epd-norge

Environmental Product Declaration

In accordance with ISO 14025

Hydroelectricity from Skjerka power station

Å ENERGI

The Norwegian EPD Foundation

Owner of the declaration:
Å Energi Vannkraft AS

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-3466-2067-EN

Registration Number:
NEPD-3466-2067-EN

Issue date: 03.05.2022
Valid to: 03.05.2027

ver-100223

Product:
Hydroelectricity from Skjerka power station

Manufacturer:
Å Energi Vannkraft AS

General information

Product:
Electricity from hydropower

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

Declaration Number:
NEPD-3466-2067-EN

This declaration is based on Product Category Rules:
PCR 2007:08, v.4.2 Electricity, steam and hot/cold water generation and distribution.

Statements:
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 evidences.

Declared unit:
1 kWh electricity produced and thereafter distributed to cosnumer.

Declared unit with option:
1 kWh electricity produced and thereafter distributed to consumer.

Functional unit:

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

internal ☐ External X

Mie Vold, LCA.no AS
(Independent verifier approved by EPD Norway)

Owner of the declaration:
Å Energi Vannkraft AS
Contact person: Oliver Germeroth
Phone: +49 (0) 179 6612 758
e-mail: oliver.germeroth@aenergi.no

Manufacturer:
Å Energi Vannkraft AS
Postboks 603 Lundsiden, 4606 Kristiansand
Phone: + 47 38 60 70 00
e-mail: firmapost@ae.no

Place of production:
Skjerkevatn, Åseral kommune, Norway

Management system:

Organisation no:
882973972

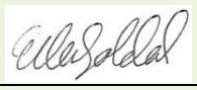
Issue date:
03.05.2022

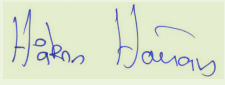
Valid to:
03.05.2027

Year of study:
2021

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

The EPD has been worked out by:
Ellen Soldal, NORSUS





Approved (Manager of EPD Norway)

Product

Product description:

110 kV hydroelectricity produced at Skjerka power station and dsitributed to consumer. The power station is located in Åseral municipality in southern parts of Norway.

Technical data:

High voltage (110 kV) hydroelectricity.

Market:

Europe

Reference service life:

NA

LCA: Calculation rules

Declated unit:

1 kWh electricity produced and distributed to consumers.

During transformation and transmission there will be loss of electricity. Loss of electricity has been included, and the loss is based on ecoinvent 3.7.1. Due to loss in transformation and transmission, electricity delivered to customers is 0,9 kWh.

Energy loss due to distribution

Voltage	Loss in %	Loss in kWh	Source
High	2,7 %	0.027 kWh	Wernet et al. 2016
Medium	1,1 %	0.011 kWh	Wernet et al. 2016
Low	6,0 %	0.058 kWh	Wernet et al. 2016

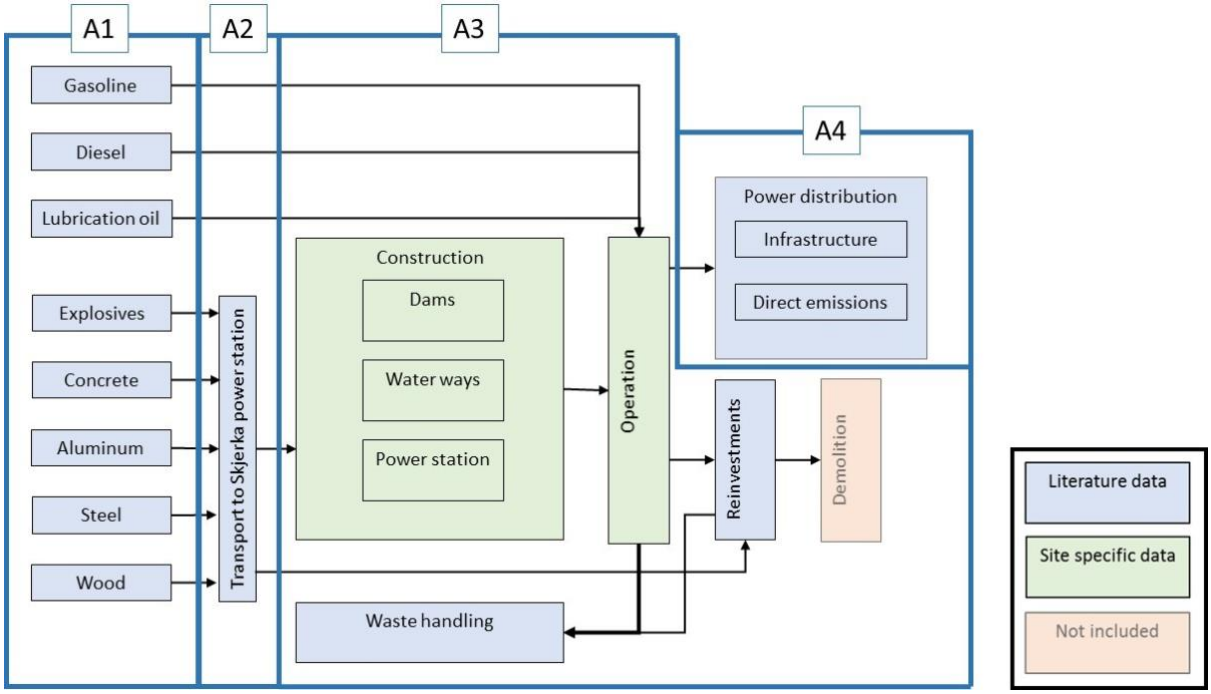
Data quality:

