

Transmission Resiliency and Innovation

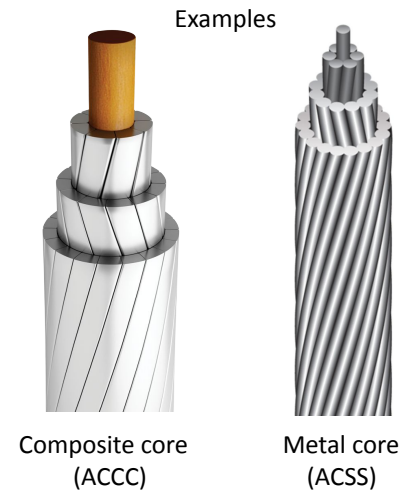
Advanced Conductor Update with
introduction to the Montana Bill
incentivizing use of High-Efficiency
Advanced Conductor

To West Virginia Energy Summit
October 24, 2023

What is an Advanced Conductor?

Advanced conductor is a modern design electric conductor that enables more current flow through a given diameter conductor with less sag than traditional conductor. Two types:

- Metal Core (introduced ~1970)
- Composite Core (introduced ~2000)



In this discussion, “Advanced Conductor” used for Reconductoring will mean only the composite core conductors



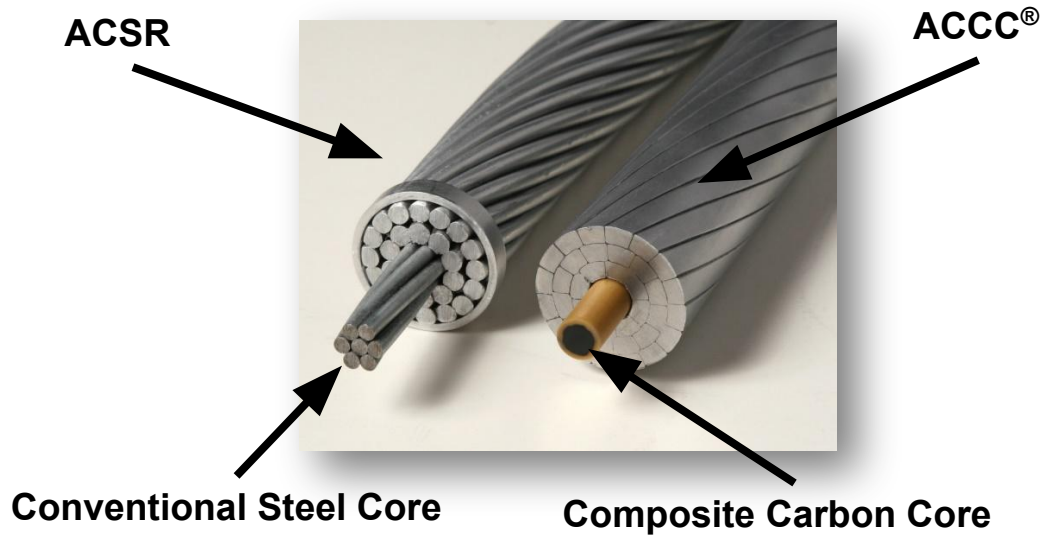
Who supplies Advanced Conductor in the USA?



4 different Advanced Conductor technologies are available in the USA.

