Mini-Documentary: *Renewable Innovation*

The Future of Solar Energy Gets Brighter

The intricately carved buildings of Nara’s Tsubosaka Temple featured in *Renewable Innovation* offer a tranquil sanctuary for time-honored ritual as well as a connection to the future. The panels helping power and preserve the landmark and light the nature that surrounds it were born of a collaboration between DuPont and Sharp that allows the temple to be powered by the sun in a manner striking in its efficiency and innovation.

The popularity, efficiency and market competitiveness of solar energy is growing quickly, with industry experts anticipating 20 percent average annual growth in solar installations over the next few years. Solar energy is quickly becoming more cost-competitive with other forms of electricity as companies like DuPont and Sharp improve the power output and reliable lifetime of solar panels, lowering the overall cost for solar energy.

The amount of sunlight converted into usable electricity through crystalline silicon (c-Si) solar cells has nearly doubled over the last 12 years through advances in the materials that make up a solar cell. Every percentage improvement in conversion efficiency results in a five percent reduction in the cost of the overall solar power generation system.

The efficiency of solar cells has nearly **doubled** within the past dozen years due to advances made in photovoltaic metallization paste materials.
that higher conversion can be achieved by grouping the electrodes together underneath the panels, ensuring that nothing would block the sunlight—a technique known as Interdigitated Back Contact (IBC). DuPont created the highly reliable, precision silver metallization paste composition for use as the electrode for the new crystalline solar cells.

The DuPont™ Solamet® photovoltaic metallization paste series offers some of the most advanced technology available today to increase the efficiency of crystalline silicon solar cells. The current industry benchmark, the DuPont™ Solamet® PV17x series, was the first commercial paste that was able to unlock efficiency gains by being able to contact lightly doped emitters (LDEs) to achieve higher efficiency. LDEs have a lower concentration of phosphorous near the exposed surface of the cell, keeping more electrons in circulation and thereby offering higher voltage and higher conductivity.

The application of Solamet® PV17x in narrower grid lines helps reduce the printed surface area, in turn reducing a shadowing effect when sunlight hits the panels, resulting in improved electrical conductivity. The breakthrough formulation of Solamet® PV17x also enables cell makers to use less material, translating into significant cost savings. More recently, DuPont has introduced Solamet® PV18x, which offers more with less—meaning more efficiency from even better contact to LDEs together with less material required.

According to industry experts, c-Si technology is used today in about 90% of the solar energy market. Conductive silver metallization paste is screen printed in a grid pattern on the delicate silicon cell to capture the electrons released when sunlight is applied to the cell surface. Working together, DuPont and Sharp improved the technology of their PV systems, enabling more sunlight to be converted directly into electricity. The inspiration behind the new crystalline solar cells used atop a Circle K Sunkus Convenience store in Japan grew from an understanding

Photovoltaic Energy is the science of converting light into electrical energy through the use of semiconductors, or photovoltaic (PV) solar cells. The cell assemblies—called solar panels or modules—are encapsulated into water-tight modules for protection from moisture and impact. The principle components of a crystalline silicon solar panel are the glass glazing, ethylene-vinyl acetate (EVA) or ionomer encapsulant, the silicon wafers and associated wiring, a protective backsheet, and a junction box.
Grid Parity

Advances achieved through the unique melding of science and technology at DuPont have helped enable grid parity in many parts of the world. DuPont is developing new families of innovative materials that could deliver panels with lifetimes from 30 to 40 years and greater power output that could result in significant reductions in solar energy system costs.

DuPont is also developing technologies aimed at boosting solar cell efficiencies beyond the level already demonstrated with Solamet® PV18x. Plans are to continue to expand the series to address the specific needs of various market segments such as achieving even finer lines to support further reductions in the cost of ownership of solar cells, and integrating materials sets to create new levels of performance from solar cells and panels in the future.

**Glossary**

**Grid Parity** – A condition that will be achieved when the cost of delivering solar energy is compatible with other forms of energy delivered on the electric grid. Industry analysts expect grid parity for solar to be reached on average around 2015.

**Lightly Doped Emitter (LDE)** – An LDE design is one that has a lower concentration of phosphorous near the exposed surface of the cell, which creates higher voltage and conductivity.

**Metallization Pastes** – A paste made from silver or aluminum that collects the energy generated on the surface of solar cells from the sun and conducts it out of cells so that it can be converted to electricity.

**Photovoltaic (PV) Cell** – A specialized semiconductor that can convert visible light into electricity. PV cells are integral to solar energy systems.

**Semiconductor** – A substance, usually a chemical one, which can conduct electricity under certain conditions.

**Silicon** – A chemical element (identified by the symbol Si with atomic number 14 in the periodic table) that, in its purified form, is widely used in semiconductor electronics. It is fundamental to solar cells because of its ability to create an electric charge when exposed to sunlight.

**Additional Resources**

- **DuPont™ Solamet® PV17x: Photovoltaic Metallization for Lightly Doped Emitter Solar Cells**, Dupont.
- **Next Generation Solamet® Frontside Silver Pastes Advance Solar Cell Efficiency**, PV18x, Dupont.