

METERING LEADER SINCE 1904



THE EASTERN SPECIALTY COMPANY

ZERO-INFRASTRUCTURE AMI SELECTION AND DEPLOYMENT



A TESCO COMPANY

Presented by Jon Scott

North Carolina Meter School
Management Track

Tuesday, June 13, 2023

8:00 AM





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

Agenda

- Introduction to TESCO Nighthawk
- Defining Zero-Infrastructure AMI
- Case Studies
 - Full AMI
 - Tactical/Targeted Deployment
 - Program-Specific Application





ZERO-INFRASTRUCTURE AMI

- About Nighthawk
 - Over 25 years of utility experience
 - 100+ utilities served
 - AMI Solutions
 - Full-Deployment
 - Tactical

Now a TESCO Company!



A TESCO COMPANY





AMI Status?

slido



When you think “Traditional AMI,” what word or phrase comes to mind?

slido



**When you think “Zero-Infrastructure AMI,”
what word or phrase comes to mind?**



ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Majority of AMI Solutions Require Costly Infrastructure:
 - Towers, Repeaters, Collectors, Access Points, etc.
- Many Require Additional Resources:
 - Network Administrators, DBA's, RF-Techs, etc.
- **Many AMI Technology Flavors**

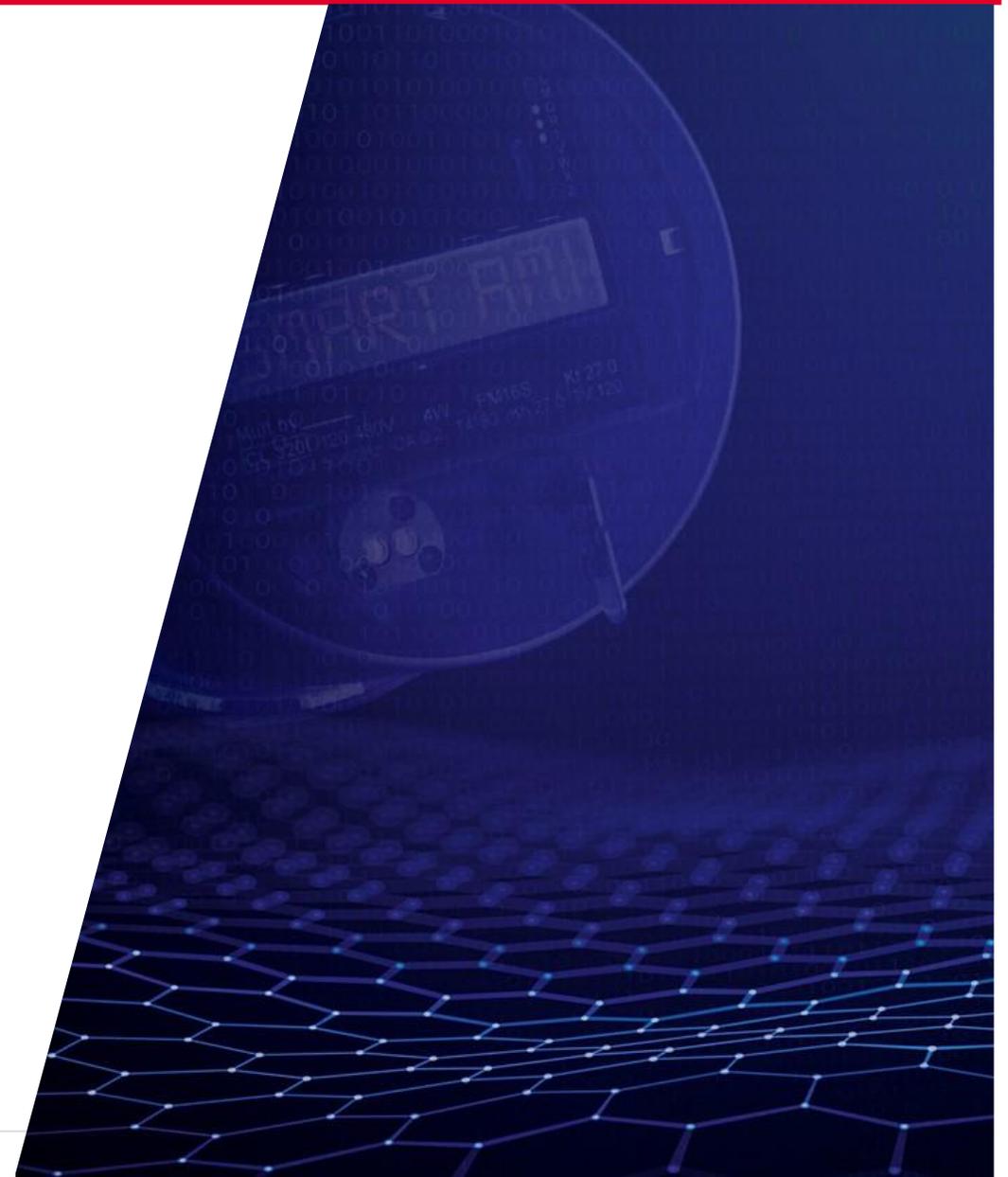




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Defining Zero-Infrastructure AMI
 - No Costly Infrastructure to Install/Maintain
 - Communications Under-Glass
 - IT Friendly / Cloud Hosted





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Zero-Infrastructure AMI
 - Cellular-Only
 - Full deployment or tactical
 - Cellular-RF Mesh Hybrid
 - Full deployment (great for small – medium size utilities)
 - Fiber
 - On the rise especially with the electric cooperatives
 - Fiber to pole or Fiber to home solutions





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Zero-Infrastructure AMI cont.
 - Leveraging Private LTE
 - Mostly applicable to large utilities / IOU's
 - Protect lifespan of the data backhaul
 - Easy access to higher frequencies and amounts of interval data for AMI 2.0 applications

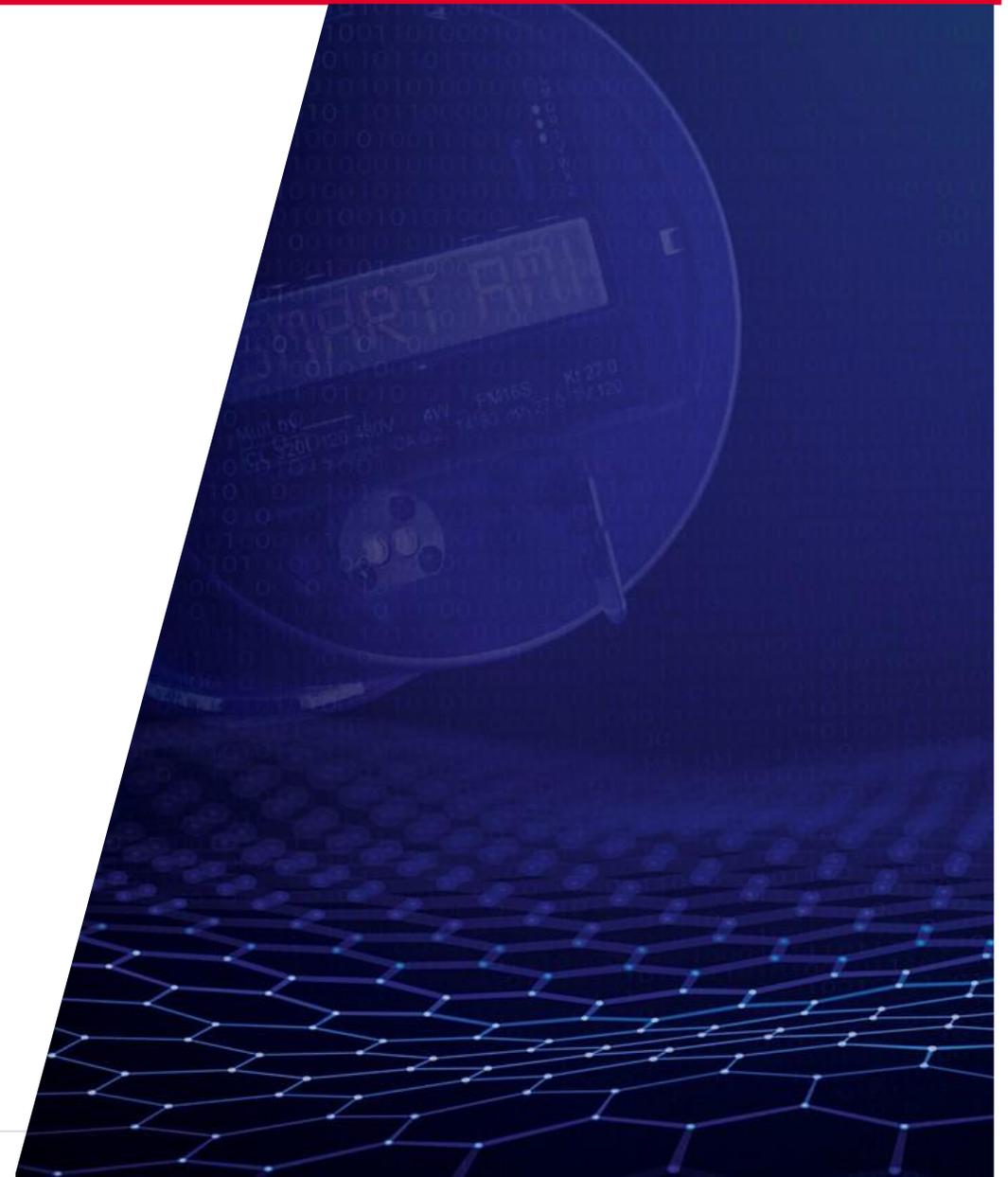




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Studies
 - Full AMI (Co-op and Municipal)
 - Tactical/Targeted Deployment
 - Program Specific Application





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI, Multi-Phase Deployment
 - **Hamilton County Electric Cooperative, TX**
 - 18,000 electric
 - Contacts
 - Lisa Lively, IT Specialist/ AMI Supervisor
 - Existing system: PLC





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Hamilton County Electric Cooperative, TX**
 - Problem/Need:
 - Current system no longer supported by manufacturer
 - New meters for current system difficult to procure
 - Need for timely outage/ voltage reporting
 - Low to zero infrastructure to install/maintain
 - Easy to self deploy
 - Must allow for multi-year, multi-phase self deployment (flexible and scalable)
 - Low latency
 - Must integrate with NISC





