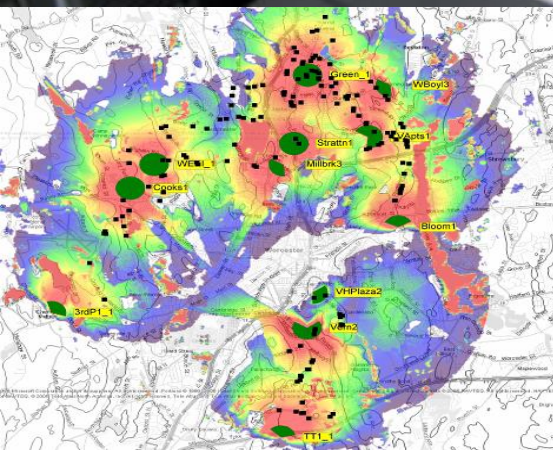
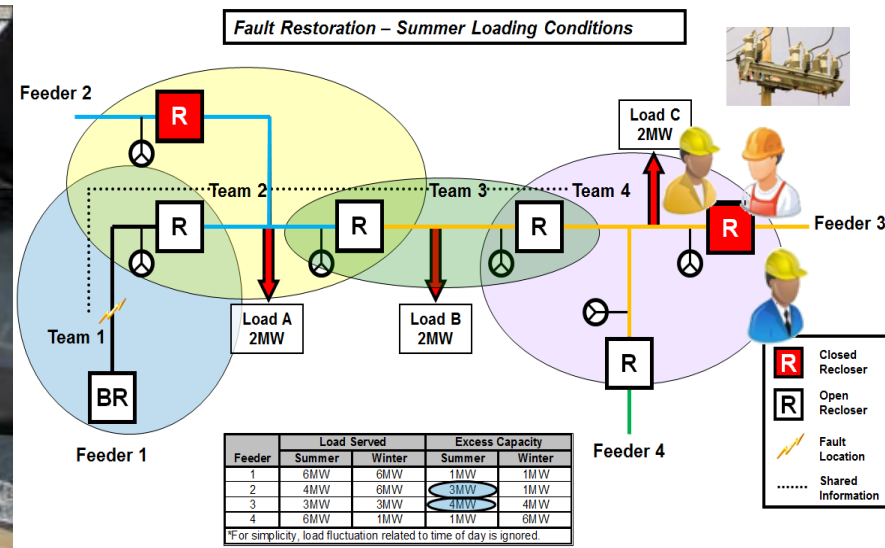


