



DR^x for Reliability Optimization



DR^x RELIABILITY OPTIMIZATION OVERVIEW DR^x – DRIVING DIGITALIZATION



Our lightweight, cost-effective solution delivers operational and predictive analytics of big data, focusing on the 6D's of Digitalization: Data Validation, Data Integration, Data Access, Data Literacy, Data Democratization, and, above all else, Deep-Dive Data-Driven Insight Generation. Our application **boosts reporting speed, enables real-time asset management, optimizes reliability, and leverages advanced statistical predictive analyses** through machine learning.



Next Level Predictive Analytics

Because the system is built on a Machine Learning AI backbone, DR^x will also provide predictive analytics based on circuit and lateral performance to better target preemptive work, saving outage minutes and extra costs.



What to Do?

But what if you easily consolidate all of that Reliability, Asset/GIS, and cost data into one place and know exactly what to do with it to answer the company's most pressing reliability questions?



Data Overwhelm

There is more reliability data available than ever before, but instead of creating deeper insights and better actions, most utilities are drowning in overwhelm.



All of that combines to be the most powerful Reliability Optimization support system on the market.



The DR^x Solution

Enter DR^x for Reliability Optimization: We focus on the 6D's of Digitalization and Analysis Acceleration. We provide access to insights in minutes that used to take weeks or months to develop across several siloed teams. For example:

- Defining the efficient frontier on critical work like hazard tree removal or animal guard replacement
- Balancing various investments and work packages across disciplines

COMMON CHALLENGES

- Utilities are under pressure to meet constant or tightening targets under changing conditions, and don't have the tools to prove how regulatory framework changes would be mutually beneficial to the company, regulator, customers, etc.
- It's difficult to pinpoint the specific circuits and segments for specialty programs and how much to spend
- Complex questions take a long time to answer, for example around forecasting to annual reliability targets and necessary reallocation of spend/resources and costs



BECOME A RELIABILITY LEADER



Speedily, Easily Answer Challenging Questions

Quickly answer questions from executives, regulators and external stakeholders with less effort and greater insight into the underlying drivers of reliability trends and/or which solutions should be adopted.



Support Beneficial Regulatory Frameworks

Robust analyses and evidence to support mutually beneficial regulatory framework changes and/or to plan appropriately for tightening targets given changing operating conditions (i.e. weather volatility / storm intensity).



Allocate Investment Optimally, Company-Wide

Don't simply set spending per region based on historical levels; rather, use data to allocate reliability investments optimally, considering efficient frontiers across asset types and specific programs, targeted to deliver maximum system-wide customer benefit

HOW DR^x CAN GET YOU THERE



Circuit Level Reliability Benchmarks and Targets

Benchmark performance of each circuit with similar circuits of peers across a variety of dimensions (both internally and externally); identify key outage causes, or areas for improvement to achieve top quartile performance



Worst Performing Circuit Analyses

Measure / forecast WPC risk, enable mid-year repairs, VM interventions, load transfers, and targeted system improvement efforts. Trend WPC recidivism to facilitate refinement of strategies and investment levels.



Reliability Forecasting

Know (and communicate) where the business is at any time during the year with respect to reliability targets, and regulatory commitments - both for reallocating resources and priorities and to clearly manage expectations.



Optimal Reliability Investment Targeting

Determine which circuits and segments to invest in, how much to spend, and which reliability improvement programs/solutions to apply to minimize risk and maximize performance.



RELIABILITY MANAGEMENT

Optimize reliability spending decisions, address worst-performing circuits, and set circuit-level reliability targets with peer benchmarks. Drive regulatory changes, refine strategies, and improve system performance efficiently.

OUTAGE TRENDS & CAUSES

Optimize reliability spending decisions with detailed cause analyses and integrated mapping. Drive regulatory changes, meet targets, and address complex inquiries effortlessly while demonstrating optimal resource allocation.

WORST PERFORMING CIRCUITS

Measure and forecast WPC risk, enable mid-year line maintenance or VM interventions and target system improvement efforts. Trend recidivism to facilitate refinement of strategies and investment levels.

PEER BENCHMARKS

Go well beyond your historical system-level Reliability benchmarks, to define circuit level reliability targets with peer benchmarks that show performance gaps of each circuit.



VEGETATION MANAGEMENT

Prove that your current VM program is optimal and be able to quantify the impact on VM Spending changes on reliability. Define the optimal cycle in years as a function of veg exposure, number of VM related outages, CI and CMI impacts, etc.



ASSET RISK PERFORMANCE

The Asset Class Strategies section provides deep dive analyses and optimization (of replacement, location, etc.) for various asset classes such as Reclosers, URD Cables, Wood poles, Distribution Transformers, etc., configured to meet your specific needs. Here we show Underground Cables as an example.



DISTRICT OPERATIONS

Analyze productivity and spending across barns/dispatch centers. Identify top performers and share best practices. Optimize capital project allocation across different areas.



ANALYTIC SANDBOX

The Analytic Sandbox enables custom chart and table creation. Choose chart type, dimensions, expressions, boundary conditions, and filters. Sort, add averages, and trend lines to the resulting chart.



