

Environmental Product Declaration

In accordance with ISO 14025

District heat Lyse Neo



Owner of declaration:
Lyse Neo AS

Product:
District heating

Declared unit:
1 kWh

Product Category rules / PCR:
PCR for electricity, steam and hot/cold water generation and distribution.

Program operator and publisher:
The Norwegian EPD Foundation

Declaration number:
NEPD-6639-5886-EN

Registration number:
NEPD-6639-5886-EN

Issue date: 21.05.2024

Valid to: 21.05.2029

General information

Product:

District heat Stavanger/Sandnes/Forus

Program Operator:

The Norwegian EPD Foundation
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Declaration number:

NEPD-6639-5886-EN

This declaration is based on Product Category Rules:

PCR for electricity, steam and hot/cold water generation and distribution. PCR 2007:08, version 4.2. Dated 2021-04-26.

Statement of liability:

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

Declared unit:

-

Declared unit with option:

-

Functional unit:

1 kWh of heat generated and distributed to customer.

Verification

Independent verification of the declaration and data, according to ISO 14025, 8.1.3 and 8.1.4

internal external



Ellen Soldal

Independent verifier approved by EPD Norway

Owner of declaration:

Lyse Neo
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Manufacturer:

Lyse Neo AS

Place of production:

Sandnes/Stavanger/Sør-Rogaland

Management system:

ISO 9001, ISO 14001, ISO 50001

Org. No:

982 929 733

Issue date:

21.05.2024

Valid to:

21.05.2029

Year of study:

2024

Comparability:

EPDs from other programmes than The Norwegian EPD foundation may not be comparable.

The EPD has been worked out by:

Synnøve Helen Gustavsén & Oddbjørn Dahlstrøm
Andvik

Approved



Managing Director of EPD-Norway

Product

Product description:

The district heating is based on the utilization of excess heat from the incineration of residual waste at Forus Energigjenvinning's incineration plant at Bærheim Forus. Peak load on the coldest days and hours is supplied with biogas based on waste resources from sludge and food waste. The heat is thereafter distributed to customers in Stavanger, Sandnes and Sola via Lyse's district heating network.

8% of the energy demand that is not covered by excess heat, Lyse Neo buys biogas produced from IVAR's biogas plants, which accounts for the entire peak load share. The biogas is upgraded before it is mixed with natural gas in a mutual pipe system and transported to customers, such as Lyse Neo's peak load centers.

Calculation rules according to PCR and guidelines from EPD-Norway indicate that biogas based on certificates or mass balance is not permitted to be presented in the core results of the EPD. Even though Lyse Neo buys biogas, the core results of the EPD will be therefore present emission figures based on the mix ratio of the pipe network, which for 2023 was 88% natural gas and 12% biogas.

The LCA results for the environmental impacts from Lyse's district heating production with 100% share of biogas (12 613 MWh) are presented under "Additional information" on page 8. These results are in accordance with the Norwegian Environment Agency's guidelines. Lyse Neo also buys guarantees of origin for electricity. This is accepted in accordance with PCR and guidelines from EPD Norway and is included in the core results.

Product specification:

The table below shows produced heat for the year 2023 from various energy carriers, heat delivered to the distribution network, and energy loss in the distribution of heat.

