### Response Basics

<table>
<thead>
<tr>
<th>Utility</th>
<th># events addressed by a First Responder</th>
<th># events addressed by a Crew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>35,679</td>
<td>9,371</td>
</tr>
<tr>
<td>Water/WW</td>
<td>9,908</td>
<td>391</td>
</tr>
<tr>
<td>Gas</td>
<td>7,950</td>
<td>376</td>
</tr>
<tr>
<td>Total</td>
<td>53,860</td>
<td>10,234</td>
</tr>
</tbody>
</table>

- 80% are small enough that a single responder can address
- Majority of events are driven by weather and other external forces
Response Process

- Preparedness
- Planning
- Response
- Customer Interactions
- Demobilization
- Evaluation
Preparedness – Before the Event

- Continuous monitoring of system conditions
- Ensuring materials are in stock
- Ensuring contracts and mutual aid are in place
- Maintaining relationships with city and county agencies
ICS Process is Key to Preparedness

- Maintaining Incident Command System (ICS) readiness
  - Emergency levels
  - Up-to-date documents and checklists
  - On call/rotational response and management staff
  - Manage by objectives
- Continuing operational readiness with training and exercises

**Level 5 – Normal Operations**
**Level 4 – Heightened Awareness**
**Level 3 – Emergency Mode**
**Level 2 – Severe Impact**
**Level 1 – Catastrophic Emergency**

<table>
<thead>
<tr>
<th>Summer Storm (Wind/Lightning)</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers Out of Power</td>
<td>&lt;10,000</td>
<td>10,000 - 30,000</td>
<td>30,000 - 50,000</td>
<td>50,000 - 75,000</td>
<td>&gt;75,000</td>
</tr>
<tr>
<td>Breakers Locked Out</td>
<td>&lt;10</td>
<td>&lt;15</td>
<td>&lt;30</td>
<td>&lt;40</td>
<td>&gt;40</td>
</tr>
<tr>
<td>Number of Events</td>
<td>&lt;100</td>
<td>100 - 200</td>
<td>200 - 400</td>
<td>400 - 600</td>
<td>600+</td>
</tr>
<tr>
<td>Estimated Duration</td>
<td>&lt;1 day</td>
<td>1 - 2 days</td>
<td>2 - 3 days</td>
<td>3 - 5 days</td>
<td>&gt; 5 days</td>
</tr>
<tr>
<td>Storm Category *</td>
<td>TS1 - Weak</td>
<td>TS2 - Moderate</td>
<td>TS3 - Heavy</td>
<td>TS4 - Intense</td>
<td>TS5 - Extreme</td>
</tr>
<tr>
<td>Outage Distribution</td>
<td>Localized</td>
<td>Moderate Spread</td>
<td>Widespread</td>
<td>Widespread</td>
<td>Widespread</td>
</tr>
<tr>
<td>ICS Mode</td>
<td>Operations</td>
<td>ICS w/remote</td>
<td>Full ICS</td>
<td>Full ICS</td>
<td>Senior ICS</td>
</tr>
<tr>
<td>Damage Assessment</td>
<td>No</td>
<td>Consider (10)</td>
<td>Yes (10-20)</td>
<td>Yes (20-50)</td>
<td>Yes (50)</td>
</tr>
<tr>
<td>Extra Contract Crews</td>
<td>No</td>
<td>Consider</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Off System Crews</td>
<td>No</td>
<td>No</td>
<td>Consider</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vegetation Crews</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Preparedness Ensures an Efficient Response

- Ensuring programs are implemented and maintained
  - Vegetation management
  - Predictive and preventative maintenance
  - Century II renewals
Planning – As the Event Begins

- Weather monitoring
- Deployment of ICS – Level 4
- Heightened Awareness
- Storm planning meetings
- Internal communication for storm readiness

**Day 1 Convective Outlook**

- **Tornado Potential**
  - High
  - Medium
  - Low
  - Very Low
- **Max Hail Size**
  - Half Dollar - Golf Ball
  - Quarter - Half Dollar
  - Nickel - Quarter
- **Max Wind Speed**
  - 80+ mph
  - 70 mph
  - 60 mph
  - 50 mph

**Operations Update**

**Status:** Heightened Awareness

KUB has implemented an expanded Incident Command Structure in response to outages in the KUB service territory.

