

COMPONENTS FOR PHOTOVOLTAIC POWER PLANTS, EXCEPT PHOTOVOLTAIC
MODULES AND PARTS THEREOF

PRODUCT GROUP CLASSIFICATION: UN CPC 4612, 4621, 4641, 4642

C-PCR-XXX (TO PCR 2019:14). DRAFT FOR OPEN CONSULTATION. DO NOT USE OR CITE.

VERSION: 20XX-YY-ZZ



COMPONENTS FOR PHOTOVOLTAIC POWER PLANTS, EXCEPT PHOTOVOLTAIC MODULES
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PRODUCT GROUP CLASSIFICATION: UN CPC 461, 462, 463, 464.

INTRODUCTION TO OPEN CONSULTATION

This draft PCR is available for open consultation from 2022-07-05 until 2022-09-04. Feel free to forward the draft to any other stakeholder you might think is relevant, including colleagues and other organisations.

We are interested in comments from stakeholders on:

- General
 - o Alignment with PCRs available in other programmes for type III environmental declarations, industry-specific LCA guides or similar.
- Scope of PCR
 - o Product category definition and description
 - o Classification of product category using CPC codes
- Goal and scope, life cycle inventory and life cycle impact assessment
 - o Functional unit/declared unit
 - o System boundary
 - o Allocation rules
 - o Data quality requirements
 - o Recommended databases for generic data
 - o Impact categories and impact assessment methodology
- Additional information

Comments may be sent directly to the PCR Moderator (contact details available in Section 1). There is a template for comments on www.environdec.com that may be used.

For questions about the PCR, please contact the PCR moderator. For general questions about the International EPD® System, EPD or PCR development, please contact the Secretariat via pcr@environdec.com.

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1 INTRODUCTION

1.1 GENERAL

This document constitutes complementary Product Category Rules (c-PCR) developed in the framework of the International EPD® System: a programme for type III environmental declarations¹ according to ISO 14025:2006, ISO 14040:2006, ISO 14044:2006, and product-specific standards such as EN 15804 and ISO 21930 for construction products. Environmental Product Declarations (EPD) are voluntary documents for a company or organisation to present transparent, consistent and verifiable information about environmental performance of their product (goods or services).

The rules for the overall administration and operation of the programme are the General Programme Instructions (GPI), publicly available at www.environdec.com. PCRs and c-PCRs complement the GPI and the normative standards by providing specific rules, requirements and guidelines for developing an EPD for one or more specific product categories (see Figure 1). A PCR/c-PCR should enable different practitioners using the PCR/c-PCR to generate consistent results when assessing products of the same product category.

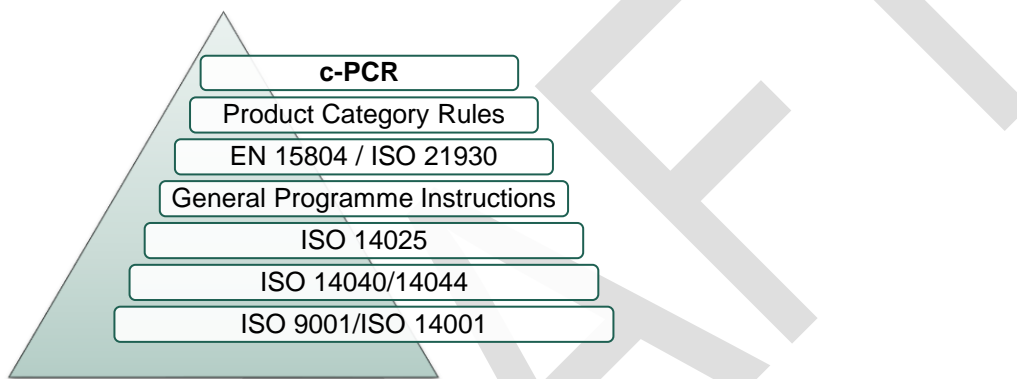


Figure 1 This c-PCR in relation to the hierarchy of standards and other documents.

Within the present c-PCR, the following terminology is adopted:

- The term “shall” is used to indicate what is obligatory, i.e. a requirement.
- The term “should” is used to indicate a recommendation, rather than a requirement. Any deviation from a “should” requirement shall be justified in the PCR development process.
- The terms “may” or “can” is used to indicate an option that is permissible.

