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Microprocessor Relays in Network Protectors

Distribution Engineering | Equipment Analysis Center (DEEAC)

Distribution Engineering Equipment Group

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Agenda

- Con Edison of NY
- Typical Secondary Network
- Microprocessor Relays
- Relay Programs
- Tools for the Field
- Leveraging Technology
- Questions

Con Edison of NY – Service Area

Customers 3.4 million
Population 9.2 million
Area 660 mi^2

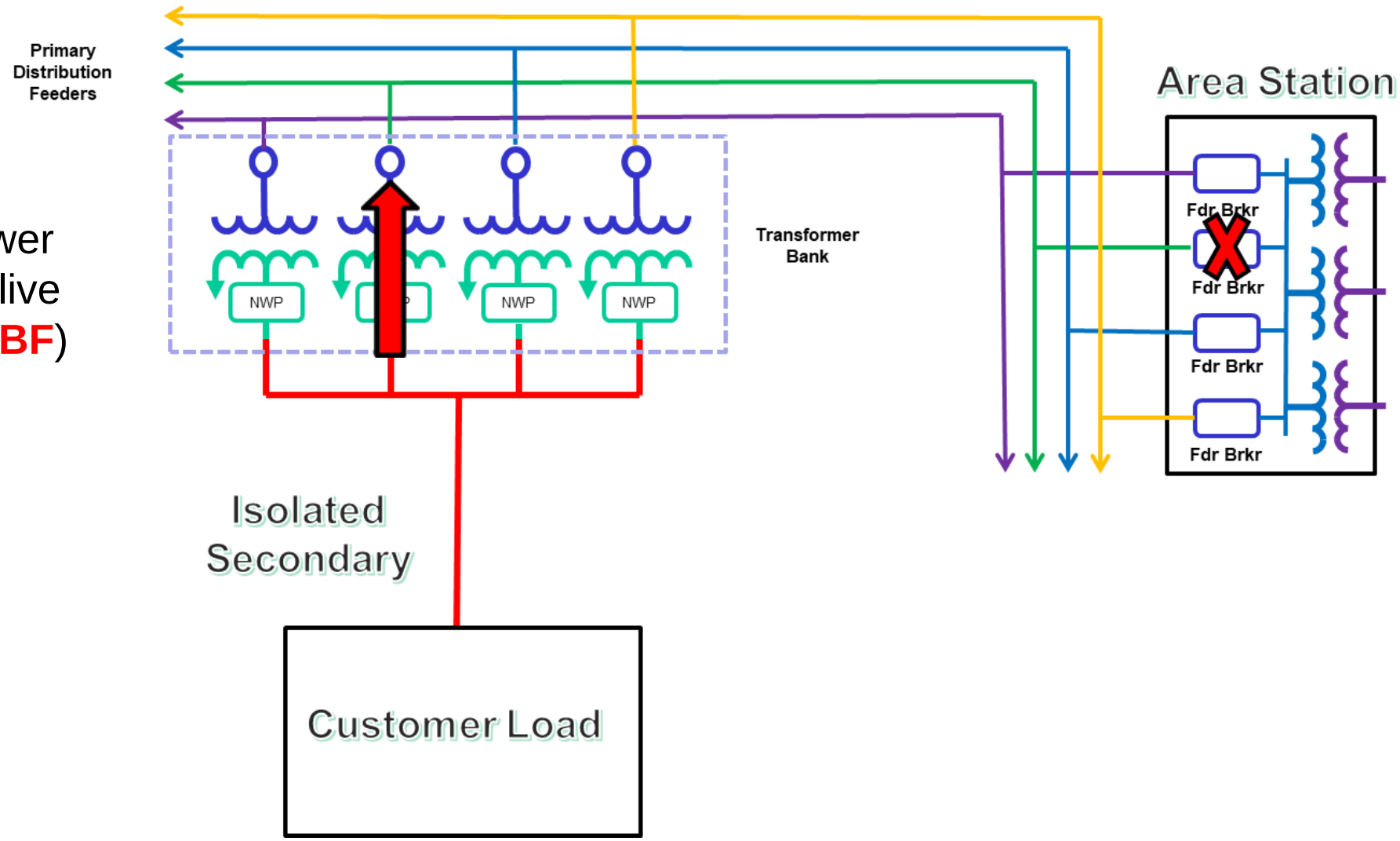
Peak Demand 13,322 MW
Con Edison Load Density 22.1 MW/mi^2
NY State Load Density 0.6 MW/mi^2

