PV CYCLE

Current situation of EoL PV module collection and recycling in Europe

Ullrich Didszun
Country Manager PV CYCLE Deutschland GmbH

Webinar PV Magazine und REC on 01./ 02. June 2022

AGENDA

1. THE HISTORY OF PV CYCLE - PURPOSE, GOAL AND REALITY

2. LEGAL BASIS FOR THE END-OF-LIFE DISPOSAL OF PV MODULES IN EUROPE - COLLECTIVE AND INDIVIDUAL PRODUCER OBLIGATIONS

3. ECONOMIC AND ECOLOGICAL EFFICIENCY OF COLLECTIVE COLLECTIONS IN THE DIFFERENT NATIONAL WEEE SYSTEMS

- SUFFICIENT INFRASTRUCTURE FOR COLLECTION
- ALLOCATION OF DIFFERENT MODULE TECHNOLOGIES TO THE RIGHT RECYCLING FACILITIES
- LOGISTICAL CARBON FOOTPRINT

4. ASSESSMENT OF RECYCLING POSSIBILITIES FOR ALL MODULE TECHNOLOGIES

PV CYCLE - MILESTONES

2014 – EPR (WEEE incl PV Panels)

2007-2013
FIRST VOLUNTARY TAKE-BACK PV PANELS

NOT-FOR-PROFIT ASSOCIATION

2010
65.000 tons – 1 GW - 11 Years

2013-2016
OPENING OFFICES across EUROPE
(DE,IT,FR,BE, NL,UK,ES)

