The Carbon Footprint of the University of Oulu

Data collection

2022

Julia Kiehle and Meeri Hilli

September 2023

Last update: 20.09.2023

Table of Contents

University of Oulu's Carbon Footprint in 2022 – Data collection 4
Scope 1 5
Emissions caused by University's own car fleet 5
Emissions caused by consumption of fuel directly on campus 6
Refrigerants 6
Scope 2 6
Electricity 6
Heat 7
Water 7
Scope 3 7
Business travel 7
Commuting 8
Restaurant services 9
Procurement 11
Properties and Waste 13
References 15

Figures

Figure 1. Carbon Footprint of the University of Oulu in 2022 4

Tables

Table 1. Emission factors and travelled distances of cars owned or leased by the University of Oulu in 2022. 5
Table 2. Consumption and emission factor utilised in the assessment of emissions for the direct fuel consumption on campus in 2022. 6
Table 3. Electricity consumption and emission factors utilised in assessment of emissions allocated to different locations, 2022. 6
Table 4. Emission factors and details on the consumption of heat on campus in 2022. 7
Table 5. Emission factors and total emissions per mode of transportation used for business travels in 2022. 7
Table 6. Emission factors utilised for food categories (based on (Latva-Hakuni, 2020)). 9
Table 7. List of research and laboratory equipment procured in 2022, with details on the caused emissions. 11
Table 8. Annual emission factors and caused emissions of procured IT-equipment in 2022. 12
Table 9. List of procurements and their related emissions in 2022. 12
Table 10. Emissions related to constructions and maintenance repairs in 2022. 13
Table 11. Information utilised for the calculation of the emissions related to the handling of waste generated at the campus areas in Linnanmaa and Kontinkangas in 2022. 13

University of Oulu's Carbon Footprint in 2022 – Data collection

University of Oulu

Staff members:	3,800
Students:	13,900
Rented or owned area:	154,000 m^2

Carbon footprint 2018

Total amount:	10,644.49 t CO_2e
Per staff/student:	0.601 kg CO_2e/person
Per m^2:	70 kg CO_2e/m^2

