The Most Accurate Distribution System Model in North America

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QUANTA TECHNOLOGY

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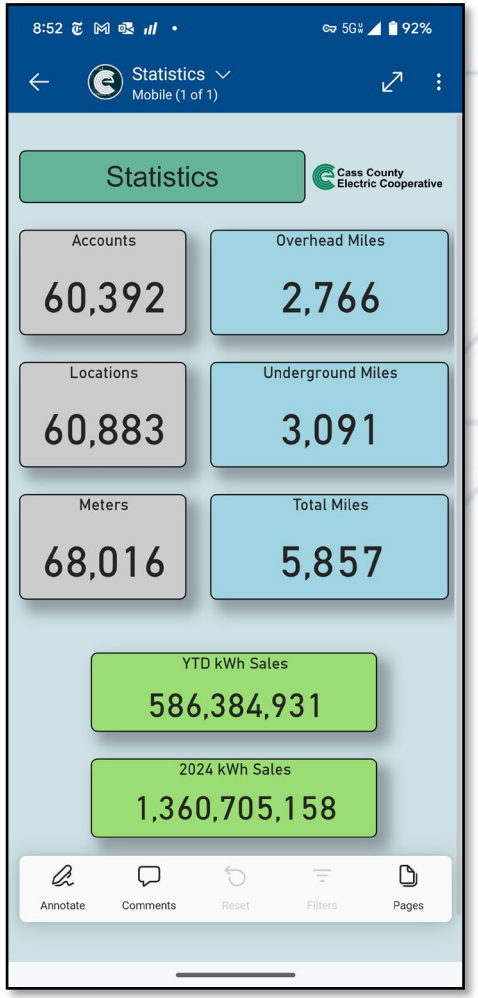
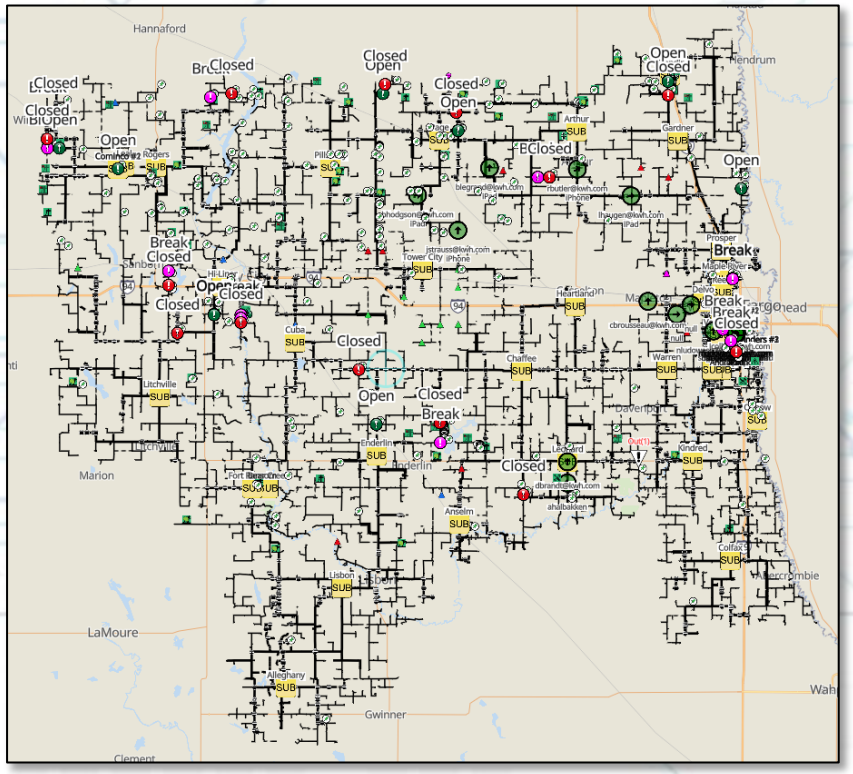
CCEC Statistics



