**Subject: Amana Substation Scope of Work**

**Dear**

Energy Parts Solutions (EPS) is pleased to present the following scope of work for the relay protection upgrades on the following Petróleos de Venezuela, S.A. (PDVSA) substations: Amana, Travieso, and Muscar substation.

The following proposal identifies the need to upgrade the existing 115kV line protection resulting from the upgrades at Furrial substation. The outdated ABB 316\*4, RFL9300 and GE D60 relays are no longer supported by the industry and with the additions to Furrial substation the need to upgrade the existing 115kV line protection is imperative. The following proposal for engineering of the new 115kV line protection includes estimates for material, labor, testing, and commissioning as well.

The existing relay cabinets along with the wiring and terminal blocks are in good shape and are suitable for re-use. We propose to replace the rack mount equipment in place, and customize rack panels as required. The scope of work will include new primary and backup protection and controls for 115kV line protection at Amana. The scope will include new rack mount SEL 421 & SEL 311L for distance, line differential, and directional over current protection for 115kV lines supplying Furrial, Jusepin II, and Muscar. The 115kV line supplying Travieso will have an SEL421 for distance and directional overcurrent only as its is believed to not have a fiber connection. The new SEL 421 will also be used for breaker failure protection where needed. All 115kV metering will be replaced with ION 8800 meters. New Iniven digital multiplexers will replace existing ABB Fox 6Plus multiplexers as needed. The 115kV line protection at Travieso substation will also be upgraded with SEL 421 distance relay with directional over current. The 115kV line protection at Muscar will also be upgraded with SEL 421 and SEL 311L relays with distance, line differential, and directional over current protection

The scope of work also includes the upgrade for the TP1 and TP2 transformer protection panel with the addition of a SEL 787 & SEL 581 differential and over current relays. The SEL 581 will serve as a backup relay. New Kelman on-line DGA monitors for each transformer will be installed and integrated into the existing SCADA and protection. All relays will be IEC 61850 compliant and manufactured by Schweitzer. The protection and relaying will be mapped into a remote terminal unit and tied into the existing fiber and SCADA system. All required yard excavation, foundations and installation of conduits or trench ways will be performed by PDVSA.

**Amana Substation:**

**Electrical Design**

* Revisions to One Line diagram
* Revisions to Three line diagram
* Schematic diagrams
* New panel layout/arrangement drawing
* Revisions to panel wiring diagrams and interconnect drawings

**115kV Line Protection Relay Panels Jusepin II, Furrial, Muscar, & Travieso**

* Remove rack mounted relays.
* SEL 421 distance, over current, directional over current relays. (Only protection for Travieso)
* SEL 311L line differential relays.

**115kV Line Protection Communication**

* Remove ABB Fox 6PLUS multiplexers for Jusepin II and Furrial.
* Replace with Iniven digital multiplexers.

**115kV Metering for Muscar, Travieso, Furrial, and Jusepin II**

* Remove rack mount panels with meters.
* New custom panel with (4) ION 8800 meters. Existing test switches to remain.

**Transformer Protection Panels (TP1 & TP2)**

* Remove GE rackmount relays.
* SEL 787 transformer protection relay with over current and differential protection.
* SEL 581 differential and over current relay.

**Transformer On-Line DGA**

* Kelman TapTrans transformer monitors.
* Develop program and I/O points list.

**Relay Settings/Programs**

* Develop Relay Protective Setting.
* Develop Programs for SEL relays.
* Develop Programs for Kelman units.
* Develop testing and commissioning requirements for new relay protection schemes.

**Testing/Commissioning**

* Relay
  + Check tightness of connections
  + Functional test of each elements used in the protection scheme.
  + Verify operation of light-emitting diodes, display, and targets.
  + Check all internal logic functions used in the protection scheme.
  + Check all output contacts
  + Check operation of all active digital inputs
* Current Transformers
  + Check tightness of connections
  + Perform Insulation-resistance test of each current transformer and its secondary wiring with respect to ground at 1000 volts dc for one minute.
  + Perform a polarity test of each current transformer.
  + Perform a ratio-verification test
* Voltage Transfromers
  + Check tightness of connections
  + Perform insulation-resistance tests winding-to-winding and each winding-to-ground.
  + Perform a turns-ratio test on all tap positions
* Wire check of all protection and control circuits to ensure wiring is installed in accordance with design drawings
* Functional testing of all Protection and control circuits.