VISUAL ANALYSIS

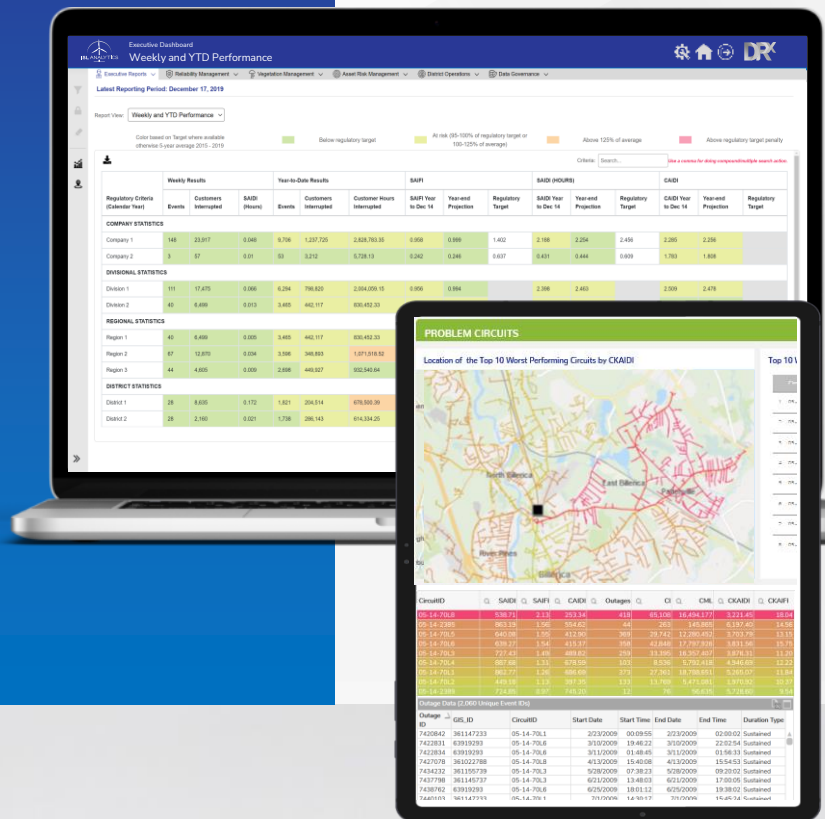
The Visual Asset Register allows the user to select a performance metric (i.e. CI, CMI, Outages, etc.) which is then geo-mapped across the feeders to create a visualization of individual feeder performance across the service territory.

