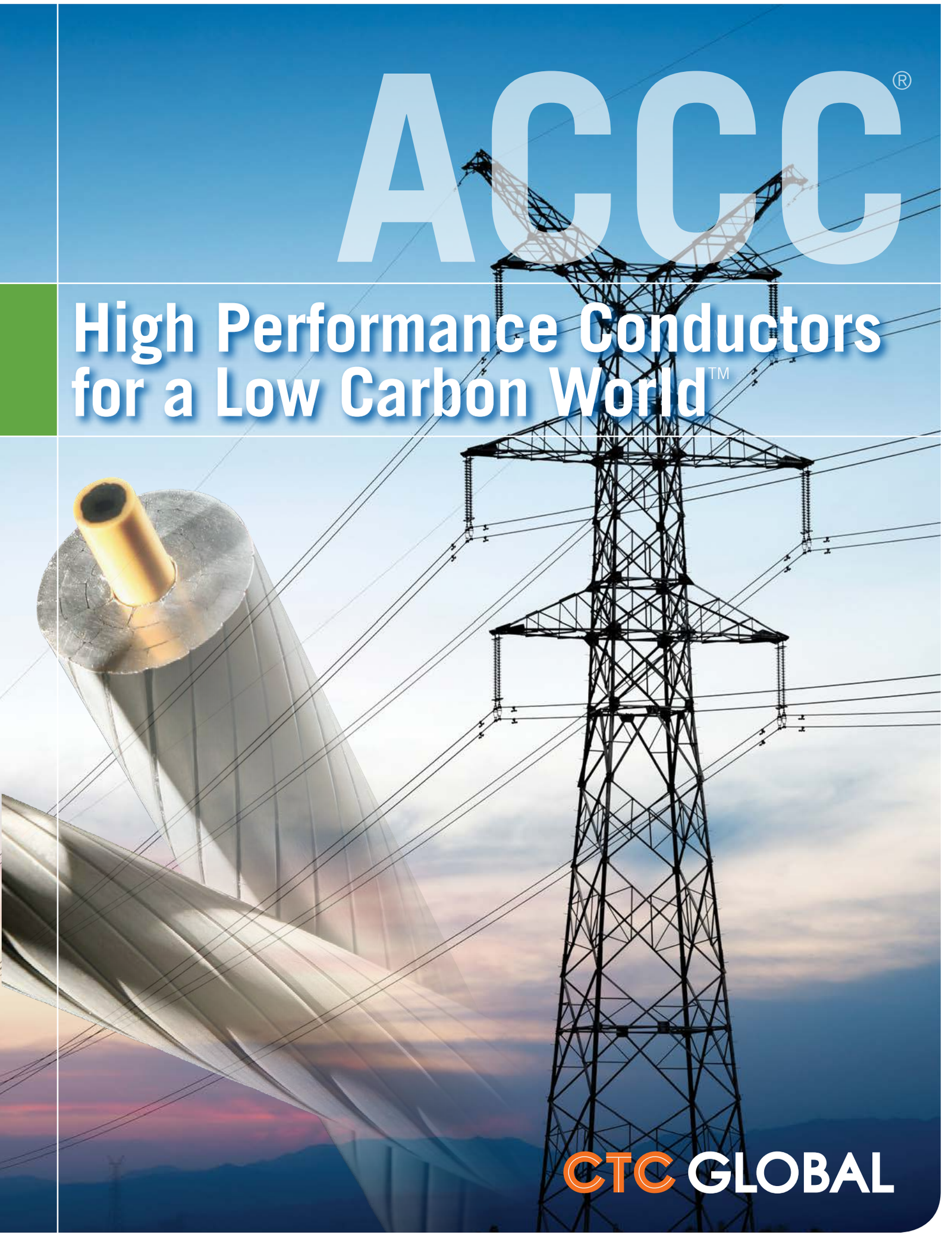
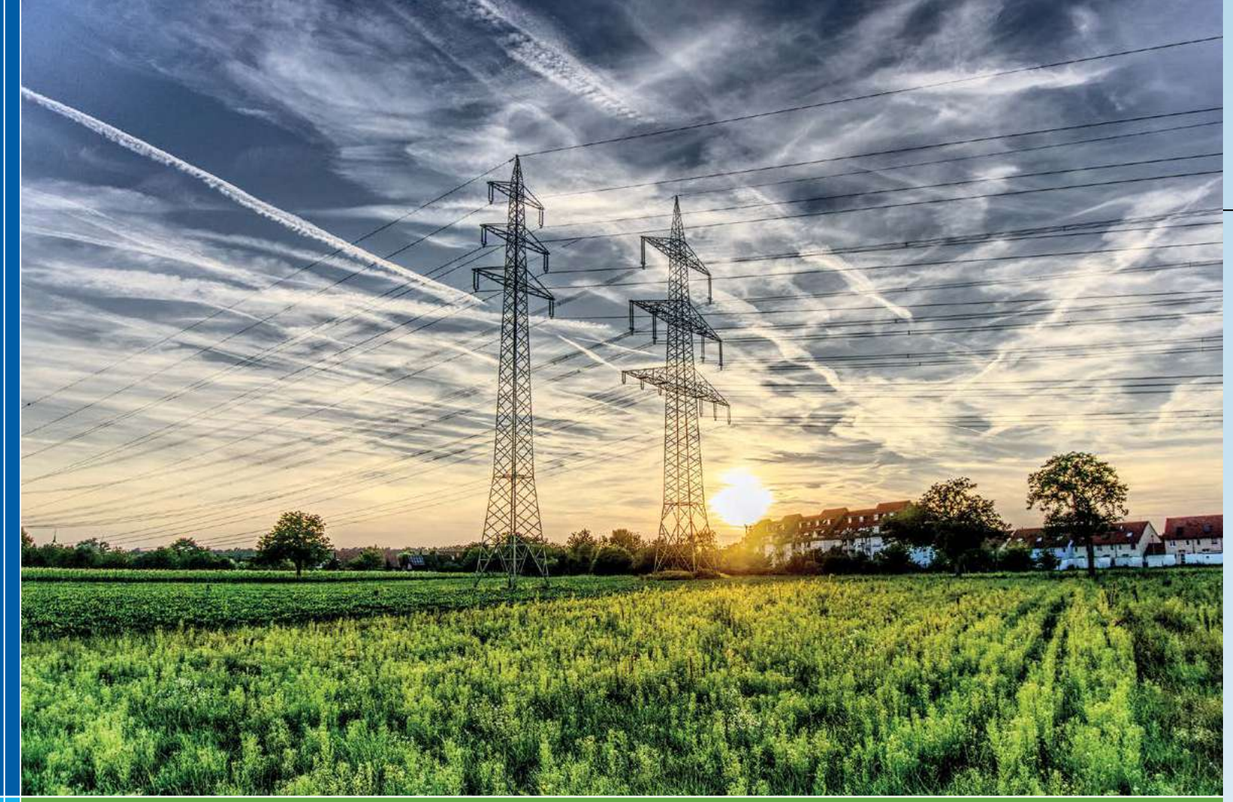
ACCC®