Network (underground) 85%
Non-network (radial, overhead) 15%

Transmission 69, 1 38, 345, 500 kV
Primary Distribution 4, 13, 27, 33 kV
Secondary Distribution 120, 265 V

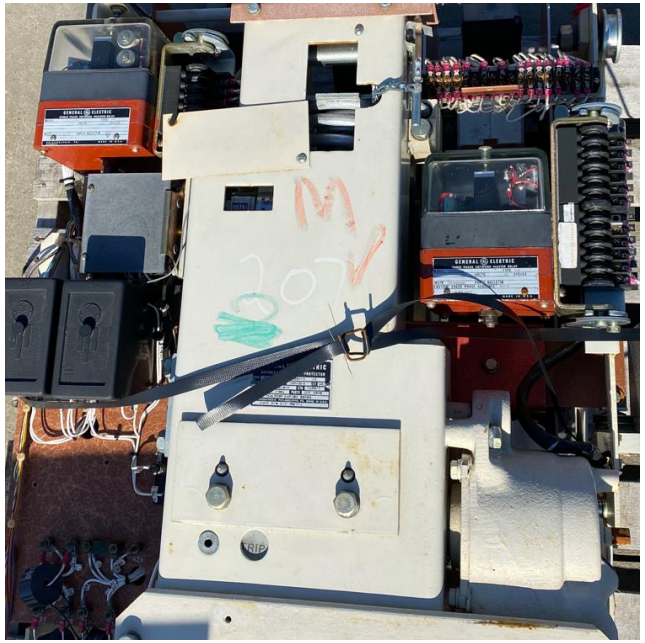
Typical Secondary Network

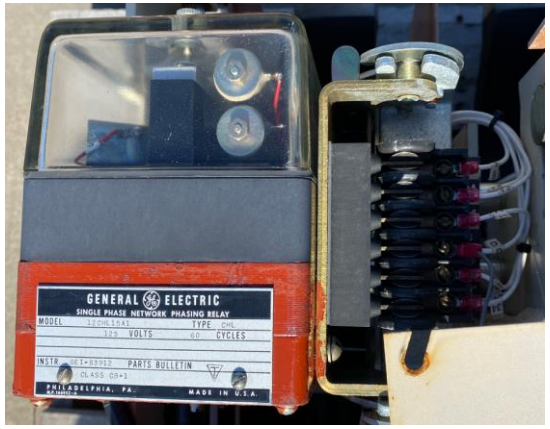
Reverse Power condition - Alive Backfeed (**ABF**)



Network Protector Relay Advancement

- Electromechanical and Solid-State Relays





- Microprocessor Relays
  - Direct replacement
  - Programmable

Microprocessor Relays – Early Stages

- Remote Monitor System (RMS)
  - Transformer: Loading, temperature, pressure
  - Network Protector: Switch status, 3 phase secondary voltages