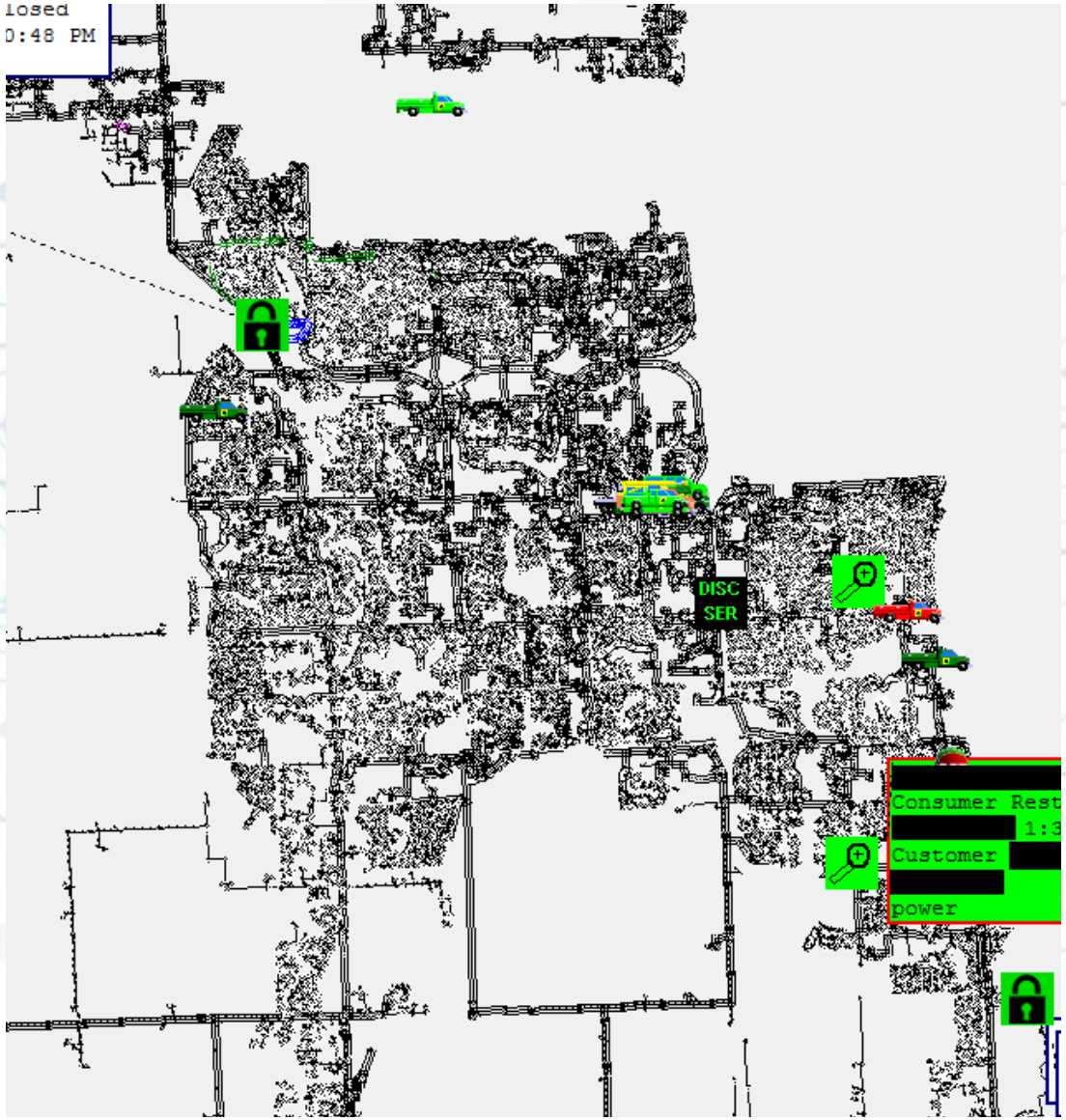
- Mixed 7,200/12,470 v and 13,800/24,000 v
- 42 Substations
  - 9 on 13.8kV
- 80% Urban
- 100% SCADA
  - 35 SCADA switches
  - 250 switches
  - 1 auto transfer switch
- 100% AMI TWACS PLC
  - Feeder detection urban subs