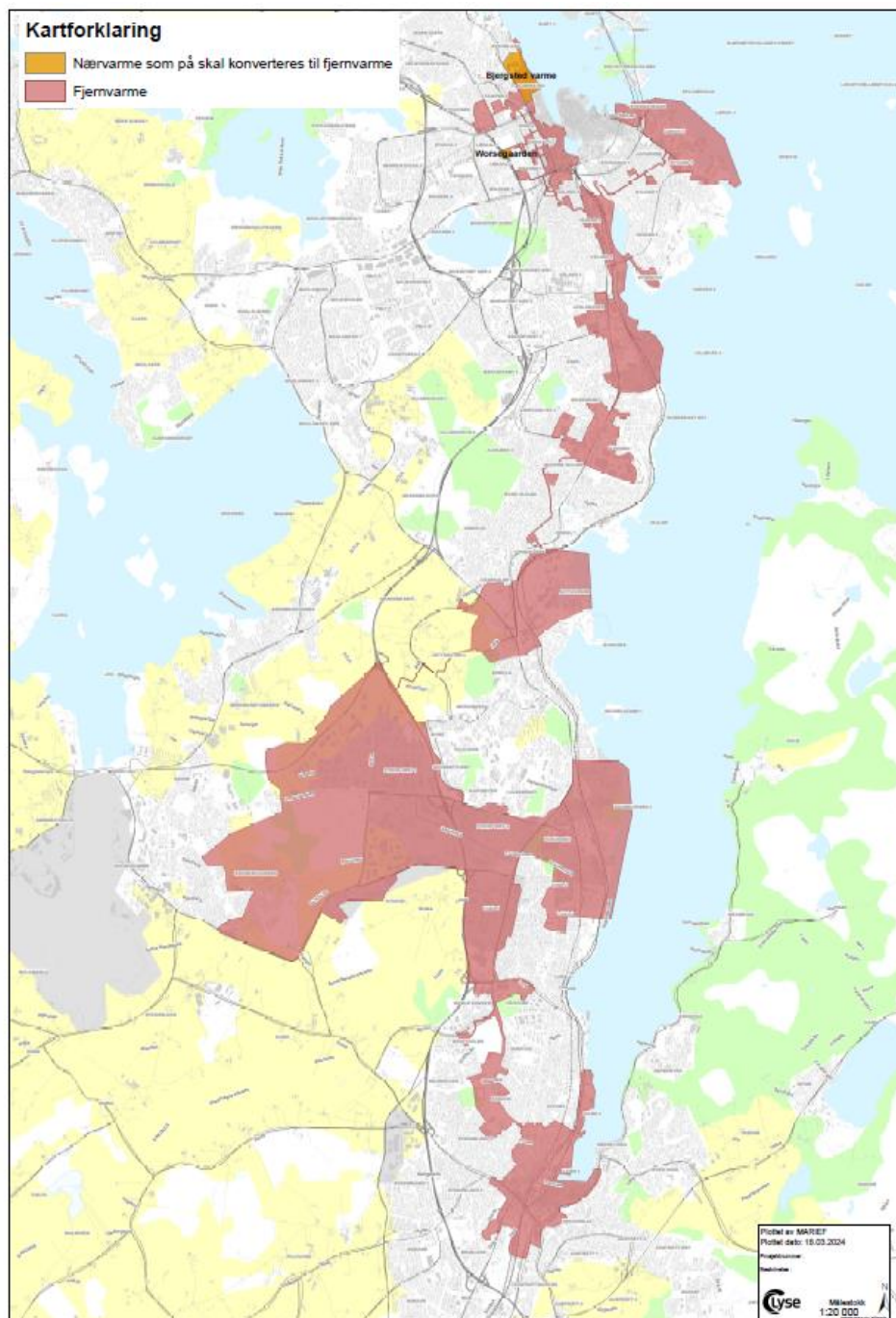
	Unit	Amount
Waste incineration	MWh	144 085
Biogas	MWh	12 613
Electricity (downstream)	MWh	1 200
Delivered heat to distribution network	MWh	156 698
Delivered heat to customer	MWh	125 953
Loss of heat in distribution	%	19,6%

Reference service life & technical data

Energy carrier	Life expectancy	Effect
Energy central (building)	50 yrs	
Distribution net for heat	50 yrs	
Gas boiler (in acc. to PCR)	40 yrs	67 050 kW
Heat exchanger	30 yrs	27 000 kW

Market

Customers in the Stavanger, Sandnes and Forus area connected to Lyse's district heating network. The map below illustrates Lyse's district heating distribution.



LCA: Calculation rules

Functional unit:

1 kWh district heating delivered to customer. As shown in table 1, there is a heat loss in the distribution network. In order to deliver 1 kWh of heat, Lyse must produce 1.24 kWh of heat.

Data quality:

Lyse Neo has provided specific data on energy products, infrastructure, produced heat, and loss of heat in distribution. The use of energy products is taken for best representative year, 2023. Generic data is from ecoinvent v.3.9.1, "cut-off by classification". No data is older than 10 years.

Allocation:

Allocation rules is in accordance with PCR 2007:08, v.4.2. PCR follows the principle of polluter pays, where the emissions related to the collection, transport and incineration of waste are allocated to the waste producer. Emissions related to the necessary equipment to utilize the heat from waste incineration are allocated to district heating.

As for biogas, the following allocation rules are considered. PCR chapter 4.6.1 states that the burden from the digestion plant is distributed waste generator according to the polluter pays principle, of which the burdens associated with equipment and processes needed to convert biogas into heat are allocated to district heating. PCR chapter 4.10.4.1 also points out that GWP biogenic is not included, provided that the fuel is obtained from residues from agriculture, food, feed or wood processing industry, or from organic waste.

