



SD-4: Reliability Monitoring Report

System Management & Nuclear Oversight Committee Report
April 13, 2021

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Vice President – Energy Delivery



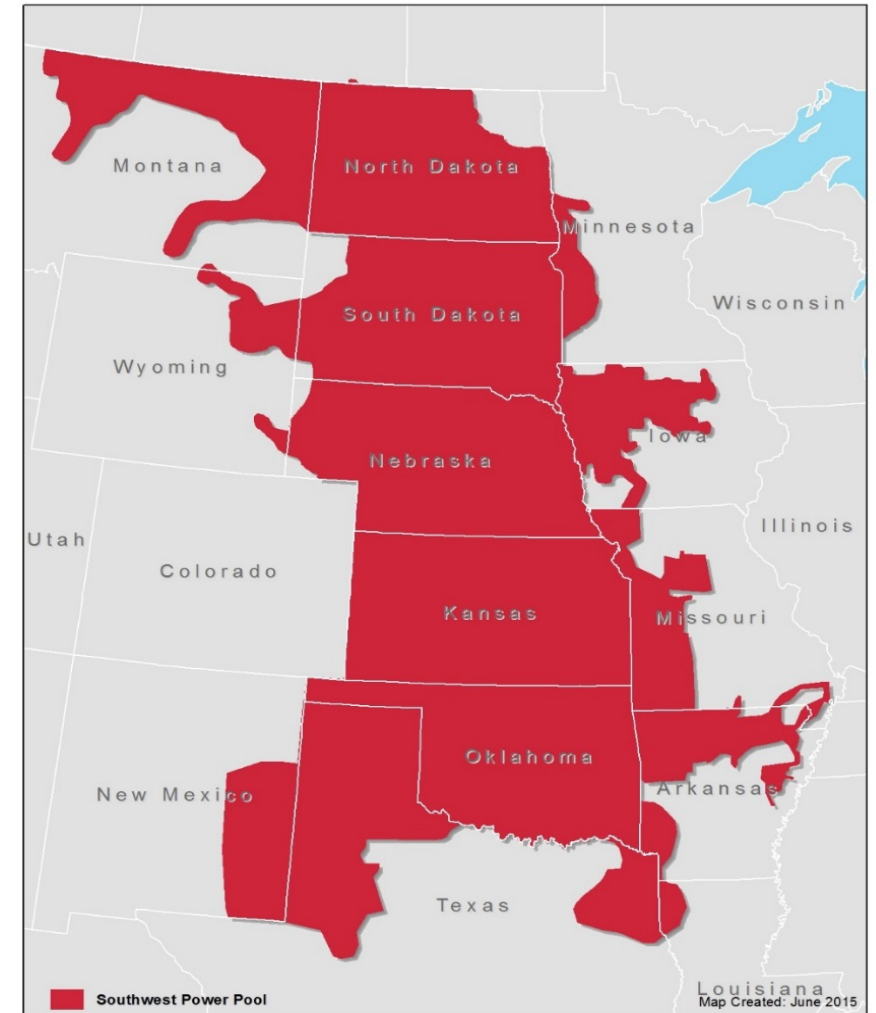
SD-4: Reliability

Generation and delivery systems must perform at a high level to provide reliable service to customer-owners. The Energy Delivery, Energy Production and Nuclear Decommissioning, and Financial Services Business Units of OPPD contribute to reliable electric service to customer-owners.

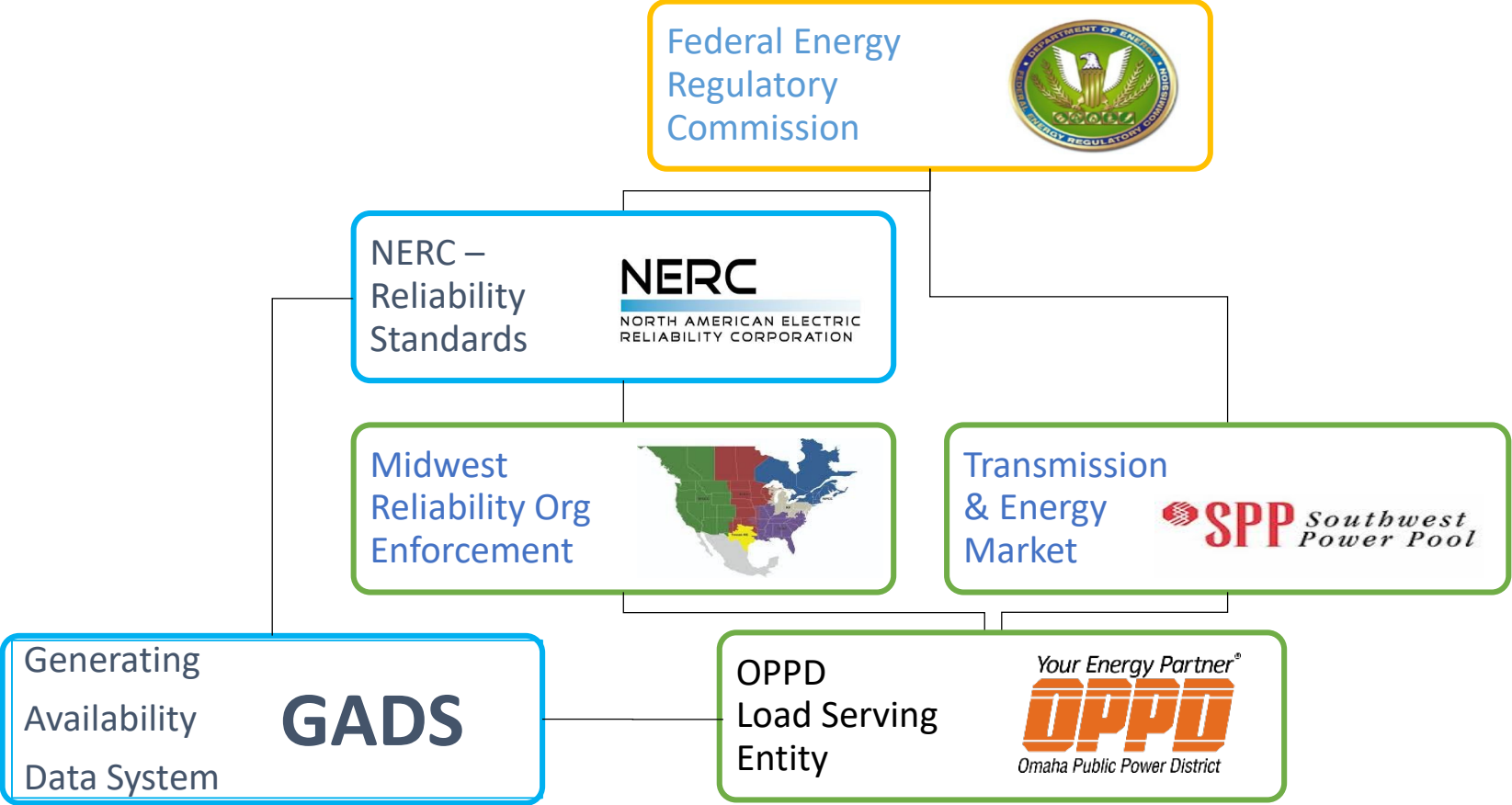
- OPPD shall assure all customer energy requirements are met through the use of its generation resources and purchase power portfolio 100 percent of the time.
- OPPD shall achieve generation reliability by:
 - Maintaining baseload unit equivalent availability factor at or above 90% on a three-year rolling average; and,
 - Maintaining unit availability above benchmark levels per industry measures such as the NERC GADS.
- OPPD shall achieve electric system reliability by:
 - Limiting the SAIDI to 90 minutes. This is the average outage duration per customer per year excluding declared major storms; and,
 - Maintaining a reliable transmission and distribution system. This will be achieved through performing the necessary maintenance and upgrades in accordance with NERC standards.

