Alabama Power Company
Siemens EM TS:
GIS Overview
Siemens Energy Management Division /
Transmission Solutions
March 8th, 2018
Agenda

11:00 – 12:30 - EPC and Project Execution
   APC Northside Layout and SLD Options

12:30 – 1:30 - Discuss Southern Company requested items
   Design considerations related to maintenance, operations, etc.
   Cover equipment access for replacement activities.
   Safety precautions
   Operations (switching and any other topics related to operating the GIS equipment)
   Monitoring
   Special protection schemes and options for turn-key P&C integrated in planned structures
   New Developments to consider such as State-of-the-art PT/CT assemblies, clean gas, etc.
   Emergency response

1:30 – 2:00 – Q & A
8DN8 GIS
Up to 170kV – 4000 A - 63kA
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
Switchgear Bay

1 Integrated local control cubicle
2 Current transformer
3 Busbar II with disconnecting and earthing switch
4 Circuit-breaker interrupter unit
5 Busbar I with disconnecting and earthing switch
6 Spring-stored-energy operating mechanism with circuit-breaker control unit (common or single drive)
7 Voltage transformer
8 Make-proof earthing switch (high speed)
9 Outgoing module with disconnecting and earthing switch
10 Cable sealing end
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A

**Rated Data**

- **Voltage**: 145 / 170 kV
- **Frequency**: 50 / 60 Hz
- **Power frequency withstand voltage (1 min)**: 275 / 325 kV
- **Lightning impulse withstand voltage (1.2/50 μs)**: 650 / 750 kV
- **Busbar current**: 3150 / 4000 A
- **Feeder current**: 3150 / 4000 A
- **Breaking current**: 40 / 63 kA
- **Short-time current (3 s)**: 40 / 63 kA
- **Leakage rate per year and gas compartment**: ≤0.5 % Routine test, ≤0.1% Type test
- **Bay width**: up to 145kV-40kA 31” (800 mm)

**Ambient temperature**: -30° C to +40° C
**Installation**: Indoor / Outdoor
**Expected lifetime**: > 50 years
**Standards**: IEC/IEEE/GOST

These details are maximum details and vary with the switchgear construction.
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
3 types of connections

- Cable Feeder
- Overheadline Feeder
- Transformer Feeder
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A

Ring Bus Arrangement
Gas-Insulated Switchgear 8DN8 up to 145 kV / 40 kA
Modular Structure 1

- Circuit Breaker
- Disconnector / Earthing Switch (Cross Module)
- Earthing Switch
- Extension Modules
  - three-phase
  - single-phase
  - Splitting Module 1/3-phase
- Cable Module
  - Outdoor Bushing
  - Transformer Module
- Current Transformer
  - Voltage Transformer
  - RC-Divider
  - Surge Arrester
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000 A
Three-position switching device with Disconnecting and Earthing Switch

- Busbar module
- Outgoing module, voltage transformer after disconnecting switch
- Sectionalizer
- Outgoing module, voltage transformer before disconnecting switch
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
Disconnecting Switch Principle

Neutral position

Disconnecting switch closed
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A

Grounding Switch Principle

Neutral position

Earthing switch closed
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
Current Transformer

- Cores with secondary winding
- Conductor / primary winding
- Inner electrode
- Grading electrode
- Secondary terminal
- Housing
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
Voltage Transformer

Secondary terminal housing
Iron core
Secondary winding
Primary winding
Bushing
Gas-Insulated Switchgear 8DN8 up to 170kV, 63kA, 4000A
Capacitive coupler for UHF-PD-measurement

Advantages barrier design with metal ring

- No corona effects at the surface due to high electrical fields
- No arcing in case of very fast transient currents at the GIS-surface
- Highest degree of SF6 gas tightness with metal-metal flanges only
- Integrated capacitive couplers in the epoxy bushing
Cable Termination Module Plug-in

- Plug-in type contact
- Epoxy resin socket
- Silicone rubber field control element
- Spring assembly
Cable Termination Module Conventional

- Connection interface according IEC 859
- Cast resin insulator
- Filling compound
- Slip-on stress cone
- Copper entrance bell
- Mechanical protection
1. **LCC cabinet:** Design made to be assembled at the manufacturing plant, and avoid opening it at site.

