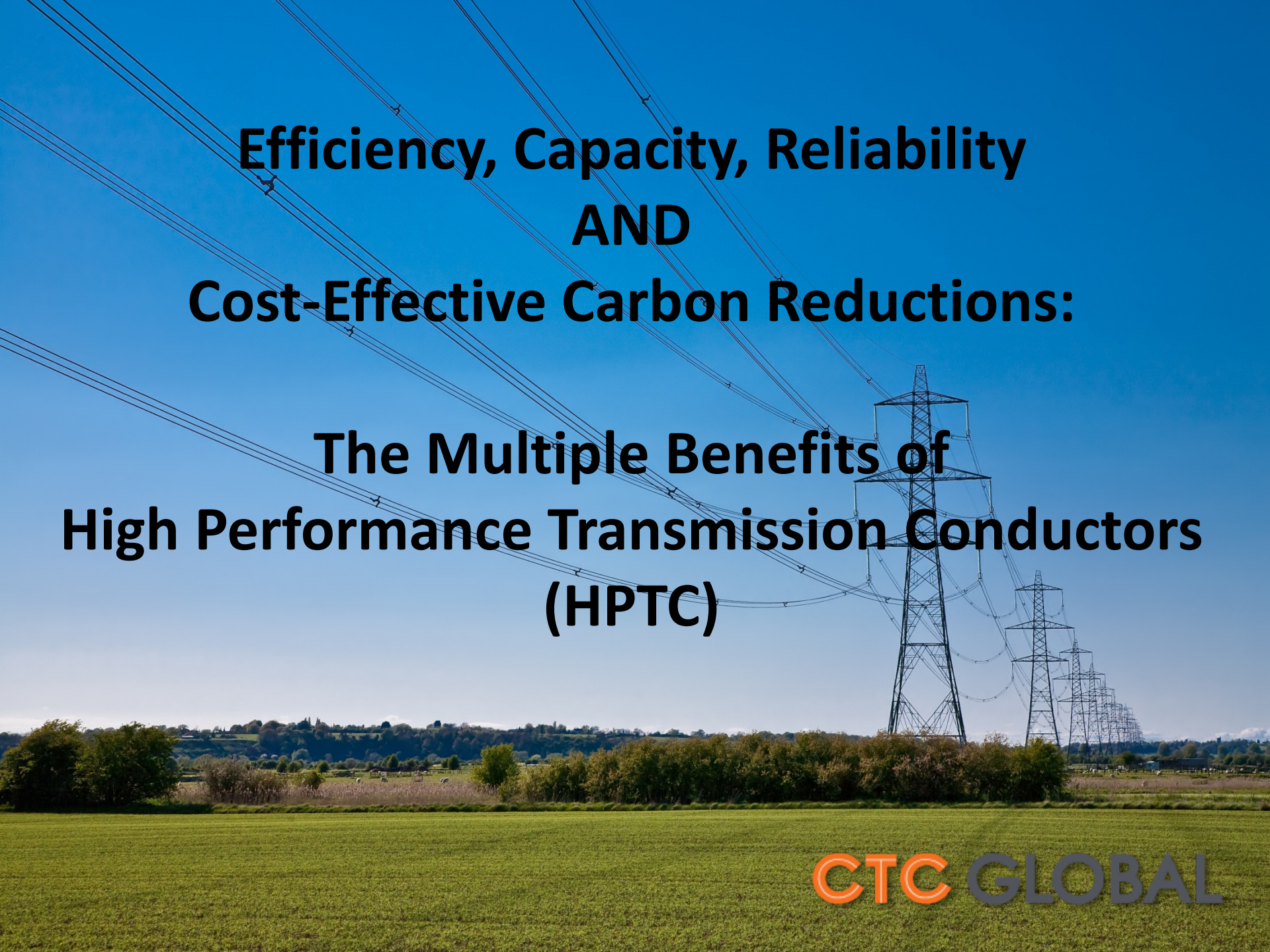


# Efficiency, Capacity, Reliability AND Cost-Effective Carbon Reductions:

# The Multiple Benefits of High Performance Transmission Conductors (HPTC)

CTC GLOBAL

# WHY ARE WE HERE?

**The Transmission System:**

**The "Backbone" of Our Electricity-Powered Nation**

- **Aging system overdue for technological innovation**
- **Increased capacity needed to accommodate renewables**
- **Constraints are costly and threaten reliability**
- **"low hanging fruit" for Energy Efficiency, Carbon Reduction**