System boundary:

The system is divided into the following modules (according to PCR): upstream, core infrastructure, core operation and downstream. The flow chart of the system is shown in the figure below.

Upstream module includes the production of materials for heat utilization, upgrading of biogas by amine technology and specific electricity consumption, as well as infrastructure for the gas pipe network allocated district heating peak load. The core module includes the production and disposal of power stations, gas boilers and heat exchangers, consumption of water and lubricating oil, and handling of operational waste. Downstream module includes consumption of electricity for pumps, and construction and disposal of the district heating network.

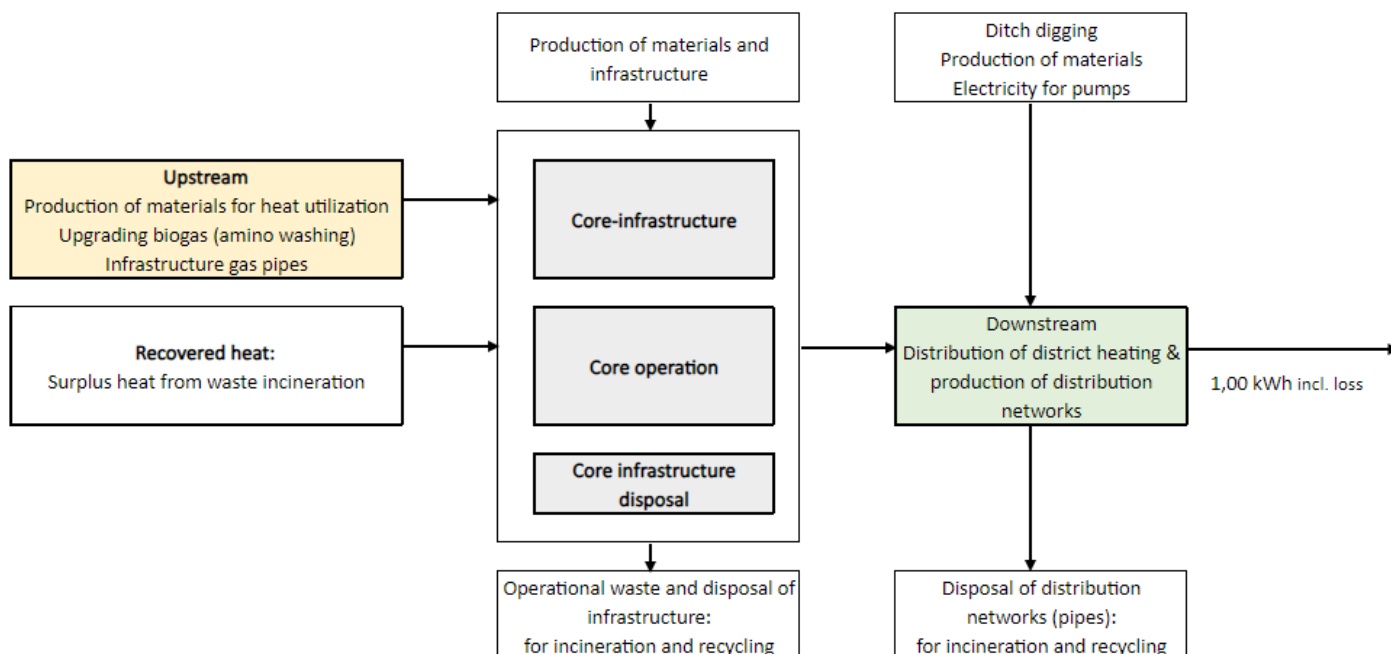


Figure 1: Flow chart illustrating the analyzed system

Cut-off criteria:

All important raw materials and energy use are included in the system. The production process for the raw materials and energy flows in very small quantities (<1%), are not included. The cut-off criteria do not apply to hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describes the scenarios for the modules in the EPD.

Downstream heat distribution is included. This module includes infrastructure for distribution networks and customer centrals, as well as heat loss in distribution. There are no emissions associated with the use and disposal of the product.

