re-sourcing

First Solar

Effective collection & treatment system for EoL PV modules

Case Introduction: Developing an effective collection & treatment system for “end-of-life” PV modules

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement № 869276

Case Study Learning Objective

- **Learn how** to design an effective recycling system for solar PV modules.
- **Understand the benefits** of an in-house recycling system from an solar PV manufacturer's perspective.
- **Get insights into** the entire recycling process, strategic choices, challenges and success factors.

Case Context

- First Solar offers collection and recyling of their EoL solar PV modules.
- First Solar was the first manufacturer to offer a pre-funded system and has now expanded their system to further financing options.
- They conduct high value recycling to decrease their environmental impact.
- First Solar‘s recycling system contributes to their Social Licence to Operate.
- First Solar is able to decrease the levelized cost of electricity through sustainable product life cycle management.

Good Practice Aspects

1. First Solar provides collection & transport of EoL modules.
2. With available technologies about 90% by weight of solar panels can be recycled.
3. To achieve high recycling rates, design for recycling is considered in the product design and manufacturing processes.
4. When selling solar PV modules, agreements between the customer and First Solar are signed that specify the recycling process of the module.

Challenges Addressed

- Management of waste streams from manufacturing and recycling processes.
- Recycling contracts with customers and financing of the recycling system.
- Constant improvements of recycling system to make recycling economically attractive.
- EHS aspects of recycling process.
- The EU has a recovery target of 85% and a preparation for reuse and recycling target of 80% for solar panels in place & more and more policy makers introduce legislation requiring their collection and treatment.

The Characteristics of "First Solar's recycling system"

- Approximately 90% of glass, metals and semiconductor materials used in a thin-film PV panel can be recovered.
- The semiconductor material can be reused 41 times (~ 1,200 years) before the material dissipates in the losses.
- For the recycling process itself renewable energy is used.
- When EoL-status is reached, First Solar provides collection and transport of the modules directly from the customer's site to their processing centers.
- Different financing models available.
- Cooperation with other sectors, such as glass and rubber industry to ensure optimized reuse of materials.

The Benefits of "First Solar's recycling system"

- Decreasing primary raw material intensity by using secondary materials from their own solar panels.
- Since 2005 technology improvements led to a cost reduction of more than 50%.
- Lower levelized costs of electricity
- Social license to operate
- Recycling contracts with customers guarantee a stable price for a two-year period for the recycling of their PV modules. Afterwards a new contract is offered, enabling the customers to profit from decreasing recycling costs.
- Compliance with recycling regulations of both manufacturer and customer

Content based on information provided on "First Solar"

re-sourcing

How Does the Recycling System Work?

1

Selling solar PV-Modules

- Agreement between customer and “First Solar”.
- At this moment funds are already set aside to cover the collection and recycling costs.

2

EoL-status reached

- Customer is required to inform the manufacturer.
- Customer: dismantling & packaging of the module.
- First Solar: provides packaging material & then collect and transport the module to processing centres.

3

Environment, Safety & Health

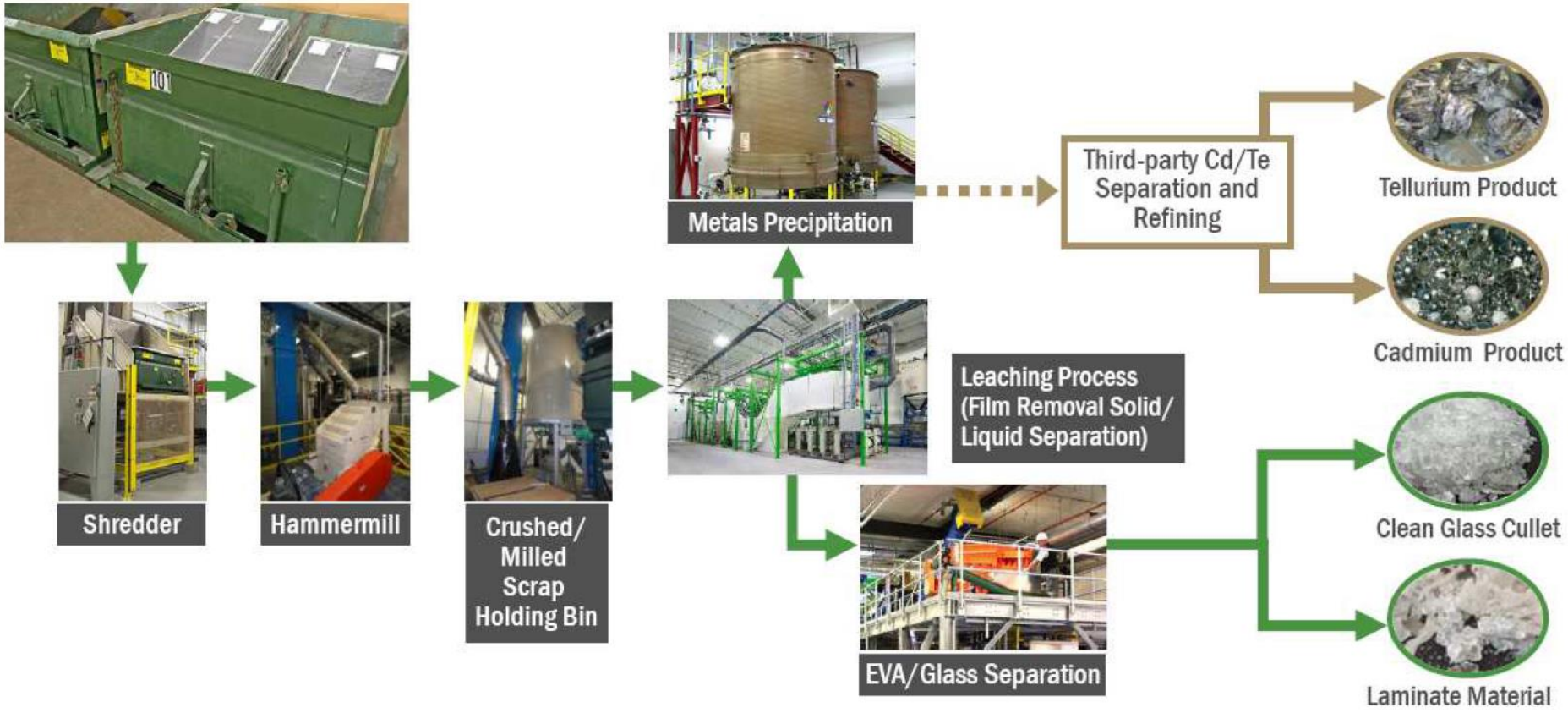
- Cadmium & Tellurium are toxic elements
- All of First Solar’s manufacturing & recycling facilities are certified to OHSAS 18001, ISO 14001, and ISO 9001.
- Air emissions are controlled using a HEPA filter system.
- Since 2018 the recycling plants generate zero wastewater. The water is treated and recirculated into the system.