For definitions of further terms used in the document, see the normative standards.

A PCR and its c-PCRs are valid for a pre-determined period of time to ensure that it is updated at regular intervals. The latest version of the PCR and its c-PCRs are available at www.environdec.com. Stakeholder feedback on PCRs and c-PCRs is very much encouraged. Any comments on this c-PCR may be sent directly to the PCR Moderator and/or the Secretariat during its development or during its period of validity.

Any references to this document shall include the PCR registration number, name and version.

The programme operator maintains the copyright of the document to ensure that it is possible to publish, update, and make it available to all organisations to develop and register EPDs. Stakeholders participating in c-PCR development should be acknowledged in the final document and on the website.

¹ Type III environmental declarations in the International EPD® System are referred to as EPD, Environmental Product Declarations.

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1.2 ROLE OF THIS DOCUMENT

This document provides complementary product category rules (c-PCR) to PCR 2019:14 Construction products available at www.environdec.com. This document cannot be used by itself but shall be used together with PCR 2019:14 and the European standard EN 15804:2012+A2:2019 (called EN 15804 in short). If a c-PCR is available for a product category, it shall be used.

See Figure 2 for an illustration on how PCR 2019:14 and this c-PCR relate to each other and the EPDs that may be based on them.

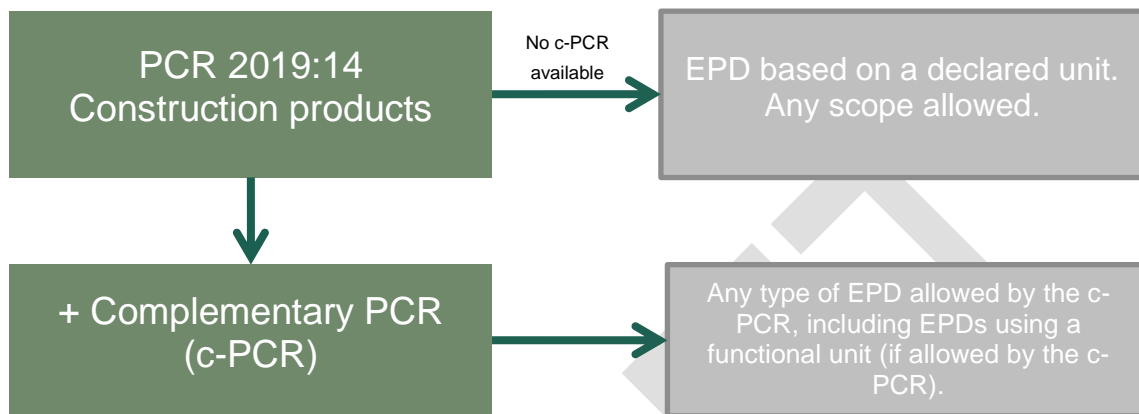


Figure 2 Overview of using PCR 2019:14 directly to develop an EPD, or how to use it together with a c-PCR.

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2 GENERAL INFORMATION

2.1 ADMINISTRATIVE INFORMATION

Name:	Components for photovoltaic power plants, except photovoltaic modules and parts thereof
Registration number and version:	<i>Added by the Secretariat</i>
Programme:	 The International EPD® System
Programme operator:	EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com
PCR Moderator:	Mr. Zhang Yuyang, Power (Beijing) Certification Centre Co. Ltd, zhangyuyang@spic.com.cn
PCR Committee:	Power (Beijing) Certification Centre Co. Ltd, IVL Swedish Environmental Research Institute (Beijing Office), GoodWe Technologies Co. Ltd, Huawei Technologies Co. Ltd, XJ Electric Co., Ltd, China Photovoltaic Industry Association
Date of publication and last revision:	<i>Added by the Secretariat</i>
Valid until:	<i>Added by the Secretariat</i>
Schedule for renewal:	<p>A PCR is valid for a pre-determined time period to ensure that it is updated at regular intervals. When the PCR is about to expire, the PCR Moderator shall initiate a discussion with the Secretariat how to proceed with updating the PCR and renewing its validity.</p> <p>A PCR may be also be updated without prolonging its period of validity, provided significant and well-justified proposals for changes or amendments are presented.</p> <p>See www.environdec.com for the latest version of the PCR.</p> <p>When there has been an update of the PCR, the new version should be used to develop EPDs. The old version may however be used for 90 days after the publication date of the new version, as long as the old version has not expired.</p>
Standards conformance:	<ul style="list-style-type: none"> ▪ General Programme Instructions of the International EPD® System, version 4.0, based on ISO 14025 and ISO 14040/14044 ▪ EN 15804:2012+A2:2019
PCR language(s):	At the time of publication, this PCR was available in English. If the PCR is available in several languages, these are available at www.environdec.com . In case of translated versions, the English version takes precedence in case of any discrepancies.

