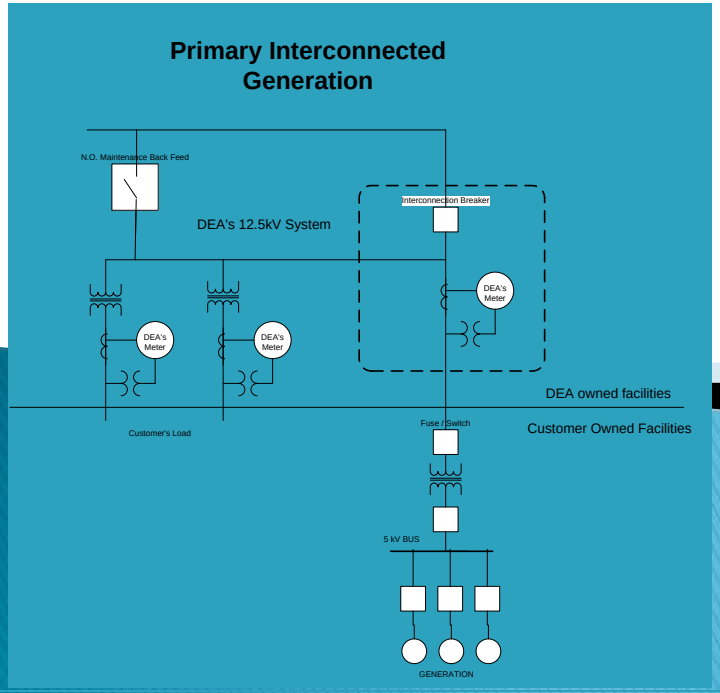
Dakota Electric Association

Campus Microgrid Systems for Demand Response, Reliability & Emergencies



Smart Grid Workshop

September 27th, 2013

Doug Larson & Craig Turner

Campus Generation

- We don't call this a microgrid
  - Term we use is Campus Generation
- # of Campus Generation Sites = 7
- Range in capacity from 1.2 MW – 14 MW
- Used for:
  - Load Management
  - Reliability (proactive during storms)
  - Emergencies (power outage)