**High Performance Transmission Conductors (HPTC)**

- **Technologically advanced conductors providing much higher efficiency, capacity, reliability, and strength**
- **HPTCs also deliver large & cost-effective carbon reductions**

- **Carbon Reduction => ALL Regulated Air Emissions from Power Plants**

# The Situation

- **CTC Global:** Inventor of Aluminum Composite Core Conductor (ACCC®), one of several HPTC technologies*
- **ACCC: 10+ Years of Excellent Global Performance**
  - **400 Projects in 40 countries**
  - **150 utilities**
  - **~40,000 km installed**
  - **24 global suppliers**
- **ACCC Multiple Benefits**
  - **Efficient: cuts line losses by 25-40%**
  - **2X Capacity: uses existing ROW; no new structures**
  - **Reliable: eliminates line sag, stronger, resists corrosion**
  - **Lower impact, cost: longer spans, fewer & smaller towers**

* 3M, CTC Global, Nexans, Southwire, Tokyo Rope, KNOWN ALSO AS HTLS CONDUCTORS

# The Situation

**Billions $$ for Generation Efficiency**

**100 year old conductor technology**

**Billions $$ for End-Use Efficiency**


**Improved Power Flow**

## Outdated Conductors Can't Meet Critical Needs of the Modern Grid:

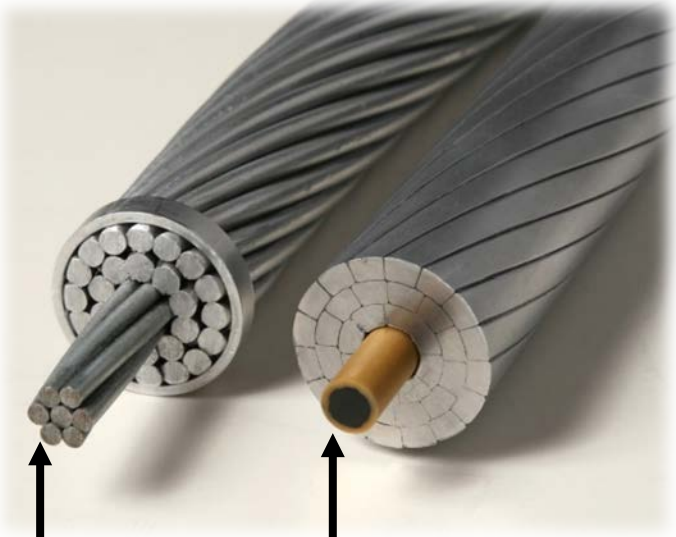
- ***More capacity to accommodate renewables and new loads***
- ***Efficiency to cut costs and emissions***
- ***Ever increasing demands for reliability, resiliency, and security***

Modern Conductors carry twice the power & cut losses by 30%

# How ACCC Works: Carbon Fiber Replaces Steel



## CTC GLOBAL ACCC



**Carbon-fiber core enables lighter, stronger & more efficient conductors**

**28% more aluminum for same weight & diameter**

**Annealed aluminum is more conductive**

**Trapezoidal design further improves efficiency**

**Minimal expansion at high load & temperature**

**Does not rust, corrode, yield, or fatigue**

**Stronger and more resilient**

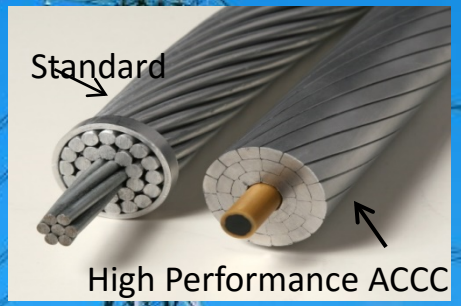
**Conventional Steel Core (100 year old technology)**

**Advanced Composite Core**

# 2016 Edison Award Winner

## AEP Texas: 120 mile, 345 kV line, 3 Phase, Double line

Replace Standard Conductor (ACSR) with High Performance Conductor (CTC Global ACCC®)




### They Wanted:

- Increased transfer capacity to accommodate load growth
- Improved reliability from storms & corrosion

### They Got:

- **Efficiency Savings (line losses cut by 30%):**

  **142,000 MWh or $7.1 million Annually PLUS 16 MW of avoided generation capacity (~$16M value) – Fast Payback**

- **Capacity:** 2X using existing towers and right of way
- **Reliability:** Eliminated line sag; stronger than steel; Corrosion resistant; performance at high loads & temps
- **Ahead of Schedule:** Faster permitting, Live reconductoring

