Downtown Network Implementation at CPS Energy

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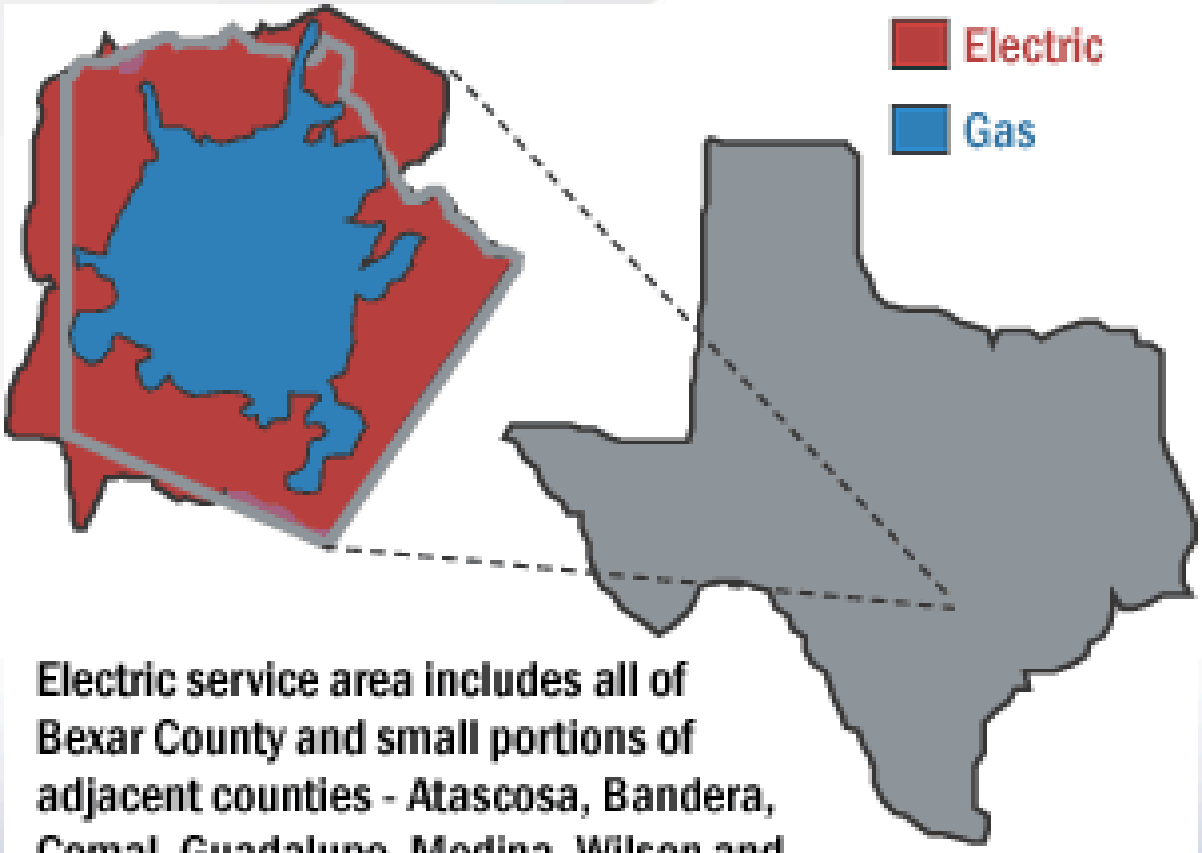
Company Profile

- Service area - 1,566 sq miles
- Electric customers - 750,000
- Natural gas customers - 330,000
- Regular employees - 3,100



Electric service area includes all of Bexar County and small portions of adjacent counties - Atascosa, Bandera, Comal, Guadalupe, Medina, Wilson and Kendall.

Electric, Gas, Fiber Statistics

- Underground Conductor
  - 4,900 miles UG Primary
  - 5,300 miles UG Secondary
  - 10,200 Miles of UG
- Overhead Conductor
  - 7,700 miles OH Primary
  - 5,700 miles OH Secondary
  - 13,400 Miles of OH
- Transmission Conductor
  - 1,500 Miles
- Conduit/Trench
  - 7,900 Miles
- Transformers
  - 220,000
- Support Structures
  - 430,000

- Gas Transmission
  - 90 Miles
- Gas Distribution
  - 5,300 Miles

- Fiber Optic Cable Miles
  - 650 Miles

CPS Energy GIS Environment

Current Environment

- Ü ArcGIS 10.2.1
  - Ü Several Extensions
- Ü ArcFM 10.2.1a
  - Ü Several Extensions
- Ü Windows Server 2012 R2
- Ü Citrix XenApp 7.6
- Ü Red Hat Linux 6
- Ü Oracle 11g

Agenda

1. CPS Energy's Downtown Network
2. Modeling a Downtown Network
3. Exporting to Network Manager DMS for Outage Management
4. Exporting to CYMDIST
5. Project Steps

What is a Downtown Network?

