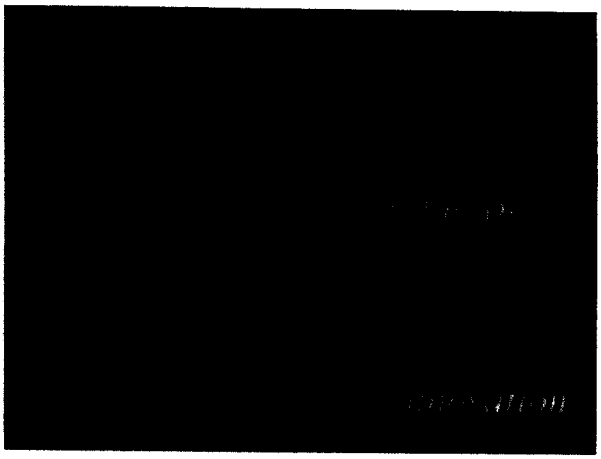
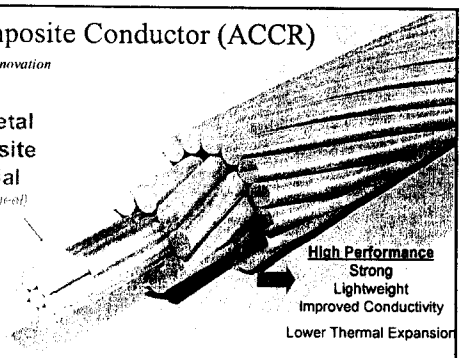


3M Composite Conductor (ACCR)

A Materials Innovation

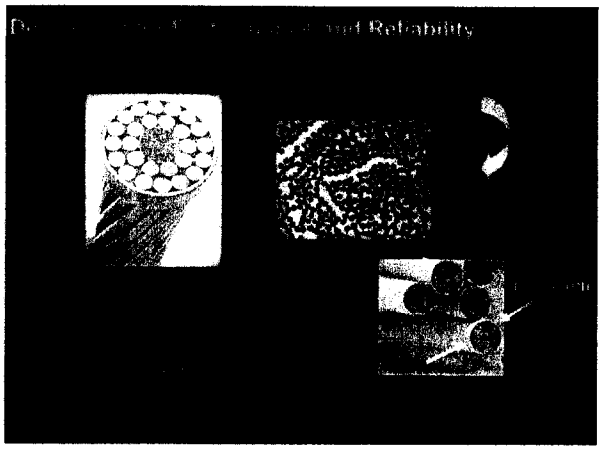
New Metal Composite Material

(replaces steel)

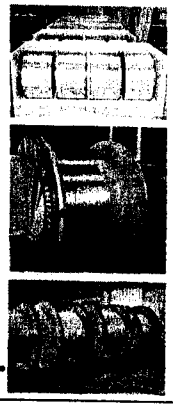


High Performance
Strong
Lightweight
Improved Conductivity
Lower Thermal Expansion

Quick solution to increase capacity of existing transmission lines without need for new towers or a visual change to line



3M Aligned with Industry Leaders



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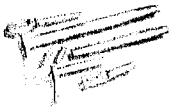


ALCOA

PLP

- Conductor & Accessories
- Installation Guidelines
- Laboratory Test Results
- Technical Support

Nexans

Extensively Tested

Strength

Thermal Expansion

Short Circuit

Torsional Ductility

Test Span

Creep (rt/et)