**AND**

**57,800 Metric Tons CO2/yr . . . FOR FREE!!**

# What is changing?

**Drive to "Get the Most" from the Existing High Voltage Grid:**

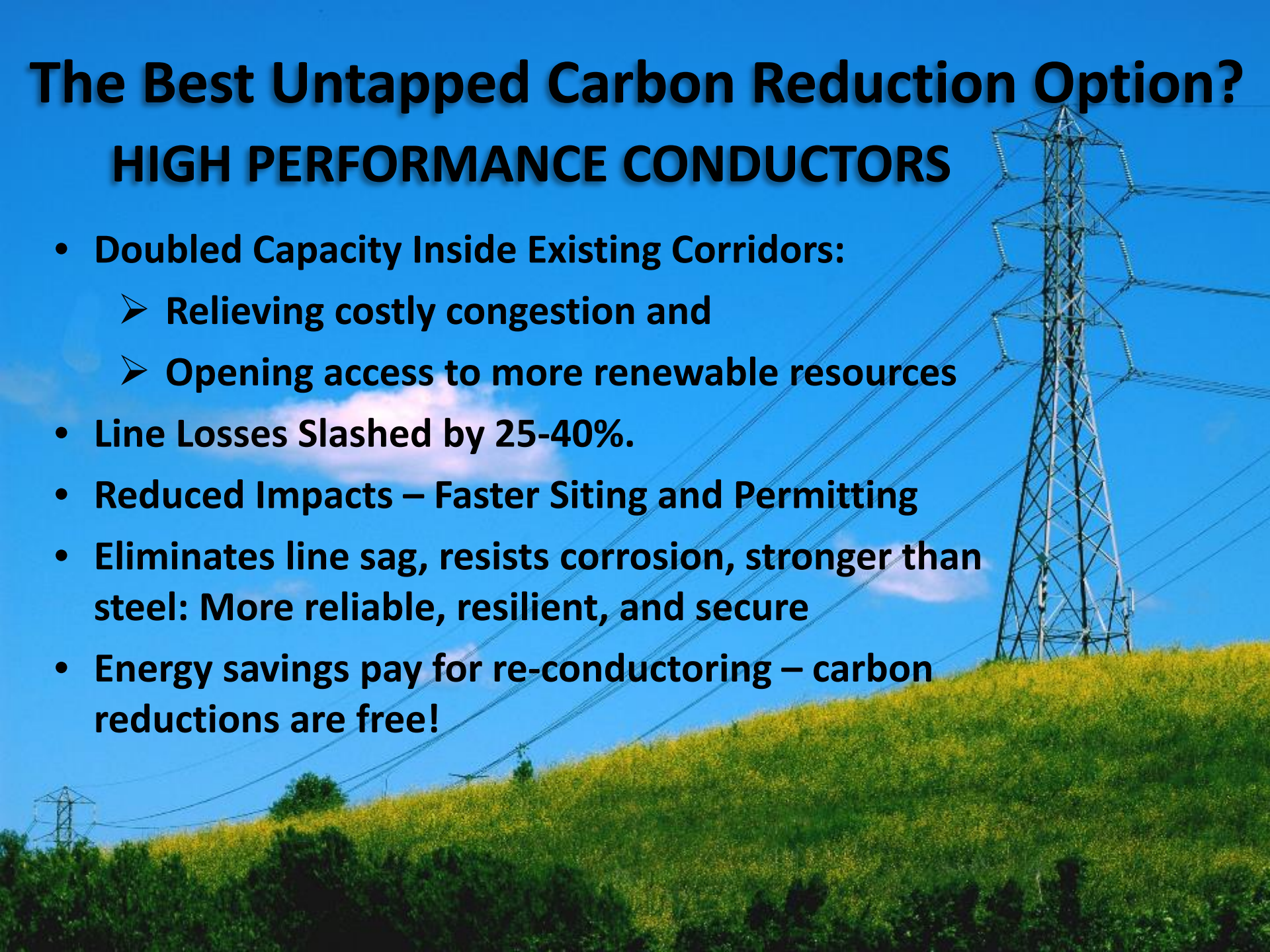
- **Expand & Balance Renewables**
- **Improve Reliability & Resiliency**
- **Universal Access & Affordability**

# What has not yet changed?

**Transmission owners, planners, and regulators are not considering the capacity, efficiency, and reliability benefits of High Performance Transmission Conductors in their decisions.**

# The Best Untapped Carbon Reduction Option?

## HIGH PERFORMANCE CONDUCTORS



- **Doubled Capacity Inside Existing Corridors:**
  - **Relieving costly congestion and**
  - **Opening access to more renewable resources**
- **Line Losses Slashed by 25-40%.**
- **Reduced Impacts – Faster Siting and Permitting**
- **Eliminates line sag, resists corrosion, stronger than steel: More reliable, resilient, and secure**
- **Energy savings pay for re-conductoring – carbon reductions are free!**