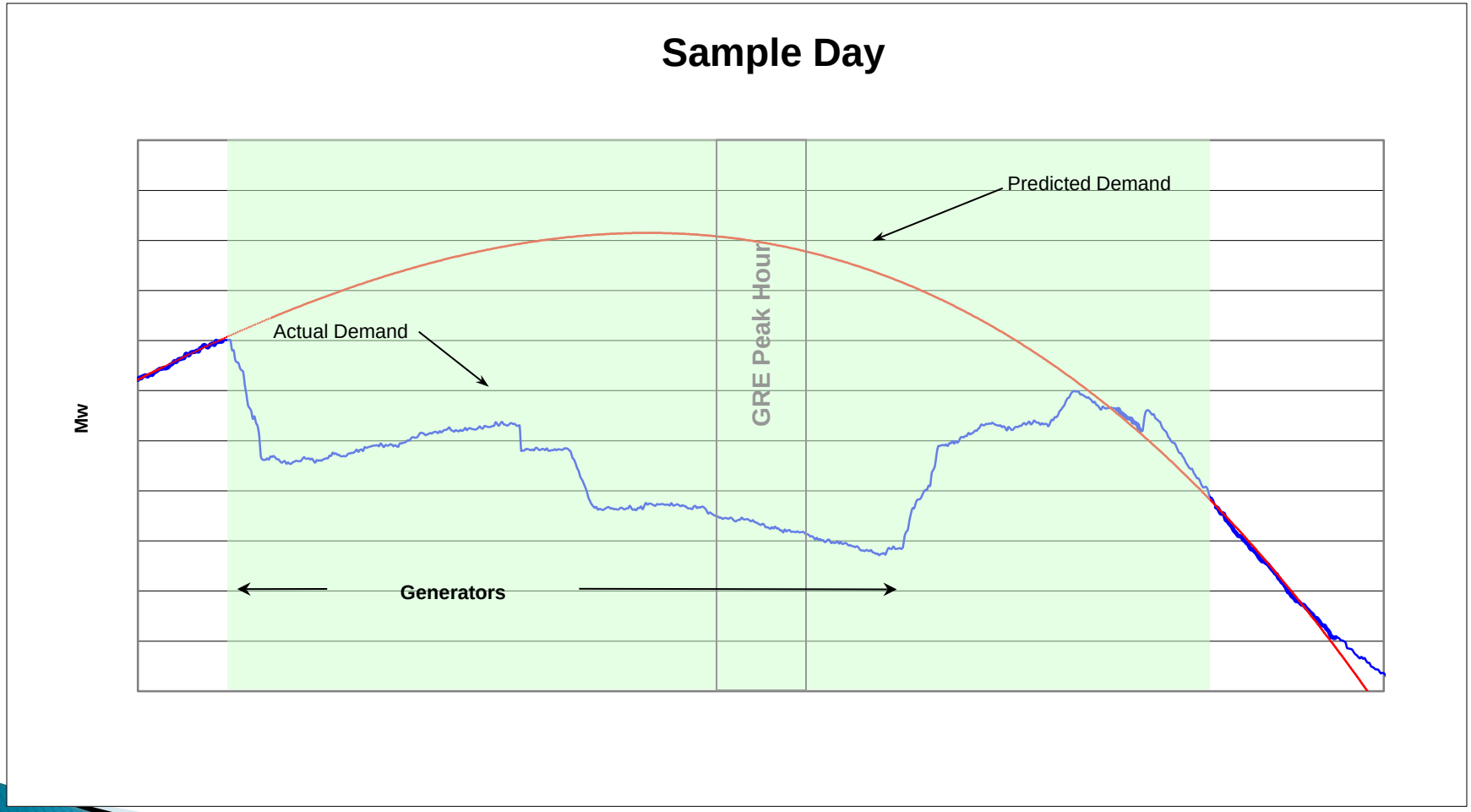
C&I Interruptible Service

- Cooperative Power (now Great River Energy)
  - Strong wholesale rate signal to reduce coincident system peaks
- C&I Interruptible Service (Schedule 70/71) established in late 1980s to provide a load control alternative for larger commercial accounts
- May control load through:
  - On-site generation
  - Curtailment