Growing Pains

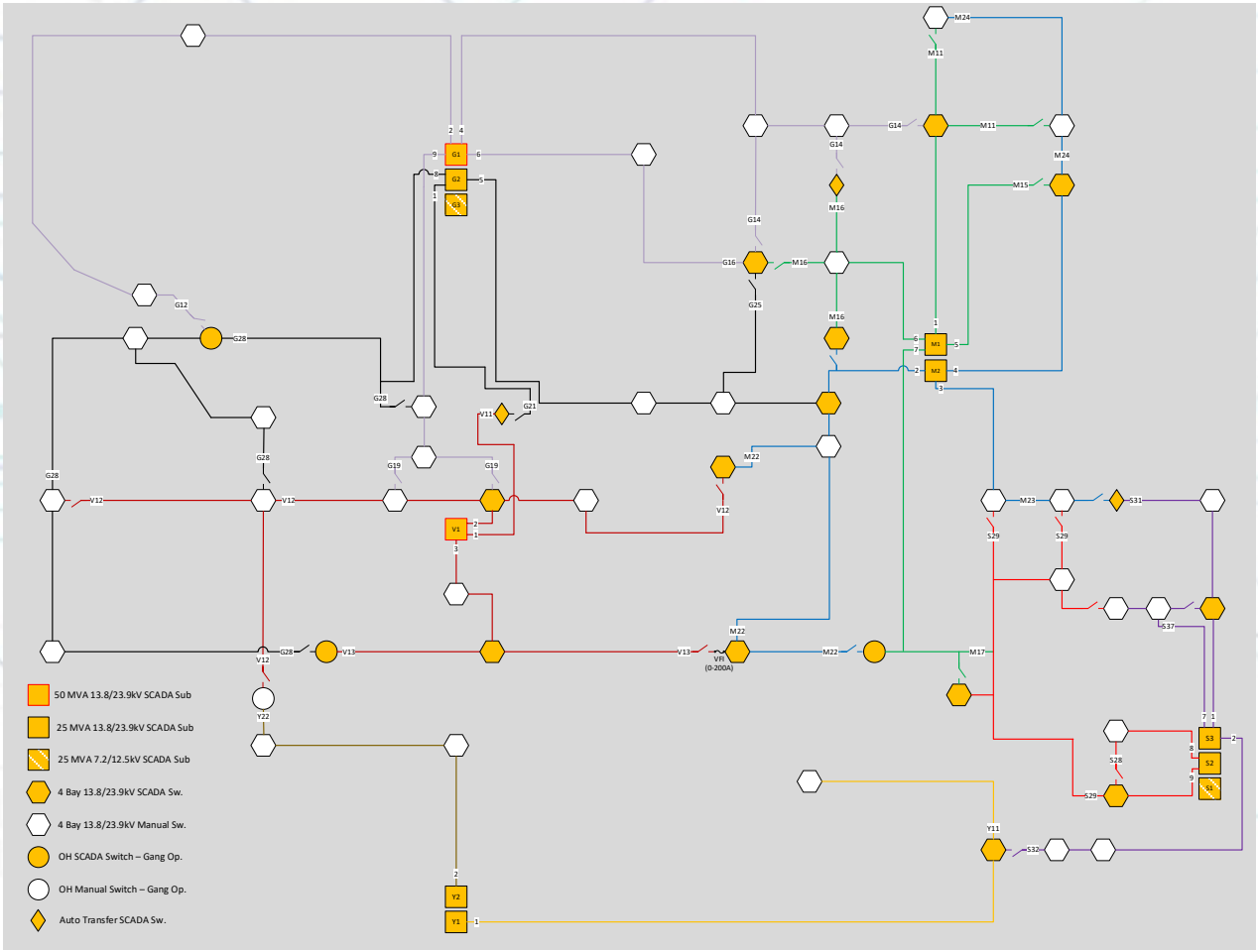
- 1,500- 2,000 new meters per year
- 1,800 Work Orders per year

- Very inaccurate GIS system spatially and electrically
- Ties between newly tied subs didn’t phase because of bad tagging
- OMS model only updated yearly
- Stacks of GIS work orders not posted to the model
- Thousands of missed reads on TWACS meters