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

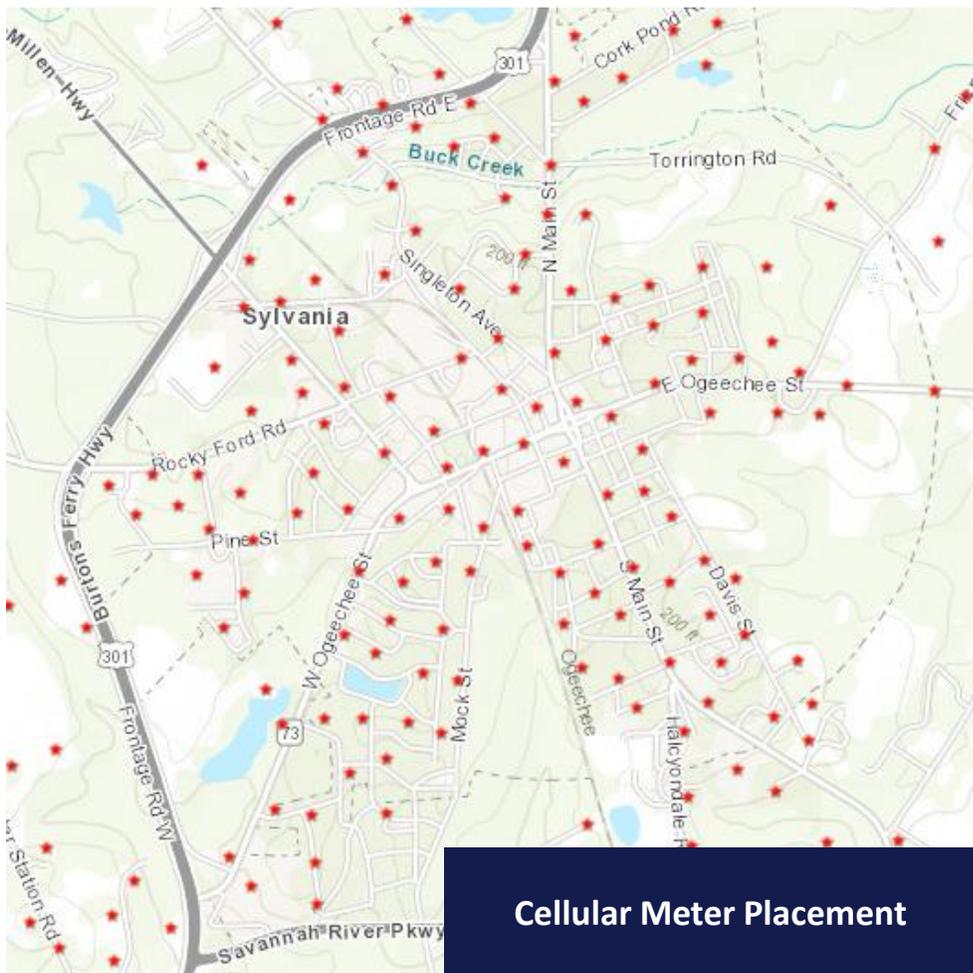
- Case Study – Full AMI
 - **Hamilton County Electric Cooperative, TX**
 - Solution:
 - Started with evaluation of AMI technology options
 - Identified Cellular-Mesh topology to be potential solution
 - Conducted thorough communications testing and RF-study
 - Provided full-system deployment plan
 - Evaluated hardware and software functionality
 - Integrated with NISC CIS
 - Used Fulcrum software for self- deployment (meter change out)
 - Typically order a substation a quarter



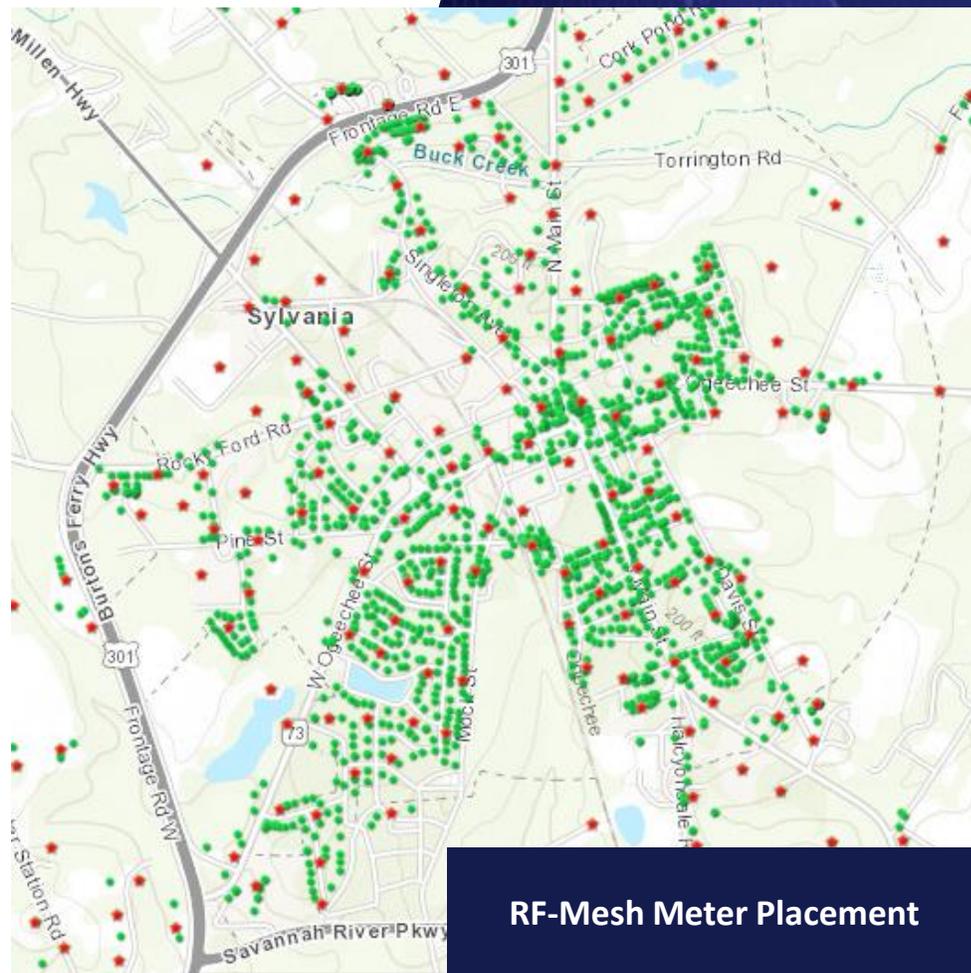


ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

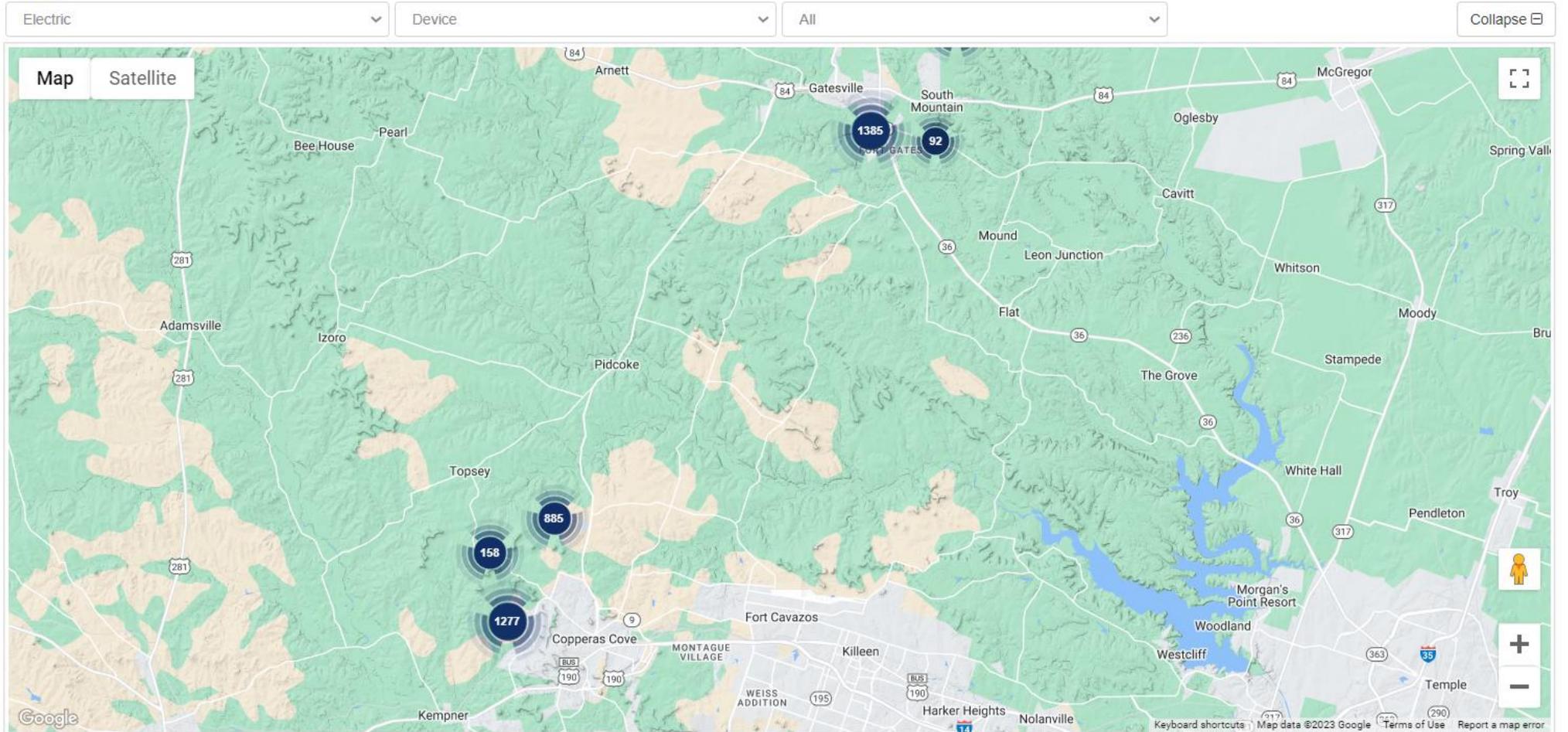


Cellular Meter Placement



RF-Mesh Meter Placement

Maps



Maps

Electric Device All Collapse

Map Satellite

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ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Hamilton County Electric Cooperative, TX**
 - Outcome:
 - 2 substations deployed with a third in the works
 - 10-30 seconds for on-demand reads, disconnects, demand resets, etc.
 - Nothing to maintain beyond the meters (zero-infrastructure)
 - Standard AMI benefits
 - Preventing truck rolls
 - Timely outage/voltage reporting
 - Remote reading/disconnect
 - Etc.