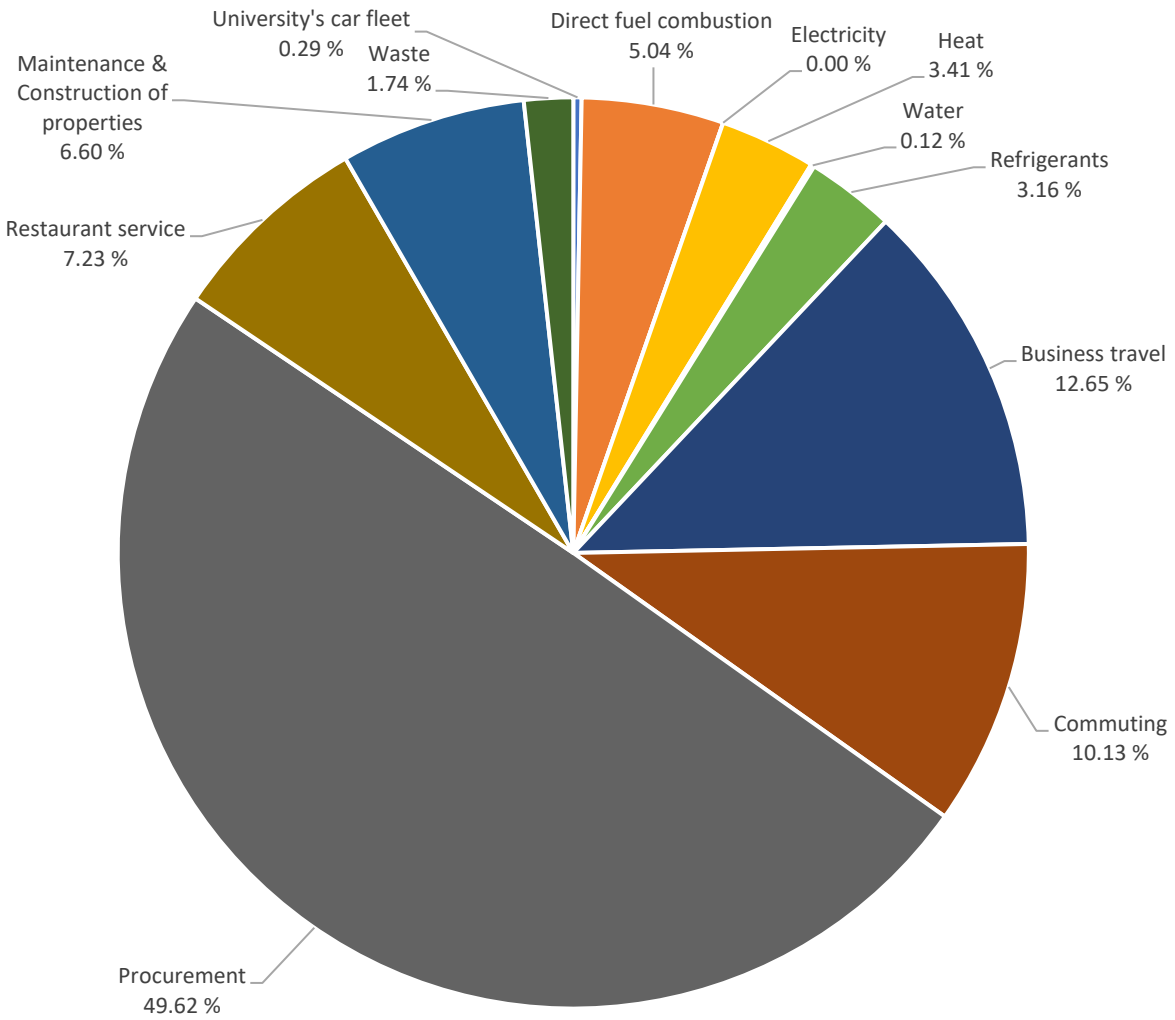

Figure 1. Carbon Footprint of the University of Oulu in 2022.

Scope 1

Emissions caused by University's own car fleet

Table 1. Emission factors and travelled distances of cars owned or leased by the University of Oulu in 2022.

Vehicle	Fuel	Type	Emission standard	Emission factor *g CO2e/km*	Mileage per year *km*	Total emissions *t CO_2e*
Transporter 3	diesel	Van (urban driving)	EURO 5	249.5[1]	2,658	0.50
Transporter 4	diesel	Van (delivery driving)	EURO 5	229.5[1]	13,000	2.30
Transporter 5	diesel	Van (urban driving)	EURO 5	249.5[1]	9,357	0.65
Caddy 2	diesel	Diesel driven car	EURO 6	121.55[1]	1,100	0.73
Car 1	diesel	Diesel driven car	EURO 6	121.55[1]	8,784	0.39
Car 2	PHEV	PHEV	EURO 6	74.39[1]	7,109	0.41
Transporter 6	diesel	Van (urban driving)	EURO 5	249.5[1]	9,377	1.97
Car 3	diesel	Diesel driven car	EURO 6	121.55[1]	11,069	1.22
Transporter 7	diesel	Van (urban driving)	EURO 5	249.5[1]	8,626	2.25
Car 4	diesel	Diesel driven car	EURO 6	121.55[1]	17,051	1.46
Car 5	diesel	Diesel driven car	EURO 6	121.55[1]	9,641	0.85
Car 6	diesel	Diesel driven car	EURO 6	121.55[1]	13,900	0.87
Car 7	PHEV	PHEV	EURO 6	74.39[1]	14,000	0.98
Car 8	diesel	Diesel driven car	EURO 6	121.55[1]	1,000	0.30
Transporter 8	diesel	Van (urban driving)	EURO 5	249.5[1]	3,540	0.80
Transporter 9	diesel	Van (urban driving)	EURO 5	249.5[1]	8,889	1.97
Transporter 10	diesel	Van (urban driving)	EURO 5	249.5[1]	10,401	0.50
Transporter 11	diesel	Van (urban driving)	EURO 6	232.5[1]	25,300	5.69

[1] LIPASTO (VTT Technical Research Centre of Finland Ltd., 2017)

Emissions caused by consumption of fuel directly on campus

Table 2. Consumption and emission factor utilised in the assessment of emissions for the direct fuel consumption on campus in 2022.

