

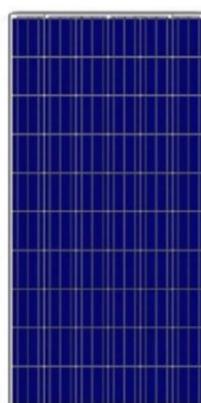
ALTERNATIVES FOR TREATING PHOTOVOLTAIC MODULES AFTER THEIR USEFUL LIFE

WHAT IS THE SITUATION IN CHILE?

Until March 2020, more than 12 million photovoltaic modules have been installed, representing 3 [GW] of installed power connected to the electrical network. They are mainly concentrated in three technologies: Monocrystalline, Polycrystalline and Thin Layer (CdTe).



MONOCRISTALLINE

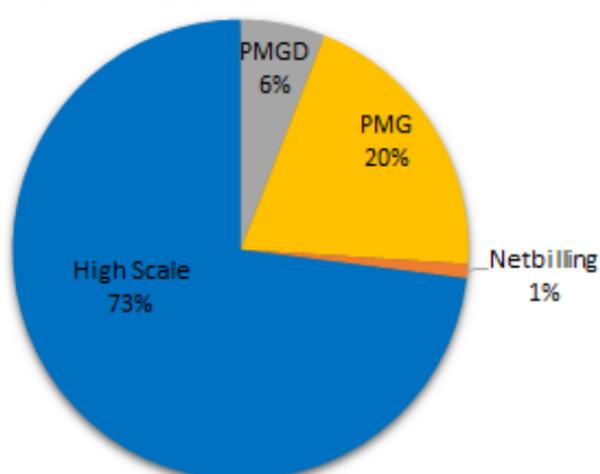


POLYCRYSTALLINE



THIN LAYER (CdTe)

DISTRIBUTION ACCORDING TO TYPE OF PROJECT



WHICH ARE THE INSTALLATIONS IN CHILE?

The study showed that 74% of the photovoltaic modules installed are Polycrystalline, 25% correspond to the Thin Layer type (CdTe) and the Monocrystalline type reaches 1%. They are mostly reflected in large-scale projects and in fewer than Netbilling projects.

AS OF MARCH 2020, CHILE HAS INSTALLED AROUND 12,508,000 PHOTOVOLTAIC MODULES

COMPOSITION AND MATERIALS OF CRYSTALLINE PHOTOVOLTAIC MODULES

78% GLASS

11% ALUMINUM

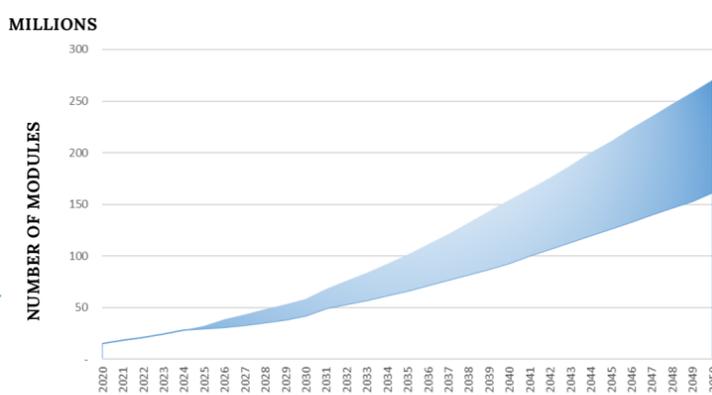
8% POLYMERS

2% SILICON

1% OTHERS

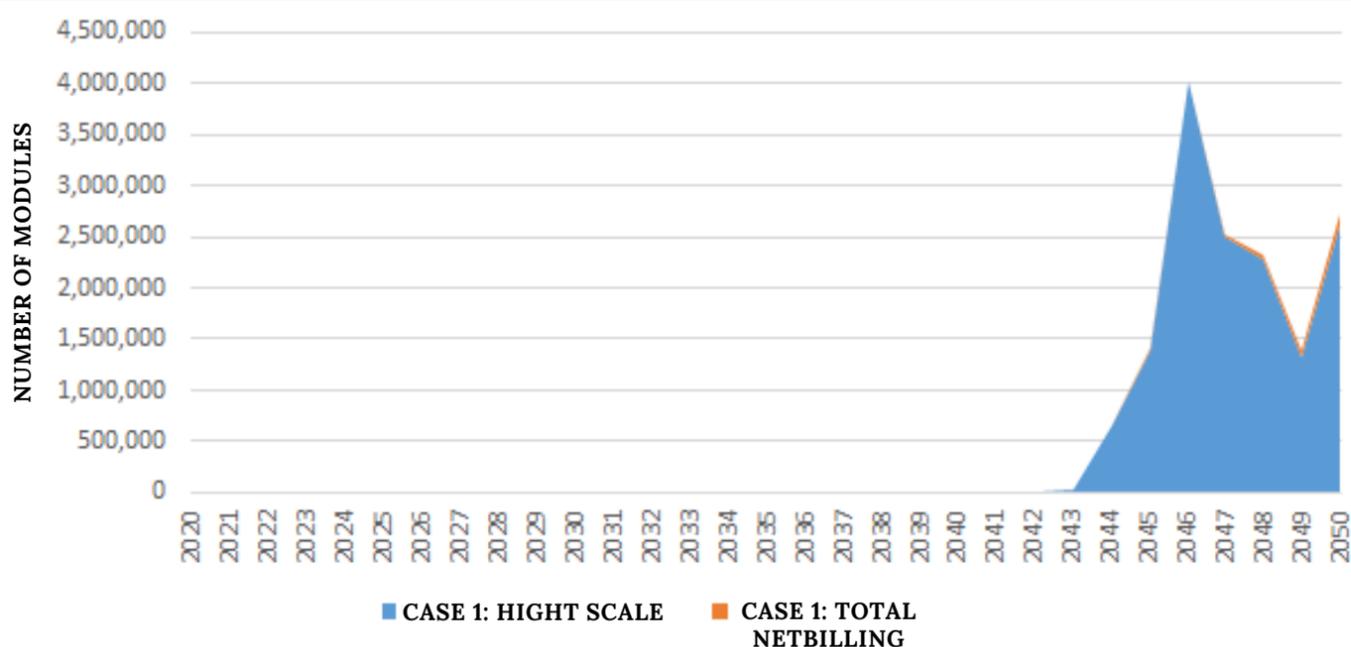
According to the technology existing in Chile today, about 77% of the weight of the photovoltaic module could be recycled

