Mega & Giga Strands for overhead power lines

Innovative solutions to power the future

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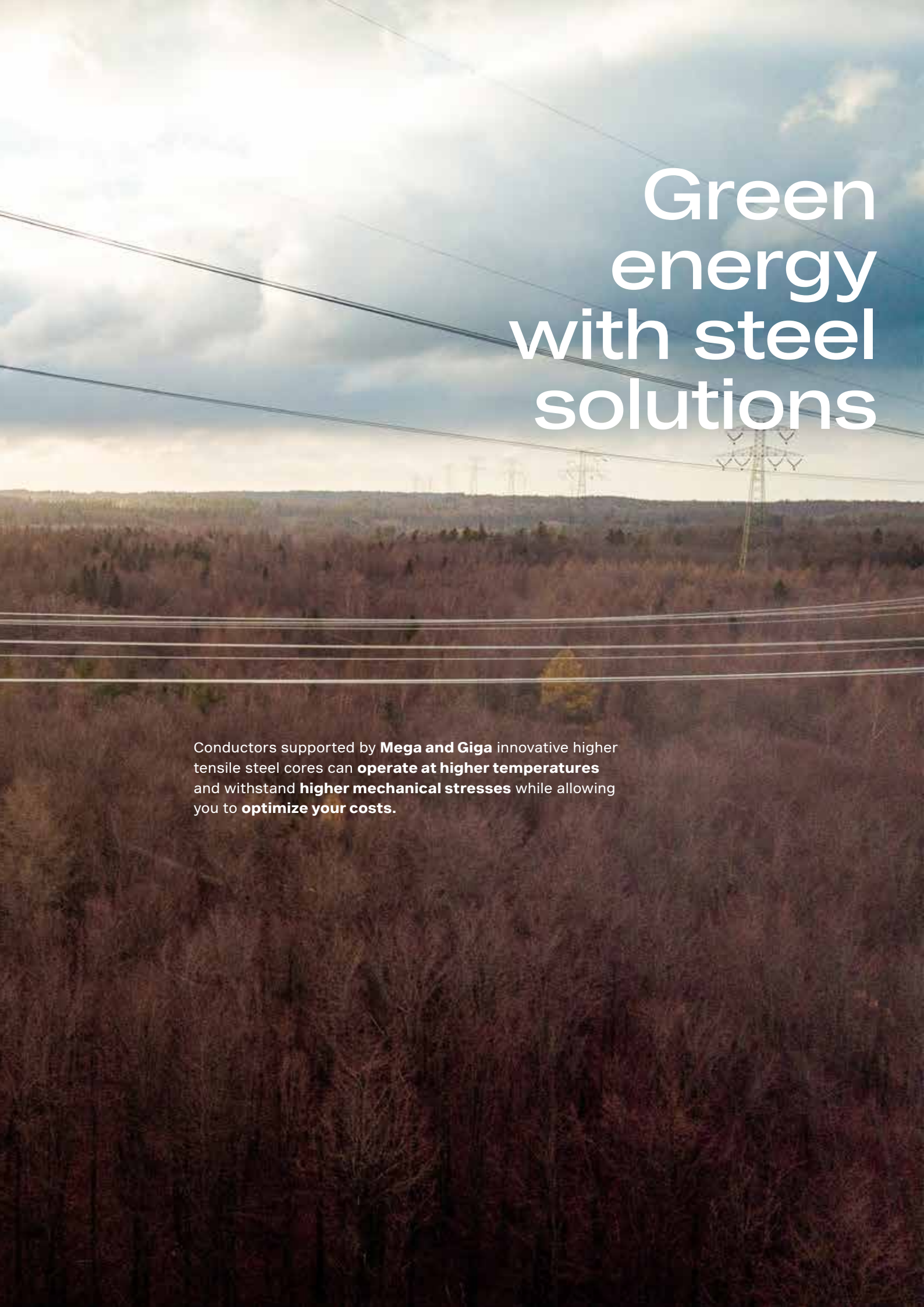


Green energy with steel solutions

Conductors supported by **Mega and Giga** innovative higher tensile steel cores can **operate at higher temperatures** and withstand **higher mechanical stresses** while allowing you to **optimize your costs.**

Enabling green energy transition

Are we ready?

Industry growth is expected to be driven by expanding investments in the commissioning of solar power plants and wind farms, as well as by the growing demand for sustainable energy. Rapid product deployment is also fueled by emerging nations' excessive use of power in conjunction with effective government initiatives for product distribution in transmission-connecting nations.

In addition, there are growing worries about **energy security and grid stability, along with higher costs** associated with building a sustainable electrical network in response to growing power use.

It is anticipated that ongoing initiatives to modernize the electrical grid, such as research and development into smart grid technology and grid energy storage, will have a favorable impact on the state of the business. The growing need for better transmission networks is driving the development of superconducting cables and the continuous extension of long-distance transmission lines. Furthermore, the industry forecast is expected to be influenced by significant efforts to update the grid infrastructure through the installation of innovative conductors and control technology.

