GAP+ CASE STUDY

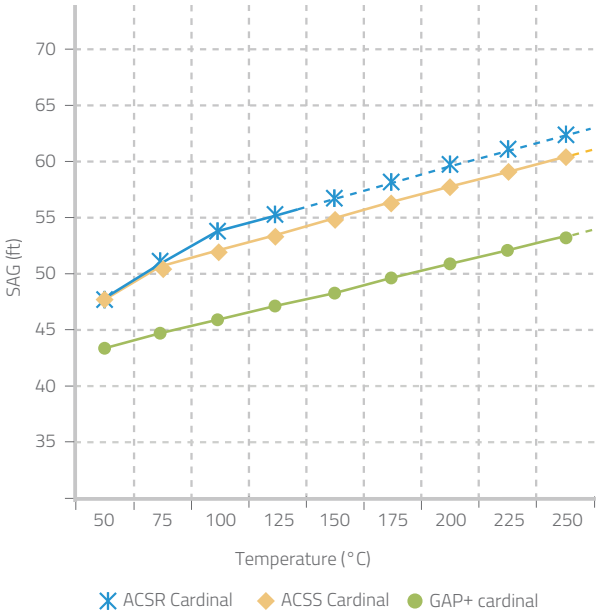
When the going gets though

THE CHALLENGE

A grid operator is confronted with a challenging line upgrade. The capacity of an existing ACSR transmission line (one circuit, twin bundle) over 70 miles has to be doubled as the operator faces issues with supply security throughout the region. Equal or better line efficiency is an important requirement for the conductor chosen to replace the ACSR.

Budgetary restrictions do not allow for thereconstruction of towers. Moreover, a solution needs to be found for a long valley crossing. The terrain is rough and weather conditions place frequent strain on the grid. During winter, up to 2 inches of high-density ice loading is not uncommon on certain sections of the line. To address the effects of ice load, the operator has calculated that the sag under high ice conditions needs to be reduced by 10% compared to the existing ASCR conductor. The new line should also be at least as, if not more efficient, than the old ACSR at its rating current. A solution involving one single conductor technology, albeit in different sizes, is preferred.

SAG VS. TEMPERATURE



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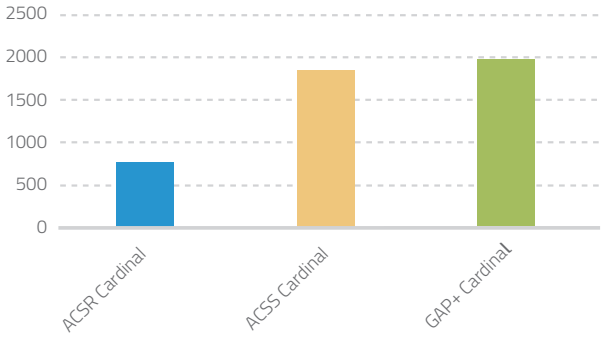
THE CHOICE FOR GAP+

In spite of the challenges of the surrounding area, the operator needs the project commissioned within a short timeframe and within the tight budget. After thorough consideration, the GAP+ conductor is selected for the project for a number of reasons. First of all, it meets the requirements for both the capacity upgrade and tower load conditions while demonstrating excellent sag behaviour and thermal ratings.

Built from robust materials with which the operator is familiar, GAP+ offers excellent value for money within the allocated budget for this project.

CURRENT AT MAXIMUM OPERATING TEMPERATURE



HOW GAP+ MAKES A DIFFERENCE

Thanks to its straightforward installation method, the difficult terrain and short commissioning timeframe were no issue for the GAP+ conductor. Built for heavy duty, GAP+ withstands high ice loads and temperature sag while offering high capacity and robustness.

Specifically, the GAP+ conductor (at 150°C) doubles the capacity of the ACSR (at 75°C) from 810A to 1620A. When both conductors run at the same current, the GAP+ is 16% more efficient. This equals a yearly cost saving of approx. $US 6,700/mile or in this particular case approximately $US 2.8 million annually for the entire line. When both conductors run at e.g. 75°C, the GAP+ runs at 8% higher capacity, from e.g. 810A to 875A.

The GAP+'s sag at highest load is 11% lower than the ACSR for the same load. Moreover, the design can easily be adapted to deliver even higher load performance in exchange for minimal reductions in capacity. The GAP+ conductor is 5 to 10% stronger than its ACSR or ACSS equivalents and is less prone to damage in rough terrain thanks to its hard-drawn wires in the outer layer.

The long crossing was also not a problem for the GAP+ since the core strength could be doubled without increasing the conductor weight. This was achieved thanks to the stranded nature of the core at the expense of the aluminium section. The required current was subsequently reached at just 200°C and the decrease in efficiency was isolated to just the crossing without effecting the rest of the line.

Overall, the GAP+ conductor proved to be the best upgrade choice for this grid operator's challenging requirements.

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CONDUCTOR COMPARISON				
Cardinal		**ACSR**	**ACSS**	**GAP+**
Conductor specifications				
Overal diameter	inch	1.20	1.20	1.17
Weight	lbs/kft	1,280.8	1,280.8	1,318.4
Strength (RTS)	lbs	33,497	34,284	37,386
DC resistance at 20°C	Ohm/kft	0.018	0.018	0.015
Conductor performance and efficiency				
Maximum operating T	°C	75	210	210
Current at maximum operating T	A	811	1,845	1,966
Improvement of current at max T	%		127.5%	142%
Current calculations with environment Temp: 40°C; Wind velocity = 2ft/s, Emissivity = Absorption coefficient = 0.5; Sun radiation = 92.9W/ft²; Assumption: "Costs of 1 MWh = $60"				
Joule losses				
Joule losses (811 A; 50Hz)	W/kft	14,743	14,170	12,322
Temperature at given current	°C	75.0	74.0	71.0
Improvement of Joule losses	%		4%	16%
Total cost Joule losses	$/kft	$7,749	$7,448	$6,476
Yearly cost savings per kft conductor	$/kft		$301	$1,273
Greenhouse gas reduction				
CO_2 reduction	%		4%	16%

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