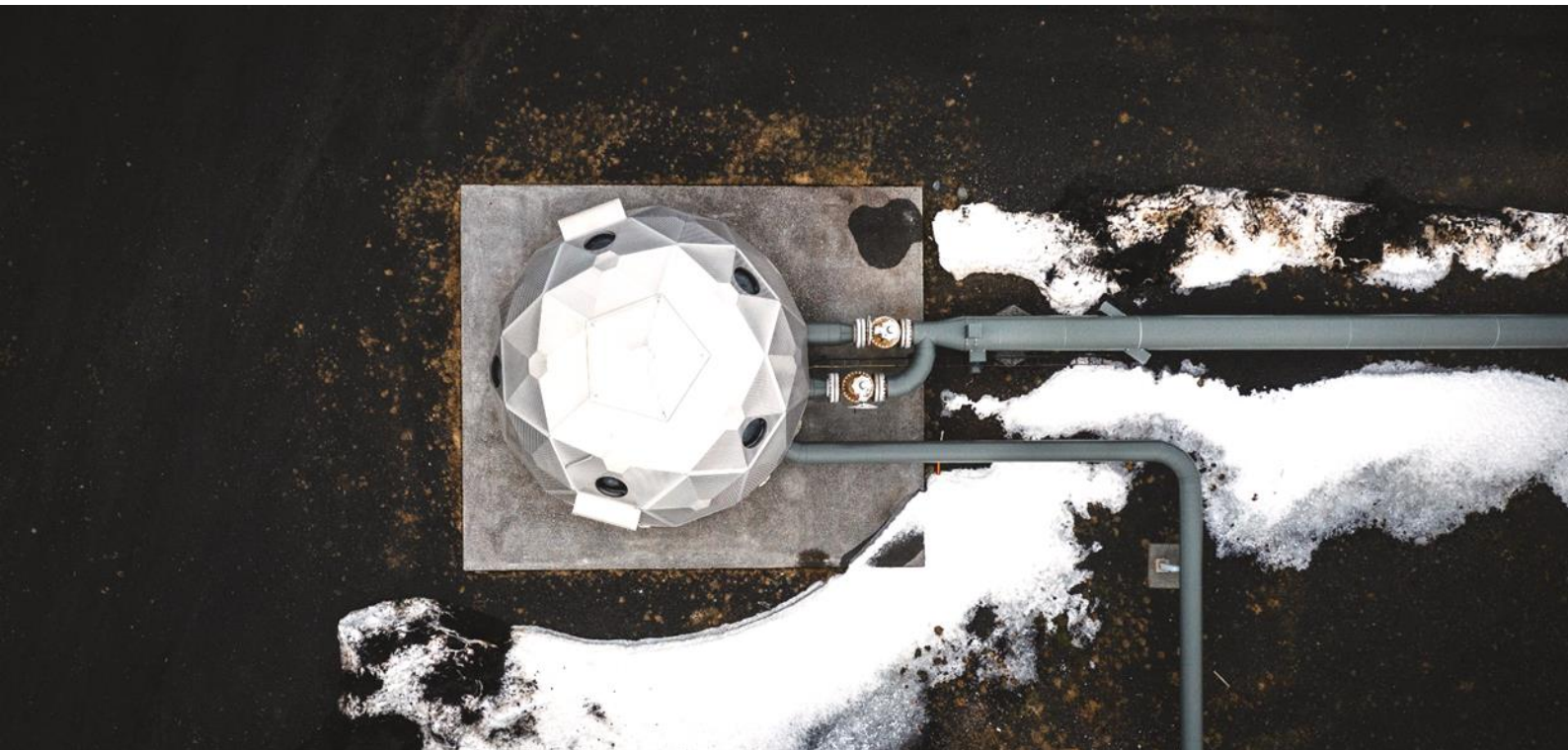


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Cover photo: Daði Freyr

Greenhouse Gas Emissions from Reykjavik Energy 2019-2022

The greenhouse gasses accounted for are carbon dioxide (CO₂), methane (CH₄), sulphur hexafluoride (SF₆), tetrafluorethane (HFC-134a) and nitrous dioxide (N₂O). Greenhouse gas emissions from ON Power's geothermal power plants in Nesjavellir and Hellisheidi are based on their operations along with drilling of makeup wells in the geothermal fields. Veitur Utilities' emissions from its supply and distribution system are due to the operation of backup generators. Sulphur hexafluoride (SF₆) is used as insulating gas in high-voltage electrical equipment in ON Power's power plants and Veitur Utilities' supply and distribution system. SF₆ is also used in tracer flow test (TFT) measurements of high-temperature production wells.

LOFTEGUND	UPPRUNI	EINING	2019	2020	2021	2022
Carbon dioxide (CO₂)	Nesjavellir	tonnes	15,500	14,500	12,900	13,800
	Hellisheidi and Hverahlid	tonnes	31,500	34,300	30,900	31,700
	Low-temperature geothermal fields	tonnes	0	0	0	0
	Supply and distribution system	tonnes	2	2	2	2
	Vehicle fleet (CO ₂ equivalents)	tonnes	470	450	450	400
	Flights, international and domestic (CO ₂ equivalents)	tonnes	100	20	5	70
	Employee transport to and from work (CO ₂ equivalents)	tonnes	110	40	70	90
	Office waste for landfilling (CO ₂ equivalents)	tonnes	10	10	10	15
	Worksite waste for landfilling (CO ₂ equivalents)	tonnes	310	370	245	300