2. **C&P connection:** Cable openings for C&P on top cabinet.

3. **GIS connection:** Cable openings for GIS under side cabinet. Connection made with harting plugs.
LCC, New Solution

Shift of SoW from site wiring and assembly hours to manufacturing line.

Complete shop drawings

Better exchange of information between RDU, Customer and MS (no third parties involved)

Avoid reworking on cabinets at site, since Siemens’ own design and manufacturing plant QA.

Improved product quality applying internal Siemens Quality Assurance procedures.

Harting plugs for GIS connection, for plug & play installation at site.

Size of LCC cabinet reduced thanks to new terminal blocks used.

New for customer
<table>
<thead>
<tr>
<th>Time</th>
<th>Inspection</th>
<th>Wear</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>after 8 years</td>
<td>visual check</td>
<td>None</td>
<td>The Switchgear remains in service. Bays checked in sequence. No opening of gas compartments</td>
</tr>
<tr>
<td>after 16 years</td>
<td>visual check</td>
<td>Circuit Breaker: after 3,000 mechanical operating cycles</td>
<td>The Switchgear remains in service. Bays checked in sequence. No opening of gas compartments</td>
</tr>
<tr>
<td>After 24 years</td>
<td>Major Inspection</td>
<td>Circuit Breaker: after 6,000 mechanical operating cycles</td>
<td>The Switchgear is taken out of service, either completely or in sections, depending on the amount of work involved. Gas compartments opened.</td>
</tr>
<tr>
<td>As specified</td>
<td>Contact System Check</td>
<td>Circuit Breaker: If the maximum allowable number of fault current operations according to attached figure has been reached. High-Speed Earthing Switch: After the second closing operation onto live parts</td>
<td>Modules must be isolated. Gas compartments need to be opened.</td>
</tr>
</tbody>
</table>
Gas-Insulated Switchgear 8DN8 up to 145 kV / 40 kA
Essentials at a glance

<table>
<thead>
<tr>
<th>Environmental-friendly</th>
<th>The enhanced 8DN8 needs 15% SF6 less compared to its predecessors, which makes it one of the most eco-friendly GIS at 145kV worldwide.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compactness</td>
<td>The enhanced 8DN8 GIS offers the most compact design at improved accessibility and a greater variety in substation configurations (e.g. 1.5 CB, H- and Ring).</td>
</tr>
<tr>
<td>Robustness</td>
<td>The fixed bay concept of the enhanced 8DN8 leads to an improved seismic resistance of 0.5g (IEC62271-207) without additional measures.</td>
</tr>
<tr>
<td>Indoor and outdoor application</td>
<td>The enhanced 8DN8 offers a very modular design and can be used for indoor and outdoor applications from -30°C to +40°C at 50/60Hz.</td>
</tr>
<tr>
<td>Highest Quality and Reliability</td>
<td>Compliance with the extended mechanical endurance class M2. 10,000 mechanical operations (CB, DS).</td>
</tr>
<tr>
<td>Accessibility</td>
<td>The enhanced 8DN8 counts with accessibility to all important devices</td>
</tr>
<tr>
<td>Adapter modules</td>
<td>Enhanced 8DN8 is compatible with all previously installed Siemens GIS of the same voltage level.</td>
</tr>
</tbody>
</table>
Summary Training – Operators

- GIS Generalities
- Visual Identification of GIS Elements
- SF6 generality
- GDM’s / Camera
- Alarms and how to react
- Question / Answer
All products

- **On**
- **Off**

“off” position

(Closing spring loaded)