	Fuel consumption *MWh*	Type of fuel	Emission factor *kg CO_2e/MWh*	Total emissions *t CO_2e*
Steam generator (Kontinkangas campus)	1,151.18	light fuel oil	261.73[1]	301.30
Heating with fuel on-site	404	light fuel oil	261.73[1]	105.73

[1] Polttoaineluokitus & Y-HIILARI (SYKE, 2021; Tilastokeskus, 2021)

Refrigerants

Emissions caused by the leakage of refrigerants: 336.5 t CO_2e (SYK, 2022)

Scope 2

Electricity

Table 3. Electricity consumption and emission factors utilised in assessment of emissions allocated to different locations, 2022.

Property	Electricity consumption *MWh*	Type of electricity	Emission factor *kg CO_2e/MWh*	Total emissions *t CO_2e*
Linnanmaa campus		100 % renewable[1]	0	0
Kontinkangas campus		100 % renewable	0	0
Oulangan tutkimusasema		100 % renewable	0	0
Sodankylän geofysiikan observatorio	164.90	100 % renewable	0	0
Haukipudas, Tekokuuasema		100 % renewable	0	0
Ii, Ulkokrunnin biologinen kenttäasema		100 % renewable	0	0
Kiiminki, Observatorio		100 % renewable	0	0
Kuusamo, Seismologinen asema		100 % renewable	0	0
Kiiminki, Seisminen asema		100 % renewable	0	0
Oulu, Linnanmaan liikuntahalli		100 % renewable	0	0

[1] (SYK, 2019)

Heat

Table 4. Emission factors and details on the consumption of heat on campus in 2022.

Property	Heat consumption *MWh*	Type of heat/fuel	Emission factor *kg CO_2e/MWh*	Total emissions *t CO_2e*
Linnanmaa campus		District heat_Oulu	carbon neutral since 07/22	270.40
Kontinkangas campus		District heat_Oulu	carbon neutral since 07/22	92.60
Haukipudas, Tekokuuasema	-	Electricity	0	-
Kiiminki, Observatorio	-	Electricity	0	-
Kuusamo, Seismologinen asema	-	Electricity	0	-
Kiiminki, Seisminen asema	-	Electricity	0	-
Oulu, Linnanmaan liikuntahalli	0	District heat_Oulu	carbon neutral since 07/22	-

[1] (SYK, 2022)

Water

Consumption of clean water: 19,769 m^3
Estimated amount of wastewater: 19,769 m^3
Emission factor for clean water: 0.073 kg CO_2e/m^3 (Helsingin seudun ympäristöpalvelut)
Emission factor for wastewater: 0.593 kg CO_2e/m^3 (Helsingin seudun ympäristöpalvelut)

Total emissions: 13.17 t CO_2e

Scope 3

Business travel

Table 5. Emission factors and total emissions per mode of transportation used for business travels in 2022.

Mode of transportation	Type	Travelled distance *km*	Emission factor *g CO_2e/km*	Total emission *t CO_2e*
Train	VR (Finland)	676,098	9.13[1]	6.17
Rental cars	petrol, diesel or hybrid EURO 6	334,430	average: 114.7[2]	45.02

Airplane	National, short-haul flight (400-1000km)	3,188,189	87.4[3]	278.65
	medium-haul flight (1000-5000km)	5,429,471	84.2[3]	457.16
	long-haul flight (over 5000km)	4,649,820	59.1[3]	274.80

[1] (Alvarez Franco, 2021)
[2] LIPASTO (VTT Technical Research Centre of Finland Ltd., 2017)
[3] Y-HIILARI (SYKE, 2021)

Hotel overnight stays

Daily emission factor: 0.5 kg CO_2e/€ (Seppälä ym., 2009)
Average fee: 123 €/night
Booked nights at hotels: 4637

Total emissions: 285.18 t CO_2e

Commuting

Based on the results of commuting surveys conducted between December 2022 and April 2023.