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2.2 SCOPE

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This c-PCR is for the assessment of the environmental performance of photovoltaic (PV) power plant components, specifically PV invertors, PV battery energy storage systems, combiner boxes and tracker systems, and the declaration of this performance by an EPD. The product category corresponds to subsets of UN CPC 4612, 4621, 4641, and 4642.

Further description of the products covered by this c-PCR:

PV invertors: is a type of electrical converter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid or used by a local, off-grid electrical network. It is a critical balance of system (BOS)-component in a photovoltaic system, allowing the use of ordinary AC-powered equipment. Solar power invertors have special functions adapted for use with photovoltaic arrays, including maximum power point tracking and anti-islanding protection.

PV battery energy storage systems, is the batteries system that capture surplus energy generated by PV system to allow store energy for use later in the day. Batteries can provide power when electrical loads require more power than the PV panels are generating. This can be due to the generation of less electricity due to adverse weather conditions, greater than normal power usage, or other anomalies with the PV power collection. Batteries also help establish the DC operating voltage for the required auxiliary components in the PV system.

PV combiner box: is the product that can connect a certain number of photovoltaic cells with the same specifications in series to form one photovoltaic series, and then connect several photovoltaic series in parallel to the photovoltaic combiner box. Its main purpose is to combine multiple DC inputs from the panels in the system into a single DC output. This output is then connected to a charge controller or inverter, depending on the type of system. They also allow plant to transition to larger wires between the array and the batteries or inverter to minimize transmission voltage drop.

PV tracker systems. Trackers help minimize the angle of incidence (the angle that a ray of light makes with a line perpendicular to the surface) between the incoming light and the panel, which increases the amount of energy the installation produces. Single-axis solar trackers direct solar panels or modules toward the sun. These devices change their orientation throughout the day to follow the sun's path to maximize energy capture. Single-axis solar trackers rotate on one axis moving back and forth in a single direction.

2.2.2 TYPE OF EPD AND INFORMATION MODULES INCLUDED

See PCR 2019:14.

2.2.3 GEOGRAPHICAL SCOPE

This c-PCR may be used globally.

2.2.4 EPD VALIDITY

See PCR 2019:14.

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3 PCR REVIEW AND BACKGROUND INFORMATION

This c-PCR was developed in accordance with the PCR development process described in the GPI of the International EPD® System, including open consultation and review.

3.1 OPEN CONSULTATION

3.1.1 VERSION 20XX-YY-ZZ

This c-PCR is available for open consultation from 2022-07-05 until 2022-09-04, during which any stakeholder is able to provide comments by contacting the PCR Moderator and/or the Secretariat.

Add information about any physical or web-based meetings held during the open consultation phase, if applicable.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders. The following stakeholders provided comments during the open consultation and agreed to be listed as contributors in the c-PCR and at www.environdec.com.

- *List of stakeholder names and affiliation to be added after the open consultation*

3.2 PCR REVIEW

3.2.1 VERSION 20XX-YY-ZZ

PCR review panel:	The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com . The review panel may be contacted via info@environdec.com . Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	<i>Added by the Secretariat</i>
Review dates:	<i>Added by the Secretariat</i>

3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

As part of the development of this c-PCR, existing PCRs/c-PCRs and other internationally standardised methods that could potentially act as c-PCRs were considered to avoid unnecessary overlaps in scope and to ensure harmonisation with established methods of relevance for the product category. The existence of such documents was checked among the following EPD programmes and international standardisation bodies:

- International EPD® System. www.environdec.com
- EPD-Norge. www.epd-norge.no
- EPDIItaly. www.epditaly.it
- European Commission PEF. <https://epca.jrc.ec.europa.eu/EnvironmentalFootprint.html>

Table 1 lists the identified PCRs and other standardised methods.