Exclusively underground

- in a complex vault–duct-conduit network

Looped network

- Not radial!
- a.k.a. Secondary Mesh Grid
- Network protector devices to protect expensive transformers

Redundancy is key!

- Each load point is served by multiple, large transformers

"Spot networks" throughout the area serving individual, large customers

Not technically a separate network...subsection of distribution

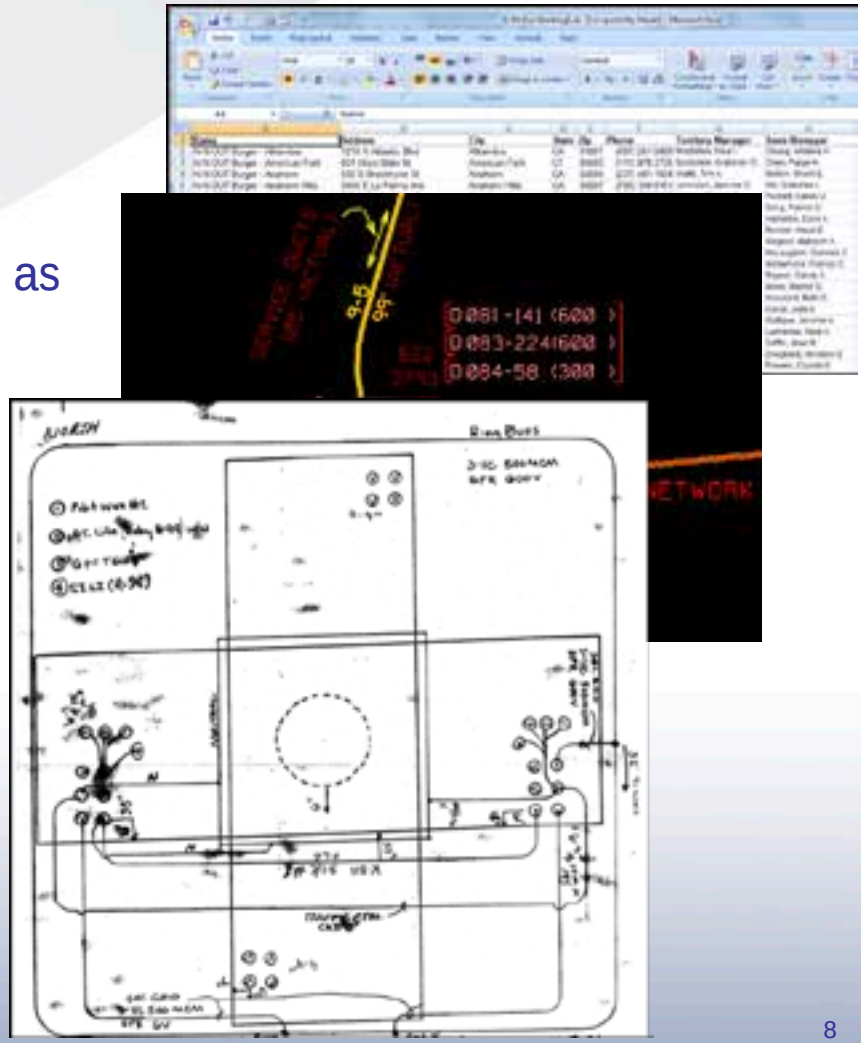
Downtown Network Statistics

- Ü 9 Downtown Networks fed by 4 substations
- Ü Each network is independent of the others
- Ü Underground Conductor - 85 miles
- Ü Network Manholes - 550
- Ü Network Vaults - 180
- Ü Network Transformers - 500
- Ü Network Services – 870