OPPD shall assure all customer requirements are met through the use of its generation resources and purchase power portfolio 100 percent of the time

- Resource planning assessments allow us to diligently plan for sufficient generation capacity/reliability in the future
- As required, OPPD plans for accredited generation resources that are 112% of expected peak load
- As necessary, transmission ‘reservations’ are in place to ensure firm delivery of electricity creating ‘right of way’ for electricity to get to OPPD load from OPPD resources
- The SPP integrated market provides OPPD with real time access to liquid power markets
- Generation (both owned and purchased) supply requirements met 100% of the time



Regulation Framework



Generation Reliability Metric

- Equivalent Availability Factor (EAF):
 - Percentage of time a unit was available to generate over a total period of time. Outages and derates impact this factor.
 - OPPD's corporate EAF is megawatt weighted. Goals are established on a 12-month basis in support of the corporate 3-year target to normalize outages across the fleet.
 - Target based on top quartile NERC/GADS benchmarking.

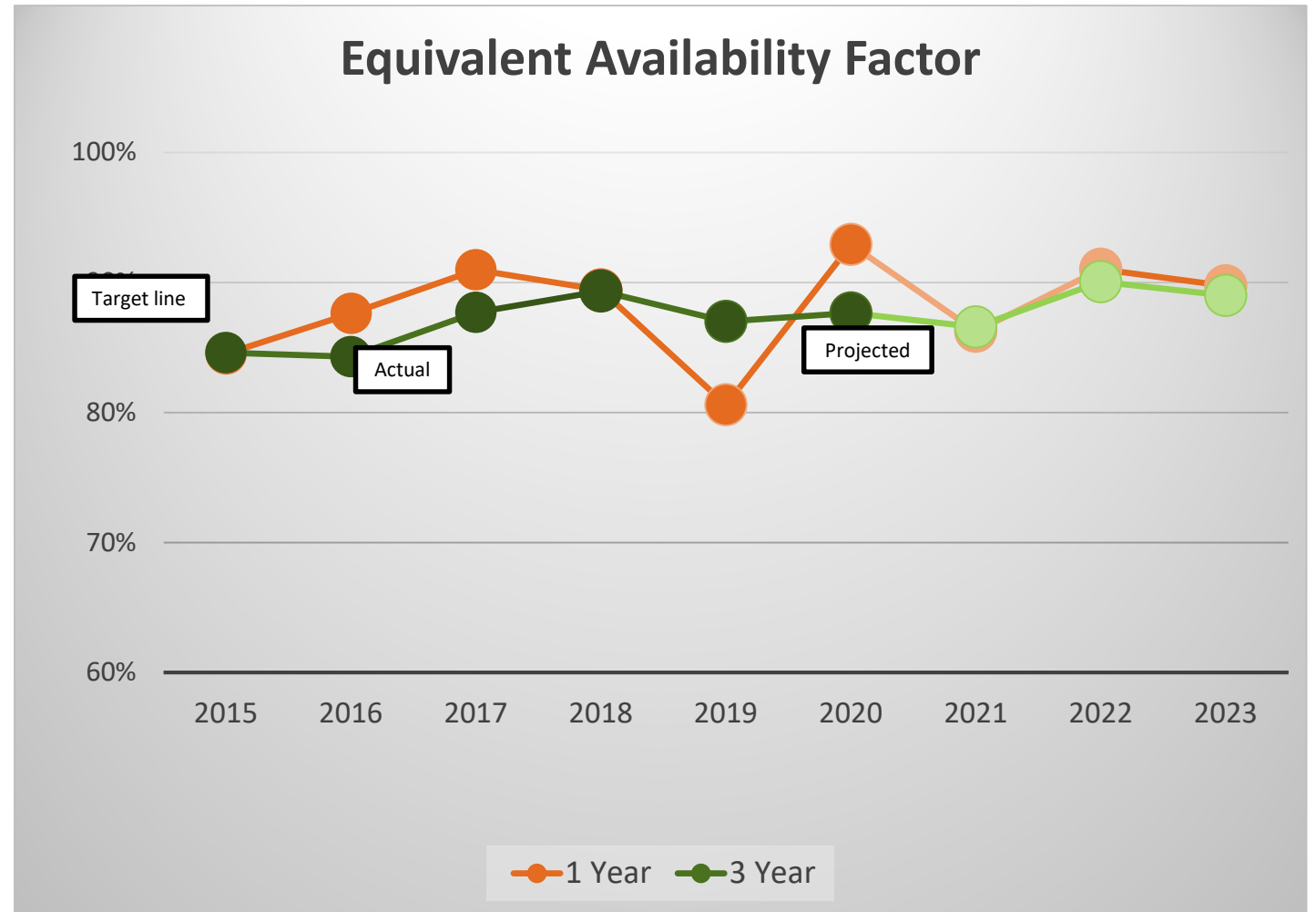


2020 Generation Performance

OPPD establishes a long term goal to achieve generation reliability by maintaining baseload unit equivalent availability factor at or above 90% on a three-year rolling average.

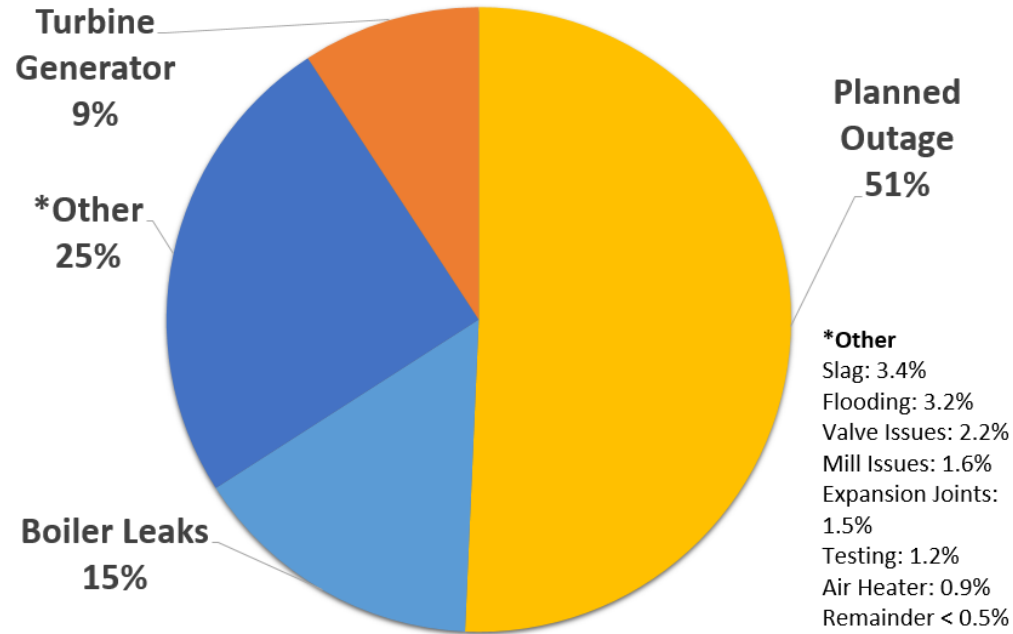
2020 year end was 87.6% vs a target of 87.8%.