National Grid's approach to commissioning of Smart Grid Pilot devices



Jorge Valenzuela
Chicago, Oct 2015

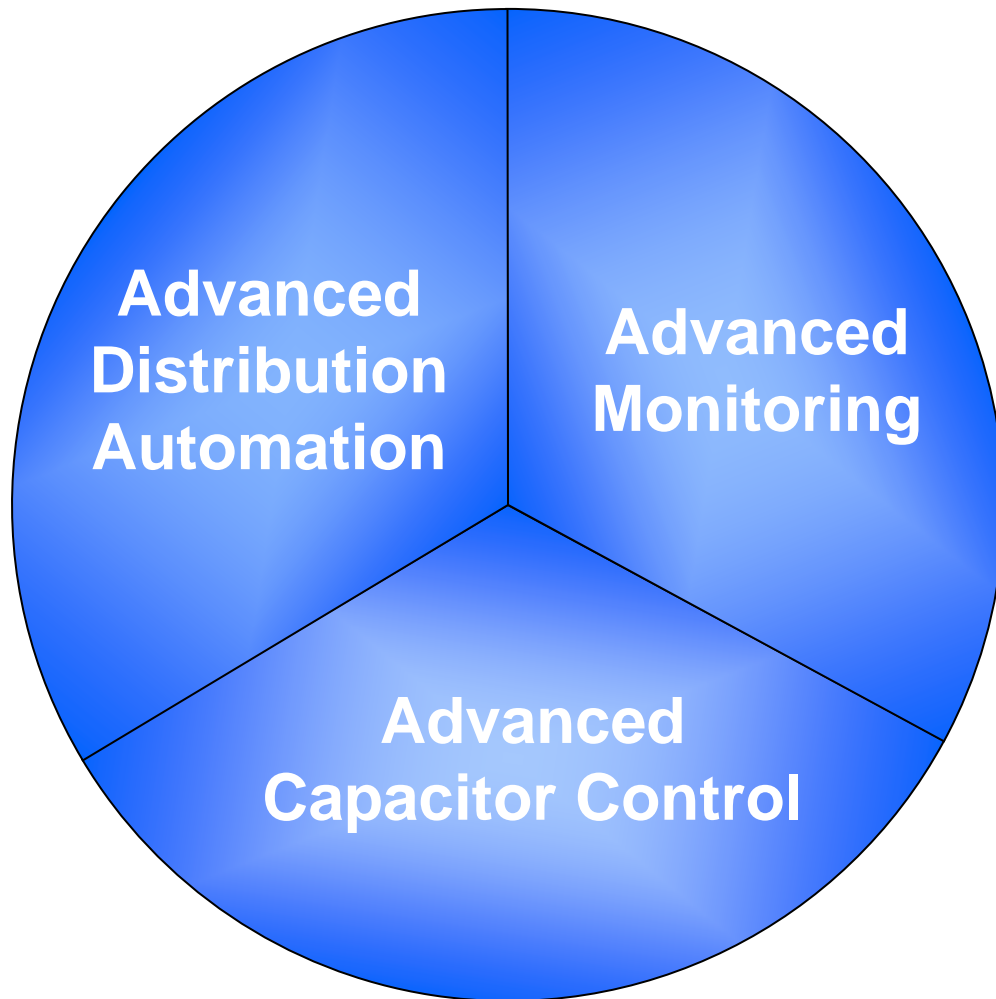
Agenda

- Background - Smart Grid Pilot
- Challenges
- Commissioning
 - Overall Process
 - Set Up “Production” Line
 - Settings’ Optimization Lab
- Initial results and obstacles
- Re-evaluation
- Remote verification
- Summary & Outlook

Background - Smart Grid Pilot

- MA Green Communities Act of 2008 required MA utilities to file a smart grid pilot proposal including the following features:
 - Should include at least 0.25% of customers
 - Must utilize advanced technology to operate an integrated grid network communication system
 - Must achieve 5% reduction in peak and average load in pilot area
 - Should incorporate Remote status detection and operation of distribution system equipment
- National Grid proposed a pilot with 2 sections: “Customer” and “D-Line”. The D-Line part of the pilot includes:
 - Advanced Distribution Automation – to improve reliability and operational efficiency
 - Advanced Capacitor Control – to reduce losses, peak, average demand and improve power factor and voltage performance
 - Advanced Grid Monitoring – to monitor loading on capacity bottlenecks and improve visibility of the distribution system for planning activities (including Distributed Energy Resources modeling, etc.)

