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115/34.5kV Solar Plant & Substation Senior Design Project

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AGENDA

- Safety Moment
- New Technology
- One-Line
- Relays
- Rigid bus material
- ETAP

- Nail down One-line and send to BV
- Look into relaying and relays we need
  - SEL
- Add ratings to One-Line
- Select rigid bus material
- Begin using ETAP to test out ratings and configurations

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SAFETY MOMENT

PPE for Visitors in Substations and Switchyards

Hard Hats - Protect against falling objects and bumps

Safety Glasses - Shield eyes from flying debris and electrical sparks

Footwear - Non-conductive, steel-toe boots to protect against electric shocks and heavy objects

Hearing Protection - For areas with high decibel levels, ear protection is necessary

High-Vis Vests - Ensure you can be seen from a distance

Clothing - Avoid any loose-fit clothing & avoid wearing hooded clothing with strings

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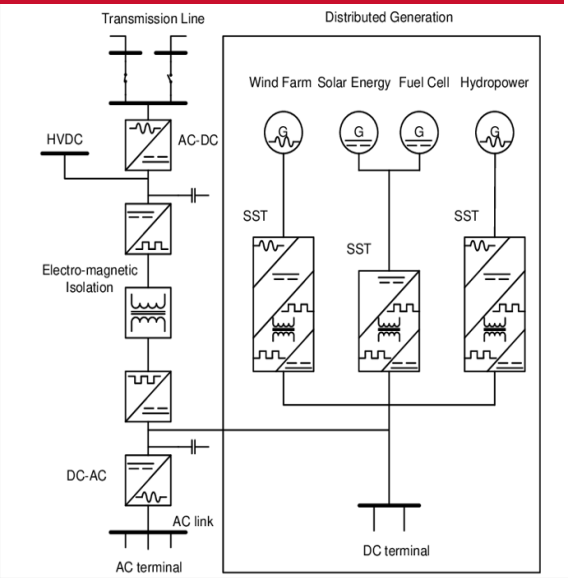
SST AND THEIR BENEFITS



- **Higher Efficiency** – Reduces losses, especially under variable solar load conditions.
- **Grid Flexibility** – Enhances smart grid integration with real-time monitoring.
- **DC-Link Capability** – Enables direct DC connection, reducing conversion losses.
- **Compact Design** – Smaller size lowers land and installation costs.
- **Advanced Control** – Improves voltage regulation and grid stability.

