ABUNDANT MATERIALS & TECHNOLOGICAL PROGRESS IN THE SOLAR INDUSTRY ENSURE A SUSTAINABLE FUTURE

1.

MATERIALS NEEDED TO PRODUCE SOLAR ARE ABUNDANT

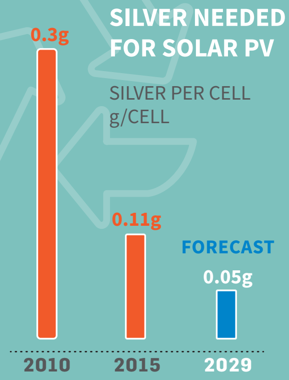
We could power the world with solar by 2050 without material scarcity.

CONCRETE	1%
STEEL	3%
PLASTIC	2%
GLASS	59%
Al ALUMINIUM	13%
Cu COPPER	20%

COMMODITY SHARE NEEDED FOR 100% GLOBAL SOLAR SCENARIO

FIGURE: Commodity material availability for meeting 100% global electricity demand in 2050 with solar. SOURCE: Jean et al., 2015.

2.



SOLAR IS LESS & LESS RELIANT ON RARE & CRITICAL RAW MATERIALS

REPLACED REDUCED RECYCLED

FIGURE: Silver amount per cell, historical data and forecast 2020-2029. SOURCE: ITRPV, 2019.

3.

SOLAR IS CONSTANTLY IMPROVING MATERIAL & MANUFACTURING EFFICIENCY

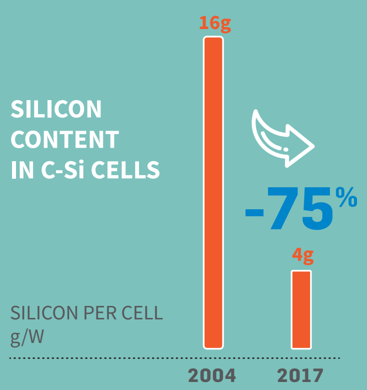


FIGURE: Silicon content in C-Si cells, g/W. SOURCE: Fraunhofer ISE, 2019.

ABUNDANT MATERIALS & TECHNOLOGICAL PROGRESS IN THE SOLAR INDUSTRY ENSURE A SUSTAINABLE FUTURE

1.

MOST ESSENTIAL RAW MATERIALS ARE ABUNDANT AND AVAILABLE

Common materials that are used for building solar panels and systems include steel, concrete, glass, plastic, aluminium and copper. These materials are abundant on our planet and are produced as primary products, therefore their production levels depend on demand rather than supply. Based on their current production levels, it would already be possible to provide enough resources to power all electricity worldwide with solar by 2050. For some commodities – glass, aluminium, and copper – solar may become a major market driver in the future.

Critical raw materials and precious metals are also used in the manufacturing of typical panels and systems, such as silicon and silver. Assuming a reduction is made in the use of silver, as anticipated, meeting 100% of the world's electricity demand with solar would not be constrained by a lack of such materials.

2.

CRITICAL RAW MATERIALS AND PRECIOUS METALS ARE INCREASINGLY BEING REPLACED, REDUCED AND RECYCLED

There are a few critical raw materials and precious metals, such as silicon and silver, used in the manufacturing of solar panels. Most of these materials are gradually being substituted and/or replaced by alternatives. Solar manufacturers are reducing the amount of silver in cells or replacing silver with copper. Between 2009 and 2016, the average silver content of solar cells decreased by 75% and between 2017 and 2027 it is expected to be further reduced by another 60%. In parallel, the amount of critical raw materials recycled and reused will increase thanks to improved high-value recycling processes.

3.

THE SOLAR INDUSTRY KEEPS RAISING THE BAR ON MATERIAL EFFICIENCY

The solar industry is constantly increasing material and manufacturing efficiency, thus helping to overcome material criticality and increasing solar competitiveness. This is being achieved by reducing solar cell thickness and energy use in the manufacturing process, increasing cell efficiency and increasing the use of recycled materials in the supply chain. For example, the silicon content of solar cells has been reduced by 75% from 16 grams per watt in 2004 to 4 grams per watt in 2017, due to more advanced manufacturing techniques. This is expected to be reduced by another 17% in the next 10 years.

Thanks to the existence of various solar technologies, solar power can be generated economically using different natural resources and materials. Therefore, a multitude of options – including PERC, thin film, bifacial, heterojunction (HJT), organic PV, and perovskites – ensures that there is always an alternative, and technology innovation keeps providing new solar pathways.

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