Information on material flows are based on site specific data. The data was collected partly in 2015 and partly in 2021. Due to long life-time of infrastructure, the data is considered to be relevant to time, geography and technology. The production of raw materials are based on generic data from the ecoinvent database, version 3.7.1 (Wernet et al. 2016).

Allocation:

The allocation is made in accordance with the provisions of ISO 14025. Effects of primary production of recycled materials are allocated to the main product in wich the material was used. The recycling process and transportation of recyled material are allocated to the user. In line with the PCR 2007:08, v.4.2 (Environdec 2021), some of the environmental burdens related to the infrastructuer, are allocated to downstream power station. The environmental impacts from dams, gates and roads upstream Skjerka and at Skjerka are allocated to Skjerka power

station and to Håverstad power station which is downstream Skjerka power station. The allocation is based on annual electricity generation and Skjerka power station recieves 70% of the environmental load.



Error! Reference source not found. shows the structure of the LCA-model. It illustrates which life cycle stages that are included and whether the data used is generic or specific.

System boundary:

The total contribution to environmental impacts for electricity generation and distribution are included. This includes raw material extraction, production and transportation, maintenance, operation and transmission (Figure 1). Dams include four upstream dams, which provide benefit to the electricity generation at Skjerka power station, and dams at Skjerka power station.

100% reinvestment of all installations are includede, divided over the technical lifetime of the installations. The environmental impacts from dams, gates and roads upstream and at Skjerka are allocated to Skjerka power station and Håverstad power station, which is downstream Skjerka. The allocation is based on annual electricity generation, and Skjerka power station is given 70% of the load.

Cut-off criteria:

All major raw materials and all essential energy is included. In this analysis, no data obtained has been omitted. All data and processes have been considered relevant and all the data attained has been analyzed.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

A4 includes distribution of electricity generated. Distribution network from ecoinvent 3.7.1 is used. This includes distribution network, loss in transformation and transmission, acquisition and emissions of sulfur hexafluoride. Transformation and transmission leads to loss of electricity, thus, delivered electricity is less than 1 kWh. No modules after A4 have been included.

LCA: Results

For the generation of electricity from reservoir hydro power, emissions of GHG from inundated land is the single most important contribution to the GWP and to eutrophication (EP). Emissions of GHG from inundated land stands for 42% of the total impact in GWP. For the other impact categories, distribution of electricity is the most important.

System boundaries (X = included, MND = module not declared, MNR = module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				After end-of-life
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
X	X	X	X	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR	MNR

Environmental impact

Parameter	Unit	A1-A2	A3	A4	A1-A4
GWP – Total	kg CO2 -eq.	7,44E-04	1,96E-03	1,84E-03	4,54E-03
GWP – Fossil	kg CO2 -eq.	7,20E-04	1,96E-03	1,80E-03	4,48E-03
GWP – Biogent	kg CO2 -eq.	2,44E-05	4,82E-08	3,82E-05	6,27E-05
GWP – Land use and land use change	kg CO2 -eq.	3,80E-07	2,74E-09	2,43E-06	2,81E-06
ODP	kg CFC11-eq.	2,86E-11	1,15E-11	1,42E-10	1,82E-10
POCP	kg C2H4 -eq.	1,90E-07	1,13E-08	8,99E-07	1,10E-06
AP	kg SO2 -eq.	5,67E-06	3,83E-07	2,22E-05	2,83E-05
EP	kg PO43--eq.	1,08E-06	6,57E-05	3,17E-06	6,99E-05
ADPM	kg Sb-eq.	1,47E-08	1,14E-11	2,12E-06	2,14E-06

ADPE	MJ	4,98E-03	8,95E-04	1,91E-02	2,49E-02
AWARE	m3	1,10E-04	4,83E-04	1,55E-03	2,14E-03

GWP Global warming potential, divided into fossil, biogenic and land use and land use change ; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources; AWARE Relative Available WAter Remaining.