**Travieso Substation:**

**Electrical Design**

* Revisions to One Line diagram
* Revisions to Three line diagram
* Schematic diagrams
* New panel layout/arrangement drawing
* Revisions to panel wiring diagrams and interconnect drawings

**115kV Line Protection Relay Panels**

* Remove existing line relaying GE D60.
* SEL 421 distance, over current, directional over current relays. (Only protection for Travieso)

**Relay Settings/Programs**

* Develop Relay Protective Setting.
* Develop Programs for SEL relays.
* Develop testing and commissioning requirements for new relay protection schemes.

**Testing/Commissioning**

* Relay
  + Check tightness of connections
  + Functional test of each elements used in the protection scheme.
  + Verify operation of light-emitting diodes, display, and targets.
  + Check all internal logic functions used in the protection scheme.
  + Check all output contacts
  + Check operation of all active digital inputs
* Current Transformers
  + Check tightness of connections
  + Perform Insulation-resistance test of each current transformer and its secondary wiring with respect to ground at 1000 volts dc for one minute.
  + Perform a polarity test of each current transformer.
  + Perform a ratio-verification test
* Voltage Transfromers
  + Check tightness of connections
  + Perform insulation-resistance tests winding-to-winding and each winding-to-ground.
  + Perform a turns-ratio test on all tap positions
* Wire check of all protection and control circuits to ensure wiring is installed in accordance with design drawings
* Functional testing of all Protection and control circuits.

**Muscar Substation:**

**Electrical Design**

* Revisions to One Line diagram
* Revisions to Three line diagram
* Schematic diagrams
* New panel layout/arrangement drawing
* Revisions to panel wiring diagrams and interconnect drawings

**115kV Line Protection Relay Panels**

* Remove existing line relaying RFL9300 and GE D60.
* SEL 421 distance, over current, directional over current relays. (Only protection for Travieso)
* SEL 311L line differential relays.

**Relay Settings/Programs**

* Develop Relay Protective Setting.
* Develop Programs for SEL relays.
* Develop testing and commissioning requirements for new relay protection schemes.

**Testing/Commissioning**

* Relay
  + Check tightness of connections
  + Functional test of each elements used in the protection scheme.
  + Verify operation of light-emitting diodes, display, and targets.
  + Check all internal logic functions used in the protection scheme.
  + Check all output contacts
  + Check operation of all active digital inputs
* Current Transformers
  + Check tightness of connections
  + Perform Insulation-resistance test of each current transformer and its secondary wiring with respect to ground at 1000 volts dc for one minute.
  + Perform a polarity test of each current transformer.
  + Perform a ratio-verification test
* Voltage Transfromers
  + Check tightness of connections
  + Perform insulation-resistance tests winding-to-winding and each winding-to-ground.
  + Perform a turns-ratio test on all tap positions
* Wire check of all protection and control circuits to ensure wiring is installed in accordance with design drawings
* Functional testing of all Protection and control circuits.

We are working on producing a schedule for this project. Currently we are waiting on equipment delivery confirmation from two vendors. Once we have this information we will send it immediately over to you. However, as you can see from the proposal there is a large amount of engineering that needs to be completed prior to ordering the materials. In order to minimize the schedule impact we ask that you evaluate our proposal as soon as possible and give us the proper instruction on whether or not to start engineering.

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| Description | Cost (US$) |
| Engineering | $898,600 |
| Installation Labor | $360,800 |
| Testing/Commissioning | $278,400 |
| Material | $1,118,200 |
|  | **$2,656,000** |

The above referenced proposal represents our understanding of your requirements based on our engineering review conducted during the week of July 5th, 2010. If for any reason you do not agree with the above proposed protection scheme please let us know immediately so that we can modify your proposal accordingly. We look forward to assisting you with the proposed protection scheme.