High Performance Conductors for a Low Carbon World™



CTC GLOBAL



The Challenge

The need to deliver reliable and affordable electric energy on a global scale has never been more important. While tens of millions of people are living with little to no access to electricity, it has become a fundamental human need. We use electricity to pump water to grow crops; power our lights, computers, and everyday appliances; build competitive manufacturing economies; and recharge our growing fleet of electrically powered vehicles.

As the effects of climate change are felt on a broader scale, new transmission lines are being built to integrate cleaner, more modern sources of electric generation. Meanwhile, existing lines are being upgraded to meet new stringent requirements and mitigate the need to build new lines whenever possible. Historically, upgrading existing lines required the removal and replacement of existing structures with larger framework and heavier wires. The ACCC® Conductor however offers a highly efficient, cost effective, and environmentally friendly alternative.

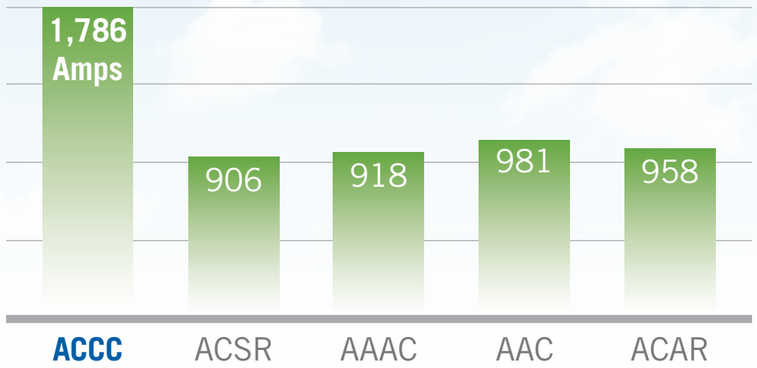
The ACCC® Solution

Commercially deployed in 2005, the ACCC® Conductor offers an abundance of advantages that help the electric power industry meet a growing list of challenges. Derived from advanced aerospace technology, the ACCC® Conductor offers:

- **Twice the electrical capacity** of conventional conductors
- **The ability to mitigate thermal sag** (due to the low coefficient of thermal expansion of its carbon fiber composite core)
- **The ability to reduce upfront capital costs** on new lines by increasing spans between fewer and/or shorter structures (due to its greater strength and improved resistance to vibration degradation)
- **An increase in efficiency ranging from 25% to 40% or more** (meaning reduced line losses due to increased aluminum content without a weight penalty, enabled by lighter core and compact aluminum strands)
- **Improved reliability** through the reduced risk of sag-trip outages, ability to endure cyclic load fatigue (vibration), and resistance to corrosion from industrial, agricultural, and corrosive air environments
- **Improved grid resilience** as the ACCC® Conductor has survived numerous catastrophic events in the field with little to no damage
- **The ability to accommodate** very long spans and/or extreme ice load conditions

ACCC vs conventional conductors with the same overall diameter and weight

Data is representative of standard Drake sized conductors at maximum recommended operating temperature.



Environmental conditions assumed are based on IEEE 738, which are:

Ambient Temp = 25 deg C
Wind Speed = 2 ft./sec
Sun Radiation = 96 Watt/ft2
Elevation = 0
Solar Absorptivity = 0.5
Emissivity = 0.5

VERIFIED by SCS GLOBAL SERVICES
✔ REDUCED LINE LOSSES
✔ REDUCED CO_2 EMISSIONS

SCS Global Certification

SCS Global Services (SCS) is a trusted, neutral global leader with more than three decades of experience in third-party environmental, sustainability and certification, auditing, testing and standards development. SCS verifies that the ACCC® Conductor reduces CO2 emissions associated with transmission line losses significantly compared to ACSR on a project by project basis.

Case Studies

While these Case Studies are categorized by their primary objective, other advantages are also presented below.

Increase Capacity of Existing Line to Accommodate Load Growth

In 2005, PacifiCorp saw the need to increase ampacity using existing structures, with large quantities of underbuilt distribution line. Such a challenge seemed unsurmountable without a sizable investment at the time. CTC Global however was able to offer a solution that raised ampacity, utilized existing structures, and resisted thermal sag to avoid contact with underbuilt lines and any associated outages. A Drake sized ACCC® Conductor was selected for the 30 kilometer, 138kV line ultimately considered a great success by everyone involved and one of the first of its kind.

Long Span Solution

In 2009, Chillectra was faced with the challenge of crossing extremely long spans using existing structures located on adjacent mountain tops in the alpine terrain found just outside of Santiago, Chile. Originally thought to be completely out of the scope of reality, Chilectra was able to use ACCC® Linnet sized conductor to reconductor the full 28 kilometer, 110 kV line through a very challenging mountainous territory. The ability to span entire valleys made for a significant reduction in the need for bulky structures and invasive rights of way. Chilectra has been able to realize significant line loss reductions by using ACCC® Conductor in over 30 projects (~500km) in addition to greatly improving grid reliability to the city and adjacent communities.

Accommodate Extreme Ice Load

In 2009, NV Energy needed to increase ampacity in the Reno to Carson City corridor, with a conductor that could easily handle (NESC Heavy) ice loading conditions, while also utilizing existing structures and substantially reducing overall project cost. The ACCC® Linnet size conductor was ultimately the only solution that could offer all of the above. The 30 mile, 120 kV line offered longer spans, increased ampacity, and provided the ability to handle heavy ice loading over winter months.

Reduce Up Front Capital Costs on New Line

In 2015, Tenaga Nasional Berhad (TNB) of Malaysia investigated cost-effective solutions to connect new generation to their severely constrained grid. They needed to build a new 50 kilometer, 275 kV line crossing a the Johor river, a corrosive marine environment. The double circuit, triple bundled ACCC® Dublin size conductor was selected for its high capacity and improved efficiency over all other viable options. The project was also finished well before the expected completion date saving additional labor costs.

Improve line efficiency to conserve generation resources

In 2016, American Electric Power (AEP) won the prestigious Edison award for the largest ever successful live line reconductor project. The challenge was to uprate the existing transmission line without losing power to customers. The 240 circuit mile, 345 kV line was able to save over 300,000 MWh, freeing up 28 megawatts of generation per year. Additionally, they were able to save over 200,000 metric tons of CO^2 per year, the equivalent of removing 34,000 cars from the road. The project was completed a full eight months ahead of schedule, while also providing the additional capacity needed.

