Introduction of High Temperature Low Sag Conductor - Projects installed in Vietnam

June 16, 2015
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## Quick View

### Sumitomo Electric Group

<table>
<thead>
<tr>
<th>Name</th>
<th>Sumitomo Electric Industries, Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Established</td>
<td>April 1897</td>
</tr>
<tr>
<td>Capital Stock</td>
<td>831 Million US Dollars</td>
</tr>
<tr>
<td>President</td>
<td>Masayoshi Matsumoto</td>
</tr>
<tr>
<td>Employees</td>
<td>206,323</td>
</tr>
<tr>
<td>Subsidiaries &amp; Affiliates</td>
<td>353 (Domestic 115, Overseas 238)</td>
</tr>
<tr>
<td>Consolidated Business Results</td>
<td></td>
</tr>
<tr>
<td>Net Sales</td>
<td>18,000 Million USD</td>
</tr>
<tr>
<td>Operating Income</td>
<td>640 Million USD</td>
</tr>
</tbody>
</table>

(As of March 31, 2013)

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Smart Energy System Proposed by the Sumitomo Electric Group
Smart Energy System Proposed by the Sumitomo Electric Group

- Energy Management System (EMS)
- Superconductor Electric Vehicle
- Photovoltaic Systems
  (Photo credit: Tokyo International Air Cargo Terminal Ltd.)
- Maritime Wind Powered Generators
- Small Battery (POWER DEPO™)
- Power Conditioner for Photovoltaic System
- Concentrator Photovoltaic (CPV) Systems
- Redox Flow (RF) Battery System
- Capacitor Voltage Transformer
- Power Capacitor
- Harmonic Filter Equipment

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2. J-Power Systems Aluminum Conductors for OHTL
Conductor Material Selection

AL conductor

HAL (90°C)
TAL (150°C)
KTAL (150°C)
ZTAL (210°C)

ST core

ST
EST
UGS
AS
EAS
AC Invar

=
## JPS Special Value-Added Conductors

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low electrical power-loss</td>
<td>LL-ACSR/AS</td>
<td>Shaped Aluminum wires with extra high strength AS core</td>
</tr>
<tr>
<td></td>
<td>LL-TACSR/AS</td>
<td>* Reduce 15-25% Power Loss</td>
</tr>
<tr>
<td>High strength &amp; heat resistant</td>
<td>KTACSR</td>
<td>Lowering tower height</td>
</tr>
<tr>
<td></td>
<td>KTACSR/AS</td>
<td>Suitable for Long Span</td>
</tr>
<tr>
<td></td>
<td>KTACSR/ES</td>
<td></td>
</tr>
<tr>
<td>Less surface Reflection &amp; High Emissivity</td>
<td>D-ACSR</td>
<td>Dull surface</td>
</tr>
<tr>
<td>Low aerial noise</td>
<td>LN-ACSR</td>
<td>ACSR with “spiral protrusion”</td>
</tr>
</tbody>
</table>
High Temperature Low Sag Conductor (HTLS)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Code</th>
<th>Up-rating ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gap type</td>
<td>GTACSR</td>
<td>1.6 times</td>
</tr>
<tr>
<td></td>
<td>GZTACSR</td>
<td>2 times</td>
</tr>
<tr>
<td>Invar core type</td>
<td>TACIR /AS</td>
<td>1.6 times</td>
</tr>
<tr>
<td></td>
<td>ZTACIR /AS</td>
<td>2 times</td>
</tr>
</tbody>
</table>
3. J-Power Systems
HTLS Conductors
- Gap Type Conductor
- Invar Conductor
Gap Conductor = Unique construction

- **G TAC CSR** / **GZTA CSR**
  - **Gap construction**
  - **Thermal Resistant Al-Alloy**
  - **Super Thermal Resistant Al-Alloy**

Invar Conductor = Unique material

- **TAC I R/AS** / **ZTA C I R/AS**
  - **Thermal Resistant Al-Alloy**
  - **Al-clad INVAR Alloy**
  - **Super Thermal Resistant Al-Alloy**
Supply Record of JPS HTLS Conductors

