INNOVATIVE STORM IMPACT ANALYTICS
An e-book dedicated to helping you meet key operational challenges.
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Chapter 1
An industry under pressure
An industry under pressure

It is the “new norm.” The frequency of major outages has increased sixfold in the past 20 years,* leaving utilities under ever increasing pressure to tackle severe weather threats to their operations.

Further complicating matters are:
• Aging infrastructure
• Savvy, technology-driven customers
• Increased regulatory demands

A costly issue
It is widely known that more than 60 percent of utilities in the United States lose an average of more than $100,000 per year in revenues due to outages.** As an extreme example, superstorm Sandy alone caused $65 billion in economic damages.

Aside from inconvenience, utility customers also pay a price for outages:

<table>
<thead>
<tr>
<th>Duration</th>
<th>Residential</th>
<th>Commercial</th>
<th>Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Momentary</td>
<td>$2.64</td>
<td>$733</td>
<td>$2,294</td>
</tr>
<tr>
<td>One-hour</td>
<td>$3.27</td>
<td>$1,074</td>
<td>$3,943</td>
</tr>
<tr>
<td>Sustained***</td>
<td>$3.62</td>
<td>$1,293</td>
<td>$5,124</td>
</tr>
</tbody>
</table>

***Sustained interruption has a mean time of 106 minutes.
Contributing factors
In recent years, increasingly volatile and extreme weather events have significantly impacted the operations and bottom lines of many utilities.

Contributing to the problem are obsolete grid assets and a lack of automation, both of which can make it difficult to predict and prepare for the impact of weather threats.

Customers also have greater expectations in regard to operational resilience. Adding to the pressure, social media puts utilities at an increased risk for public scrutiny if unhappy customers complain openly about poor outage response times. In addition, there is greater regulatory and political scrutiny over outages.

In this e-book we’ll discuss these three key factors, the case for change, and the new customer experience in the future.

New, innovative storm impact analytics technology will help utilities better prepare for storms — reducing restoration times, cutting costs, and minimizing impacts on customers.
Increasing weather volatility

In recent years, severe and increasingly volatile weather has significantly impacted utility operations and their bottom lines.

Due to the number of superstorms in recent years, there have been thousands of outages, and utilities have spent significant unplanned dollars on recovery and restoration efforts.

Some key figures include:

- Outages due to the weather: 44 percent
- Major grid disruptions related to the weather: 78 percent*
- The frequency of major outages has increased six-fold in the past 20 years
- In the last decade, extreme weather losses have totaled $476 billion

If you look at other trends, such extreme rainfall amounts in recent years, it also supports the argument that this volatility will continue into the future.

Utilities are under pressure to tackle severe weather risks to their operations. To make matters even more challenging, electric utilities have an “aging infrastructure” problem.

A 2013 American Society of Civil Engineers (ASCE) report showed that overall electric grid investments are not on track to meet their 2020 goals. The industry is behind by several billion dollars, both in transmission and distribution investments. This aging infrastructure is put under considerable pressure during larger weather events.

Due to this, utilities are working with leaner organizational structures, often contracting or sharing resources with other utilities using mutual assistance framework to manage significant weather events.

By 2020 the distribution investment gap will grow to $57 billion; the transmission gap will widen to $37 billion. Now is the time for solutions.
Increased expectations

Utilities are also facing the heat from customers and regulators. Today, there is less public tolerance for major outages, most likely stemming from increased media and social media attention. Growing regulatory and political scrutiny leads to fines and denied costs when recovery rates increase.

Executive concerns about reputation
There is increasing media attention around weather events, and it is amplified by social media, which tracks these events much more closely. This makes it extremely important for utilities to have a good customer communication strategy backed by as much data as possible. Sometimes it is not so much about what a utility is doing as it is about what they plan to do. Predictive information, no matter how small, can be extremely valuable.

The regulatory side is not much different. Utilities are scrutinized, needing to justify all of their operational decisions during significant weather events. This makes data critical to optimal weather-based decisions.
How do we respond today?

