THE 23rd INTERNATIONAL CONFERENCE AND EXHIBITION ON **ELECTRICITY DISTRIBUTION**

0401 New generation of micro-alloyed copper conductors to face distribution system operators challenges

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DSO CHALLENGES

- Renewable energy power stations are often built in remote areas
- Increasing frequency of blackouts caused by severe climate conditions
- High variability of supply; lines operating at the limit of their capacity
- Improve line's efficiency
- Resistance to construction of new OHL's

CAC TECHNICAL ADVANTADGES

- ✓ Ability to cope with peak overloads due to its high annealing temperature
- ✓ High capacity
- ✓ Fewer losses due to Skin and Corona effects, thanks to its dielectric coating
- ✓ Lighter in the worst scenario due to its smaller diameter for the same current capacity
- ✓ Reduced ice accretion on the conductor's surface because of its hydrophobicity
- ✓ Outstanding corrosion resistance of copper alloys; further reinforced by its coating
- ✓ Specially suitable for existing line's upgrading; capacity increase avoiding pole's replacement or reinforcement
- ✓ Allows important savings on towers and foundations in new line's construction

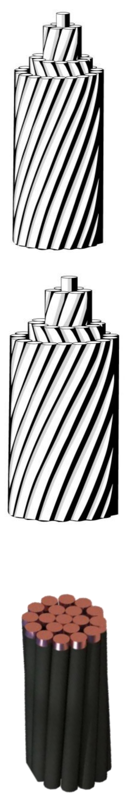
DNV KEMA CASE OF STUDY

Conductors' comparison

ACSR – Hawk LA 280
630 A @ 80ºC

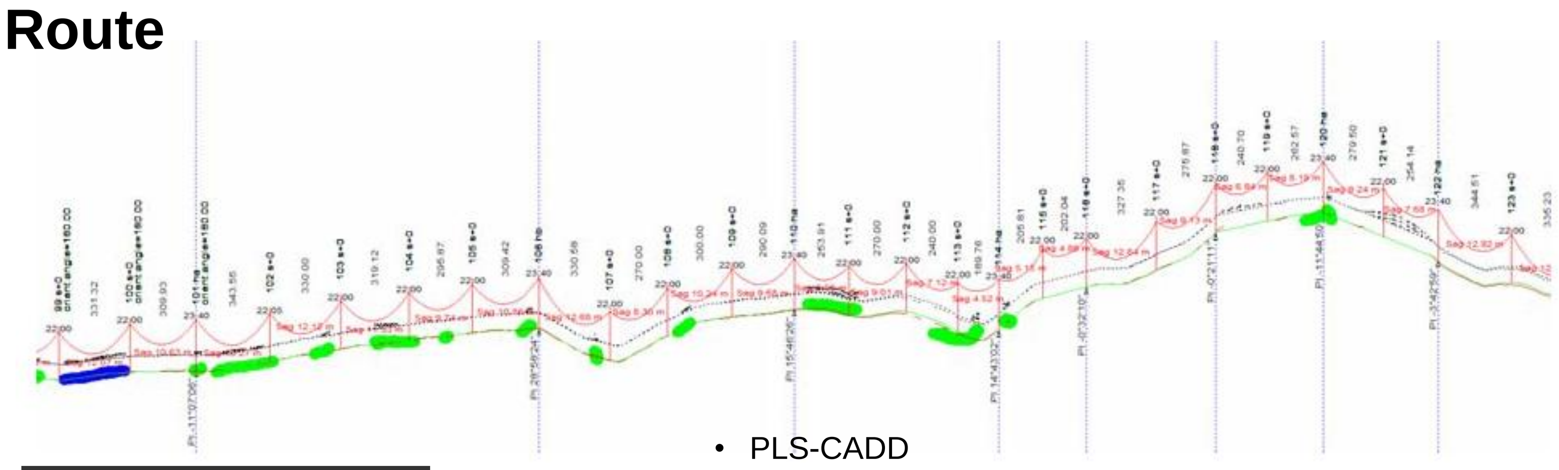
ACSR Eagle LA 350
700 A @ 80ºC
Higher investment
Lower losses

Copper conductor CAC 185
700 A @ 80ºC
1115 A @ 150ºC
Higher investment
Lower losses



	ACSR Hawk	ACSR Eagle	CAC 185
Cross section (mm²)	280	350	185
Current capacity at 80 °C (A)	630	700	700
Current capacity at 150 °C (A)	-	-	1115
Weight (kg/km)	982.3	1,301.8	1,652
Electrical resistance (Ohm/km)	0.1195	0.103	0.09
Tensile strength (kN)	85	123.6	93
Elasticity (kN/mm2)	77	81	32
Thermal expansion (1/°C)	0.0000189	0.0000178	0.000017
Max operational temp (°C)	80 °C	80 °C	150 °C

Route



70 km – 220 kV
Double circuit
Simulated but realistic route

- PLS-CADD
- Based on standard EN 50341-1:2001
- Overhead line route is optimized for each conductor type, based on the specified conductor properties.
- Tension vs suspension towers: 1:5