**Movie**

1. Closing release
2. Cam plate
3. Coupling linkage
4. Operating rod
5. Closing spring connecting rod
6. Opening spring connecting rod
7. Closing spring
8. Hand-wound mechanism
9. Charging mechanism
10. Charging shaft
11. Roller lever
12. Closing damper
13. Operating shaft
14. Opening damper
15. Opening release
16. Mechanism housing
17. Opening spring
All products

- Common drive
- Single pole drive
**All products**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>First operation (France)</td>
</tr>
<tr>
<td>1937</td>
<td>First patent as insulating gas (Cooper)</td>
</tr>
<tr>
<td>1938</td>
<td>First patent as arc quenching gas (Grosse)</td>
</tr>
<tr>
<td>1948</td>
<td>Start of technical production (USA)</td>
</tr>
<tr>
<td>1960</td>
<td>First SF₆-Power circuit breaker (Westinghouse)</td>
</tr>
<tr>
<td>1964</td>
<td>First Siemens-SF₆-Power circuit breaker (puffer type)</td>
</tr>
<tr>
<td>1968</td>
<td>First Siemens-GIS with SF₆-Insulation</td>
</tr>
<tr>
<td>1974</td>
<td>First Siemens-GIL</td>
</tr>
<tr>
<td>1995</td>
<td>First Siemens-SF₆-Power circuit breaker (self compression)</td>
</tr>
</tbody>
</table>

**Advantages:**
- High dielectric strength
- Regeneration capacity
- Low pressure increase in the case of breakdown

**Packaging:**
Specifications in accordance to DIN IEC- 60376
Steel cylinders of 5, 10, 20, 40 or 50 kg
Container with 460 or 600 kg
All products

Schematic diagram of contacts of density meter with ranges of tolerances

- Nominal filling pressure
- Min. SF₆ operating pressure

Example: gas schema of a 8DN8 Circuit Breaker

- Upper tolerance limit of first contact
- Lower tolerance limit of first contact
- Upper tolerance limit of second contact
- Lower tolerance limit of second contact

Design feature:
The SF₆ gas inside the reference chamber and the SF₆ gas of the switchgear have the same temperature. In case of equal gas temperatures the density comparison can be replaced by a pressure comparison.

This means „temperature compensated“.

\[ \frac{F}{A} = F - p \cdot A \text{ with } A = \text{const} \Rightarrow \frac{F}{A} = p \]

- F - force
- A - area
- \( \Delta F \) - travel
- K - instrument constant
All products
All products

The measured gas should not have an air proportion of more than 5% to ensure the necessary insulation properties.

→ min. allowed value for SF₆ is 95%
All products

How it works.
All cameras installed on the GIS view ports are connected to the camera hubs. The cameras are connected individually to the ports on the hubs. Card 1 is a platform and allows port to port viewing. It’s also a bridge between the cameras and the router/computer. Card 2 will transform the signal and communicate to the router.
## All products

<table>
<thead>
<tr>
<th>Substation</th>
<th>Camera</th>
<th>Cable CAT 5e 4X2XAWG26 Length (ft) Qty</th>
<th>USB Hub</th>
<th>LAN Cable CAT 5e 4X2XAWG26 Length (ft) Qty</th>
<th>LAN Switch</th>
<th>LAN Cable CAT 5e 4X2XAWG26 Length (ft) Qty</th>
<th>PC</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Image" /></td>
<td><img src="image2.jpg" alt="Image" /></td>
<td><img src="image3.jpg" alt="Image" /></td>
<td><img src="image4.jpg" alt="Image" /></td>
<td><img src="image5.jpg" alt="Image" /></td>
<td><img src="image6.jpg" alt="Image" /></td>
<td><img src="image7.jpg" alt="Image" /></td>
<td><img src="image8.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>
All products

- ISCM Cubicle (Integrated Substation Condition Monitoring)
- GDM Node Unit
- Indoor/Outdoor Marshalling Box
- Trafag Hybrid Density Transducer
- Fibre Optic Power
- Multi Core Cable
- Transducer Cable