System boundary (X = included, MID = not declared, MIR = not relevant)

Acc. NS3720 modules	Product stage			Assembly		Use stage							End of life stage				Benefits & loads beyond system boundary
	Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	x	x	x	x	x	x	x	x	x	x	x	x	MIR	MIR	MIR	MIR	MIR
Acc. PCR	Upstream			Core		Downstream							Not relevant for system				

LCA: Results

The figures below show results for GWP total for district heat with two different peak load sources: production mix natural gas/biogas (88/12), and biogas (100%). The figures only illustrate the results for the environmental impact category GWP-total. Lyse Neo buys 100% biogas for its district heating business based on the mass balance principle, which ensures equal amounts of sold biogas as produced. This principle is how the Norwegian Environment Agency enforces the regulations for climate quotas in line with EU directives, which Norway must comply with.

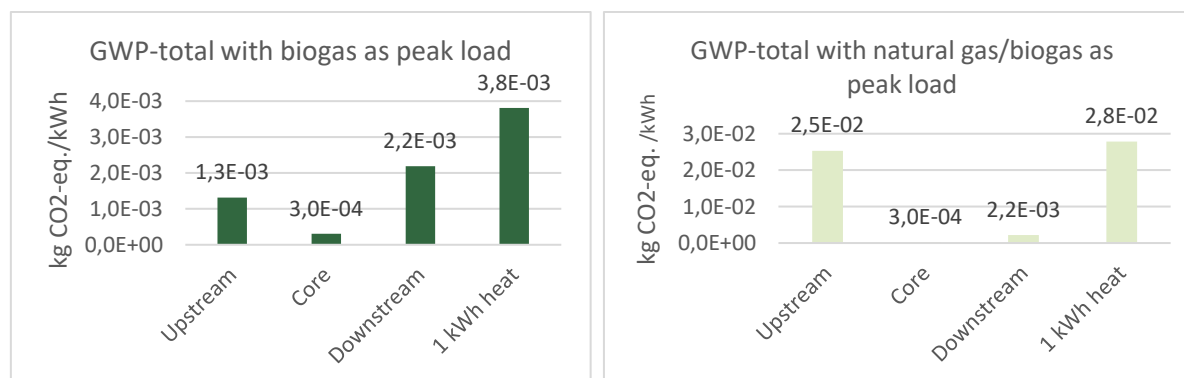


Figure 2 – The diagrams show GWP total for two different peak load sources. On the left GWP with 100% biogas is presented, which is what Lyse buys for its peak load consumption. The diagram on the right shows the GWP total for the use of a mix of natural gas and biogas (88/12) which corresponds to the mixture ratio in the gas distribution network, as EPD Norway requires that there be documents in accordance with PCR. For both diagrams, 92% waste heat is the basis.

Core environmental impact indicators

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
GWP- total	kg CO2 -eq.	2,5E-02	3,0E-04	2,2E-03	2,8E-02
GWP- fossil	kg CO2 -eq.	2,5E-02	2,9E-04	2,2E-03	2,8E-02
GWP- biogenic	kg CO2 -eq.	1,3E-04	6,7E-06	2,6E-05	1,6E-04
GWP- LULUC	kg CO2 -eq.	6,5E-06	9,3E-07	6,1E-06	1,4E-05
ODP	kg CFC11-eq.	1,1E-09	4,8E-12	5,9E-11	1,2E-09
AP	Mol H ⁺ eq.	9,6E-07	2,7E-07	8,3E-07	2,1E-06
EP – fresh water	kg P-eq.	6,8E-06	3,8E-07	3,0E-06	1,0E-05
EP - marine	kg N -eq.	7,4E-05	5,4E-06	2,7E-05	1,1E-04
EP - terrestrial	mol N-eq.	4,4E-05	1,6E-06	1,1E-05	5,7E-05
POCP	kg NMVOC- eq.	8,5E-08	3,1E-08	1,5E-08	1,3E-07
ADP-M&M	kg Sb-eq.	3,6E-01	3,3E-03	2,9E-02	3,9E-01
ADP- fossil	MJ	9,8E-04	1,5E-03	1,0E-03	3,5E-03
WDP	m ³	2,5E-02	3,0E-04	2,2E-03	2,8E-02

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; See "additional Norwegian requirements" for indicator given as PO4 eq. 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

Resource use

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
RPEE	MJ	6,9E-02	6,4E-04	3,9E-02	1,1E-01
RPEM	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
TPE	MJ	6,9E-02	6,4E-04	3,9E-02	1,1E-01
NRPE	MJ	2,9E-01	3,3E-03	2,9E-02	3,2E-01
NRPM	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
TRPE	MJ	2,9E-01	3,3E-03	2,9E-02	3,2E-01
SM	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
RSF	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
NRSF	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
W	m ³	4,9E-04	3,7E-05	3,1E-04	8,4E-04