DR^x RELIABILITY OPTIMIZATION MODULE HIGHLIGHTS

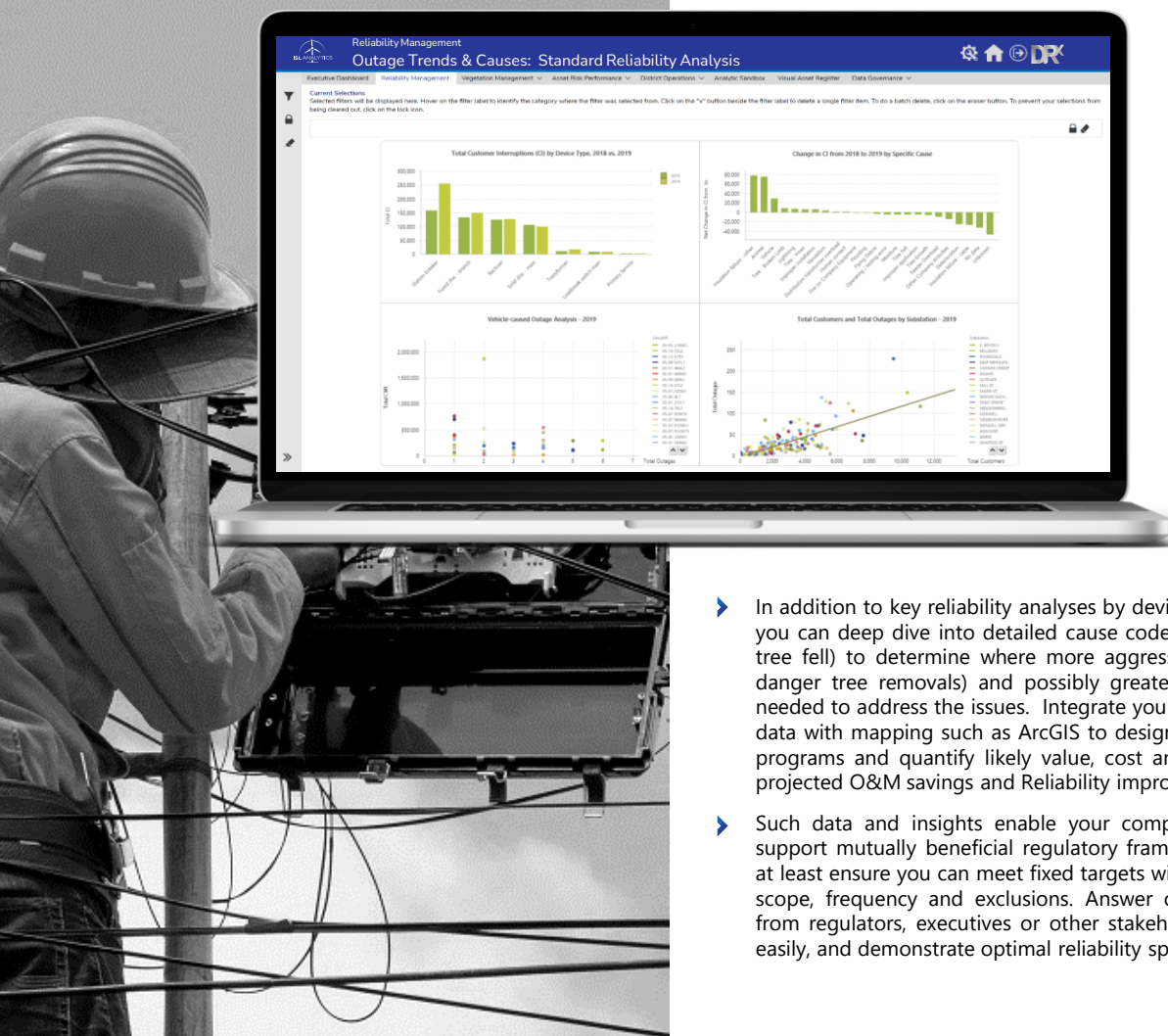
EXECUTIVE DASHBOARD & REPORTS

Custom Executive Dashboards at Your Fingertips

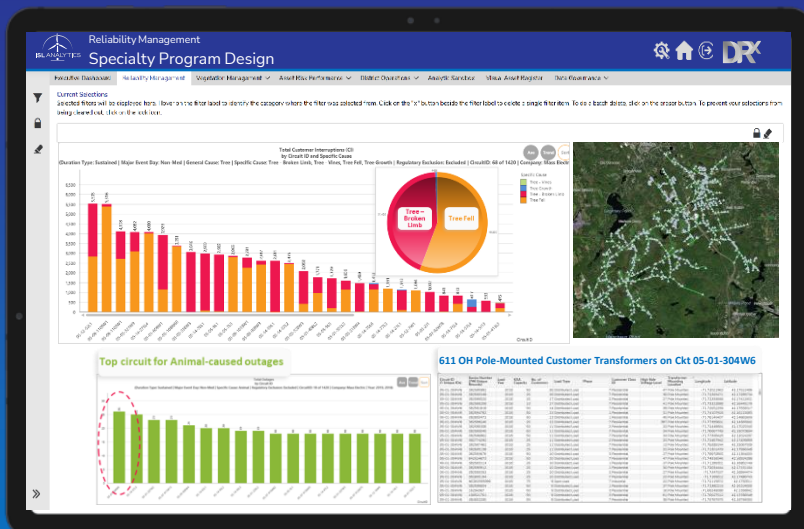
- ▶ Get a clear picture of distribution system "hot spots" at a glance, tailored to what you want to see.
- ▶ Drill down yourself or send data with requests for further investigation to your team.
- ▶ Quickly "See" (with integrated asset, outage and customer data mapping) where problems or critical issues are located on your system.
- ▶ Understand the impact of current outage events on YTD and projected Year-End results vs. targets.
- ▶ Choose the KPIs and key data that are meaningful to you, grouped into dashboard topics and visuals.
- ▶ Key domains include Reliability, Problem Circuits, Investment Levels, Inspection/Repair Compliance, Storm Analysis/Prep, and much more.



RELIABILITY MANAGEMENT: OUTAGE TRENDS & CAUSES



- In addition to key reliability analyses by device type and cause, you can deep dive into detailed cause codes (i.e. tree limb vs. tree fell) to determine where more aggressive programs (i.e. danger tree removals) and possibly greater spend might be needed to address the issues. Integrate your enterprise system data with mapping such as ArcGIS to design optimal specialty programs and quantify likely value, cost and ROIC based on projected O&M savings and Reliability improvements.
- Such data and insights enable your company to drive and support mutually beneficial regulatory framework changes, or at least ensure you can meet fixed targets with changing storm scope, frequency and exclusions. Answer complex questions from regulators, executives or other stakeholders quickly and easily, and demonstrate optimal reliability spending decisions.



- Explore the root causes of your outages as well as trends (issues becoming worse as well as those already improving), then delve into specific problem circuits that will benefit from specialty mitigation programs / investments.

RELIABILITY MANAGEMENT: WORST PERFORMING CIRCUITS

Measure and forecast WPC risk, enable mid-year line maintenance or VM interventions and target system improvement efforts. Trend recidivism to facilitate refinement of strategies and investment levels.

WORST PERFORMING CIRCUIT INDUSTRY CHALLENGES

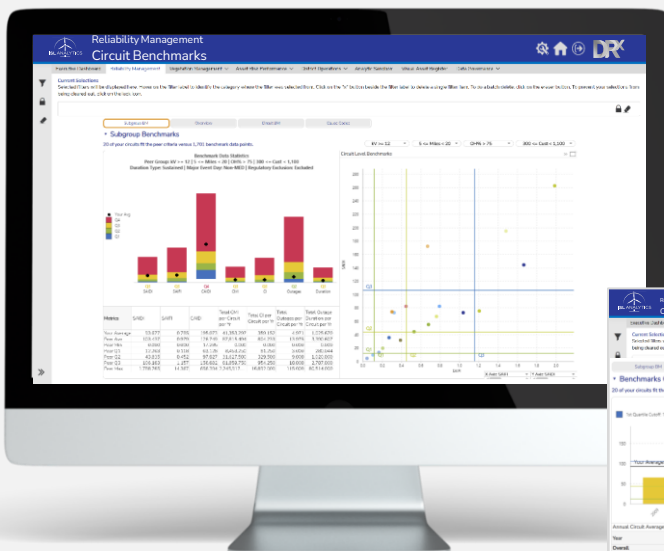
- Many regulators require utilities to report the list of "Worst Performing Circuits" (or Feeders) each year (i.e., the 5% or 10% of circuits with the worst SAIFI and SAIDI).
- Some regulators place penalties on repeat offenders showing up on this list multiple times in a given period. In at least one case, a utility could be fined up to \$7M per "Chronic circuit" appearing on the list for 3 successive years for both SAIDI and SAIFI.

