Enhancing Transmission Utility System Reliability Through Advanced Power Blackout Mitigation Measures: A Georgia Case Study
GSE Customer Base

• Power Distribution Companies (DSOs)
  o Telasi, JSC
  o Energo-Pro Georgia, JSC
  o Kakhetis Energo Distributsia, JSC

• Georgian Railway (GR)

• Large Manufacturers
  o Georgian Manganese, LLC

• Other Utilities
  o Georgian Water and Power, LLC
  o Rustavi Water Company, LLC
Blackouts and Brownouts Before Implementation of New Technology

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Blackouts</th>
<th>Duration of Blackouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>32</td>
<td>75.27</td>
</tr>
<tr>
<td>2004</td>
<td>42</td>
<td>70.45</td>
</tr>
<tr>
<td>2005</td>
<td>36</td>
<td>42.93</td>
</tr>
<tr>
<td>2006</td>
<td>11</td>
<td>7.75</td>
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<tr>
<td>2007</td>
<td>14</td>
<td>24.48</td>
</tr>
<tr>
<td>2008</td>
<td>6</td>
<td>4.42</td>
</tr>
<tr>
<td>2009</td>
<td>4</td>
<td>4.48</td>
</tr>
<tr>
<td>2010</td>
<td>10</td>
<td>11.05</td>
</tr>
</tbody>
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GSE’s Approach to Resolve Blackouts and Power Outages

- Decided to determine the **Root Cause** of existing problems
- The major **Root Cause** was determined over months of research
- Looked for supplier with the latest technologies to solve the problem
- Specifications were written describing the root problem
- Supplier (SEL) was chosen
- Project was implemented
- New system has been operating for 4 years
Blackouts And Brownouts After Implementation of New Technology

- **Number of Blackouts**
  - 2003: 32
  - 2004: 42
  - 2005: 36
  - 2006: 11
  - 2007: 14
  - 2008: 6
  - 2009: 4
  - 2010: 10
  - 2011: 6
  - 2012: 9
  - 2013: 2
  - 2014: 6
  - 2015: 4

- **Duration of Blackouts**
  - 2003: 75.27
  - 2004: 70.45
  - 2005: 42.93
  - 2006: 7.25
  - 2007: 4.42
  - 2008: 11.05
  - 2009: 2.13
  - 2010: 7.75
  - 2011: 2.48
  - 2012: 7.28
  - 2013: 1.77
  - 2014: 0.00
  - 2015: 0.00
RAS Operations for 2014
RAS Operations for 2015

08/06/2016
RAS Operations for 2016

![Bar Chart]

- January: 3 Brownouts (6), 2 Blackouts (3)
- February: 1 Brownout (1), 1 Blackout (1)
- March: 1 Brownout (1), 1 Blackout (1)
- April: 0 Brownouts, 1 Blackout (1)
- May: 0 Brownouts, 0 Blackouts

08/06/2016
GDP Georgia is $1.59M per hour
RAS cost today is $2M
Other Benefits to GSE

- New technology can be easily installed in existing installations
- This technology allows engineers and operators to know the interaction of all the components & devices in their power system – that was unknown before.
- This technology allows engineers to see the cascading effects after a contingency occurs.
- Create a separate communication network that is very reliable for emergency and protection
- Using PMU Technology not only for ECS and RAS, but also for SCADA
- GSE engineers are learning very quickly to understand data and information about their power system that was unknown before the new technology.
Future Benefits

• This new technology is based on relays that have not only the protection functionality but also have synchrophasor technology, control logic, and I/O (RTUs).
• These relays have eliminated the need to specify synchrophasor units, RTUs, and Controllers.

  • Savings in hardware

  • Savings in installation, maintenance and testing

• The new grid technology will provide savings for future budgets for EMS & SCADA

• EMS will use new data from this technology to predict what will happen in the power system
**Definitions**

- **RAS** – is the Remedial Action Scheme, in other places this is called Special Protection Systems and could also be called Wide Area Monitoring System (New technology by SEL Implemented for GSE.)

- **ECS** – Emergency Control System

- **EMS** – Energy Management System

- **SCADA** – Supervisory Control and Data Acquisition

- **PMU** – Phasor Measurement Unit

- **Contingency** – A Change in the Power System topology from normal operation
Definitions

• GDP – Gross Domestic Product

• Blackout - when the whole country is without electricity

• Brownout - a section of the country’s power system without electricity
Thank you for your attention!