NEXANS WEBINAR

Medium Voltage Solutions for Solar Applications

April 19, 2023

By: Wayne Popowich & Wissam Geahchan

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ATTENTION

AUDIENCE PARTICIPATION

- Questions can be asked at any time using the chat function on the webinar screen
- Any unanswered questions will be followed up through email
- This presentation, a recording of the webinar, and a brief survey will be emailed to all registrants

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PRESENTERS

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Prescriber - New Products/Services

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Agenda

1 SOLAR MARKET ASSESSMENT STUDY

2 MV CABLE SELECTION FOR SOLAR PROJECTS

3 NEXANS MV CABLE APPLICATION / SOLUTIONS

4 NEXANS SUPPORT AND SERVICES

5 CLOSING REMARKS

6 QUESTION & ANSWER

A Canadian Industrial Footprint

Three Canadian industrial facilities cover a wide range of products.

Fergus, Ontario

Weyburn, Saskatchewan

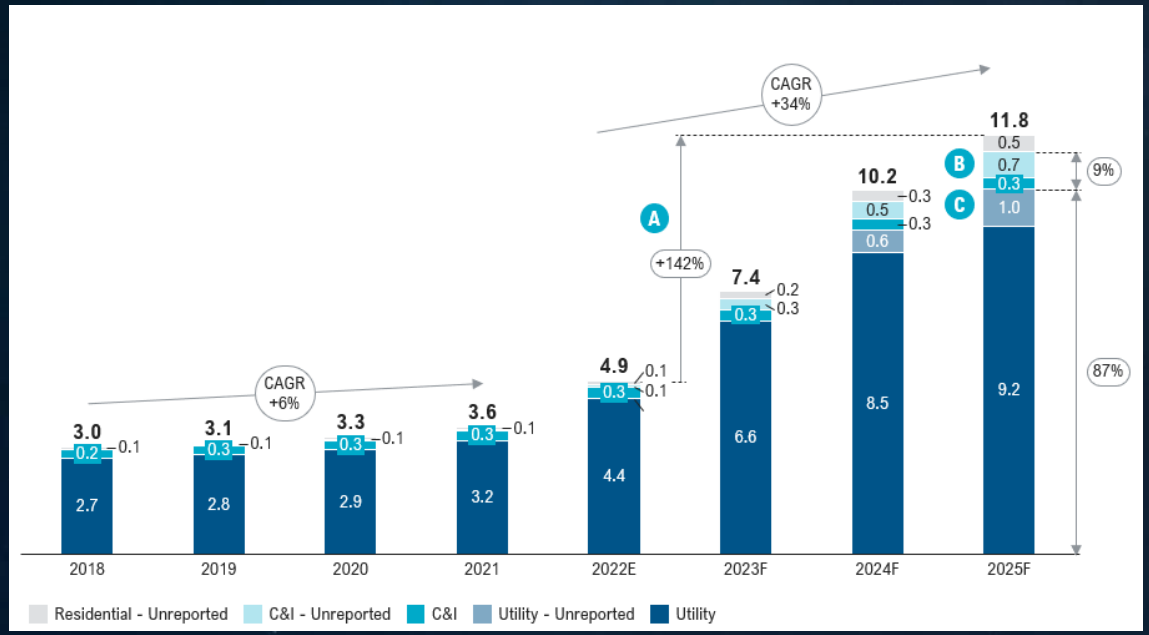
Montreal Rod Mill

CANADIAN OPERATIONS CELEBRATING MORE THAN 110 YEARS PRESENCE IN CANADA

Solar Market Insights

PV installed capacity will reach 11.8 GW by 2025, a +142% increase vs 2022 – mainly driven by utility-scale projects.

Solar PV installed capacity in Canada by category usage [GW; 2018-2025F]



- A • CAGR from 2022 to 2025 – 34%
- B • Projects unreported – 9%
- C • Estimation of projects not yet announced - 1%.