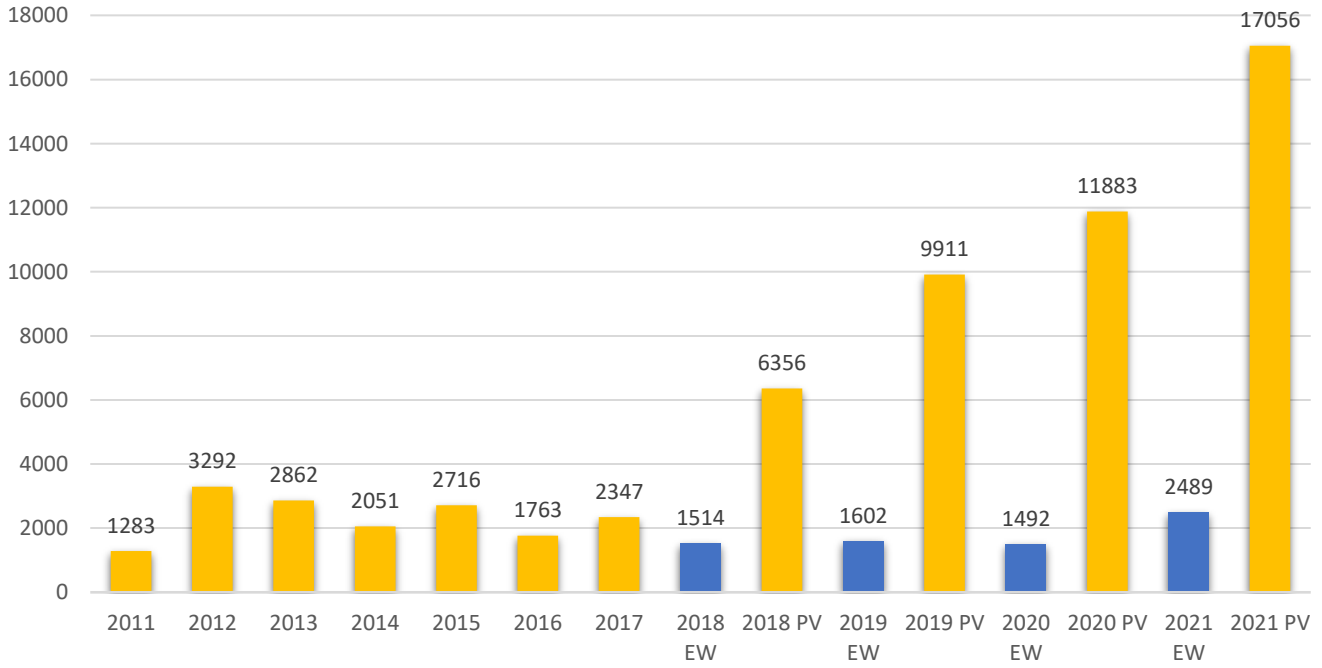
2015
ISO 9001 & ISO 14001
Group

2017
GLOBAL OPERATIONS

2022
15 EMPLOYEES

OPERATIONS - END 2021

TOTAL COLLECTED TONS YTY



Total collected tons PV Panels 2011-2021 all TBS only B2B direct activities: **t 65.320** **+/- 1 GW**

EW = E-Waste

AGENDA

1. THE HISTORY OF PV CYCLE - PURPOSE, GOAL AND REALITY

2. LEGAL BASIS FOR THE END-OF-LIFE DISPOSAL OF PV MODULES IN EUROPE - COLLECTIVE AND INDIVIDUAL PRODUCER OBLIGATIONS

3. ECONOMIC AND ECOLOGICAL EFFICIENCY OF COLLECTIVE COLLECTIONS IN THE DIFFERENT NATIONAL WEEE SYSTEMS

- SUFFICIENT INFRASTRUCTURE FOR COLLECTION
- ALLOCATION OF DIFFERENT MODULE TECHNOLOGIES TO THE RIGHT RECYCLING FACILITIES
- LOGISTICAL CARBON FOOTPRINT

4. ASSESSMENT OF RECYCLING POSSIBILITIES FOR ALL MODULE TECHNOLOGIES

LEGAL BASICS

EPR – EXTENDED PRODUCER RESPONSIBILITY

WEEE – DIRECTIVE 2012 / 19 / EU

TRANSFORMATION INTO NATIONAL LEGISLATION

REGISTRATION OF ALL PRODUCERS/ DISTRIBUTORS AND ALLOCATION OF DISPOSAL RESPONSIBILITY (COLLECTIVE AND INDIVIDUAL)

LEGAL BASICS

DIFFERENT SYSTEMS / APPROACHES IN EU COUNTRIES

- Declaration b2b or b2c Product
- Advance and visible disposal fee for all market participants
- Collective or individual infrastructures for collection and recording
- Use of public / municipal collection structures
- Accredited compliance and take-back systems (monopoly, oligopoly)
- A legal association of producers that only organises and monitors without service contracts (Germany). Operational services through diverse take-back systems.

AGENDA

1. THE HISTORY OF PV CYCLE - PURPOSE, GOAL AND REALITY

2. LEGAL BASIS FOR THE END-OF-LIFE DISPOSAL OF PV MODULES IN EUROPE - COLLECTIVE AND INDIVIDUAL PRODUCER OBLIGATIONS

3. ECONOMIC AND ECOLOGICAL EFFICIENCY OF COLLECTIVE COLLECTIONS IN THE DIFFERENT NATIONAL WEEE SYSTEMS

- SUFFICIENT INFRASTRUCTURE FOR COLLECTION
- ALLOCATION OF DIFFERENT MODULE TECHNOLOGIES TO THE RIGHT RECYCLING FACILITIES
- LOGISTICAL CARBON FOOTPRINT

4. ASSESSMENT OF RECYCLING POSSIBILITIES FOR ALL MODULE TECHNOLOGIES

REQUIREMENT FOR COLLECTION:

EFFICIENT ALLOCATION OF THE COLLECTED PV MODULES TO THE RIGHT RECYCLING PLANT

- Ideal case: at the point of generation (solar installation), the EoL modules are picked up directly and taken to the correct suitable recycling facility.

- Less ideal, but accessible to all owners of EoL modules:at a general collection point installed for smaller disposal quantities, all solar modules are accepted unsorted.

- Sorting task:

    - Directly at the collection point (often lacks competence or authorisation).
    - At a recycling facility that is only allowed to process certain modules (cherry picking or/and conflict with permit).
    - At separate additional places with provision of consolidated transport quantities per module type (logistical need for optimisation).