If you typically have storm or emergency response duties, please be advised you may be needed. Please check in with your team leader or supervisor to see if you can assist with the restoration efforts.

Restoration updates will be delivered via message monitor and email as appropriate, approximately every 4-6 hours, throughout the restoration efforts.
Crews React in the Planning Stage

- Material and equipment checks
- Return system(s) to normal and postpone planned work
- Crews are held and/or noticed for response
Move to ICS Level 3
- Use of checklists for all roles
- Many normal functions and services are paused

Resource coordination critical
- Internal restoration crews (KUB and contractor)
- External restoration crews (contractor and other utilities)

Triggers “all-hands-on-deck” philosophy
- Work groups roll into non-traditional “storm mode” duties
- Shifts are moved from 8 to 16 hours
Restoration Philosophy

- **Critical system loads**
  - Hospitals, communications systems, water/wastewater pump stations, and other services vital to public welfare

- **Transmission lines**
  - Backbone of our electric system serving the largest number of customers

- **Substation equipment**
  - Serve large numbers of customers and communities as a whole
Restoration Philosophy

- **Distribution lines**
  - Serve subdivisions, large residential areas, and commercial areas

- **Service lines and transformers**
  - Serve small numbers of customers

- **Balancing aging versus customer volume**
Data Driven Response

- Restoration philosophy supported via technology
  - Advanced meters
  - System protection
  - Smart switches
  - Advanced Distribution Management System (ADMS)
  - Mobile app - FieldWork

- Other data analytics
  - Outage map
  - Restoration reports
Response Resources - Field

- Troubleshooters
- Damage Assessors
- Site Safety Attendant
- Vegetation Management
- Traffic Control
- Restoration Line Crews
  - KUB
  - On-system contract
  - Off-system contract
  - Partnering utilities
Response Resources - Support

- Electric System Operators
- Planner/Schedulers
- Storeroom
- Transportation
- Material Delivery
- Communications
- Customer Service Representatives

- Information Technology
  - Hardware
  - Software
  - Smart device support

- Technical Specialists
  - Safety
  - Environmental
  - Engineering

- Logistical Support
Response Resources - Wastewater

- Plant operators
- Pump station and storage tank operators
- Field responders
- Wastewater system operators
Response Key Factors

- Sizing up the storm
  - Damage types
  - Location
- Safety
Few Customer Impacts but Hours of Work

- Tree on single phase wire with a service
- Impacts 2-4 customers
- Requires
  - Damage Assessor (1)
  - Tree Crew (1)
  - Line Crew (1)
- Job length is 2-3 hours
Many Customers Out – Large Effort

- Trees on transmission lines
- Impacts to thousands of customers
- Requires
  - Damage Assessor (1)
  - Isolation Crew (1)
  - Labor Crew (1)
  - Tree Crews (2)
  - Transmission Line Crews (2)
- Job length is 16+ hours
Customer Focus

- Multiple channels of communication
- Outage Map
  - Estimated Restoration Time (ERTs)

KUB’s Outage Restoration Process

KUB damage assessors (DAs) and line crews begin work to restore power to customers as soon as conditions are safe to do so.

How to Identify Damage Assessment & Line Work

Damage Assessors (DA) are sometimes on-site in pickup trucks before line crews to determine what materials and resources crews need to make each repair. Please drive with caution around DA vehicles, as they make frequent stops to inspect damage and collect information. Once DAs relay necessary information to KUB System Operations, they move to the next outage location to assess there. Line crews in bucket trucks are then able to begin work restoring power as quickly as possible using the information DAs provide.

KUB Order of Restoration

During a typical outage, KUB uses the sequence below to determine the order of restoration. Each sequence is represented by different color outage markers on KUB’s outage map.
Interacting with Customers

- Social media
- Local media
- Community partners
KUB Customer Mobile App – Report Outage

Outage Center

5600 Main St.
Outage Reported: 08/32/20 at 3:38am
Estimated time to full restoration: 3 hours

REPORT AN OUTAGE

Outage Center

Report an Outage

Please select where you would like to report an outage:

- Service Address
  - 5600 Main St
- Use my current location
- Search by address

NEXT

Report an Outage

Please select the outage type:

- Service Type: Electric
- Problem Type: Power Off
- Additional Information: Tree on Line
- Anything else we should know?
  - Bad storm last night, wires down close to my house behind the metal fence

Please enter your contact information:

Name
Phone Number: 8271283749

SUBMIT OUTAGE REPORT

Thank you!