Assetguard ISCM Cubicle Software Training

Contract Award → Engineering & Hardware Build → Factory Testing → Site Installation → Commissioning → On-site Training → Warranty → Service Level Agreements → 6 Month Customer Feedback → 2 Yearly Calibration → Customer Acceptance → Customer Feedback → Training Refresh

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Home Screen & System Overview

Customer Data

Return to Main Menu Screen

Access to Installed Monitoring Systems

UPS - Uninterruptable Power Supply

GPS - Global Positioning Satellite Time Synchronisation

Alarm/Event Lists

System Health

Home Screen & System Overview

Language

Time & Date

General Information

Inventory*

Dashboard*

ISCM Health*

System Login

Notification of Alarm in Progress - Alarms Active

- Only available within the GIS Menu
System Login

1. To login, click Area 1 System login and levels of access are subject to User Name and Password verification.

2. The password can be changed using the Change Password Button within the login drop down menu. What do you add to change the password? User Name and current password or just username?

Notes
- Health screens and Customer Data can be accessed without logon.
- User Administration Authorisation is required to:
  - Create a User Group
  - Create a New User
  - Create or Amend Authorities
The Customer Data screen gives information regarding:

- End user data.
- Where notifications are addressed.
- Information about the service agreement including contact data.

A Service Level Agreement tailored to the Client's requirements can be discussed.

These fields will be populated but can be changed with the appropriate user access.
Menu Options

The Menu Option provides links to the following:

- Assetguard System Manuals
- System Documents
- Customer Modifications
- Version
- Contact / Service
- Contract (Black/Grey)
- Legend

Notes
For all installed systems alarm indication is given on all screens. A colour indicates the severity of the alarm while the status is indicated by a flashing, solid or hollow box.

- **Red**  Stage 2 Alarm
- **Amber**  Stage 1 Alarm
- **Yellow**  Gas Density Falling
- **Purple**  Gas Overpressure
- **Blue**  Communications Failure

The status (flashing, stable, hollow) provides the acknowledgement status of the user.

- **Flashing**  Alarm is active and not acknowledged.
- **Stable**  Alarm is Active and is acknowledged.
- **Hollow Flashing**  Alarm was active.
Alarm List Display Options
1. No. of current alarms
2. No. of unacknowledged alarms
3. Data filter options
   - General, Search functions
   - Times, Search using time
   - Columns, Data type to view
   - Text, Search by word
   - Status, Search by status
   - Project, Search by project
   - Equipment modeling, Not used

Alarm Functions
1. Show all actual alarms
2. Show current alarms
3. Show not acknowledged alarms
4. Show alarm history
5. Acknowledge alarm
6. Acknowledge page
7. Acknowledge all
Event List

What does this screen show?

What are CEL Functions?

EA to provide information on this page.

Alarm Functions

1. Show all actual events
2. Data filter options
3. Show all actual events
4. Show event history
5. Stops current search (allows further refinement via display options)
Navigation Process

1. Select GDM from the System Overview Page
2. Assetguard will display a Single Line Diagram of the Substation. Within the Single Line Diagram select an area of the substation you wish to view System Data.
3. Assetguard will show the selected area and highlight in a blue shade the monitored gas zones within the selection.
4. When a monitored zone is selected the system data is presented which details:
   1. Single Line Section
   2. The Available Monitored Gas Zones
   3. Current Gas Density Status
   4. Gas Density Historical Trends
   5. Inventory
   6. Alarm Settings
   7. Predicted Alarm Activation Dates, if available.
Gas Zone Alarm Examples 1/2
Gas Zone Alarm Examples 2/2
Detailed Information

Sensor Information
The system provides four data points concerning the Sensor:
- Gas Zone Designation, Phase, Chamber ID, Logical ID

Specifications

Status
- The Status provides a Leak Rate from the Node Unit Inventory.
- A full inventory report is available from the node.

Inventory
- 1st stage Warning: 
  - Customer defined to indicate leak in progress
- 1st stage Alarm: 
  - Gas density falling
- 2nd stage Alarm: 
  - Switchgear lock-out
- Overpressure alarm: 
  - Set below bursting disk operating pressure.