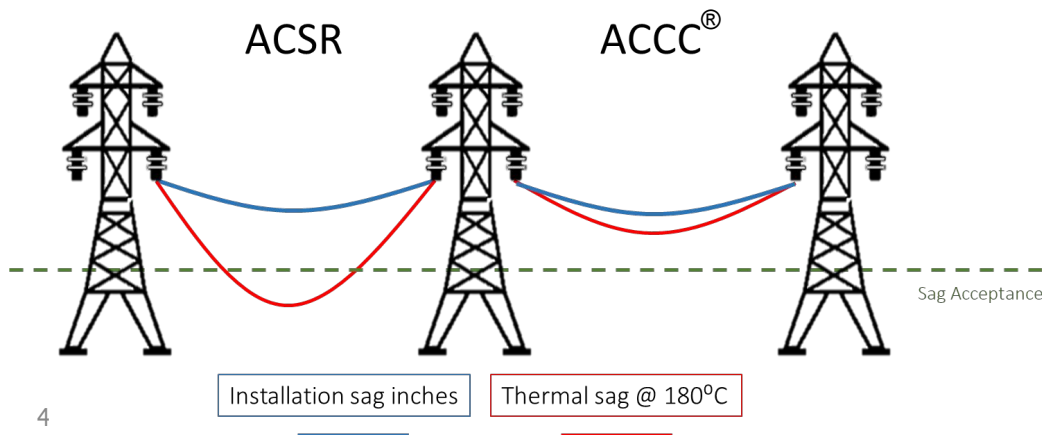
- All use carbon / composite core technology
(lighter, stronger, with lower sag than steel core)
- All supply trapezoidal fully annealed wire configuration
(for capacity and for lower resistance/higher efficiency)
- Company, Technology, Providers in USA
 - CTC Global, ACCC[®] Conductor, Prysmian / Lamifil / Taihan
 - Southwire, ACFR, Southwire
 - 3M, ACCR, 3M (Southwire strander)
 - TS Conductor, TS Conductor, TS Conductor (WTEC Stander)

Advanced Conductors – Designed for Performance



Advanced vs. Conventional

- Replace steel and hard aluminum with carbon and annealed aluminum
- More aluminum that is more efficient =
 - 2x capacity
 - More efficient (30% lower losses)
- Lower thermal expansion means 50% less thermal sag
- Corrosion resistant

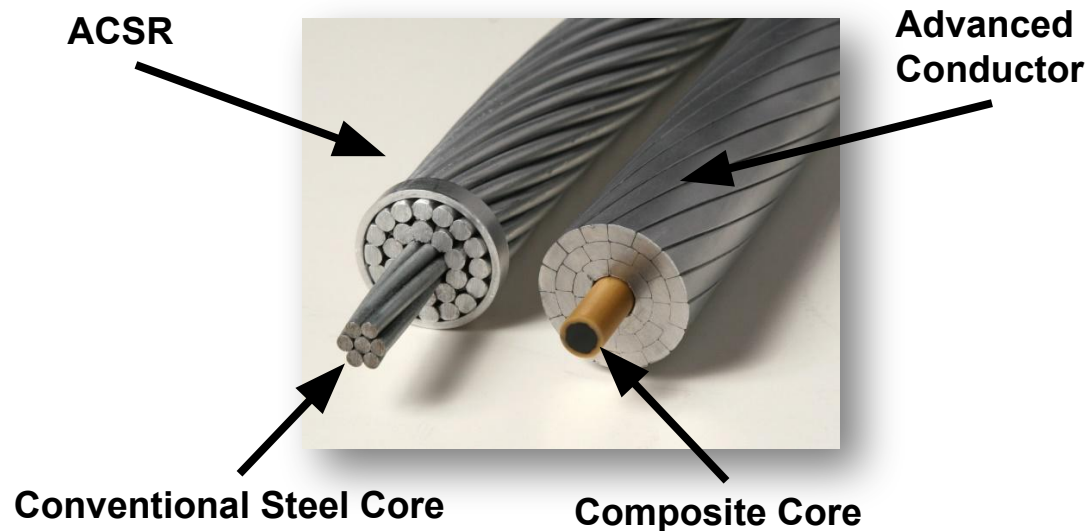


- Less sag means smaller towers or fewer towers
- **Less sag means wildfire risk mitigation**

Composite Core: Enables a Unique Capability

Composite core is stronger and lighter than the same diameter steel core.

Even after more aluminum is added, the composite core Advanced Conductor weighs about the same as the conventional ACSR of the same diameter.



ENABLES A UNIQUE CAPABILITY:

High-efficiency Advanced carbon-core Conductor can be installed on the same tower/structure that was designed for the conventional ACSR (same diameter) and provides much greater capacity and energy efficiency (and lower sag).

ADVANCED RECONDUCTORING

What Does Advanced Reconductoring Enable?