In 2020, 90% EAF represents top quartile of industry peers.



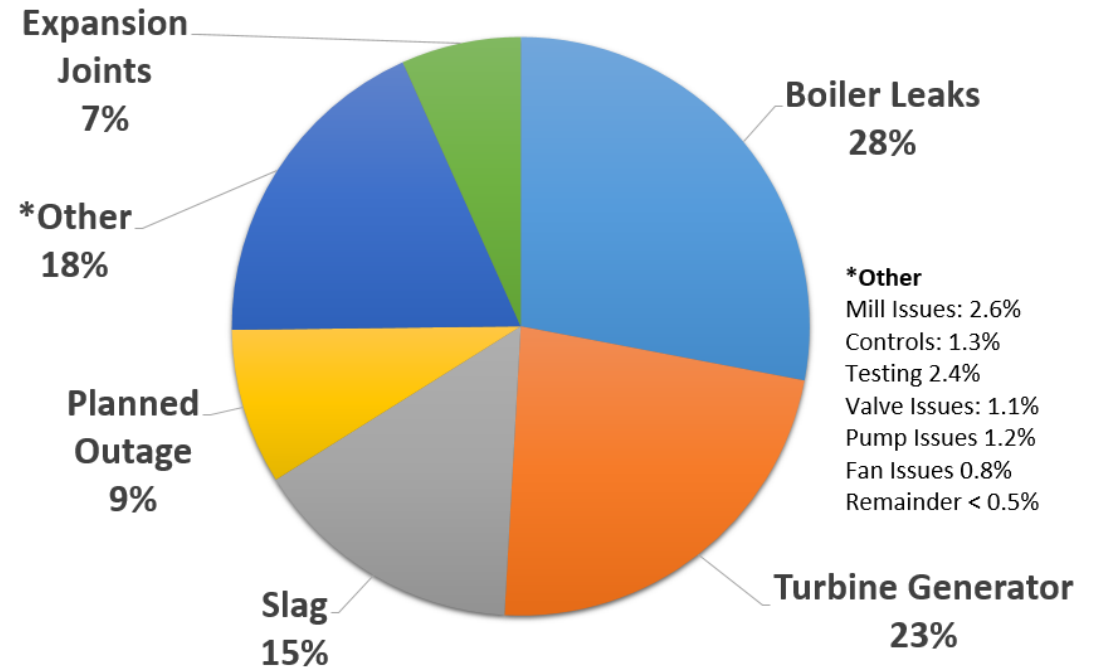
Generation Reliability Drivers

2019 EAF Outages and Derates
(With more than 5% of annual total)



2,861,000 Equivalent Megawatt Hours Unavailable

2020 EAF Outages and Derates
(With more than 5% of annual total)



1,042,000 Equivalent Megawatt Hours Unavailable

Generation Reliability Programs

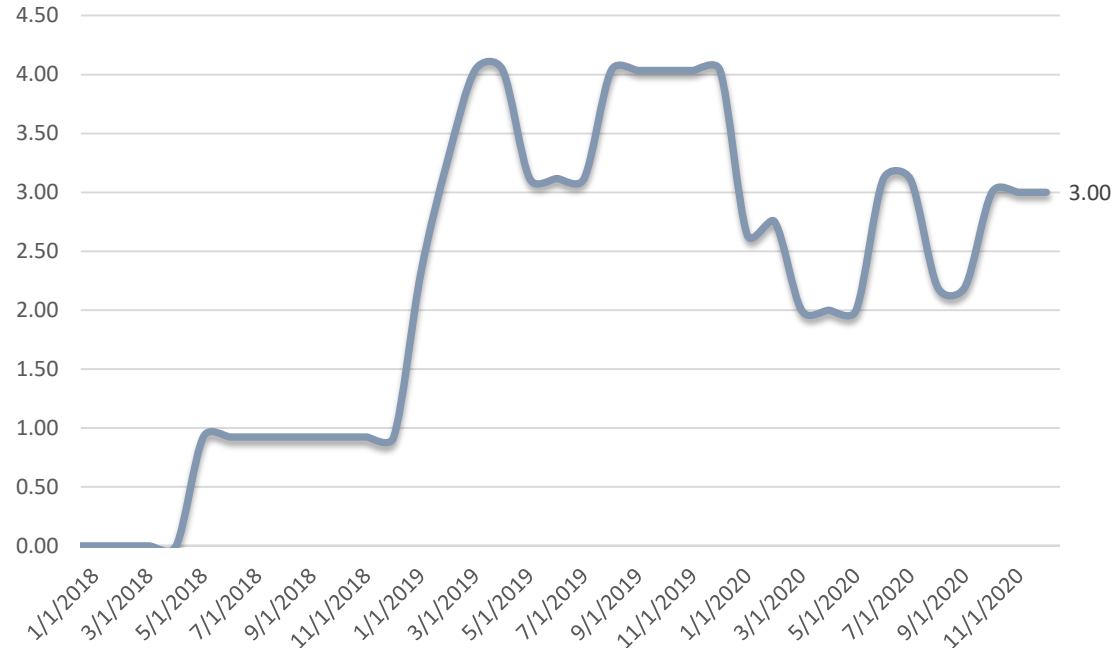


- GREAT focused on tracking availability losses and related causes.
- Plant Equipment Reliability Program in development.
- Predictive Maintenance Program
 - Vibration Monitoring
 - Oil Sampling
 - Motor Testing Program
 - Ultrasonic Testing
 - Acoustic Testing
 - Boiler Chemistry Analysis and Monitoring
- FACT focused on specific boiler reliability issues.