Improve Grid Reliability to Accommodate N-1 Emergency Condition

In 2018, Southern California Edison (SCE) saw the need for a significant improvement in reliability (N-1 conditions) in Palm Springs, CA. This area's climate is hot and arid with frequent strong winds. The ACCC® Laredo sized conductor was chosen for its thermal properties as well as its self-dampening characteristics. The 38 kilometer, 115 kV line was energized ahead of schedule, with virtually no environmental impact on the surrounding protected wildlife.

Technical Resources & Quality Assurance

CTC Global, the original developer of the patented ACCC® Conductor, offers numerous resources to ensure your project achieves all design objectives and exceeds overall expectations. CTC Global offers Application Engineering and Design Support; Extensive Product and Project Knowledge; Pre-Construction Services and Crew Training; Onsite Field Support; 24-7 Customer Service; and an industry-leading Product Warranty. You can also leverage our many close relationships with experienced engineering and installation firms, as well as our growing list of conductor and hardware manufacturing partners. CTC Global can also assist with type certification programs and any other testing requirements you may have.

CTC Global's on-site testing capabilities include a substantial range of equipment used to ensure the quality of incoming raw materials, as well as our finished composite core. Conductor and hardware samples provided by our manufacturing partners are also tested both internally and externally. All of our ACCC® Core manufacturing facilities in the United States, Indonesia, and China are certified to current ISO 9001-2015 standards.

ACCC® Technical Background

In the wake of the major blackout in the Eastern United States and Canada in 2003, CTC recognized the need to develop a conductor that could withstand extreme peak load demand conditions, while mitigating thermal sag, which ultimately led to a series of sag-trip outages during this extreme event. Our material scientists and management team, supported by a number of key utilities and manufacturing partners, went to work designing and developing the best possible conductor solution. Though many alternatives were considered, we discovered that the best possible solution consisted of a single composite core design that utilized high-strength, light-weight carbon and glass fibers that provided superior toughness and flexural strength as well as a very low coefficient of thermal expansion to prevent thermal sag. The fibers are embedded with a high-temperature, toughened thermoset resin which enables hundreds of thousands of individual structural fibers to work in unison.

The ACCC® Core (produced to ASTM B987 / B987M - 17 “Standard Specification for Carbon Fiber Thermoset Polymer Matrix Composite Core (CFC) for use in Overhead Electrical Conductors.”) provides the primary strength member, while the highly conductive compact aluminum strands accommodate increased electrical loading. The ACCC® Conductor is available in a wide range of sizes and is offered with a standard 310 ksi composite core or a 375 ksi higher strength “ULS” core, and is available with fully annealed aluminum or aluminum zirconium alloy. (For comparison, steel used for conventional steel reinforced conductors is generally rated around 210 ksi, while high strength steel is rated at 285 ksi).

About CTC Global

CTC Global, of Irvine, California, USA, began developing the patented ACCC® Conductor in 2003. Since that time CTC Global has expanded manufacturing into multiple countries and installed over 65,000 km of ACCC® Conductor worldwide. Over 200 utilities have made the ACCC® Choice with over 650 of their projects in 50+ countries across the globe. In addition to the many and varied financial benefits realized on behalf of utilities and end users alike, the installation of ACCC® Conductor has led to an overall emissions reduction equivalent to removing an estimated 11 million cars from the road.

CTC Manufacturing Partners

CTC Global works with a number of highly qualified manufacturing partners to deliver ACCC® Conductor and ACCC Hardware to the end user. Each manufacturer is rigorously tested and ultimately qualified by CTC Global to produce the patented ACCC® Conductor and ancillary ACCC Hardware. All ACCC® Conductor manufacturers must be ISO certified and pass substantial internal and third-party testing before becoming contractually authorized to produce ACCC® Conductor. The ACCC® Core is shipped from CTC Global manufacturing facilities to our manufacturing partners worldwide. There, the ACCC® Core is stranded with a CTC Global approved trapezoidal alloy, and ultimately shipped to the end user/customer.

Over 650 Projects Completed Worldwide

CTC GLOBAL

2026 McGaw Avenue
Irvine, CA 92614 USA

Phone: +1 (949) 428-8500
Web: www.ctcglobal.com
E-Mail: info@ctcglobal.com