Schedule 70/71 Rate Design

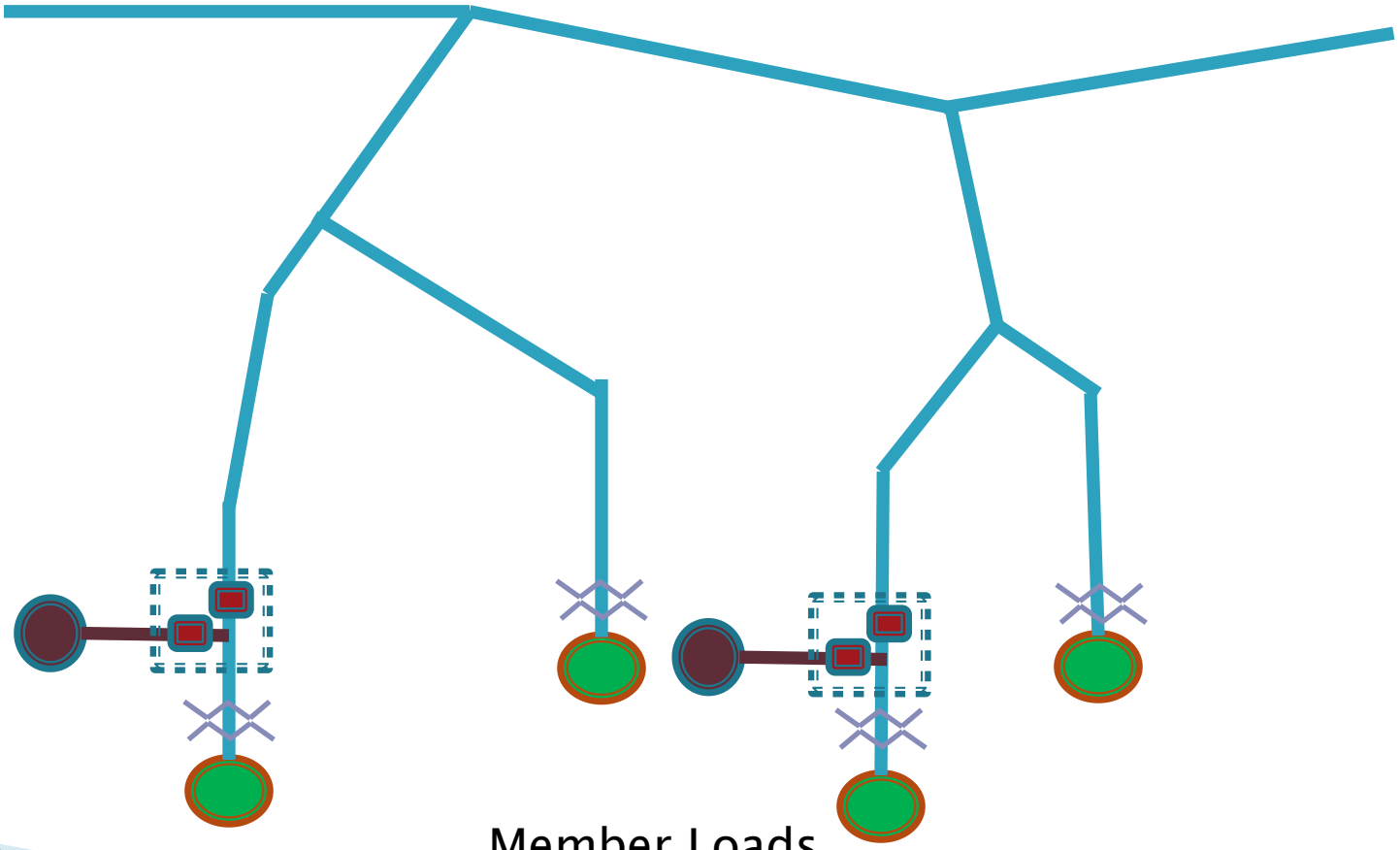
- Monthly Fixed Charge
- Energy Charge
- Noncoincident Demand
- Coincident Demand
  - Summer
  - Winter
  - Spring/Fall
- Failure to Control Charge