Net RMS

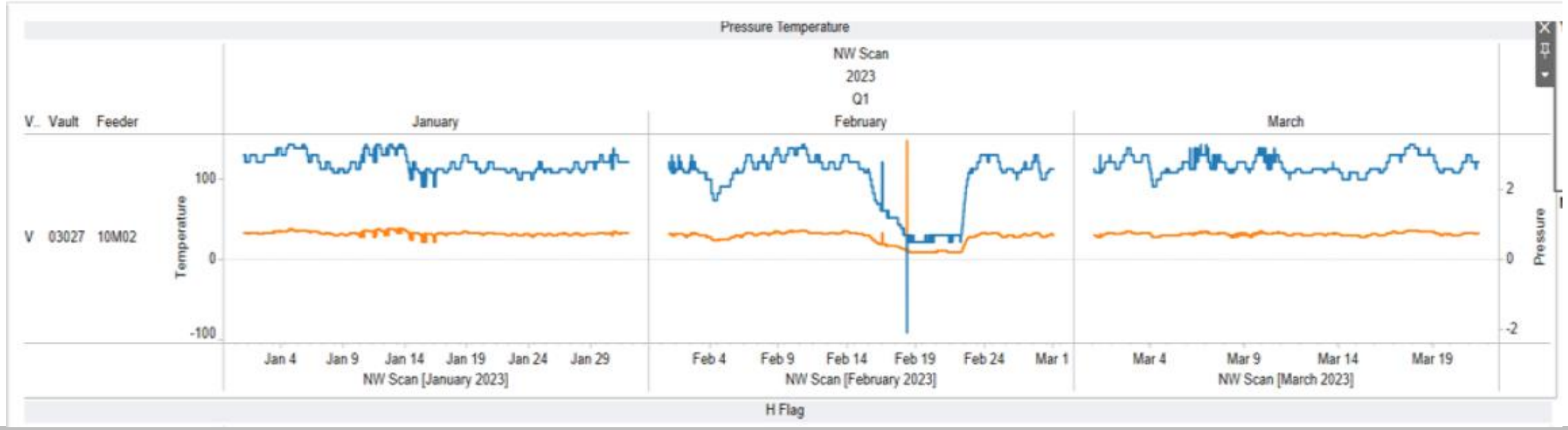
SHERIDAN SQUARE: V 03027 and Its Nearbys

Target		FDR	Address	STATUS	LOAD (A B C)			(avg)	VOLTAGE A		C	TEMPERATURE	PRESSURE
V 03027	☑	10M02	HUDSON ST 405	closed	47	45	45	(46)	122	121	121	33	2.8

Nearby	NBF	FDR	Address	Status	Loads(%) A	B	C	(avg)	Voltages A	B	C	Temperature T/Oil	H/Spot	Pressure
VS07764	15	10M12	111 LEROY ST	closed	34	34	34	(34)	121	122	121	0		-2.1
V 07062	12	10M01	LEROY ST 126	closed	41	44	44	(43)	121	122	121	27		2.5
V 01289	4	10M03	W HOUSTON ST 284 WLV CTR	closed	45	49	54	(49)	0	121	121	41		1.6
V 01636	4	10M11	W HOUSTON ST 284 ELY	open	0	0	0	(0)	121	121	120	35		3.5
VS01604	4	10M04	130 LEROY ST	open|old	0	0	2	(2)	114	120	97	28		18.4
VS07368	4	10M05	130 LEROY ST	closed	20	22	20	(21)	121	122	121	9		1.2

Leveraging Microprocessor Relay Data

- Driving Operational decisions
  - Real time data acquisition
- Supporting Engineering analysis tools
  - Visualization tools and alerts
  - Moving from time-based to condition-based inspections