Content based on information provided on “First Solar”

How Does the Recycling System Work?

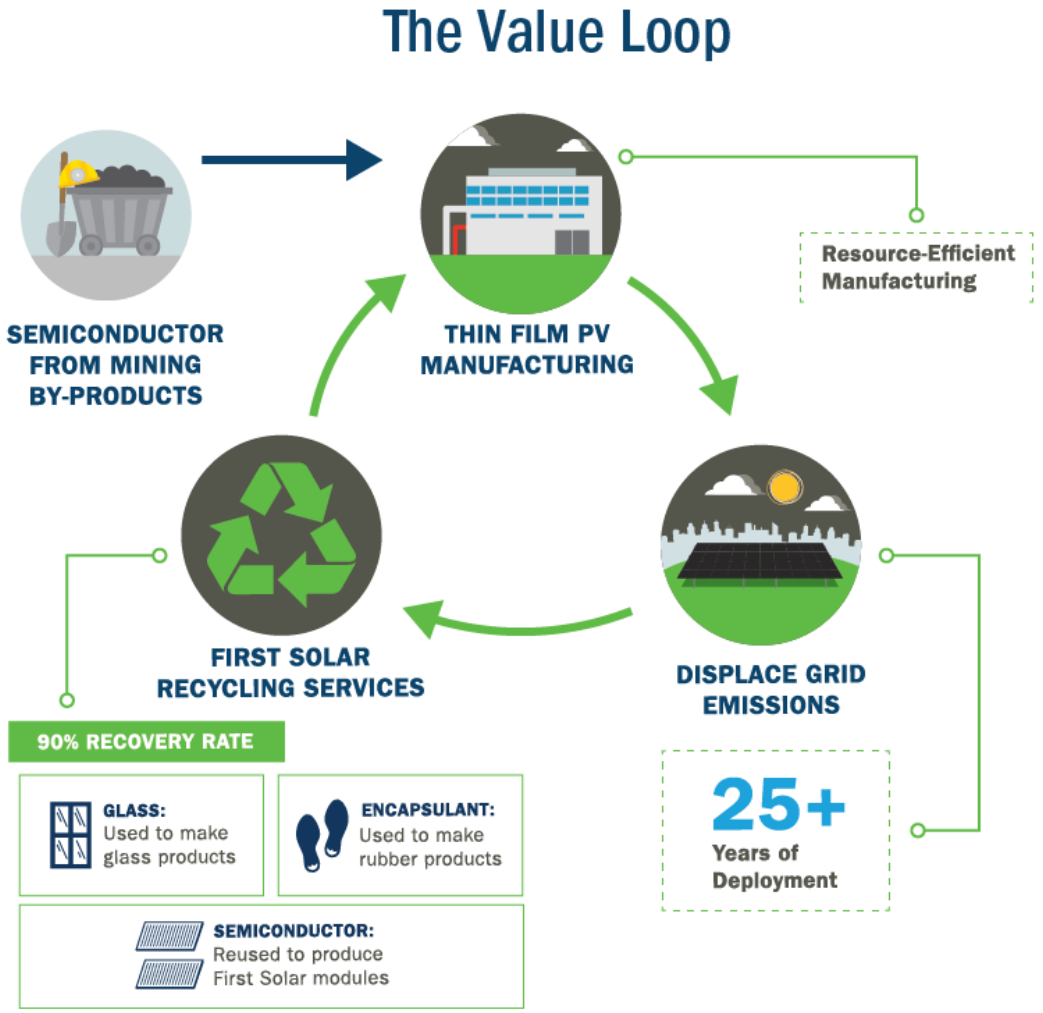
4

Recycling Process



Content based on information provided on "First Solar"

Circularity Approach



TYPICAL RECYCLING RATES

AUTOMOTIVE
~75%

INFORMATION TECHNOLOGY
~45%

FIRST SOLAR MODULES
~90%

Content based on information provided on "First Solar"