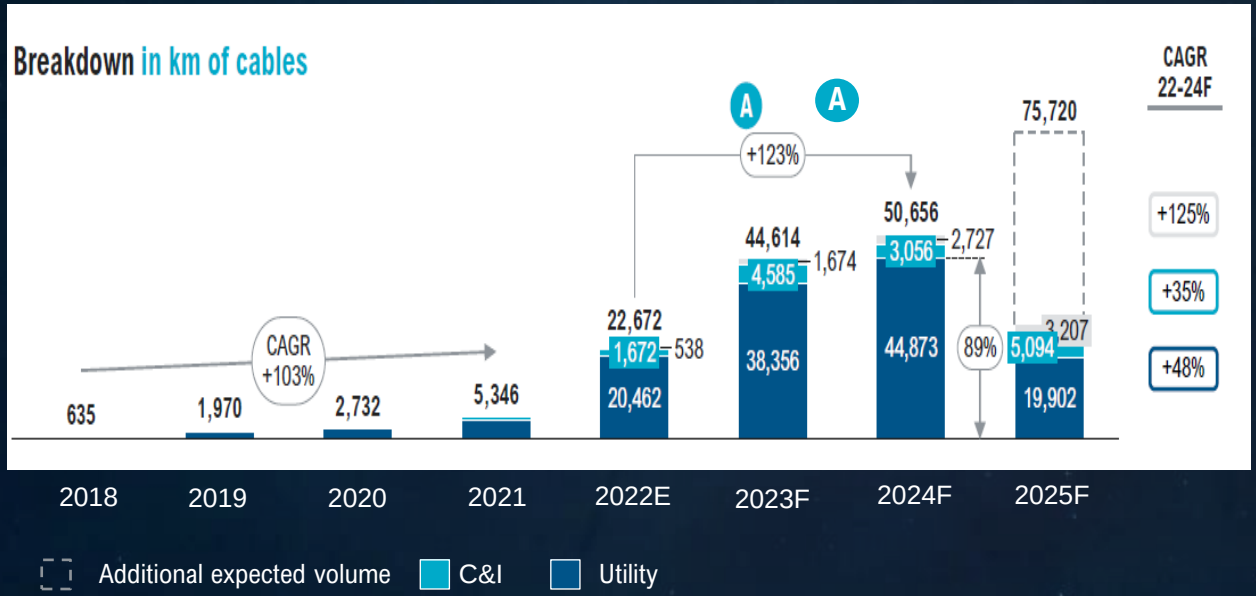
Renewable Project Trends

- Increasingly affordable and more programs to incentivize growth in renewables.
- Increasingly, Developers are considering sustainability and carbon impact as they release projects for tender.
- The utility scale projects are growing in size to take advantage of economies of scale.
- Increased projects on BESS (Battery Energy Storage Systems)

Solar Market Insights

In Canada, the annual solar PV cable market is expected to reach ~50,000 km in 2024, of which ~90% for utility-scale projects – representing a +123% increase vs. 2022

Forecast of the annual solar PV cable market in Canada by usage category [km: 2018 - 25]



- By 2024, **~5.5 GW are expected to be added** to the current Canadian solar PV capacity which is more than the total electricity generated by the province of Saskatchewan and will require ~ 17,600 kms of MV cable to service those projects.
- Growth in Canada will be driven by Alberta and of all the projects planned though to 2025; 93% will be built in Alberta

Solar Market Insights – Supply Chain Pressures

Solar Market Insights – Supply Chain Strategies

Nexans

Making your Supply Chain a strategic priority…

Getting creative with vertical integration

- Establishing long-term partnerships and supply agreements can be critical levers to secure materials and decrease price volatility.

Supporting suppliers to boost manufacturing capacity.

- Establishing a supply-relationship with forecasting to promote the expansion of manufacturing capacity with your suppliers.

Making risk management a common practice.

- Tools such as price hedging and long-term agreements that secure the price of materials can significantly mitigate the effects of sharp price increases.

Solar Market Insights – Supply Chain Strategies

"While many industries are struggling with supply chain issues, those with a forecast of rapidly increasing demand face particular challenges. Early development of creative strategic measures is critical. With a focus on vertical integration, strategic diversification, and proactive risk management, renewables developers can prepare for the challenges ahead."

McKinsey and Company February 17, 2023

As a global supplier, Nexans is assessing the growing demand for Medium Voltage and PV cables. We have been evolving our strategies to meet the needs of the renewable industry and we look forward to working in partnership with our Customers to strengthen the Renewable Energy supply chain.