**Gap Conductor**
- Supply Year: 1971～
- Supply Length: 27,621 km (as of Dec. 2014)
- Voltage: ~ 400 kV

**Invar Conductor**
- Supply Year: 1981～
- Supply Length: 8,295 km (as of Dec. 2014)
- Voltage: ~ 500 kV
Supply Record of JPS HTLS Conductors

Middle East & North Africa

**GAP Conductor**
Country: Saudi Arabia, Oman, Kuwait, UAE, Qatar, Iran, Libya
Supply Year: 1981 ~
Voltage: 33 kV ~ 400 kV
Supply Length:
- GTACSR 2490 km
- GZTACSR 10320 km

**Invar Conductor**
Country: UAE, Egypt
Supply Year: 1996 ~
Voltage: 66 kV ~ 220 kV
Supply Length:
- ZTACIR 530 km
Supply Record of JPS HTLS Conductors

**Europe**

**GAP Conductor**
Country: UK, Ireland, Spain, Russia
Supply Year: 1997 ~
Voltage: 110 kV ~ 400 kV
Supply Length:
- GTACSR 1070 km
- GZTACSR 4490 km

**Invar Conductor**
Country: Italy, Greece, France
Supply Year: 1994 ~
Voltage: 132kV ~ 150 kV
Supply Length:
- ZTACIR 80 km
## Supply Record of JPS HTLS Conductors

### East, South East, South Asia

<table>
<thead>
<tr>
<th>GAP Conductor</th>
<th>Country</th>
<th>Supply Year</th>
<th>Voltage</th>
<th>Supply Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China, India, Indonesia, Malaysia, Malaysia, Vietnam</td>
<td>1997 ~</td>
<td>66 kV ~ 400 kV</td>
<td>GTACSR 4740 km, GZTACSR 2250 km</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Invar Conductor</th>
<th>Country</th>
<th>Supply Year</th>
<th>Voltage</th>
<th>Supply Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China, Hong Kong, Korea, Sri Lanka, Taiwan, Thailand</td>
<td>1990 ~</td>
<td>66 kV ~ 161 kV</td>
<td>ZTACIR 2100 km</td>
</tr>
</tbody>
</table>
4. Gap Conductor Projects in Vietnam
# Summary of Vietnam Projects

<table>
<thead>
<tr>
<th>Utilities</th>
<th>No. of projects installed</th>
<th>Voltage, Line Name</th>
<th>Supplied Length (km)</th>
<th>Existing Conductor</th>
<th>Gap Conductor</th>
<th>Delivery of 1st projects (Year/Month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVNHANO I</td>
<td>6 projects</td>
<td>110kV Soc Son – Dong Anh, etc.</td>
<td>293.2</td>
<td>ACSR 185/29sqmm</td>
<td>GZTACSR 200sqmm</td>
<td>2009.02</td>
</tr>
<tr>
<td>EVNHANO I</td>
<td>1 project</td>
<td>110kV Ha Dong – Thuong Dinh</td>
<td>25.7</td>
<td>ACSR 150/24sqmm</td>
<td>GZTACSR 150sqmm</td>
<td>2010.02</td>
</tr>
<tr>
<td>EVNHCMC</td>
<td>2 projects</td>
<td>110kV Phu Lam – Cho Lon 1,2, etc.</td>
<td>55.1</td>
<td>ACSR 240sqmm</td>
<td>GTACSR 240sqmm</td>
<td>2010.07</td>
</tr>
<tr>
<td>EVNHCMC</td>
<td>2 projects</td>
<td>110kV Phu Dinh – Hung Vuong, etc.</td>
<td>14.5</td>
<td>ACSR 795MCM</td>
<td>GZTACSR 410sqmm</td>
<td>2010.11</td>
</tr>
<tr>
<td>Dong Nai PC</td>
<td>1 project</td>
<td>110kV Long Binh – Xuan Truong</td>
<td>17.4</td>
<td>ACKP 195sqmm</td>
<td>GTACSR 185sqmm</td>
<td>2011.07</td>
</tr>
<tr>
<td>EVNCPC</td>
<td>2 projects</td>
<td>110kV Pleiku – Kon Tum etc.</td>
<td>121.7</td>
<td>ACSR 150sqmm</td>
<td>GZTACSR 200sqmm</td>
<td>2011.06</td>
</tr>
</tbody>
</table>

Total: 14 projects, 523.7 km
Why Gap type conductors are required?