CPS Energy's Downtown Network

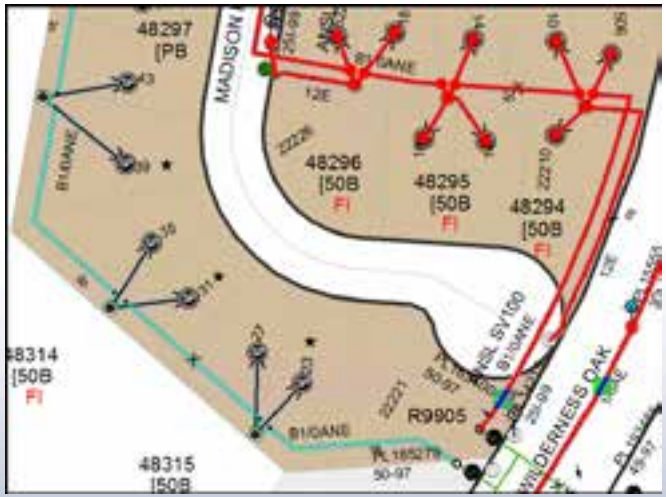
Existing processes and inefficiencies:

- Ü Determining load could take weeks
- Ü A combination of sources are used such as SAP, spreadsheets, Microstation, index cards, and in some cases hand written notes to accomplish day-to-day tasks
- Ü Database not centralized



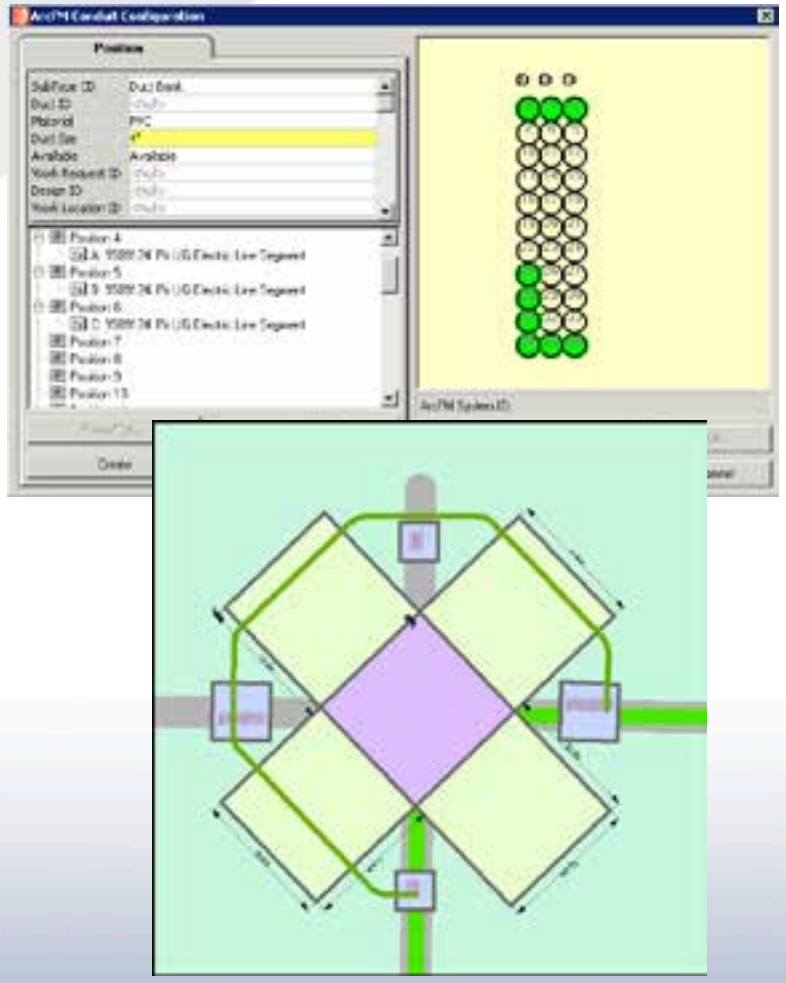
Benefits of ArcGIS - ArcFM for Downtown Network

- Ü Availability of connected features through a geometric network
- Ü Customer information is readily available in GIS
  - Ü Integration between GIS and SAP
- Ü Centralized Database
- Ü Availability of related maintenance records for installed devices in conjunction with mobile field users
- Ü Reporting capabilities



Benefits of ArcGIS - ArcFM for Downtown Network

- Ü Schneider Electric's Conduit Manager & UFM
  - Ü See duct banks that are occupied and available
  - Ü UFM especially useful for the downtown San Antonio area
  - Ü Butterfly diagrams for manholes and vaults
- Ü Tools can be developed like the Transformer Load Management Tool
- Ü Hyperlinked vault polygons and manholes with Microstation drawings



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Modeling a Downtown Network

Key requirements and decisions

- Ü Traceable from substation
- Ü Use ArcFM Feeder Manager for downtown conductor, if possible
- Ü Follow precedent of another utility's solution
- Ü Extend existing ArcFM Network Adapter interfaces
- Ü Minimize disruptive data model changes e.g. new electric network features

Modeling a Downtown Network
Key Decisions

1. No new feature classes

2. Subtypes added to existing features

- Transformer -> Network Transformer
- Dynamic Protective Device -> Network Protector
- Various other features were added to model such as Trifurcator, Fuse Pad, Ring Bus, Collector Bus, etc.

