

Automated PV production

Quality control; automated string testing cell



Automated Assembly Propelling Solar Panel Productivity

By Tim Metko | Photos courtesy of KUKA Systems

At the beginning of the 20th century, Ransom Olds patented the first industrial assembly line and Henry Ford accelerated it, but it was another seven decades before robots began performing most mind-numbing tasks like welding and painting. By contrast, manufacturers of photovoltaic panels have had the ability to automate virtually from the get-go. With the relentless downward pressure on PV panel manufacturing costs—the \$1 per watt barrier was breached last year—full-line automation is becoming indispensable for assembling PV modules in Europe, Japan, and North America.

Competition from developing countries is becoming a major factor because of their highly competitive wage rates. Automation can shrink that labor cost gap significantly and allow other advantages, like incentives or proximity to customers, to level the playing field. It also goes hand-in-hand with capturing ever-larger economies of scale. Yesterday, plants assembling 25 megawatts (MW) of PV panels annually were considered large. Today, large is 100 MW to 200 MW and rising.

Automation generates fast payback

As a general rule, a 50 MW plant is about the threshold where automating module assembly becomes economically compelling. In the 25MW area, the utilization rate for a fully automated module assembly line would be just 55% to 60%. But at 50 MW, utilization jumps up to the mid-80% range and increases from there. A pair of parallel lines with a combined capacity of 150 MW, sharing one pack-out station, can reach as high as 95%. The fastest 100 MW line in the world produces a finished panel every 28 seconds.

Another example of a 100 MW line in the US, employing 200 workers in manual production, if fully automated could run by 17—with an annual labor cost savings of \$12 to \$14 million. Every situation is different, but it takes about 24 months on average to receive a complete payback on an investment in full-line automation.

Automation of all PV module assembly functions

Full line systems integrators trace their modern origins to the advent of industrial robotics, equip standard robots

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with specialized end effectors (the sophisticated tools on the robot arm), and the necessary software to create robotic work stations to perform specific module assembly tasks. A typical fully automated module line installed would feature automated glass-loading, string measurement and layup, foil layup, lateral soldering, trimming and taping, as well as a series of automated cell, matrix and panel tests, and final pack-out.

When automating an entire module assembly line, the integrator supplies and integrates the various work stations and other manufacturing and testing equipment, as well as all gantries and conveyors. It designs all control and power systems to optimize a line's performance, just as in other industries. That foundation of mature technology and decades of accumulated expertise has enabled integrators to adapt full-line automation to assembling all types of PV modules. It works equally well with thin-film or crystalline silicon cells, solid or liquid encapsulates, and any layout processes while complying with all electrical, noise, safety, and quality standards.

Automation delivers quality benefits

Automated assembly is ergonomically superior and produces higher quality product than a manual operation. Robots will routinely hoist and rotate glass or modules, as large as 1.4 x 1.2 meters, and have even handled modules 2.5 meters square. Automation also means less breakage, fewer defects, and greater consistency for a more reliable panel. Automated inspections can detect micro-cracks in cells that visual inspections miss, cracks that might only become a problem months or years later.

Without automation and inspection criteria in place, one might never catch a micro-crack that would have to be reworked or replaced in a panel in the field—and who knows how much that would cost to troubleshoot and resolve.

Kuka Systems is a full line systems integrator in Sterling Heights, Michigan.

Kuka Systems

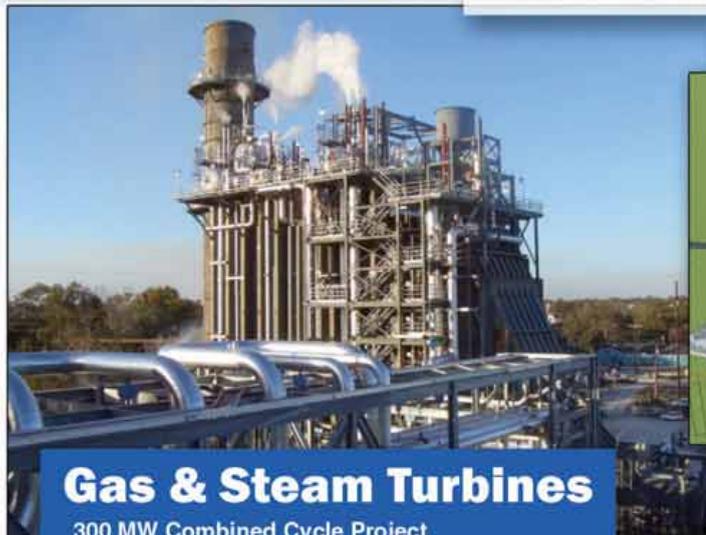
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