



NEWS RELEASE

Solar Frontier Sets Thin-Film PV World Record with 20.9% CIS Cell

Fraunhofer Institute verifies new CIS conversion efficiency breakthrough

Tokyo—April 2nd, 2014 — Solar Frontier, in joint research with the New Energy and Industrial Technology Development Organization (NEDO), has achieved 20.9% conversion efficiency on a 0.5cm² CIS cell. This is a world record conversion efficiency for thin-film photovoltaic technologies, beating Solar Frontier's previous world record of 19.7% conversion efficiency for CIS thin-film cells that do not contain cadmium, on top of the previous-best 20.8% cell efficiency record set for all thin-film PV technologies. The result has been independently verified by the Fraunhofer Institute, Europe's largest application-oriented research organization.

"Solar Frontier's new 20.9% efficiency record resulted from a CIS cell cut from a 30cm by 30cm substrate produced using a sputtering-selenization formation method - the same method we use in our factories. The significance is twofold: it ensures we can transfer our latest achievement into mass production faster, and it proves the long-term conversion efficiency potential of Solar Frontier's proprietary CIS technology," said Satoru Kuriyagawa, Chief Technology Officer of Solar Frontier. "Solar Frontier has entered into the next phase in the development of CIS technology, and we look forward to building on this achievement and driving our efficiency even higher."

Conversion efficiency is a popular measurement used to compare the performance of solar modules. Actual performance after installation, however, depends on how differing PV technologies react to their surrounding environment and climate. Solar Frontier's CIS modules are proven to generate more electricity (kWh/kWp) in real operating conditions than crystalline silicon modules. Together with high automation and precision manufacturing in Japan, CIS modules provide long-term competitive and reliable returns on investments for customers.

Solar Frontier's latest efficiency record was achieved at the Atsugi Research Center (ARC) in Kanagawa, Japan. As part of the ARC's customer-centric approach, it focuses on boosting the conversion efficiency of its CIS modules, developing its proprietary mass production machinery, and reducing overall system costs for end users. The ARC has been at the forefront of advancing CIS technology, setting numerous world records since it was established in 2009.

About Solar Frontier

Solar Frontier K.K., a 100% subsidiary of Showa Shell Sekiyu K.K. (TYO:5002) ("Solar Frontier"), has a mission to create the most economical, ecological solar energy solutions on Earth. Building on a legacy of work in solar energy since the 1970s, Solar Frontier today develops and manufactures CIS (denoting copper, indium, selenium) thin-film solar modules for customers in all sectors around the world. Solar Frontier's gigawatt-scale production facilities in Miyazaki, Japan, integrate compelling economical and ecological advantages into every module: from lower energy requirements in manufacturing to the higher overall output (kWh) of CIS in real operating conditions. Solar Frontier is headquartered in Tokyo, with offices in Europe, the U.S.A., and the Middle East. Visit www.solar-frontier.com for more information.

Showa Shell Sekiyu K.K.

Showa Shell Sekiyu K.K. is listed on the Tokyo Stock Exchange and has roots dating back more than 100 years in the downstream energy business.

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