epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14025

Owner of the declaration:
Hafslund Oslo Celsio

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3785-2721-EN

Registration Number:
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Product name

District heating

Name
Hafslund Oslo Celsio

The Norwegian
EPD Foundation

General information

Product:
District heating

Program Holder:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Phone: +47 23 08 80 00
Email: post@epd-norge.no

Declaration Number:
NEPD-3785-2721-EN

This declaration is based on Product Category Rules:
PCR for electricity, steam and hot/cold water generation and distribution. PCR 2007:08, v.4.2 (Environdec 2021)

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to the manufacturer, life cycle assessment data and evidence.

Declared unit:
-

Declared unit with option:
-

Functional unit:
1 kWh of district heating produced and delivered to customers.

Verification:
Independent verification of the declaration and data, according to ISO14025:2010, 8.1.3 and 8.1.4.

internal ☐ external ☒

Sign

Ole M. K. Iversen
(Independent verifier approved by EPD Norway)

Owner of the declaration:
Hafslund Oslo Celsio AS
Contact person: Jon Iver Bakken
Phone: +47 916 97 299
Email: jon.iver.bakken@celsio.no

Manufacturer:
Hafslund Oslo Celsio AS
Postboks 1022 Hoff, 0218 Oslo
Phone: +47 916 97 299
Email: jon.iver.bakken@celsio.no

Place of production:
Oslo

Management system:
ISO 14001 and ISO 9001

Organisation no:
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Issue date:
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Valid to:
10.10.2027

Year of study:
2022

Comparability:
EPDs from other programmes than The Norwegian EPD Foundation may not be comparable.

The EPD has been worked out by:
Maciej Biedacha and Ellen Soldal

Approved (Manager of EPD Norway)

Product

Product description:

District heating is produced at multiple sites in Oslo, Norway. The heat is distributed to customers connected to the district heating network owned by Celsio. The heat is mainly produced by waste heat from waste incineration (63%), followed by electric boilers and heat pumps using heat from the sewage system.

Technical data:

There are 14 production sites, with varying heat capacities, going from 6 MW to 187 MW. Table 1 gives produced heat per year from different energy carriers, total heat amount delivered to the distribution network, heat delivered to customers and subsequent losses in distribution.

Table 1 Heat generated by Celsio, specified by energy carrier. The heat is delivered through a distribution network, causing a loss of heat.

Energy carrier	Unit	Average (2017-2021)
Waste (incineration)	GWh	1 105
Heat pumps	GWh	121
Electricity (electric boiler)	GWh	399
Pellets (incineration)	GWh	90
LNG (incineration)	GWh	25
Biooil/-diesel	GWh	31
Fossil fuel oil	GWh	0.5
Heat delivered to the distribution network	GWh	1 768
Heat delivered to customers	GWh	1 616
Loss of heat in distribution	%	8,6 %

Market:

District heating customers in Oslo region that are connected to the network operated by Celsio.

Reference service life infrastructure:

Infrastructure component	Expected life-time
Buildings	60 years
Oil boiler	40 years
Electric boiler	30 years
Heat pumps	20 years
Distribution network	50 years
Combustion technologies	40 years
General	40 years

LCA: Calculation rules

Functional unit:

1 kWh of district heating delivered to customers. As seen in Table 1, there is a loss of heat between the heat being produced until it reaches the customer. Hence, in order to deliver 1 kWh of district heating to customers, Celsio has to generate 1.1 kWh of heat.

Data quality:

Celsio has provided specific data on energy carriers, infrastructure, produced heat and loss of heat in distribution. The use of energy carriers is averaged over a five-year period (2017-2021). Generic data is from ecoinvent v. 3.8, cut-off by classification (Wernet, Bauer et al. 2016). No data is older than 10 years.

Allocation:

Allocation procedures follow the PCR 2007:08, v.4.2. The PCR uses the Polluter Pays principle, hence, production and incineration of waste is allocated to the producer of the waste whereas emissions from equipment and processes needed to recover and make use of the recovered heat are allocated per kWh of district heat.