DR^x WORST PERFORMING CIRCUIT BENEFITS

- DR^x provides users with powerful statistical analysis, forecasting, and risk mitigation capabilities – to measure and forecast WPC risk, to enable mid-year line maintenance or VM trimming interventions and to target system improvement efforts.
- DR^x helps to reduce risk from Worst Performing Circuits
- For Problem Circuits: Implement interventions commensurate to the underlying causes of outages / reasons for extended restoration times
- For Poor Performing Circuits: Apply statistical analytics to narrow focus of direct intervention to a subset of these circuits
- DR^x also trends recidivism (i.e., repeat listings in various years over the last decade) to facilitate refinement of asset strategies, line design/configuration and investment levels.

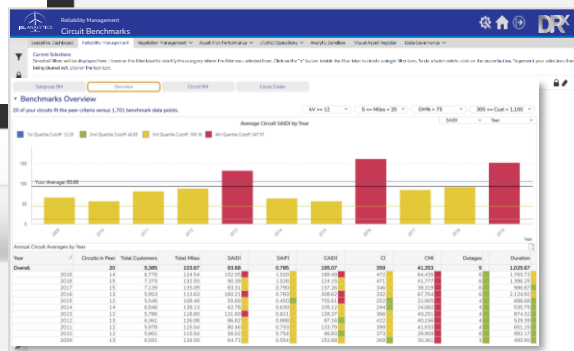
RELIABILITY MANAGEMENT: PEER BENCHMARKS

Go well beyond your historical system-level Reliability benchmarks, to define circuit level reliability targets with **peer benchmarks** that show performance gaps of **each circuit**.



Circuit Level Reliability Benchmarks and Targets

Benchmark performance of each circuit with similar circuits of peers across a variety of dimensions (both internally and externally); identify key outage causes, or areas for improvement to achieve top quartile performance.



Gain insights on Tree Related Outages, including their location, timing, and type. Demonstrate the optimization of your current VM program and quantify the impact of VM Spending changes on reliability. Determine the optimal cycle in years based on Veg exposure, number of VM related outages, CI and CMI impacts, etc.

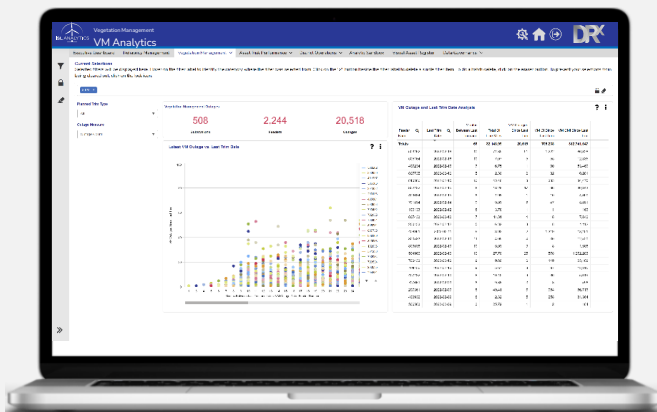


DR^x VM Benefits

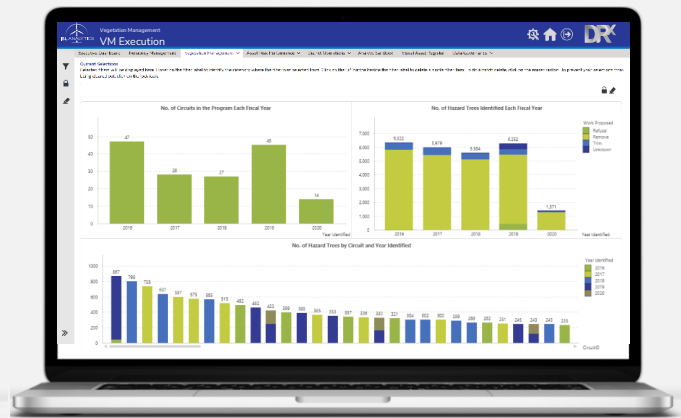
- Quick analyses of all Tree related outages, including more targeted danger tree analyses. Analysis and predictions for reliability impacts of the vegetation management (VM) program
- Trend analyses (costs, productivity, miles/danger trees, right-of-way acres, etc.) and optimization of trim cycles
- A performance dashboard to track progress vs. plan for the entire VM program
- Comparative performance of Contractors, Crews, Foresters, etc.
- Geospatial mapping for planning, analysis, and pattern recognition
- Cost optimization for all VM spending (for cost reductions and cost increases)
- A repository that integrates all data required to effectively manage your VM outreach program

Understand Your VM Performance Results and Better Manage and Optimize Your VM Program

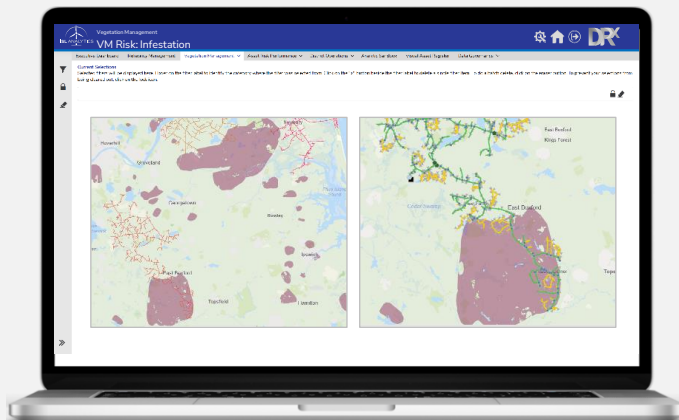
The robust DR^x VM Module covers VM Deep Dive Outage Analyses, VM Strategy, VM Work Planning, and VM Execution.