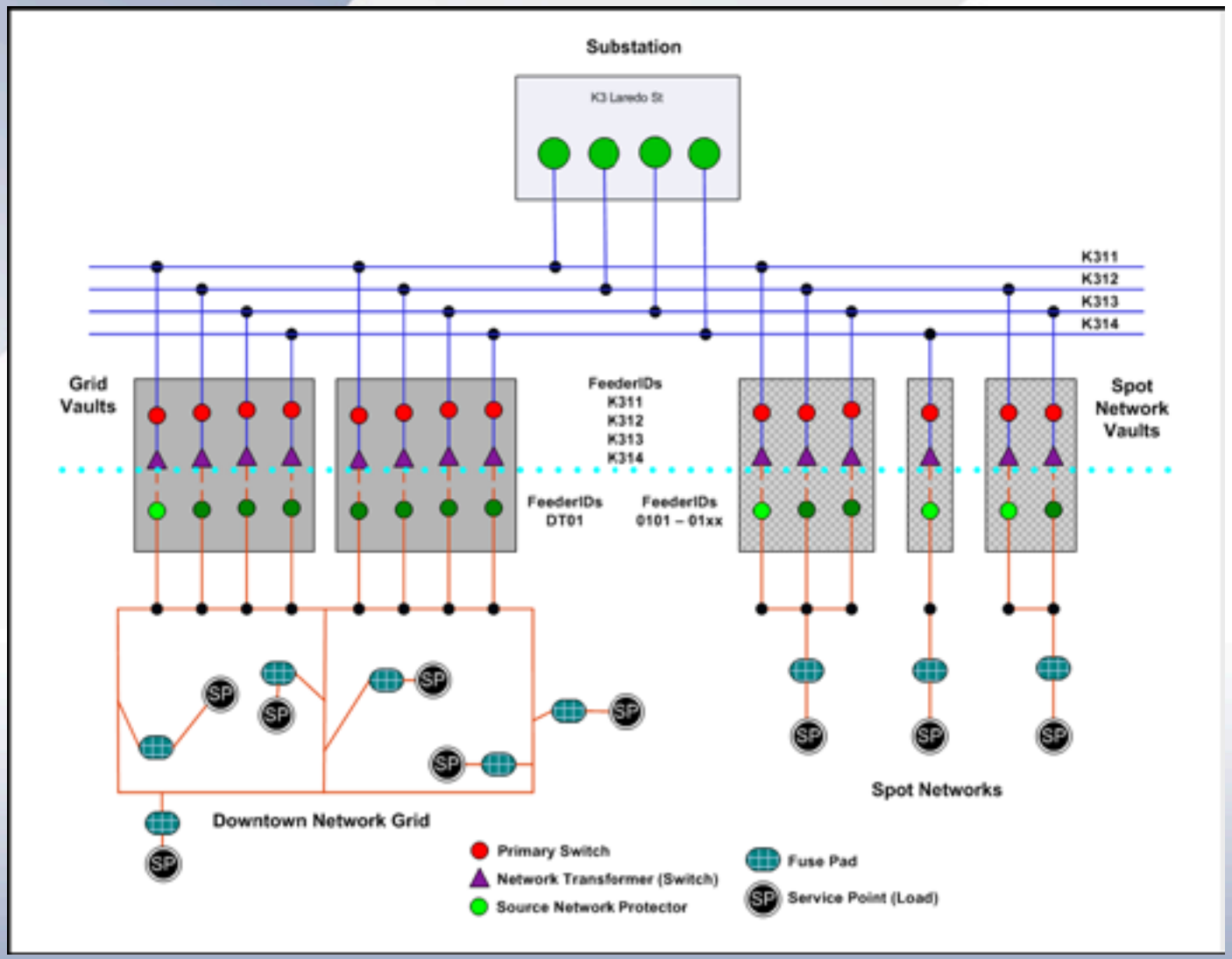
Modeling a Downtown Network
Key Decisions