System boundary:

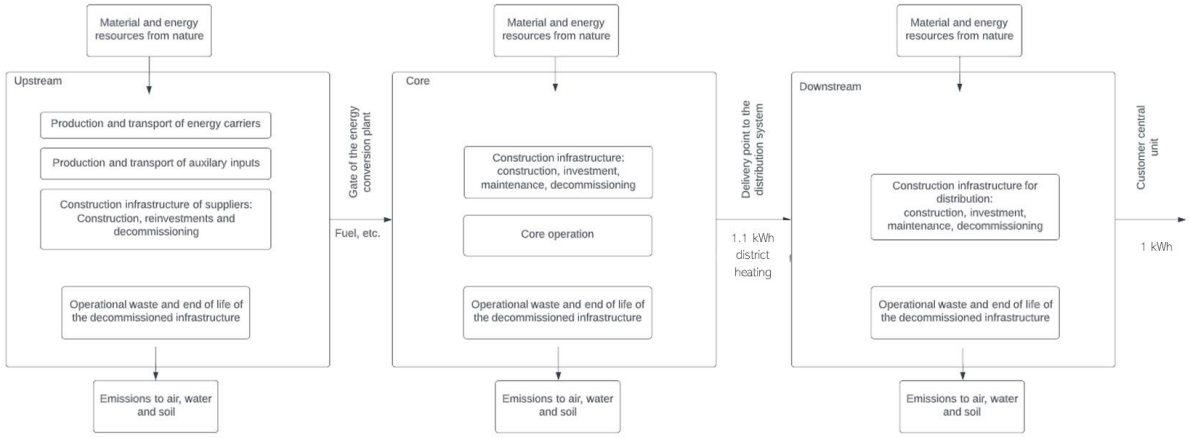

Figure 1: Technical flow chart of the system

Upstream, core and downstream modules are included. The upstream module includes the production and transport of any goods used. The core module includes the use of and transformation of energy goods in order to generate heat. The core module also includes construction, annual investment and waste handling of energy conversion plant infrastructure. Leakage and refilling of refrigerant are included in the core module. The downstream module includes construction, annual investment and waste handling of distribution network and customer centrals.

Cut-off criteria:

All major raw materials and energy are included. Materials and energy used in small amounts (<1%) may be excluded. This cut-off rule does not apply to hazardous materials and substances. Energy consumed in office activities is excluded.

LCA: Scenarios and additional technical information

The following information describes the scenarios in the different modules of the EPD. Downstream heat distribution is included. This module includes infrastructure for the distribution network and customer centrals, as well as loss of heat in distribution. There are no emissions related to the use and disposal of the product.

LCA: Results

For the production and distribution of district heating, energy carriers used to generate the heat are very important for the final environmental impact. The fossil share (GWP-fossil) is the major contributor (86%) to the total GWP (GWP-total) while the biogenic share (GWP-biogenic) contributes 14%. Fossil greenhouse gas emissions (GWP-fossil) is calculated to 17.2 g CO_2-eq. per kWh district heating delivered to the customer. For GWP-fossil, it is the upstream module that has the greatest impact (54.9%), where generation of electricity contributes to 35.8% of the total load for this indicator. The core module accounts for 32.1% of total GWP-fossil, in which the combustion of LNG is the most important factor with a contribution of 19.3%-points. The downstream module has the lowest impact of 13% of GWP-fossil.

Core environmental impact indicators

Indicator	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
GWP-total	kg CO2 eq.	-1.59E-02	3.37E-02	2.24E-03	2.00E-02
GWP-fossil	kg CO2 eq.	9.44E-03	5.51E-03	2.24E-03	1.72E-02
GWP-biogenic	kg CO2 eq.	-2.53E-02	2.82E-02	3.14E-06	2.81E-03
GWP-LULUC	kg CO2 eq.	4.37E-05	2.59E-06	1.35E-06	4.77E-05
ODP	kg CFC11 eq.	7.19E-10	5.91E-10	1.39E-10	1.45E-09
AP	mol H^+ eq.	6.91E-05	2.69E-05	9.62E-06	1.06E-04
EP-freshwater	kg P eq.	6.08E-07	6.62E-08	9.36E-08	7.68E-07
EP-marine	kg N eq.	3.63E-05	8.98E-06	2.12E-06	4.74E-05
EP-terrestrial	mol N eq.	2.27E-04	1.06E-04	2.08E-05	3.54E-04
POCP	kg NMVOC eq.	3.48E-05	2.71E-05	9.01E-06	7.09E-05
ADP-M&M	kg Sb eq.	2.00E-07	7.08E-08	2.74E-08	2.98E-07
ADP-fossil	MJ	1.55E-01	1.30E-02	3.06E-02	1.98E-01
WDP	m^3	7.05E-03	-1.05E-04	9.83E-04	7.93E-03

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption*

Additional environmental impact indicators

Indicator	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
PM	Disease incidence	1.11E-09	1.94E-09	1.36E-10	3.18E-09
IRP	kBq U235 eq.	2.63E-03	1.53E-04	5.15E-05	2.83E-03
ETP-fw	CTUe	2.53E-01	2.45E-01	7.94E-02	5.77E-01
HTP-c	CTUh	1.34E-11	6.95E-12	1.29E-11	3.33E-11
HTP-nc	CTUh	3.30E-10	1.79E-10	9.45E-11	6.03E-10
SQP	Dimensionless	7.01E-01	5.40E-03	5.37E-03	7.12E-01