Staff members

Emissions of all staff members for one commuting day: 3.214 t CO_2e
Average number of commuting days per week*: 3.17
Working weeks per year: 48
Emissions of all staff members for the entire year: 454.51 t CO_2e

Students

Emissions of all students for one commuting day: 7.16 t CO_2e
Average number of commuting days per week*: 2.99
Weeks per year for studying on campus: 31
Emissions of all students for the entire year: 623.97 t CO_2e

*This value has not been used for the calculation and is just displayed for a better understanding of the commuting behaviour in general. The average number of commuting days was separately calculated for different distances.

Restaurant services

Emission factors utilised for reported order data of raw food materials

Table 6. Emission factors utilised for food categories (based on (Latva-Hakuni, 2020)).

Food category		Emission factor *kg CO_2e/kg product*
Vegetables	Root vegetables	0.37
	Cabbage	0.6
	Cucumber, national	2
	Cucumber, international	0.33
	Leaf vegetables	1
	Corn	1.17
	Mushrooms	2.14
	Onions	0.34
	Tomatoes, national	2.6
	Tomatoes, international	1.12
	Other vegetables	1.04
	Corn	1.17
Fruits and berries	Pineapple	1.31
	Bananas	0.77
	Other fruits	0.72
	Dried fruits	2.7
	Berries	0.99
	Apples	0.37
	Citrus fruits	0.45
Cereals and side dishes	Bread	0.94
	Oat	0.72
	Potatoes	0.35
	Special cereals	0.7
	Rice	2.67
	Rye	0.71
	Wheat	0.68
	Wheat products (pasta, etc.)	0.9
Vegetable protein	Vegan meat substitutes	2.27
	Peas	0.93
	Dry beans and lentils	1.05
	Canned beans	1.3
	Quorn	3.91
	Soy meal	1.72
	Tofu	0.81
	Gluten-based products (e.g., seitan)	3.81
	Nuts and seeds	1.46
Meat and eggs	Broiler	5.08

	Eggs	2.22
	Processed meat (sausages, nuggets, etc.)	6.3
	Bovine	28.8
	Game	0.5
	Pig	6.78
	Other meat	13.55
Fish	Salmon	4.08
	Lake fish	1.69
	Saithe	2.25
	Baltic herring	1.29
	Shrimp	15.59
	Tuna	3.63
	Other fish	3.67
Milk products	Yoghurt	1.34
	Cheese	8.39
	Cream/Whipping cream	4.94
	Milk	0.95
	Butter	10.01
	Milk-based vegetable fat mixtures	1.31
	Other milk products	1.75
Plant-based milk products	Oat yoghurt	0.44
	Oat cream	0.6
	Oat drink	0.3
	Almond, rice and coconut drink	0.5
	Coconut milk	0.42
	Soy yoghurt	1.5
	Soy drink	0.74
	Plant-based cheese	0.52
	Vegetable fat blends	1.49
Oil	Rapeseed oil	2.7
	Olive oil	4.33
	Other vegetable oil	2.03
Seasoning	General dry spices	1.37
	Sugar	0.76
	Honey	1.1
	Salt	0.2
Sweets	Pastry	1.78
	Candies	1.53
	Chocolate	1.53
Ready-made products	Fruit products (jams, purées, etc.)	2.25
	Veggie products (e.g., falafel)	1.7
	Meat products	7.83
	Fish products	2.55
	Seasoning sauces	2.25

	Tomato products	1.27
	Canned vegetables and fruits	0.9
	Mayonnaise	1.95
	Vinegar	2.24
Drinks	Juice	1.5
	Ground coffee	5.8
	Beer	40.3
	Bottled water	0.23
	Tea	2.45
	Cider	1.9
	Wine	1.47
	Liquors	1.7
	Soft drinks (soda, glögi, etc.)	0.3

Total emissions: 769.50 t CO_2e

Procurement

Research and laboratory equipment

Table 7. List of research and laboratory equipment procured in 2022, with details on the caused emissions.