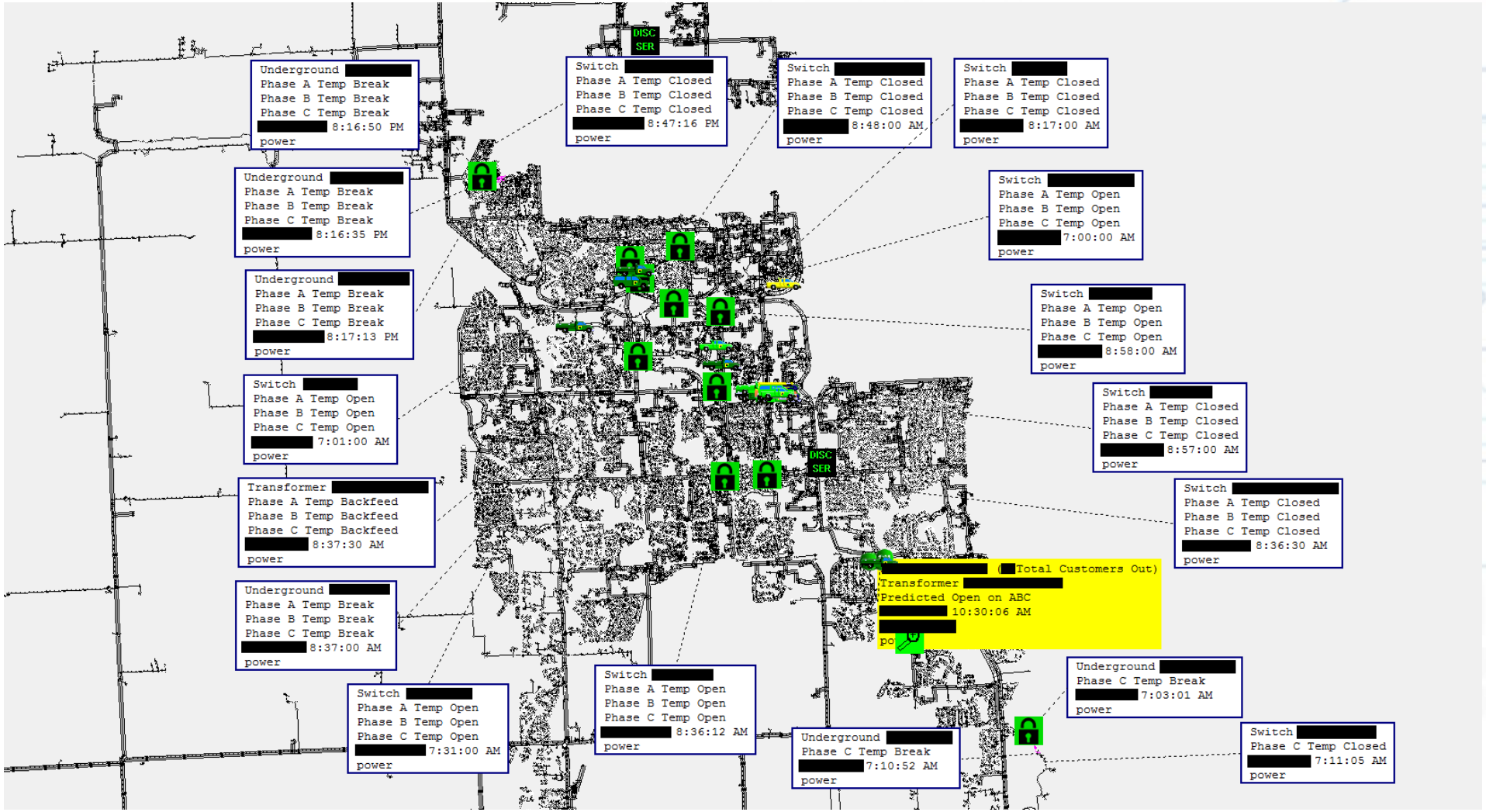


High Level One Line

- Looped system
- 49,000 Meters
- 24 Feeders
- 250 Pad Mount Switches
- Tens of Thousands of Transformers
- Tens of Thousands of medium voltage junctures
- Fractional % provisions for instrumentation



Monday Morning



Distribution Switching Example & Quantity

Engineering and Operations

Date:

To: Power Control, Linecrew

From:

Re: Switching to isolate cable to cut in junction box and change feeds to lift station. Outage is scheduled from 9-11 a.m. on .