3. Simulate Sub Circuit Breaker for Feeder Manager

- Network Transformer acts like a Switch
- Trace weight manipulation via AU
- Circuit Source relationship to the Network Protector

4. Relationship between Service Point and Network Transformer

- Unlike normal distribution, downtown load is served by *multiple* transformers (redundancy!)
- Devised an AU to find closest, connected *single* transformer


Substation
K3 Laredo St
K311
K312
K313
K314
Grid Vaults
FeederIDs
K311
K312
K313
K314
Spot Network Vaults
FeederIDs DT01
FeederIDs 0101 – 01xx
SP
Downtown Network Grid
Spot Networks
Primary Switch
Network Transformer (Switch)
Source Network Protector
Fuse Pad
Service Point (Load)

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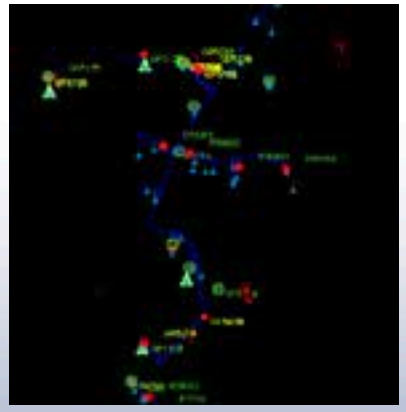
Current ArcGIS-to-OMS export

- Ü CPS Energy has been using ABB's Network Manager DMS (CADOPS) for many years
- Ü In progress: Upgrade to v7.2
  - Ü Modeling capabilities
- Ü Export from GIS on a weekly basis
  - Ü Partial post and As-Builts
- Ü Export 20 – 40 circuits a week based on number of edits
- Ü Custom ArcFM Network Adapter interface
  - Ü Working on updated Cadops Export Tool