Solar Market Insights – Customer insights

Top Three key purchasing criteria as identified by Customers… Quality, Lead-time, and Price

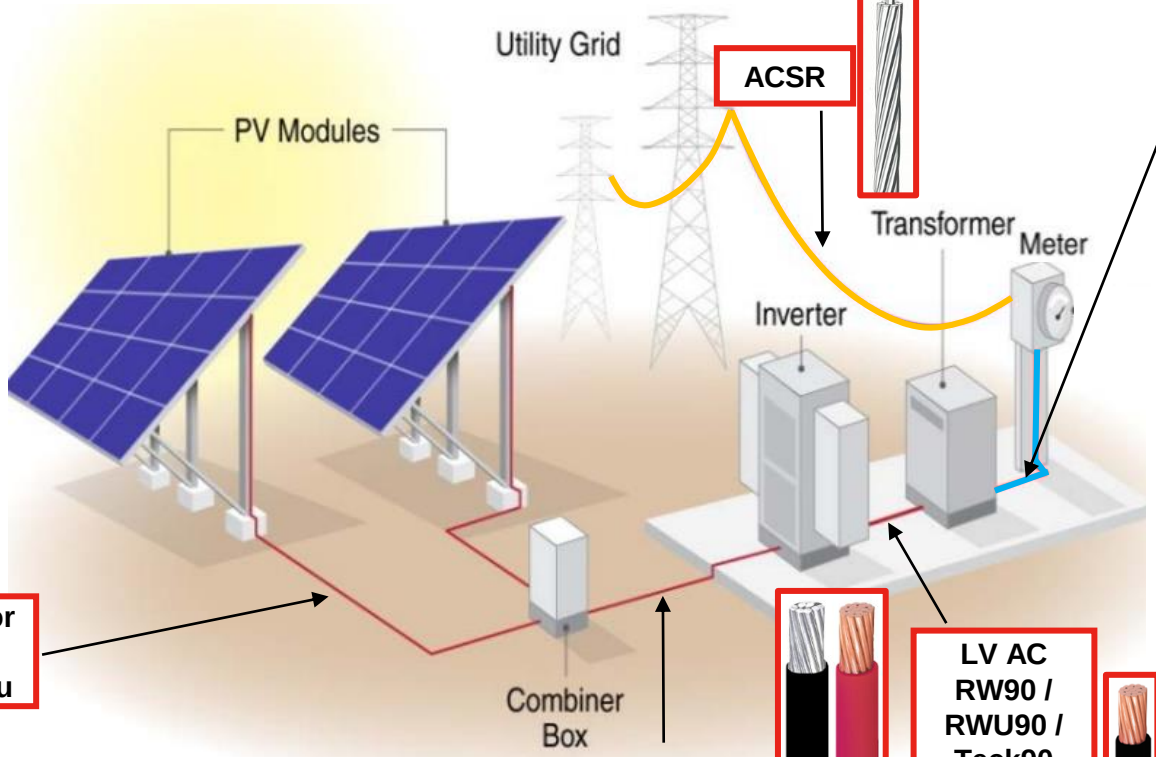
The importance of QA/QC for Solar Energy projects?

- To ensure solar projects deliver **clean, safe, reliable energy for the long term**.
- **Reduce the risk** of costly downtime, losses of revenue, litigation.
- **Ensure developer/investor confidence** in their selected EPC and Supply partners.
- Renewable energy production is now an **important part of our electrical grids** and as the share of renewable generation grows the **impact of outages will be greater**.

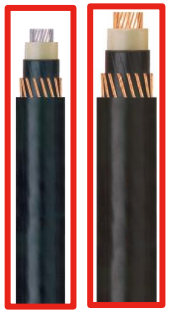
Nexans "Utility Grade" cables meet the demanding needs of utility-application projects.

- The **life-expectation of projects is increasing** as investors expect a long-term performance of projects.
- Nexans Weyburn facility has been supplying the Utility market with **MV cables for over 3 decades**.
- We meet expectations from Customers using 3rd-party quality control labs, under **quality-control measures that exceed industry standards.**
- We operate our facilities under Quality Management Systems that are **audited to international standards**. Our experience with QMS provides our Customers with **confidence in products** and **assurances** that we stand behind the quality of our products.

Solar Power Systems: Nexans Cable Portfolio



MV 5 kV to 46 kV



Today, we discuss MV design considerations that can be incorporated into solar projects

#10 AWG or #8 AWG RPVU90 Cu

LV DC > 250 kcmil RPVU90 Al

LV AC RW90 / RWU90 / Teck90

Low Voltage power solutions
Medium Voltage power solutions
ACSR

Nexans SOLAR Product Offering

Nexans RPVU 90 Solar/Photovoltaic Cu or Al

Description:

RPVU90 cables offer exceptional performance, easy installation and long-term reliability for DC and AC connections. They link photovoltaic panels on rooftops or solar farms and also connect them to the array box (if one exists), and to the inverter which transforms DC solar energy into usable AC electricity. They can be installed indoors and outdoors, both above and below ground or directly buried. RPVU90 cables can also be used in raceways and in conduits.