Lightening

Drop Test

Vibration Fatigue

Axial Impact

Sheave

Shotgun

Crush

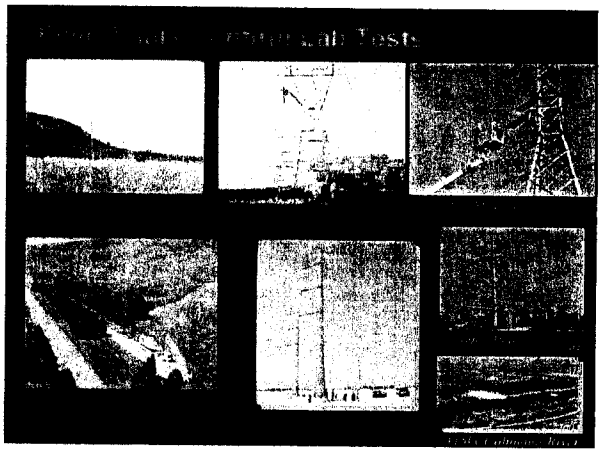
Galloping

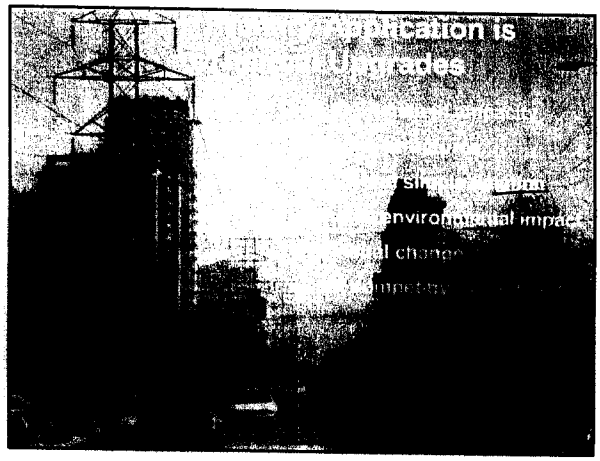
TRAC

UT-BATTELLE
OAK RIDGE NATIONAL LABORATORY
U.S. DEPARTMENT OF ENERGY

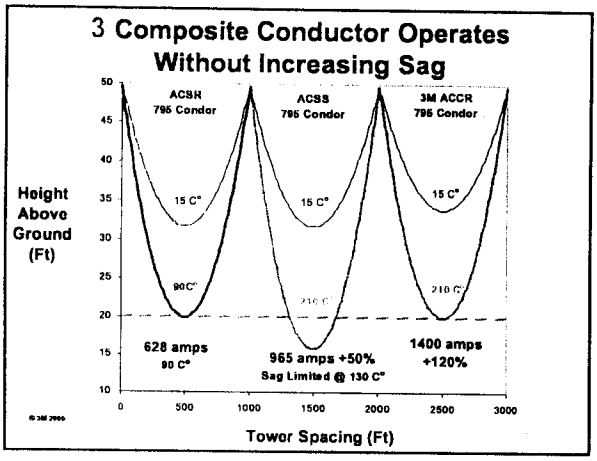
KINECTRICS

PLP

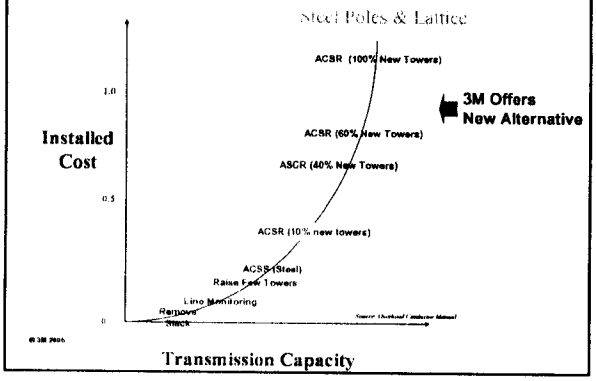




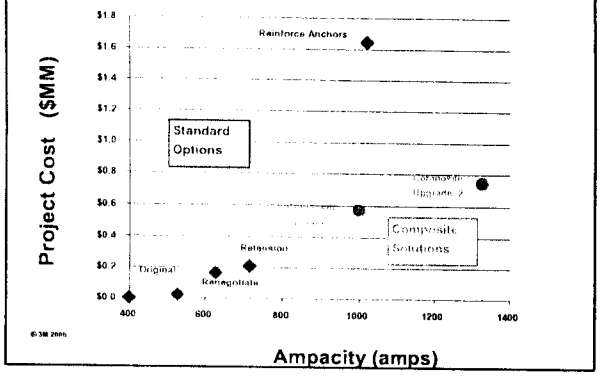
3 Composite Conductor Operates Without Increasing Sag