Background - Smart Grid Pilot



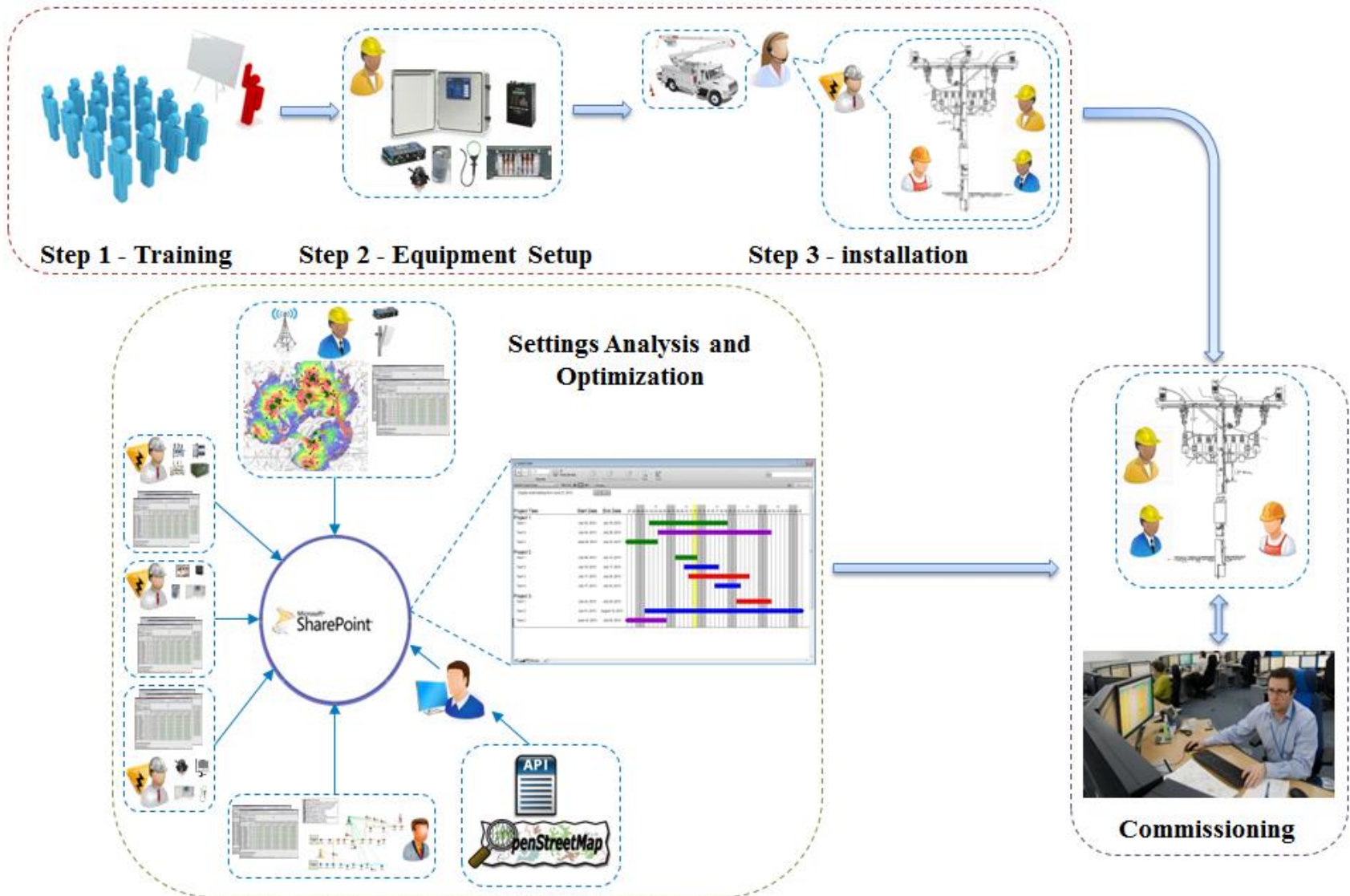
Initial characteristics:

- 188 Distribution Line devices deployed along 11 13.8kV feeders, involving 5 substations
- WiMAX communication technology. Infrastructure design and implementation, shared by all the features, under contract with GE MDS
- Includes “experiments” based on unique functionalities and expected benefits (ex: Single Phase Capacitor Switching)
- Device components selected based on desired features (in most instances from different manufacturers)
- Currently, in final stages of implementation & commissioning 4

Challenges

- Several devices were not part of the National Grid standard equipment catalog. New commissioning procedures had to be designed for them
- Different devices for each of the Pilot features. In some instances required in-house modifications (ex: Transformer Monitor)
- Required that different tech groups had to work on each unit to make it functional (the same is valid for commissioning)
- Some of the commissioning involves multi-device verification
- Communications playing an important role in the commissioning process. First time that a significant number of D-Line devices, with diverse number of data points, were going to be sharing a wireless network and providing data to EMS and PI historian (it required de creation of a separate network on its own DMZ)
- Limitations on availability from internal resources made immediate commissioning (by NG personnel) impossible

Commissioning – Overall Process



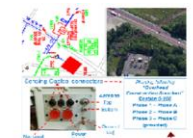
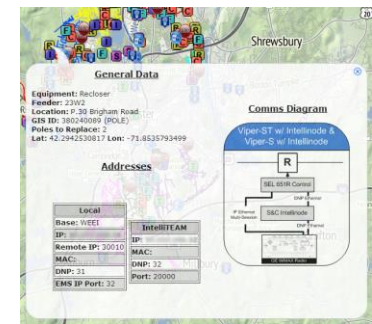
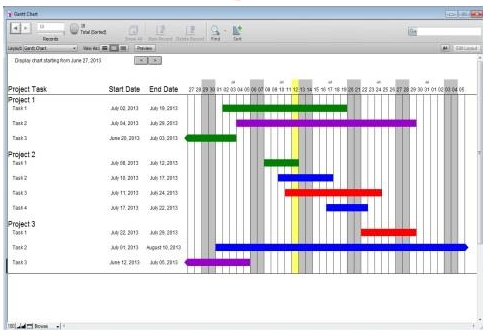
Commissioning – Set Up “Production” Line