# What can we do?

**Consider High Performance Transmission Conductor (HPTC) for EVERY transmission project:**

- **Re-conductor heavily used lines to maintain reliability, reduce losses, and increase capacity**
- **New lines: minimize environmental impact and maximize capacity & efficiency**
- **Renewable "feeder" lines**

**Establish transmission efficiency standards**


THANK-YOU
High Performance Conductors
Providing
Efficiency, Capacity, Reliability
AND
Cost-Effective Carbon Reductions:
CTC GLOBAL

David Townley
781-710-0351
dtownley@ctcglobal.com

Bill White
818-416-4745
bwhite@ctcglobal.com

Back-up and additional info slides follow

# See June 2016 Public Utility Fortnightly

Pages 52-54

**High Performance Transmission Conductors Are Improving Grid Efficiency**

And Why it matters

By Dave Bryant

"Leveraging high performance conductors has become particularly important today. They not only serve to improve efficiency and reliability, they also allow us to increase the capacity of existing transmission lines so we can access cleaner sources of generation."

http://www.fortnightly.com/fortnightly/2016/06/high-performance-transmission-conductors-are-improving-grid-efficiency

# The National Perspective…

| Benefits of Upgrading the Grid with High Performance ACCC Conductor | | |
|---|---|---|
| US Generation | 4,093,606,000 | MWh |
| Delivery System Losses (6%) | 245,616,360 | MWh |
| 30% Reduction using ACCC | 73,684,908 | MWh |
| Annual CO2 Reduction (1,100#/MWh) | 35,842,454 | Metric Tons |
| | | |
| *Value of Line Loss Reduction (at $50/MWh)* | $3.7 | Billion |
| Generation Capacity Savings (80% Capacity Factor) | 10,514 | MW |
| *Value of Generation Capacity Savings* | $10.5 | Billion |

*EIA 2014 Utility-Scale

# The California Perspective…

| Benefits of Upgrading the Grid with High Performance ACCC Conductor | | |
|---|---|---|
| California Generation (total-direct use) | 199,996,478 | MWh |
| Delivery System Losses (7%) | 13,999,753 | MWh |
| 30% Reduction using ACCC | 4,199,926 | MWh |
| Annual CO2 Reduction (633 #/MWh) | 1,208,433 | Metric Tons |
| | | |
| *Annual Value of Line Loss Reduction (at $50/MWh)* | $210 | Million |
| Generation Capacity Savings (80% Capacity Factor) | 599 | MW |
| *Value of Generation Capacity Savings* | $599 | Million |

**AND DOUBLE THE POWER CAPACITY OF THE UPGRADED LINES!**

*EIA 2014 Table7 & 10

# The Georgia Perspective…

| Benefits of Upgrading the Grid with High Performance ACCC Conductor | | |
|---|---|---|
| Georgia Generation (total-direct use) | 121,271,378 | MWh |
| Delivery System Losses (5.9%) | 7,181,503 | MWh |
| 30% Reduction using ACCC | 2,154,451 | MWh |
| Annual CO2 Reduction (1,093 #/MWh) | 1,177,407 | Metric Tons |
| | | |
| *Annual Value of Line Loss Reduction (at $50/MWh)* | $108 | Million |
| Generation Capacity Savings (80% Capacity Factor) | 307 | MW |
| *Value of Generation Capacity Savings* | $307 | Million |

**AND DOUBLE THE POWER CAPACITY OF THE UPGRADED LINES!**

*EIA 2014 Table7 & 10

# AEP Wins the EEI EDISON AWARD

The EEI announcement… (Please also note outstanding video link)

http://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/American%20Electric%20Power%20Awarded%20EEI%E2%80%99s%202016%20Edison%20Award.aspx

**American Electric Power Awarded EEI's 2016 Edison Award**

CHICAGO (June 13, 2016) – American Electric Power (AEP) today received the Edison Electric Institute's (EEI's) 2016 Edison Award, the electric power industry's most prestigious honor, for its Energized Reconductor Project in the Lower Rio Grande Valley of Texas. A panel of former electric company chief executives selected AEP for the 89th annual award from a group of distinguished finalists.

A video overview of the project is available online.
https://www.youtube.com/watch?v=aPaNHawIdFA&feature=youtu.be

David Townley
818-416-4745
710-0351
dtownley@ctcglobal.com

Bill White
781-
bwhite@ctcglobal.com