Q&A with General Cable

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- Wind cables are constructed with excellent flexibility, as well as resistance to high-torsion stress, vibration, oils, and abrasion.

General Cable is a FORTUNE 500® company with headquarters in Highland Heights, Ky., and annual sales approaching $6 billion. It operates 55 manufacturing facilities in 25 countries, with 13,000 associates worldwide. The company develops, designs, manufactures, markets, and distributes copper, aluminum, and fiber-optic wire and cable for the energy, industrial, specialty, and communications markets.

General Cable has a long, rich history that spans more than a century since supplying insulated wire to Samuel Morse for his historic communications between Washington and Baltimore in 1844. Today General Cable offers a broad product line; has built brand recognition; has grown its distribution and logistics capabilities, and strives to offer exceptional sales and customer support.

The company said it invests heavily in developing innovative wire and cable systems, including application-specific cables to support power generation, transmission, and distribution of clean renewable and alternative energy sources.

What role does cabling play in transmitting renewable energy?

Craig Snyder, General Cable: Our cables link wind turbine and solar photovoltaic (PV) energy sources to energy users. They are varied and application-specific [see lead image and Figure 1].
Within the nacelles and towers of wind turbines where electricity is created, our nacelle and tower cables connect tower control boxes to collection system transformers [see Figure 2].

Our solar cables connect solar PV panels to combiner boxes and inverters where the DC solar power is converted into AC power [see Figure 3].

From the wind tower or solar transformer, medium-voltage collection system cables deliver power to the substations [see Figure 4].

Once the green energy reaches the substation, it is stepped up in voltage and transmitted long distances via overhead bare aluminum cables to secondary substations where the power is transformed to a lower voltage for local distribution.

From the secondary substation, we deliver green power via a variety of overhead and underground distribution cables directly to homes and buildings [see Figure 5].

We also produce various fiber-optic, signal, and control cables to effectively monitor solar and wind networks.

How do products for renewable energy transmission differ (if at all) from products for conventional energy transmission?

Cables used to transmit solar power must be designed for sunlight resistance and a broad operating temperature range to maintain performance and reliability in long-term harsh environments.

Wind generation applications also require cables with the ability to operate within a wide range of operating temperatures. They must have excellent flexibility, as well as resistance to high-torsion stress, vibration, oils, and abrasion typically found in turbine applications.

Throughout the collection system, cable design must be optimized to minimize line power losses to help make wind and solar projects economically viable.

To optimize efficiencies, cables for renewable energy differ at the point of power generation. A higher voltage rating is required than for conventional applications—2,000 V instead of 600 V.

Custom cable assemblies for solar and wind applications are also pre-made with factory termination to help save time and labor costs.
To meet global requirements, cables must be compliant with several listings and specifications.

**Q** What are some of the unique challenges you have encountered in supplying cable to wind farms?

**A** In the past few years, European wind turbine companies have penetrated the U.S. market, driving wind-specific requirements like torsion. Therefore, wire and cable must be designed to meet European specifications, while still complying with domestic UL and NEC standards for voltage and temperature ratings. This requires more intensive R&D and in-house testing capabilities, especially because no standardized test method for torsion resistance currently exists.

For wind generation, the collection system’s efficiency is critical; it needs to capture as much power as possible. Moving power from areas with excellent wind resources to more densely populated areas effectively is a key industry challenge. So too is forecasting cable demand in an evolving market with unsteady government support.

**Q** How have you handled those challenges?

**A** We work closely with individual turbine component manufacturers to understand their needs and direct our R&D efforts accordingly. Our advanced insulation and jacketing material development expertise has allowed us to meet manufacturers’ needs, as well as both domestic and European standards requirements. WindGen® cables are designed to withstand torsion and vibration while also providing stable electrical properties over a broad temperature range. They also are resistant to oil and ozone and are flame-retardant to maximize safety.

To establish a more efficient, environmentally friendly collection system for wind power applications, we re-engineered our traditional medium-voltage utility cable to have a higher temperature tolerance rating, while reducing the amount of copper in the concentric neutrals of the cable, and using a cross-linked polyethylene (XLPE) jacketing. This provides better efficiency through cooler operation, lower line loss, and better resistance to deformation.

To improve forecasting and help deliver renewable power to the grid, we work to accelerate grid modernization efforts and standards development by supporting key industry partners such as the American Wind Energy Association (AWEA); Electric Utility Industry Sustainable Supply Chain Alliance; Arkansas Advanced Energy Association (AAEA); utility regulators; and federal, state, and local policymakers.