Resource use

Parameter	Unit	A1-A2	A3	A4	A1-A4
RPEE	MJ	3,45E+00	2,40E-06	5,64E-03	3,45E+00
RPEM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TPE	MJ	3,45E+00	2,40E-06	5,64E-03	3,45E+00
NRPE	MJ	5,64E-03	8,99E-04	2,11E-02	2,76E-02
NRPM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
TRPE	MJ	5,64E-03	8,99E-04	2,11E-02	2,76E-02
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	9,86E-06	7,61E-04	3,54E-05	8,07E-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 Non renewable primary energy resources used as 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. Includes evapotranspiration from reservoir.*

End of life - Waste

Parameter	Unit	A1-A2	A3	A4	A1-A4
HW	KG	1,39E-05	2,60E-09	6,86E-08	1,40E-05
NHW	KG	8,18E-04	1,78E-06	3,06E-02	3,14E-02
RW	KG	2,05E-08	6,47E-09	6,28E-08	8,98E-08

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

End of life – output flow

Parameter	Unit	A1-A2	A3	A4	A1-A4
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	0.00E+00	2,79E-03	0.00E+00	2,79E-03
MER	kg	0.00E+00	1,85E-06	0.00E+00	1,85E-06
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+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*10-3 = 0,009

Additional environmental information

Key environmnetal indicators	Declared unit (DU)	
	1 kWh electricity produced and ready to be distributed	0.9 kWh distributed to customers
GWP – total	2,68 g CO2-eq/DU	4.49 g CO2-eq/DU
Use of primary energy resources	3.46 MJ/DU	3.48MJ/DU
Renewable energy share	100%	99%

Å Energi's hydropower plants are not located in protected areas or in protected water ways. Their power installations and activities do not have a bigger impact on nature or society than is usual for this kind of business. Within the framework of Å Energi's existing licenses, various statutory and voluntary measures are taken to reduce the negative environmental impacts. These measures include releasing water to entice fish to swim up rivers and building salmon ladders, putting out fish and roe in reservoirs, and actions for reduction of Eurasian eagle-owl death by power lines (Å energi 2015).

In order to reduce the risk of flooding in relation to the new dam constructed at Lake Skjerkevatn, Å Energi is building a spillway, as well as a diversion tunnel with outlet gates to ensure that flood water is safely diverted.

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase

National production mix from import, low woltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess(A3).

Data source	Amount	Unit
ecoinvent 3.7.1 (Wernet et al. 2016)	23	g CO2-eq/kWh

Dangerous substances

- x The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- o The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- o The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.

- The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

The product does not lead to indoor emissions.

Bibliography

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
EN 15804:2012+A1:2013	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
Environdec 2021	PCR 2007:08, version 4.2. Electricity, steam and hot/cold water generation and distribution. Date: 2021-04-26. Valid until: 2024-03-16.
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products
Soldal, E. 2021	Background report for the Environmental Product Declaration for Å Energi Vannkraft. OR.53.21. NORSUS.
Wernet 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**	tlf	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-post:	post@epd-norge.no
	Norway	web	www.epd-norge.no
epd-norge The Norwegian EPD Foundation	**Publisher**	tlf	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-post:	post@epd-norge.no
	Norway	web	www.epd-norge.no
Å ENERGI	**Owner of the decleration**	tlf	+ 47 38 60 70 00
	Å Energi Vannkraft AS	Fax	
	Kjøita 18	e-post:	oliver.germeroth@aenergi.no
	4630 Kristiansand S	web	www.ae.no
NORSUS Norsk institutt for bærekraftsforskning	**Author of the life cycle assesment**	tlf	+47 41 44 95 24
	Ellen Soldal, NORSUS	Fax	
	Stadion 4, 1671 Kråkerøy	e-post:	ellen@norsus.no
	Norway	web	www.norsus.no

EPD for the best environmental decision

Global Program Operator

The Norwegian EPD foundation
www.epd-norge.no

epd-norge