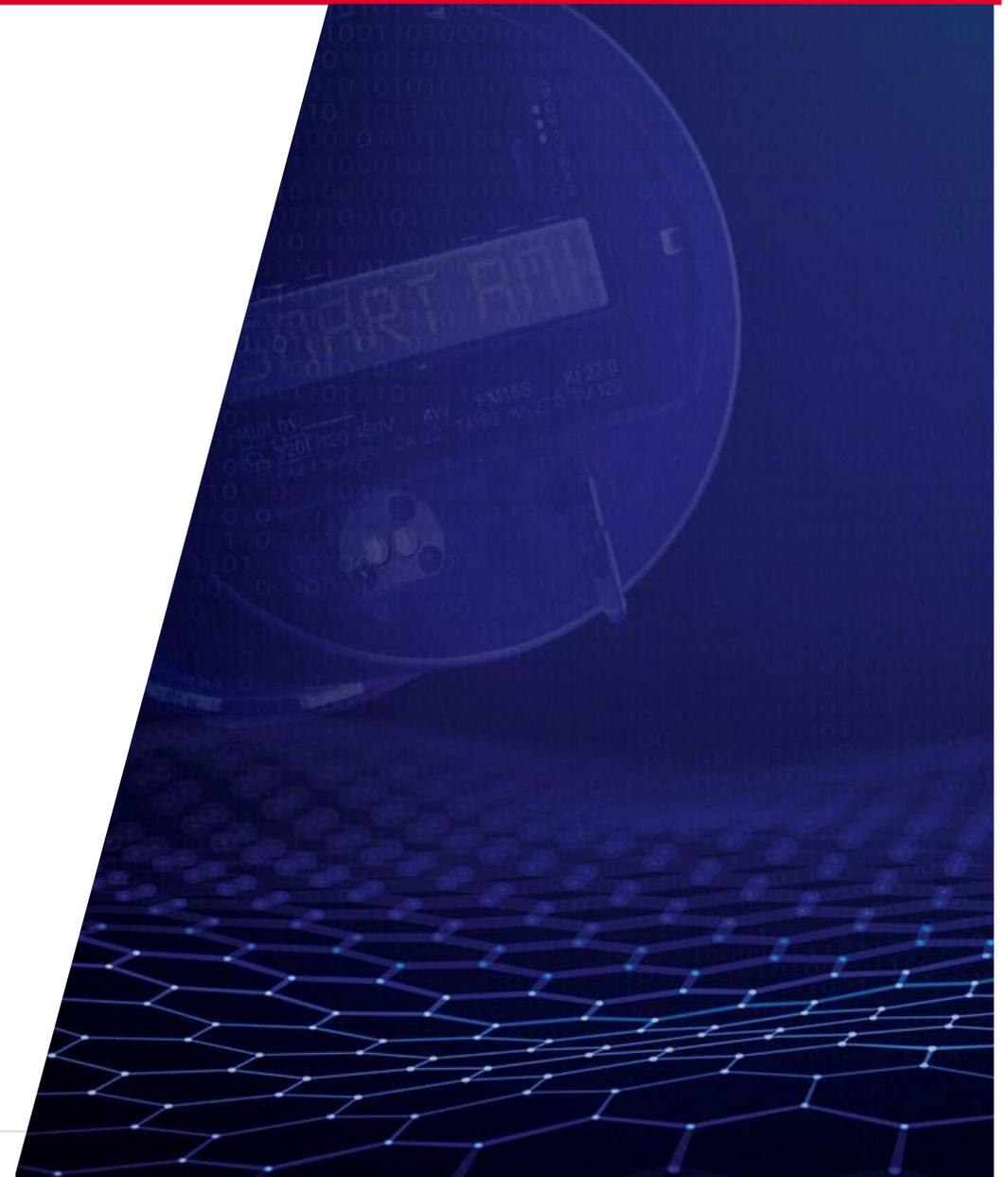




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Hamilton County Electric Cooperative, TX**
 - Challenges/Lessons Learned:
 - Working the wrinkles out of the billing integration
 - Maintaining consistency from previous system
 - Meter lead times jumping from 3-4 weeks to 6-8 weeks
 - Resource bandwidth (manpower to deploy)





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Hamilton County Electric Cooperative, TX**
 - What's next:
 - Continue per-substation deployment





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI

- **Louisville Utilities, MS**

- 3,200 electric, 3,200 water
- TVA member
- Contacts
 - Wilson Webb, General Manager
 - Jay McLendon, Office Manager
- Old system: 10+ year old Electric and Water AMR solution





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI

- **Louisville Utilities, MS**

- Problem/Need:

- Remote Disconnect/Read, Outage/Voltage reporting
- Limited resources
- Low to zero infrastructure to install/maintain
- Easy to self deploy
- Not turning meter-techs into RF techs
- Must allow for multi-year, multi-phase self deployment (flexible and scalable)
- No onsite server requirement (hosted)
- Easy to operate single-software solution (no DBA or network admin)
- Low latency
- Must integrate with CSA MDM/CIS
- Multi-service





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

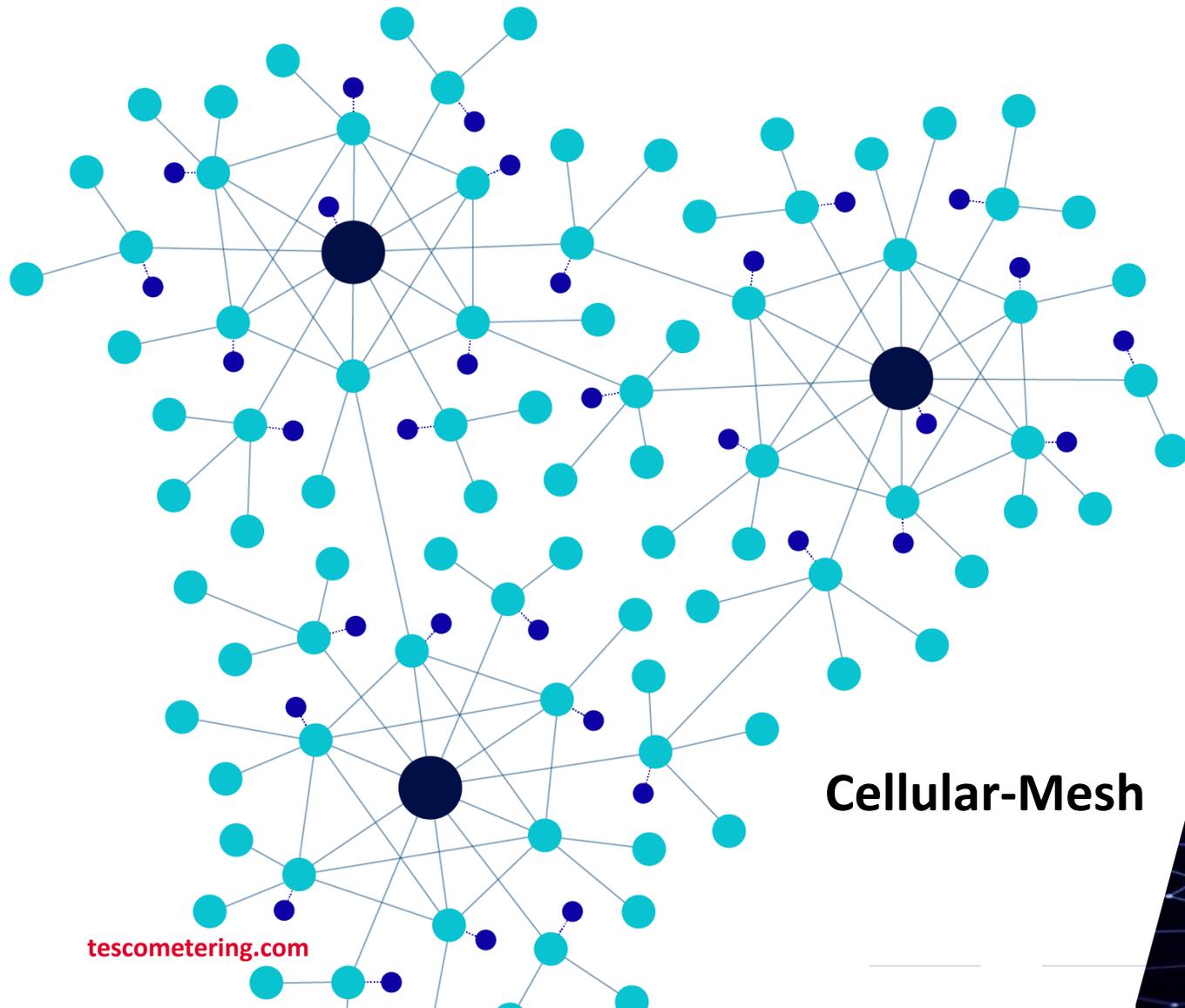
- Case Study – Full AMI
 - **Louisville Utilities, MS**
 - Solution:
 - Started with evaluation of AMI technology options
 - Explored remote ERT collection as a “bridge” to full AMI
 - Because of Water-ERT age-related limitations , decided to go straight to AMI
 - Identified Cellular-Mesh topology to be potential solution
 - Conducted thorough communications testing and RF-study
 - Provided full-system deployment plan
 - Deployed 3-month pilot in “worst case scenario” location
 - Integrated with CSA MDM
 - Evaluated hardware and software functionality
 - Used Fulcrum software for self- deployment (limit human error)
 - “Pallet a Month Club” to compensate for resource/budget realities