Boiler Reliability Progress in 2020

NO4 boiler maintenance and preparation for NC2 reheater tubing replacement were areas of focus

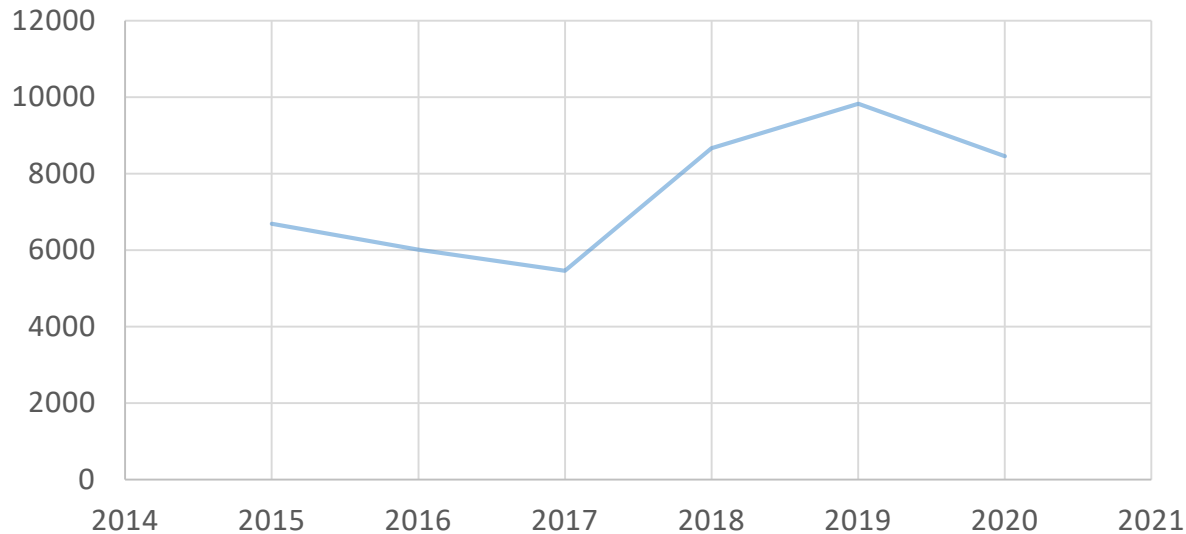
NC2 Boiler Unavailability 2018 -2020



Reheat tube failures on NC2

Reliability Work in 2020

Annual Preventative Maintenance Tasks Performed
at North Omaha & Nebraska City Stations



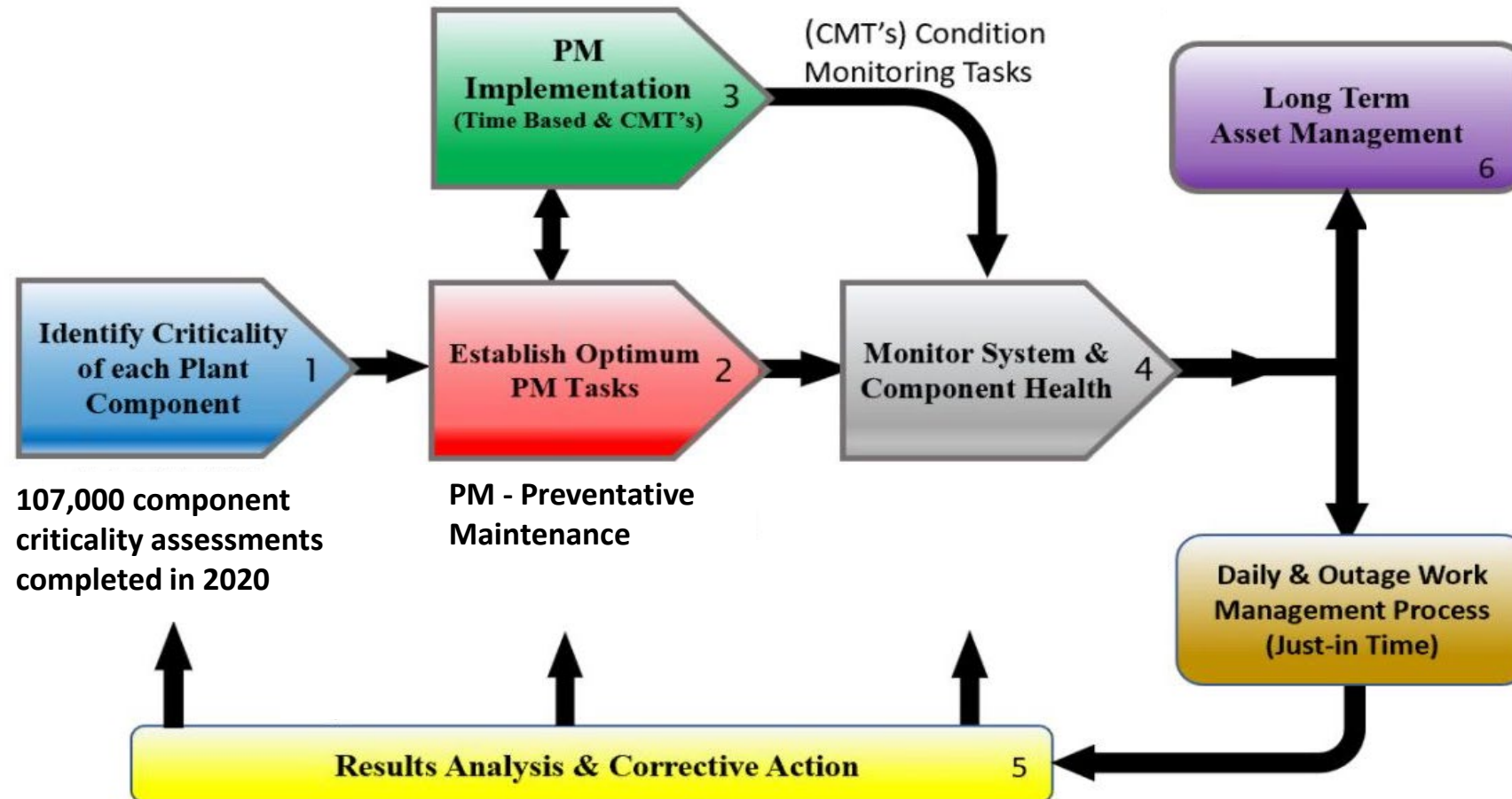
Continuous Improvement Technologies:

- Pursuing state of the art data analytics service
- Expanded drone inspection capabilities with boiler safe drones

- Over 8,000 Preventative Maintenance tasks performed
- 172 pieces of equipment monitored monthly for vibration
- Oil analysis semi-annually on 83 pieces of equipment
- 108 large electric motors tested annually
- Predictive Maintenance Program Formalized
 - Vibration monitoring now performed in house
 - New oil lab procured for in house oil analysis
 - Equipment condition reports issued for rotating equipment

Equipment Reliability Program

Aligning with industry best practices and asset management principles



System Reliability Metric

OPPD shall achieve electric system reliability by:

Limiting SAIDI to 90 minutes. This is the average outage duration per customer per year excluding declared major storms.