	Organic waste for compost (CO ₂ equivalents)	tonnes	8	8	15	15
	Total CO₂	tonnes	48,010	49,700	44,562	46,392
Methane (CH₄)	Nesjavellir	kg	35,000	50,000	45,000	45,000
	Hellisheidi and Hverahlid	kg	55,000	80,000	75,000	70,000
	Total CH₄	kg	90,000	130,000	120,000	115,000
Nitrous oxide (N₂O)	Supply and distribution system	kg	0	0	0	0
	Total N₂O	kg	0	0	0	0
Tetrafluorethane (HFC-134a)	Supply and distribution system	kg	15	15	15	0
	Total HFC-134a	kg	15	15	15	0
Sulphur hexafluoride (SF₆)¹	Nesjavellir	kg				
	Hellisheidi	kg				0.53
	Tracer flow tests (TFT) in the Hengill area	kg	0.07	0.03	0.03	0.02
	Supply and distribution system	kg	0	0	2.2	0
	Total SF₆	kg	1.07	1.03	2.23	0.55

¹Total quantity of SF₆ in Veitur utilities' electronic equipment is approx. 4.3 tonnes and approx. 1 tonne in supplies. Total quantity of SF₆ in ON Power's electronic equipment is approx. 50 kg. RE's R&D holds approx. 0.4 kg of SF₆ in supplies.

Information for global warming potential (GWP) of greenhouse gasses, see: http://www.ipcc.ch/pdf/assessmentreport/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf and in an annex on conversion coefficients

Global Warming Potential, other Coefficients for Calculating Emissions and Sequestration in CO₂ equivalents

Global warming potential coefficients for the most commonly emitted greenhouse gasses, published by the International Panel of Climate Change, IPCC¹, the UK government², the International Civil Aviation Organization, ICAO³, and Icelandic coefficients that are used for calculating CO₂-equivalents in emissions and sequestration^{4,5,6}.