VM Analytics: Latest VM Outages vs. Last Trim Date



VM Execution: Danger Tree Removal Tracking and Documentation



VM Risk: Infestation
Merge GIS, CYME, and other data with state shape files to identify system risk from insect infestations (for example, Gypsy Moth or Ash Borer Beetle).



VM Strategy: Cycle Trim Savings and Risk Analysis

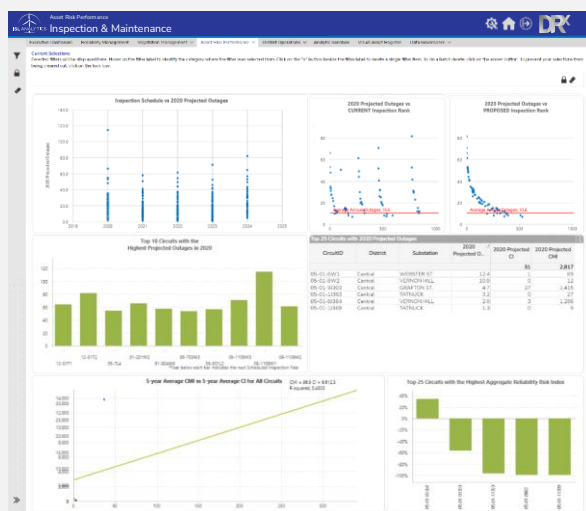
The Asset Risk Performance section covers various critical sub-sections, including Investment Optimization and Inspection & Maintenance (highlighted here) as well as Asset Class Strategies, described on the following pages.



The **Investment Benefits** section provides insights around effectiveness of investments shown by avoided CMI per money spent by individual circuit as well as rollup area (i.e., District), prioritization of circuits for rebuild, reliability spend vs. longer term performance, cost outlier views, and more.

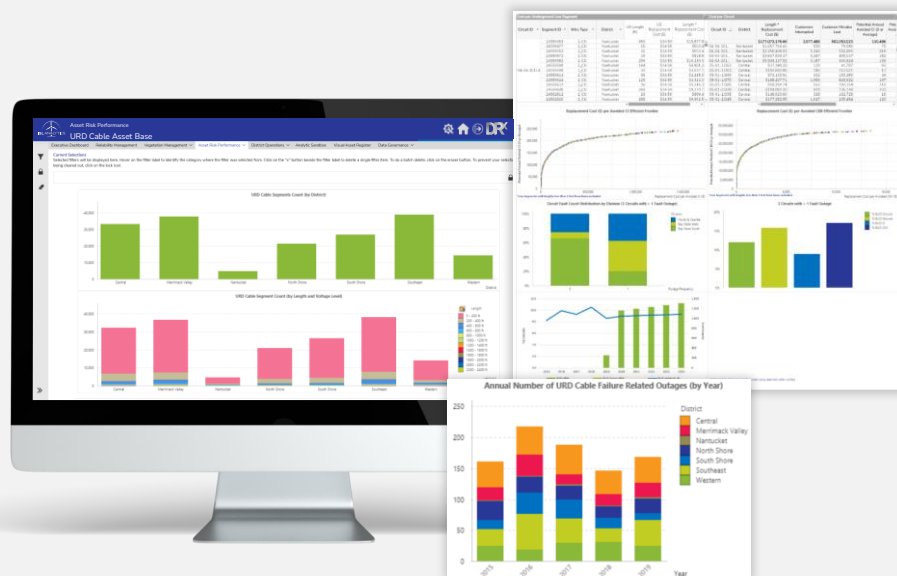


The **Inspection & Maintenance** section shows project outage views, both [raw] and in combination with inspection schedule, a current vs. proposed inspection schedule by circuit, and circuit prioritization based on aggregate risk. These analyses lay the foundation for discussions with the regulator about optimizing I&M program efficiency and effectiveness and may also serve as a catalyst for reconsideration of associated capitalization practices.





PRACTICAL APPLICATION: URD CABLE TARGETED REPLACEMENT STRATEGY USE CASE



Understand Your URD Cable Asset Base and Determine an Optimal Replacement Strategy

A company utilized DR^x to identify which cable segments had faulted and been repaired multiple times but had not yet been replaced. Based on calculated stress on adjoining upstream segments, they were able to **develop a risk model to prioritize which segments to replace**.

The graphics to right illustrate the URD Cable Asset Base along with associated outage, and replacement analyses.

DISTRICT OPERATIONS

This sections provides Productivity analyses across different types of barns/dispatch centers (i.e. OH, UG, Substation), including O&M spend breakdowns by center and activity as well as a spend cost matrix view. **Identify your best performing centers and spread their best practices.**

Analyze Capital projects by barn/dispatch center (OH, UG) and individual Capital project. See the spread across areas and reallocate as needed.