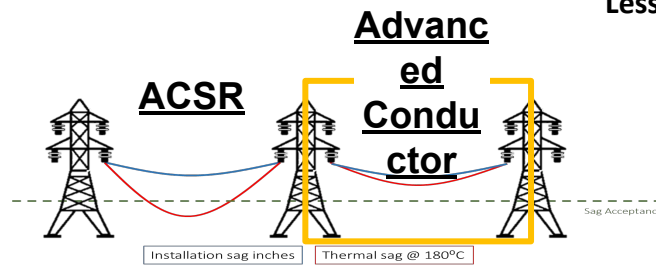
SPEED! DECARBONIZATION! RESILIENCE!

Reconductoring with Advanced Conductor using the same structures in existing ROW, results in:

- 50%-100% more operating capacity in same ROW
- 25%-40% lower line losses
- About HALF the cost of conventional structural rebuild to uprate line
- Fast Process: ~12 - 24 months from decision to energized line
 - Construction permit (& process) is eliminated
 - Maintenance practices for installation
- Wildfire risk mitigation / Ground Clearance



More Capacity
More Energy Savings
Less Carbon Emissions
Faster, Less Costly Upgrade
Less Sag (no ground clearance issues)



Near-term Opportunity for Decarbonization

Grid Strategies Report

ADVANCED CONDUCTORS ON EXISTING TRANSMISSION CORRIDORS TO ACCELERATE LOW COST DECARBONIZATION



>200,000 miles

of transmission lines in NERC region will be \geq 60 years old in the next 10 years

If only 2.5% of the lines were reconducted with Advanced Conductors annually, then over the next decade reconductoring:



Capacity

Creates grid capacity to interconnect **270,000 MW** of renewable generation (27 GW/yr)



Renewable Energy

Enables 3.5 billion MWh of renewable energy to be distributed efficiently around the grid



CO₂

Reduces CO₂ emission by nearly 2.4 billion metric tons*



Consumer Savings

Reduce consumer electric bills by at least \$140 billion

March 15, 2022

[Grid Strategies Report](#)

* Equivalent to OVER 80 X 800MW coal plants at 85% CF for 10 years

AEP Energized Reconductor Project Example

Description: Reconductor 240 circuit miles, 345 kV line, double bundle
(replace 1,440 miles of ACSR conductor with ACCC)

Met Objectives

- Improve reliability (less sag and corrosion)
- Increased capacity (65%) to serve growth
- Retain existing structures – to reduce costs
- Eliminate down time w/ Live Line Reconductoring

