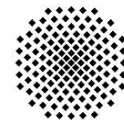




# Towards an Environmental Product Declaration (EPD) of PV Modules and Systems





# LCA of PV – Some considerations

## LCA of PV

EDP

EPD of PV

General

Example

PCR

Conclusion

- PV systems have better environmental performance over the life cycle compared to conventional electricity conventional systems (e.g. present UCTE mix)

however

- Some case of misleading communication in the past
- Wide range of results reported in literature



# Why an EPD of PV? – Issues of LCA

LCA of PV

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Conclusion

- PV fast evolving technology, dynamic LCA and some kind of technological forecasting needed
- Several PV applications (e.g.: different kind of integration in buildings, multi-functional uses)
- Energy yields depend on local conditions

**All assumptions made must be described  
in the most transparent way as possible**

# Why an EPD of PV?

LCA of PV  
EDP

EPD of PV

General

Example

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Conclusion

**EPD enhances credibility  
and comparability of LCA results,**

through:

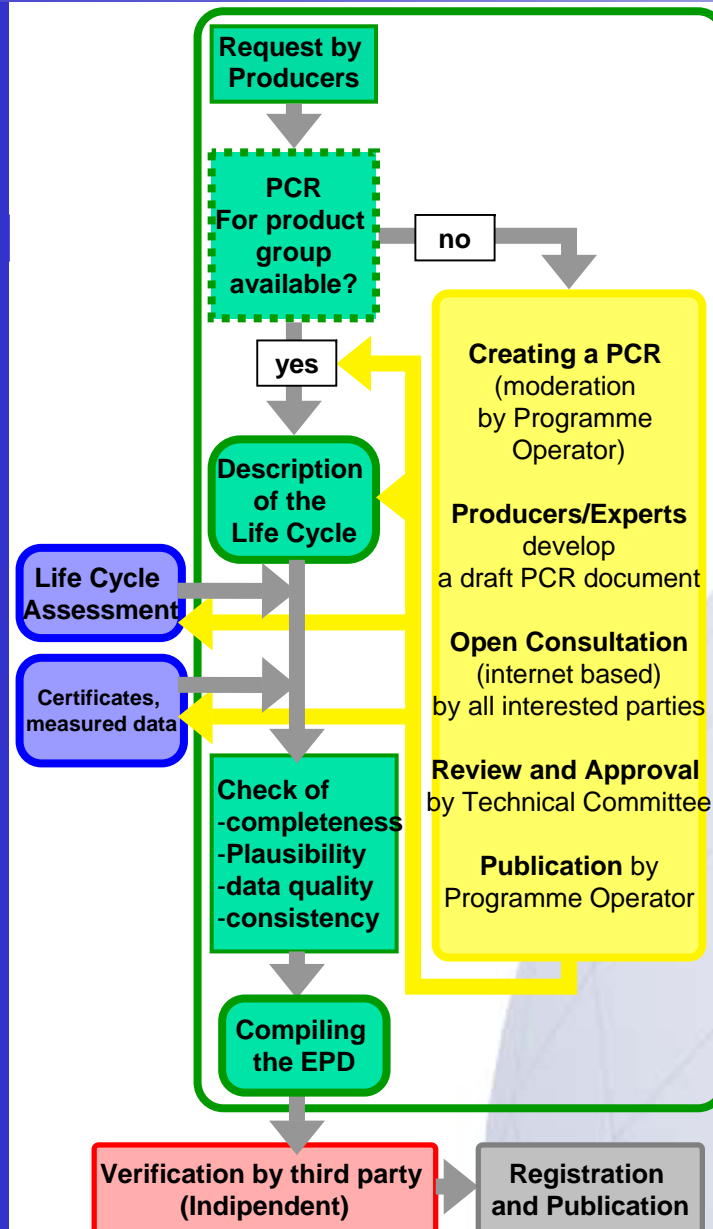
- *PCR = Product Category Rules*
  - **All assumptions** made for both communication format of EPD and underlying LCA study defined in an **open consultation process** of stakeholders
    - ⇒ Common agreed rules → Comparability
- *3rd party certification*
  - Data, model and reporting quality
    - ⇒ Enhanced Credibility

Most diffused EPD programme in Europe:

**Swedish EPD system** managed by SEMC

# How does an EPD work?

LCA of PV  
EDP  
EPD of PV  
General  
Example  
PCR  
Conclusion



## Procedure in 3 steps:

### 1. Product Category Rules (yellow)

- Draft PCR by Producers and Experts
- Open consultation
- Review and Approval by Technical Committee
- Publication

### 2. EPD (green/blue)

- Life Cycle Documentation, LCA, certificates for measured data
- Check of completeness, consistency, plausibility, and data quality
- Compiling EPD

### 3. Verification of the EPD (red)

- by independent third party

# EPD example

LCA of PV  
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EPD of PV  
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Summary of Vattenfall AB's Certified  
Environmental Product Declaration  
of Electricity from Vattenfall AB's  
Swedish Windpower Plants



EPD

## Production Phase

A very brief summary of inventoried data is presented below:

Category	Unit/kWh	Total
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## PSR 2004:2 (Product Specific Requirements - Production of Electricity and District Heating)

### However:

- Too generic on electricity generation systems
- Functional Unit: 1kwh delivered
- Applicable to a PV system, i.e. specific BOS and location

The windpower plants Håstholmen (1 turbine) on the shore of Lake Vättern, Humlekärn (2 turbines) and Skärbo (6 turbines) in Bohuslän at the Western coast, BreggÅlma (1 turbine) at Suona in the far North and Sigvards 3 (1 turbine) on the island Gotland East of the Swedish mainland have been inventoried regarding construction, operation and dismantling. The assumed technical lifetime of a windpower plant is 25 years. Selected turbines account for one third of Vattenfall's installed windpower capacity and of Vattenfall's total windpower generation in Sweden during a normal year. Studied plant suppliers have delivered 75% of all Vattenfall's windpower plants in Sweden operated during 2001. The main part of Vattenfall's windpower electricity is generated in studied geographic regions.