100-YEAR GLOBAL WARMING POTENTIAL (GWP) FOR CALCULATING CO ₂ -EQUIVALENCIES OF GREENHOUSE GASSES		
GREENHOUSE GAS	COEFFICIENT	SOURCE
Carbon dioxide (CO ₂)	1	IPCC ¹
Methane (CH ₄)	28	
Nitrous oxide (N ₂ O)	265	
Tetrafluorethane (HFC-134a)	1,300	
Sulphur hexafluoride (SF ₆)	23,500	

EMISSION FACTORS FOR CALCULATION OF CO ₂ EMISSIONS/SEQUESTRATION				
TYPE OF EMISSION / SEQUESTRATION	ENERGY SOURCE/ SEQUESTRATION	UNITS	COEFFICIENT	SOURCE
Transportation / Backup power	Gasoline	kg CO ₂ /L fuel	2.20	Department for Business, Energy & Industrial Strategy ² U.S. Argonne National Laboratory ³
	Diesel	kg CO ₂ /L fuel	2.63	
	Methane	kg CO ₂ /L fuel	2.10	
	Flight emissions	See calculator ⁴	Variable ⁵	International Civil Aviation Organization (ICAO) ⁴
Sequestration of CO ₂ in Nature	Forestry	t CO ₂ /ha ⁶	4.40	Joel Chales Owona 2019
	Land reclamation	t CO ₂ /ha ⁷	2.75	National Inventory Report 2008
Emission Mitigation	Wetland reclamation	t CO ₂ /ha ⁸	20	Gudmundsson, J., & Oskarsson, H. 2014.

¹ IPCC, 2013: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar5/wg1/>

² Emission factors for transportation and waste: UK Department for Business, Energy & Industrial Strategy. <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>

³ Mintz, M., et al. Well-to-Wheels analysis of landfill gas-based pathways and their addition to the GREET model. No. ANL/ESD/10-3. Argonne National Lab.(ANL), Argonne, IL (United States), 2010.

⁴ Calculator for flight emissions: <http://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx> Um On premises of calculator: http://www.icao.int/environmentalprotection/CarbonOffset/Documents/Methodology_ICAO_Carbon_Calculator_v9_2016.pdf

⁵ Coefficient factors depend on fuel type, length of flight, type of aircraft, weight of cargo, etc

⁶ Joel Chales Owona 2019. Áhrif nýskógræktar á kolefnisbindingu í jarðvegi á Íslandi.

<https://skemman.is/handle/1946/34470>

⁷ National Inventory Report 2008,

https://www.ust.is/library/Skrar/Atvinnulif/Loftslagsbreytingar/ICELAND_NIR_2010.pdf

⁸ Gudmundsson, J., & Oskarsson, H. 2014. *Carbon dioxide emission from drained organic soils in West-Iceland*. Soil carbon sequestration for climate food security and ecosystem services pp. 155-159.

EMISSION FACTORS FOR WASTE EMISSION CALCULATIONS

Waste Classification from Waste Collectors	Assumed Disposal Method	UK Emission Factors ⁹
General waste	Landfill	0.446
Bulk waste	Landfill	0.001
Asbestos	Landfill	0.006
Sludge (solid constituents from sewage)	Landfill	0.271
Green bin	Combustion	0.021
Metals	Closed-Loop	0.001
Timber – unpainted	Landfill	0.828
Timber – painted	Landfill	0.828
Garden waste	Landfill	0.579
Glass and minerals	Open-Loop	0.021
Plastic	Combustion	0.021
Corrugated cardboard	Closed-Loop	0.021
Mixed cardboard and paper	Closed-Loop	0.021
Office paper	Closed-Loop	0.021
Newspapers and magazines	Closed-Loop	0.021
Organic waste	Landfill	0.627
Unknown substances	Landfill	0.467
Light bulbs	Landfill	0.021
Batteries	Landfill	0.021
Car batteries	Landfill	0.021
Electronic equipment	Landfill	0.021
Paint and print waste	Landfill	1.042
Oil and oil contaminated waste	Landfill	0.018
Solvents	Landfill	0.001
Organic pollutants, cooking oil	Landfill	0.627
Inorganic pollutants	Landfill	0.001

⁹Emission factors for waste: UK Department for Business, Energy & Industrial Strategy.
<https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>