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**En spaning på internationell
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De solceller som dominerade marknaden år 2022 var kisel- eller silikon-baserade (ca 95% silicon-based cells; mono-Si [82,3%] och multi-Si [12,7%]) och dessa hade blivit billigare. Mycket tyder på att dessa äldre celler kommer att ersättas med en ny generation solceller med bättre prestanda.

De första perovskite-baserade solcellerna togs fram 2009 då forskare från Tohoku University i Japan introducerade dem för omvärlden. Då var tekniken inte särskilt stabil, och omvandlingseffektiviteten så låg som 3,8 procent, jämfört med dagens noteringar på silikonceller, som ofta ligger mellan 19-22%. Solcellslösningar som inkluderar perovskite kommer att bli ännu effektivare. Detta då de absorberar andra spektra av solljus jämfört med silikon. Det är också möjligt att kombinera silikon och perovskite, så kallade tandemceller för att nå ett brett ljusspektrum och därmed mycket hög omvandlingseffektivitet.

I optimistiska prognoser är den nya generationen solceller med ”miracle material” perovskite, lättvikt, flexibel, och mycket billigare att producera, samt har högre effektivitet. Detta bäddar för ett kommersiellt genombrott.

Det finns numera en omfattande och mycket dynamisk forskning i världen på olika tekniska lösningar med perovskite. Till exempel finns det i Sverige forskning på KTH¹, LiU², LU³, UU⁴.

Det är dock inte all forskning som ger kommersiella tillämpningar, men ibland sker det genombrott snabbt. Nedanstående spaning fokuserar på kommersiella genombrott för perovskite inom en snar framtid i hela världen. Den är inte heltäckande, eftersom den enbart bygger på publika källor. Den är dessutom en ögonblicksbild (nulägesspaning) som snabbt kan ändras. Nedan har textutsnitt på engelska återgetts som pekar på satsningar hos många aktuella aktörer. En alternativ lista, som är delvis överlappande, på ca 20 utvecklare av Perovskite ges av Perovskite-info.com⁵.

¹ [Forskare gör framsteg med ny solcellsteknik | KTH](#)

² [Stort steg närmre stabila högeffektiva perovskitsolceller - Linköpings universitet \(liu.se\)](#)

³ [Sn-Pb-mixtures for Perovskite Solar Cells | Lunds universitet](#)

⁴ [Första anslagen till WISE-projekt vid Uppsala universitet - Uppsala universitet \(uu.se\)](#)

⁵ <https://www.perovskite-info.com/companies/perovskite-solar-panels-developers>

Perovskite har redan funnit tillämpningar på vissa nischmarknader såsom ”Displayer” och den är nära ett genombrott för massproduktion på minst följande ställen i världen:

1. **Saule Polen. Commercialization** is coming very **soon**. (02.02.2022)⁶
2. **Voltec Solar. French** solar module manufacturer and the IPVF have announced plans to set up a factory for (4T) tandem perovskite solar panels in France. The first **pilot production line by the end of 2023**. February 2, 2023: In France, the IPVF solar institute has partnered with French manufacturer Voltec Solar to build a solar panel factory that will produce Tandem 4T Perovskite/Silicon cells. The partners aim to **start production in 2025** and ramp up capacity to 5 GW by 2030. (Febr 14, 2023)⁷
3. **HoloSolis, France**. Set up in 2022, HoloSolis intends to open a EUR-700-million (USD 755m) factory with the capacity to produce **10 million solar panels annually**. The production base will be located in Hambach, northern France, and will employ about 1,700 people. It is **set to be put on stream in 2025 and reach full capacity two years later**.
4. **Oxford PV** The company has achieved significant success in the solar market and is planning on expanding its presence via **the introduction of a new factory** to support its lofty goals (Sept 6 2023)⁸
5. **Helio Display Materials** UK has announced it will be moving its perovskite-based display materials (that were jointly invented within Cambridge and Oxford Universities) to **pilot-scale production**. (Dec 08,2023)⁹
6. **GCL System Integration, München**. GCL-SI **has launched a new 320 W perovskite solar module** perovskite solar panel with 16.02% efficiency. The company guarantees that the 10-year end power output will be at least 90% of the nominal output power, which decreases to 80% after 25 years. (June 26, 2023)¹⁰
7. **Midsummer** inked a deal with the European Union Innovation Fund grant to receive €32.3 million (\$34.8 million) to pay for a third of the company’s soon-to-be-built copper indium gallium selenide (CIGS) solar module production facility in **Sweden**. Midsummer currently operates a 50 MW manufacturing facility in Bari, southern Italy, and another