**Q** What are some challenges you encounter that are unique to supplying to solar farms?

**A** North America is an emerging solar market with developing standards. Establishing uniform wire and cable design specifications and installation practices is in development. Several traditional cable technologies may not necessarily support long-term solar needs. Meeting evolving standards and developing cables that will support the long-term needs of solar applications require engineering expertise, efficient manufacturing capabilities, and a strong commitment to the solar energy market.
We must ensure that our solar cables continue to meet evolving UL 4703 standards for sunlight resistance, operating temperature, and the aforementioned higher 2,000-V ratings. In addition, they must meet Canadian Standards Association (CSA) requirements and stringent TÜV global standards that have been established to govern solar wire and cable systems.

**For wind generation, the collection system’s efficiency is critical because it must capture as much power as possible.**

And they must do so while including features that minimize installation cost. Recent changes to the National Electrical Code (NEC) require that solar PV source, output, and inverter circuits be identified at all points of termination. Like the wind farm industry, the evolving solar industry also presents the challenges of forecasting demand and effectively getting power to the grid.

**How have you resolved those challenges?**

**Q**

**A**

Our continued participation with utility regulators and renewable energy developers, as well as active involvement in standards development, is helping to establish consensus for solar wire and cable standards.

At the same time, our R&D efforts have resulted in the development of the standards-compliant SunGen® cable, including compliance with CSA ratings for direct burial and the very latest UL 4703 standards.

The multiconductor microinverter cables produce grid-matching power directly at the back of the panel and then to the grid feed. To better meet recent NEC identification requirements for PV

**Figure 2**

Nacelle and tower cables connect tower control boxes to collection system transformers.

**Figure 3**

Solar cables connect solar PV panels to combiner boxes and inverters.
circuits, we recently engineered all sizes of the sun-resistant UL 4073 wire in a full array of colors.

Cables for renewable energy differ at the point of power generation. A higher voltage rating is required than for conventional applications—2,000 V instead of 600 V.

As a result of our dedicated R&D efforts, compound expertise, and in-house testing capabilities, our solar cables effectively meet the stringent TÜV standards for halogen-free, fire-retardant, and low-corrosive gas emissions required in Europe. The cables also meet ratings requirements for global tropical environments and hot, dry desert areas where many utility-scale solar farms are located.

How is cabling manufactured, handled, and installed differently for offshore wind applications?

Submarine cables are required to collect and transfer renewable energy generated from offshore wind farms to land. Manufacturing submarine cables is highly specialized, requiring a facility designed specifically for processing these cables. The cables are constructed with waterproofing layers and other unique characteristics to withstand saltwater conditions. We must consider a variety of variables, such as water depth, seabed conditions, and distance when manufacturing submarine cable for offshore applications.

We manufacture these cables at our dedicated Norddeutsche Seekabelwerke GmbH (NSW) location in Germany, which has been manufacturing them since...
1899. The facility is equipped with its own deep-water loading pier, an installation barge with vertical injector, and a trencher for adequate handling and installation with minimal environmental impact.

**Q** What achievements earned you an Arizona Public Service (APS) Supplier of the Year Award?

One of our largest utility customers, APS has entrusted us with effectively managing its medium-voltage cable requirements.

To win the APS Supplier of the Year Award, General Cable exceeded a 98 percent rating in performance, environment, health, safety, customer service, value-added relationship, commitment to sustainability, and community involvement. We achieved a 100 percent rating in several categories.

Through our Vendor Managed Inventory service that provides a historical view of usage and fluctuations, we provided accurate forecasting and suggested buying practices that helped APS establish more accurate stock levels and maximize inventory management. This helps APS to ensure that its shipments are completed on time and with accurate invoicing.

We have also worked to foster a relationship with APS engineering personnel, providing support and quality material. In turn, APS has been receptive to our addressing challenges within the industry, which has led to a valued partnership.

**A** What other types of green initiatives and sustainable efforts are you addressing?

We recognize that our business has an impact on the environment, and to reduce this impact, we incorporate responsible practices into our daily business operations around the world. Preserving the environment through energy consumption reduction, eliminating or substantially decreasing hazardous materials, and recycling robustly are part of our continuous improvement culture.

All of our plants have facility-specific waste-reduction objectives, addressing energy usage, greenhouse gas emissions, water usage, recycling, waste, and packaging. In 2011 we recycled 30,852 metric tons of copper and aluminum scrap, as well as 25,691 metric tons of other nonmetal materials globally.

As a result of these efforts, we have developed several environmentally friendly cables with characteristics such as halogen-free construction, less material, safety features, and improved efficiency.

At the same time, our returnable steel and wood reel recycling programs encourage environmentalism, promote goodwill, and maintain our commitment to local, national, and global communities.

Images courtesy of General Cable, Highland Heights, Ky.

General Cable Corp., 4 Tesseneer Drive, Highland Heights, KY 41076, 859-572-8000, info@generalcable.com, www.generalcable.com

For more information about renewable energy transmission, visit www.greenmanufacturer.net:

- “Sage Supplier: Wind power transmission provides manufacturing opportunities: Taking the wind to the mountain”
- “NEMA publication focuses attention on power transmission corridors”