Rapid Economic Growth in Vietnam
→ Electric Power Consumption reaches the limitation of T/L’s Capacity

Construction of New OHTL
- New Right of Way
- Long Period for Construction
- Huge Initial Cost
- Issue for EIA

Replacing by GAP conductor
- 1.6 – 2.0 times current capacity
- No modification on existing towers
- Need Replacing only

No ROW issue
Short Period & Low Cost
## Simulation for beneficial effect by reconductoring with Gap conductor

### Division | Case 1 | Case 2 | Case 3
---|---|---|---
**Materials** |  |  |  
Tower | 0 | 2,000 | 3,000  
Conductor | 1,200 | 800 | 1,600  
Earthwire | 100 | 100 | 100  
Insulator | 0 | 350 | 500  
Fittings | 100 | 250 | 400  
Sub total | 1,400 | 3,500 | 5,600  
**Construction** |  |  |  
Foundation | 0 | 1,000 | 1,500  
Tower Erection | 0 | 300 | 450  
Conductor Stringing | 350 | 300 | 450  
Sub total | 350 | 1,600 | 2,400  
**Dismantle** |  |  |  
Conductor, etc. | 100 | 0 | 150  
Tower | 0 | 0 | 250  
Foundation | 0 | 0 | 300  
Scrap (Raw Materials) | ▲400 | 0 | ▲600  
Sub total | ▲300 | 0 | 100  
Aquisition of land | 0 | ??? | 0  
**Total** | 1,450 | 5,100+α | 8,100

### Existing Condition
- Voltage: 110kV (2cct)
- Length: 50km
- Conductor: ACSR240sqmm (Single per phase)

### Case 1:
Reconductoring with GZTACSR 240sqmm

### Case 2:
Construct new 110kV T/L

### Case 3:
Dismantle existing T/L and
Construct 110kV T/L with twin bundled ACSR 240sqmm
Projects installed in Vietnam (1)

   - Existing conductor: ACSR 185/29
   - Up rating by: GZTACSR200mm²: -
   - Voltage class: 110KV
     (continuous operating temperature 210°C)
   - End User: EVNHANOI

2. Chem – Ha Dong  (171 – 172):
   - Existing conductor: ACSR 185/29
   - Up rating by: GZTACSR200mm²: -
   - Voltage class: 110KV
     (continuous operating temperature 210°C)
   - End User: EVNHANOI
   - Time of installation: Jan. 2010
Projects installed in Vietnam (2)

3. Thu Duc – Thanh Da:
- Existing conductor: ACSR 240
- Up-rating by: GTACSR240mm²: -
- Voltage class: 110KV
  (continuous operating temperature 150°C)
- End User: EVNHCMC
- Time of installation: September. 2010

4. Phu Dinh – Hung Vuong:
- Existing conductor: ACSR 795MCM
- Up-rating by: GZTACSR410mm²: -
- Voltage class: 110KV
  (continuous operating temperature 210°C)
- End User: EVNHCMC
- Time of installation: November. 2010
5. Long Binh – Xuan Truong:
- Existing conductor: ACKP 185
- Up-rating by: GTACSR185mm²: -
  - Voltage class: 110KV
  - Length: 17.427km
- End User: DONG NAI POWER COMPANY
- Time of installation: July. 2011

6. Kon Tum – Pleikrong:
- Existing conductor: ACKP 150
- Up-rating by: GZTACSR200mm²: -
  - Voltage class: 110KV
  - Length: 19.298km
- (continuous operating temperature 210°C)
- End User: EVNCPC
- Time of installation: April. 2012
5. Conclusion

- 27,000 km of Gap Conductor and 8,000 km of Invar conductor to the world for more than 30 years.

- We hope that our products could be more helpful to construct high reliable transmission lines in Asian countries.
Thank you!