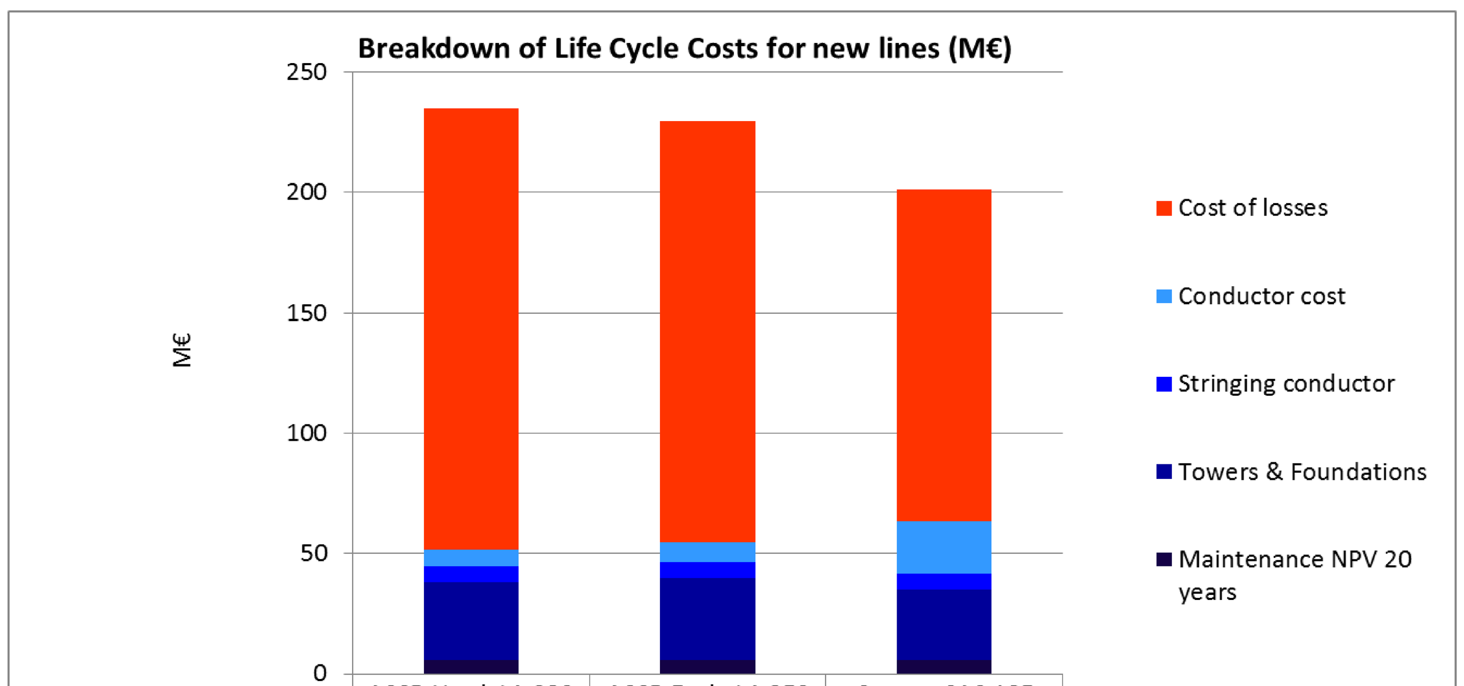
Life cycle cost analysis

- Load profile:
  - 100% of the full load 25% of the time
  - 80% of the full load 20% of the time
  - 40% of the full load 55% of the time
- Electricity price: 0.05 €/kWh
- Life cycle duration: 20 years

Climate conditions

- Based on standard EN 50341-1:2001:
  - Extreme wind load at 15ºC → 45 m/s
  - Wind load at minimum temperature of -20ºC → 25 m/s
  - Combined wind and ice load at -5ºC → 25 m/s + 19,8 mm

New line's construction



	ACSR Hawk LA 280	ACSR Eagle LA 350	Copper CAC 185
Cost of losses	183,5	174,9	138,0
Conductor cost	6,8	8,4	21,7
Stringing conductor	6,8	6,8	6,8
Towers & Foundations	32,3	33,9	29,2
Maintenance NPV 20 years	5,7	5,7	5,7

CONCLUSIONS

- Copper Alloy Conductors offer an interesting alternative to aluminium or aluminium/steel conductors thanks to their improved mechanical and electrical characteristics
- The stringing and maintenance costs of Copper Alloy Conductors are equal to the ones of the reference ACSR conductors, because no special tools or procedures are required for their installation.
- Thanks to their increased mechanical strength and reduced cross section, lower costs in towers and foundations can be considered.
- Even that the conductor's cost in the CAC case is higher, it only represents a 10,7% of the life cycle costs.
- In the present case of study CAC-185 could reduce a **14,3%** the life cycle costs of the reference conductor ACSR HAWK