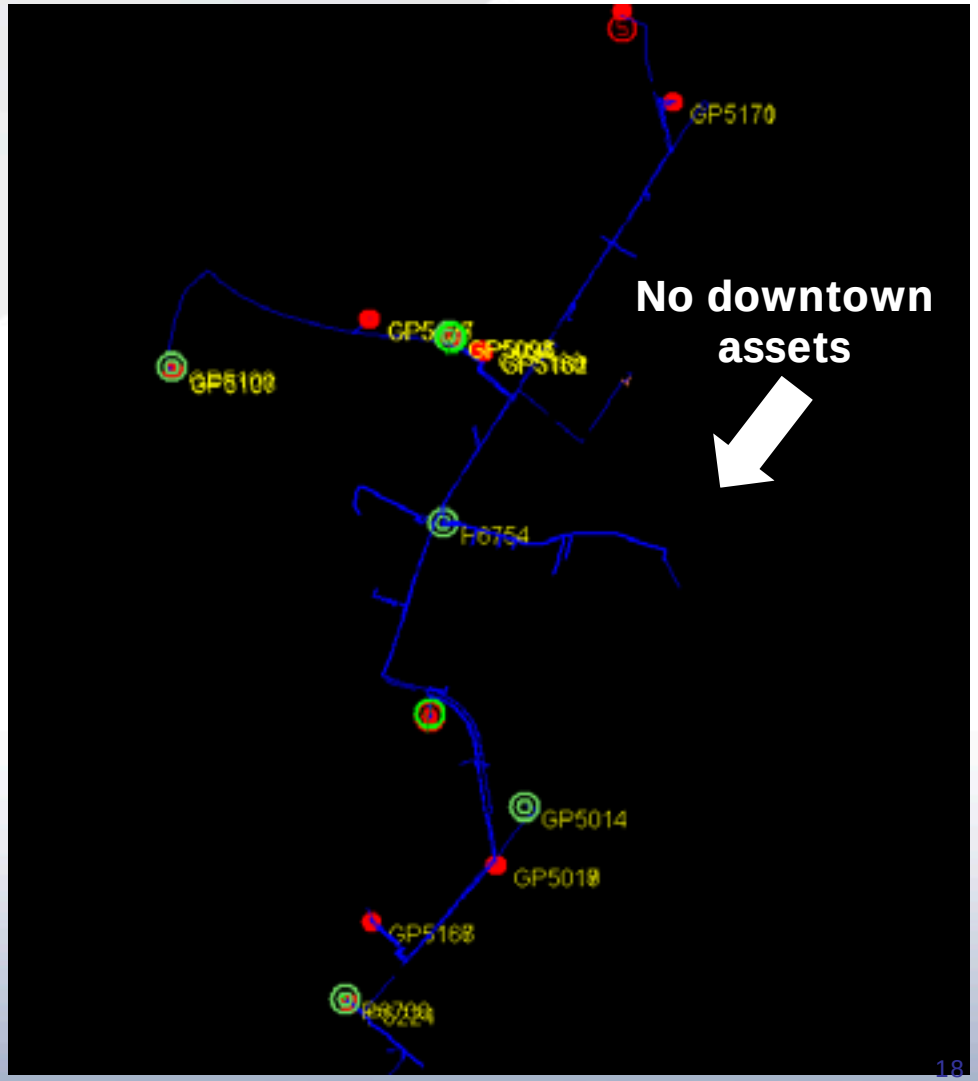


Business case: Manage downtown customers in OMS

Calls come in with problem in downtown area

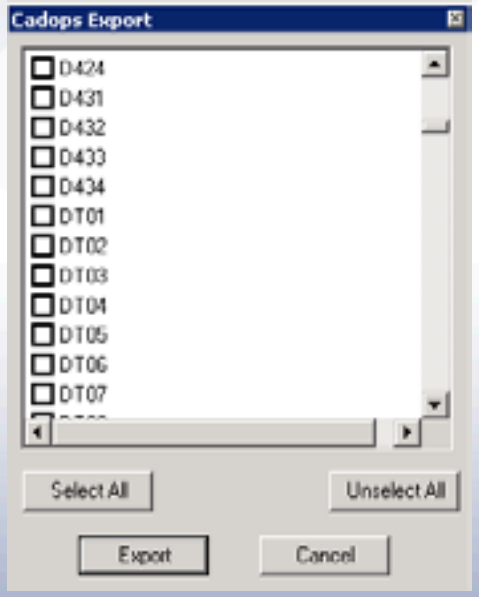
OMS operators need to see the customer locations and closest transformer

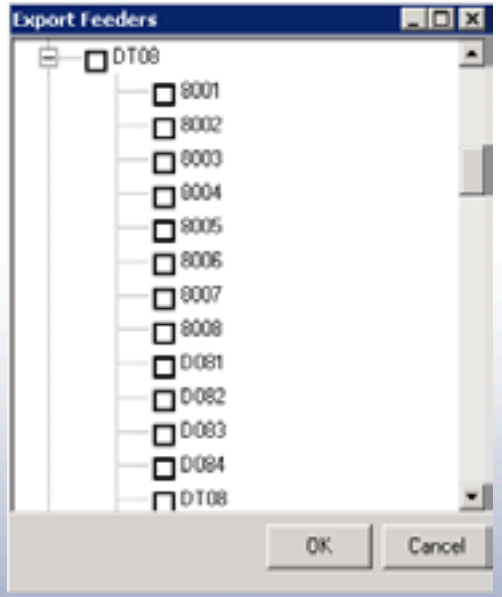
Need downtown network features represented in OMS to make that prediction



The OMS Export Solution

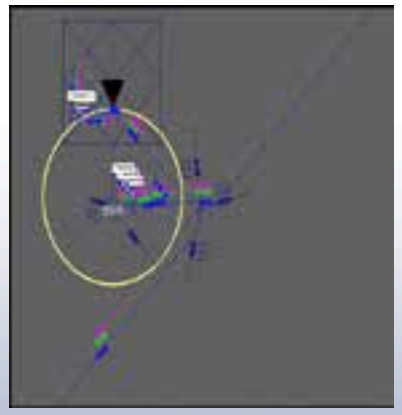
- Ü Extend export tool to include downtown “feeders” i.e. sections of 9 downtown networks
- Ü Customer information included in export especially vault location
- Ü Load for each service point included in export for future use in OMS v7.2