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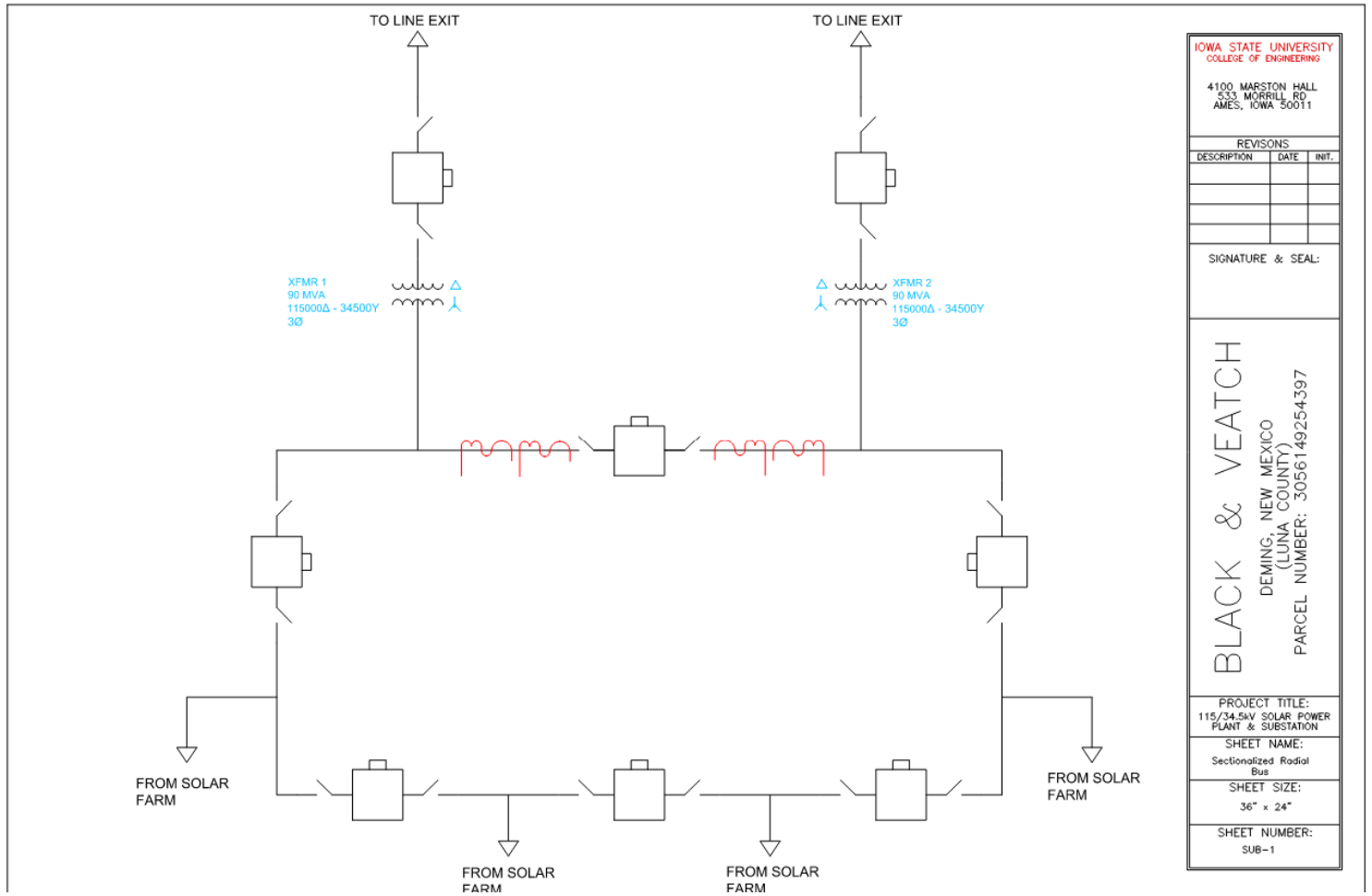
One-Line



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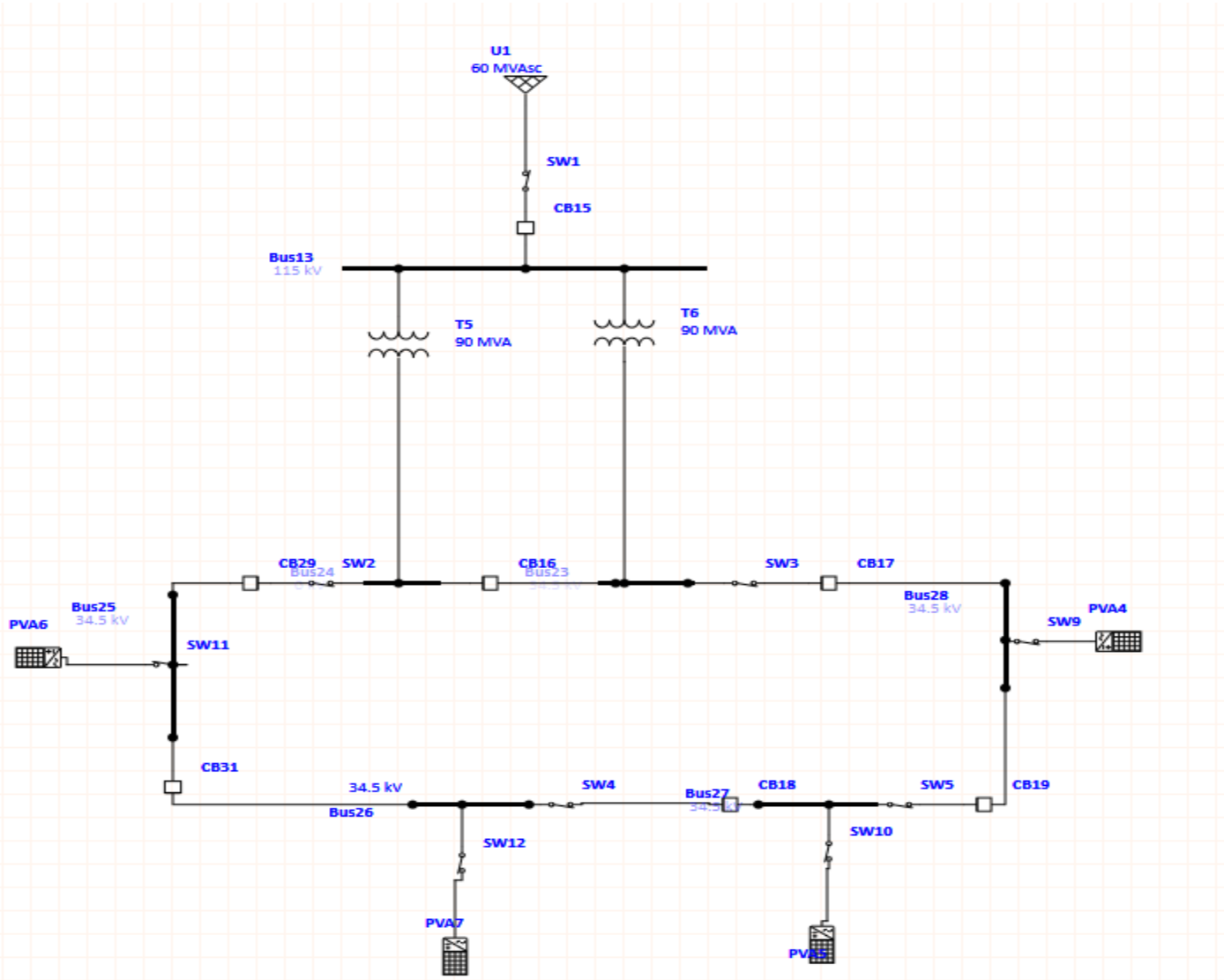
ETAP