Procurement category	**Investment/sum of depreciations**	**Emission factor[1]**	**Total emission**
	€	*kg CO_2e/€*	*t CO_2e*
Laboratory equipment	414,520.67	0.5	207.26
Laboratory supplies	804,716.74	0.5	402.36
Laboratory chemicals	1,812,490.40	0.8145[2]	1,476.28
Laboratory animals	3,583.92	0.5	1.79
Animal feed	34,073.33	0.5	17.04
Other animal supplies	50,290.61	0.5	25.15
Laboratory equipment over 5,000€ investment cost per item, 2022 (depreciations)	1,022,184.93	0.5	511.09
Laboratory equipment over 5,000€ investment cost per item, 2018-2021 (depreciations)	1,737,385.67	0.5	868.69

[1] (Larsen ym., 2013)
[2] EXIOBASE 3 (SYK, 2022)

IT-equipment

Table 8. Annual emission factors and caused emissions of procured IT-equipment in 2022.

Item	Amount	Usage time	Annual emission factor	Total emissions
	pcs	*years*	*kg CO_2e/pcs*	*t CO_2e*
Mobile phone	351	3	8.26[1]	2.90
Laptop	962	3	51.07[1]	49.13
Monitor	589	5	66.38[1]	39.10
Desktop computer	93	5	92[2]	8.56
Tablet computer	105	3	33.33[2]	3.50
Printer	2	10	410[3]	0.08

[1] Based on research carried out by CF Working Group's summer trainee Amin Javid.
[2] WWF Ilmastolaskuri 2020. (Horn ym., 2020)
[3] (WWF Ilmastolaskuri, 2017)

Annual allocation of previous years' procured equipment: 147.21 t CO_2e

Other procurements

Table 9. List of procurements and their related emissions in 2022.

Procurements	**Investment**	**Emission factor**	**Total emission**
	€	*kg CO2e/€*	*t CO_2e*
Furniture	413,842.63	0.4033[3]	166.93
Office supplies	185,866.42	0.5[1]	92.93
Educational materials	224,359.00	0.5[1]	112.18
Audio-visual equipment	30,099.33	0.472[3]	14.21
Other procurements	1,945,484.68	0.5[1]	972.74
Groceries and refreshments	72,862.39	0.5[1]	36.43
Advertising, gifts and clothes	128,899.91	0.5[1]	64.45

Printed books/publications	512,963.11	0.102[2]	52.32

[1] (Larsen ym., 2013)
[2] (Eskelinen, 2021)
[3] EXIOBASE 3 (SYK, 2022)

Paper

Consumed printing paper: 9955.644 kg
Emission factor (cradle to grave): 0.905 kg CO_2e/kg paper (Pihkola et al., 2010)
Total emissions: 9.01 t CO_2e

Properties and Waste

Table 10. Emissions related to constructions and maintenance repairs in 2022.

Property	**Emissions related to maintenance repairs, maintenance and outdoor cleaning[1]** *t CO_2e*
Linnanmaa campus	514.10
Kontinkangas campus	167.20
Oulangan tutkimusasema	21.00

[1] (SYK, 2022)

Waste

Table 11. Information utilised for the calculation of the emissions related to the handling of waste generated at the campus areas in Linnanmaa and Kontinkangas in 2022.

Waste type	**Amount of waste** *t*	**Waste collection** *times/year*	**Transport distance** *km*	**Transport** *tkm/year*	**Treatment emission factor[1]** *kg CO2e/t waste*	**Transportation emission factor** *kg CO2e/tkm*	**Total emissions** *t CO_2e*
Biowaste	109.37	100	5	54,685	119.3	0.1	18.52
Carton & cardboard	68.09	47	-	-	53.43	43.64 (kg CO_2e/t waste)	6.61
Iron scrap	20.88	-	5	104	17.9[2]	0.1	0.38
Glass	7.23	-	580	4,193	13.17	0.1	0.51

Paper	48.07	47	-	-	72.55	43.64 (kg CO_2e/t waste)	5.59
Mixed waste/combustible municipal waste	290.66	47	6	81,966	400	0.1	124.46
Wood waste	0.52	-	5	3	142.5	0.1	0.07
electrical and electronic equipment waste	7.72	-	5	39	720	0.1	5.56
Batteries	0	-	160	0	927.58	0.1	0
Hazardous waste	19.11	-	570	10,893	1170	0.1	23.45
Plastic for recycling	3.75	-	570	2,138	365.9	0.1	1.59

[1] Y-HIILARI (SYKE, 2021)

[2] Melanen et al. (2000)

References

Alvarez Franco, D. E. (2021). *Carbon footprint of transport and mobility: The case of a higher education institutions* https://jyx.jyu.fi/bitstream/handle/123456789/75053/URN%3ANBN%3Afi%3Ajyu-202104142365.pdf?sequence=1

Eskelinen, M. (2021). *Hiilineutraali UEF 2025 - Raportti vuoden 2019 hiilijalanjäljestä.* ().University of Eastern Finland.