1. Power Control get permission to tie S #2 and #3
2. Power Control set regulators on S #2 and #3
3. Set VFI going south/west in switch A to 200A
4. Close tie in transformer B
5. Open going north in transformer C
6. Pull and park A, B, C phase elbows going south in switch A
7. After new junction box is cut in and ready to move east feed out of transformer C, move on to step 8, there will be an outage for Z meters.
8. Open B phase going north out of transformer B
9. Open A phase going east out of transformer D
10. Open C phase going east out of transformer E
11. Pull and Park A, B, C phase elbows going east and west on feed thru insert on transformer C
12. Remove feed thru insert in transformer C
13. Plug back on cables feeding west in transformer C

Note: Power control check for any hold tags in area.

Back to normal:

1. Make sure VFI going south/west in switch A is set to 200A
2. Power Control get permission to tie S #2 and #3
3. Power Control set regulators on S #2 and #3
4. Plug on A, B, C phase elbows going south in switch A
5. Close B phase going north in transformer B
6. Close A phase going east in transformer D
7. Close C phase going east in transformer E
8. Close in going north at transformer C
9. Open back at normal open going north in transformer B

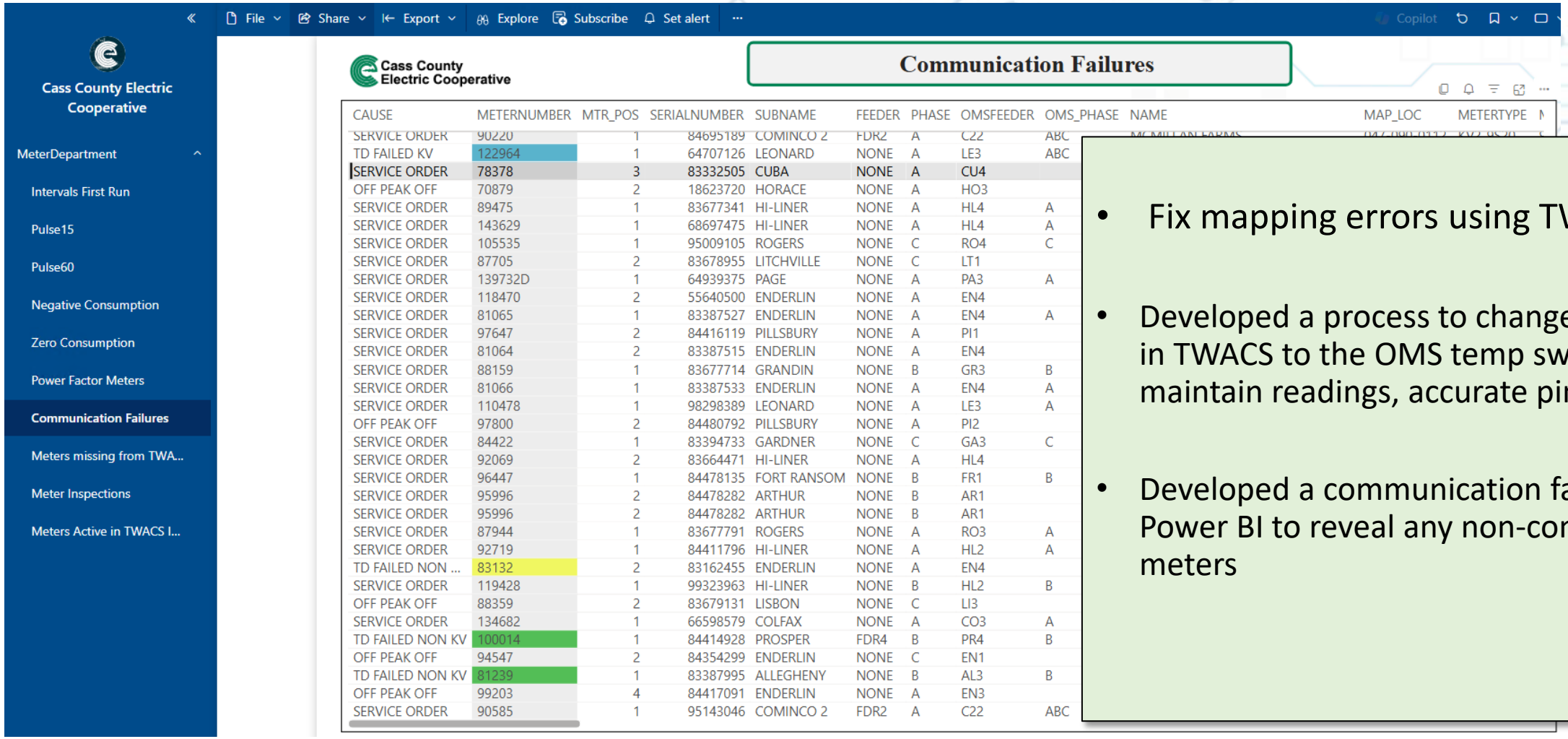
Day of Week	Day Offset	Quantity of Meters Impacted
Monday	DAY	7916
Sunday	DAY -1	0
Saturday	DAY -2	0
Friday	DAY -3	1122
Thursday	DAY -4	2
Wednesday	DAY -5	3850
Tuesday	DAY -6	9115
Monday	DAY -7	0
Sunday	DAY -8	0
Saturday	DAY -9	0
Friday	DAY -10	0
Thursday	DAY -11	0
Wednesday	DAY -12	0
Tuesday	DAY -13	1
Monday	DAY -14	4
Sunday	DAY -15	0
Saturday	DAY -16	0
Friday	DAY -17	4
Thursday	DAY -18	582
Wednesday	DAY -19	0
Tuesday	DAY -20	1
Monday	DAY -21	592
Sunday	DAY -22	0
Saturday	DAY -23	0
Friday	DAY -24	0
Thursday	DAY -25	0
Wednesday	DAY -26	0
Tuesday	DAY -27	0
Monday	DAY -28	367
Sunday	DAY -29	0
Saturday	DAY -30	0
Friday	DAY -31	182