In the upcoming years, the ultra-high strength segment is expected to increase at a notable rate. Because of the product's **high thermal resistance, thermal sag, and additional sag** caused by various load situations, such as ice loading and severe winds, long-distance overhead conductors must be exceptionally strong.

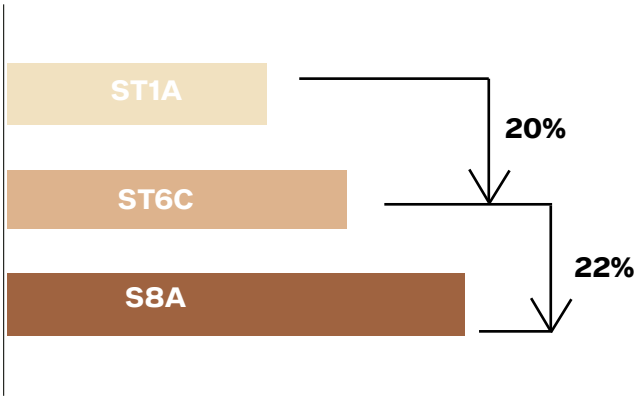
These conductors find extensive usage on account of their **ability to bear loads, enabling efficient long-distance electrical transmission with minimal loss.**

Protect your investment, rely on time-tested steel solution

For more than 100 years, steel cores have ensured that power conductors can withstand the rigors of Mother Nature and keep delivering energy to millions of people and businesses.

Mega and Giga strands are innovative higher tensile steel cores whose designs are compatible with the current proven designs of conductors. Conductors supported by either of these steel cores can operate at higher temperatures and withstand higher mechanical stresses while allowing you to optimize your costs.

Mega and Giga (S7A & S8A) wires & cores are now **included in the latest norm - EN IEC 63248:2022,** which has finally backboned our long-term used solution.



An illustrative example of the yield strength (Re) of different steel grades with core diameter 2,75 mm

High tensile steel core to your benefit

Increase capacity

- the conductors reinforced with higher tensile steel cores will sag less.
- **operating at higher temperatures** without exceeding existing sag and ground clearances resulting in **higher energy transfer**

Reduce power losses

- the conductors with a high tensile steel core can have a smaller steel cross-section, impacting aluminum cross-section
- more efficient conductor core can result in l**ess energy losses,** possibly even up to 20%

Reduce total project cost

- power lines supported with a high tensile steel core are the ideal solution for new-build and challenging projects
- reduction of height and number of towers (up to 12%)
- an ideal **solution for hardly accessible places and new projects**

Meet special conditions

- higher tensile steel cores can withstand extreme mechanical stresses
- reduction of conductor´s OD up to 12% while keeping the same ampacity
- **preferable solution for locations facing extreme weather conditions** such as heavy ice and wind loadings.

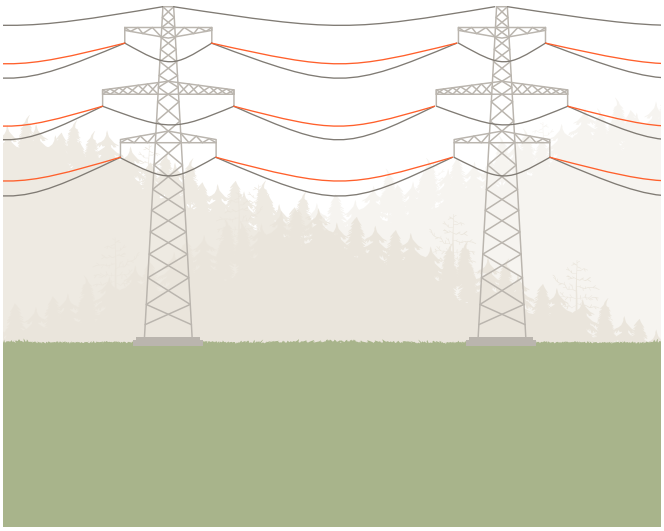
Your project, your strand

Increase capacity

Re-conductoring & New lines

To meet the growing demand for high-capacity power lines, contractors are replacing traditional power lines with high-temperature, low sag (HTLS) conductors or building new HTLS lines.