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING



Cellular-Mesh

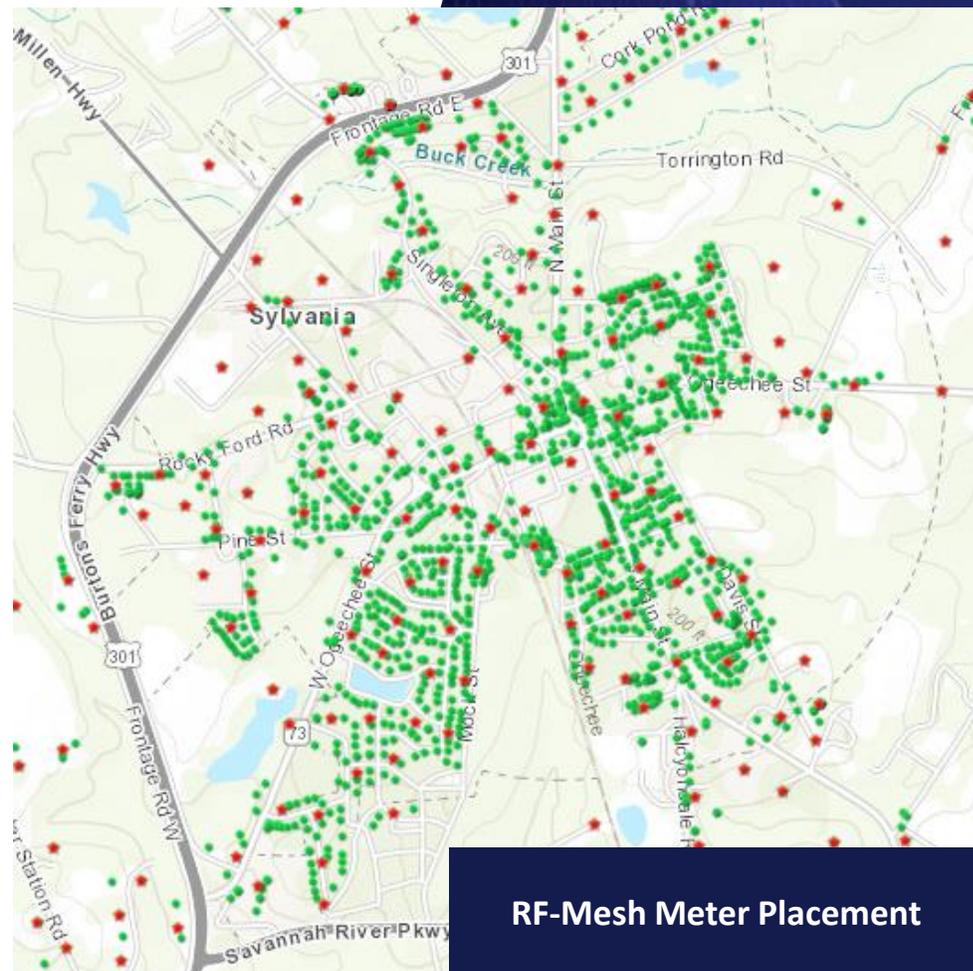
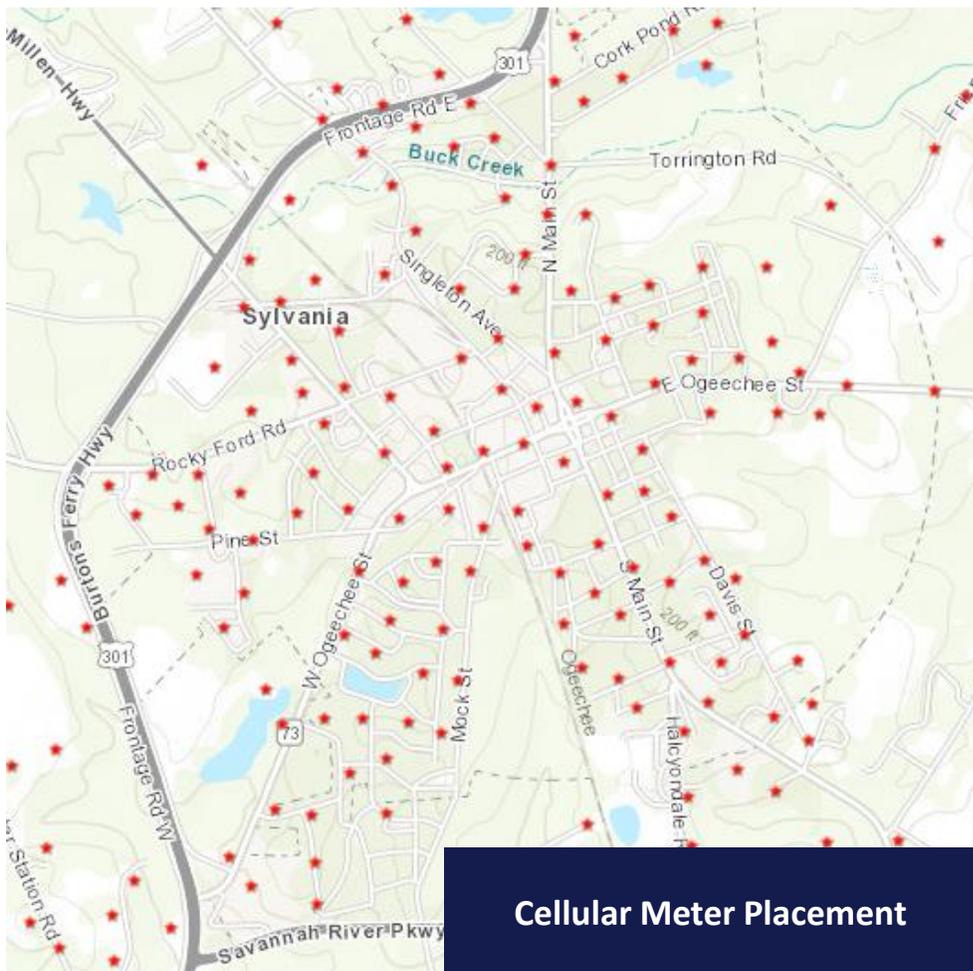
tescometering.com





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING





ZERO-INFRASTRUCTURE AMI

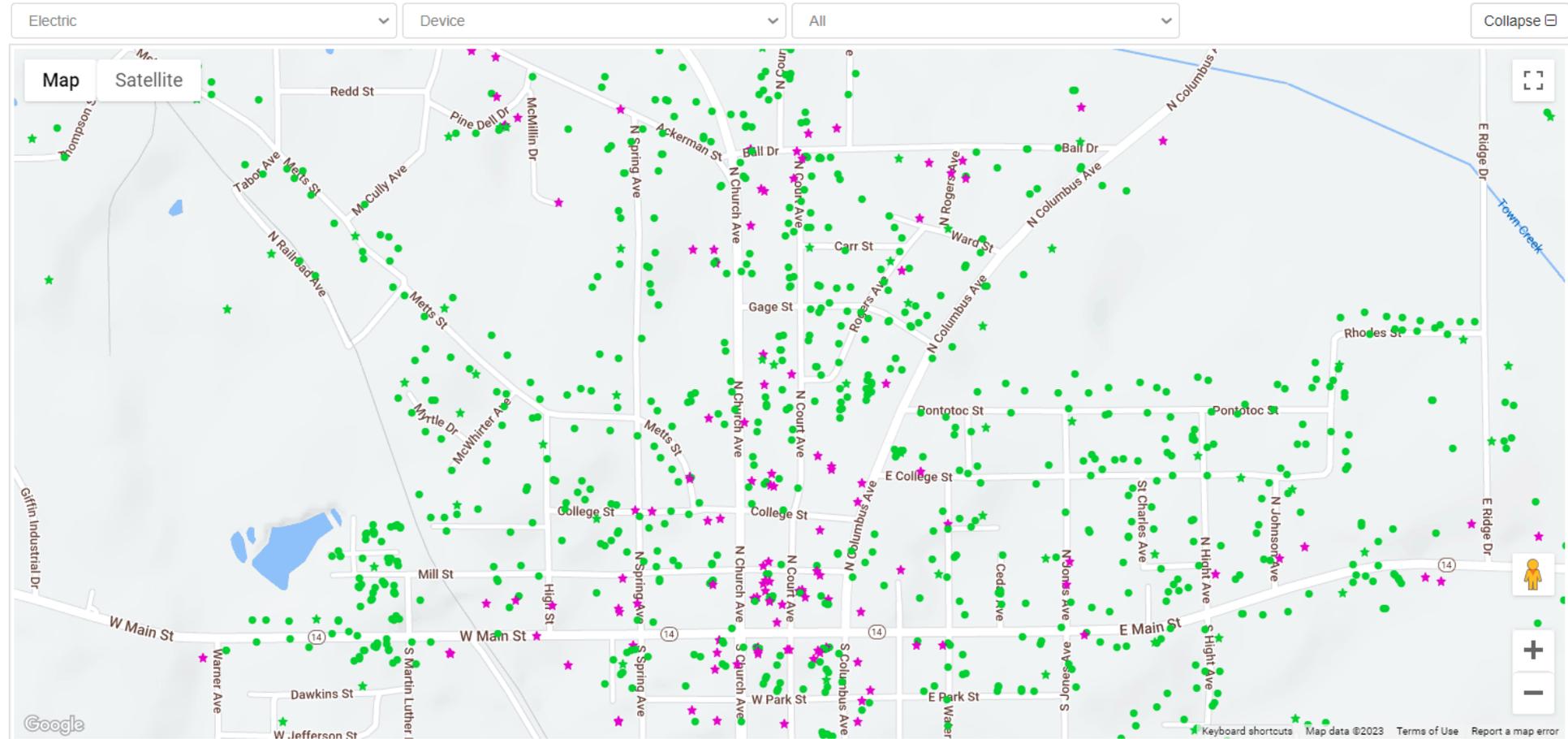


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- CUSTOMERS
- REPORTS
- SYSTEM SETUP
- USERS



ZERO-INFRASTRUCTURE AMI



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BILLING



OPERATIONS



CUSTOMERS



REPORTS



SYSTEM SETUP



USERS

Customer Detail

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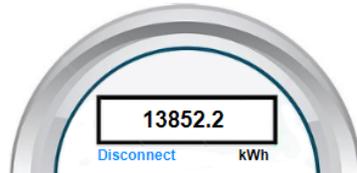