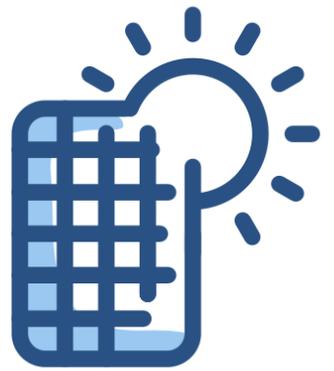
PROJECTIONS OF THE NUMBER OF PHOTOVOLTAIC MODULES IN CHILE IN 2050



Projection according to PELP; according to the development of technology and the power of each module

PROJECTION OF PHOTOVOLTAIC MODULES THAT REACH TO THE END OF THEIR USEFUL LIFE





ALTERNATIVE TREATMENTS FOR PHOTOVOLTAIC MODULES AFTER THEIR USEFUL LIFE

MAIN IMPACTS OF PV MODULE WASTE

- Lead Filtration
- Cadmium Filtration
- Loss of conventional resources (glass and aluminium)
- Rare metals loss

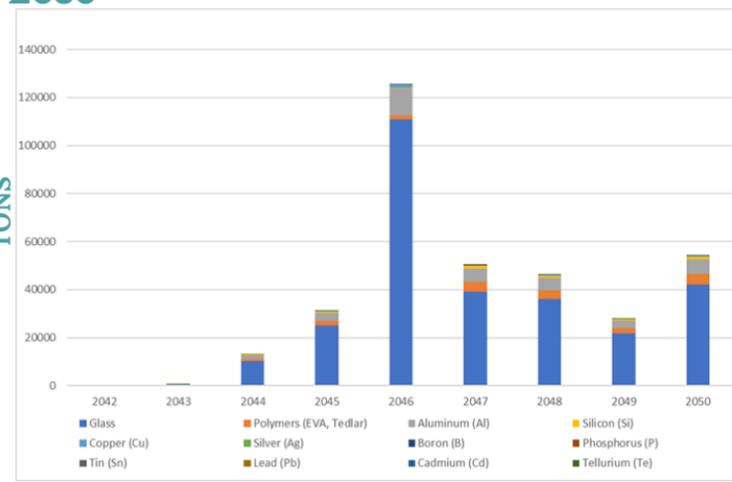
POSSIBLE SOLUTIONS IN CHILE FOR THE TREATMENT OF PV MODULES

DELAMINATION
MECHANICAL
CHEMICAL
THERMAL
OPTICAL

SEPARATION:
MECHANICAL
CHEMICAL

MATERIAL PURIFICATION:
CHEMICAL
THERMAL

TOTAL GENERATION BY TYPE OF PV MODULE WASTE MATERIALS IN CHILE IN 2050



DEFINED USEFUL LIFE TYPES FOR PV MODULES

- Performance warranty according to manufactures: 25 years
- Around 50% of the projects have declared a useful life greater than 30 years
- Financial useful life: Profitability evaluated in a horizon of 20 to 25 years



PROPOSAL FOR THE COLLECTION, TRANSPORT AND STORAGE OF PV MODULES TO CHILE

PICKING

It's proposed that the owners of large plants can be in charge of the delivery of PV panels to recycling centers

TRANSPORT

Guarantee given by the manufactures and distributors of PV panels a system of national coverage for their extraction

STORAGE

Establish the maximum useful life of the photovoltaic panels.
Diagnosis of the potential of reuse that a PV module will have

TREATMENT

The treatment will depend on the recyclability index of each component of PV modules for an intensive recycling High Value Recycling (HVR) or a basic recycling Low Value Recycling (LVR)

CONCLUSIONS AND BENEFITS

An economic benefit is expected for Chile that could reach from 100,000 to 750,000 UF and job creation of more than 1,000 jobs depending on the type of recycling that is done.

Chile has the following challenges to approach the treatment of photovoltaic modules