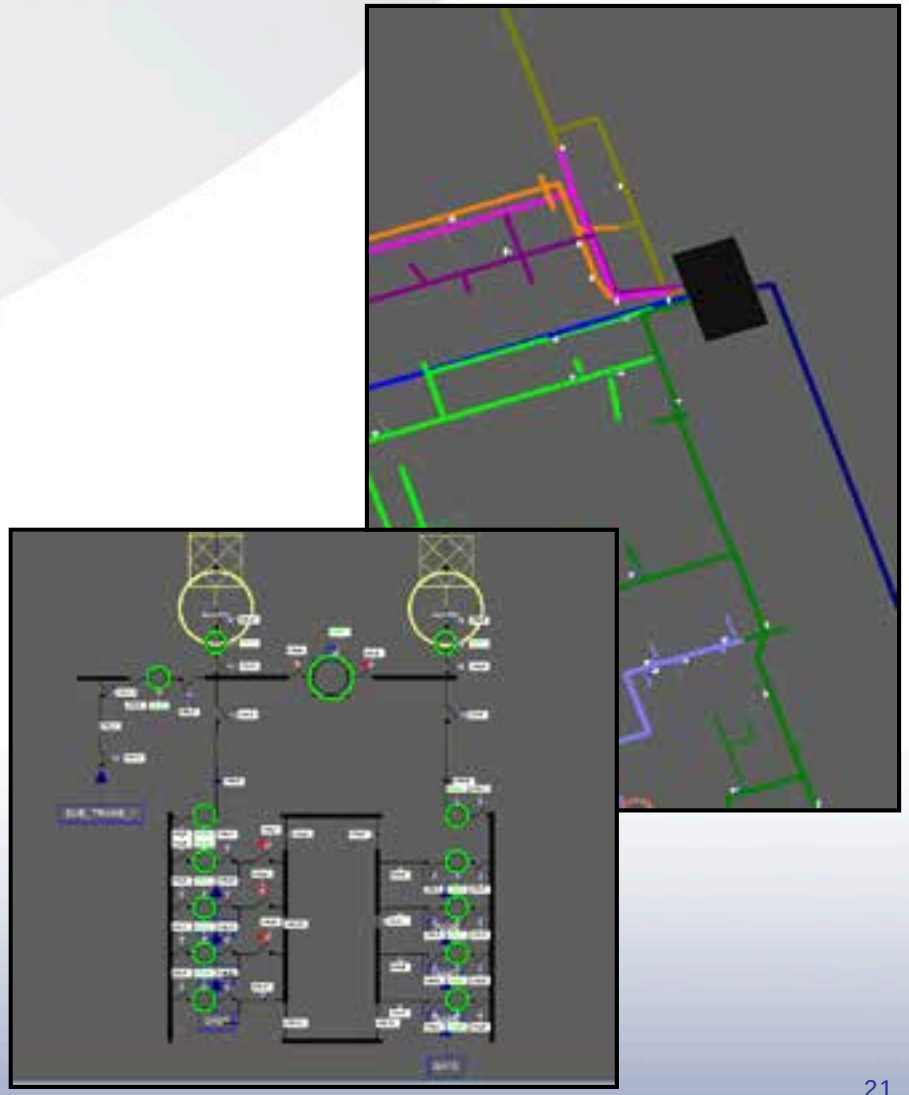
Current ArcGIS-to-CYMDIST export

- Ü CYMDIST Distribution Analysis software used for determining load and planning in growth areas
- Ü Distribution Planning group currently use CYMDIST
- Ü Export on a semi-annual basis and periodic intervals
- Ü Export all 700+ circuits



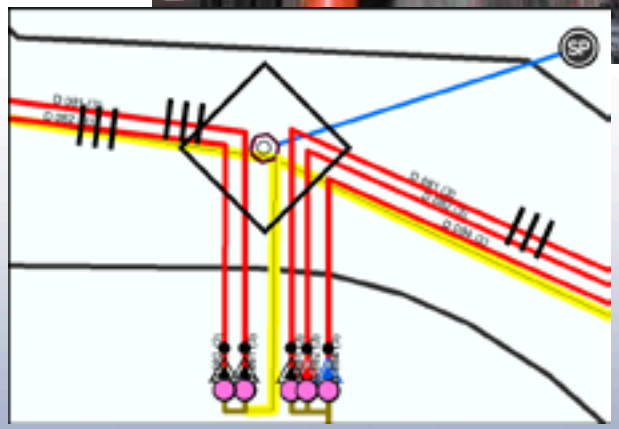
Business case:
How to analyze downtown core in CYMDIST?

- Ü **Accurate load analysis** using CYME's new Secondary Grid Network Analysis module
- Ü **Prevent and predict loading issues** e.g. "hot spots" and underutilized areas
- Ü **Perform analysis more quickly** than is possible with paper maps, spreadsheets and service cards



The CYMDIST Export Solution

- Ü New CYMDIST extension for Secondary Grid Network Analysis module
- Ü Load for each service point is included in export
- Ü Impedances are exported on service conductor
- Ü Network Transformer simulation for Feeder Manager removed on export.
- Ü Ring bus modeled and exported as line feature for maximum flexibility



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Next Steps: Complete the Project!