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Nonrenewable primary energy resources used as energy carrier; NRPM Nonrenewable 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

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
HW	KG	4,8E-06	2,0E-06	1,4E-06	8,2E-06
NHW	KG	1,1E-03	1,3E-04	7,6E-04	2,0E-03
RW	KG	1,4E-07	6,2E-09	3,1E-08	1,8E-07

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

End of life – output flow

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
CR	kg	0,0E+00	0,0E+00	0,0E+00	0,0E+00
MR	kg	0,0E+00	2,4E-04	0,0E+00	2,4E-04
MER	kg	0,0E+00	4,0E-04	0,0E+00	4,0E-04
EEE	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00
ETE	MJ	0,0E+00	0,0E+00	0,0E+00	0,0E+00

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 = $9,0 \cdot 10^{-3} = 0,009$

Additional information

Environmental impact – with biogas

Lyse Neo district heating buys biogas produced from organic waste from IVAR IKS. This is documented with an annual self-declaration. This is part of the additional information in the EPD, with emphasis that the GWP total with 100% biogas used as peak load in Lyse's district heating production gives an emission factor of **3,8g CO₂e/kWh**.

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
GWP- total	kg CO ₂ -eq.	1,3E-03	3,0E-04	2,2E-03	3,8E-03
GWP- fossil	kg CO ₂ -eq.	9,5E-04	2,9E-04	2,2E-03	3,4E-03
GWP- biogenic	kg CO ₂ -eq.	3,6E-04	6,7E-06	2,6E-05	3,9E-04
GWP- LULUC	kg CO ₂ -eq.	4,9E-06	9,3E-07	6,1E-06	1,2E-05
ODP	kg CFC11-eq.	2,7E-11	4,8E-12	5,9E-11	9,1E-11
AP	Mol H ⁺ eq.	7,4E-07	2,7E-07	8,3E-07	1,8E-06
EP – fresh water	kg P-eq.	1,7E-06	3,8E-07	3,0E-06	5,1E-06
EP - marine	kg N -eq.	1,9E-05	5,4E-06	2,7E-05	5,1E-05
EP - terrestrial	mol N-eq.	6,3E-06	1,6E-06	1,1E-05	1,9E-05

Indicator	Unit	Upstream	Core	Downstream	1 kWh heat to customer
POCP	kg NMVOC- eq.	9,0E-08	3,1E-08	1,5E-08	1,4E-07
ADP-M&M	kg Sb-eq.	1,5E-02	3,3E-03	2,9E-02	4,7E-02
ADP- fossil	MJ	6,6E-04	1,5E-03	1,0E-03	3,2E-03
WDP	m ³	1,3E-03	3,0E-04	2,2E-03	3,8E-03

Greenhouse gas emissions from the use of electricity in the production phase

Lyse Neo district heating buys guarantees of origin for their electricity consumption. The guarantee of origin used in this EPD is given by Lyse with hydropower as power source. Contact the EPD owner for more information on the guarantee of origin.

Electricity mix	Amount [kWh]	GWP _{total} [kg CO ₂ /kWh]	Total [kg CO ₂ eq]
Amount of guarantee of origin electricity. 100% electricity from hydropower	0,0062	0,0091	0,000056
Low voltage NO, residual mix	0,0062	0,521	0,003232

The guarantee of origin used in this EPD is provided by Lyse Neo, with a validity period of 5 years (2024-2029).

Emissions from the use of residual mix are also highlighted in accordance with reporting requirements from EPD-Norway. The emission factor for residual mix is taken fromecoinvent v.3.9.1, "Electricity, low voltage [NO], residual mix"

Hazardous substances






- The product contains no substances given by the REACH Candidate list.
- The product contains substances given by the REACH Candidate list that are less than 0,1 % by weight.
- The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List, see table.
- The product contains no substances given by the REACH Candidate list.
- The product is classified as hazardous waste, see table.

Indoor environment

Not relevant

Bibliography

NS-EN ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
NS-EN ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
Gustavsen, Synnøve. 2024	LCA-report for Lyse Neo heat distribution production, from Asplan Viak AS, Sandvika, Norway. 2024
Ecoinvent v3, 2019	Allocation, cut-off by classification. Swiss Centre of Life Cycle Inventories.
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

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