GE MDS
industrial wireless networks

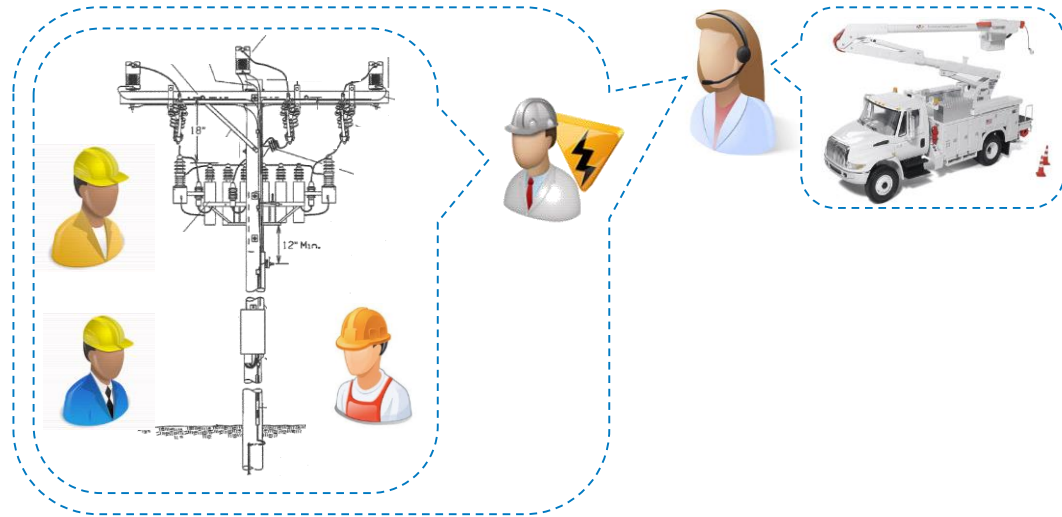
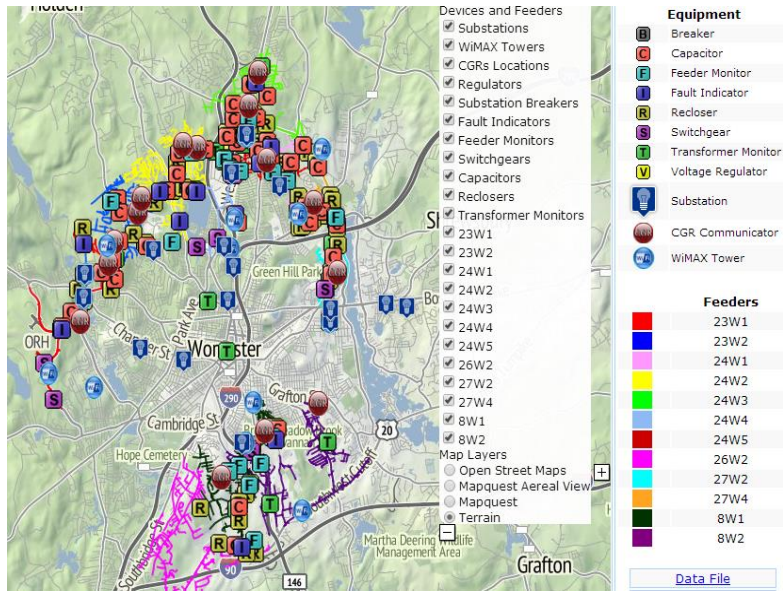