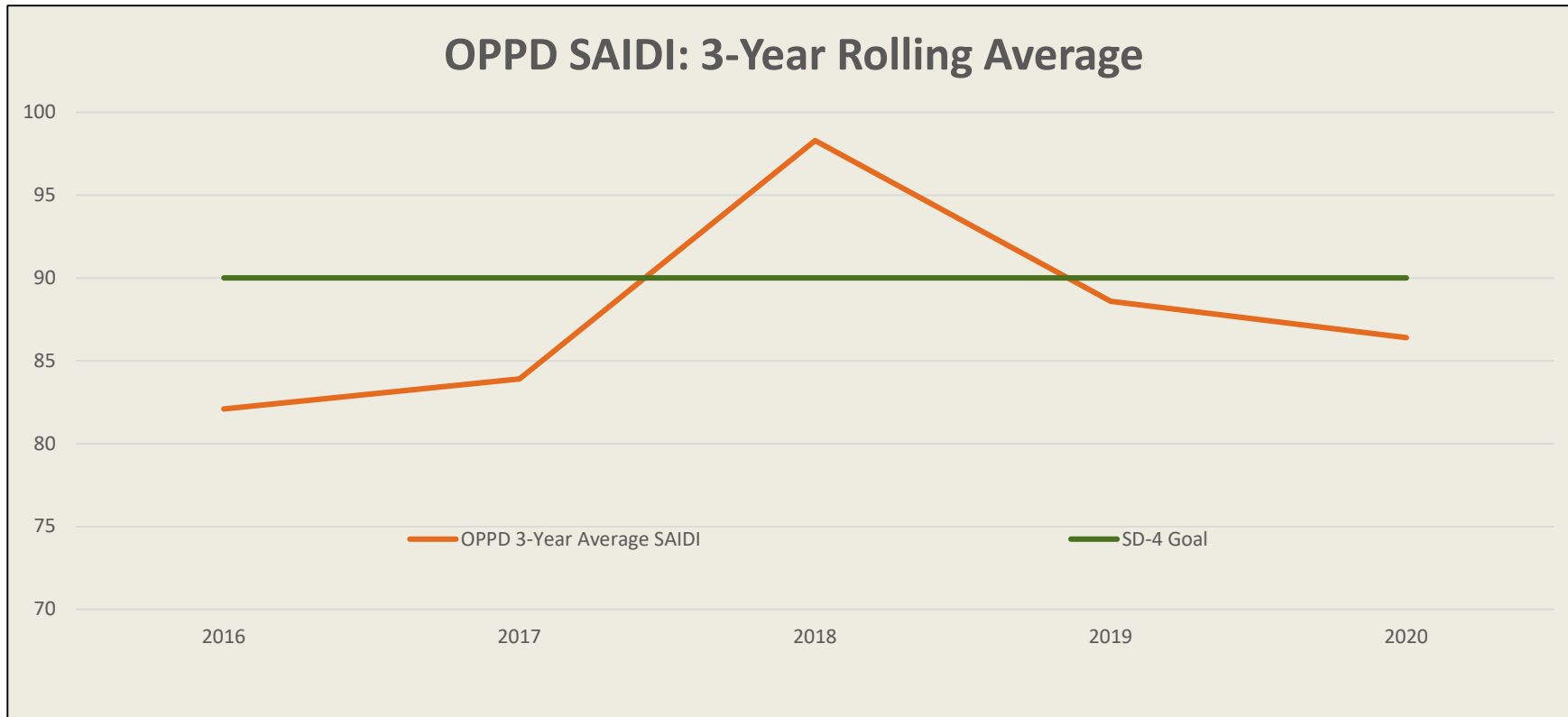
- SAIDI: System Average Interruption Duration Index
- Nationally recognized standard
- A SAIDI of 90 minutes = 99.98% availability, generally first quartile



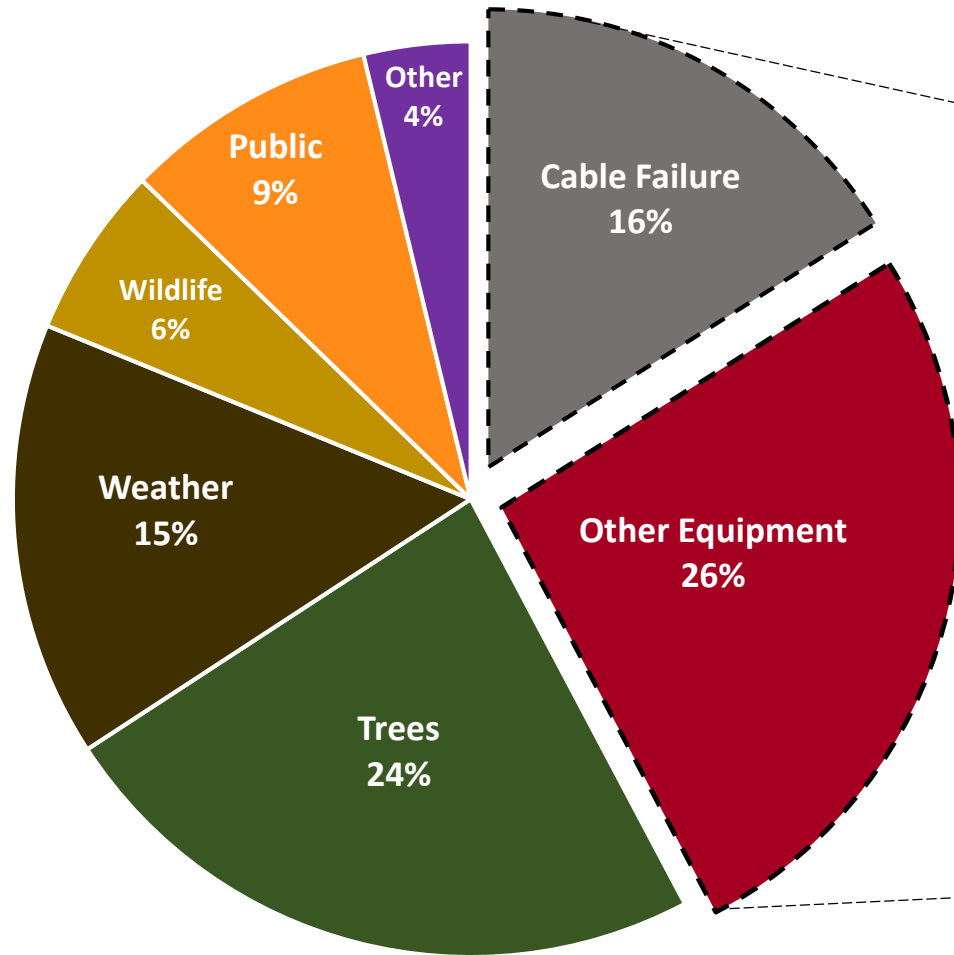
System Reliability Metric: SAIDI

SAIDI at the end of 2020 was 86.4 minutes

- After exceeding the 90 Minute threshold in 2018, system performance continued its positive downward improvement trend