These conductors feature a high tensile steel core, making them **more suited for higher operating temperatures and thus enabling them to transfer more power**. By reconductoring existing lines rather than replacing the line completely, contractors are able to **reduce project costs, construction time, and the impact on the environment.**

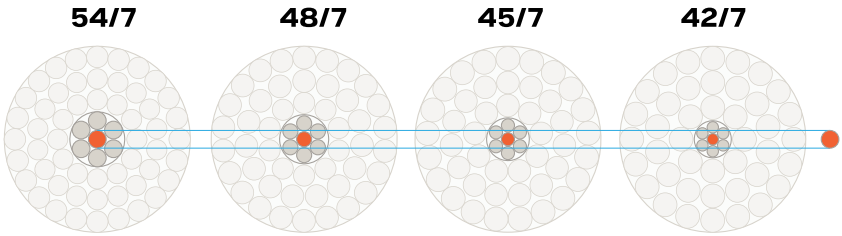


Reduce line losses

Bekaert Mega and Giga steel cores are thinner than standard steel cores. This enables producers to increase the aluminium in conductors while maintaining the same cross-section. With **the same conductor diameter and same strength, you can use a bigger aluminium section which allows you to increase the ampacity** of the line or reduce losses while keeping the same ampacity.

Conductor
476-AL1/62-ST1A

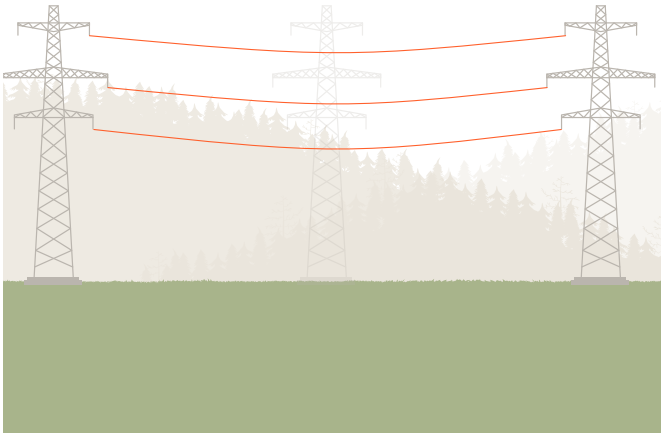
Conductor
509-AL1/26-ST7A

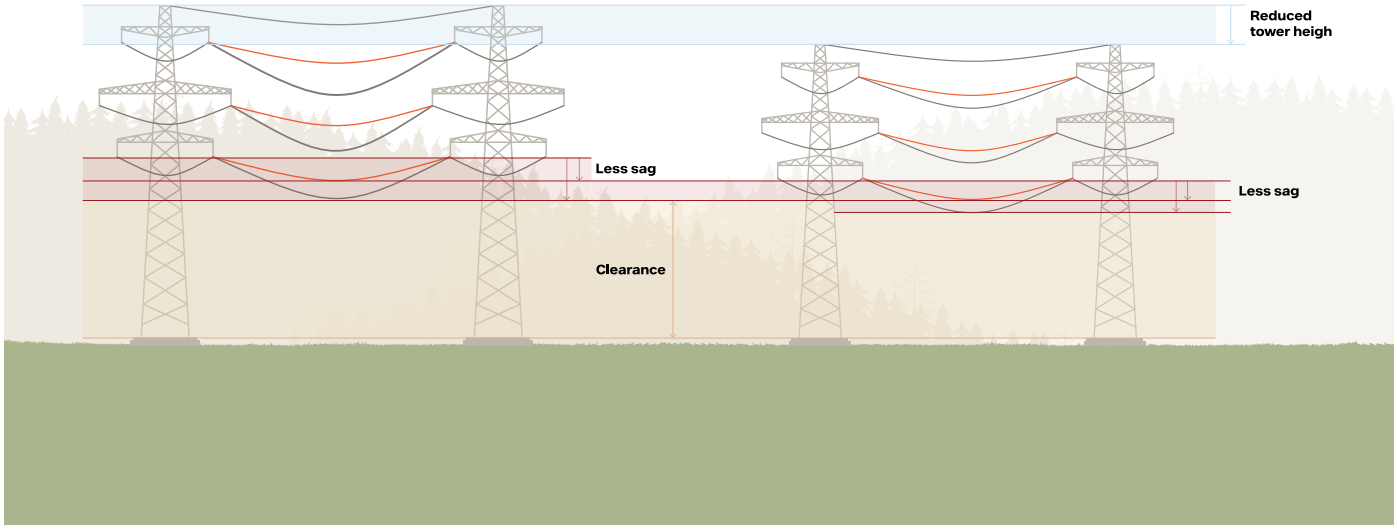


Based on the TCO calculation you can see that there is an option to **reduce core by 35,4 %**

Reduce total project costs

Using the **same conductor diameter and aluminium section, but with increased strength** you can decrease the height of the tower with less sag or increase span keeping the sag the same resulting in **fewer towers used or lower material needs.** These options either **lower environmental impact, help speed up building permits, and ease the process of land acquisitions.**

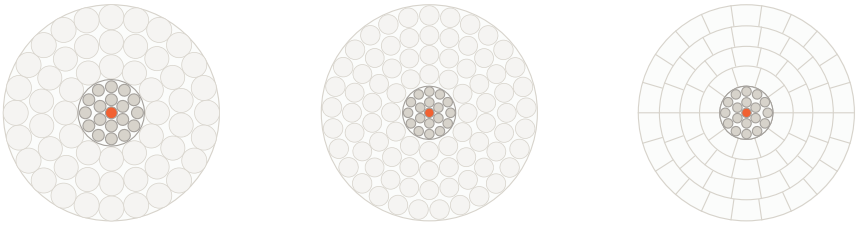




Cope with extreme weather conditions

The higher tensile steel cores prevent line sagging in the most challenging projects. They are the **perfect solution for long spans over river crossings and uneven grounds,** and they withstand various load conditions such as hard winds and heavy ice loads.