Dakota Electric Demand



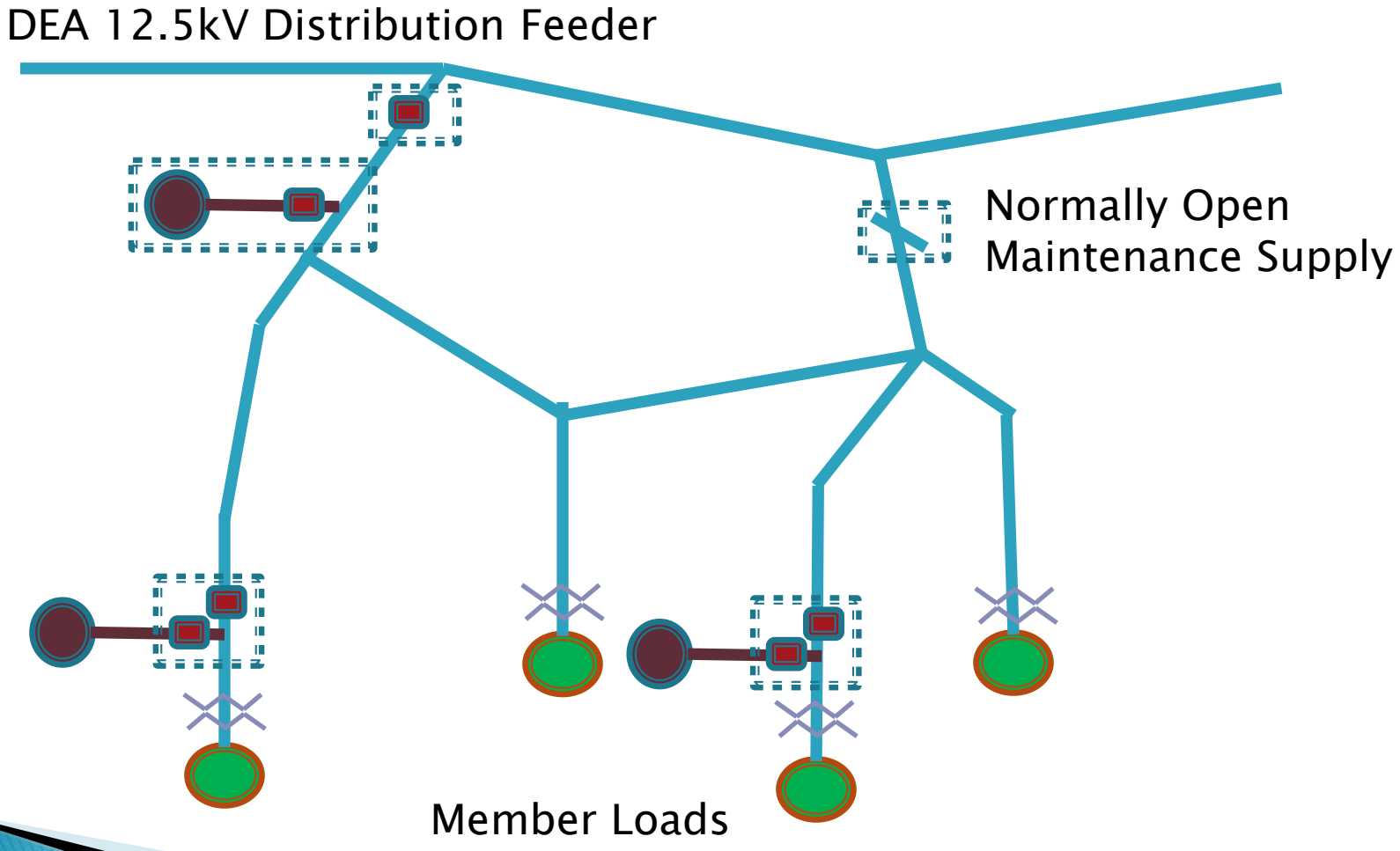
History of DEA Campus Generation

DEA 12.5kV Distribution Feeder



Member Loads

History of DEA Campus Generation



Member Benefits of Campus Generation vs. Individual Units

- Less Equipment required
  - Transfer switches & Generators etc.
- Less Maintenance cost for the member
- Smaller total generation capacity required
  - Can “share” spare generation capacity between services vs. extra spare capacity at each service
- Lower overall installation and operating costs