Fingrid Oyj. (2021). *Real-time CO2 emissions estimate.* https://www.fingrid.fi/en/electricity-market/electricity-market-information/real-time-co2-emissions-estimate/

Horn, Judl & Pesu. (2020). *Material, energy and climate issues related to ICT devices in Finland.* . ().Publications of the Ministry of Transport and Communications 2020:12.

Larsen, H. N., Pettersen, J., Solli, C. & Hertwich, E. G. (2013). Investigating the Carbon Footprint of a University - The case of NTNU. *Journal of Cleaner Production, 48*(3), 39-47. https://doi.org/10.1016/j.jclepro.2011.10.007

Latva-Hakuni, E. (2020). *Opiskelija- ja työpaikkaravintoloiden ilmastovaikutukset ja toimenpiteet niiden vähentämiseksi: case Semma Oy* https://jyx.jyu.fi/bitstream/handle/123456789/73602/URN%3aNBN%3afi%3ajyu-202101141080.pdf?sequence=1&isAllowed=y

Melanen, M., Palperi, M., Viitanen, I., Dahlbo, H., Uusitalo, S., Juutinen, A., Lohi, T., Koskela, S. & Seppälä, J. (2000). *Metallivirrat ja romun kierrätys Suomessa*. Suomen ympäristökeskus.

Pihkola H., Nors M., Kujanpää M., Helin T., Kariniemi M., Pajula T., Dahlbo H. & Koskela S. 2010. Carbon footprint and environmental impacts of print products from cradle to grave. Results from the LEADER project (Part 1). Espoo 2010. VTT Tiedotteita – Research Notes 2560. [WWF Ilmastolaskuri, 2020].

Seppälä, J., Mäenpää, I., Koskela, S., Mattila, T., Nissinen, A., Katajajuuri, J., Härmä, T., Korhonen, M., Saarinen, M. & Virtanen, Y. (2009). *Suomen kansantalouden materiaalivirtojen ympäristövaikutusten arviointi ENVIMAT-mallilla*. Suomen ympäristökeskus.

Suominen, K.Turun yliopiston laskelma toimintansa hiilijalanjäljestä. Esitetty konferenssissa *Hiilineutraalit Yliopistokampukset,* 12.

SYK. (2019). *Oulun kampuksen kulutusraportit.* Julkaisematon materiaali. Haettu Mar 15, 2021,

SYK. (2020). *Oulun kampuksen kulutusraportit 12/2020.*

SYK. (2021). *Oulun kampuksen kulutusraportit.*

SYK. (2022). *Oulun kampuksen kulutusraportit.*

SYKE. (2021). *Y-HIILARI Hiilijalanjälki-työkalu* https://www.syke.fi/fi-FI/Tutkimus__kehittaminen/Kulutus_ja_tuotanto/Laskurit/YHiilari

Tilastokeskus. (2021). *Polttoaineluokitus.* https://www.stat.fi/tup/khkinv/khkaasut_polttoaineluokitus.html

University of Helsinki. (2019). *Hiilifiksu laskuri.* Julkaisematon materiaali. https://blogs.helsinki.fi/hiilifiksu/laskuri/

VTT Technical Research Centre of Finland Ltd. (2017). *LIPASTO unit emissions - database.* http://lipasto.vtt.fi/index.htm

WWF Ilmastolaskuri. (2017). *Ilmastolaskurissa käytetyt oletuskertoimet ja -arvot.* https://www.motiva.fi/files/6515/Ilmastolaskurissa_kaytetyt_oletuskertoimet_ja_-arvot.pdf