Global Champions for Advancing Clean Energy – Innovation & Manufacturing

Circular Economy: Impediments and Impetus

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First Solar.

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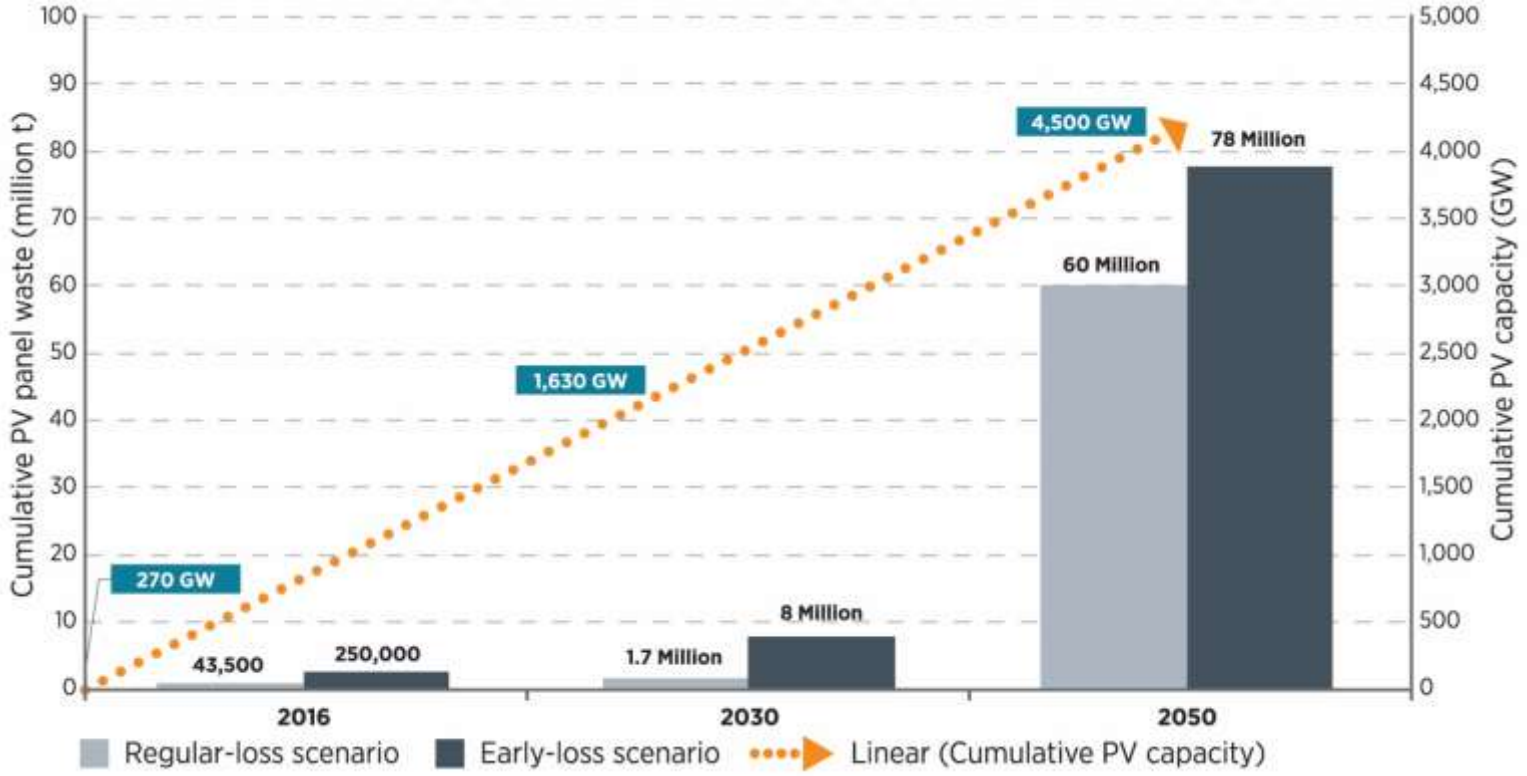
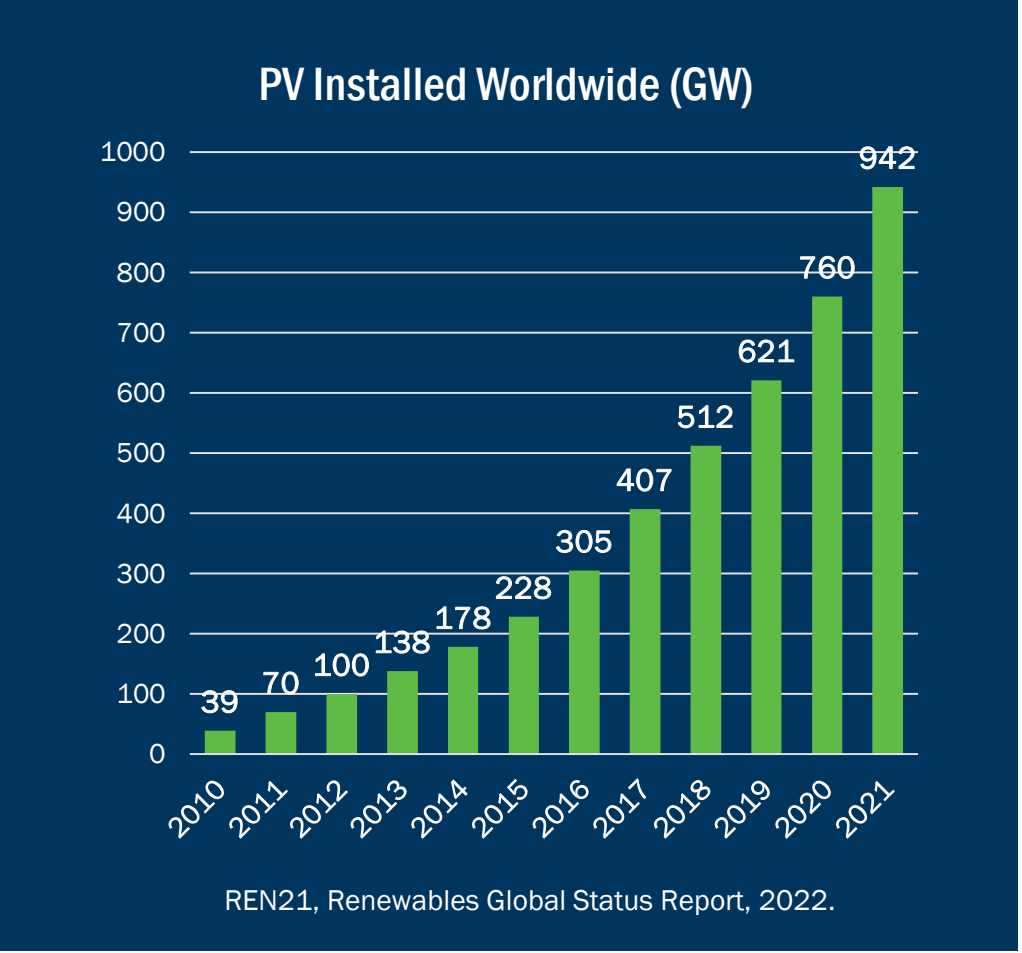
Global PV Panel Waste Projections 2016-2050