Alternatively, these high-tensile cores also **allow you to produce lighter and thinner conductors**. As you can see from the illustration below, the high loading capacity of the steel enables you to use thinner cores while maintaining the same strength and amount of aluminum as a typical design.



		original conductor 679-AL1/86-ST1A	Case 1a: same overall diameter 716-AL1/48-ST8A		Case 1b: same overall diameter 906/48-AT1F/ST8A- 360	
Core wires		19 x 2,40 x ST1A	19 x 1,80 x ST8A		19 x 1,80 x ST8A	
Aluminium wires		54 x 4,00 x AL1	80 x 3,375 x AL1		64 x h3,375 AT1 ZW	
Overall diameter	mm	**36,00**	**36,00**		**36,00**	
Core cross-section area	mm²	85,95	48,35		48,35	
Aluminium cross-section area	mm²	**678,58**	**715,69**	**5,47%**	**906,17**	**33,54%**
Overall cross-section area	mm²	764,54	764,04		954,52	
Rated tensile strength	kN	206,56	207,54		236,24	
Unit mass (no grease)	kg/km	**2 549,60**	**2 359,93**	**-7,44%**	**2 887,14**	**13,24%**
DC resistance at 20°C						
- total	Ω/km	0,0418	0,0400	-4,23%	0,0322	-22,95%
- without core (AL part only)	Ω/km	0,0426	0,0404	-5,06%	0,0325	-23,76%

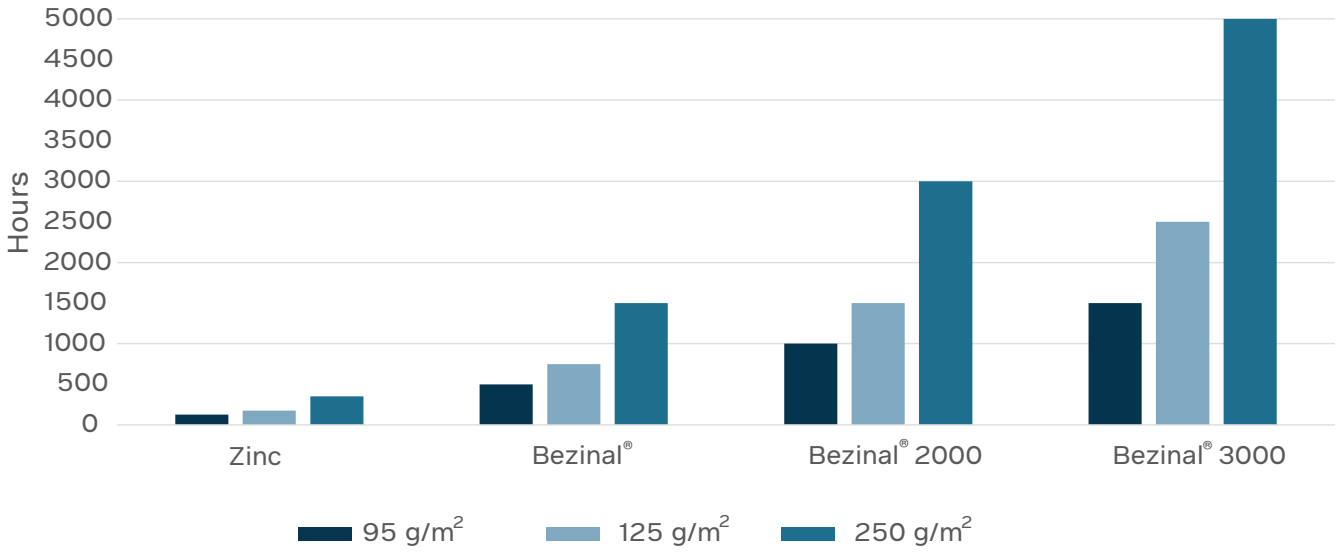
Advanced solution...

Your successful projects need reliable materials. Steel is a long-standing and industry-proven solution for power line conductors. Together with the suitable coating, you can eliminate not only the occurrence of corrosion but also possibly greasing operations to make your project more sustainable.