The complete certified declaration also includes descriptions of risks, biodiversity impacts and land use, in accordance with PSR.

Greenhouse gases	g GWP eq (100 years)	10.4	6.78	10.7	7.86	12.4	10.3
Ozone-depleting gases	g CFC-11 eq (20 years)	1.75·10 <sup>-10</sup>	2.03·10 <sup>-10</sup>	1.57·10 <sup>-10</sup>	0.38·10 <sup>-10</sup>	3.83·10 <sup>-10</sup>	2.52·10 <sup>-10</sup>
Acidifying substances	mass H <sup>+</sup>	1.11·10 <sup>-10</sup>	9.27·10 <sup>-11</sup>	1.10·10 <sup>-10</sup>	1.11·10 <sup>-10</sup>	1.43·10 <sup>-10</sup>	1.25·10 <sup>-10</sup>
Gases contributing to the formation of ground-level ozone	g ethane eq	1.66·10 <sup>-10</sup>	1.42·10 <sup>-10</sup>	1.13·10 <sup>-10</sup>	1.24·10 <sup>-10</sup>	2.58·10 <sup>-10</sup>	1.94·10 <sup>-10</sup>
O <sub>3</sub> -consuming substituting substances	g O <sub>3</sub>	1.50·10 <sup>-10</sup>	1.11·10 <sup>-10</sup>	1.56·10 <sup>-10</sup>	1.32·10 <sup>-10</sup>	1.87·10 <sup>-10</sup>	1.60·10 <sup>-10</sup>
Toxic substances							
Aromatic	g eq	1.08·10 <sup>-10</sup>	5.20·10 <sup>-11</sup>	4.62·10 <sup>-10</sup>	7.02·10 <sup>-10</sup>	0.08·10 <sup>-10</sup>	8.14·10 <sup>-10</sup>
Dioxine	g eq	5.13·10 <sup>-10</sup>	2.97·10 <sup>-10</sup>	6.21·10 <sup>-10</sup>	2.54·10 <sup>-10</sup>	5.50·10 <sup>-10</sup>	4.32·10 <sup>-10</sup>
Lead	g eq	7.89·10 <sup>-10</sup>	3.84·10 <sup>-10</sup>	3.47·10 <sup>-10</sup>	5.14·10 <sup>-10</sup>	6.68·10 <sup>-10</sup>	6.00·10 <sup>-10</sup>
PAH	g eq	1.64·10 <sup>-10</sup>	1.66·10 <sup>-10</sup>	9.70·10 <sup>-11</sup>	1.43·10 <sup>-10</sup>	3.13·10 <sup>-10</sup>	2.30·10 <sup>-10</sup>



## Proposal: a new PCR on PV Modules

LCA of PV

EDP

EPD of PV

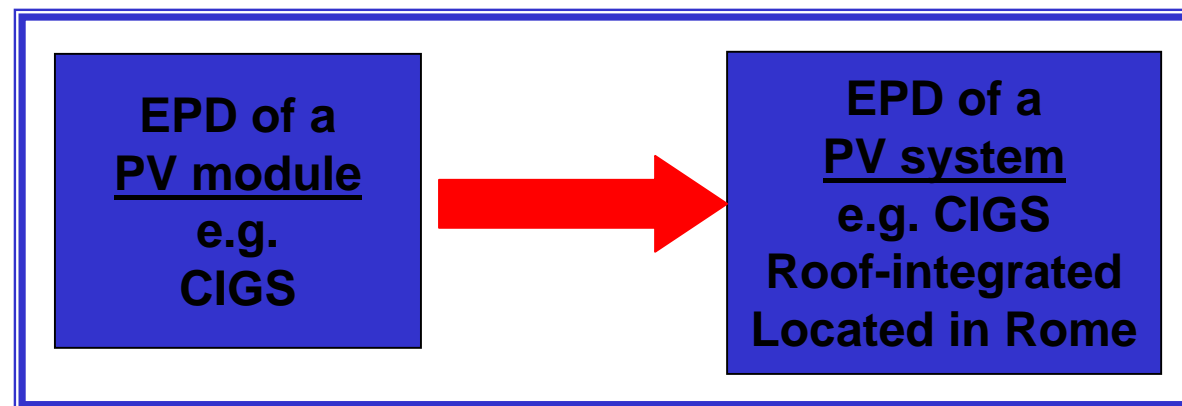
General

Example

PCR

Conclusion

- More precise and focused assumptions on different PV technology manufacturing (and end-of-life) processes
- Valid for PV modules, i.e. independent from application and site – FU: Wp
- Compatible with ISO 14025 principle of modularity of EPDs
  - Standard **ISO 14025**, published 1st July 2006
- EPD of PV module can be used / is part of an EPD of a PV system, according to ISO norms



## Conclusion/ Discussion

LCA of PV

EDP

EPD of PV

General

Example

PCR

Conclusion

- Environmental Performance of PV systems better than conventional systems
- PCR for electricity not suitable for PV modules
- PCR for PV modules (FU 1Wp) should be created

**Thank you for your attention !**