Features:

- **Copper:** - sizes from #14 AWG to 1000 kcmil, solid or stranded
  - bare, stranded annealed per ASTM B8 Class B compressed
- **Aluminum:** - sizes from #6 AWG to 1000 kcmil, stranded
  - compact stranded AA-8000 series aluminum conductor material (ACM) per ASTM B801 Class B or ASTM B836
- 2 kV rated
- Temperature rating of 90ºC dry and wet; marked -40ºC & sunlight resistant

Specifications:

- Meets CSA C22.2 No. 271 Photovoltaic Cables
- Meets CSA C22.2 No. 38 Thermoset Insulated Wires and Cables
- CSA File Number: LL23462 Class 5721 02

Nexans SOLAR Product Offering

ACSR

Description

The bare aluminum and ACSR conductors are suitable for installation in all practical spans on transmission towers, wood poles and other structures, ranging from long distance EHV transmission lines to sub-service spans at distribution, renewable energy inter-connections to the power grid or utilization voltages on private premises. The choice of conductor size, type and strength should take into account factors such as electrical load, voltage regulation, corona losses, ice and wind loading, extreme temperatures and vibration. Nexans is prepared to assist in the evaluation of these factors as they apply to specific installations.

Copper Ground

Description

ASTM B-3 Soft or Annealed Copper Wire. ASTM B-3 Specification details the requirements for solid wires and the individual wires in stranded conductors. ASTM B-8 Concentric - Lay - Stranded Copper Conductors Solid or stranded 100% conductivity copper conductors.

Application: Used for Bonding or Grounding electrical circuits and systems in all renewable energy applications.

Nexans SOLAR Product Offering

Nexans ENERGEX® Medium Voltage Standard 90ºC or High Temperature 105ºC Distribution Cable

Type: Concentric Neutral (CN)

Description:

ENERGEX® MV are single conductor concentric neutral power cables available from **15 kV to 35 kV** using TR-XLPE. They are suitable for continuous operation at 105°C, wet or dry, and are sunlight resistant. They can be used above ground in open air, in conduit in air, directly buried, **or in underground ducts.**

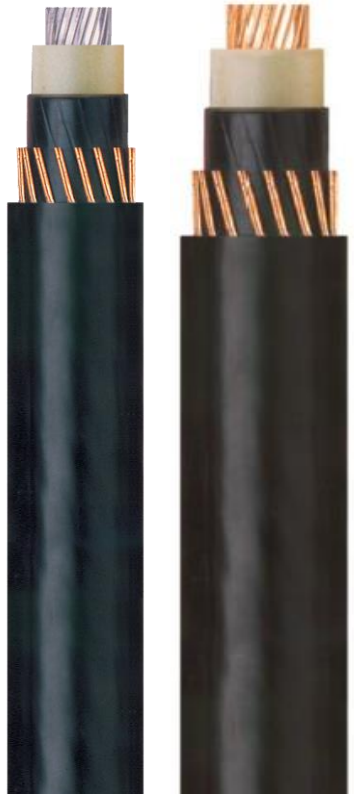
Advantages of using 35 kV 1000 MCM 105°C CN 1/6:

- **Reduction in conductor diameter** translates to overall smaller cable diameter to fit into tight duct systems.
- Often conductor size can be reduced one gauge size with near the same ampacity resulting in **weight savings and cost savings in metal.**
- **Therefore, you get a smaller, lighter, easier to install, and less costly solution**

Specifications:

- Meets CSA C68.5 Primary shielded and concentric neutral cable for distribution utilities

Medium Voltage Cable Design

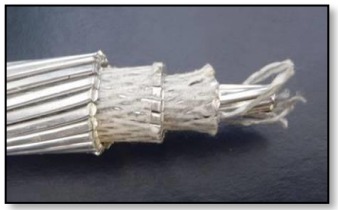


Medium Voltage – Strandblock

PATENTED WATER BLOCKING SYSTEM TO PROTECT YOUR ASSETS

Traditional Technology (Bitumen)	Nexans Technology (Water swellable Yarns & Tapes)
Messy to work with ✗	Cleaner, faster installation and more reliable terminations/splices ✓
Process difficult to control ✗	Simpler manufacturing process ✓
Little to no salvage value for metal ✗	No penalty for metal recovery ✓
Environmentally unfriendly ✗	Environmentally friendly ✓

Current Water Blocking Technology – Bitumen



New Water Blocking System – Water Swellable Yarns & Tapes

Medium Voltage – Insulation Levels

WHAT IS THE BEST INSULATION LEVEL FOR MY PROJECT?

