

OR Annual report 2020

Appendices



Greenhouse gas emissions, global warming potentials and coefficients for calculations



Table of contents

Greenhouse Gas Emissions from Reykjavik Energy 2017-2020.....	1
Global Warming Potential, other Coefficients for Calculating Emissions and Sequestration in CO ₂ equivalents	2

Cover photo: Gretar Ívarsson

Greenhouse Gas Emissions from Reykjavik Energy 2017-2020

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. In 2020 the emission of carbon dioxide from Hellisheidi and Hverahlid increased compared to 2017 while it was reduced in Nesjavellir. Methane emissions from both power plants increased. Greenhouse gas emissions from the vehicle fleet were reduced from previous years. 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	2017	2018	2019	2020
Carbon dioxide (CO₂)	Nesjavellir	tonn	15,000	15,000	15,500	14,500
	Hellisheidi and Hverahlid	tonn	25,500	28,000	31,500	34,300
	Low-temperature geothermal fields	tonn	0	0	0	0
	Supply and distribution system	tonn	3	1	2	2
	Vehicle fleet (CO ₂ equivalents)	tonn	550	500	470	450
	Flights, international and domestic (CO ₂ equivalents)	tonn	70	75	100	20
	Employee transport to and from work (CO ₂ equivalents)	tonn	105	120	110	40
	Office waste for landfilling (CO ₂ equivalents)	tonn	27	14	10	10
	Worksite waste for landfilling (CO ₂ equivalents)	tonn	360	320	310	370
	Organic waste for compost (CO ₂ equivalents)	tonn	5	5	8	8
Total CO₂		tonn	41,620	44,035	48,010	49,700
Methane (CH₄)	Nesjavellir	kg	35,000	30,000	35,000	50,000
	Hellisheidi and Hverahlid	kg	55,000	55,000	55,000	80,000
	Total CH₄		kg	90,000	85,000	90,000
Nitrous oxide (N₂O)	Supply and distribution system	kg	0	0	0	0
	Total N₂O		kg	0	0	0
Tetrafluorethane (HFC-134a)	Supply and distribution system	kg	15	15	15	15
	Total HFC-134a		kg	15	15	15
Sulphur hexafluoride (SF₆)¹	Nesjavellir	kg				
	Hellisheidi	kg				
	Tracer flow tests (TFT) in the Hengill area	kg	0.08	0.09	0.07	0.03
	Supply and distribution system	kg	1	1	1	1
	Total SF₆		kg	1.08	1.09	1.07

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. 0.3 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 gases, 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 GASES		
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	0.28	
	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	6.3	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.

EMISSION FACTORS FOR WASTE EMISSION CALCULATIONS

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.

Waste Classification from Waste Collectors	Assumed Disposal Method	UK Emission Factors⁹
General waste	Landfill	0.586
Bulk waste	Landfill	0.099
Asbestos	Landfill	0.001
Sludge (solid constituents from sewage)	Landfill	0.271
Green bin	Combustion	0.021
Metals	Closed-Loop	0.021
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	0.579
Unknown substances	Landfill	0.586
Light bulbs	Landfill	0.016
Batteries	Landfill	0.016
Car batteries	Landfill	0.016
Electronic equipment	Landfill	0.016
Paint and print waste	Landfill	0.099
Oil and oil contaminated waste	Landfill	0.099
Solvents	Landfill	0.099
Organic pollutants, cooking oil	Landfill	0.099
Inorganic pollutants	Landfill	0.099

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