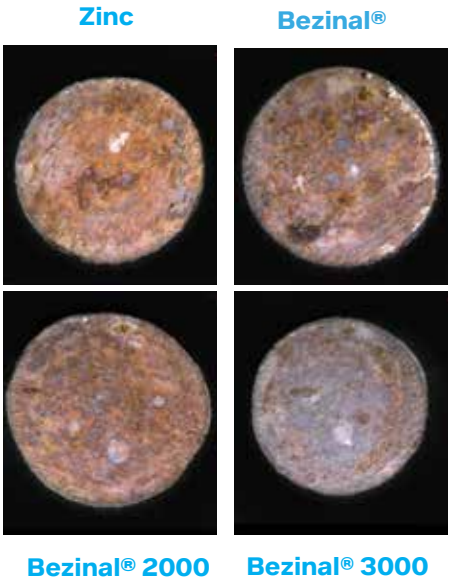
Advanced coating to protect your investment

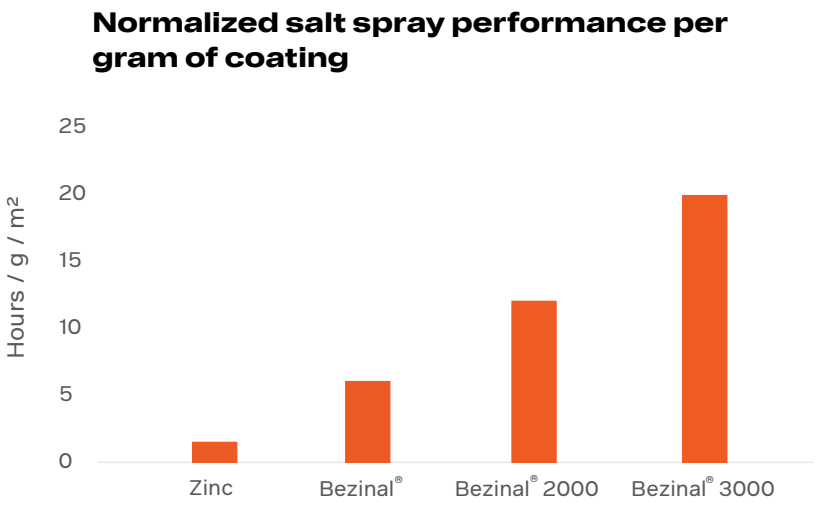
Bekaert is well known for its expertise in coating development. We offer advanced coating options for your conductor cores to prolong their lifetime and reduce failures and CO_2 footprint.

Salt spray resistance till 5% dark brown rust for 2,5 mm cotaed wire



... for lower CO_2 footprint



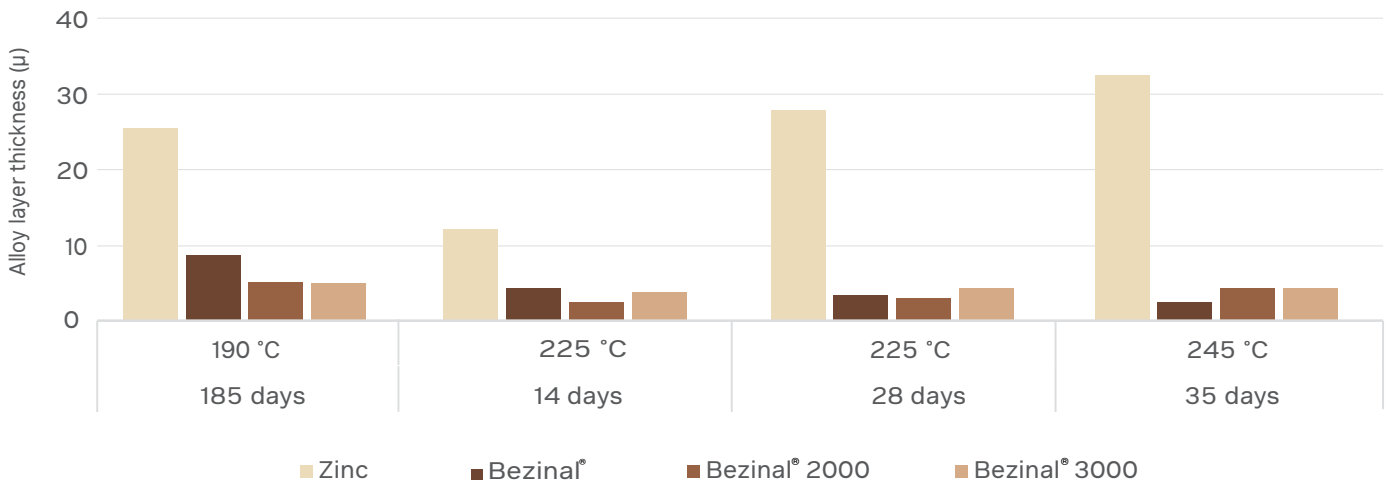


The performance of overhead power lines depends on their parameters. One of the main parameters is the thermal limit of the line, which affects the sag.

Our steel cores with advanced coatings ensure the stable quality and performance of the conductor, no matter the temperature.