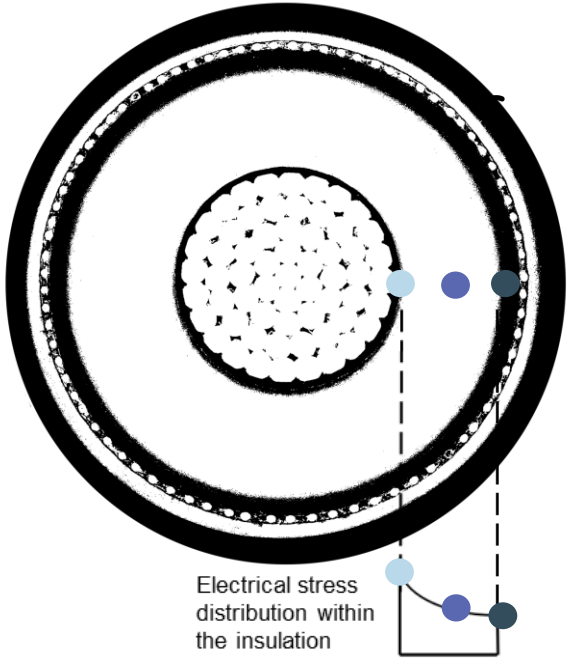
100% vs **133%** vs **173%**

As insulation level increases so does the **insulation thickness** for a given voltage class.

If a fault is to be cleared in 1 min or less, use a 100% insulation level cable

If a fault is to be cleared from 1 min to 1 h, use a 133% insulation level cable.

If the fault clearing time is indefinite, use a 173% insulation level (uncommon).



4/0 AWG Al CN 25kV **100% Insul Level**

Stess at CondSHLD/INSULATION interface	3.23	kV/mm
Stess at INSULATION midpoint (AVERAGE)	2.15	kV/mm
Stess at InsulSHLD/INSULATION interface	1.51	kV/mm

*illustrative only

4/0 AWG Al CN 25kV **133% Insul Level**

Stess at CondSHLD/INSULATION interface	2.98	kV/mm
Stess at INSULATION midpoint (AVERAGE)	1.91	kV/mm
Stess at InsulSHLD/INSULATION interface	1.33	kV/mm

*illustrative only

Medium Voltage – Shielding

WHY DO MV CABLES NEED TO BE SHIELDED?

For cables rated higher than 5 kV, a conductor shield AND an insulation shield become necessary.

Shields consist of a non-metallic (semi-conducting) component and a *metallic component*.

The insulation shield:
- controls stress at the insulation surface and within the insulation wall.
- protects personnel from shock hazard by accidental contact with the cable

The metallic component carries leakage current, short circuit current and in some cases neutral current to ground.

Metallic shield types

1. Copper Tape
2. Wire Shield
3. Concentric Neutral
4. LC Shield
5. Metal Sheath

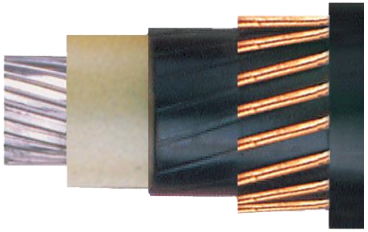
A CONCENTRIC NEUTRAL SHIELD OFFERS A HIGH SHORT CIRCUIT CAPACITY

Medium Voltage – Short Circuit Capacity (Shield)

WHAT SIZE NEUTRAL DO I NEED FOR MY PROJECT?

$$\frac{I_0^2\ t}{A^2} = 247.0\times10^{-6}\,(SG)(SH)\left[\frac{T_0+\lambda}{P_0}\right]\left(\mathrm{Log}_{10}\left[\frac{T_2^{*}+\lambda}{T_1+\lambda}\right]\right)$$

*Source: ICEA P-45-482 – Short Circuit Performance of Metallic Shields/Sheaths
**Assumes ADIABATIC heat generation*