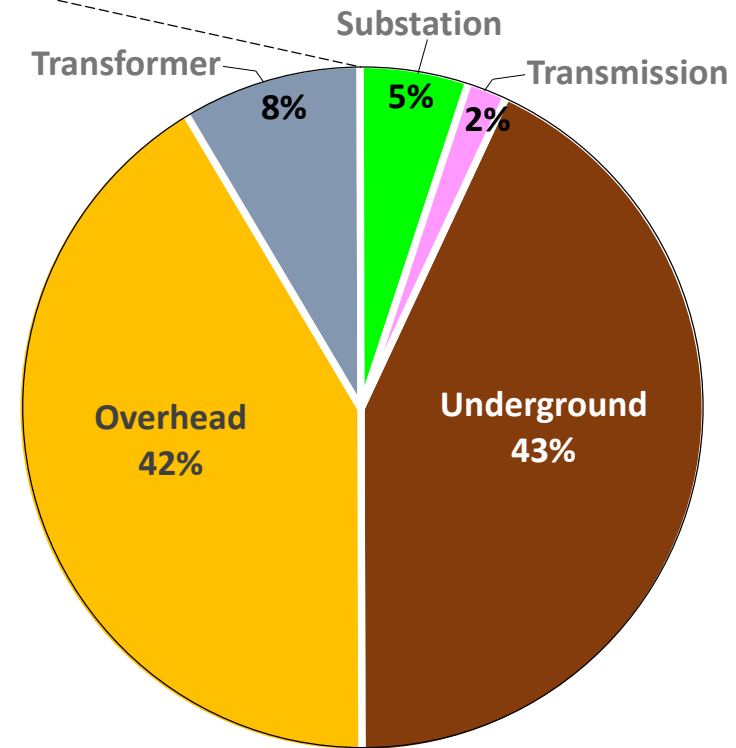


2020 Outage Causes



Customer Outage Minutes by Cause

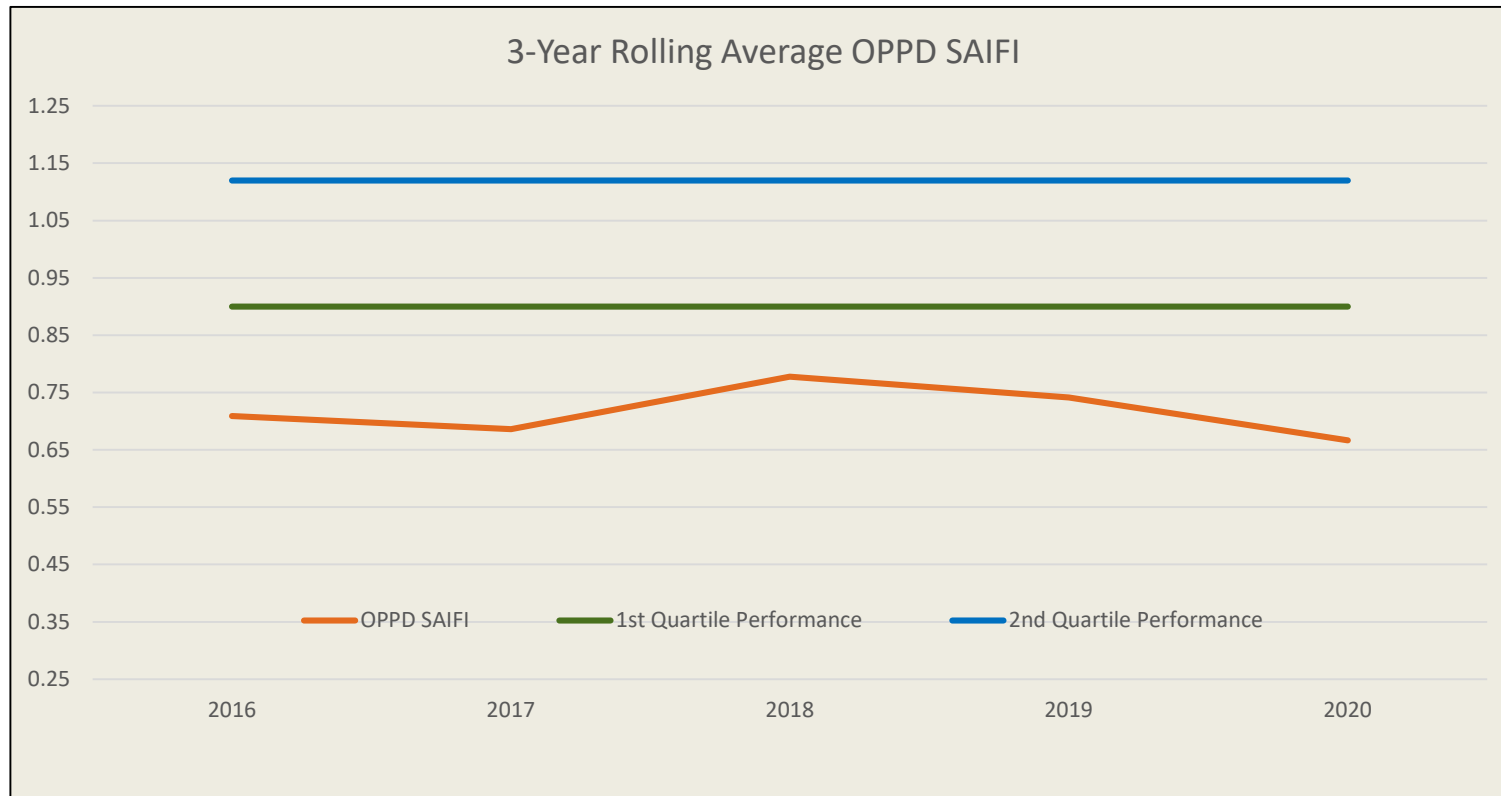
Overhead & Underground Equipment Impacts Nearly Equal



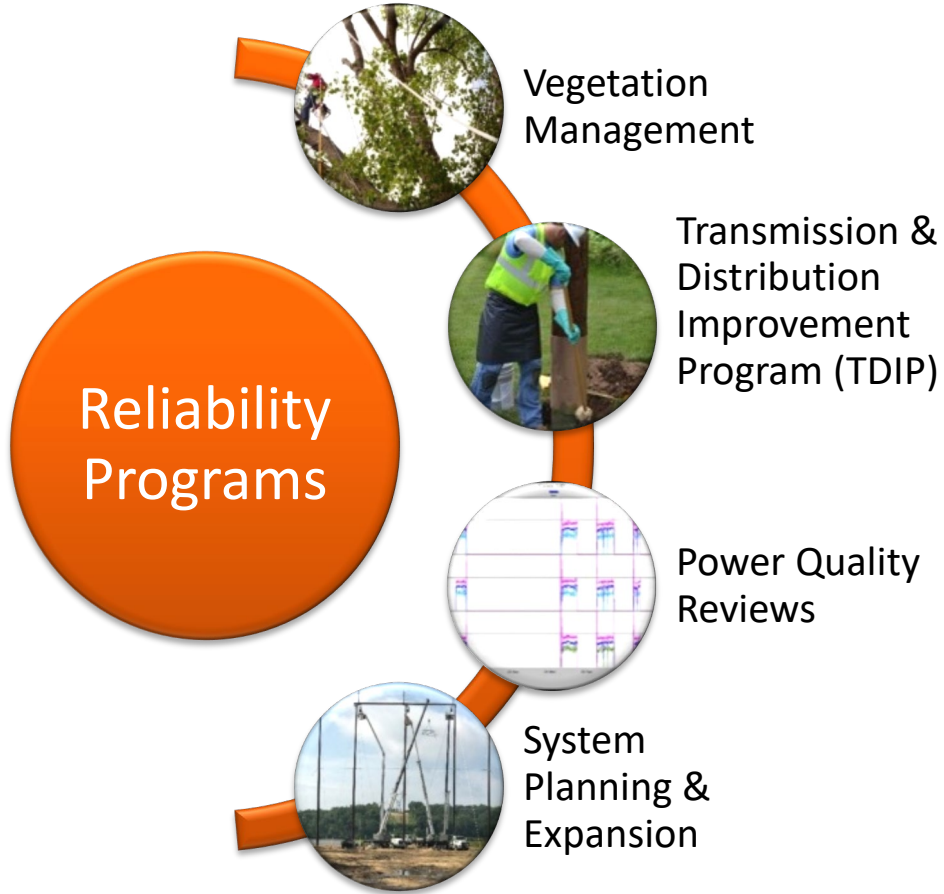
Equipment Failure Breakdown

Outage Frequency (SAIFI)

- SAIFI (System Average Interruption Frequency Index) measures outage frequency. This metric represents the frequency of sustained outages (>5 Minutes) any given customer on the system will see during a year.
- Per the IEEE Distribution Reliability Working Group annual benchmarking survey, a SAIFI of 0.90 or less will typically be first quartile performance.
- Improvements in SAIFI = a reduction in the frequency of outages.