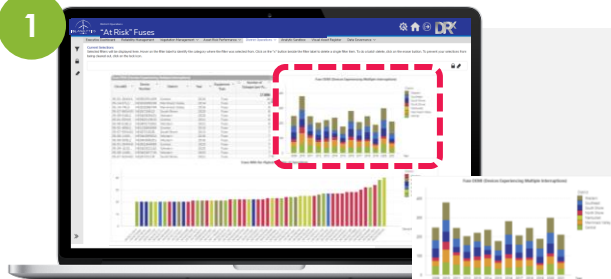


PRACTICAL APPLICATION: RECLOSER AND FUSE SAVER OPPORTUNITIES USE CASE

The DR^x platform has powerful abilities to blend analytics with visualization to enable analysts and managers to see how various strategies will play out, and where new or additional assets like reclosers or fuse-savers (mini-reclosers) make sense to install next.

For one utility, we found underutilization of reclosers compared to the industry's ramp-up of installing fuse-savers. Using DR^x, we analyzed historical reliability to pinpoint optimal fuse-saver locations on their circuits.

1



Analysis was conducted on the frequency of fuse operations and the reliability impact of such outages.

200-300 fuses operate multiple times each year across the system, some as many as 6 times.

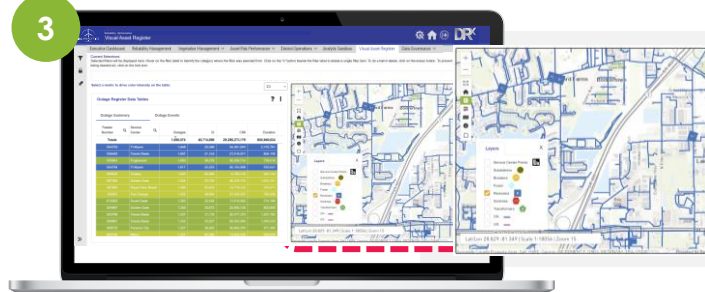
40-50k (~4%) CIs and over 9M (~7%) CMI's each year stem from these outages.

2



We calculated the cost benefit for each potential replacement then ranked these fuses in terms of greatest benefit / cost ratio (i.e., lower cost per avoidable CI and CMI).

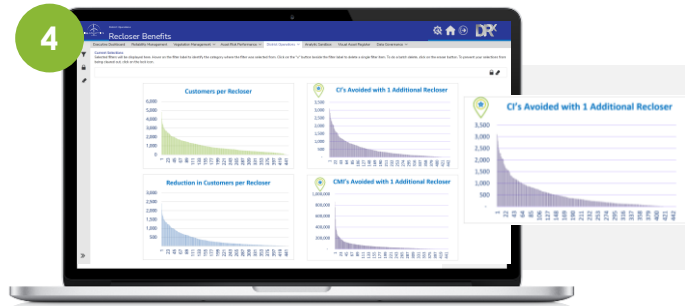
3



The number of reclosers ranged from 13 to 1 per circuit, with no reclosers on more than 60% of circuits.

The placement of reclosers within each circuit were sometimes heavily focused in a narrow portion of the circuit.

4

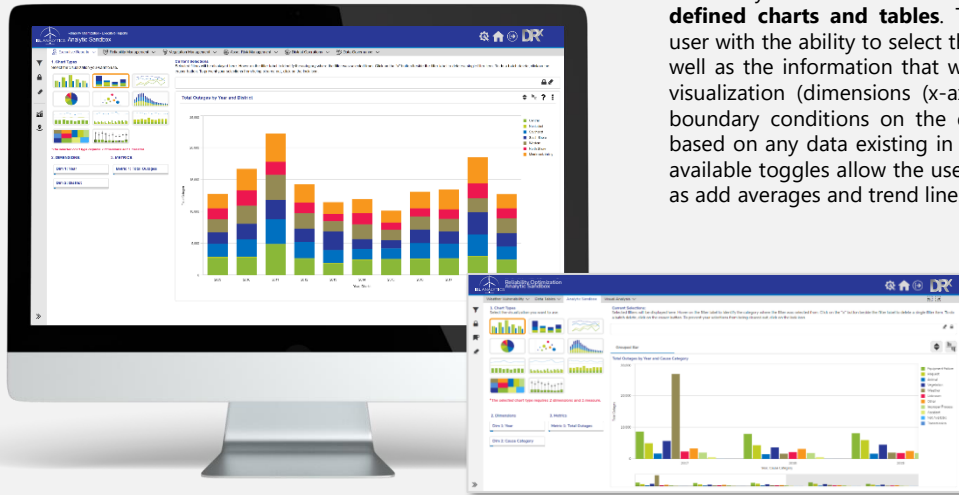


DR^x analyses estimated the benefit (in reduction of CIs and CMI's) that 1 or 2 additional reclosers could have on each circuit.

We found more than 60 opportunities to save 1,000 CIs/year or more by adding a recloser. Similarly, over 65 opportunities were identified to save 100,000 or more CMI's/year by adding a recloser.