Maintenance mode:
- Maintenance / Top-up mode is indicated as active with a yellow highlight. This indicates the sensor is no longer logging data.
  - This mode is set at the node.

Predictions
- Assetguard provides a date when, with the current data, alarms will be activated.
- The prediction accuracy increases with time as more data becomes available.

Actual Values
Actual Alarm Values - gives visual indication of current measured density.

Proximity to alarms:
- Green: Normal
- Yellow: Leak in progress
- Orange: Gas pressure falling
- Red: Lock-out
- Turquoise: Overpressure

Current measured pressure with alarm proximity
The ISCM Health Screen defaults to the health of the Assetguard ISCM Cubicle and displays the following health indications to confirm live connection of key system components:

- Cubicle AC Power
- Cubicle Fans and Lights
- Node Unit AC Supply
- UPS Output
- Communications AC Supply
The following screen identifies the current status of the Services running within the system. When an issue is identified the status lamp turns red to highlight an issue which needs further investigation.

GDM CSV Service error.
If you select a Node Unit the system health highlights the health of key Assetguard™ Node unit components.  

- Positive Left Power Supply
- Negative Left Power Supply
- Positive Right Power Supply
- Internal Temperature

It is possible to remote access to the selected Node Unit from the Remote Connection link. The Assetguard™ Node Unit Training Module covers the functionality available on the Node Unit.
The Assetguard GDM Inventory provides an overview of the full system. Key information provided includes:

- Total Number of Nodes
- Total Number of Gas Zones
- Total Installed Gas
- Total Gas Lost - This is based on Installed gas to current amount.

A summary of System Nodes, Installed and Gas Lost is followed by an individual status of gas per Zone and current alarm status.
The Assetguard ISCM Cubicle Dashboard gives the user the ability to select any system zone or multiple of zones across the entire system and see a summary of the information below. The graphics are toggles using the Flip Button.

- The Alarm Thresholds for the Zone
- The current Gas Density
- Table of Basic statistics:
  - Current Density
  - Current Loss
  - Total Loss
How to react

Gas Alarm from the GDM
• Find where the gas zone alarming is on the computer
• Inspect the LCC’s annunciators to verify the location and ensure that the alarm is due to a stage alarms reached.
• If no alarms on the annunciator then it could be the preventive alarm that got reach and more investigation.

CB alarms : 3 alarms possible :
• Motor run overtime
• Spring discharged
• Discrepancy of phases (only on single phase)

Camera system not responding
• Camera is not responding
• Go to the GIS room, power off the Hub
• Wait 1 minute
• Power on the Hub
• Reset the computer
Energy Management
Transmission Solutions RU
Energy Management Global – a powerful player within Siemens

Energy Management Business Units

<table>
<thead>
<tr>
<th>Energy Management Business Units</th>
<th>Market position</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Voltage Products</td>
<td>#1</td>
</tr>
<tr>
<td>Transformers</td>
<td>#2</td>
</tr>
<tr>
<td>Transmission Solutions</td>
<td>#1</td>
</tr>
<tr>
<td>Medium Voltage &amp; Systems</td>
<td>#3</td>
</tr>
<tr>
<td>Low Voltage &amp; Products</td>
<td>#4</td>
</tr>
<tr>
<td>Digital Grid</td>
<td>#1</td>
</tr>
</tbody>
</table>

1 Power Generation Services is part of PG and WP
Always close – global availability of technology and expert know-how

~ €2 bn
Revenue

~ 70 m
R&D Budget

~ 11.000
Employees

~ 10
Factories

1) Please note: The scales of Hawaii and Alaska match the scale of the main land, the positions do not.
**Energy Management Business Units Full-Range Portfolio**

**High Voltage Products**
- Gas-insulated switchgear (GIS systems)
- Circuit breakers
- Disconnectors and earthing switches
- Surge arresters
- Instrument transformers
- Coils
- Bushings
- Insulators