Reliability Improvement Programs



- A more extensive vegetation management program was launched in 2019 with increased funding
- TDIP funding is focused on
 - Underground cable replacement
 - Wood poles evaluation and replacement
 - Downtown Network upgrades
 - Overhead conductor
 - Substation Modernization
- Power quality programs continued to focus on addressing pocketed areas needing additional attention
- System Planning & Expansion continues to add new facilities to strengthen reliability

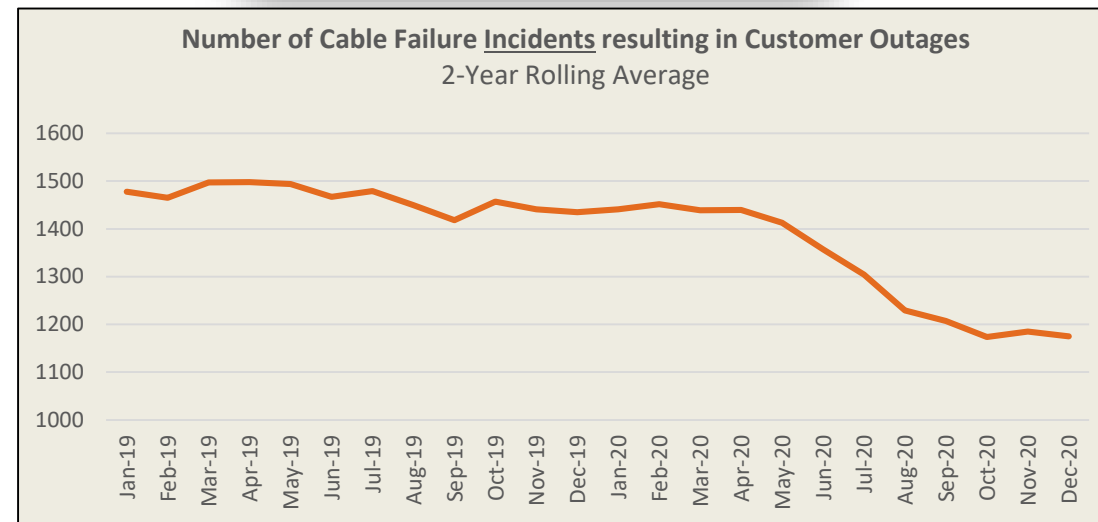
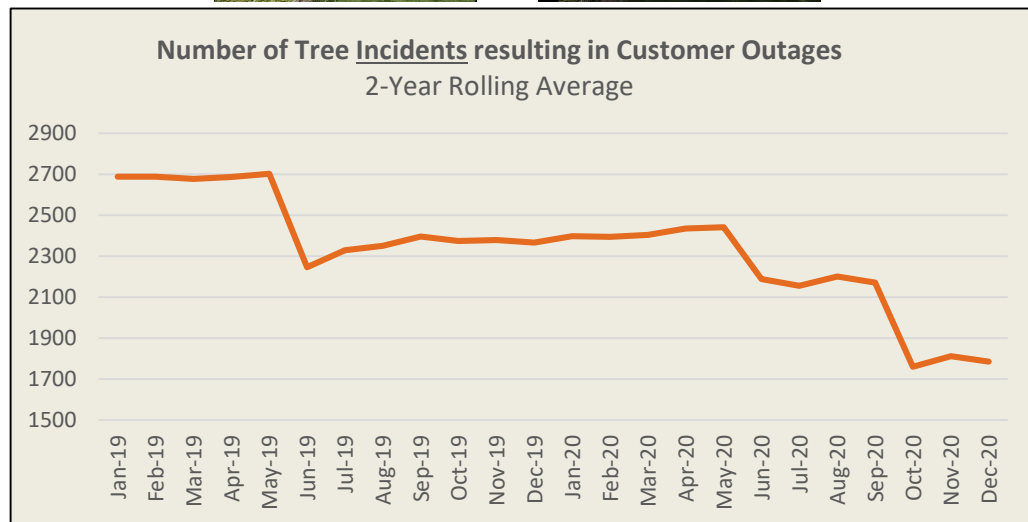
Program Effectiveness Examples

Vegetation Management & Cable Replacement have been targeted for increased spend and programmatic replacement programs in 2018 due to an increasing trend in negative reliability performance.

