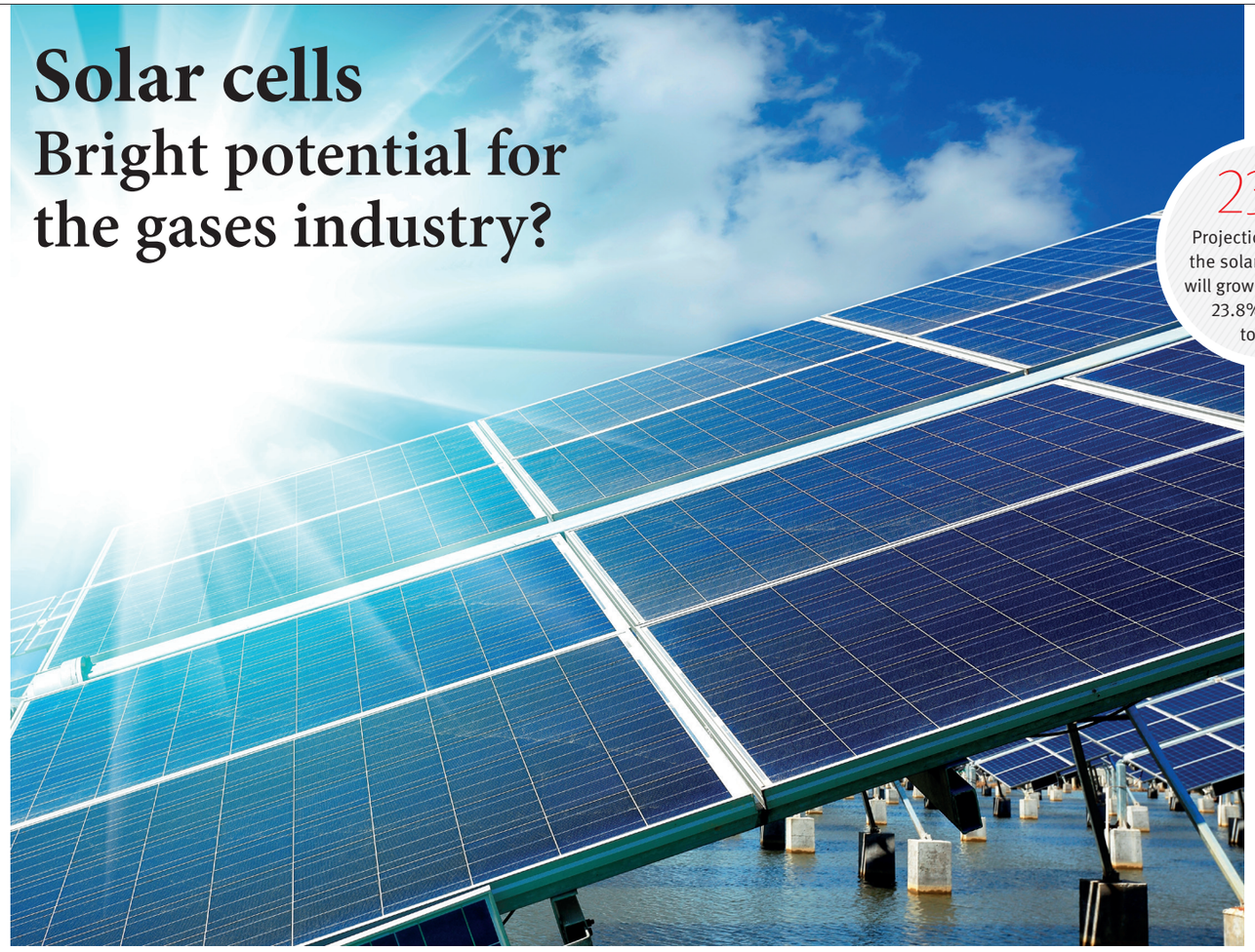
HOT TOPIC

Solar cells
Bright potential for the gases industry?



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When Linde announced in mid-March that it had been awarded multiple gas and chemical supply contracts for a number of world leading photovoltaic (PV) cell manufacturer's first plants in South East Asia, it threw fresh spotlight on the potential that this market affords.

Although specific companies – and how many – were not disclosed, it is understood that the Tier One business will provide materials and engineering solutions to deliver high-value advantages to customers in the competitive PV Asian market. Expansion in the PV industry is moving quickly in countries such as Thailand, Malaysia and India, and cell manufacturers are taking advantage of the growing markets.

This is affirmed in recent research reports from both *Grand View Research, Inc.* and *Research and Markets*, each offering bullish growth expectations for the global solar cell market, **gas**world found. According to the former global solar cell industry is expected to reach over 1,087.0 GW by 2022, with emerging economies including China, Indonesia, India and Japan expected to experience significant growth in the market – owing to supportive government programmes and policies – over the next seven years. Meanwhile, *Research and Markets* projects the global solar cell market as poised to grow at a compound annual growth rate (CAGR) of around 23.8% during its study period from 2015 to 2025.

