



The world of solar energy is constantly evolving, with cutting-edge technologies emerging to make solar panels more efficient, durable, and cost-effective. Two of the most exciting developments in recent years are **Heterojunction (HJT)** and **Tunnel Oxide Passivated Contact (TOPCon)** solar panels. Both offer advanced performance and better energy yields compared to traditional solar cells—but they do so in very different ways.

In this blog, we'll explore how HJT and TOPCon panels work, their key differences, and which might be the better choice for your solar project. Whether you're a homeowner, installer, or solar business owner, understanding these technologies can help you make more informed decisions.

What is HJT solar technology?

HJT stands for **heterojunction technology**, a type of solar cell that combines two different types of solar technologies—crystalline silicon and thin-film amorphous silicon. By merging these two materials, HJT panels are designed to maximize the strengths of each and minimize their weaknesses.

How HJT solar cells are built

An HJT solar cell typically features a **monocrystalline silicon wafer** in the center. This high-purity silicon wafer acts as the base of the solar cell. On either side of this wafer are thin layers of **amorphous silicon**—a material that reduces the number of electrons that get lost during energy generation. This layered structure helps capture more sunlight and convert it into usable electricity.

The full stack usually includes:

- A crystalline silicon (c-Si) base
- Two intrinsic (non-doped) amorphous silicon (a-Si:H) layers
- Two doped layers of amorphous silicon for electrical contact

Key benefits of HJT panels

- **High efficiency:** HJT solar panels can reach up to **26.7% efficiency** in monofacial formats. When configured as **bifacial panels** (which collect sunlight from both sides),

their output can exceed **30% efficiency** when combined with other technologies.

- **Low temperature coefficient:** These panels lose less efficiency in hot weather, making them ideal for areas with high ambient temperatures.
- **Superior longevity:** Thanks to their reduced electron recombination, HJT panels tend to last longer and degrade more slowly than conventional silicon panels.
- **Advanced bifaciality:** HJT technology is naturally compatible with bifacial designs, making it easier to capture reflected light from the ground or surroundings.

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Manufacturing considerations

Producing **HJT panels** requires more advanced manufacturing equipment than traditional panels. While this adds to the upfront cost, ongoing innovation is bringing those costs down, making HJT more competitive.

What is TOPCon solar technology?

TOPCon stands for **Tunnel Oxide Passivated Contact**, and it represents an evolution of the well-known **PERC (Passivated Emitter Rear Contact)** solar cell. It's based on **n-type crystalline silicon**, which naturally avoids some of the performance issues seen in traditional p-type cells.

TOPCon improves upon standard PERC cells by adding a **thin tunnel oxide layer** and a **passivated contact** made of doped polycrystalline silicon. This reduces energy loss due to surface defects and helps electrons move more efficiently.

Key benefits of TOPCon panels

- **High efficiency:** TOPCon solar cells reach efficiencies between **24% and 28%**, significantly higher than standard PERC cells.
- **Reduced degradation:** These panels use **phosphorus doping** instead of boron, which avoids the light-induced degradation that affects other types of panels.
- **Improved temperature tolerance:** Like HJT, TOPCon panels perform well in hot climates, maintaining strong efficiency even under intense sunlight.
- **Greater bifaciality:** TOPCon panels can absorb sunlight from both the front and rear sides, with a high **bifaciality factor** that boosts their total energy output.
- **Easy upgrades from PERC:** Manufacturers can produce TOPCon panels by slightly modifying existing PERC manufacturing lines, making it easier to scale production.

Comparing HJT and TOPCon: which one is better?

Both HJT and TOPCon are leading-edge technologies with significant advantages over conventional solar panels. However, they differ in structure, manufacturing requirements, and ideal use cases.

Efficiency

While both offer high efficiency, **HJT panels can exceed 26%**, and **TOPCon panels typically range from 24–28%**. With added technologies like bifacial design and reflective mounting surfaces, either panel type can be a powerful solution for maximizing output.

Temperature performance

HJT panels have a **slightly better temperature coefficient**, meaning they lose less energy in high temperatures. This makes HJT a top performer in very hot or sunny regions.

Bifacial capabilities

Both panels can be used in bifacial configurations, but **TOPCon panels naturally offer a higher bifaciality factor**, meaning they're better at converting light reflected from the ground into usable energy. This can be especially beneficial in snowy or sandy environments.

Manufacturing and cost

TOPCon has a major advantage when it comes to **manufacturing compatibility**. Since it's built as an upgrade to existing PERC lines, manufacturers can transition more easily and at lower cost. HJT, on the other hand, requires completely different equipment, which can lead to higher initial investments.

However, as more companies invest in HJT technology, those costs are coming down quickly.

Which solar panel type should you choose?

The choice between HJT and TOPCon depends on your project goals and conditions.

- If you're focused on **ultra-high efficiency** and are installing solar in a hot climate, **HJT** might be the better option.
- If you're upgrading an existing **PERC production line** or want a **cost-effective** way to boost performance, **TOPCon** may be your best bet.
- If **bifacial energy generation** is a priority—especially in reflective environments—**TOPCon** panels may offer slightly better results.

Ultimately, both technologies are far superior to standard silicon panels and are leading the charge in next-generation solar energy.

Final thoughts

HJT and **TOPCon solar panels** represent two of the most advanced solar technologies available today. While they approach energy generation differently, both aim to increase efficiency, improve temperature performance, and reduce long-term costs. As solar continues to grow in popularity and importance, understanding the differences between these two technologies can help you make better choices for your solar project—whether it's a small rooftop system or a large commercial installation.

Looking ahead, both HJT and TOPCon are expected to play key roles in making solar energy more accessible and powerful than ever.

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