Vegetation Management

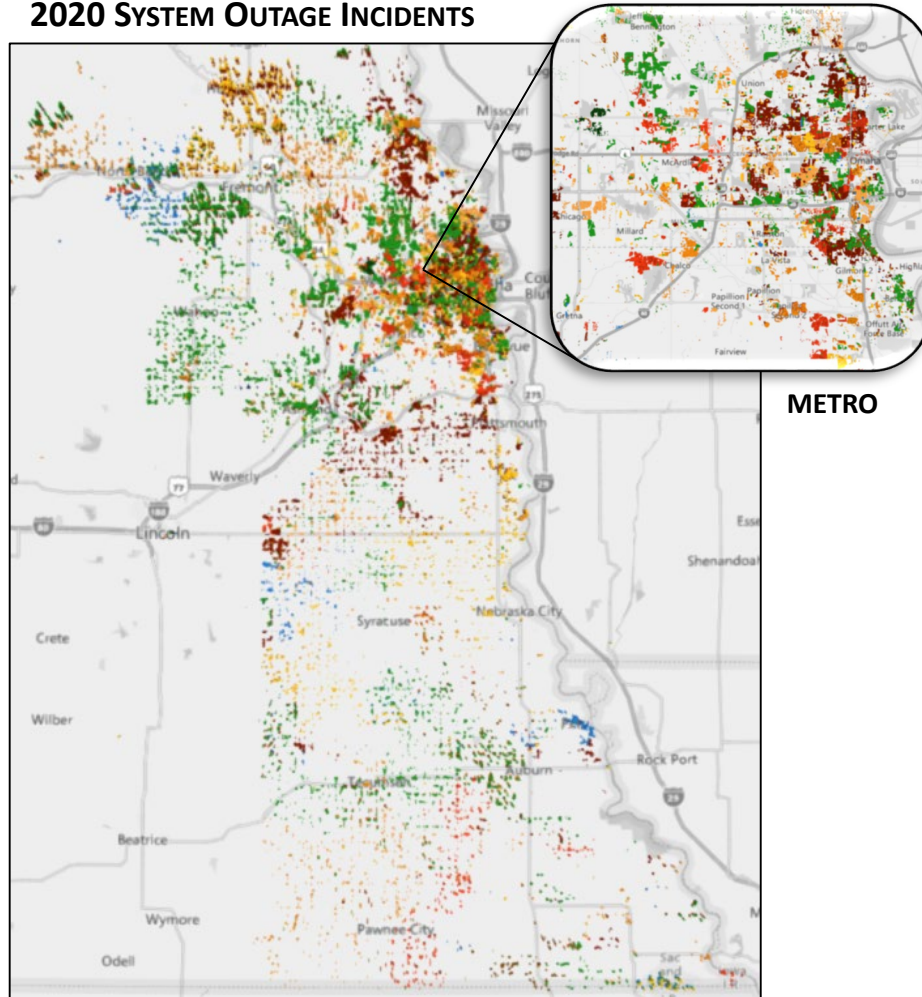


Proactive Cable Replacement



Circuit Analytics Improvements

2020 SYSTEM OUTAGE INCIDENTS



Distribution Circuit Performance Management & Conductor Replacement Improvements

REVIEW CIRCUIT PERFORMANCE



LINE MAINTENANCE TECHNICIANS PATROL CIRCUIT TO IDENTIFY ISSUES



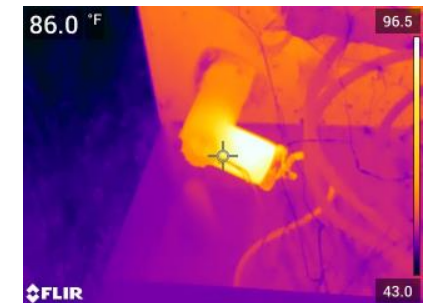
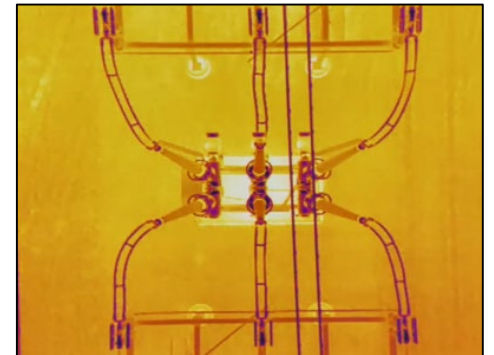
DESIGN CIRCUIT IMPROVEMENTS



FIELD CONSTRUCTION

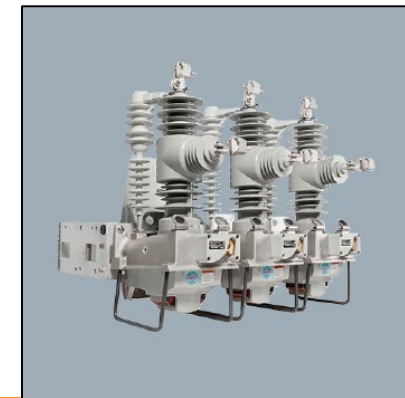
Inspection Programs

- OPPD inspects transmission, substation, and distribution equipment through formal programs
- These programs improve the resiliency and reliability of the system and also help ensure the safety of our equipment for OPPD personnel and the public
 - GLIT (Ground-Line Inspection and Treatment) inspects poles across all of OPPD's service territory on a 10-year cycle
 - Aerial drone inspections of all 345kV substations in 2020
 - Substation inspections look at equipment at all 125 substations
 - Annual infrared thermography and dissolved gas analysis of substation power transformers
 - Transmission lines are inspected on a 3-year cycle
 - In 2020, 75 miles were inspected using drones and 123 miles were inspected using a helicopter.
 - The Surface Mount Equipment Inspection (SMEI) program was revitalized in 2020
 - Program inspects the outside and inside of equipment, including assessment of paint and recommended maintenance
 - Downtown Network annually inspected utilizing methods such as dissolved gas analysis and thermography



Continuous Improvement

- Drones continue to see increased use in inspection applications
- The installation of Smart Line Reclosers began in 2020 and will continue in 2021
- Air Flow Spoilers to prevent the galloping of transmission lines were installed while lines were 'hot' to eliminate the need for outages
- Twisted pair conductor is being piloted for distribution to limit galloping of lines during icing events
- Collaborating with neighboring utilities to build mutually beneficial distribution ties

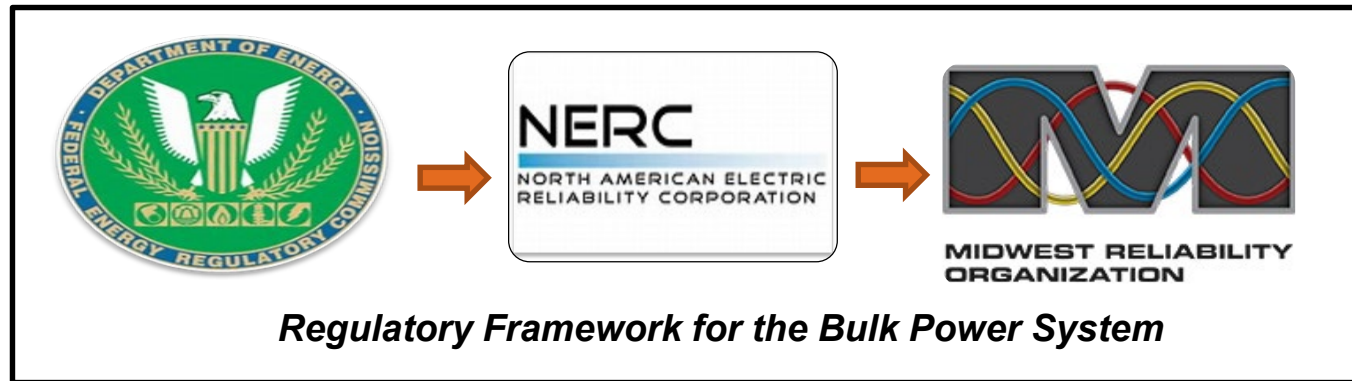


Reliability Focus Areas 2020-2021

- **Arlington**
 - Piloting two (2) miles twisted pair distribution conductor on a line that has had past galloping issues
 - Rebuilding 18 additional miles of overhead conductor, six (6) miles will transition to underground
- **SE Nebraska / Rulo Area**
 - Over 12 miles of new construction to add stronger ties to this load area.
- **Colon**
 - Rebuild of almost 20 miles of aging conductor
 - Created loops and converted many areas from overhead to underground
- **Fort Calhoun**
 - Detailed circuit wide inspection and work package including fusing and creature guarding for 109 transformers, 44 poles, and rebuild of distribution conductor
- **West of Humboldt**
 - Detailed circuit wide inspection and work package including transformer fusing and creature guards
 - 20 miles of distribution rebuild and replacement of 52 transformers
- **168th & Pacific**
 - Proactive Substation Transformer replacement
- **Bellevue**
 - Fused and creature guarded 103 transformers, replaced 46 transformers, and creature guarded 13 poles
 - Three (3) miles of distribution rebuild in 2021
- **132nd & Giles**
 - Addition of Faulted Circuit Indicators (FCIs) in underground loops to facilitate faster trouble shooting of cable outages

System Reliability Standards

Achieved through performing the necessary maintenance and upgrades in accordance with NERC standards.



- OPPD is audited on-site every 3-years, with the next in 2022
 - MRO Self-Certification is performed Quarterly
- OPPD has had no enforceable violations since the last SD-4 update

Recommendation

The System Management & Nuclear Oversight Committee has reviewed and accepted this Monitoring Report for SD-4 and recommends that the Board find OPPD to be sufficiently in compliance with Board Policy SD-4.