Connected

Recent Activity: TI received at 01:40:44 AM on March 14, 2023



Last Read



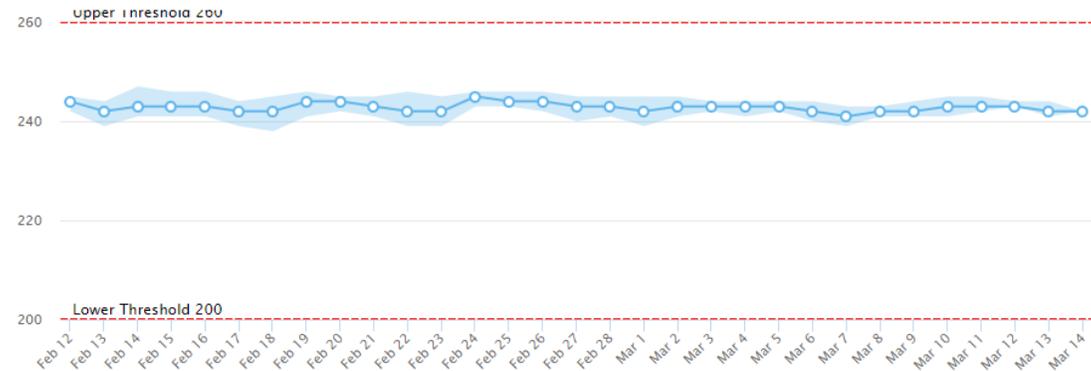
Utility:	Electric
Multiplier:	1
Radio Type:	Nighthawk
Serial Number:	
Meter Number:	
Meter Form Factor:	02
Firmware Version:	3.61
Meter Status:	Installed
Device Type:	Hub
Associated Leafs:	9

Meter Activity

Interval Daily Monthly Yearly

[Consumption](#) [Voltage](#) [Outage](#) [Device Map](#)

Daily Voltage Summary



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ZERO-INFRASTRUCTURE AMI



BILLING



OPERATIONS



CUSTOMERS



REPORTS



SYSTEM SETUP



USERS

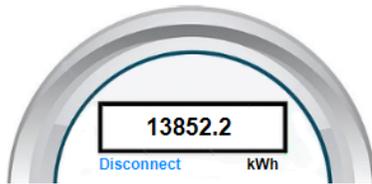
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Connected
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Serial Number:	
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Meter Status:	Installed
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Associated Leafs:	9

Communication Log

Meter Activity

Interval
 Daily
 Monthly
 Yearly

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[Outage](#)
[Device Map](#)

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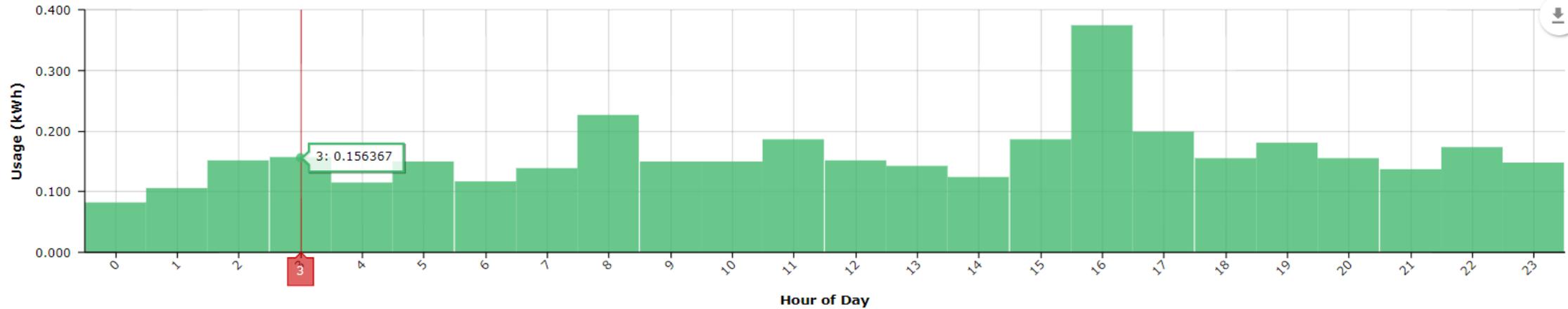
Outage StartTime	Outage EndTime	Event Type	Outage Time	Blink Count
01/08/2023 01:29:11 AM	01/08/2023 01:29:12 AM	Momentary	0:00:01	
02/22/2023 02:43:53 AM	02/22/2023 02:43:54 AM	Momentary	0:00:01	
03/03/2023 10:23:44 AM	03/03/2023 10:23:45 AM	Momentary	0:00:01	
03/05/2023 09:26:33 AM	03/05/2023 09:26:39 AM	Momentary	0:00:06	
03/11/2022 10:45:30 PM	03/11/2022 11:50:18 PM	Sustained	1:04:48	
03/30/2022 06:30:01 PM	03/30/2022 06:30:02 PM	Momentary	0:00:01	
03/30/2022 06:38:29 PM	03/30/2022 06:38:31 PM	Momentary	0:00:02	
05/07/2022 09:31:46 AM	05/07/2022 09:31:48 AM	Momentary	0:00:02	
05/07/2022 09:32:10 AM	05/07/2022 09:32:12 AM	Momentary	0:00:02	
05/24/2022 04:42:07 PM	05/24/2022 04:42:08 PM	Momentary	0:00:01	

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ZERO-INFRASTRUCTURE AMI

Average Hourly Use



Consumption Intervals

Bad Read (QC)
Zero Usage
Low for Day
Critical Peak
High for Day
Estimated Read
Missing Read

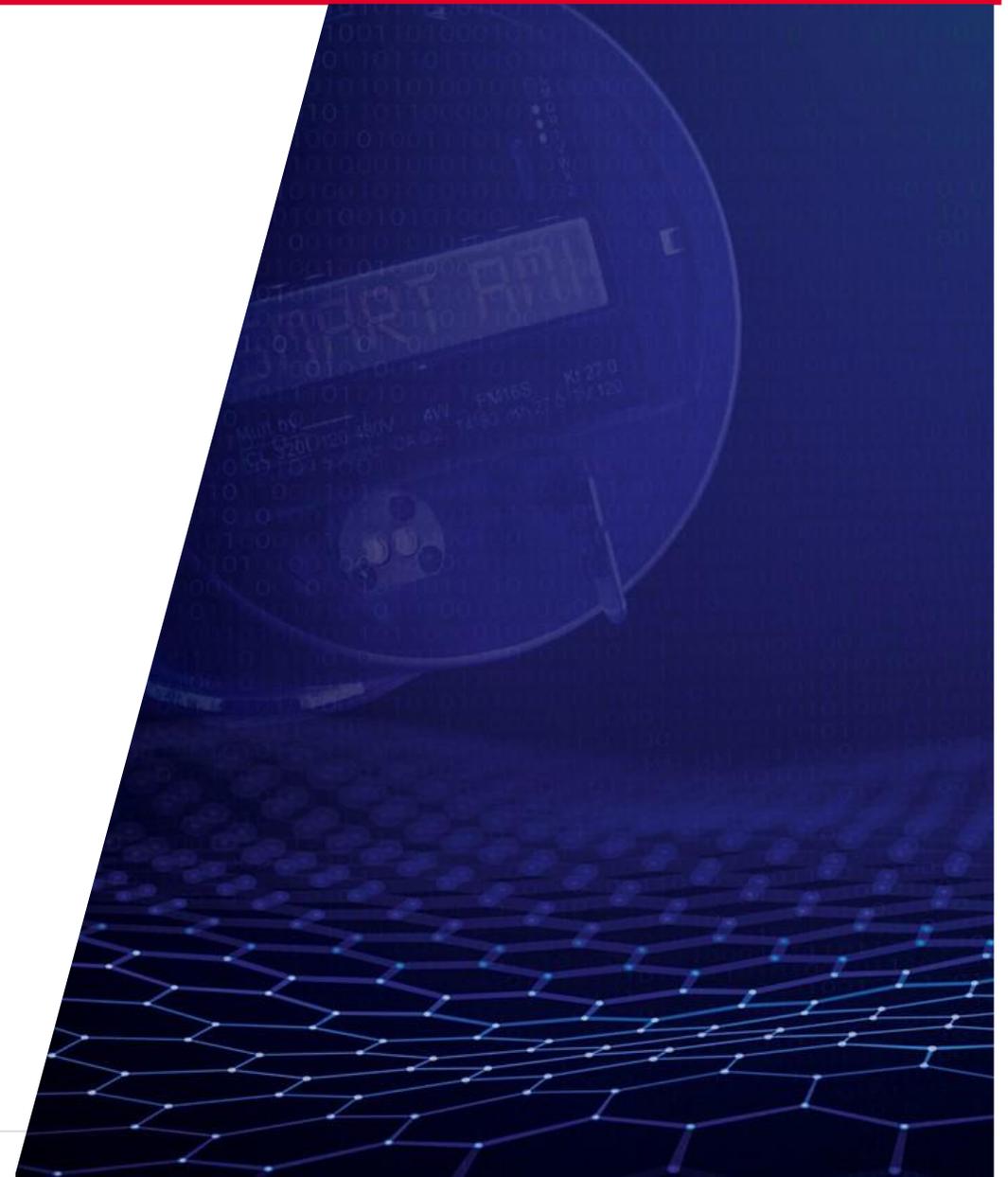
Date	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
03/13/2023	0.046000	0.087000	0.046000	0.046000	0.381000	0.086000	0.045000	0.045000	0.093000	0.368000	0.045000	0.050000	0.080000	0.046000	0.373000	0.372000	0.173000	0.046000	0.046000	0.418000	0.046000
03/12/2023	0.085000	0.049000	0.047000	0.047000	0.047000	0.346000	0.106000	0.046000	0.078000	0.062000	0.046000	0.415000	0.046000	0.046000	0.087000	0.046000	0.079000	0.369000	0.046000	0.086000	0.046000
03/11/2023	0.075000	0.046000	0.406000	0.046000	0.059000	0.075000	0.046000	0.413000	0.046000	0.046000	0.072000	0.063000	0.362000	0.086000	0.047000	0.047000	0.089000	0.046000	0.420000	0.059000	0.046000
03/10/2023	0.046000	0.142000	0.450000	0.046000	0.046000	0.084000	0.063000	0.045000	0.395000	0.059000	0.046000	0.095000	0.046000	0.051000	0.426000	0.046000	0.097000	0.046000	0.064000	0.075000	0.370000
03/09/2023	0.047000	0.047000	0.093000	0.380000	0.073000	0.067000	0.045000	0.088000	0.057000	0.369000	0.081000	0.061000	0.045000	0.094000	0.076000	0.477000	0.087000	0.046000	0.094000	0.046000	0.100000
03/08/2023	0.071000	0.069000	0.046000	0.094000	0.381000	0.093000	0.045000	0.069000	0.079000	0.046000	0.419000	0.058000	0.046000	0.095000	0.046000	0.054000	0.403000	0.046000	0.091000	0.046000	0.050000
03/07/2023	0.060000	0.053000	0.087000	0.046000	0.140000	0.429000	0.046000	0.072000	0.068000	0.045000	0.101000	0.364000	0.072000	0.071000	0.083000	0.152000	1.393000	0.049000	0.092000	0.045000	0.090000
03/06/2023	0.092000	0.046000	0.089000	0.379000	0.046000	0.097000	0.046000	0.046000	0.087000	0.446000	0.061000	0.088000	0.046000	0.062000	0.083000	0.045000	0.095000	0.379000	0.049000	0.091000	0.046000
03/05/2023	0.046000	0.095000	0.046000	0.066000	0.399000	0.046000	0.088000	0.046000	0.046000	0.085000	0.367000	0.090000	0.057000	0.046000	0.091000	0.046000	0.382000	0.077000	0.046000	0.094000	0.046000



ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Louisville Utilities, MS**
 - Outcome:
 - Electric 80% deployed
 - Water 10% deployed
 - 10-30 seconds for on-demand reads, disconnects, demand resets, etc.
 - Nothing to maintain beyond the meters (zero-infrastructure)
 - Standard AMI benefits
 - Preventing truck rolls
 - Outage/voltage reporting
 - Remote reading/disconnect
 - Etc.