**Transformers**
- Power transformers
- Reactors
- Transformers for industrial applications
- Phase shifting transformers
- HVDC transformers
- Distribution transformers
- Traction transformers

**Transmission Solutions**
- High-voltage substations (AIS / GIS / Data Centers)
- Flexible AC transmission systems (FACTS)
- High-voltage direct current transmission systems (HVDC)
- Grid access solutions
- Power transmission lines
- Customer Service
- Training

**Medium Voltage & Systems**
- Air- and gas-insulated medium-voltage switchgear
- High-current generator breaker system
- Medium-voltage outdoor systems
- Active power systems
- Subsea solutions
- Low-voltage switchboards
- Low-voltage busbar-trunking systems

**Low Voltage & Products**
- Low-voltage protection devices
- Low-voltage switching devices
- Low-voltage measuring, and monitoring devices
- Low-voltage distribution boards and systems
- Medium-voltage vacuum circuit breakers
- Medium-voltage contactors
- Medium-voltage interrupters

**Digital Grid**
- Smart metering and communications
- Grid protection, automation and power quality
- Grid control and applications
- IT/OT integration and data analytics
- Grid consulting, planning and simulation
- Solutions for distribution automation, microgrids, renewables integration
## Transmission Solutions Portfolio at a Glance

### HVDC
- High-voltage direct-current transmission
  - Classic
  - PLUS (VSC)
  - MVDC

### Grid Access
- Offshore grid access
  - HVAC
  - HVDC

### FACTS
- Solutions for grid stabilization
  - Parallel Compensation
  - Series Compensation

### PTL
- Solutions for power transmission lines
  - Gas-insulated transmission lines (GIL) for AC and DC
  - HV power cable systems EPC mode, mainly in house

### Turnkey Substations
- HV substations with air-insulated switchgear
  - EPC business
  - 52-800 kV
  - Greenfield and modernizations/extensions
  - Datacenters
  - HV Industrial Applications

### HV substations with gas insulated switchgear
  - EPC business
  - 52-800 kV
  - Greenfield and modernizations/extensions
  - Mobile Substations
  - HV Industrial Applications

### LTS: Large Transmission Solutions
- Substation & FACTS

- Grid Access
- FACTS
- PTL
- Turnkey Substations
- Service

### VSC: Voltage-sourced Converter; FACTS: Flexible AC Transmission System; PTL: Power Transmission Lines; SEA: Substations

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**Page 55**
Transmission Solutions
Organization/Capabilities
Siemens connects the power networks of New Jersey and New York City

Market requirements
- Increase in power transfer to Manhattan/New York by interconnection of power networks
- Low space requirements, robust design with high availability
- Controlled power transfer by use of HVDC Back-to-Back Converter Technology

Solution
- Turnkey 660 MW Back-to-Back HVDC Classic
- Especially compact and low-noise design for an urban area
- Converter station connects two power systems from New Jersey / Bergen 230 kV Substation via 11 km AC cable crossing the Hudson river to Manhattan at 345 kV AC

Customer benefit
- Commercial operation six weeks ahead of schedule
- Cost savings of USD 1 billion over project lifetime
- No emissions or combustion, no visual impacts, cleaned up a former industrial site

Customer: Hudson Transmission Partners LLC
Location: NY, USA
Date: 2013
Siemens Synchronous Condenser solution provides short circuit power for grids with increasing renewable energy share

Market requirements
- Short circuit power requirements due to increasing share of renewable energy in California
- Provision of reactive power for the existing grid

Solution
- Synchronous condenser turnkey
- Solution with direct air cooled generator and brushless excitation system

Customer benefit
- Increasing short circuit power in the system
- Improvement in dynamic stability of transmission systems
- Increase in power quality in the transmission grid
- Capability to ride through network disturbances
- Shut-down of thermal powerplants which provided these services before

Customer
Location
Date
SDG&E
San Diego
2015
Siemens designed SVC PLUS to compensate for phase unbalanced in the grid