SCHWEITZER
ENGINEERING
LABORATORIES



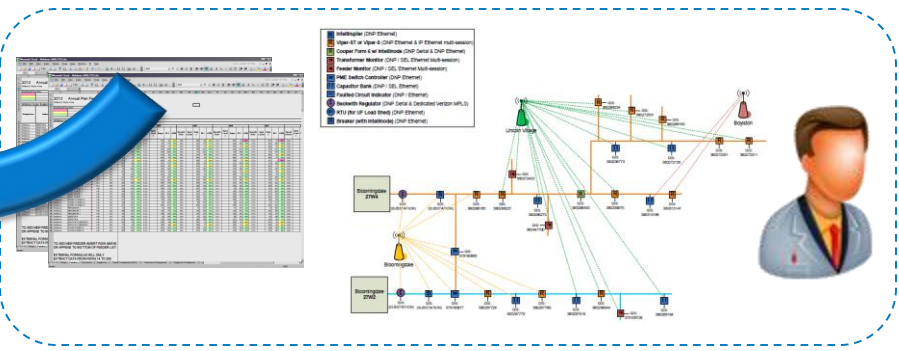
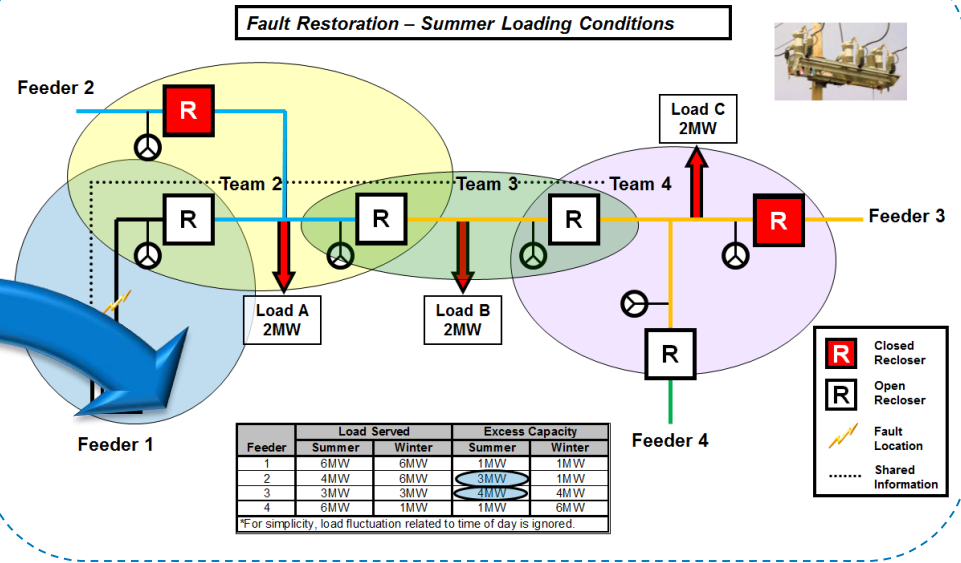
Controls	SEL 734B FM Control
Group	WIMAX_Subscriber_Serial_Number
Commissioned_date	05/05/14
Comm_type	WIMAX
Attachments	SP_FM.rdb dod

Commissioning – Set Up “Production” Line benefits



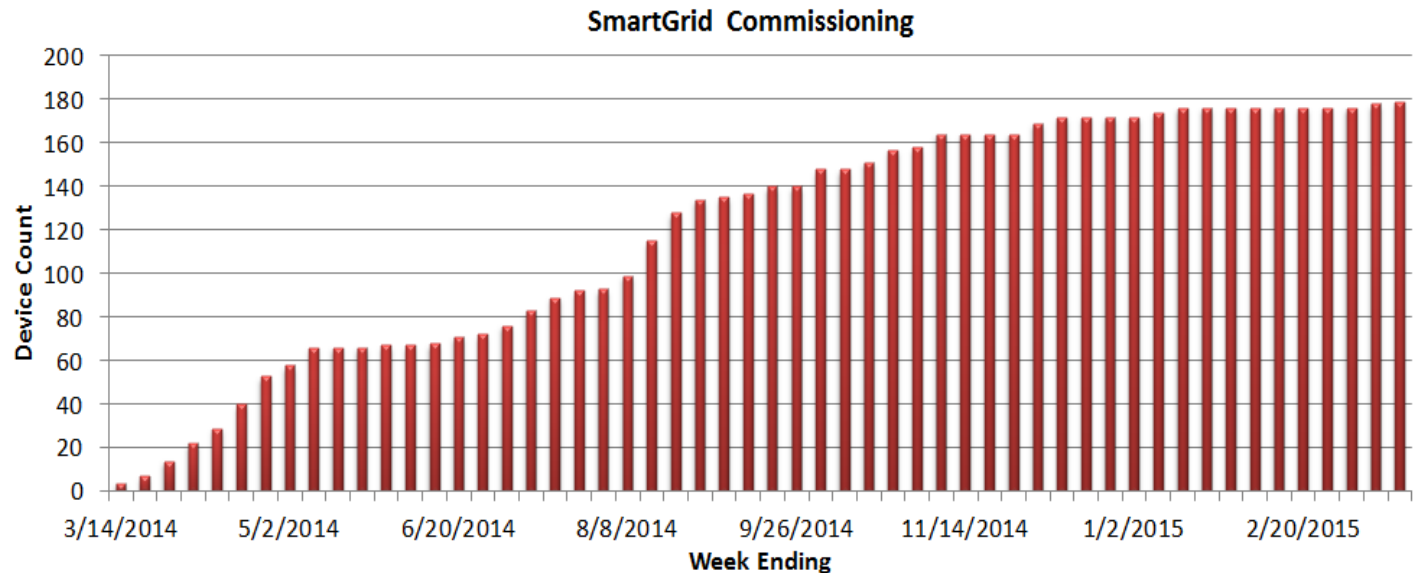
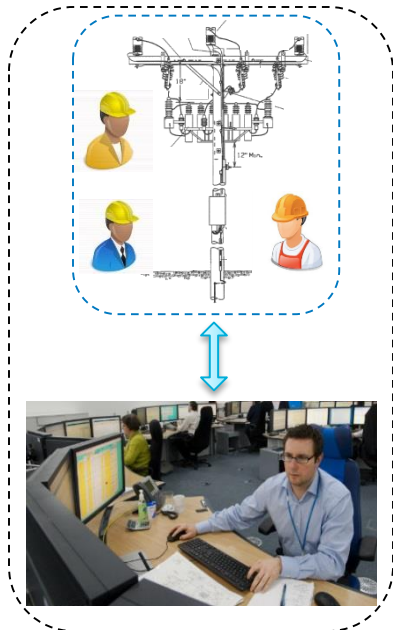
- Our geographical project management tool was particularly useful to plan installations as follows:
 - Schedule same type of work in consecutive days (ex: a crew installing all Feeder Monitors on a given week)
 - Segment the work by location and available resources (external crews' requests, etc.)
- The “inventory” of prepared equipment started to be cleared up quickly