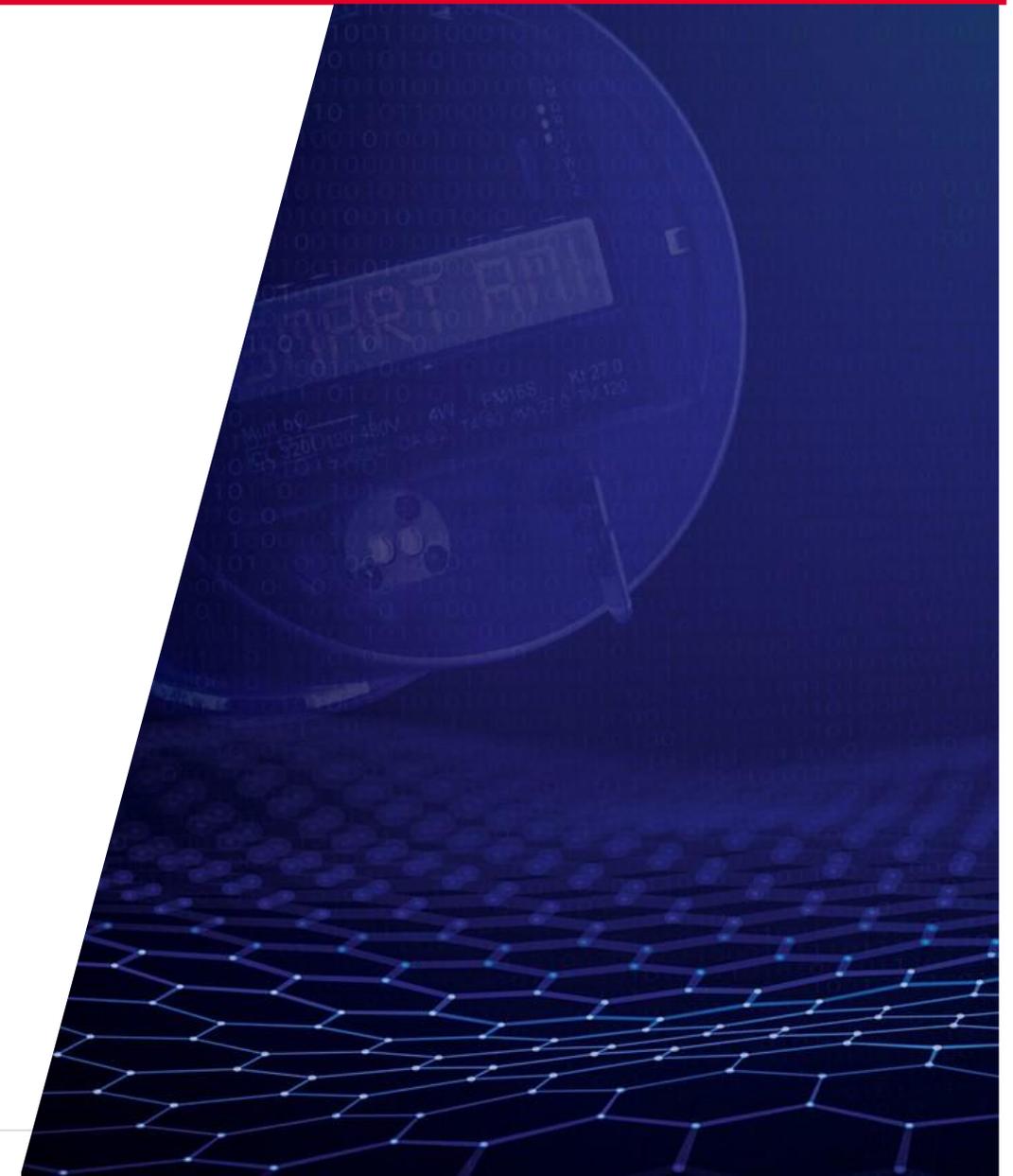




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Louisville Utilities, MS**
 - Challenges/Lessons Learned:
 - Older water meter registers hindering retrofit
 - Meter lead times jumping from 3-4 weeks to 6-8 weeks





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Full AMI
 - **Louisville Utilities, MS**
 - What's next:
 - Leveraging MDM for AMI commands (deeper integration)
 - Using AMI data and CSA MDM for transformer loading, line/water loss recovery and other advanced analytical applications





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Tactical/Targeted Deployment
 - **Lexington, NC**
 - Problem/Need:
 - Targeted remote disconnect solution for electric system
 - Needed to be read by existing drive-by AMR setup
 - Flexibility to deploy anywhere without infrastructure build-out





ZERO-INFRASTRUCTURE AMI

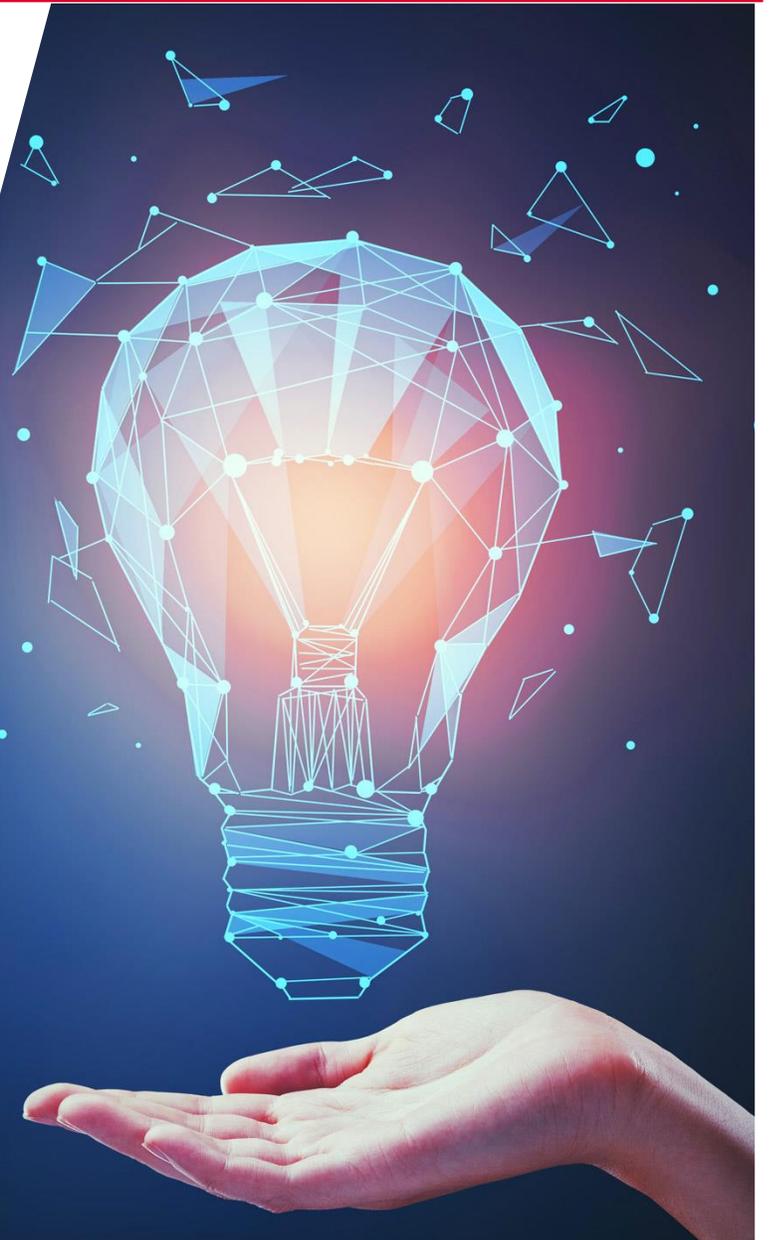
AMI | ADVANCED METERING

- Case Study – Tactical/Targeted Deployment

- **Lexington, NC**

- Solution:

- 100% LTE cellular under-glass solution w/ ERT transmit
- AMI headend for remote disconnect (single and batch), outage, voltage and additional command/visualization options





ZERO-INFRASTRUCTURE AMI



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REPORTS



SYSTEM SETUP



USERS

Electric ▼ Device ▼ All ▼ Collapse ☰

Map Satellite

30/30

Map data ©2023 Google



ZERO-INFRASTRUCTURE AMI

SYSTEM SETUP

USERS



Utility:	Electric
Multiplier:	1
Radio Type:	Nighthawk
Serial Number:	
Meter Number:	
Meter Form Factor:	02
Firmware Version:	3.61
Meter Status:	
Device Type:	Hub
Associated Leafs:	None

Communication Log

Customer Information

Customer Number:	
Customer Name:	
Address	
City	Lexington
State	North Carolina
Zip	27292
Bill Cycle	
Route	

Read Details

Midnight Read on March 14, 2023	5398.22
Last Meter Read at 09:00:00 AM on March 14, 2023	
Meter Reading	5407.72
kWh Received	0
Voltage	244.6 V
Current	1.4 A
Instantaneous Demand (KW)	0.34

History

- Consumption
- Voltage
- Outage
- Device Map

Daily Consumption (kWh)



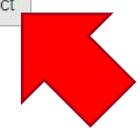
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Meter Control Options

Disconnect Show Status

This device is currently Connected!