Market requirements
- Fast, dynamic voltage control at four different 132kV substations
- Unbalance control for power supply
- Low acoustic noise generation

Solution
- Four SVC PLUS converters, installed in a building (latest Multilevel Voltage-Sourced Converter Technology) with a dynamic operating range of +/-125 MVar each
- Strong voltage support and stabilization capability
- Negative phase sequence control enables phase unbalance control

Customer benefit
- Best fit-for-purpose equipment for competitive price
- No harmonic generation of SVC PLUS leads to minimum noise contribution
- A small physical footprint helps reduce property costs

Customer Location
- Dominion Virginia

PAC Date
- 2016
Largest GIS in North America reinforces New Jersey’s transmission backbone

**Customer**
PSE&G

**Location**
Bergen/NJ, USA

**PAC Date**
2013

**Market requirements**
- Public Service Electric and Gas Company (PSE&G) upgraded its existing 138-kV lines to 230 kvolts
- Due to the higher power level, the max. short circuit level had to be increased to 80 kA

**Solution**
- Turnkey delivery of 31 bays 8DQ1 type GIS, 230 kV, 80 kA, 5,000 A
- 2,700 meters of gas-insulated bus-ducts connect the GIS with the AIS part
- The 245-kV breakers are the world's first of its kind to switch a short-circuit current of 80 kA

**Customer benefit**
- The GIS helps provide additional load capacity and enhances safety and reliability by redundancy in system design and earthquake resistance
- The compact GIS design allowed to save space in a vulnerable environment (wetland area)
Transmission Solutions
Signature Solutions
Siemens proposes a new methodology to optimize the site construction process. Our concept offers four new techniques that manage to recover lost time and eliminate risks during construction phase. It improves quality, performances, logistics, congestions at site by utilizing Siemens’ off-site locations near the installation site. The new integrated Scope of Work will improve the overall process to help our customers to maintain deadline.
## Signature Solution concept

<table>
<thead>
<tr>
<th>Feature</th>
<th>Pre-assembly @ Siemens locations</th>
<th>Load</th>
<th>Wiring</th>
<th>Pre-testing</th>
<th>Core asset</th>
<th>Recommended when…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard product containerized</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Pre-assembly @ Siemens locations</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>Pre-assembled modules (3T to 10T)</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiring</td>
<td>Pre-wiring CT’s/VT’s on equipment side only</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-testing</td>
<td>CT’s / VT’s / Density monitors</td>
<td></td>
<td>✔</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Bays GIS assembled on a transportable skid (10T to 30T)</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All bays wired to control panels and tested prior shipment</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combination of Smart Integration / Smart House / Smart Installation</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split of work (wh/site)</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td>90% WH / 10% Site</td>
</tr>
<tr>
<td>Core asset</td>
<td>Flexibility to work with others</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td>Reduction of civil input/ slab size</td>
</tr>
<tr>
<td>Recommended when…</td>
<td>site access is difficult or there is no laydown yard</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td>site access is difficult or there is no laydown yard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
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</tr>
</tbody>
</table>

90% WH / 10% Site

- Reduction of civil input
- Flexibility on SoW

Recommended when…

- site access is difficult or there is no laydown yard
- site access is difficult or there is no laydown yard
Traditional process vs Signature Solution process

**Traditional Process**

- Civil
- Building erection
- Building fit out
- GIS
- C&P
- BoP
- Energization

**SMART Process**

- Off-site execution
- GIS off-site
- Building fit out
- C&P
- GIS on-site + C&P
- BoP
- Energization

- 30%/40% earlier
Smart Integration

Options

- Skid designed and dimensioned for IEEE 693-2005

Assembly:
- 3 bays together for 1 ½ configuration 69-345kV
- 6 bays for ring bus/double bus bar configurations 69-170kV
- 3 bays ring bus/double bus bar configuration for 230-550kV
Signature Solution References

31 projects

31 projects