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RELAYS

- SEL 451 Protection, Automation, and Bay Control System

https://selinc.com/products/451/

- Speed, power, and flexibility to combine complete substation bay control with high-speed breaker protection in one economical system.
- Reduce maintenance.
- Dual Breaker Bay Control.
- Hight-Impedance Fault Detection: Arc sense Technolgy (AST).
- Complete Overcurrent Protection.
- Pad-Mounted Switchgear Protection.
- Flexible Communications Options.

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RELAYS

- SEL 751 Feeder Protection Relay

https://selinc.com/products/751/

- Feeder Protection: Protect radial and looped distribution circuits with comprehensive protection capabilities, including time-overcurrent, directional overcurrent, autoreclosing.
- LEA Sensor Inputs: Medium- and low-voltage applications.
- Arc-Flash Mitigation.
- High-Impedance Fault Detection: Detect downed conductors, even on poorly conducting surfaces.
- Reliable Protection in Harsh Environments: operating temperature of –40° to +85°C (–40° to +185°F).
- Event Analysis: Conduct post-event analysis more efficiently with detailed event records.

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RELAYS

- SEL 487E Transformer Protection Relay

https://selinc.com/products/487E/

- Multiwinding Protection: uses up to six restraint currents, including single transformers with tertiary windings.
- Sensitive Turn-to-Turn Fault Detection.
- High-Speed, Adaptive Differential Protection.
- Protect large transformers with breaker-and-a-half high- and low-side connections.
- Pad-Mounted Switchgear Protection: protect pad-mounted switchgear with low-energy analog (LEA) voltage inputs.
- Configurable Distance Protection: Apply up to four zones of phase and ground distance protection.

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RELAYS

- SEL 487b - https://selinc.com/products/487B/
- Provides bus differential and breaker failure protection
- Ensures that the currents entering the bus are equal to currents leaving.

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RELAYS

- SEL 311L - https://selinc.com/products/311L/
- Provides transmission line protection
- Has 4 zones of protection for distance and overcurrent protection

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BUS MATERIAL

Aluminum Pipe

Aluminum Seamless Bus Pipe

- **FEATURES:**
  - Only one-third the weight of copper
  - Highly corrosion resistant
  - Dissipates heat rapidly and evenly
  - Very strong yet lightweight
  - Easy to fabricate
  - Conducts equivalent loads of electric power with one-half as much material weight as copper

APPLICATIONS:

- 6061-T6 alloy used in high strength applications
- 6063-T6 alloy used in higher current carrying applications
- Indoor or outdoor use

https://edge.sitecorecloud.io/americafuji9ddc-aflglobaldebc30-prod7ddb-7b7b/media/Project/AFL-Global/Product-Specification-Sheet/Conductor-Accessories/aluminum-seamless-bus-pipe.pdf?am_en_0a18f29fddeb452ab4d55eca6b0c80b9

THANK YOU