Design

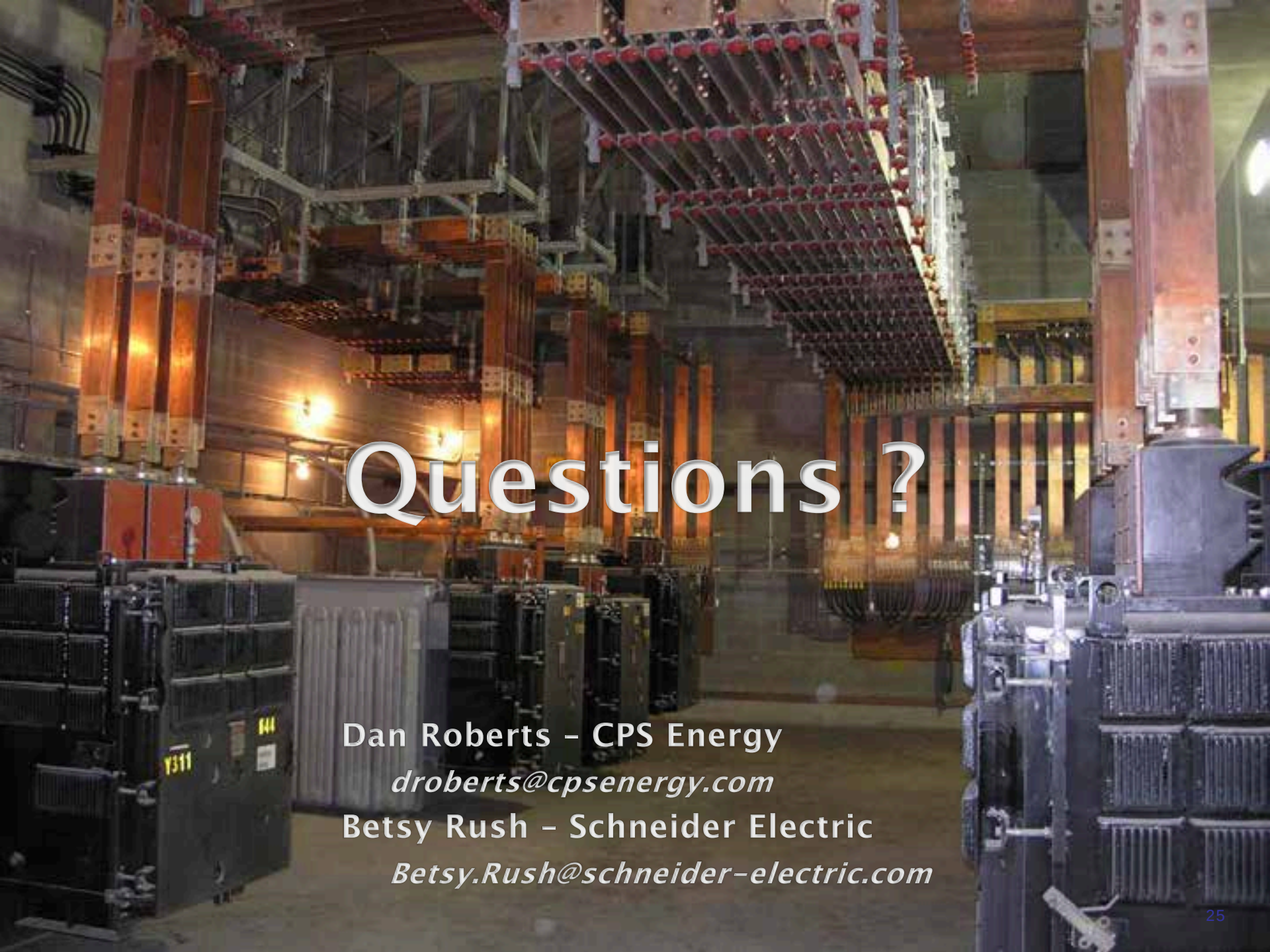
2 Months
- ü Project Kick-off
- ü Requirements gathering
- ü Component and model design

Develop

4 Months
- ü Component development
- ü Factory Acceptance Testing
- ü Pilot data conversion

Deploy

1 Month
- ü Site Acceptance testing
- ü Deployment



Questions ?

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