Additional benefits received by AEP

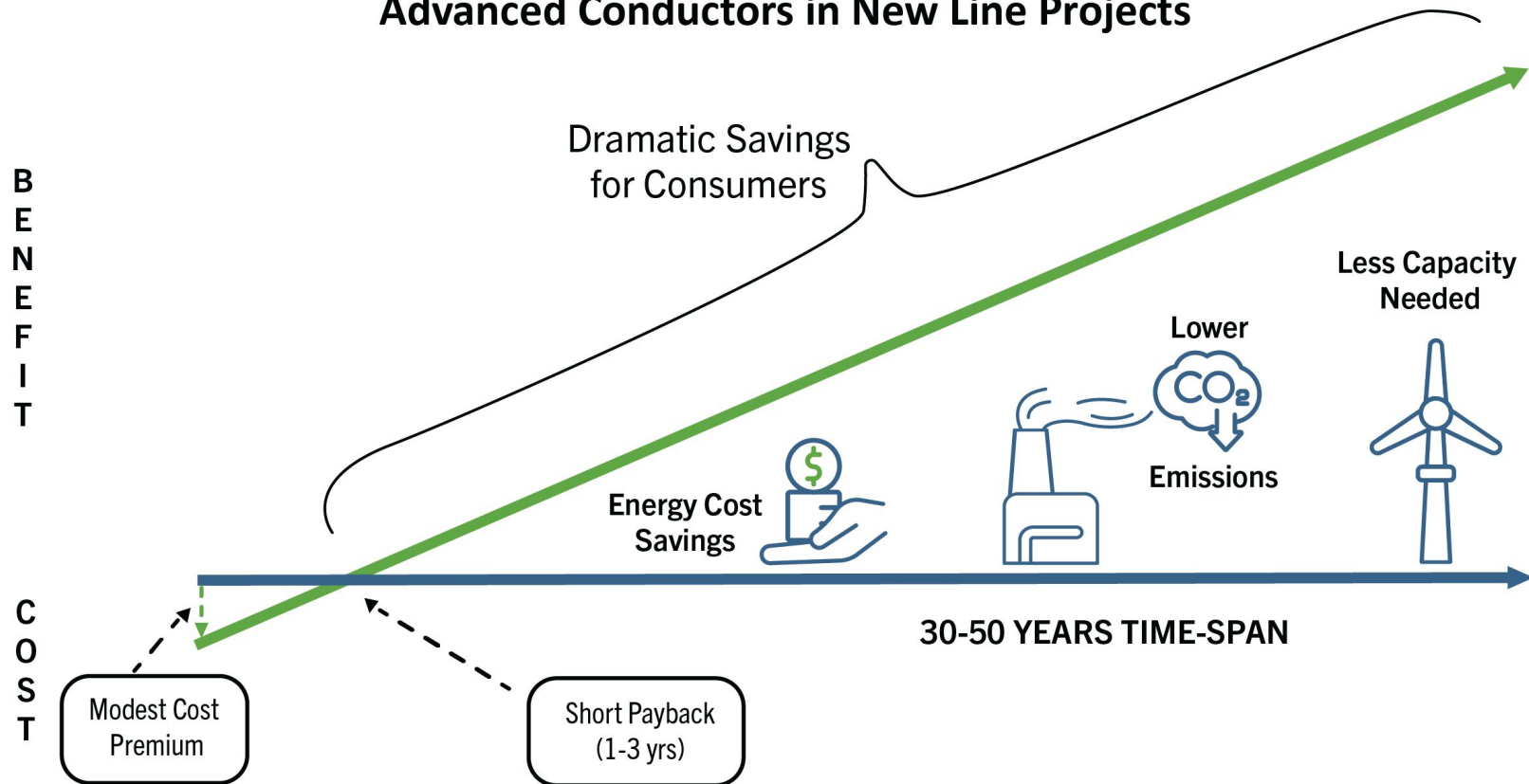
- Project completed **eight months ahead of schedule**
at about **half traditional rebuild cost**
- Reduced line losses by 30%
 - *Saving Consumers \$15 million/yr.
(300,000 MWh at \$50)*
 - *Reducing CO2 emissions by -200,000 metric
tons per year (= -34,000 cars off the road)*
 - *Freeing up -34 MW of generation*
 - *Saving 3.5 billion gallons of water/yr.
(avoided 12k gal/MWh that would have been consumed in fossil-fuel
steam power plants to produce the energy saved)*



*This project won EEI Transmission Project of
the Year – 2016*

Advanced Conductor Results in Consumer Savings

Advanced Conductors in New Line Projects



The conductor cost in a new line project is a relatively small portion of the total project cost. So even if the conductor were 2X the conventional conductor cost, the increased Project cost is small e.g. 5%-10%. The reduced losses from using the more efficient Advanced Conductor may provide immediate energy savings that are 2.5% - 5% of the total project cost per year (project specific results). These energy saving benefits to the customer quickly payback (1-3 years is common) the small incremental premium for using the more efficient and resilient advanced conductor. And these energy, emissions, and resiliency benefits continue every year for the life of the project (often 40-50 years or more).

Advanced Conductor Summary

- **GRID EFFICIENCY** matters and should be part of the project design process
- **Reconductoring with Advanced Conductors** is the fastest, lowest cost way to add substantial grid capacity to accelerate grid modernization & decarbonization
- **Building New Lines with Advanced Conductors** is a win for consumer, the environment, and the grid.
- **Low-sag Advanced Conductors** reduce wildfire risks (adds grid resiliency)

**Speed! Resilience!
Decarbonization!**



CONDUCTOR EFFICIENCY STANDARD

FY '23 DOE Appropriations Omnibus Direction

The Department is directed to provide to the Committee not later than 180 days after enactment of this Act a **report regarding the environmental, economic, and clean energy deployment benefits of establishing an energy conservation standard for overhead electricity conductors** that move electricity at voltages equal to or larger than 69 kV on the electric grid from sources of generation or storage into the distribution system for final delivery. For the purposes of the report, **the standard should be based on the electrical resistance** of such conductors as measured at 20 degrees Celsius. The report shall examine whether establishing such a standard will:

- 1) Reduce line losses and their associated emissions;
- 2) Expedite the deployment of additional renewable capacity on the electric grid;
- 3) Reduce transmission line sagging in wildfire-prone regions;
- 4) Reduce permitting timelines for adding new transmission capacity to the electric grid; and
- 5) Any additional matters the Department deems appropriate.