Thanks to our **Mega & Giga steel cores,** you can safely transmit more energy efficiently, even with higher operating temperatures**. The high tensile will reduce the sag, and advanced coatings will protect your core.**

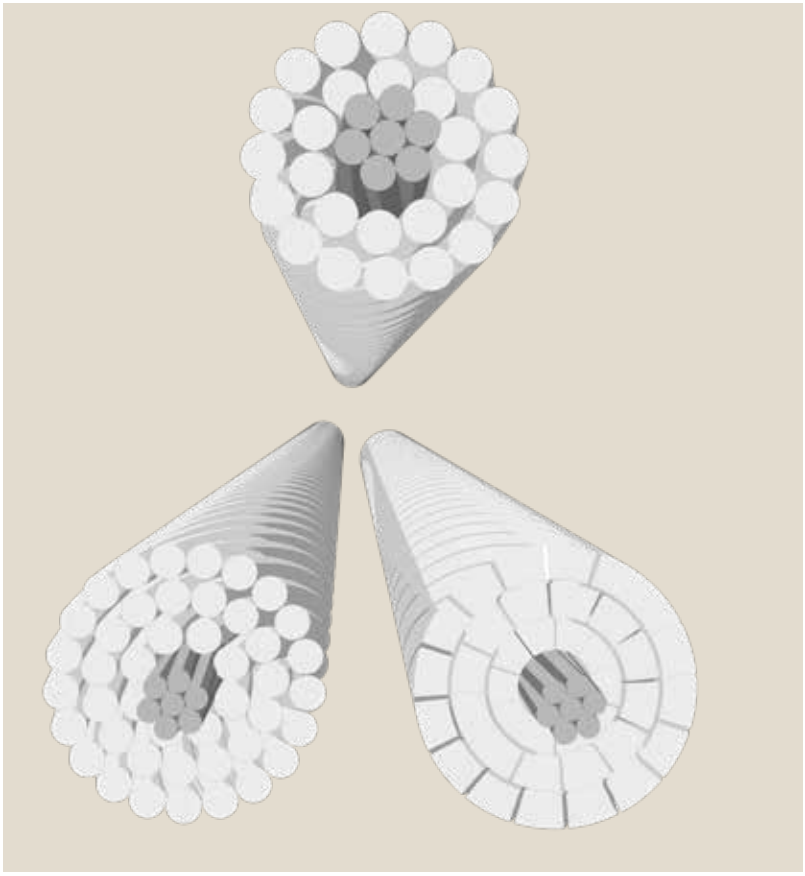
Intermetallic layer thickness after heat treatment starting from 3-6 µ initial alloy layer for different coatings



Challenging projects with ease

The higher tensile steel cores prevent line sagging making them the perfect solution for long spans over river crossings and uneven grounds, Our core can easily withstand various load conditions such as hard winds and heavy ice loads.

We do not only claim it...



TCO calculation for overhead power line V483/484*

We compared our **Mega and Giga steel core conductors** with the existing conductor 476-AL1/62-ST1A, on line V483/484. The calculations were performed in PLC CAD by an external line designer.

The technical parameters of our strands were processed according to IEC 63248. The calculation methods were defined according to STE EN 50182 IEC61597 and CIGRE TB601 and TB 207.

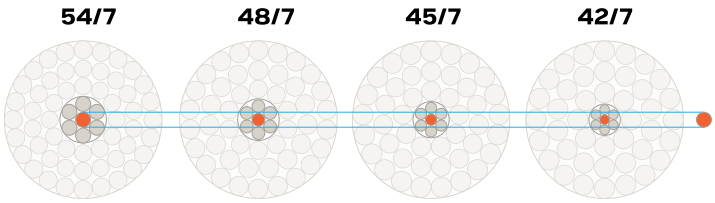
8 different variants of the Mega & Giga solutions were chosen, resulting in:

- extended distance between towers,
- effective distributions of towers and loads on towers,
- focus on maximum elimination of losses

**2x 400 kV, accroding to STN EN 50341-1:2003*

...we prove it

In the data below you can see different types of conductors used for calculations, the matrix of solutions of skipping or reducing towers with different steel tensile strength conditions, and also power line terrain.