DEA System Benefits

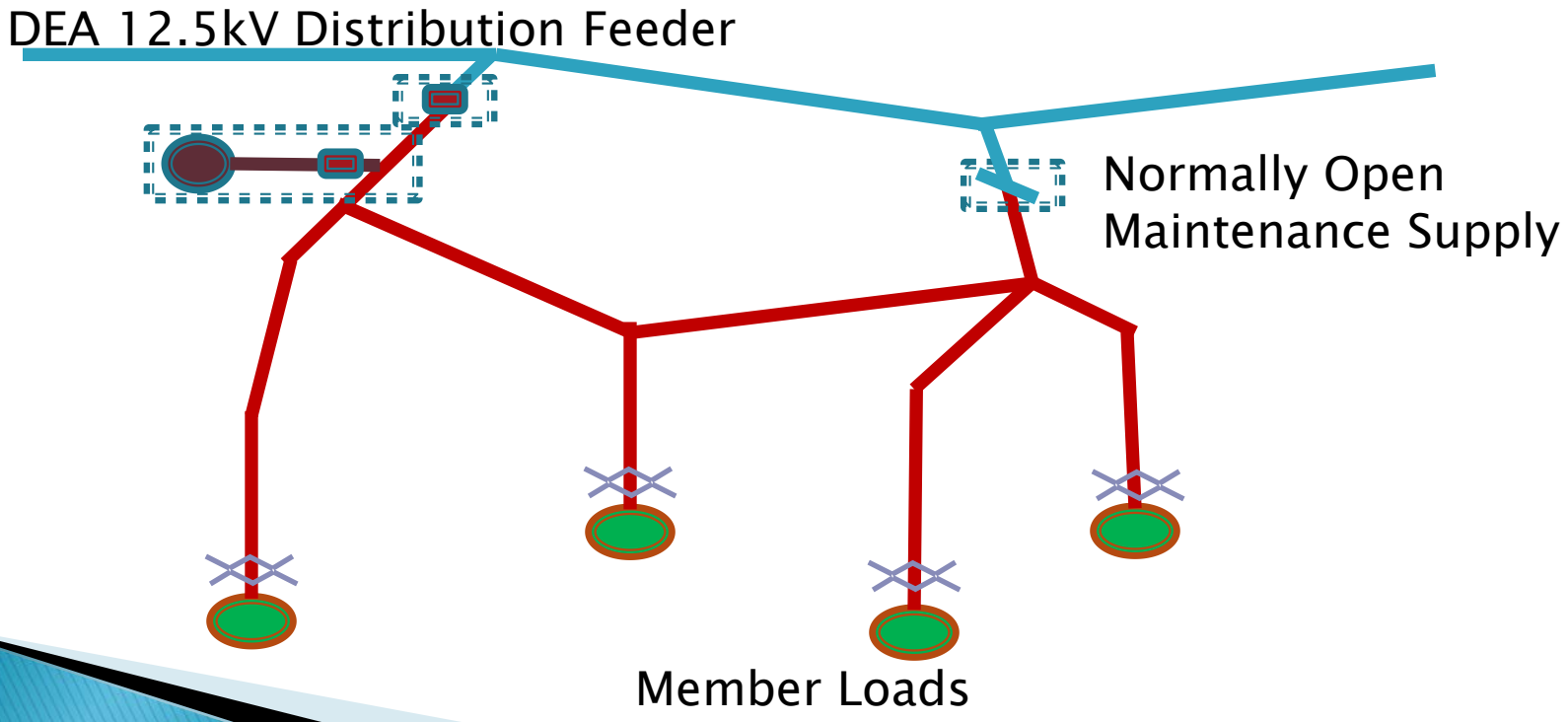
- Reduced Demand
  - Most of the savings are from reduced wholesale power bills
  - Possibly some savings for Dakota Electric from reduced distribution system capacity
    - Very small distribution cost savings
      - Need to have distribution system available to carry load in the event of member generation system failure or member leaving program
    - Savings are in freeing up substation capacity for emergency contingency response
      - Through use of the member's generation to off load substation to allow it to pick up neighboring loads
      - Only works for minimal length of time (few hours max, fuel costs add up)
  - Happy Member

Campus Generation Requirements

- Must be able to load follow
- Support inrush requirements for motor starting
- Frequency and Voltage control
- Softly load and unload from distribution system
- Ability to block load during outages