ASSESSMENT OF CURRENTLY PRACTICED B2C COLLECTION SYSTEMS

- Restrictive acceptance of the public collection points - no definition of a maximum acceptance quantity (poor service for small end users)

Insufficient quality of provision at the public law collection points:

- Mix of all module types provided
- no load securing
- poor communication of volumes to be collected
- unnecessary time pressure (48-hour deadline)

- Many fail tours, permanent redirection of the modules to the right recycling plant (mixed potpourri of Module Types provided and not accepted in the plant)

- Still low official collection volumes for EoL Modules

- Decreasing willingness of manufacturers for voluntary take-back activities

- Despite the obligation to provide proof for end users, no sufficient monitoring of commercial waste disposal, many non-transparent channels due to RE-USE activities that do not comply with the regulations.

AGENDA

1. THE HISTORY OF PV CYCLE - PURPOSE, GOAL AND REALITY

2. LEGAL BASIS FOR THE END-OF-LIFE DISPOSAL OF PV MODULES IN EUROPE - COLLECTIVE AND INDIVIDUAL PRODUCER OBLIGATIONS

3. ECONOMIC AND ECOLOGICAL EFFICIENCY OF COLLECTIVE COLLECTIONS IN THE DIFFERENT NATIONAL WEEE SYSTEMS

- SUFFICIENT INFRASTRUCTURE FOR COLLECTION
- ALLOCATION OF DIFFERENT MODULE TECHNOLOGIES TO THE RIGHT RECYCLING FACILITIES
- LOGISTICAL CARBON FOOTPRINT

4. ASSESSMENT OF RECYCLING POSSIBILITIES FOR ALL MODULE TECHNOLOGIES

Assessment of Recycling options

Focus c - Si and a-si

- Approach to glass recovery (mechanical) with various complementary sensor sorting technologies and further development of recovery options for other materials (semicondictor metals, precious metals)

Other processing technologies (under development)

- Light pulses
- Chemical thermal processes
- Solar Cell Recovery
- Heat knife – Separation of the layers (Mitsubishi Metals)

Other modular types

- Special treatment of CdTe (chemical)Special
- processing of various (CIGS, CIS etc.)
- Downcycling (landfill construction materials)

ANOTHER RECYCLING OPTION IN EUROPE

- Manual dismantling (frame, junction box and cable) with processing of the glass fraction in a metallurgical melting process:
  - Slag buider or heat E qualiser - Use of operating medium = acceptance for recycling
  - Recovery of semiconductor metals, precious metals from the slag = recycling
  - Organic part of the glass/film mass is used energetically - Energy recovery

- Mechanical processing with multi-stage separation and classification processes
  - Application of Glass fraction as a carrier for building materials
  - Partial energetic and material recycling of the plastics

- At present, no particular recycling prospects can be identified for other "non-SI-based" modular types and grades.

MATERIAL AND DESIGN BARRIERS TO RECYCLING

- Particles of the busbards (aluminium) remain in the glass.

- Too fine a grain size after shredding prevents sensor-based detection of foreign particles

Limits for inert glass contents

- Lead : 100 mg / kg (CENELEC EN 50625 - 2 - 4 and TS 50625 - 3 -5)
- Cadmium: 1 mg/kg (CENELEC EN 50625 - 2 - 4 and TS 50625 - 3 -5)
- Selenium: 1 mg/kg (CENELEC EN 50625 - 2 - 4 and TS 50625 - 3 -5)
- Antimony: no definition in a standard but limits for material applications

Recommendations for study:
EURIC REACTION ON THE ENVIRONMENTAL IMPACT OF PHOTOVOLTAIC MODULES, INVERTERS AND SYSTEMS
28 OCTOBER 2021

Thank you very much for attention!

PV Cycle Deutschland GmbH
Ullrich Didszun
Country Manager
Prinzenallee 7
40549 Düsseldorf
T. 0211 52391183
M.0151 15630027
Ullrich.Didszun@pvcycle.org