⁶ [Saule Technologies Brings Perovskites To ESLs | Printed Electronics Now](#)

⁷ [Perovskite solar goes commercial as yield gains align with market forces | Reuters](#)

⁸ . ‘All options are open’ on new solar facility location for Oxford PV, says CTO - Solar Power Portal
⁹ <https://www.perovskite-info.com/helio-display-materials-move-perovskite-based-display-materials-pilot-scale>

¹⁰ [GCL-SI unveils perovskite solar panel with 16.02% efficiency – pv magazine International \(pv-magazine.com\)](#)

factory in **Sweden**. The factory is tipped to **produce thin cells suitable for European roofs in the first quarter of 2026**. Midsummer said its long-term goal is to expand the factory's production to over 1 GW by 2030. Swedish thin-film solar manufacturer Midsummer. (Dec 6, 2024)¹¹

8. **QD Solar Inc., Toronto, Canada** - a Toronto-based venture - **3rd party-validated efficiencies** of their single junction perovskite cells among the highest efficiencies ever reported for this material class. (Febr 14, 2023)¹²
9. **First Solar Louisiana manufacturing plant** are expected to **start commercial shipments** by the first half of **2026**. Evolar's laboratory in **Uppsala, Sweden**, will continue to conduct research activity for First Solar. (September 21, 2023)¹³
10. **Tandem PV** - San Jose, **California** - perovskite-specific reliability tests - in (PACT) New Mexico. **The latest step** that seven-year-old Tandem PV is taking **toward commercializing**. (May 27, 2023)¹⁴
11. **Cubic PV**. CubicPV aims to build 10 gigawatts (GW) of wafer production in the **United States**. Solar wafer manufacturer NexWafe recently secured €30 million (~\$32 million) from investors, including Reliance New Energy, to **accelerate the construction of its first commercial-scale green solar wafers production facility in Germany's Bitterfeld**. In parallel, NexWafe will work with one of its other investors Aramco Ventures, on a green solar wafer production facility that will be built in **Saudi Arabia** with participation from the latter's \$1.5 billion Sustainability Fund. (June 16, 2023)¹⁵
12. **Caelux**. The company makes perovskite-coated photovoltaic glass to be used in solar panel manufacturing, and Chief Executive Scott Graybeal said that the new **Baldwin Park facility** (California) will be producing more than 500,000 square meters of the glass **by the end of next year**. (AUGUST 14, 2023)¹⁶
13. **Sekisui Chemical Japan** to mass-produce bendable perovskite solar cells in an effort to catch up with Chinese competitors. **A new manufacturing facility** with an annual production volume of several

¹¹ <https://www.pv-magazine.com/2023/12/06/midsummer-secures-funding-for-200-mw-swedish-solar-factory/>

¹² [QD Solar reports on highly efficient perovskite solar cells developed for large scale manufacturing | Business Wire](https://www.businesswire.com/news/home/20230214005234/en/QD-Solar-reports-on-highly-efficient-perovskite-solar-cells-developed-for-large-scale-manufacturing)

¹³ [First Solar, Inc., First Solar Breaks Ground on \\$1.1 Billion, 3.5 GW Louisiana Manufacturing Facility](https://www.firstsolar.com/newsroom/2023/09/21/first-solar-breaks-ground-on-3-5-gw-louisiana-manufacturing-facility)

¹⁴ <https://supertandem.eu/>

¹⁵ [Solar Technology Provider Cubic PV Raises \\$100 Million - Mercom Capital Group](https://www.mercomcapitalgroup.com/news/solar-technology-provider-cubic-pv-raises-100-million)

¹⁶ [Caelux Opens New Facility - Los Angeles Business Journal \(labusinessjournal.com\)](https://www.labusinessjournal.com/news/caelux-opens-new-facility)