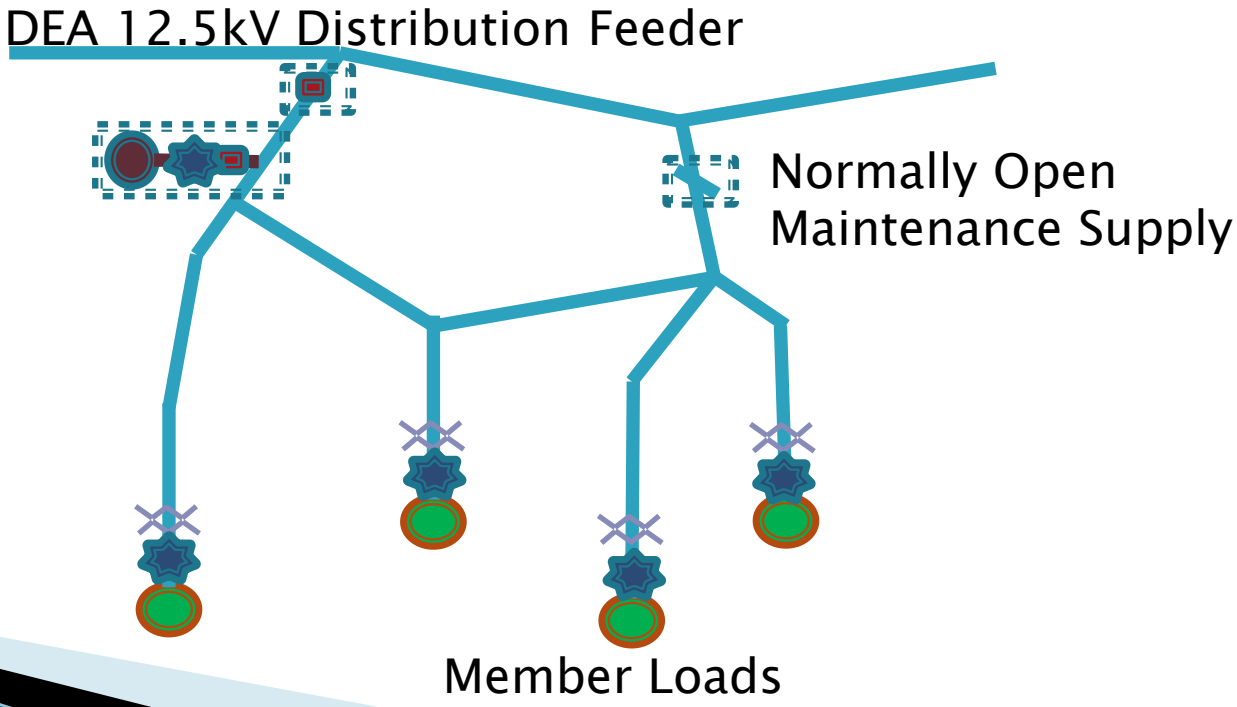
Campus Generation Design

- DEA still owns and operates the area downstream of the campus generation (stocks replacement wire, switches and transformers!)

