Transformer Loading
Driving Enterprise Decisions with ArcGIS Online
Agenda

- Introductions
- Business Drivers
- Business Challenges
- Solution Overview
  - Establish Relationships
  - Data Aggregation
  - Reporting & Visualization
- Demo
- Business Benefits
Introductions

Nathaniel Everett | Middle Tennessee EMC
• GIS Technical Lead
• Covers ArcGIS / ArcFM / Designer
• Information Services Department

Skye Perry | SSP Innovations
• Principal Consultant
• Esri & Schneider Electric Technical Architect
• Utility-Focused ArcGIS Online Specialty Partner
• Began work with MTEMC in 2013
Business Drivers

Transformer Failures Occur Regularly

- Troubleshooter assesses transformer in the field
- Transformers are replaced
- Often up-sized to handle an overloaded scenario (25 kVA to 37.5 kVA)
- Data is not available to see consumption/loading information

Result:
- Inefficiencies in Network
- Cost Impact
Business Drivers

Engineering Asked For Help

- Desire to utilize consumption data to determine transformer sizing
- Provided an Example Report that would help
- Provided all Engineering Calculations
Business Challenges

- No DB relationship between Service Location & Transformer
  - Network Traceable Relationship in GIS
- SAP CIS Consumption Data Not Available in GIS
  - Current Monthly Reads, Use with AMI in the Future
- How Best to Expose Reports & Map to users
Engaged with SSP Innovations to Design and Develop

- SSP is the in house Esri / Schneider Electric support vendor

SSP & MTEMC Broke the Effort into Three Phases:
1. Establish Maintainable Relationships from Xfr to Service
2. CIS Consumption Load & Aggregation
3. Reporting & Visualization
Phase 1 - Xfr to Service

- Schema changes on Service Point
  - Track Xfr Company Number by Phase
- Initial script to establish relationships
  - Trace via Electric Network
  - SQL Script to Not Impact Versioning Performance
- AutoUpdaters to maintain relationship
Phase 1 - Byproduct

Data QAQC of Energized Phases & Connectivity

- **NoXfrFnd** – Indicates that no energized power is being fed from a valid transformer bank
- **MultSrcXfr** – Indicates that multiple transformer banks were found upstream of the service point
Phase 2 - CIS Data Usage

Chose **SSP Nightly Batch Suite** for Fast Batch Apps

-Series of three integration applications
  1. Load the raw CIS consumption data into GIS
     - Applied Engineering Calculations
  2. Aggregate max consumption to Transformer Unit (by phase)
     - By Month & Season
  3. Create Summary Feature Points for Each Xfr Asset
Phase 2 - CIS Aggregation

Run on weekends to exclude production impact
Phase 2 - CIS Aggregation

Single Phase Aggregation
# Phase 2 - CIS Aggregation

## Three Phase Aggregation

<table>
<thead>
<tr>
<th>OBJECTID</th>
<th>DeviceLocation</th>
<th>AccountNumber</th>
<th>MeterReadDate</th>
<th>KW</th>
<th>KVA</th>
<th>Active</th>
<th>KVA_Rating</th>
<th>PowerFactor</th>
<th>Season</th>
<th>Year</th>
<th>GISLoadDate</th>
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<td>7/1/2013</td>
<td>10200</td>
<td>86.4 / 3 (Loaded Divider) = 28.8</td>
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\[ \text{KVA} = \frac{\text{KWH} \times \text{KVA Rating}}{\text{Power Factor}} \]

- Transformer
  - Load Info
    - Light Billing Info
    - MTEMC_GIS.GISADMIN.Transformer.CoNumberKvaText
  - Oil Structure
  - Substation
  - Transformer Unit

- Transformer Unit
  - 50 KVA/OH
  - SAP Load Data
    - 57017 - 2013:Summer, 57.6%
    - 57016 - 2013:Summer, 57.6%
  - Transformer Unit
    - 57017 - 2013:Winter, 52.53%
    - 57016 - 2013:Winter, 52.53%

- Transformer Load Data
  - 57017 - 2013:Summer, 57.6%
  - 57016 - 2013:Summer, 57.6%
Phase 3 - Reporting

Utilized SQL Server Reporting Services

- Out of the Box Web Reports
- Provided Query Screen to Engineers:
## Phase 3 - Reporting

Three Level Report - **Level 1 Shows Transformer Unit**

### Transformer Loading Report

<table>
<thead>
<tr>
<th>Company #</th>
<th>Transformer Size</th>
<th>Total Usage (Kwh)</th>
<th>Total Usage (KW)</th>
<th>Total Usage (KVA)</th>
<th>Power Factor</th>
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</table>
Phase 3 - Reporting

Three Level Report -
Level 2 Shows Adjusted Meter Consumption
Phase 3 - Reporting

Three Level Report -
Level 3 Shows Raw Meter Data from SAP
Phase 3 – Visualization

Utilized ArcGIS Online –
Created Thematic Map Showing Xfr Load vs. Capacity
Phase 3 - Visualization

- Exposed via **ArcGIS Online** as a WebMap
- Troubleshooter uses their phone or tablet when they arrive on scene
- Zoom via GPS in the device
- View transformer loading data by color
- Click any transformer to view details

Live Demo...
Transformer showing under-loaded scenario:
Phase 3 - Visualization

Transformer showing overloaded scenario:
**Business Benefits**

**Operations**

- Empowered Engineers & Troubleshooters with New Data
- Provided Real Time Data Access in field from **ANY Device**
  - Allows for educated decision making
- Engineering Can Review Existing Xfr Installs Against Usage
  - May reallocate network
- **Net Result is Cost Savings, Better Efficiency, & System Awareness**
Business Benefits

**IT/ GIS**

- Demonstrated capabilities of ArcGIS Online
  - Have fully functioning DMZ/ internal ArcGIS Server architecture
  - Ready for additional data publishing, editing, and collection via ArcGIS Online
  - Includes Active Directory Authentication and SSL (https)

- Will Allow for Other Patterns to be Implemented
  - Quickly & Easily
Questions?
Transformer Loading
Driving Enterprise Decisions with ArcGIS Online