

Recommendations for evaluation of new module manufacturing sources



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Introduction

In recent years requirements for capturing the highest value tax incentives for projects were contingent upon procuring as much domestically manufactured equipment as possible. The initial push was to comply with the Inflation Reduction Act ("IRA"). The current focus is to be in compliance with the Foreign Entities of Concern ("FEOC") rules, which have recently been released. In reacting to these requirements, some foreign module manufacturers began investing in domestic manufacturing locations, both self-operated and via the utilization of contract manufacturers.

Overview

Many standards and best practices provide guidelines for manufacturing and product quality. Additionally, it's widely accepted that cell manufacturing is both the most complicated part of a module to manufacture and has the most potential for innovation. The structure of the process, the organization, and the sourcing may also have an effect on the equipment installed in a PV generating facility. The 2026 PV Module Manufacturing Quality Report from Kiwa PI Berlin, summarizing factory audits, production oversight and pre-shipment inspections in domestic manufacturers, found defect patterns in high-impact processes, including layup precision, lamination integrity and junction box assembly¹. This study will examine what data and information independent engineers would utilize to opine on product quality and reliability.

What questions need to be answered?

Many standards and best practices provide guidelines for manufacturing and product quality. Additionally, it's widely accepted that cell manufacturing is both the most complicated part of a module to manufacture and has the most potential for innovation.

1. Manufacturing

- Is it vertically or horizontally integrated manufacturing?
- Is the process just assembling parts from other sources?
- Are the raw materials or subcomponents sources from the same supplier as the previous international manufacturing location?
- If the raw materials and/or subcomponents are from a new source, does that source have the requisite certifications, audits, and testing necessary to provide confidence in quality and performance?
- What certifications does the manufacturing location have?
- What reputable audits have been performed?
- What is the bill of materials ("BOM"), and has the BOM changed in comparison to the previous international manufacturing location?

2. Testing and monitoring

- Has the BOM-specific product achieved appropriate certifications?
- Is there adequate manufacturing controls, quality assurance procedures, in place and how automated is the process?
- Has the product undergone rigorous testing at a reputable laboratory for the BOM to be deployed?
- Are all of the results and reports provided for review?
- Has the module been tested for the expected mounting configuration?
- Is the third party validated .PAN file generation and report available for review?

3. Operation

- Is there any historical operational data for manufacturing lots from the new manufacturing location?
- What are the useful key performance indicators ("KPIs") do they track for operation?

4. Warranty

- Is the warranty industry standard?
- What is the rate of warranty claim for the supplier and for the new facility?
- What is the supplier's reputation for denying warranty claims?
- What are the exclusions?
- Is shipping included?
- What is the mean time between warranty claim submission and closure?
- Do the warranty terms provide the supplier an option to close a claim with a monetary award rather than equipment replacement?



General recommendations

1. Manufacturing

- Ensure robust requirements under the procurement agreement for testing, certifications, quality assurance, inspections, BOM, etc.
- If manufacturing is vertical, review all the sub-processes. If it is horizontal, review all the sub-suppliers.
- Confirm the manufacturing location has achieved appropriate manufacturing and product certifications including but not limited to ISO 9001, ISO 14001, IEC 61215, and UL 61730.
- Review independent, reputable manufacturing audits.
- Verify the BOM for sub-components, content, and origin for the specific modules to be procured.
- Confirm test results align with the performance from other manufacturing facilities from that supplier, if applicable.
- Confirm the racking and module have undergone compatibility testing and are suitable for the expected site conditions.

2. Operation

- Current U.S. manufacturing capacity is 3.2 GW for cells and 60 GW for modules (SEIA 2025 data)². Ensure a ramped-up manufacturer installation base and distribution record from the new facility to prevent any teething issues.
- Useful operational KPIs include but are not limited to: performance ratio and temperature corrected performance ratio; energy performance index (specific yield / expected yield); field failure rates; and degradation.

3. Warranty

- Industry standard warranties are at least 30-year performance and 10-year workmanship.
- Review of warranty claim rates for the modules to be procured from a supplier can inform spare parts needs, or reliability concerns.
- Exclusions from the warranty should not include any damage or mis-use that could potentially be caused by the supplier.
- Shipping and de-installation/re-installation labor costs are likely to be higher than the replacement modules.
- Closure of a warranty claim with a monetary award rather than equipment replacement may be advantageous to the project.

Conclusion

PV silicon module manufacturing has been dominated by Asia based companies. Geopolitical pressure over the last decade has shifted the landscape, providing both incentives under the IRA and penalties under FEOC. Some added benefits have been realized in the re-shoring efforts, namely a reduction in carbon footprint in procuring equipment for PV generating facilities, the ability to have greater control over quality, and ensuring safe labor practices. Quality control of the U.S. based manufacturing facilities and their processes can be derisked with proper certifications, adequate third-party independent auditing, adequate warranty coverage, high value testing, and consistent manufacturing KPIs. Despite substantial oversight and implementation of such recommendations, only time will allow for enough installed base of modules manufactured domestically in order to provide the necessary reliability and performance data.

References & data sources

- <https://www.kiwa.com>, "The 2026 PV Module Manufacturing Quality Report", Mahyar Mohammadnezhad, Fei Lu, and Don Cowan.
- <https://www.solarpowerworldonline.com>, "The entire solar supply chain has now been reshored in the US" By Kelsey Misprenner, October 29, 2025.