

Courtesy of Bosch Rexroth.



Solar Energy

THE ALTERNATIVE ALTERNATIVE

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While gear and bearing manufacturers engage in a wind energy arms race, the robotic automation industry has its sights set directly on the sun. Solar power—wind energy’s somewhat neglected step brother—has been gaining ground in alternative energy since 2001.

Robotics companies can provide solar cell wafer handling, panel and module assembly, spraying, inspection and packaging processes to solar manufacturers. In a market that handles delicate materials like mirrors, panels and small components, robotic automation will see plenty of growth opportunities in

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the next five to 10 years, and the power transmission industry is starting to pay attention.

“Robotic automation is a perfect fit for solar manufacturing applications because [robots] help manufacturers improve productivity by reducing scrap and rework, improving product quality and reducing the labor required to manufacture the products,” says Keith Fox, business development-alternative energy at ABB Robotics.

“The industry and processes are evolving so rapidly that flexibility in capital investment to manufacture the product is key to the solar OEM’s ability to survive,” adds Chris Blanchette, national distribution account manager at FANUC Robotics America, Inc. “The ability to utilize the same equipment for the manufacturing process will significantly reduce the changeover time and the cost associated.”

Robotics and Solar: Two Peas in a Pod

FANUC has been involved to some degree in solar power manufacturing since the early 2000s, from the production of raw silicon material to the assembly of completed solar panels.

“We increased our involvement as the industry evolved and demand for the products increased,” Blanchette says. “As the demand has grown, there has been a need to shift to more reliable, repeatable and faster mechanisms of manufacturing.”

Currently, FANUC has more than 200 robot model variants designed to suit an array of application needs as well as engineering experience to help guide the selection process. The company continues to develop products to serve growth industries like solar manufacturing, so it can respond with developments supportive of the processes required. These include unique integrated intelligent-based options that are built into many of their robotic systems.

“Some of these developments have features like vision, force control, and accuracy tools,” Blanchette says. “These built-in features allow users to process parts with much less difficulty in programming and at a lower cost. Because

FANUC has a large development team right here in North America, we are very quick to react to process needs that require product changes or new options.”

ABB Robotics first became active in solar panel manufacturing in Germany in 2005 when manufacturers were looking to increase throughput and quality as well as reduce overhead costs.

“We provide a number of products and solutions for solar panel system builders, integrators and manufacturers,” Fox says. “This includes six-axis articulated robot products with lifting capacities that range from the new IRB120 with a 3 kg lifting capacity to the IRB7600 robot that features a 500 kg lifting capacity.”

In addition, ABB has a unique second-generation, four-axis robot, the IRB360, which is typically utilized for wafer and cell handling. ABB has developed three standard manufacturing cells for the solar manufacturing industry including an automated robotic bussing station, an automated robotic panel trimming and taping cell and an automated robotic framing station.

According to both companies, the growth in the solar industry in the last three years has been relatively significant in Europe and Asia. In 2009, the market has begun to pick up in North America.

“With help from the economic stimulus fund and government direction for green energy, the solar market in North America is ramping up rapidly,” Blanchette says. “Solar power manufacturing has been one of the top three growth areas this year at FANUC.”

Fox has noticed the solar market expanding outside of Europe today more than ever with growth areas in North America, South America, China and India.

“To date, ABB has seen a lot of activity that revolves around the American Recovery and Reinvestment Act as well as our government’s incentives,” Fox says. “However, it has taken a while for the activity to turn directly into ‘real’ opportunities. With that being said, it looks like we are in for a busy 4th quarter and are looking forward to the opportunities in 2010.”

And the optimism couldn’t come at a better time. Many robotics companies are still trying to bounce back from the shaky collapse of the automotive industry.

“The North American automotive sector has declined dramatically over the past year with the bankruptcy announcements by Chrysler Corp and General Motors,” Fox says. “But we’ve seen dramatic cutbacks by all automotive manufacturers including Toyota, Honda and other transplants that are manufacturing vehicles here.”

