Why High Temperature Low Sag Conductor (HTLS)?

- Rapid Growth of Electricity Demand
- Increasing presence of Electric Vehicles and Electric Cooking is giving pressure to the transmission system
- Rate of construction of new transmission lines are below rate of increase of power generation
- Nowadays it is difficult to construct new transmission lines due public, social, economic and environmental constraint
- No new right of way available /Occupied by existing lines
- Time for construction of new line is far more than the tolerable limit of utility
HTLS conductors in NEA Transmission System

Normal ACSR Conductor

ACCR

ACCC
HTLS conductors in NEA Transmission System
Use of HTLS conductors in NEA

- **Old Transmission Lines** – Existing
  Transmission lines are required to be upgraded to increase the current transmission capacity

- **New Transmission Lines** - Design the new transmission lines with HTLS conductor. However more design options and flexibility are available.
Nepal Power Generation & Transmission System

Scenario

- **Power Generation**
  - Installed Hydropower- 2750MW
  - Under Construction – 5000MW
  - Potential – 43000MW
  - Waiting for PPA – 10000MW
HTLS conductors in NEA Transmission System

Nepal Power Generation & Transmission Scenario

- **Power Generation**
  - Installed Generation - 2750MW (including 70MW Solar)
  - Under Construction – 7000MW
  - Potential – 43000MW
  - Waiting for PPA – 10000MW
HTLS conductors in NEA Transmission System

Nepal Power Generation & Transmission Scenario

- **Power Transmission Existing**–
  - 400kV TL – 78km (circuit km)
  - 220kV TL – 741 km (circuit km)
  - 132kV TL – 3950 km (circuit km)
  - 66kV TL – 514 km (circuit km)

- **New Transmission Lines** -
  - Upgrading of older transmission lines and build new transmission lines to address the industrial residential consumer
  - New Lines for evacuation of under construction hydro-power plants (7000MW)
  - Future transmission lines for remaining power plants (10000MW)
  - Cross-Border transmission lines
HTLS conductor in NEA Transmission System

Different types of HTLS conductors used in Nepal

- ACCC-Aluminum Conductor Composite Core
- ACCR-Aluminum Conductor Composite Reinforced (Aluminum matrix core)
- ACIR-Invar Core Conductors (Invar Alloy core 64% steel and 36% nickel)
HTLS conductors in NEA Transmission System

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Transmission Line Section</th>
<th>Length (km)</th>
<th>Voltage Level (kV)</th>
<th>Type of Circuit (SC/DC)</th>
<th>Old Conductor</th>
<th>Ampacity (MW)</th>
<th>MW loading</th>
<th>New HTLS Conductor</th>
<th>Ampacity (MW)</th>
<th>MW loading</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Bhaktapur Baneshwor</td>
<td>8.8</td>
<td>66</td>
<td>SC</td>
<td>LGJ 120 and WOLF</td>
<td>300</td>
<td>35</td>
<td>ACCC-Silvasa</td>
<td>600</td>
<td>70</td>
<td>Completed and Under Operation (NEA Internal Funding)</td>
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<td>WOLF and LGJ 120</td>
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<td>3</td>
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<td>DOG</td>
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<td>WOLF</td>
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<td>INVAR</td>
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<td>3M (ACCR)</td>
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<td>ACCC-Cordoba</td>
<td>1200</td>
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<td>600</td>
<td>2x125</td>
<td>ACCC-Cordoba</td>
<td>1200</td>
<td>2x250</td>
<td>Under Construction (ADB Funding)</td>
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<td>DC</td>
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<td>DC</td>
<td>BEAR</td>
<td>600</td>
<td>2x125</td>
<td>ACCC-Cordoba</td>
<td>1200</td>
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<td>Suichatar Balaju</td>
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<td>SC</td>
<td>DUCK</td>
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<td>125</td>
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<td>DC</td>
<td>BEAR</td>
<td>600</td>
<td>2x125</td>
<td>BEAR Equivalent HTLS Conductor</td>
<td>1200</td>
<td>250</td>
<td>Bid Submission Phase (ADB Funding)</td>
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</tbody>
</table>
HTLS conductors in NEA Transmission System

Results and Achievements

- Transmission capacity of the selected lines nearly doubled
- Implemented within 1.5 to 2 years
- No Right of Way (RoW) faced during implementation
- IEE and other project studies for new transmission line not required.
- No trees are required to cut
- No extra social and environmental safeguards required during implementation
HTLS conductors in NEA Transmission System

HTLS in new Transmission Lines

- Kushma-New Butwal 220kV TL Under Kaligandaki corridor TL Project funded by Asian Development Bank (ADB)

- Khudi-Udipur-Bharatpur 220kV TL Under Marsyangdi corridor TL Project funded by European Investment Bank (EIB)
HTLS conductors in NEA Transmission System

Use of HTLS conductors in new transmission lines in Nepal - selected lines

- Enhance current carrying capacity at lesser voltage level
- Reduction in overall capital expenditure
- Shorter project duration
- Reduction in overall operation expenditure
### New Transmission lines Using HTLS Conductor in Nepal

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<thead>
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<th>S.N.</th>
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<th>Voltage Level (kV)</th>
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<th>New HTLS for 220kV</th>
<th>Status</th>
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<tbody>
<tr>
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<td>Conductor</td>
<td>Ampacity</td>
<td>MW loading</td>
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<td>1</td>
<td>Kushma New Butwal (Kiligandaki Corridor)</td>
<td>88</td>
<td>220</td>
<td>DC</td>
<td>Twin Moose</td>
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<td>2x580</td>
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<td>Khudi-Udupur-Bharatpur (Marshyadi Corridor)</td>
<td>67</td>
<td>220</td>
<td>DC</td>
<td>Twin Moose</td>
<td>2x835</td>
<td>2x580</td>
</tr>
</tbody>
</table>

**220kV Vs. 400kV Transmission System**
## HTLS conductors in NEA Transmission System

**220kV Vs. 400kV Transmission system**

### New Transmission lines Using HTLS Conductor in Nepal

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<tbody>
<tr>
<td></td>
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<td></td>
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<td>Line cost (MUSD)</td>
<td>ROW cost (MUSD)</td>
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<tr>
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<td>Kushma New Butwal (Kaligandaki Corridor)</td>
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<td>220</td>
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<td>33.5</td>
<td>15.49</td>
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### New Transmission lines Using HTLS Conductor in Nepal

<table>
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<th>S.N.</th>
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<th>Voltage Level (kV)</th>
<th>Type of Circuit (SC/DC)</th>
<th>400kV Quad Moose TL</th>
<th>Cost /km (USD)</th>
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<tbody>
<tr>
<td>1</td>
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<td>400</td>
<td>DC</td>
<td>12.15</td>
<td>706,000.00</td>
</tr>
</tbody>
</table>
HTLS conductors in NEA Transmission System

Results and Achievements

- Right of Way costs are growing recently due to land cost, social and environmental safeguard. These are minimized by constructing 220kV lines instead of 400kV lines for transferring the same amount of power.
- Implemented short period than 400kV lines.
- Higher the voltage level - higher right of way and increased social and environmental problems.
- Less trees are cut than 400kV transmission line.
HTLS conductors in NEA Transmission System
HTLS conductors in NEA Transmission System