hundred thousand square meters by **2030** (Aug 19,2023)¹⁷

14. The automotive company **Toyota Motor Corp in Japan** and the start-up **EneCoat Technologies Co.**, with headquarters in Kyoto prefecture, have announced a project for the development of state-of-the-art **perovskite (PSC) solar cells**. It is a particular type of lighter and thinner photovoltaic cells than those made of crystalline silicon, and they are also foldable. They are expected to be used in **electric vehicles** already in 2026. According to some rumours, the Japanese **Itochu Corporation** might soon start collaborating with **ZF German Group**, third world supplier of car components, **for the launch of a commercial electric vehicle already in 2026**¹⁸. (Jan 13, 2024)
15. **Qcells, Seoul, South Korea** – will build a **pilot tandem-cell production line** at its Jincheon factory in South Korea. The facility is expected to be operational by **late 2024**. (May 17, 2023)¹⁹
16. **Microquanta Hangzhou**, Chinese perovskite module maker Microquanta has reported 20.2% conversion efficiency on a 20cm², 'third generation' solar cell. The Company said the result had been confirmed by Chinese government's 'China Institute of Metrology'. Perovskite solar developer Microquanta and Xiaer Tela, a company specializing in floating PV applications, recently **signed a strategic cooperation agreement to develop water surface perovskite applications** and various floating solar products. (Jun 05,2023)²⁰
17. **UtmoLight** Wuxi Jiangsu Province, “UtmoLight started research work on perovskite photoelectric technology in 2018....**pilot production lines are also under construction** in an area of more than 5000m² “ (19/08/2023)²¹
18. **RenShine Solar China** plans to bring online a 150 MW **mass production line** at the Changshu Economic Development Zone in **Q3/2023** (October 29 2022)²²
19. **GCL Group Holdings**, a major Chinese solar materials maker, has reportedly begun building '**the world's biggest perovskite solar cell factory**' in the city of Suzhou. The plant's production capacity will reach

¹⁷ [Sekisui Chemical to mass-produce bendable perovskite solar cells | Perovskite-Info](#)

¹⁸ [Perovskite solar cells for vehicle-integrated - Electric Motor Engineering](#)

¹⁹ [Qcells Solar Review: A Solid Manufacturer Expanding Its Reach - CNET](#)

²⁰ [Microquanta Semiconductor | Perovskite-Info](#)

²¹ [Wuxi Utmost Light Technology \(UtmoLight\) | Perovskite-Info](#)

²² [China's RenShine Solar Reports 'World Record' Steady-State Efficiency For Perovskite Tandem Cell Module – EQ Mag Pro – The Leading Solar Magazine In India](#)

two gigawatts, according to GCL Photoelectric Materials (Dec 28,2023) ²³.

20. **Beijing Yaoneng Technology Co. (Auner)**. In early 2023, a pilot production base with production capacity of 2MW of perovskite products was established by Auner in Beijing City of China.... **The first mass production pilot line with a production capacity of 100 MW of perovskite-silicon tandem solar cells will then be launched in 2024**. Focusing on the technology and processing of perovskite cells, Auner is continuously making breakthroughs to lead the perovskite cells and modules in the PV industry²⁴. (MAY 12, 2023)

21. **DaZheng** has sold more than 100 megawatts worth of perovskite panels to customers in China, the U.S. and and Australia, according to the company... Ma's firm aims to **build a factory to produce 100 megawatts of panels a year, and has plans to lift annual capacity to 1,000 megawatts as early as 2025**²⁵.

Andries Wantenaar (Solar Analyst - Rethink Energy) bedömde den 30e oktober 2023²⁶ att "First movers" kommer att bli fem aktörer; Microquanta Hangzhou, UtmoLight Wuxi Jiangsu Province, GCL System Integration München, Caelux Kalifornien, och Oxford PV UK. Han bedömde också ett genombrott för nästan alla aktörer år 2026.

Kina producerade år 2022 ca 78% av alla silikon-solceller. Det är stora svårigheter att bedöma genombrott för perovskite i Kina, bland annat beroende på språkbarriären. Det finns dock ett uttalande i The Japan Times (2023-03-13):

"It's now among at least 14 Chinese entities seeking to add perovskite manufacturing lines"²⁷.

Sex aktörer i Kina finns med i ovanstående lista på 21 aktörer, men referensen från Japan Times, som är svår att kontrollera, indikerar att det är många fler.

Bedömningen som Wantenaar gör avser ca två år fram i tiden. En bedömning som berör en sådan kort tidsperiod, är klart säkrare än en femårsbedömning. Ju längre fram i tiden en framtidsbedömning gäller, desto mer osäker blir den. Wantenaars bedömning verkar också stämma bra med genomgången av information om aktörerna som listats ovan.

²³ [GCL announces new perovskite solar cell plant | Perovskite-Info](#)

²⁴ [30.83%! Auner Sets World Record for Large Tandem Solar Cell Efficiency - PVTIME](#)

²⁵ [China is still backing an elusive breakthrough for solar panels - The Japan Times](#)

²⁶ [Commercial perovskites imminent – pv magazine International \(pv-magazine.com\)](#)

²⁷ [China is still backing an elusive breakthrough for solar panels - The Japan Times](#)