Blanchette notes that solar power gives robotics companies an additional opportunity outside their automotive comfort zone, though many aren’t ready to pull the plug on the Detroit Three quite yet.

“We’ve seen some decline in the automotive and related industries, but we fully expect that these sectors will recover over the next few years. We see solar market opportunities as an expansion of our current business and not a replacement for traditional business.”

The topsy-turvy marketplace won’t keep companies from searching for growth potential in areas like alternative energy.



FANUC has incorporated vision, force control and accuracy tools into robotics used in solar manufacturing (courtesy of FANUC).



ABB Robotics provides diverse robotic solutions for solar PV lines (courtesy of ABB).

“Solar manufacturers can see positive results by incorporating robots into their manufacturing processes as early on as the development stage of the product. Having robotics perform many of these processes generates consistency in the final product,” Blanchette says. “We’ve had many startup companies purchase robots specifically for this purpose. Adding robotics to the mass manufacturing process also helps to reduce the time it takes to get into production because the processes can be predicted and optimized more quickly.”

Typically, the capital payback for solar manufacturers that incorporate robotics is between 12–18 months.

“This does not include the immediate impact on scrap savings and a reduction in warranty costs once the products have been sold,” Fox says. “This market is another avenue for ABB to sell its products and services. Additionally, it provides us a new customer base that can provide feedback for robot products that are needed in the marketplace, but not yet engineered.”

Industry Specific Applications

One doesn’t need to be a robotics company to find opportunities in solar energy. Companies like Bosch Rexroth and SKF have been keeping a close market watch on solar manufacturing as well, offering a variety of tools to complement the industry’s various needs.

For Bosch Rexroth, the plan is to offer custom automation support to clients involved in solar manufacturing since standard solutions are rarely enough to get the required results. This is especially the case in filigree handling systems where more often than not special machine construction

and standardization are considered incompatible. Handling system operations that include gripping, lifting, rotating, positioning and placing are usually never undertaken by a complete system.

Bosch Rexroth has recently changed this trend with a partnership between Schiller GmbH & Co. KG of Sonnenbühl, Germany. Schiller develops automation solutions in the production of solar cells. In order to achieve accuracy requirements for individual handling systems, the company incorporated Bosch Rexroth’s Cartesian Motion building system, called the camoLINE, a modular system that covers common handling tasks with linear motion, assembly, pneumatics and drive and control technology.

In a case study by Rexroth, Karl Letzgas, chief designer at Schiller explained the benefits of the handling system.

“With this system we can guarantee repetitive accuracies of 0.02 mm and in particular stress-free handling of sensitive cells.”

This was accomplished by interlinking 18 process modules, including de-stacking and transport of the blanks, loading and unloading of the process stations, precisely aligning the cells, inline quality checks and sorting into power ratings, through to magazinging of the finished solar cells.

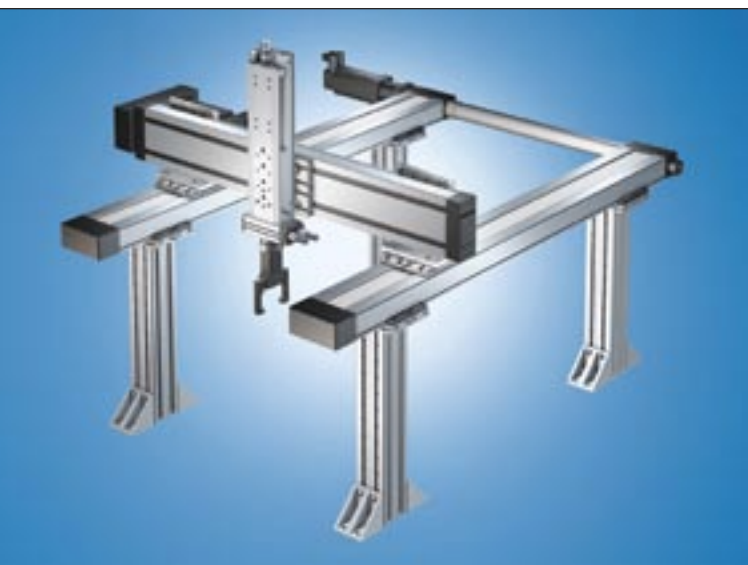
“We can now achieve a level of accuracy in the basic structure that we could previously only obtain with specially milled parts,” Letzgas adds.