PM: *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts/soil quality*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator

Resource use

Parameter	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
RPEE	MJ	1.21E+00	6.42E-02	1.47E-03	1.27E+00
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TPE	MJ	1.21E+00	6.42E-02	1.47E-03	1.27E+00
NRPE	MJ	1.55E-01	1.30E-02	3.06E-02	1.98E-01
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	1.55E-01	1.30E-02	3.06E-02	1.98E-01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m^3	7.91E-03	4.56E-04	2.51E-05	8.39E-03

RPEE *Renewable primary energy resources used as an energy carrier;* ***RPEM*** *Renewable primary energy resources used as raw materials;* ***TPE*** *Total use of renewable primary energy resources;* ***NRPE*** *Non-renewable primary energy resources used as an energy carrier;* ***NRPM*** *Non-renewable primary energy resources used as materials;* ***TRPE*** *Total use of non-renewable primary energy resources;* ***SM*** *Use of secondary materials;* ***RSF*** *Use of renewable secondary fuels;* ***NRSF*** *Use of non-renewable secondary fuels;* ***W*** *Use of net fresh water*

End of life - Waste

Parameter	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
HW	kg	1.59E-07	2.38E-07	1.25E-07	5.23E-07
NHW	kg	1.22E-02	1.84E-03	1.63E-03	1.57E-02
RW	kg	1.40E-06	8.00E-08	5.00E-08	1.53E-06

HW *Hazardous waste disposed;* ***NHW*** *Non-hazardous waste disposed;* ***RW*** *Radioactive waste disposed*

End of life – output flow

Parameter	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	0.00E+00	8.66E-05	2.32E-04	3.19E-04
MER	kg	0.00E+00	9.60E-06	8.58E-05	9.54E-05
EEE	MJ	0.00E+00	2.60E-05	2.32E-04	2.58E-04
ETE	MJ	0.00E+00	1.79E-04	1.60E-03	1.78E-03

CR *Components for reuse;* ***MR*** *Materials for recycling;* ***MER*** *Materials for energy recovery;* ***EEE*** *Exported electric energy;* ***ETE*** *Exported thermal energy*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional environmental information

Impact on climate change given in g CO_2-eq./kWh produced and distributed to customer.

Indicator	Unit	Upstream	Core	Downstream	1 kWh heating, delivered to the customer
GWP-total	g CO2 eq.	-15.9	33.7	2.2	20.0
GWP-fossil	g CO2 eq.	9.4	5.5	2.2	17.2
GWP-biogenic	g CO2 eq.	-25.3	28.2	0.0	2.8
GWP-LULUC	g CO2 eq.	0.04	0.00	0.00	0.05

Additional Norwegian requirements

Greenhouse gas emissions (GWP) from the use of electricity in the core module

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in the grid) of applied electricity for the manufacturing process (core module).

Electricity mix	Data source	Unit	Value
Low voltage, NO	ecoinvent 3.8	g CO2 eq./kWh	26,8

Dangerous substances

The product contains no substances given by the REACH Candidate list or the Norwegian priority list (of 01.01.2013).

Indoor environment

Not relevant.

Bibliography

Environdec: 2021.	ELECTRICITY, STEAM AND HOT WATER GENERATION AND DISTRIBUTIONPRODUCT CATEGORY CLASSIFICATION: UN CPC 171, 173, 2007:08, version 4.2. E. International, EPD International
ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
Wernet, G., et al.: 2016.	The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment **21**(9): 1218-1230

epd-norge The Norwegian EPD Foundation	**Program Operator**	Phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email	post@epd-norge.no
	Norway	Web	www.epd-norge.no
epd-norge The Norwegian EPD Foundation	**Publisher**	Phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	Email	post@epd-norge.no
	Norway	Web	www.epd-norge.no
Hafslund Oslo Celsio	**Owner of the declaration**	Phone	+47 916 97 299
	Hafslund Oslo Celsio AS		
	Postboks 1022 Hoff, 0218 Oslo	e-post:	jon.iver.bakken@celsio.no
	Norway	web	www.celsio.no
NORSUS Norsk institutt for bærekraftsforskning	**Author of the life cycle assessment**	Phone	+47 69 35 11 00
	NORSUS		
	Stadion 4, 1671 Kråkerøy	Email	post@norsus.no
	Norway	web	www.norsus.no

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Global Program Operator

The Norwegian EPD foundation
www.epd-norge.no

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