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Table 1 Existing PCRs/c-PCRs and other internationally standardized methods that were considered to avoid overlap in scope and to ensure harmonisation with established methods.

NAME OF PCR/STANDARD	PROGRAMME/ STANDARDISATION BODY	REGISTRATION NUMBER, VERSION NUMBER/DATE OF PUBLICATION	SCOPE
Part B for photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials	EPD-Norge	NPCR 029, version 1.2, 2022-03-31	Photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials
ELECTRICITY PRODUCED BY PHOTOVOLTAIC MODULES	EPDIItaly	EPDIItaly 014, version 1.1, 2022-02-08	Electricity produced by photovoltaic modules
PEFCR- PHOTOVOLTAIC MODULES USED IN PHOTOVOLTAIC POWER SYSTEMS FOR ELECTRICITY GENERATION	European Commission	Version: 1.1, 2019-02-12	Production of photovoltaic modules used in photovoltaic power systems for electricity generation
PEFCR - Product Environmental Footprint Category Rules for High Specific Energy Rechargeable Batteries for Mobile Application.	European Commission	Version: 1.1, 2020-02	The types of battery in the scope of the PEFCR only comprise part of the broader category of batteries identified under the CPA (European classification of products by activity) code: 27.20.23. (27. Electrical equipment/20. Batteries and accumulators/23. Nickel-cadmium, nickel metal hydride, lithium-ion, lithium polymer, nickel-iron and other electric accumulators)

3.4 REASONING FOR DEVELOPMENT OF C-PCR

This c-PCR was developed to provide requirements and guidelines additional to those in PCR 2019:14 and EN 15804, for developing EPDs for the product category. The c-PCR thereby enables different practitioners to generate consistent results when assessing the environmental impact of products of the same product category, and thereby it supports comparability of products within a product category.

For existing PCRs related to solar power, most of them are only applicable for PV Panels. Only PCR in EPD-Norge system is applicable for some components used in PV system (i.e. Part B for photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials). However some other important components, such as inverter, energy storage, tracker, combiners box and other components

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or systems necessary that are used to connect the photovoltaic module to the electrical grid are not included. It is necessary to develop a new c-PCR to cover more components for PV system to increase the transparency of the environmental impact analysis of the full PV system.

3.5 UNDERLYING STUDIES USED FOR C-PCR DEVELOPMENT

The methodological choices made during the development of this c-PCR (declared/functional unit, system boundary, allocation methods, impact categories, data quality rules, etc.) were primarily based on the following underlying studies:

- Footprint analysis report of one row of trackers from Nextracker, 2020.
- Life Cycle Assessment of Current Photovoltaic Module Recycling, Report IEA-PVPS T12-13:2018
- LCA study of inverter GW136K-HTH of Goodwe company. China Quality Certification Centre, 2021-04.
- Life cycle assessment of low power solar inverters (2.5 to 20 kW), Laura Tschümperlin, Philippe Stolz, Rolf Frischknecht, Uster, 2016-10-03
- Life Cycle Assessment of Photovoltaic Systems in the APEC Region, APEC Energy Working Group, 2019-04
- Life Cycle Assessment of the 33 kW Photovoltaic System on the Dana Building at the University of Michigan, University of Michigan, Ann Arbor, 2006-06-01
- Optimization of PV generator/inverter coupling in terms of DC cable losses and series/parallel connections of PV module, Master Thesis, Andrea Orlandini, 2019-03
- Product Carbon Footprint Report of Inverter of Huawei, Reliability Laboratory of Huawei Technologies, Co., Ltd, 2021-04
- Preparatory study for solar photovoltaic modules, inverters and systems, Draft Report Task 5: Environmental and economic assessment of base cases, Dodd, Nicholas; Espinosa, Nieves – JRC B5 Van Tichelen, Paul; Peeters, Karolien – VITO
- Solar photovoltaic modules, inverters and systems: options and feasibility of EU Ecolabel and Green Public Procurement criteria, Dodd, N, Espinosa, Preliminary report, EUR 30474 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-26819-2, doi:10.2760/29743, JRC122430, 2021

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4 GOAL AND SCOPE, LIFE CYCLE INVENTORY AND LIFE CYCLE IMPACT ASSESSMENT

This section provides specific rules, requirements and guidelines for developing an EPD for the product category as defined in [Section 2.2.1](#).