Stress-free handling is the key to the process, as the slightest stress could shatter the solar cells. Splinters can also contaminate and damage the system; therefore, special

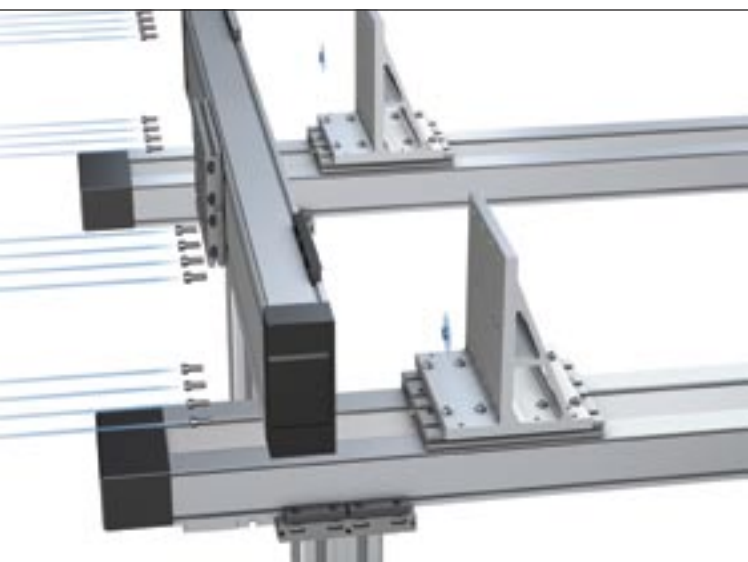
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ABB sees the solar market as a growth opportunity to expand its customer base (courtesy of ABB).



Bosch Rexroth worked with Schiller GmbH on the automation of solar cells using its camoLINE modular system (courtesy of Bosch Rexroth).



Bosch Rexroth's camoLINE offers multiple modular systems to fit Schiller's solar manufacturing needs (courtesy of Bosch Rexroth).

motion profiles have been implemented for safe cleaning.

Since the manufacturing of solar cells needs more than individual modules to fulfill the requirements, Rexroth's camoLINE has been a great fit for solar applications.

"On completion of the concept phase we are up to 30 percent faster with such components in the subsequent project design phase by using this modular building system," Letzgus says.

The camoLINE product offers electrical and pneumatic axes, connecting elements and profile struts, ball screw assemblies for high positioning accuracy and toothed belt drives. Depending on customer requirements either servo or stepping motors can be used with integrated belt drive or planetary gear.

"Even once we have developed a modular system with which the customer can realize complex tasks completely independently, we would never leave him in the lurch," says Ralf Schirmer, sales representative at Rexroth.

Schiller was able to combine aluminum profiles, linear motion systems and electric and pneumatic drives thanks to this collaboration.

"We have achieved a high-precision and stable supporting system for the first time by using intelligent connection technology," Letzgus says.

Also, the shorter response time to changes made in the outline conditions makes it considerably easier when it comes to meeting the deadline for commissioning the solar cells.

"In a simultaneous engineering process we have actually realized the various handling modules being carried out by the customer," Letzgus adds.

Companies like SKF see solar energy as a business venture that will allow them to offer complete system solutions across the board.

