Observatoire Europe-Afrique 2030

Data Sheet « Value Chain »

Data sheet n°5

Photovoltaïc Panels

1. Technologies

Monocrystalline solar panels

Monocrystalline solar panel cells are made by cutting a single block of silicon. The manufacturing process is relatively energy-intensive and costly, but they benefit from high yields, often 20% higher than other types of solar panels. They perform better in low-light conditions, capturing the sun's rays earlier in the morning and later in the evening. Their manufacture from pure silicon crystal gives them a uniform hue ranging from gray to dark blue.

Polycrystalline solar panels
Polycrystalline solar panels are composed of several silicon crystals. They are manufactured from silicon scrap, which is melted, cooled and assembled using a faster, more economical process than monocrystalline panels. As a result, they are less expensive, but have lower yields, averaging 14% to 18%. Polycrystalline solar panels are easily recognized by their non-uniform midnight-blue color.

Amorphous (or thin-film) panels
Amorphous solar panels are by far the cheapest and least efficient solar panels on the market (between 5 and 7%).
This is mainly due to the way they are manufactured. An amorphous solar panel uses just 1% of the amount of silicon needed to create a mono or polycrystalline panel. Here, uncrystallized silicon is bonded to an amorphous material (glass, steel or plastic) to create flexible solar panels. They are dark gray in color. Amorphous solar panels are unique in that they can produce energy with artificial lighting.

2. Manufacturing stages

Today, the vast majority of photovoltaic solar panels are made from silicon.

The first step is to manufacture "metallurgical" silicon. To do this, a mixture of silica pieces (usually quartz pieces) and wood is "reduced". The mixture is then heated to a very high temperature (around 3,000°) before being purified to 99.9999%. The result is solar-grade silicon in the form of "pebbles" or crystals. These are then fired at around 1,450° to create silicon ingots. Once cooled, the ingots are cut into wafers no thicker than 200 microns. In other words, the thickness of a sheet of paper.

Silicon wafers receive an anti-reflective treatment, giving them a characteristic blue color, to increase the amount of light absorbed. They are then doped with phosphorus or boron. The result is cells that, when exposed to sunlight, generate electricity.

Finally, an electrical circuit must be printed on the surface of the wafer so that the collected current can be transferred.

Finally, the cells (between 48 and 72 per panel) are connected, soldered, encapsulated between a glass plate and a polymer layer, and framed to form a photovoltaic panel.

3. Sources of information

Les centrales solaires photovoltaïques commerciales – « Guide à l'intention des promoteurs de projets» - IFC - 2015.
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