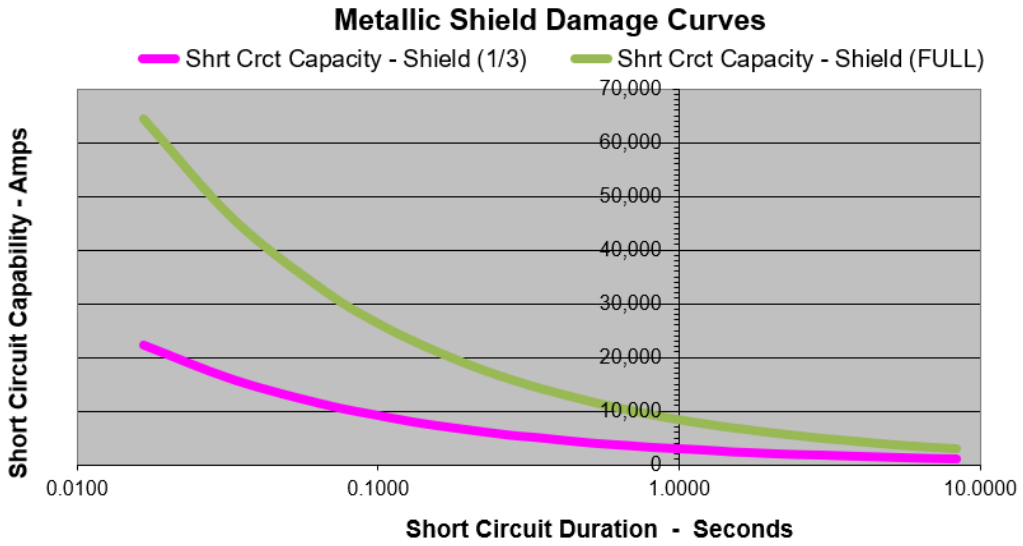


FULL

CSA 1C 4/0(18) AWG AAC CT SB SSCS
260 TRXLPE **32 x 14 (100%) CN** 25kV
100% Insul Level Blk LLDPE Cable

REDUCED (1/3)

CSA 1C 4/0(18) AWG AAC CT SB SSCS
260 TRXLPE **11 x 14 (33%) CN** 25kV 100%
Insul Level Blk LLDPE Cable



Medium Voltage – Short Circuit Capacity (Shield)

WHAT SIZE NEUTRAL DO I NEED FOR MY PROJECT?

CN SIZING

FULL vs 1/3 vs 1/6 vs 1/8 vs 1/12

	Neutral Size				
Cable	designation	# of wires	wire size (AWG)	x-section (kcmil)	SSC* (A)
1C 500 kcmil AAC 25kV	full				
1C 500 kcmil AAC 25kV	1/3	25	14	102.7	6500
1C 500 kcmil AAC 25kV	1/6	13	14	53.4	3400
1C 500 kcmil AAC 25kV	1/8	10	14	41.1	2600
1C 500 kcmil AAC 25kV	1/12	7	14	28.7	1800
*Short-circuit capacity for metallic shield for a short circuit duration of 1 second					

Medium Voltage – Jacket

WHAT JACKET MATERIAL SHOULD I SPECIFY FOR MY PROJECT?

LLDPE vs PVC vs XLPE

The standard jacket on Nexans ENERGEX® concentric neutral cables is an extruded-to-fill jacket composed of black insulating linear low-density polyethylene (LLDPE), which meets, or exceeds the CSA, AEIC, and ICEA.

Table 4

Values for T_2, Maximum Allowable Shield or Sheath Transient Temperature, °C

Source: ICEA P-45-482 – Short Circuit Performance of Metallic Shields/Sheaths

	Cable Material in Contact with Shield or Sheath	T_2
AVAILABLE UPON REQUEST	Crosslinked (thermoset)	350*
	High Heat Deformation**	350*
STANDARD OFFER	Thermoplastic	200
	Impregnated Paper	200
	Varnished Cloth	200

NOTE: The temperature of the shield or sheath shall be limited by the material in contact with it. For example, a cable having a crosslinked semi-conducting shield under the metallic shield and a crosslinked jacket over the metallic shield would have a maximum allowable shield temperature of 350 °C. With a thermoplastic jacket it would be 200 °C.

*For lead sheaths this temperature is limited to 200 °C.
**See ICEA S-113-684 for definition of High Heat Deformation

Optional feature: RODENT PROTECTION

Medium Voltage – Short Circuit w/XLPE jacket

Jacket Comparison – LLDPE vs XLPE

	Neutral Size						
Cable	designation	# of wires	wire size (AWG)	x-section (kcmil)	SSC* (A) LLDPE jkt	SSC* (A) XLPE jkt	Difference (A)
1C 500 kcmil AAC 25kV	full						
1C 500 kcmil AAC 25kV	1/3	25	14	102.7	6500	9100	2600
1C 500 kcmil AAC 25kV	1/6	13	14	53.4	3400	4700	1300
1C 500 kcmil AAC 25kV	1/8	10	14	41.1	2600	3600	1000
1C 500 kcmil AAC 25kV	1/12	7	14	28.7	1800	2600	800
*Short-circuit capacity for metallic shield for a short circuit duration of 1 second							

Nexans High Temperature MV Cables

HOW TO SAVE ONE **AWG** SIZE?