Commissioning – Settings' Optimization Lab

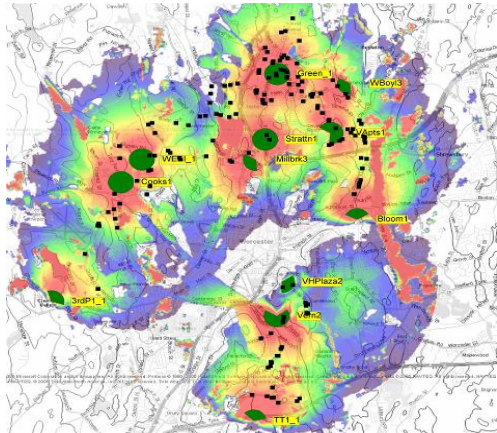


Initial results and obstacles

- The commissioning process started to generate results rather quickly
- However, communication infrastructure development got in the way introducing delays and adding another layer of complexity
- This created another set of challenges:
 - Equipment reassignment (antenna to new base, etc.)
 - Change on communication technology used (WiMAX for Cell, etc.)
 - Inability to commission broader schemes (some FLISR components with no comms.)



Re-evaluation



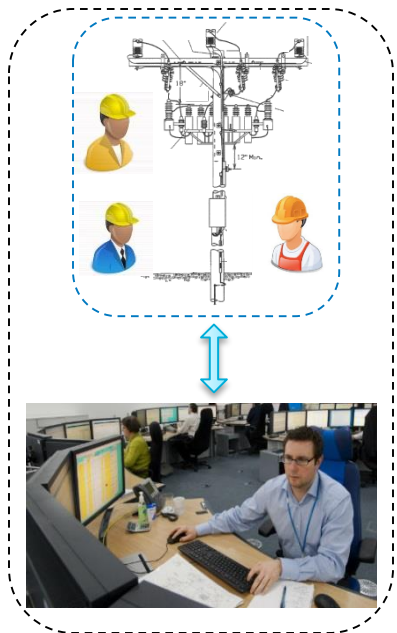
- As the communication related hold ups were being cleared (licensing, board approvals, etc.) a procedure was established to accelerate the commissioning process:

- A crew (OH – UG) would visit all the locations to be commissioned and verify that the installation was exactly as designed (outsourced ones previously found to have some discrepancies)

- A crew (PTO) would visit all the locations to be commissioned and get the communication equipment ready (lesson learned from initial commissioning). This includes unforeseen vegetation changes, antenna alignment, etc.