Response is critical to successfully managing severe weather events. There are typically three response timeframes for a major weather event: before, during, and after.

Current technology has traditionally supported utilities with data and services, hours — even days — before a storm, as well as during.

**Before and during the storm**
- Track all relevant forecast metrics
- Meteorological consultations
- Alerts to both approaching and real-time conditions
- Tracking severe weather through customized risk indices
- Situational awareness throughout the duration of the storm
Chapter 2
How can we do better?
How can we do better?

While it is imperative to have “before and during the storm” weather intelligence that projects the severity of a storm, any predictive information that allows utility operations teams to get an initial estimate of the impact of an incoming storm can be used to save time and resources during storm response efforts.

Some of the key questions that need to be quickly answered with predictive information are:

• How bad is asset damage? Where?
• What resources and materials are needed for repairs?
• What requests for help or commitments for helping others should be made through mutual assistance?
• How did the forecast change during the event?
• How can I adjust my crewing needs to meet a specific estimated time of restoration goal for my region or service territory?
• How can we improve communication between utilities?
• How can we plan a coordinated response to an event?
Introducing predictive damage response

Ultimately, a storm impact analytics model applies a combination of weather parameters — such as high winds, lightning, ice accretion, and more — to determine the strength of incoming storms and the associated risks at various time horizons.

Combine this information with non-weather data — such as vegetation, utility asset records, and other variables — to create an application that predicts and displays severe weather threats as they move through a service territory.

Statistical modelling and predictive analytics help determine the impact of weather on assets at specific geographical locations. Such an application can produce decision points, reports, and predicted impact scenarios for any incoming severe weather event.

Finally, this is translated into impact statistics, such as damage and restoration effort estimates.
Training the model

Train the model in three simple steps:
1. Identify historic storm-related outages that have impacted the service territory using corresponding outage data. Thunderstorms, ice storms, wind storms, heat, population density etc.
2. Gather as much data relevant to the processes that influence outages.
3. Aggregate all of the variables on a grid or geographic unit (2 km, 5 km, by town, by region, etc) and you’re ready for modeling impact on assets and outages per unit area.
Chapter 3

The new experience
A new interface

The advanced storm impact analytics application is built on DTN’s WeatherSentry® Online platform using its proprietary forecasts, which intersect with a utility’s own asset data.

With the storm impact analytics model, a utility can map all parts of its service territory impacted by forecasted severe weather. Such insight can improve the speed of service restoration while reducing associated costs. Further, this information can be used to enhance customer communications.

This solution can help a utility better prepare for future storms and identify at-risk areas within its service territory, supporting targeted hardening efforts. It also allows utilities to work with multiple scenarios, simulating how different conditions can evolve during a severe weather event. This can help utilities optimize their response times and restoration strategies.
The results

New datasets will deliver new results, which will help the utility industry thrive and grow.

Increasing situational awareness throughout the service territory will not only improve the ability to identify at-risk utility assets, but also populations and vital facilities at risk, such as mission-critical infrastructure locations, hospitals, and schools.

Crew analytics, including capacity and need, will be captured to help support staging response and scheduling around shifts, making hold overs and on-call decisions more intuitive. Mutual assistance needs will be more easily identified and coordinated.

Working with first responder organizations and other community leaders will become the norm, supporting better informed decisions and training opportunities for mutual emergency response scenarios.

Proof and evidence of the situation at the time of the decision will be archived for executive and regulatory agencies. Further, a scenario management model will improve ETRs.
Looking to the future

Turning weather forecasts into actionable data for such things as asset damage prediction can improve operational efficiencies, as well as short and long-term planning.

It is vital that utilities move beyond simply looking at a weather forecast to deriving the weather’s impact and predicting damage from severe weather. Doing so helps utilities optimize restoration and recovery efforts within their service territory.

DTN, the University of Connecticut, and Eversource Energy are partnering to bring innovative storm impact modeling capabilities to the broader utility industry.