Type	0	A1	A2	B1	B2	C1	C2	D1	D2
Construction	54/7	54/7	54/7	48/7	48/7	45/7	45/7	42/7	42/7
Conductor type	476-AL1/ 62-ST1A	476-AL1/ 62-ST1A	476-AL1/ 62-ST1A	476-AL1/ 43-ST1A	476-AL1/ 43-ST1A	502-AL1/ 35-ST7A	502-AL1/ 35-ST8A	509-AL1/ 26-ST7A	509-AL1/ 26-ST8A
Aluminium wires	AL1 3,35 mm	AL1 3,35 mm	AL1 3,35 mm	AL1 3,62 mm	AL1 3,62 mm	AL1 3,77 mm	AL1 3,77 mm	AL1 3,93 mm	AL1 3,93 mm
Steel wires	ST1A 3,35 mm	ST7A 3,35 mm	ST8A 3,35 mm	ST7A 2,81 mm	ST8A 2,81 mm	ST7A 2,51 mm	ST8A 2,51 mm	ST7A 2,19 mm	ST8A 2,19 mm
Conductor Ø	30,15 mm	30,15 mm	30,15 mm	30,15 mm	30,15 mm	30,15 mm	30,15 mm	30,15 mm	30,15 mm
Cross-section	537,6 mm^2	537,6 mm^2	537,6 mm^2	537,4 mm^2	537,4 mm^2	537,0 mm^2	537,0 mm^2	535,8 mm^2	535,8 mm^2
Weight	1,799 kg/m	1,799 kg/m	1,799 kg/m	1,705 kg/m	1,705 kg/m	1,659 kg/m	1,659 kg/m	1,614 kg/m	1,614 kg/m
E-modulus	70,5 GPa	70,5 GPa	70,5 GPa	65,9 GPa	65,9 GPa	63,7 GPa	63,7 GPa	61,6 GPa	61,6 GPa
Coef. Thermal expantion	19,44 $.10^{-6}$ 1/K	19,44 $.10^{-6}$ 1/K	19,44 $.10^{-6}$ 1/K	20,32 $.10^{-6}$ 1/K	20,32 $.10^{-6}$ 1/K	20,79 $.10^{-6}$ 1/K	20,79 $.10^{-6}$ 1/K	21,26 $.10^{-6}$ 1/K	21,26 $.10^{-6}$ 1/K
RTS (Tensile)	164,6 kN	182,8 kN	187,7 kN	153,7 kN	157,2 kN	139,9 kN	142,7 kN	128,2 kN	130,3 kN
DC resistance + 20°C	0,0608 Ω/km	0,0608 Ω/km	0,0608 Ω/km	0,0585 Ω/km	0,0585 Ω/km	0,0575 Ω/km	0,0575 Ω/km	0,0567 Ω/km	0,0567 Ω/km
I_{max} = (T_c =80°C)	808 A	808 A	808 A	808 A	808 A	829 A	829 A	834 A	834 A

Tower matrix

Type	p.b. 220	p.b. 221	p.b 222	p.b. 223	p.b. 224	p.b. 225	p.b. 226	p.b. 227
0	N+9	N+9	N+6	N+6	N+6	N+6	N+3	N+6
A1	N+9	N+9	N+9	N+6	--	N+6	N+3	N+3
A2	N+6	N+9	N+6	N+6	--	N+3	N+3	N+3
B1	N+9	N+9	N+3	N+6	N+3	N+3	N+3	N+6
B2	N+9	N+9	N+9	N+3	--	N+6	N+3	N+6
C1	N+9	N+9	N+6	N+6	N+6	N+6	N+3	N+6
C2	N+9	N+9	N+6	N+3	N+6	N+6	N+9	N+6
D1	N+12	N+9	N+9	N+6	N+6	N+6	N+9	N+6
D2	N+12	N+9	N+9	N+6	N+3	N+6	N+9	N+6

Type - type of conductor, see table above

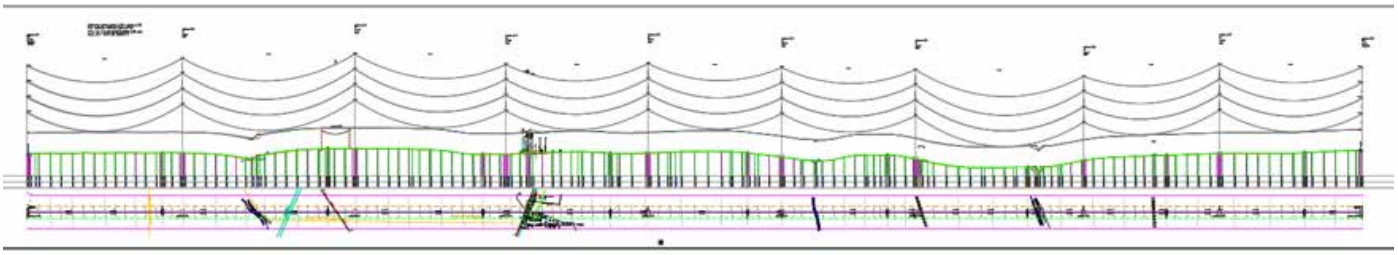
p.b. 220 - 227 - tower number in terrain with skipped or reduced height

0 - original conductor with proposed tower height

A1-D1 - proposed design of conductor with mega tensile strength effecting the height of towers

A2 -D2 - proposed design of conductor with giga tensile strength effecting the height of towers

-- - skipped tower



Brabo project - Innovation in practice

In Bekaert, **we always strive for innovation**. As the partner of choice, we often cooperate with the industry players and with our customers on challenging R&D projects. One such was the Brabo project - where High tensile low sag conductors (HTLS), were used for the first time ever in Belgium.