"SKF has been monitoring growth opportunities in solar power with significant annual growth rates across the various solar technologies" says Mahdi Sebti, global business development-renewable energy at SKF. "With SKF's multi platform strategy, SKF can offer a complete array of tracking solutions to the market including bearings, lubrication and lubrication systems, sealing solutions, mechatronics, which include actuation systems, and service."

The company is focusing on solar tracking components and systems, developing the controller and modifying the satellite actuator product for solar energy collectors, a technology that will maximize energy from solar cells by enabling them to accurately track the sun. They've even dedicated team members to seek out specific solar energy applications where SKF can provide optimal results.

"SKF is supporting this growing industry through development activities with some key market players, which consists of design development, design optimization, design validation, problem solving, as well as engineering consultancy services" Sebti says. "SKF is looking at providing reliable solar tracking solutions through the integration [of] its 100 years of engineering knowledge, multi platform capabilities, and its more recent renewable energy experience. SKF's value offerings consist of bearings, sealing solutions, lubrication solutions, and actuation systems (mechatronics)."

Much like the robotics organizations, SKF is prepping

for a surge in solar energy on a global basis, which could be supported by their global developments centers and global manufacturing footprint.

The Sun Will Come Out

Though the economic downturn took some of the buzz away from growth opportunities in alternative energy, the general consensus is that wind, hydroelectric, geothermal and solar will be just fine in the long run. The largest solar trade show in North America, the Solar Power International 2009 takes place from October 27–29 in Anaheim, California, covering the entire supply chain including photovoltaic, solar thermal and concentrating solar. As the general economy picks up, so will new energy business.

“925 companies from the solar value chain sold out the exhibit floor at the Anaheim Convention Center, reserving a record 203,900 net square feet of floor space. In 2008, Solar Power International had 422 companies occupying 88,000 net square feet of floor space,” says Monique Hanis, spokesperson for the Solar Energy Industries Association. “Solar can be deployed in a variety of ways from distributed generation to utility-scale with a variety of technologies that accommodate different climates and locations. It works in all 50 states and the public is unanimously supportive of expanding our nation’s use of solar, more than any other energy source, traditional or renewable.”

Neal Lurie, director of marketing and communications for the American Solar Energy Society, says solar energy is a multi-billion dollar industry that has been growing steadily since 2001.

“Currently, manufacturing production capacity and supply exceed demand due to the recent economic downturn,” Lurie says. “This has put downward pressure on solar prices and decreased profit margins. But lower prices will boost demand in the months ahead.”

Both Lurie and Hanis see a manufacturing renaissance in fields dedicated to solar energy applications.

“Manufacturing automation will be a core part of solar production and solar installation will continue to be a more labor-intensive process,” Lurie says. “The industry offers tremendous long-term opportunities for robotics companies.”

“Many photovoltaic manufacturers are implementing similar manufacturing processes and techniques used in the semiconductor industry,” adds Hanis. “Equipment manufacturers from semi have moved into PV, like Applied Materials and Oerlikon, bringing their expertise to the emerging U.S. solar market.


“Several new plants will be built in the United States over the next one to five years. There will also still be the need for labor in construction of manufacturing plants, construction of utility-scale solar plants and installation of rooftop and ground-mounted solar energy systems,” Hanis says.

Lurie notes that many experts fully expect that the U.S. will be the world’s largest solar market by 2013, if not sooner. “By then, prices will be on par with (or lower than) fossil fuel prices, without government incentives in the next four to eight years. Once that happens, growth will only accelerate.”

And when the big players get involved, that’s when the industry really begins to gain some momentum. General Electric recently announced plans to produce a thin-film solar

cell material made from cadmium telluride at the EmTech conference at MIT.

In a luncheon presentation at the conference, Michael Idelchik, vice president of advanced technologies at GE Global Research, explained that solar would be the next wind at GE. “It’s not there yet, but it’s moving very rapidly.”

By 2030, these opportunities in solar energy are expected to double. Seems like the perfect time to pay a little more attention to the sun. 

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