How do we fix it?

- Moved the plant to GPS Accurate Aerial photography
- Line Crews, Pole Testers collected plant data
- Used Phase ID tool to accurately phase the TWACs installations
- Retaped the phasing in the field
- Created an Oracle/SQL procedure to compare TWACS and GIS/OMS sub feeder phase to correct the GIS/OMS.
- Implemented electronic staking and a policy of posting work orders to GIS as soon as they are energized.
- Milsoft's circuit diagnostic tool to fix any incorrect circuit element definitions

How do we maintain it?

What about temp switching?



CAUSE	METERNUMBER	MTR_POS	SERIALNUMBER	SUBNAME	FEEDER	PHASE	OMSFEEDER	OMS_PHASE	NAME	MAP_LOC	METERTYPE
SERVICE ORDER	90220	1	84695189	COMINCO 2	FDR2	A	C22	ABC			
TD FAILED KV	122964	1	64707126	LEONARD	NONE	A	LE3	ABC			
SERVICE ORDER	78378	3	83332505	CUBA	NONE	A	CU4				
OFF PEAK OFF	70879	2	18623720	HORACE	NONE	A	HO3				
SERVICE ORDER	89475	1	83677341	HI-LINER	NONE	A	HL4	A			
SERVICE ORDER	143629	1	68697475	HI-LINER	NONE	A	HL4	A			
SERVICE ORDER	105535	1	95009105	ROGERS	NONE	C	RO4	C			
SERVICE ORDER	87705	2	83678955	LITCHVILLE	NONE	C	LT1				
SERVICE ORDER	139732D	1	64939375	PAGE	NONE	A	PA3	A			
SERVICE ORDER	118470	2	55640500	ENDERLIN	NONE	A	EN4				
SERVICE ORDER	81065	1	83387527	ENDERLIN	NONE	A	EN4	A			
SERVICE ORDER	97647	2	84416119	PILLSBURY	NONE	A	PI1				
SERVICE ORDER	81064	2	83387515	ENDERLIN	NONE	A	EN4				
SERVICE ORDER	88159	1	83677714	GRANDIN	NONE	B	GR3	B			
SERVICE ORDER	81066	1	83387533	ENDERLIN	NONE	A	EN4	A			
SERVICE ORDER	110478	1	98298389	LEONARD	NONE	A	LE3	A			
OFF PEAK OFF	97800	2	84480792	PILLSBURY	NONE	A	PI2				
SERVICE ORDER	84422	1	83394733	GARDNER	NONE	C	GA3	C			
SERVICE ORDER	92069	2	83664471	HI-LINER	NONE	A	HL4				
SERVICE ORDER	96447	1	84478135	FORT RANSOM	NONE	B	FR1	B			
SERVICE ORDER	95996	2	84478282	ARTHUR	NONE	B	AR1				
SERVICE ORDER	95996	2	84478282	ARTHUR	NONE	B	AR1				
SERVICE ORDER	87944	1	83677791	ROGERS	NONE	A	RO3	A			
SERVICE ORDER	92719	1	84411796	HI-LINER	NONE	A	HL2	A			
TD FAILED NON ...	83132	2	83162455	ENDERLIN	NONE	A	EN4				
SERVICE ORDER	119428	1	99323963	HI-LINER	NONE	B	HL2	B			
OFF PEAK OFF	88359	2	83679131	LISBON	NONE	C	LI3				
SERVICE ORDER	134682	1	66598579	COLFAX	NONE	A	CO3	A			
TD FAILED NON KV	100014	1	84414928	PROSPER	FDR4	B	PR4	B			
OFF PEAK OFF	94547	2	84354299	ENDERLIN	NONE	C	EN1				
TD FAILED NON KV	81239	1	83387995	ALLEGHENY	NONE	B	AL3	B			
OFF PEAK OFF	99203	4	84417091	ENDERLIN	NONE	A	EN3				
SERVICE ORDER	90585	1	95143046	COMINCO 2	FDR2	A	C22	ABC			

- Fix mapping errors using TWACS
- Developed a process to change the read path in TWACS to the OMS temp switched state to maintain readings, accurate pinging
- Developed a communication failure report in Power BI to reveal any non-communicating meters

Current Use Cases and Benefits

- Communication failure report
  - Missed switching
  - GIS errors
  - Unreported outages
  - Power theft
  - Bad meters
- OMS that accurately represents the current state of the system
  - Safety
  - Switching
  - More accurate outage reporting pinging, statistics
- Miss fewer meter reads
  - Important for Time of Use rates
  - Demand analysis
  - Important for Cost of Service Studies
  - Customer Usage reporting
  - Substation metering vs aggregated meter reading
    - Line losses
    - Wholesale Power billing review
- More accurate load studies
- More accurate switching procedures
- Live field viewer with outage and tracing

