

**GRIDWEEK**<sup>TM</sup>

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# **The Modern Grid**

## **An Industrial Customer's Perspective**

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## Typical Electric Utility Supply

- Utility transmission line, nominal 115 kV or higher that interconnects multiple generating stations.
- The transmission line is looped into a main substation dedicated to and located at the plant site.
- A combination of circuit breakers and switches provide protection to the line and step down transformers located in the substation.
- The service is capable of meeting the plant demand load with one part of the loop out of service.
- The Utility transformers are sized to serve the plant maximum demand load with the single largest piece of equipment (transformer, circuit breaker, etc.) out of service

A fault on the transmission grid in the electrical vicinity of the plant results in a voltage sag to the plant

The Manufacturing Environment:

- Highly automated
- Processor controlled environment with high density of processors controlling manufacturing operations
- Micro-processors interlaced through-out the power distribution system in the facility
- Numerous variable frequency drives and DC power supplies with transistor controlled front ends

### Impacts of Voltage Excursions:

- When voltage drops below approximately 75% of nominal (Ref. SEMI F47 and ITIC curves) processor or controls interrupt immediately
- Interruption of a single dept cascades through-out the plant
  - Assembly Facility (Impact varies by dept – welding, painting & final assembly)
    - **Body**
      - Robots stop, must be re-homed and manually restarted (Numerous robots in a body shop)
      - If Robot has complex entry path, it must be manually withdrawn
      - Check and manually clear parts with “Bad” welds
    - **Paint**
      - Robots stop, must be re-homed and manually restarted
      - Oven burner shuts off, unit goes into purge then reheat, strip partially cooked bodies and scrap or repaint – Several hours to restore operation
      - Any body in a ELPO (electro-static) dip tank is scrap
    - **Final Assembly**
      - Restart conveyors and re-zero select machines

## Impacts of Voltage Excursions (Cont.):

- Powertrain Facility
  - Grinders – Wheel often breaks if in contact with part at time of disruption
  - Servo Gantries – Must be manually re-home – approx 1 hr/gantry
  - Multi-head Drills – Broken bits must be replaced before restart
  - If a PLC or PC loses retentive memory, it must be reprogrammed
  - Scrap damaged parts
- Metal Stamping Facility
  - Jammed parts in the multi-stage automatic transfer presses must be manually cleared
  - Dies may break and require replacement and repair (very large multi-ton dies)
  - If a PLC or PC loses retentive memory, it must be reprogrammed

GM Systems in place for monitoring and managing power disruptions

- I-Grid Monitoring and Notification System
- Root Cause Database:
  - Identify and document irreversible corrective actions to prevent recurrence
  - Identify trends
  - Drive down the number of occurrences
- Utility Interface Meetings:
  - Review disruptions
  - Share Best Practices