Disconnect





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Tactical/Targeted Deployment
 - **Lexington, NC**
 - Outcome:
 - Reliable, scalable and flexible disconnect solution for electric system
 - Integrates with existing drive-by AMR setup
 - Maximized AMR investment

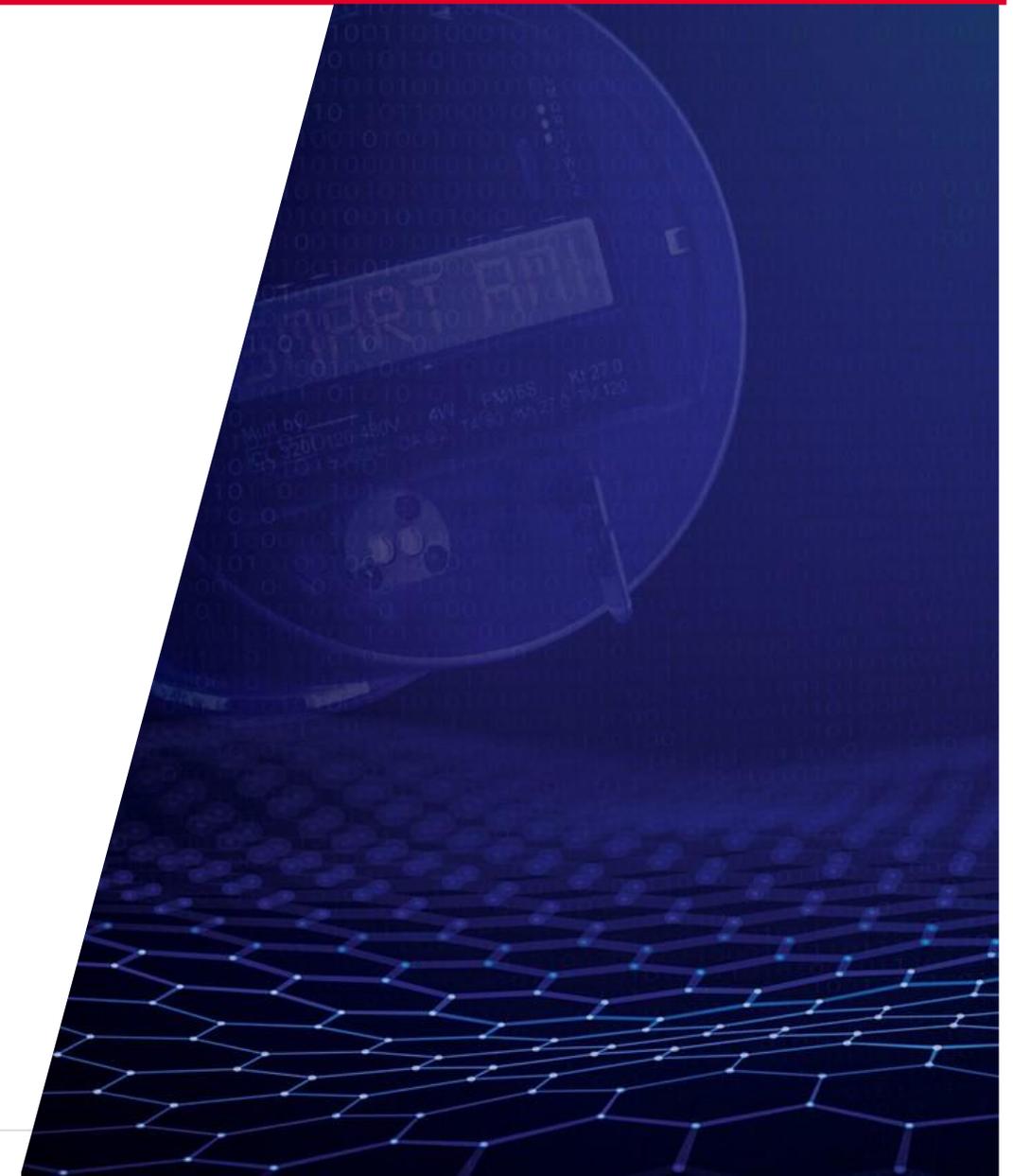




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Tactical/Targeted Deployment
 - **Lexington, NC**
 - Challenges/Lessons Learned:
 - Transition from CDMA to LTE

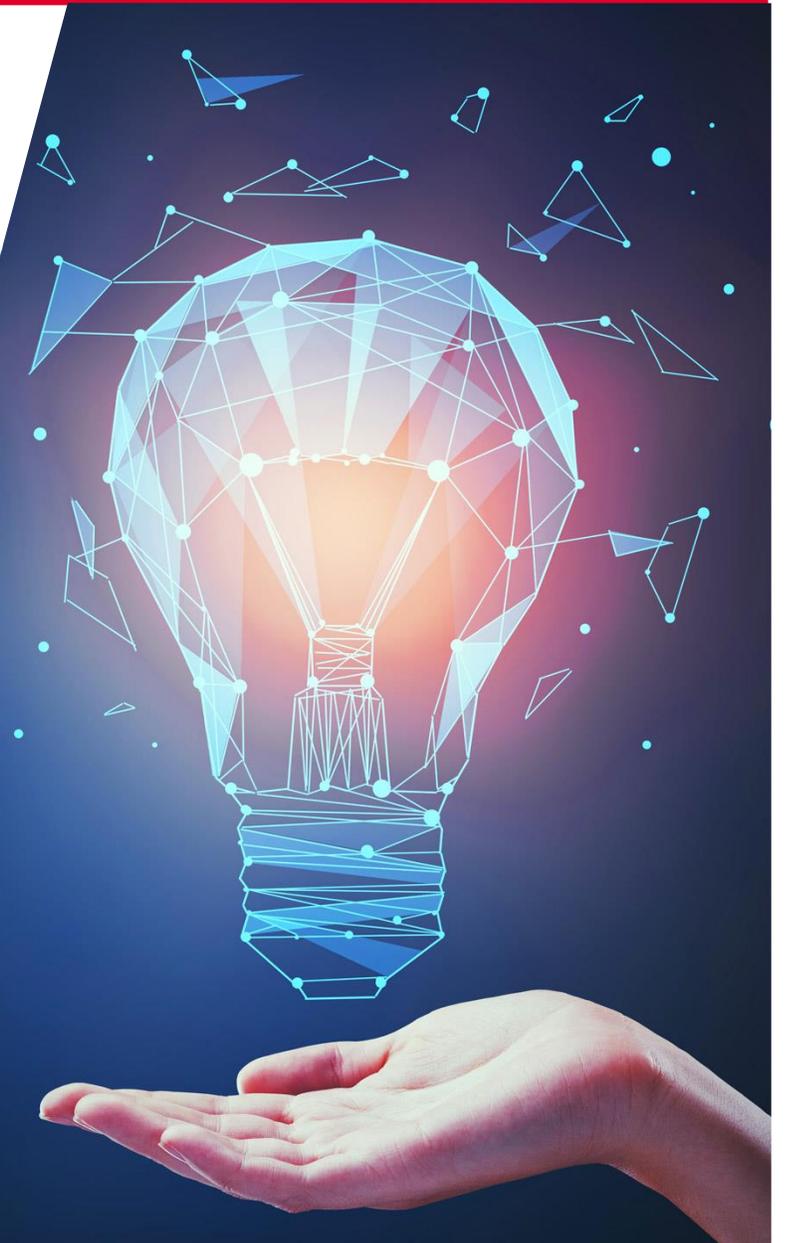




ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Tactical/Targeted Deployment
 - **Lexington, NC**
 - What's next?:
 - Existing system can transition to Cellular-Mesh hybrid system if desired
 - Electric system can act as the communication scaffolding for water and/or gas





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia, GA**
 - Contact:
 - Brian Jaynes, Vice President, Engineering
 - Electric Cities of Georgia (ECG) is a non-profit organization providing strategic and technical services to 52 public power communities with utility operations.
 - Program: Customer Choice





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia (ECG), GA**
 - Program: Customer Choice – Georgia PSC
 - Any provider (IOU, Co-op, Municipal) can bid on customer projects typically 900kW and greater
 - Crypto-mining facilities ~50% - hourly market rates
 - Warehouses, Movie Studios, etc.
 - ECG will work with providers on project bids, rate design, and metering, reading, and billing if needed
 - Typically medium to small utilities
 - ECG is able to handle the complicated rates/ interval data needed for incentive rates.





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia (ECG), GA**
 - Problem/Need:
 - Resource constraints
 - Needed an easily maintainable, under-glass solution
 - Wanted all infrastructure in meter to simplify deployment
 - No need for a cabinet or power source for external modem/ components
 - Cost effectiveness upfront and ongoing a factor
 - Software/Hardware needed to provide interval data (hourly and sub hourly)