35 kV 1250 MCM 90°C CN 1/6 becomes **35 kV 1000 MCM 105°C CN 1/6**

Cables	AMPACITY* 90C	105C	Improvement Amps	%
1000 Al 35kV 25x14 (1/6) CN Encap	**629**	**682**	53	8.4
1250 Al 35kV 20x12 (1/6) CN Encap	687	748	61	8.9

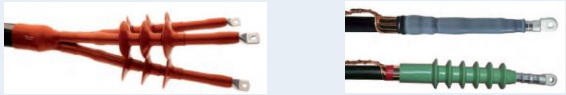
Nexans High Temperature 105°C MV

- Only a **5 A** difference between the 1250 AL 35 kV **90°C** (1/6) CN and the 1000 AL 35 kV **105°C** (1/6) CN.
- 1000 AL 35 kV **105°C** (1/6) CN improves the ampacity by **53 A** compared to the 1000 AL 35 kV 90°C (1/6) CN and can have significantly lower operating losses due to smaller circulating currents in the neutral.
- **20 % reduction in weight of ALUMINUM.**
- In summary, with the Nexans High temperature MV 105°C, you get a **smaller, lighter, easier to install, and less costly solution.**

* Ampacities shown are for illustrative purposes only. Actual ampacity will be dependent on many variables such as soil resistivity and other factors. Consult your cable manufacturer for more information. Highlighted rows show that operation at 105°C can yield very nearly the same ampacity as the next larger conductor size at 90°C.

Nexans Medium Voltage Accessories

105C rated accessories

Connectors 	• Premoulded EPDM • Separable connectors • Surge arrestors
Straight and transition joints/splices 	• Cold shrinkable solutions • Heat shrinkable solutions • Reliable transition joints
Terminations 	• Cold-shrinkable solutions • Heat shrinkable solutions • Moulded silicone rubber

MV Applications for Solar - Summary

Through our engineering expertise and wide MV product portfolio, Nexans is here to support your solar projects by providing :

- Full engineering support during the **Design, Installation and Operation** phases.
- Dedicated expertise to **optimize project costs and solar farm reliability** through its cable system through:
  - Optimization of conductor & neutral sizing;
  - Verification of material selection; and
  - Offering easier and more reliable installations with our utility-grade cables with advanced and patented water blocking systems along with our MV accessories.
- **Availability** through cable selection

For assistance with your cable selection, feel free to contact us!
wissam.geahchan@nexans.com

Nexans Unique Services and Solutions

Examples of dedicated Nexans services & solutions to secure your Solar project :

- Digital Supply Chain with Connected Reels Tracking Solution - Ultracker™
- Carbon quotation & environmental impact through Environmental Product Declaration (EPD)
- Solar Tracking Structures to maximize the revenue of the solar project.
- Secured supply of copper on the long-term leveraging of unique Nexans verticalized model

THE AUGMENTED REEL SOLUTION

ULTRACKER

GET MORE FROM YOUR REEL DATA

Reel Geolocation

Monitor your reel fleet

Reel Theft and loss

Save Money

Stock Management

Follow your residual length and optimize your inventory

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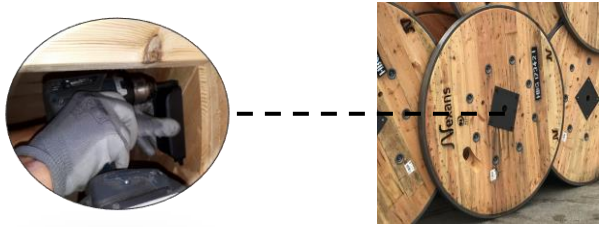
How it works?

Hardware



Devices embeded in our reels

Géolocation

~4 year battery

Movement Sensors

2-4 G LTE-M Sigfox

Infrastructure

Software

SAAS platfrom connected with your ERP System

For a more detailed overview, contact: wayne.popowich@nexans.com

Nexans Unique Services and Solutions

Do you need to calculate the environmental or carbon impact of your solar farm?

- The Environmental Product Declaration (EPD) provides a breakdown of the environmental impact on each of the Nexans products.
- Offering a carbon quotation on a tender can help win a bid and national authorities are starting to request this type of product information as we see regulation entering the market.
- Nexans is a unique leader among cable companies and the first to have 100% of our products categorized in a fully transparent manner and certified to international recognized standards.