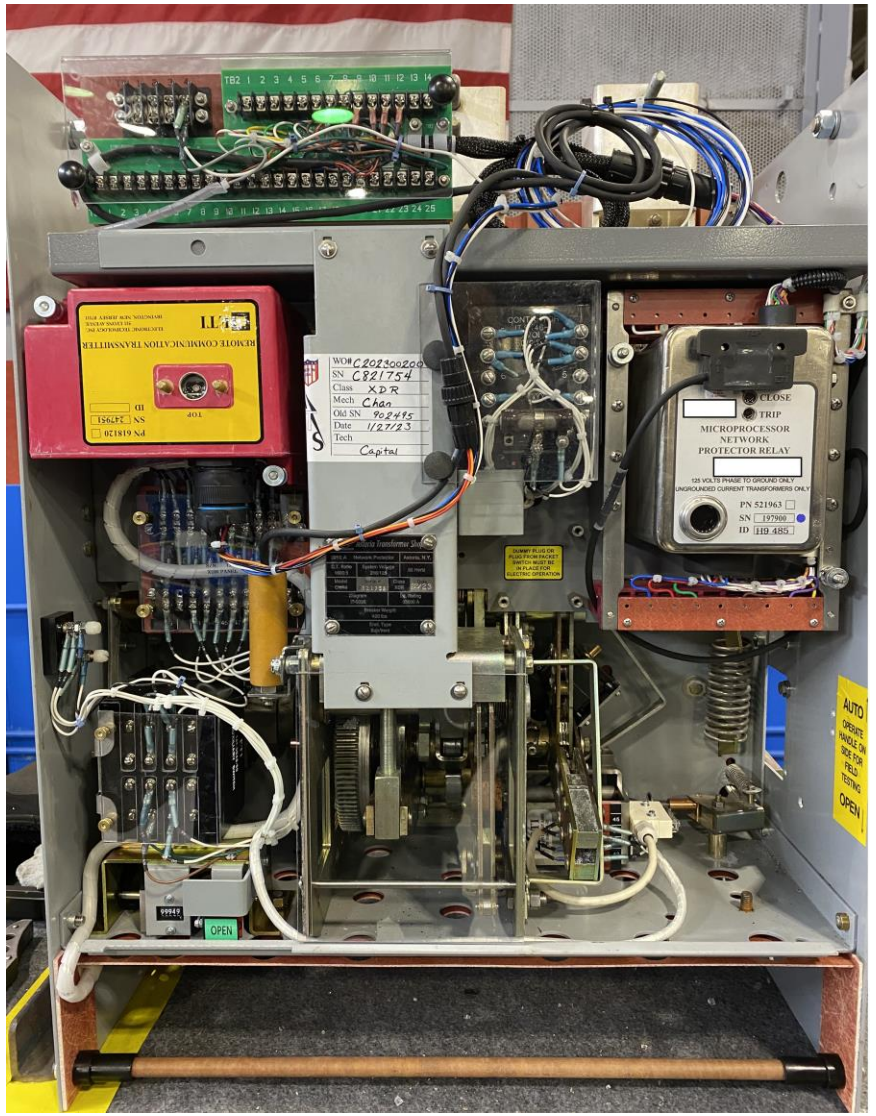


Microprocessor Relays – Trip Modes

- Sensitive
  - Relay will trip if power flow is greater than 0.15% of the CT's rating
- Time Delay
  - Relay will initiate a “2.5 minute” trip delay during reverse power flow condition
- Insensitive
  - Relay will allow reverse power flow less than the instantaneous trip level.
- Adaptive Trip
  - Allows reverse power flow
  - Distributed Generation (DG) locations
  - Prevents unwarranted network protector (NWP) operations

Evolving Relay Programs

- NWP Auto Exercise (AE)
  - Automatically exercise NWP in the field
  - RMS flags will aid in identifying defective NWP
- Two Stage Closing (2SC)
  - Automatically close NWPs that remained open
  - Close NWP at 5 Volts difference
- SCADA Capabilities & H9 Relays
  - Allowing us to clear an Alive Backfeed (ABF) remotely
  - Utilize the relay as a diagnostic tool for the NWP



NWP with Relay at Con Edison's Astoria Transformer Shop

Question

- *How is your company managing Distribution Energy Sources (DERs) in network areas?*