So what's driving growth? Increasing demand for electricity, coupled with rising consumer awareness regarding the environmental benefits of renewable energy sources, are the overriding factors driving growth in the solar cell industry, according to *Grand View Research*. Stringent government regulations in various economies to encourage the use of solar energy through incentives and feed-in-tariffs is also anticipated to drive demand.

Further still, technological advancements have led to efficient performance and reduction in the manufacturing cost of the cells, which is naturally fuelling growth as the economics become such that it is too compelling not to drive this market forward. Moreover, rising demand for eco-friendly energy sources in order to reduce dependence on fossil fuels and achieve energy security is expected to propel growth over years ahead. Solar was among many 'environmental' technologies cited for improved policy support in China's latest five-year plan, for example, unveiled in March.

All of which is fuelling such growth expectations for the market and, in turn, positive projections for industries such as the gases business.

International supply chains

Multi-crystalline and monocrystalline, which form the silicon wafer segment, contributed to an overall market share of approximately 90% of aggregated installation capacity in 2014, according to the report from *Grand View Research*.

Such are the properties of monocrystalline solar cells, including stability, high efficiency and compact design, that demand for these products is expected to propel over the next seven years in both emerging and developed markets alike. Multi-crystalline silicon cells are projected to witness rapid growth exceeding 25% in the report's forecast period, owing to the simple production processes that are leading to reduced costs. The Asia-Pacific region is expected to be a major market for multi-crystalline solar cells owing to their demand in residential and commercial applications and increasing consumer awareness regarding cost efficiency of the product.

All of which is good news for the gases industry. Air Liquide has previously made considerable investment in the development of crystalline solar cell manufacturing technologies, acquiring Silexium™ coating technology and associated IP from Sixtron, a Canadian company, in 2011 and inaugurating a dedicated R&D laboratory for such technologies in Plateau de Saclay, near Paris, France in 2012. The company has been the world's leading supplier of gases, advanced molecules and services for the solar industry for a number of years.

Now, Linde is another high-profile example of a gases company riding the crest of the wave in PV technologies. Linde offers the complete portfolio of gas and chemical products required for PV processes, with typical bulk gases used including nitrogen, hydrogen, oxygen, argon and occasionally helium, whilst a long list of specialty gases are also needed such as silane, ammonia, nitrous oxide, carbon dioxide, methane, hydrogen fluoride, phosphine and diborane.

Additionally, Linde provides a full range of wet chemicals, including high-purity aqueous acids, bases and etchants for the market, together with its subsidiary Asia Union Electronic Chemical Corporation (AUECC), which has manufacturing sites in China and Taiwan.

With its multiple contracts revealed in March, Linde will provide those companies with international material supply chains and will build the necessary gas and chemical distribution systems through these new links. Such build-out will likely proliferate across the industry in the years ahead if the solar cell market's growth potential is realised as projected through to 2022, while the exploration of new PV technologies may also drive a whole new wave of growth for the gases industry.

23%
Projections suggest the solar cell market will grow at a CAGR of 23.8% through to 2025

Research and development aimed at incorporating magnetic nanoparticles in manufacturing solar cells owing to enhanced performance is anticipated to open new avenues over this period, according to *Grand View Research*, while Oxford Photovoltaics Limited (Oxford PV) believes it has new technology at its fingertips that could transform solar power generation and potentially open up new market growth.

Oxford PV was founded in 2010 as a spin-out from the University of Oxford in the UK, focused on the commercialisation of new technology for thin-film solar cells, and Co-Founder Professor Henry Snaith was amongst the first to recognise the potential of a chemical structure called perovskite to act as a low-cost, highly efficient solar cell absorber material to convert sunlight into electricity.

As the first mover in leading the commercialisation of perovskite technology, Oxford PV is naturally confident in the structure's potential to transform the market, as Chief Technology Officer Chris Case told **gas**world, "Within the next three years, experts, and myself also, believe, the cost of PV generated electricity will be below the marginal distributed cost of electricity by any other means, anywhere in the world. At that point, PV growth is unstoppable."

"If solar PV were to continue to grow at the most recent 42% CAGR, by 2030, all energy could be produced by photovoltaics. Of course, maintaining that growth rate is unrealistic."

"However, when combined with silicon wafers as a tandem solar cell, perovskite technology offers more energy per unit area," he explained. "In the longer term, perovskite solar cells can accelerate the transition to an all-electric economy, whether that is 2030, 2050 or beyond."

What could all of this mean for the gases industry? Though not appearing to offer any stark additional uplift in gas demand, Case points out that the same base silicon cell would be required as part of any perovskite-enabled solar cell and so, therefore, would the same specialty gases used today. "A silicon cell would be required as part of any perovskite/silicon tandem solar cell. Silicon PV cell production is quite chemical and gas intensive and one should expect increasing demand for gases such as silane, trichlorosilane, and phosphoryl chloride."

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