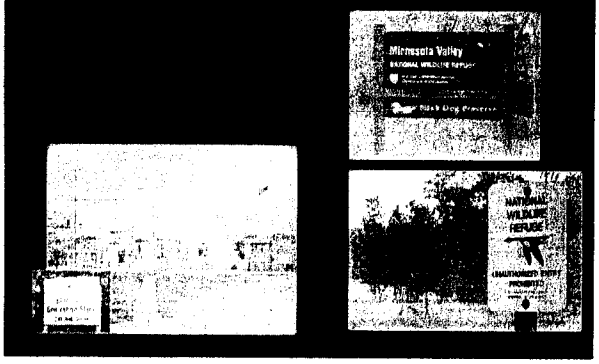
Economics of Thermal Upgrades



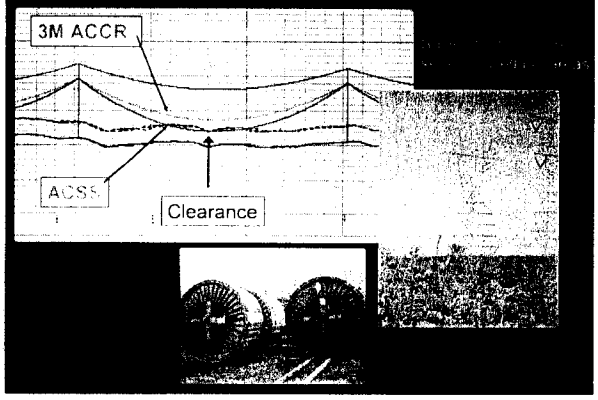
Construction Cost Example

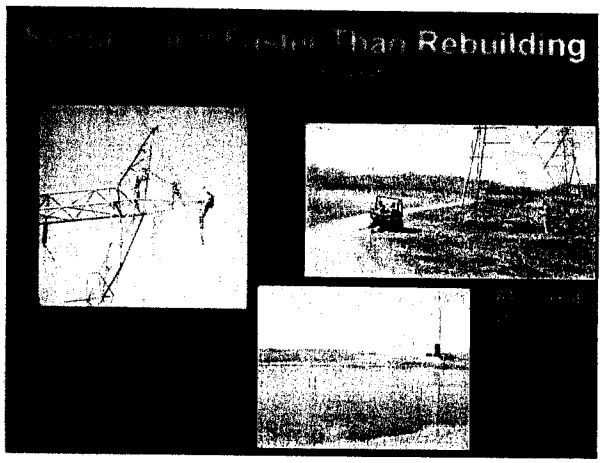


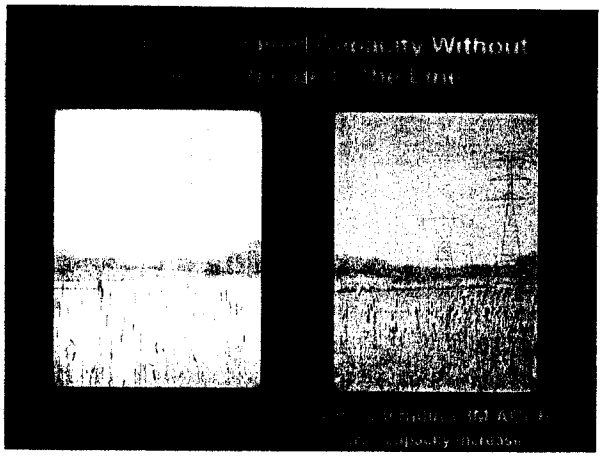
Commercial Installation

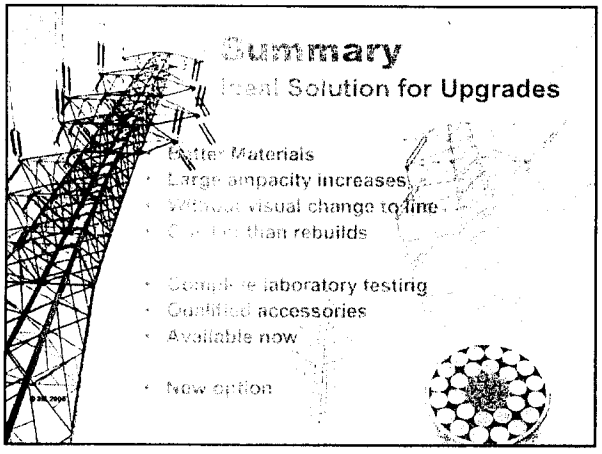


3M Solution Avoided Tower Replacement




Than Rebuilding


Without


Summary
Solution for Upgrades
Materials
Large capacity increases
Without visual change to line
than rebuilds
laboratory testing
accessories
Available now
New option

Backup

ACCR Conductor Ratings

Kcmils	Stranding	Ampacity (amps) continuous	MVA rating continuous 115kv	230kv
336	26/7	937	200	400
477	26/7	1,179	252	504
636	26/19	1,426	305	610
795	26/19	1,653	354	708
954	54/19	1,840	395	789
1,272	54/19	2,229	478	957
1,590	54/19	2,586	556	1,112

ACCR (round construction Ampacity at 210C°)

ACCR Electrical Properties

		477-T16	795-T16	1272-T13
Resistance				
DC @ 20C	ohm/mi.	0.1832	0.1100	0.0700
AC @ 25C	ohm/mi.	0.1875	0.1126	0.0717
AC @ 75C	ohm/mi.	0.2247	0.1349	0.0858
AC @ 210C	ohm/mi.	0.3249	0.1951	0.1241
AC @ 240C	ohm/mi.	0.3472	0.2084	0.1327
GMR	ft	0.0290	0.0375	0.0466
Reactance				
Inductive Xa	ohm/mi.	0.430	0.399	0.372
Capacitive X'a	ohm/mi.	0.0988	0.0912	0.0847

Thermal Upgrade Application Guide

Competitive Performance: % Increase ABOVE ACSS

Loading Zone	Span (ft)	No Sag Margin	Sag Margin
1 Light	600	66%	35%
	900	81%	76%
	1200	79%	105%
3 Heavy	600	37%	17%
	900	58%	38%
	1,200	86%	68%

Thermal Upgrade Application Guide

Competitive Performance: AVOIDING REBUILDS

Replacement ACCR	Ampacity ACCR	Capacity Increase (x times ACSR)		Equiv. ACSR Line
kcmil	amps	min	max	kcmils
336	937	1.6	3.1	636
397	1,046	1.6	3.1	795
477	1,179	1.6	3.1	1,033
795	1,653	1.6	3.3	1,590
1033	1,940	1.7	3.4	2 X 636
1272	2,229	1.7	3.5	2 X 954
1590	2,586	1.7	3.5	2 X 1113