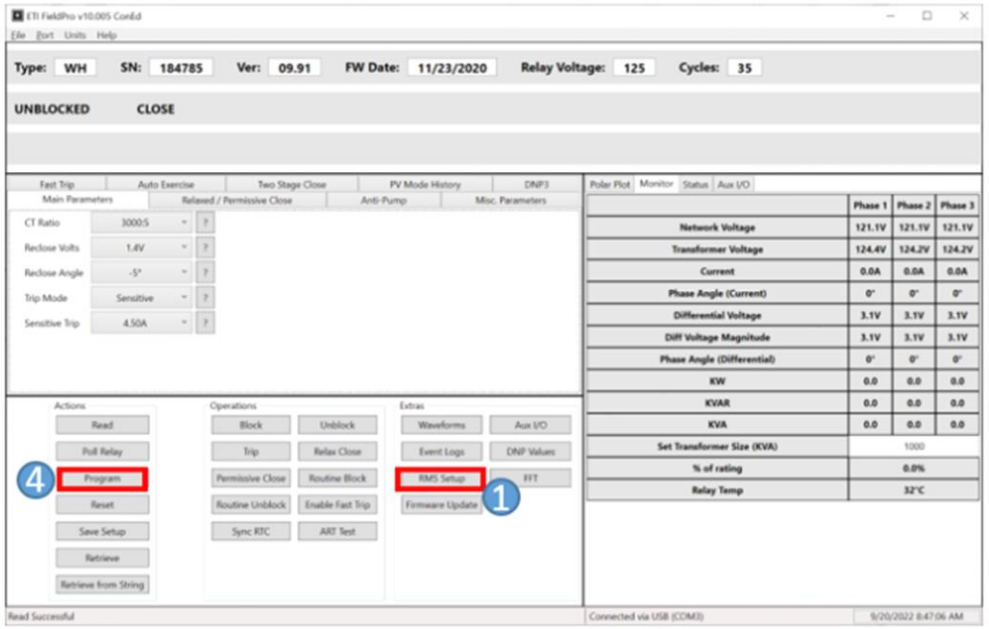
Tools – Troubleshooting Guide

- Creating dynamic guides for Field personnel
- Maintaining Relays
  - Firmware
  - Settings
  - Resetting RMS

Troubleshooting Steps ***RESETTING RMS***

1) Click 'RMS Setup'
2) Ensure "Enable RCT PLC Link" box is checked. Verify ID, CT multiplier, and Frequency are correct.
3) Close the RMS setup window
4) Click 'Program'

A common mistake is forgetting to perform steps 3 and 4.



Tools – Relay Checklist (Phase I)

- Field to provide more detailed information
  - Relay serial number
  - Environment / observations
  - Operational performance
- Coordinate analysis
  - Obtains Relays & Data
  - Involving vendor(s)
  - Provide analysis reports
- Provide findings
  - Provide solutions to the Field
  - Work with the vendor

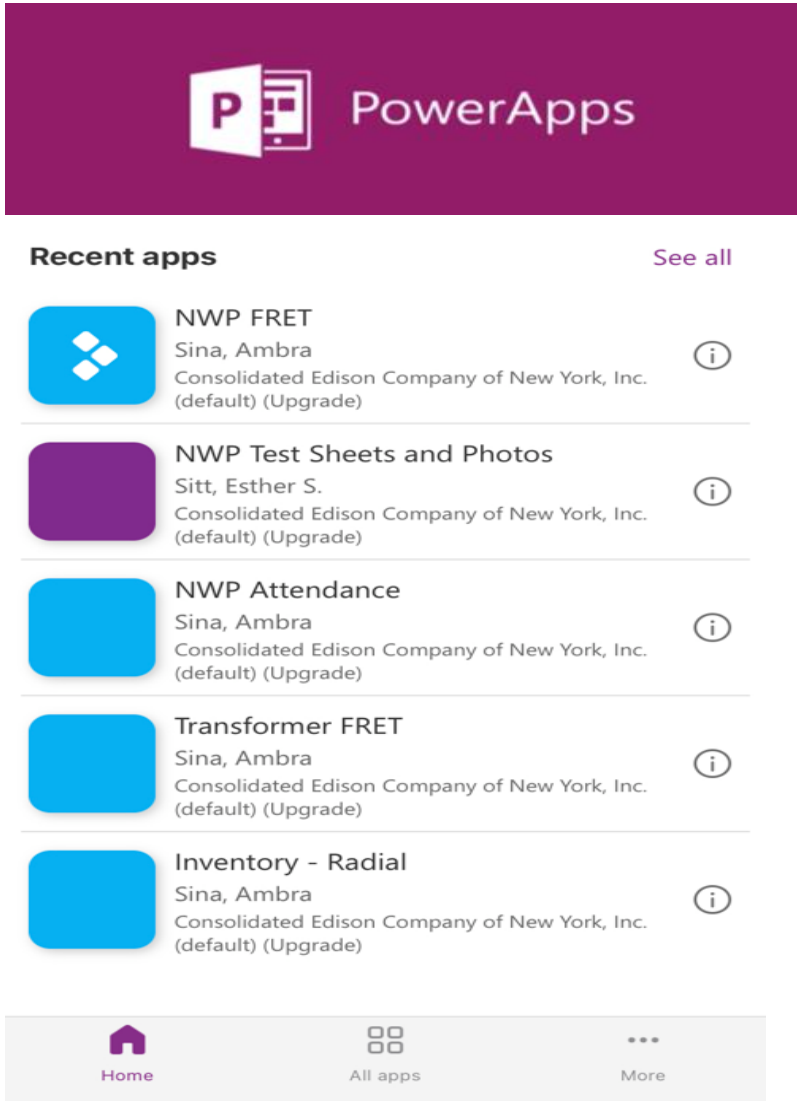
Relay Checklist:

☐	Location (Borough)	
☐	Structure Number	
☐	Feeder	
☐	Voltage	
☐	Employee ID	
☐	Date	
☐	Relay - Serial Number	
☐	Relay - Firmware version	
☐	Relay - Temperature	
☐	24-point or 25-point RMS Board	
☐	Error Code Displayed	
☐	Pulse Trip Reset – Boxed Checked	
☐	Damage Insulation Wiring	
☐	Unresponsive Relay – No Scroll	
☐	General Field Comments	

Tools – Power Apps (Phase II)

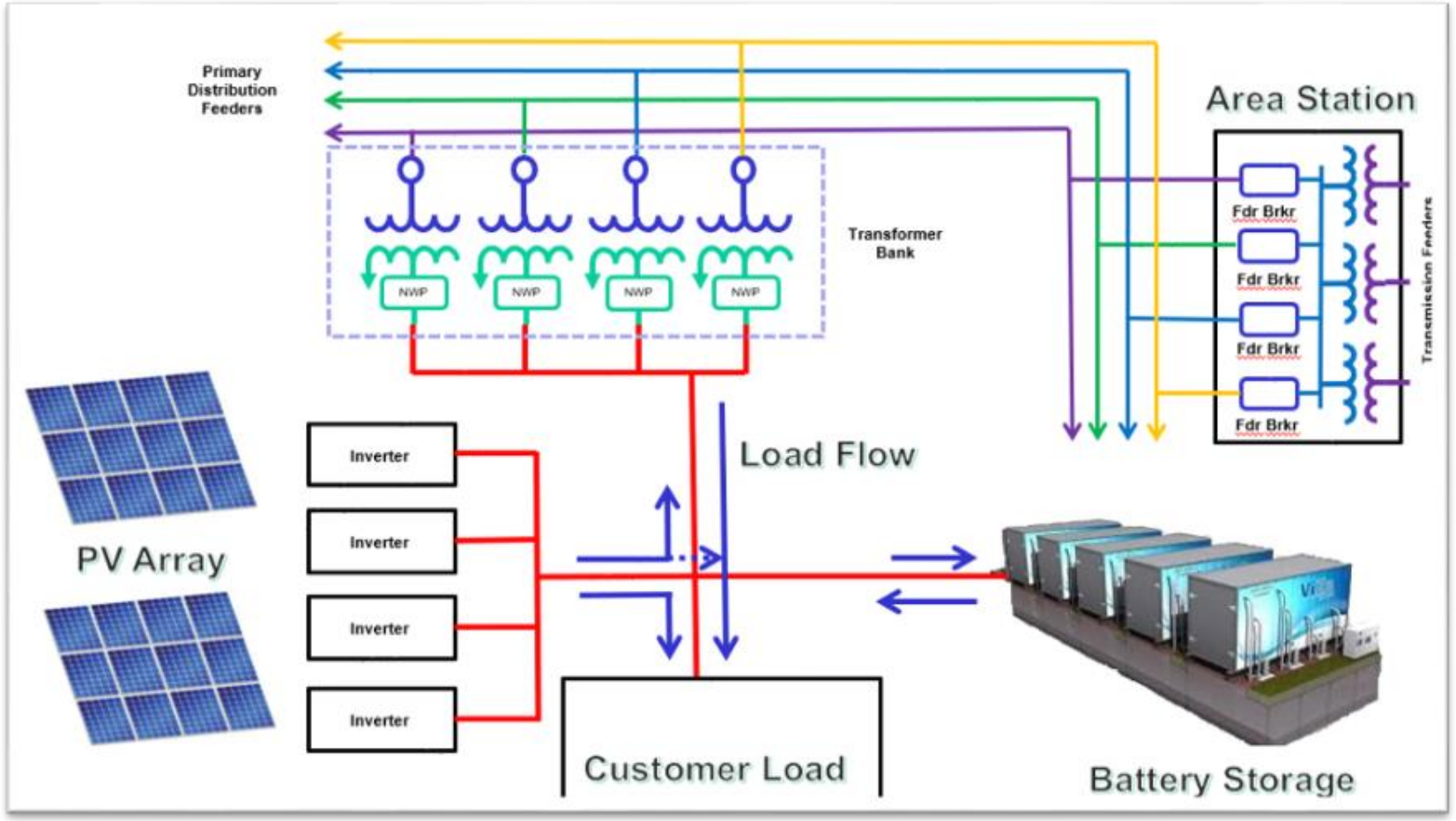
- Current tool (Paper Checklist)