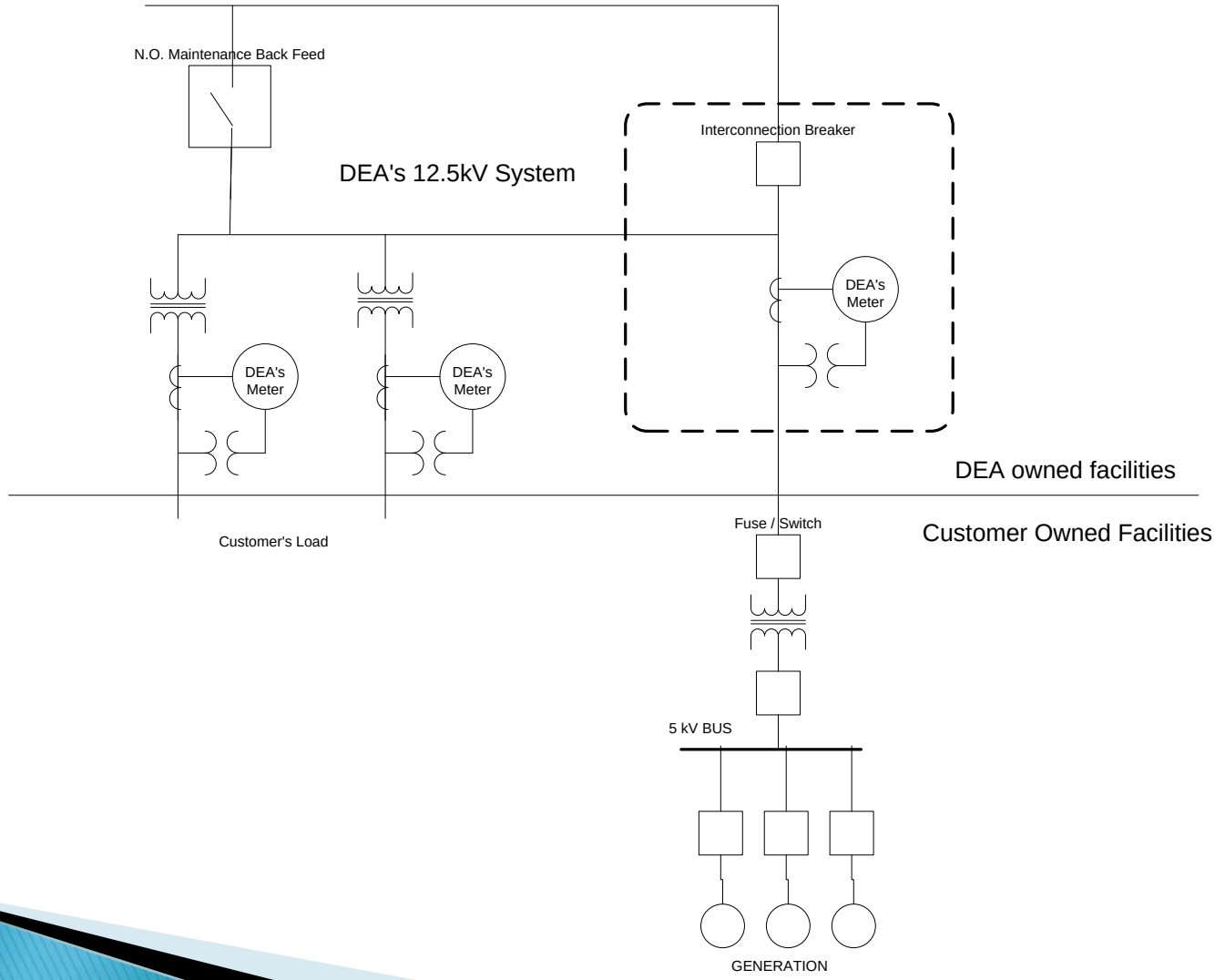


Design Issues – Metering

- All loads are metered at the normal service
- The generation output is metered
- The generation output is credited to member's loads



Primary Interconnected Generation



Design Issues – SAFETY!

- Campus Generation is unique for our field crews
  - Not something they see everyday
- Crews are working down stream of a member owned generation system
- Requires full DEA access to generation system/control
- Requires full review of system design
- Requires installation of DEA interconnection switchgear (We call this a fish house.)