ADDITIONAL ANALYSIS CAPABILITIES

ANALYTIC SANDBOX

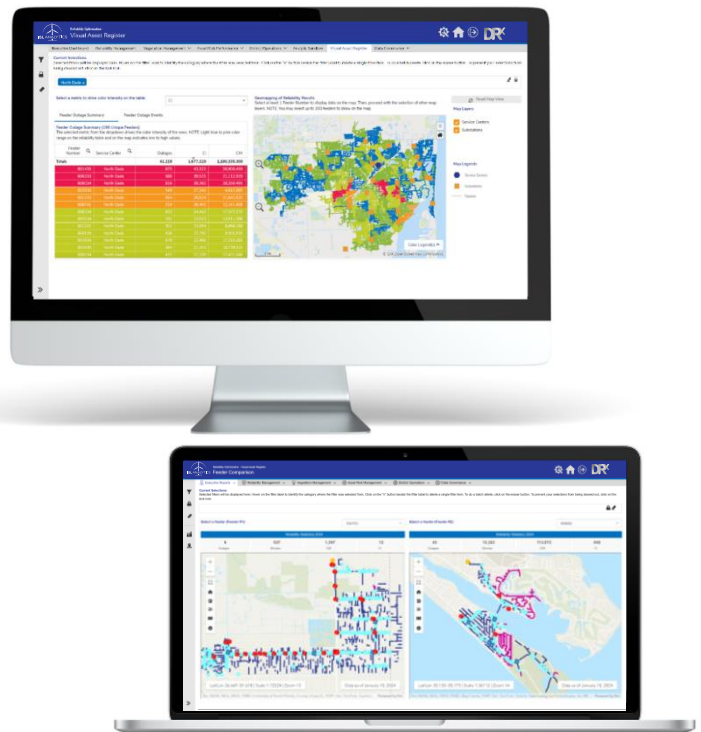


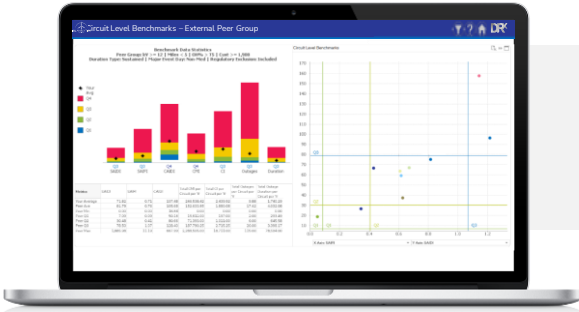
The Analytic Sandbox allows for the **creation of custom, user-defined charts and tables**. The available options provide the user with the ability to select the type of chart to be generated as well as the information that will be utilized to feed the selected visualization (dimensions (x-axis), expressions/measures (y-axis), boundary conditions on the data, and filters of your choosing based on any data existing in the application). Once created, the available toggles allow the user to sort the resulting chart as well as add averages and trend lines.

VISUAL ANALYSIS

The Visual Analysis section includes the Visual Asset Register and Feeder Comparisons. The **Visual Asset Register** geo-maps performance metrics (CI, CMI, Outages, etc.) across feeders, visually representing their performance in the service territory. Color coding indicates performance levels. Users can also include additional assets like substations and reclosers in the geo-mapped results.

The Feeder Comparison section **enables users to directly compare two feeders, quickly revealing performance differences** (CI, CMI, Outages, etc.) and providing geo-mapped visualizations. Users can differentiate asset characteristics, such as underground vs. overhead segments, associated substations, and feeder size, etc.





1

Go well beyond your historical system-level Reliability benchmarks, to define circuit level reliability targets with **peer benchmarks** that show performance gaps of **each circuit**.



2

Understand your current **worst performing circuit profile** and the probability of having "repeat offenders" for consecutive years, as well as the effectiveness of your current problem circuit program.



3

Explore the **root causes** of your outages as well as trends (issues becoming worse as well as those already improving), then delve into specific problem circuits that will benefit from **specialty mitigation programs / investments**

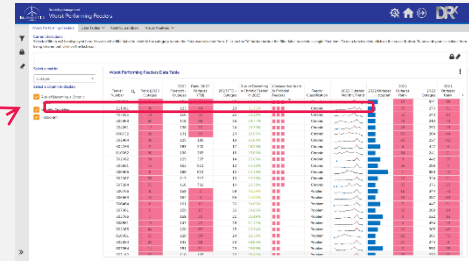
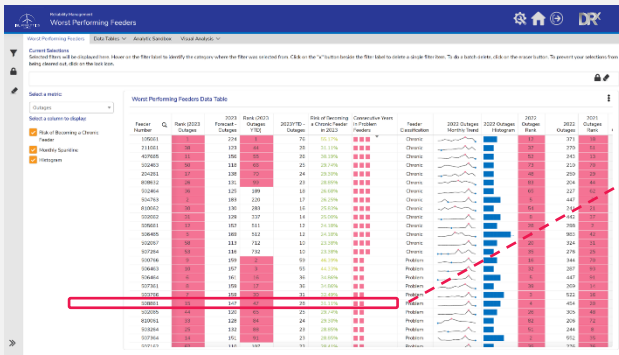


4

Analyze detailed cause codes (i.e. tree limb vs. tree fell) to determine where more aggressive programs (i.e. danger tree removals) and possibly greater spend might be needed to address the issues. **Integrate** your enterprise system data with Google Earth to **design** optimal specialty programs (i.e. Animal Guards) and **quantify likely value, cost and return on Capital** based on **projected O&M savings and Reliability improvements**.

With these data and analyses, enable your company to **drive and support mutually beneficial regulatory framework changes**, or at least ensure you can meet fixed targets with changing storm scope, frequency and exclusions. **Answer complex questions** from regulators, executives or other stakeholders quickly and easily, and **demonstrate optimal reliability spending decisions**.

1 Assess the risk of new and repeat worst performers, up-to-date and at-a-glance



Forecast the risk of each 2-year worst performing circuit hitting the WPC list for a third year – i.e., moving from 57.9% in January to 87.4% in June. Ensure improvement measures are in place.

INTELLIGENT AUTOMATION AT YOUR FINGERTIPS

2 Benchmark your individual circuits against other companies

*Actual demo results

"Your benchmark data shows that you're performing very well with the exception of these 2 circuits."