The **Office of Electricity shall coordinate with** the Grid Deployment Office, the Office of Energy Efficiency and Renewable Energy, and the Federal Energy Regulatory Commission on the report.

CONDUCTOR EFFICIENCY STANDARD - STATUS

- DOE Office of Electricity is lead for Study
 - OE has engaged some labs to assist
 - Will not make the “180 days”, but working expeditiously
 - “Drafts” circulating internally at DOE OE, GDO, and EERE
- Effort has Secretary-level interest and support
- White House interested and supportive
- Congressional leaders ready to support Bill language for a Conductor Efficiency Standard when study is completed



MONTANA HB729: What is it all about?

MONTANA HB 729

What is it?

How did it happen?

What's happening now?



MONTANA HB 729: Signed into law May 2023

What is it?

AN ACT PROVIDING FOR ADVANCED CONDUCTOR COST-EFFECTIVENESS CRITERIA; ALLOWING ADVANCED CONDUCTOR RATE BASING; PROVIDING A DEFINITION; AMENDING SECTION 69-3-702, MCA; AND PROVIDING AN IMMEDIATE EFFECTIVE DATE. BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MONTANA:

Section 1. Criteria for allowable advanced conductor programs.

- (1) The commission may **approve cost-effectiveness criteria** for advanced conductor **projects that may be placed into a utility's rate base** under this part.
- (2) **Criteria** must be based on established **direct current resistance** at standard pressure and a temperature of 20 degrees Celsius.
- (3) As used in this section, "**advanced conductor**" means an overhead electricity conductor installed in a transmission or distribution project that has a direct current **electrical resistance at least 10% lower** than existing conductors of a similar diameter on the system.
- (4) In establishing **cost-effectiveness criteria**, the commission **may consider decreased electrical losses and any other relevant consumer, environmental, and system benefits** provided by advanced conductors.

Section 2. Section 69-3-702, MCA, is amended to read: "69-3-702. Eligible conservation. **Conservation purchases or investments are eligible** under this part if they are provided for in 69-3-1206 and in accordance with [section 1] or 69-3-1209."

Section 3. Codification instruction. [Section 1] is intended to be codified as an integral part of Title 69, chapter 3, part 7, and the provisions of Title 69, chapter 3, part 7, apply to [section 1].

Section 4. **Effective date. [This act] is effective on passage and approval.**

MONTANA HB729: How did this get accomplished?

Montana Public Service Commissioner Pinocci lead an effort to incentivize high-efficiency, high-capacity, low-sag advanced conductors for use on the Montana electric grid: a substantial benefit for Montana ratepayers and for the grid. He:

- Established an “Education Docket” for the PSC to have the Commissioners hear about advanced conductors.
- As former legislator, Commissioner Pinocci worked with colleagues in the House and Senate to draft language for a Bill that could be passed by Energy Committees in both chambers.
 - House Energy Committee took up the bill first and unanimously passed the language with minor improvements.
 - Bill passed the House floor vote unanimously.
 - Senate Energy Committee passed the House language with a single dissenting vote and passed the Senate floor vote unanimously.
 - **Unanimous vote was “(pleasantly) BEYOND OUR WILDEST DREAMS!”**
 - The Governor signed the Bill in May 2023.

MONTANA HB729: What is happening now?

- The first utility project using advanced conductors that meet the 10% lower resistance threshold is currently being developed. Conductor has been delivered to the Project. The advanced conductor selected is ~30% lower resistance than the same size ACSR (that usually would have been used for the Project).
- The PSC will develop the cost-effectiveness criteria for advanced conductor projects and establish the appropriate incentive ROI adder for a project presented to the PSC for rate-basing.

Questions?

- Thank-you for your interest!
- For more information:
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