DEA Interconnection Switchgear

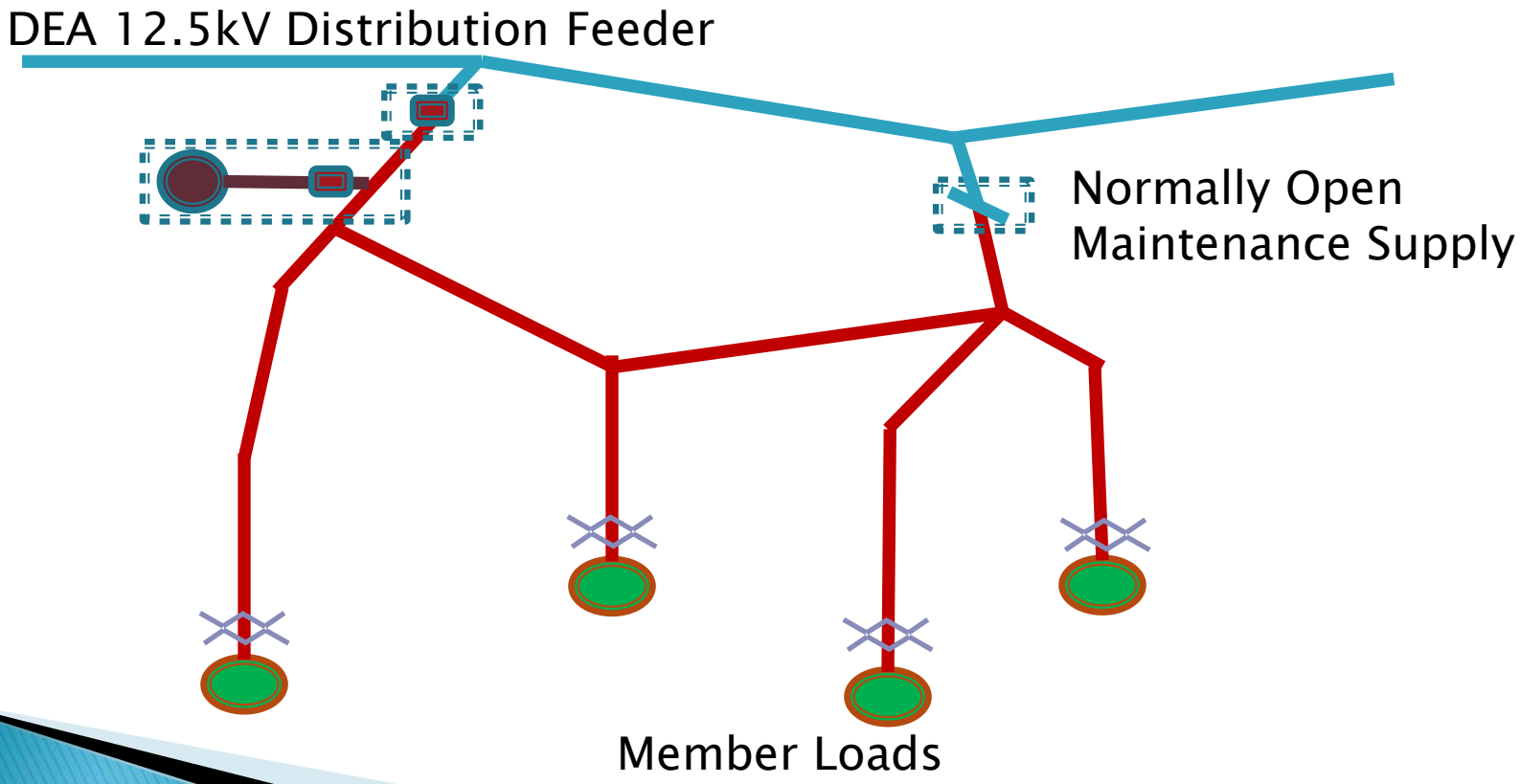
- Standard switchgear provides our crews with a standard look and feel at all campus generators
- Reduces training and improves safety

DEA Interconnection Switchgear

- Standardized Gear
  - Allows for spare equipment
  - Standard procedures
  - Improved maintenance
  - Reduced cost
  - Improved reliability of equipment

Campus Generation – Design Issues

Campus system is “out of sync” with rest of distribution system (while campus generation is running)



Warning sign used at Opens

Summary

- Members save money with Campus generation (reduced demand charges)
- Dakota Electric operations acquires some operating flexibility with firm power of member generation system
  - Coincident demand charges for non operation of generation system when required assures generation is available when needed