- Transition to a digital format (Power App)
  - Replace the paper checklist
  - Photos & Videos



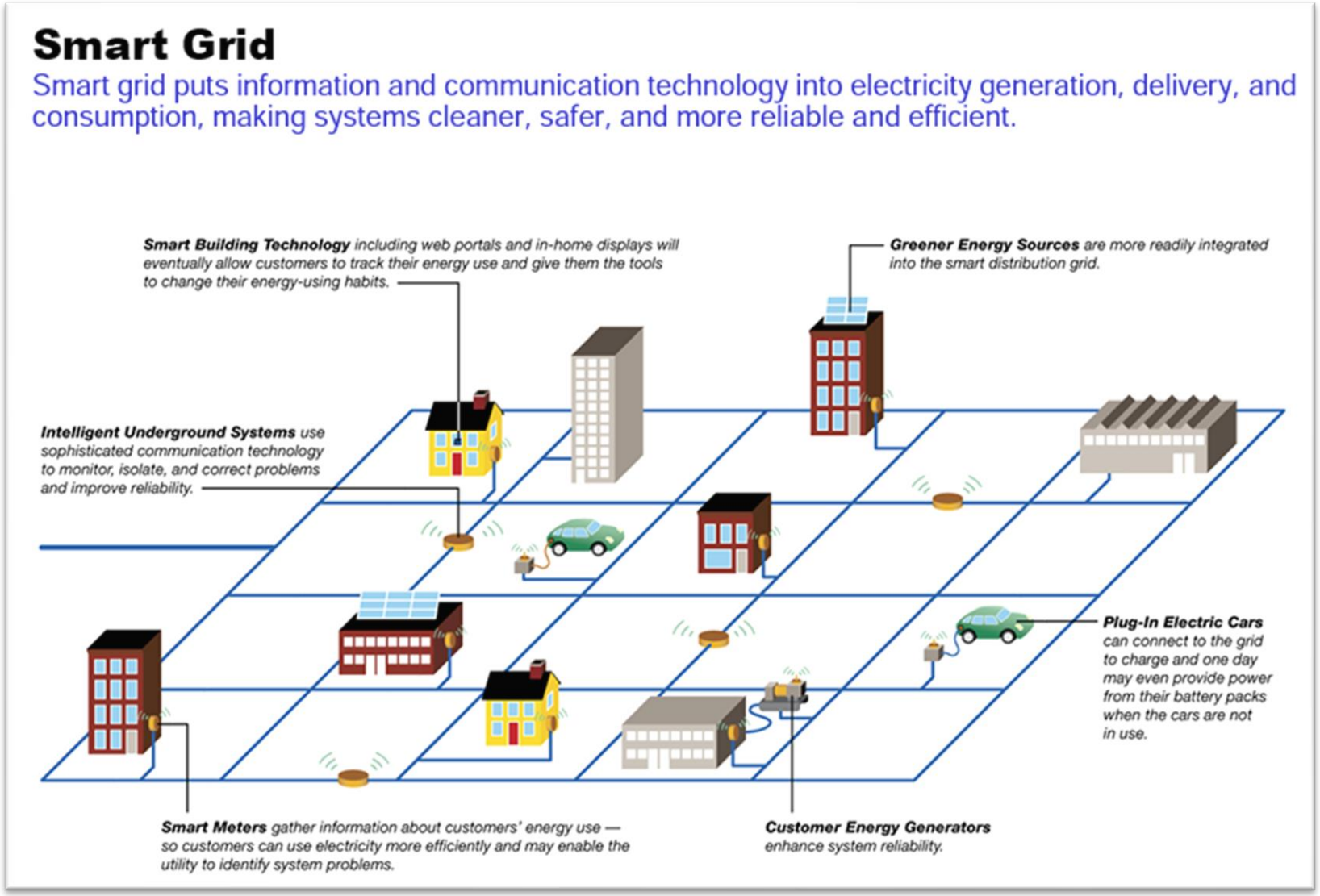
Leveraging Technology to meet Business Needs