ZERO-INFRASTRUCTURE AMI

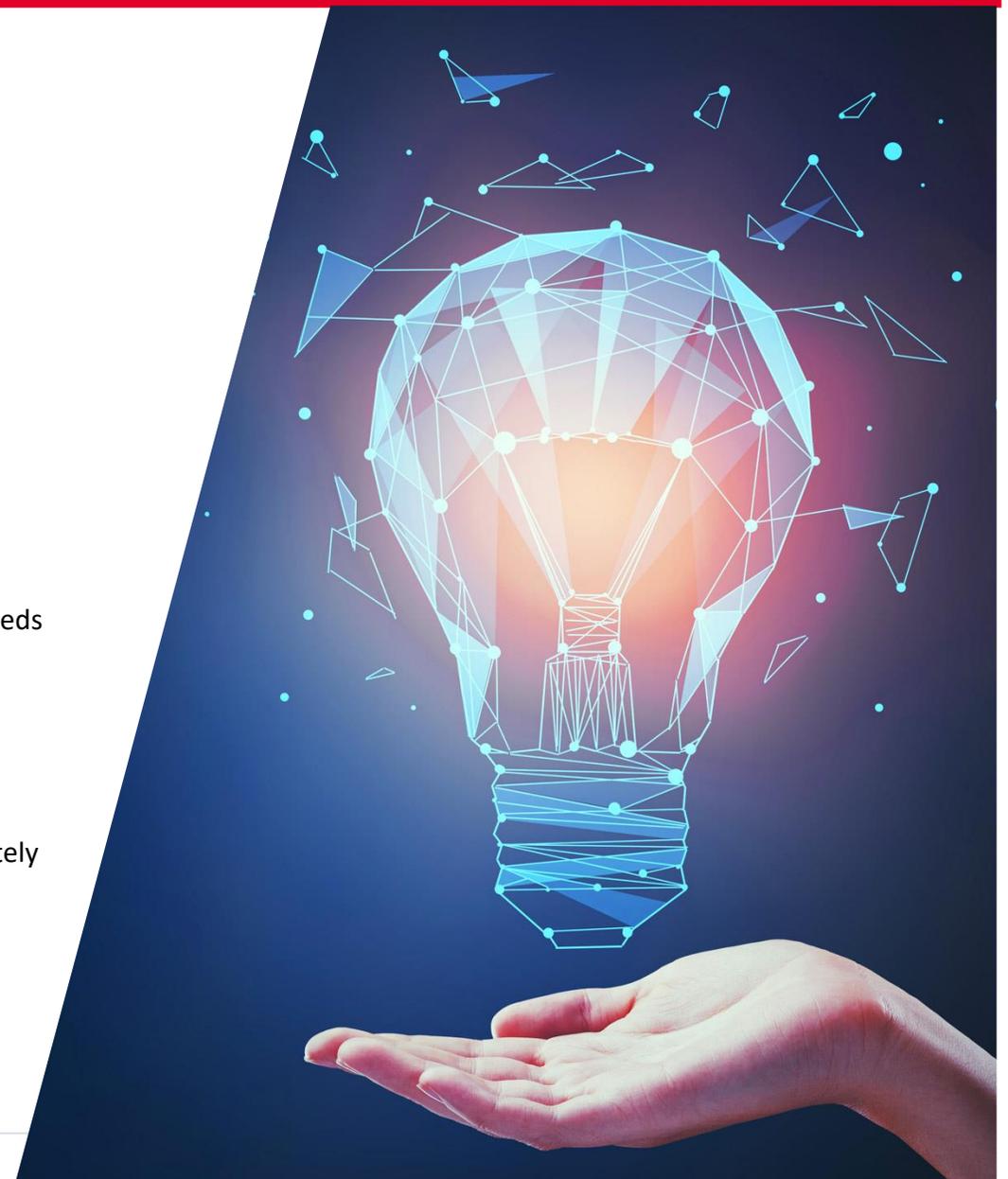
AMI | ADVANCED METERING

- Case Study – Program Specific Application

- **Electric Cities of Georgia (ECG), GA**

- Solution:

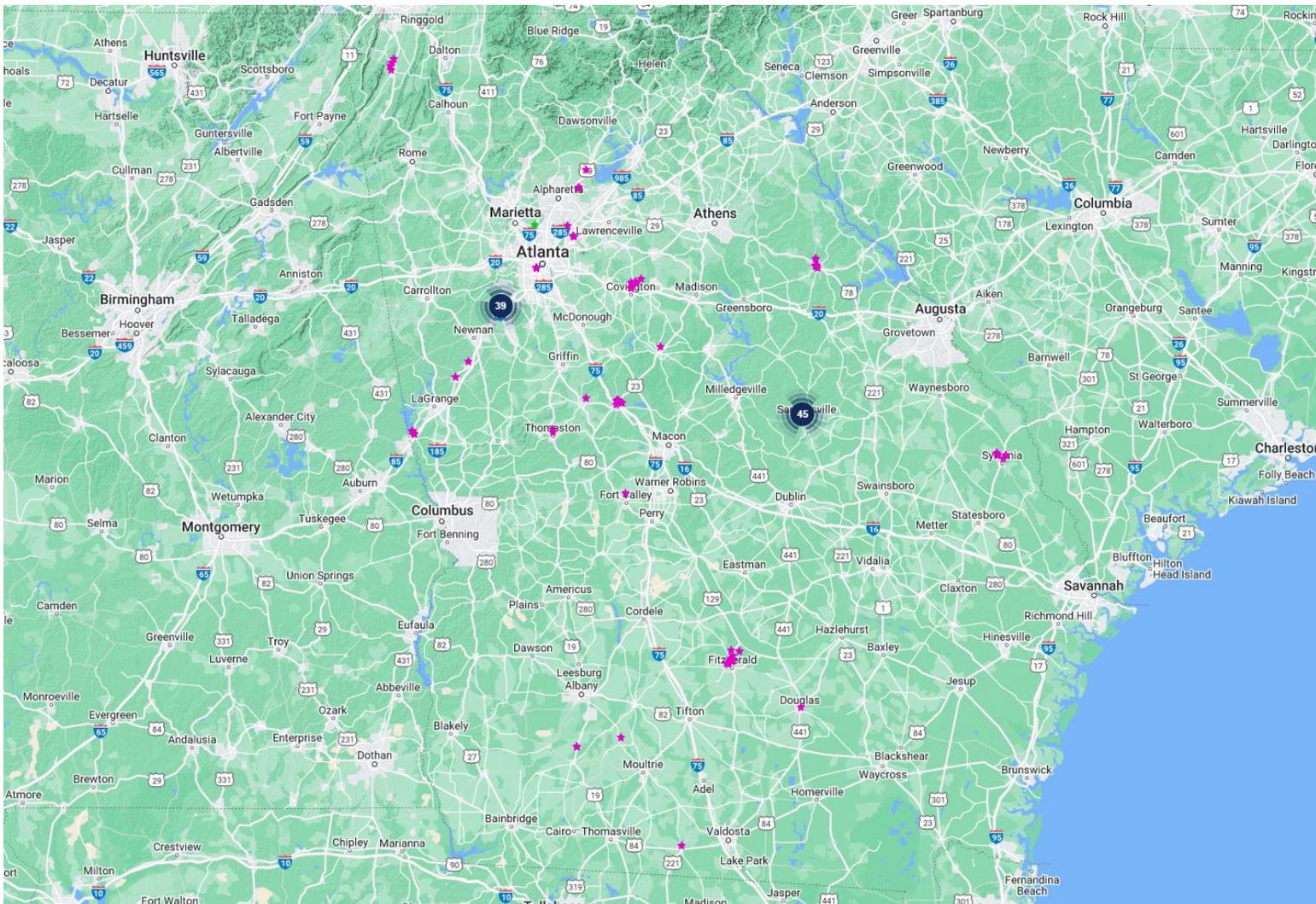
- Evaluated several solutions
 - Laden with cumbersome communications (dial-up)
 - Not cost effectively scalable
 - Lacked the configuration flexibility to meet the ECG's specific needs
- Chose a solution that offers a 100% LTE under-glass option
- Vendor handles all communication contracts
- Majority of locations use a 9S/20 kV2c.
- Headend Software is a scalable AMI dashboard that allows ECG to remotely read and monitor meters across the state of Georgia
- Software exports a file that is used by ECG for customer billing





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING





ZERO-INFRASTRUCTURE AMI



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USERS

Customer Detail

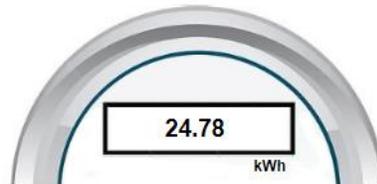
Back Edit Delete

Connected

Recent Activity: ANSI Parsing received at 01:01:20 AM on March 14, 2023



Last Read



Utility:	Electric
Multiplier:	1
Radio Type:	Nighthawk
Serial Number:	
Meter Number:	
Meter Form Factor:	09
Firmware Version:	3.61
Meter Status:	Installed

Meter Activity

Interval Daily Monthly Yearly

Consumption

Outage

Device Map

Daily Consumption (kWh)



Estimated



ZERO-INFRASTRUCTURE AMI

- 
 BILLING
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- 
 USERS

C&I Daily Snapshot

Start Date: End Date:

[Register Settings](#)

Customer Number _____ Customer Name _____
 Address _____ Meter Number _____
 Serial Number _____

Show entries

Filter

Read Date & Time	kWh Delivered	kWh Received	Prev Demand Reset Date	Prev Max KW Delivered	Prev Max KW Received	Max KW Delivered	Max KW Received	KVARH Lead	KVARH Lag	Prev Max KVAR Lead	Prev Max KVAR Lag	Max KVAR Lead	Max KVAR Lag	KVAH Total	Prev Max KVA Total	Max KVA Total
03/12/2023 3:43 AM	23.607	0	01/01/1900 12:00 AM	0	0	0.049	0	0	123.983	0	0	0	0.232	168.6	0	0.305

Phase A Voltage 124.1
 Phase A Voltage Angle 0
 Phase A Current 0.3
 Phase A Current Angle 65.1
 Phase B Voltage 123.6
 Phase B Voltage Angle 240.9
 Phase B Current 0.3
 Phase B Current Angle 334.8
 Phase C Voltage 124.1
 Phase C Voltage Angle 120.4
 Phase C Current 0.5
 Phase C Current Angle 201.4
 Cautions None
 Diagnostics Current Phase Angle Alert
 Errors None



ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia (ECG), GA**
 - Outcome:
 - Grown from 7 initial meters/locations to close to 200 (and growing)
 - System that's both easy to deploy, operate and maintain
 - Can easily access needed hourly and sub-hourly interval meter data
 - Can see almost instantly if locations are mis-wired from system dashboard
 - Speeds up troubleshooting / system roll out





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia (ECG), GA**
 - Challenges/Lessons Learned:
 - Tracking meter inventory
 - Deployment process training





ZERO-INFRASTRUCTURE AMI

AMI | ADVANCED METERING

- Case Study – Program Specific Application
 - **Electric Cities of Georgia (ECG), GA**
 - What's next? :
 - Bi-directional/Solar metering for providers
 - Using same headend software - residential and polyphase



METERING LEADER SINCE 1904



THE EASTERN SPECIALTY COMPANY

QUESTIONS?



A TESCO COMPANY

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TESCO HOSPITALITY SUITE

You're invited...

We would like you to join us in the TESCO Hospitality Suite for networking and more discussions about metering. The discussion will not be exclusively metering.....but we love metering and that is the most common topic.

TESCO Hospitality Suite – Brighton Tower

Monday and Tuesday 8:00 PM – 10:00 PM



We Hope you Can Join Us!