KEYLIOS® TRACKER

Our KNOW-HOW : A UNIQUE CONCEPT

ROBUSTNESS | MINIMAL FOOTPRINT | MINIMAL MAINTENANCE | FAST INSTALLATION

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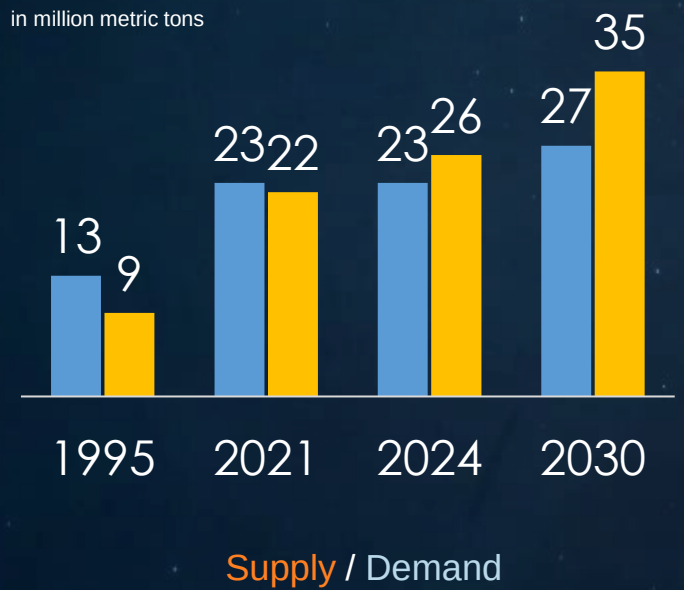
Nexans Unique Services and Solutions

RAW MATERIAL SCARCITY

COPPER DEMAND TO OUTSTRIP SUPPLY BY 2024



Source: Nexans, JP Morgan

Leverage Nexans' Unique Operational Model

Nexans Solar exclusive offer in a nutshell

Secure supply

1. Wide cable portfolio offering 100% of cable needs for a solar project
2. Forward capacity booking & short delivery Lead-time
3. Metal supplies secured on long-term leveraging a unique verticalized model for Copper
4. Nexans Ultracker to reduce to zero the risk of cable loss and thefts

Secure profitability

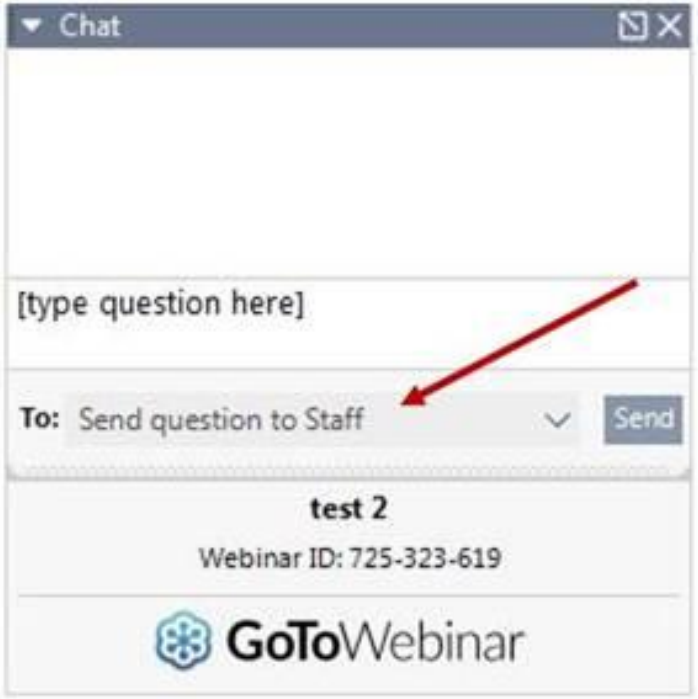
1. Engineering services to save costs & time by optimizing the whole cabling architecture
2. Hedging services to secure stable costs along all your project
3. Extended guarantee for solar cables
4. Nexans Solar Tracker to increase solar farm productivity during its whole life duration

Secure sustainability

1. Nexans Solar cables produced 100% in Canada
2. Carbon quotation & environmental impact calculation available on demand
3. High quality products designed for severe Canadian weather conditions to maximize your solar project duration
4. Recycling services

For a more detailed overview, contact:
wayne.popowich@nexans.com

Questions



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Thank you for your attention!

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