Elia, as a project owner, stood in front of a great challenge - a large Scheldt river crossing. Bekaert development of high tensile steel wire cores (Mega & Giga) gave Elia the right conductor core solution, meeting all their requirements in terms of **ampacity, diameter, sag, and max tower loads.**

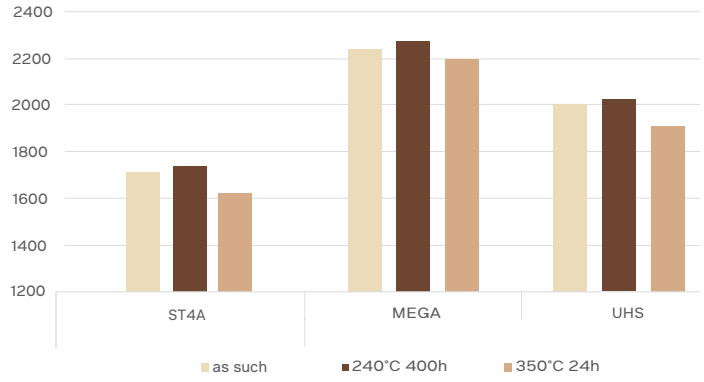
For this project, MEGA High Strength steel wires were considered, which main tensile properties are:

- > - Breaking tensile strength ≥ 2150 MPa
- > - Stress at 1 % elongation ≥ 1720 MPa

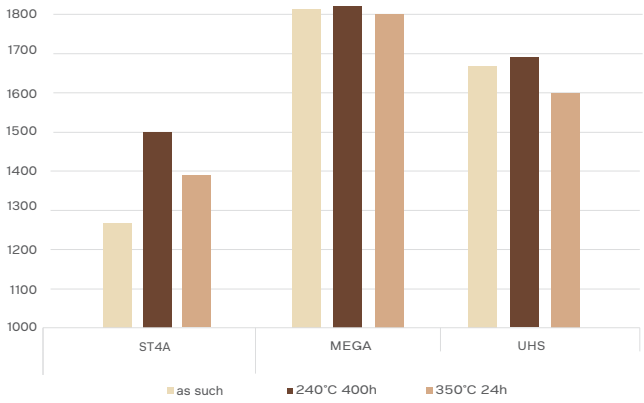
In addition, a Zn95Al5 advanced metallic coating was used to enhance the corrosion resistance performance of the steel wires for long-term life expectancy. This alloy also guarantees a better thermal resistance than traditional galvanizing.

** project data and pictures are used with reference to official CIGRE document B2-203 from 2020*

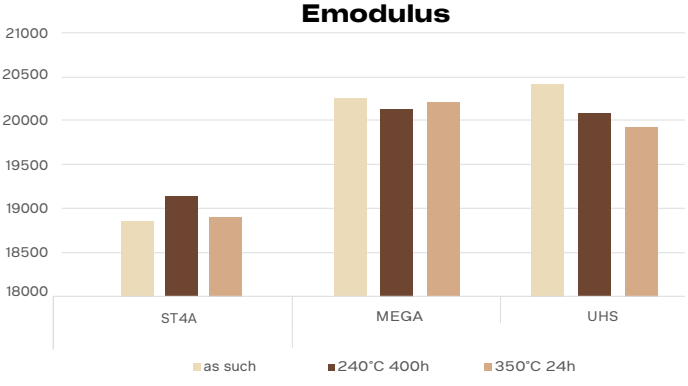
Rm (N/mm²)



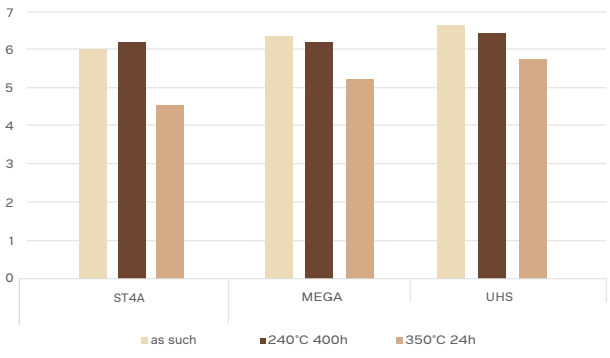
Re 1% (N/mm²)



Emodulus



A% (LO = 250mm)



Contribution to Brabo project using our Mega steel core

- specific solution **overcoming large river crossings**

- high tensile core **withstanding heavy ice loads**

- core design option **reducing the diameter, keeping the same breaking load**

- enhanced corrosion protection & thermal resistance of the core

Not decided yet?

We realize that every power line project is different. Whether you want to upgrade the old line, build a new line, or overcome a challenging environment, you can find the right solution in Bekaert.

Get in touch to see how we can help you succeed with your project.

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