Your outage has been successfully reported. We'll get working on it as quickly as possible.

Service type: Electric
Problem type: Power Off
Additional Information: Tree on Line
Address: 123 Main St.
Demobilization – Closing the Event

- Move to ICS Level 5 – Normal Operations
- Gradual reduction of resources as they finish their work
  - Release partnering utilities and off-system crews first
  - Roll back support services
- Transition to other post-storm mode functions
  - Follow up work to permanently repair any temporary repairs
  - Non-outage repair work
  - Patrol for tree and system damage risks
Evaluation – Improving for the Next Event

- Debrief sessions held with key resources
- Collect ideas, improvements, and suggestions from field staff
- Create action items and assign initiatives through our Corrective and Preventative Action Program (CAPA)
  - Damage assessment
  - Incident command
  - Maximizing limited resources
## Historical Storm Comparison

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers out</td>
<td>40,000+</td>
<td>75,000+</td>
<td>127,000+</td>
<td>56,000+</td>
<td>54,000+</td>
<td>32,000+</td>
<td>32,000+</td>
</tr>
<tr>
<td>Poles replaced</td>
<td>100</td>
<td>142</td>
<td>151</td>
<td>81</td>
<td>40</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Transformers replaced</td>
<td>45</td>
<td>91</td>
<td>132</td>
<td>40</td>
<td>19</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Customer Events</td>
<td>N/A</td>
<td>7,754</td>
<td>23,283</td>
<td>2,700</td>
<td>3,363</td>
<td>1,018</td>
<td>4,500</td>
</tr>
<tr>
<td>Customer calls</td>
<td>50,000+</td>
<td>45,000+</td>
<td>220,000+</td>
<td>71,000+</td>
<td>28,000+</td>
<td>21,000+</td>
<td>21,600+</td>
</tr>
<tr>
<td>Restoration length</td>
<td>8 days</td>
<td>7 days</td>
<td>7 days</td>
<td>3 days</td>
<td>2.5 days</td>
<td>1.5 days</td>
<td>4 days</td>
</tr>
<tr>
<td>Estimated cost</td>
<td>$2 million</td>
<td>$2 million</td>
<td>$4 million</td>
<td>$2.5 million</td>
<td>$1.2 million</td>
<td>$900,000</td>
<td>$1.5 million</td>
</tr>
</tbody>
</table>

* June 2011 event includes two separate storms on June 21 and June 23
Example - Storm Readiness

- NWS predicted weather event one day in advance
- NWS predicted slight risk level of storms from 4–10 p.m.
- Holiday weekend
- KUB ensured key resource availability
Example - Storm Impact

- Storm began 10:30 p.m. Saturday
- Winds over 50 miles per hour
- Widespread trees, limbs down
- Over 54,000 customer outages
- Fifth largest storm in 10 years
- Large number of trouble events
Example - Storm Response

- Implemented ICS
- Holiday weekend response
  - 116 KUB and contractor crews
  - 18 off-system crews
  - 16,000+ employee hours worked
  - 60+ administrative staff
- Service restored 2.5 days
- FEMA reimbursement
Peak customer outages at 36,000

Focus (red dots)
- Critical loads
- Transmission lines
- Substation breakers
Example – Sunday 6:00 AM

- Outages reduced to less than 10,000
- Focus
  - Extend red dots due to new events coming in
  - Begin to address purple dots
Example – Sunday 6:00 PM

- Outages reduced to less than 3,900
- Focus
  - Remaining purple dots
  - Begin to address green dots
Example – Monday 6:00 AM

- Outages reduced to less than 1,300
- Focus
  - Remaining green dots
  - Begin to address orange dots
Example – Monday 6:00 PM

- Outages reduced to less than 200
- Focus
  - On all outages remaining
  - Significant work remains
Example – Tuesday 6:00 AM
CANNOT thank you enough for your unbelievable assistance today. You saved us!!
– Cliff Rodgers, Knox County Elections Administrator