4.1 DECLARED/FUNCTIONAL UNIT

Functional Unit is defined as: 1 kWh of AC power output from a reference photovoltaic system under predefined climatic and installation conditions (such as solar resource, operating hours per year, etc) as defined for a typical year and assuming a service life of 25 years. A converting factor shall be reported in the EPD to convert the results related to one declared product to 1 Wp photovoltaic module.

4.2 SYSTEM BOUNDARIES

See PCR 2019:14 and Section 6.3.5.2 of EN 15804.

4.3 SYSTEM DIAGRAM

The system boundaries depend on the type of EPD that is declared, see [Section 2.2.2](#).

4.4 CUT-OFF RULES

See PCR 2019:14 and EN 15804.

4.5 ALLOCATION RULES

See PCR 2019:14 and EN 15804.

4.6 DATA QUALITY REQUIREMENTS

See PCR 2019:14 and EN 15804.

4.7 ENVIRONMENTAL PERFORMANCE INDICATORS

See PCR 2019:14 and EN 15804.

4.8 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

See PCR 2019:14.

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5 CONTENT AND FORMAT OF EPD

See PCR 2019:14.

5.1 EPD LANGUAGE

See PCR 2019:14.

5.2 UNIT AND QUANTITIES

See PCR 2019:14.

5.3 USE OF IMAGES IN EPD

See PCR 2019:14.

5.4 EPD REPORTING FORMAT

See PCR 2019:14.

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6 LIST OF ABBREVIATIONS

See PCR 2019:14.

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7 REFERENCES

- CEN (2019) EN 15804:2012+A2:2019, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.
- EPD International (2019) PCR 2019:14 Construction products, version 1.2.
- EPD International (2021) General Programme Instructions of the International EPD® System. Version 4.0, dated 2021-03-29. www.environdec.com.
- Footprint analysis report of one row of trackers from Nextracker, 2020.
- ISO (2006a) ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.
- ISO (2006b) ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework.
- ISO (2006c) ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines.
- ISO (2017) ISO 21930:2017, Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services.
- Life Cycle Assessment of Current Photovoltaic Module Recycling, Report IEA-PVPS T12-13:2018
- LCA study of inverter GW136K-HTH of Goodwe company. China Quality Certification Centre, 2021-04.
- Life cycle assessment of low power solar inverters (2.5 to 20 kW), Laura Tschümperlin, Philippe Stolz, Rolf Frischknecht, Uster, 2016-10-03
- Life Cycle Assessment of Photovoltaic Systems in the APEC Region, APEC Energy Working Group, 2019-04
- Life Cycle Assessment of the 33 kW Photovoltaic System on the Dana Building at the University of Michigan, University of Michigan, Ann Arbor, 2006-06-01
- NPCR 029 of EPD-Norge, Part B for photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials, version 1.2, 2022-03-31.
- Optimization of PV generator/inverter coupling in terms of DC cable losses and series/parallel connections of PV module, Master Thesis, Andrea Orlandini, 2019-03
- PCR ELECTRICITY PRODUCED BY PHOTOVOLTAIC MODULES I of EPDIItaly, version 1.1, 2022-02-08
- PEFCR-PHOTOVOLTAIC MODULES USED IN PHOTOVOLTAIC POWER SYSTEMS FOR ELECTRICITY GENERATION, Version 1.1, 2019-02-12
- PEFCR - Product Environmental Footprint Category Rules for High Specific Energy Rechargeable Batteries for Mobile Application, Version: 1.1, 2020-02
- Product Carbon Footprint Report of Inverter of Huawei, Reliability Laboratory of Huawei Technologies, Co., Ltd, 2021-04
- Preparatory study for solar photovoltaic modules, inverters and systems, Draft Report Task 5: Environmental and economic assessment of base cases, Dodd, Nicholas; Espinosa, Nieves – JRC B5 Van Tichelen, Paul; Peeters, Karolien – VITO
- Solar photovoltaic modules, inverters and systems: options and feasibility of EU Ecolabel and Green Public Procurement criteria, Dodd, N, Espinosa, Preliminary report, EUR 30474 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-26819-2, doi:10.2760/29743, JRC122430, 2021

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8 VERSION HISTORY OF C-PCR

VERSION 20XX-YY-ZZ

Add description of the c-PCR version, e.g. "Original version of the c-PCR".

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