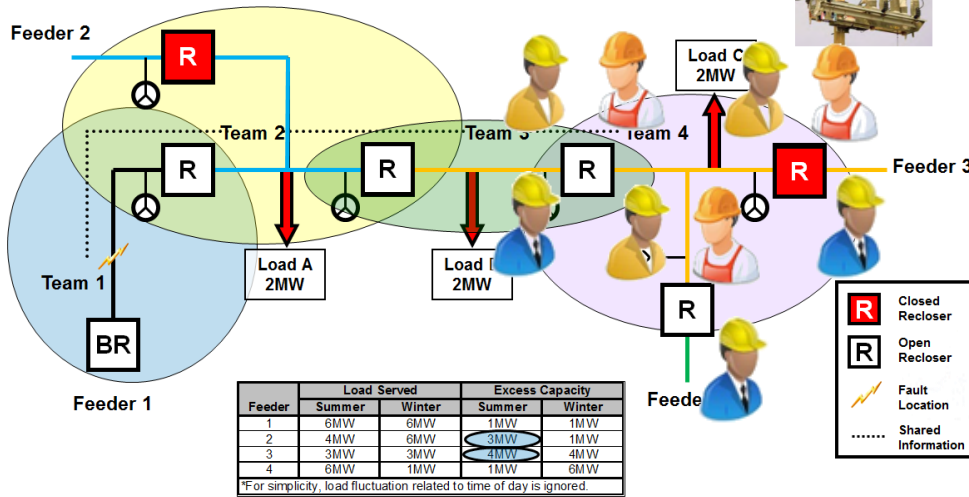
- The communications configuration for the device would be cleared up to the Data Concentrators (inclusive) before engaging EMS for commissioning (done remotely via “Smart Lab”)

- This “tuning” produced a high rate of “1 shot” commissioning events reducing the average number of hours required to “re-work” units



Remote verification

Fault Restoration – Summer Loading Conditions



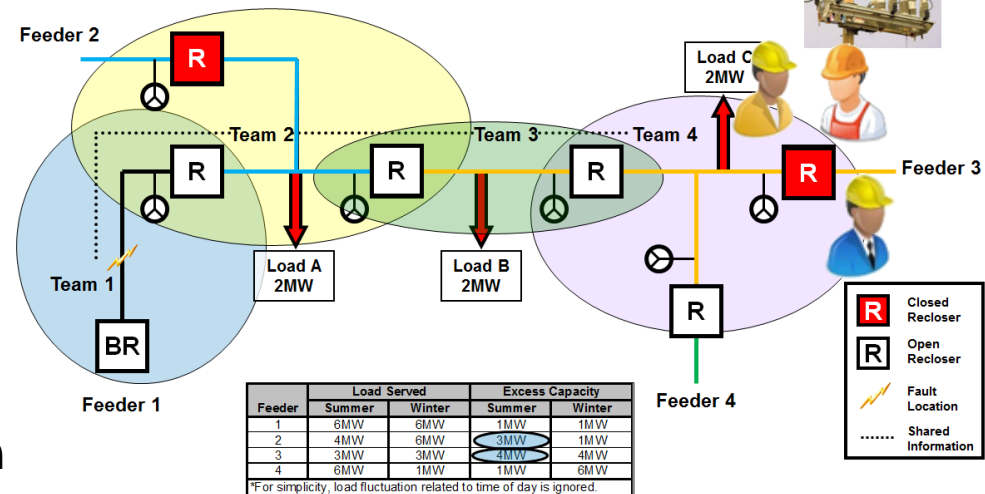
FLISR Commissioning “Original”

- Local initiation and verification of commands
- Required crews to move from device to device

FLISR Commissioning “New”



Fault Restoration – Summer Loading Conditions



- Local initiation and remote verification (network)
- Crews would finish the device’s commissioning at same location

Summary & Outlook

The successful and timely progression of the commissioning phase of the project was substantially due to the creation of the following items:

- Centralized application to manage and share the progress, store critical information and coordinate work across departments
- Streamlined procedure to prepare and test equipment in the lab ahead of installation
- Proactive inspection program for verification of installed equipment ahead of commissioning
- Comprehensive testing lab environment to debug and optimize advanced schemes
- Methodology to support commissioning of advanced schemes through the communication network

As National Grid continues to move forward towards modernization initiatives in New York, Rhode Island and Massachusetts, the success and learnings provided by the experience gained on this pilot will shape our approach when considering the integration of new technology to our systems

Questions?