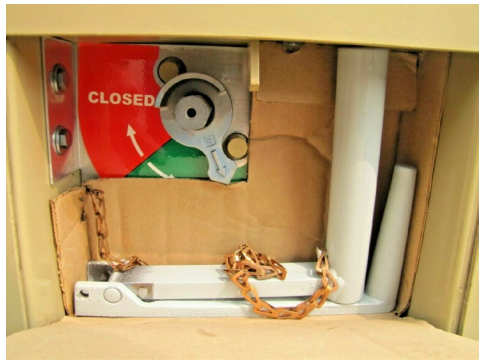
Important thoughts

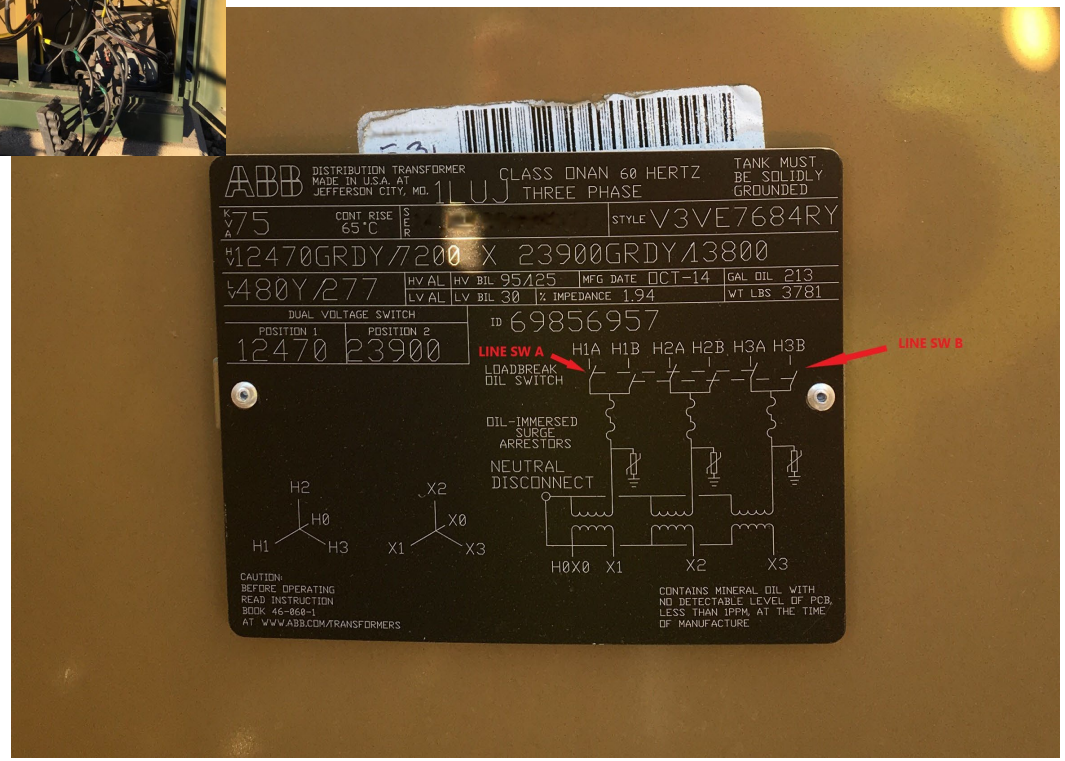
- All made possible because of data system integration GIS, OMS, AMI, CIS
- Must post construction work to the model as energized

The side effect of TWACS power line communication is that you get precise knowledge on an endpoints sub, feeder, and phase.

Medium Voltage Junctions

…Switches, Elbows etc.





Distribution Switching Present State & Industry Trends

- 2018: 250 Distribution Switching Orders moved greater than 500 meters to a different Sub, Feeder, Phase for more than 1 hour
- Found 18% of Meters with a change to their Sub, Feeder, Phase in one day
- Found Sub, Feeder changing most often as in Phase ties are most beneficial to Ops dept

Utility 1

68K Meters

- 2019: 24,404 executed switching steps in 561 total Switching Orders
- 2020: 27,685 executed switching steps in 700 total Switching Orders

Utility 2

130K Meters

- Thousands to Tens of Thousands (minimum #) of meters change their Sub/Feeder/Phase changes per day
- 220K Meters Connected to the wrong Sub in GIS & OMS

Utility 3

1.5M Meters

- ~30,000 Switch Plans/year
- Disabled Distribution Remedial Action Schemes
- FLISR disabled permanently
- 4 kV to 12 kV conversions not in OMS

Utility 4

1.5M Meters

- 16,000 Temp Ops in OMS in 9 months
- 8,000 at a SCADA device
- 8,000 at non-SCADA devices

Utility 5

3.8M Meters

- Distribution System is modeled in 5 different pieces of software (OMS, GIS, Synergi, ADMS, and CYME)
- Linemen and System Operators use the model they maintain with a sharpie and a ruler
- Questioning ADMS value internally
- Not archiving ADMS data for months now

Utility 6

3.7M Meters

Contact & Follow Us

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