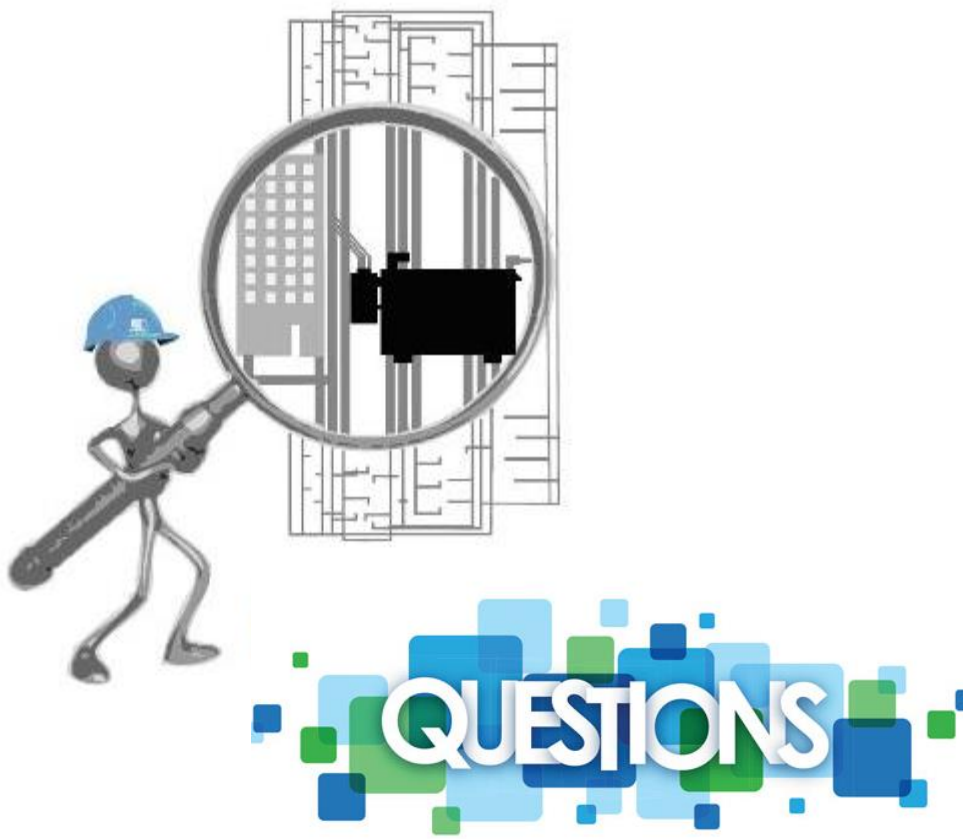
- Complex Relays/ SCADA for a complex distribution system
  - Coordination with costumers



Meeting the Future Power Grid

- Distribution Generation (DG)
  - Growing volume
  - More reverse power conditions
  - Explore technology to work and coordinate together
  - Grow our understanding of the impact to our system




QUESTIONS