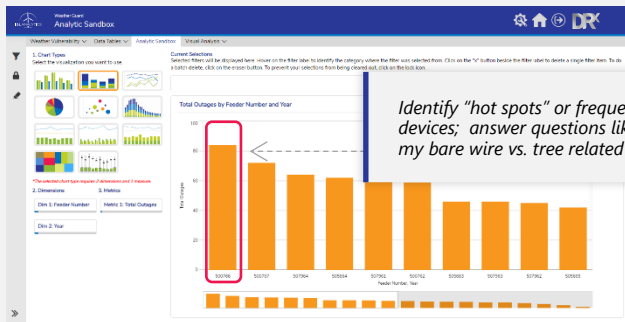
"Team, do we have improvement programs for those circuits?"

"Not yet, but we will by the end of the day."



ACHIEVE NEW DEPTHS OF TRANSPARENCY DRIVING ACTION

3 Visualize your assets in new ways

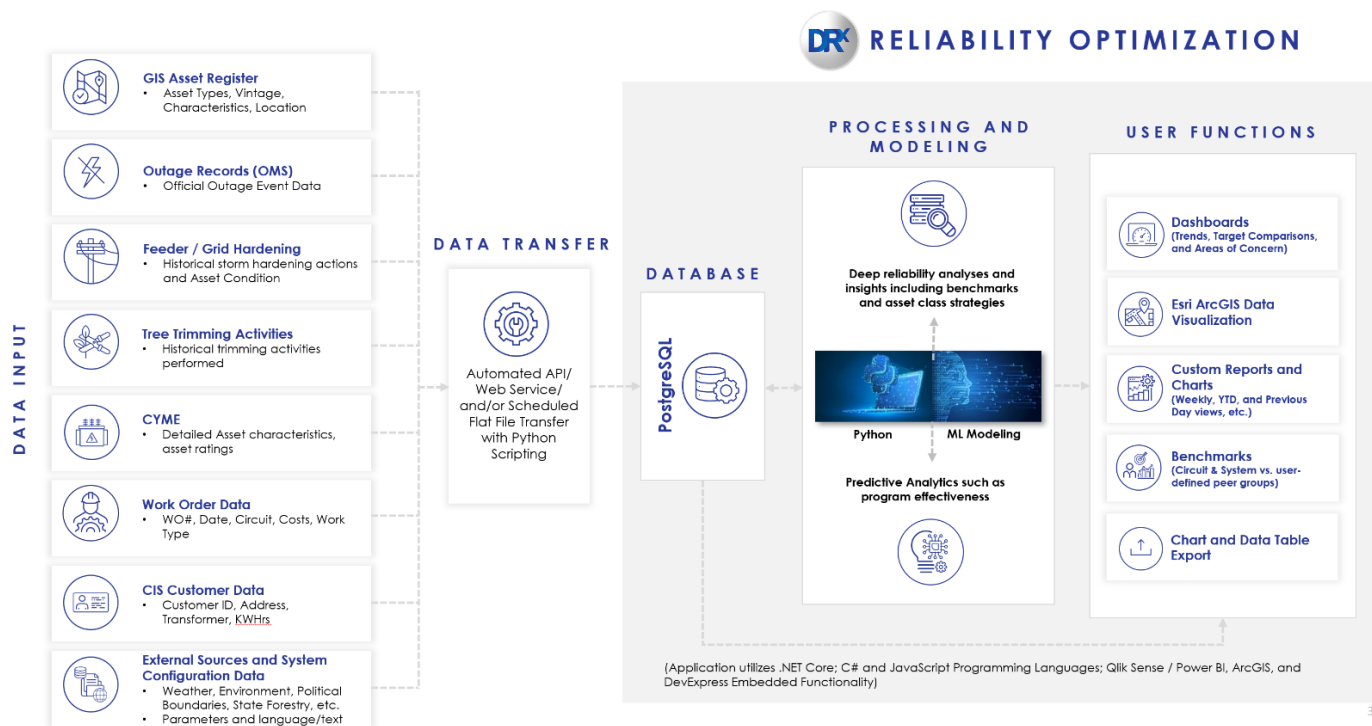


Identify "hot spots" or frequently operating devices; answer questions like "where are my bare wire vs. tree related outages?"

Visually review circuits and key attributes of segments and devices



IDENTIFY AND ADDRESS CRITICAL ISSUES YOU DIDN'T KNOW YOU HAD



ABOUT DR^x

"DISTRIBUTION RELIABILITY EXCELLENCE"

Our solution helps executives, managers, and reliability engineers manage key metrics and essential data. The Reliability Optimization Module leverages utility and external data along with AI and proprietary modeling techniques to help you plan programs to meet targets, optimizing both reliability and related spend.

WHY ISL ANALYTICS

We pride ourselves on being a strategic partner - external experts / consultants with broad industry experience in helping utilities adapt and drive sustainable change and performance gains across their business. Besides 30+ years bringing best practices and pragmatic insights to the utility industry, data scientists in our analytics & tool dev center use machine learning / AI to embed that operating expertise into advanced decision support tools that eliminate 70-80% of analyst work required to get answers.

"Great information - the history and patterns of when outages are occurring on a circuit, and the probability of the circuit breaching WPC thresholds is very useful. This would normally take us a week to develop."

Senior Director, T&D Asset Management – Mid-sized Southwestern Electric Utility



www.islanalytics.com
info@islanalytics.com
+1.702.724.2683