IRENA and IEA-PVPS (2016), "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems.



REN21, Renewables Global Status Report, 2022.

Why Does High-Value PV Recycling Matter?

Crucial to managing large future PV waste volumes

- Over 1 TW PV installed worldwide

Recycling is important for all PV technologies

- Environmentally sensitive materials are common in the industry (Pb, Cd, Se, Ag…)

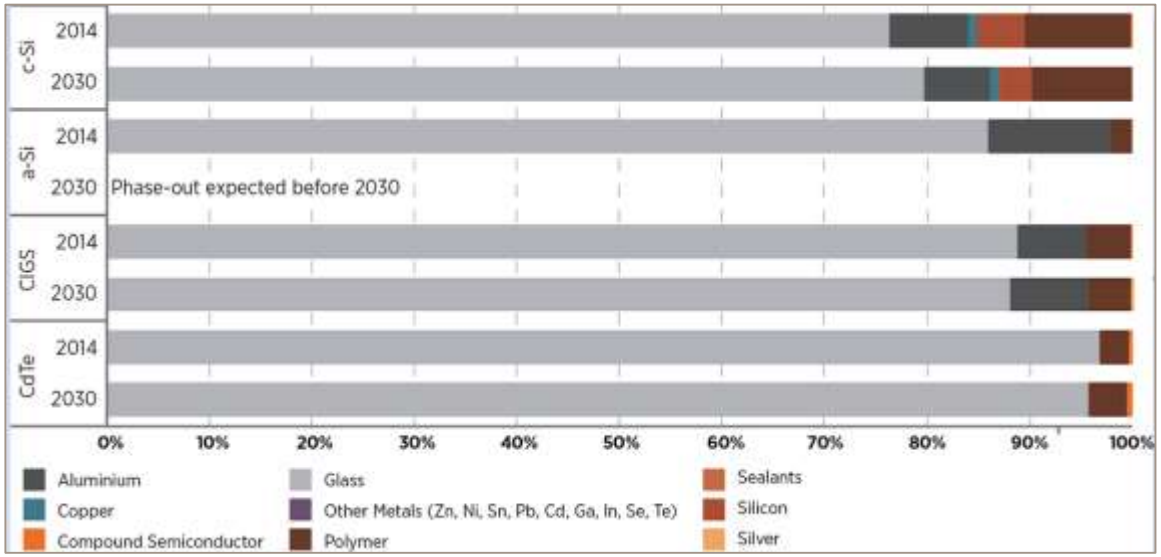
Provides socio-economic and environmental benefits

- Minimizes life cycle impacts
- Reclaims valuable and energy intensive materials
- Creates jobs and economic benefits
- Recoverable value could exceed $15bn by 2050

Recycling maximizes resource recovery and increases the sustainability of PV

Composition of PV modules

- PV modules consist of glass, aluminum, copper, and semiconductor materials that can be successfully recovered and reused
- By weight, more than 80% of a PV module is glass and aluminum
- High-value recycling recovers environmentally sensitive, valuable and energy-intensive materials

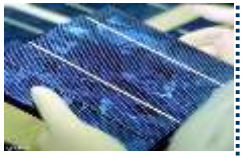


IRENA and IEA-PVPS (2016), "End-of-Life Management: Solar Photovoltaic Panels," International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems.

A Short History of PV Recycling

1st global PV recycling program in the industry

2005



Ökopol Study

2007

PV Cycle Industry Initiative

2007

EU WEEE Directive

2012

U.S. Industry Program

2016

PV Recycling Treatment Standard (EN 50625)

2017

Sustainability Leadership & Recycling Standards

2020/2021

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PV CYCLE

SEIA PV RECYCLING PROGRAM

CENELEC

NSF

epeat

R2

PV EOL Recycling in India

- **PV included as part of e-waste rules in Nov'22**
  - Recycling is the only solution for EOL
  - Extended producer responsibility
  - Reporting obligations to commence by 2034
- **Clarity required from CPCB**
  - Definition of "high value" recycling
  - Finalizing fee structure
  - Qualification of recyclers
  - Market mechanism (PRO?)
  - Interim storage challenges at sites

Additional Topics to deliberate

- Harmonization of PV EOL standards.
- Inclusion of recycling obligations in procurement guidelines
- Create market frameworks that enable financing of recycling expenses
- Identifying technology/implementation partners across regions

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