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Helping to keep the lights on,
businesses running
and communities strong®

2020 10-Year Assessment
Preliminary Needs

Stakeholder and Customer Presentation
March 10, 2020
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Purpose

- Solicit Input on Needs
  - Network/System Planning
  - Generation Interconnection/Generation to Transmission (G-T) and Distribution to Transmission (D-T)
  - Asset Renewal
  - Communications
- Solicit Input on Public Policy Driven Needs
- Summarize Next Steps

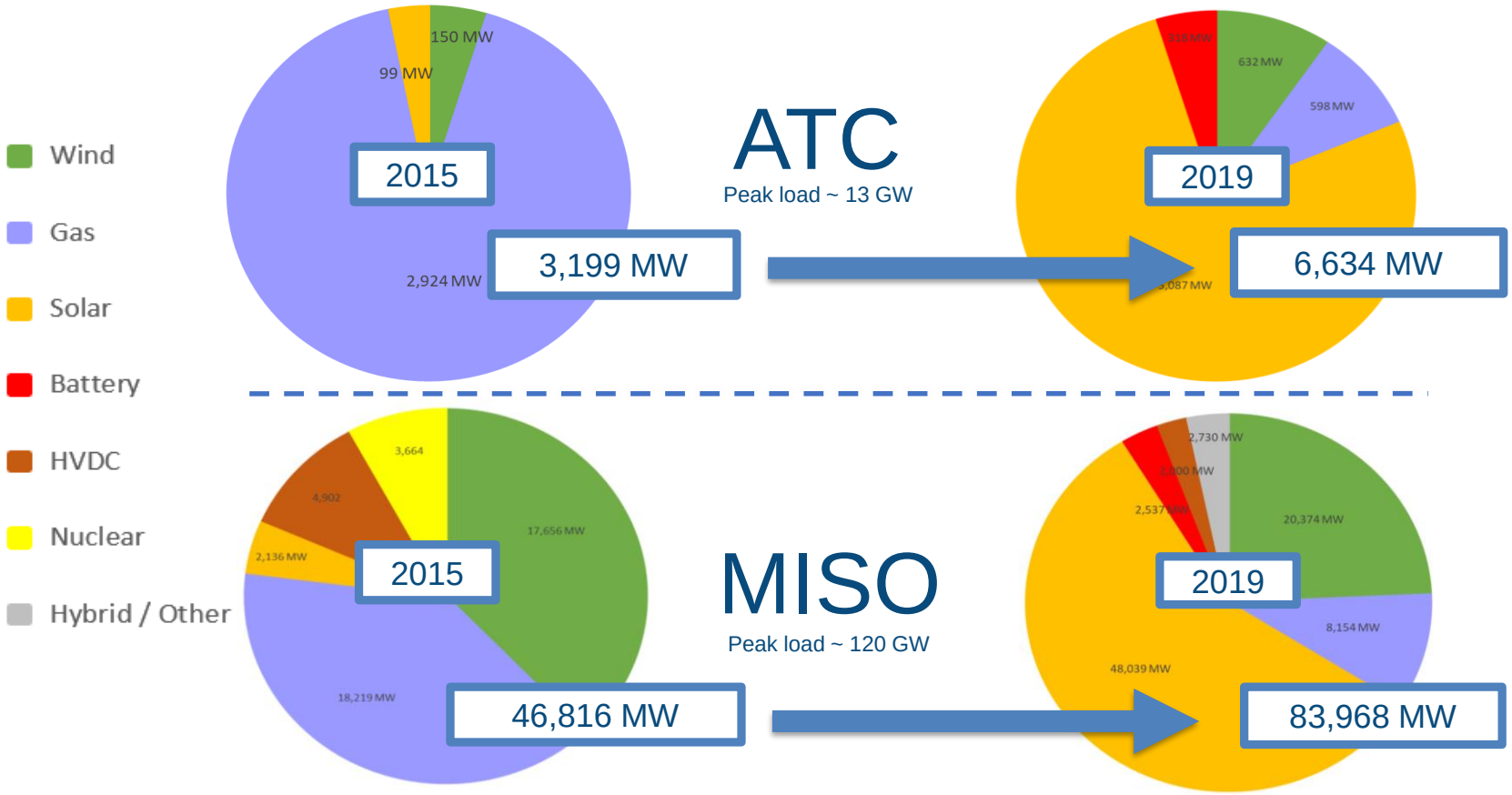
Changing Landscape

- Project needs are shifting.
  - Reduced need for new load-growth driven projects.
  - Both the G-T and D-T queues are large.
  - Aging infrastructure can jeopardize reliability.
    - Asset Renewal addresses these risks.
  - Telecommunications risks:
    - Telephone company maintenance of older telecommunications infrastructure, including ATC's leased circuits, may be of lower priority.
    - Older 3rd party communication pathways may be less secure.
    - ATC's Optical Ground Wire (OPGW) network addresses these issues.
    - Our distribution customers, who are facing similar issues, can also use ATC's OPGW network.

Changing Landscape

- Network/System Planning Needs
  - Some new needs related to multiple contingencies.
    - Maine-Hilltop 115 kV overloads (P6 and P7 contingencies)
    - Weston-Morrison-Sherman 115 kV overloads (P6 and P7 contingencies)
    - Lost Dauphin-Red Maple 138 kV overloads (P3 and P6 contingencies)
  - However, if much of the G-T queue is developed, more reliability projects may be needed in the future.
    - G-T analysis identifies individual generator needs.
    - May not capture all of the reliability needs associated with a large number of new generators.
- Presentation concentrates on the current areas of largest need, i.e. on G-T, D-T, Asset Renewal, and Communications.

G-T Queue Snapshot: EOY 2015 vs. EOY 2019



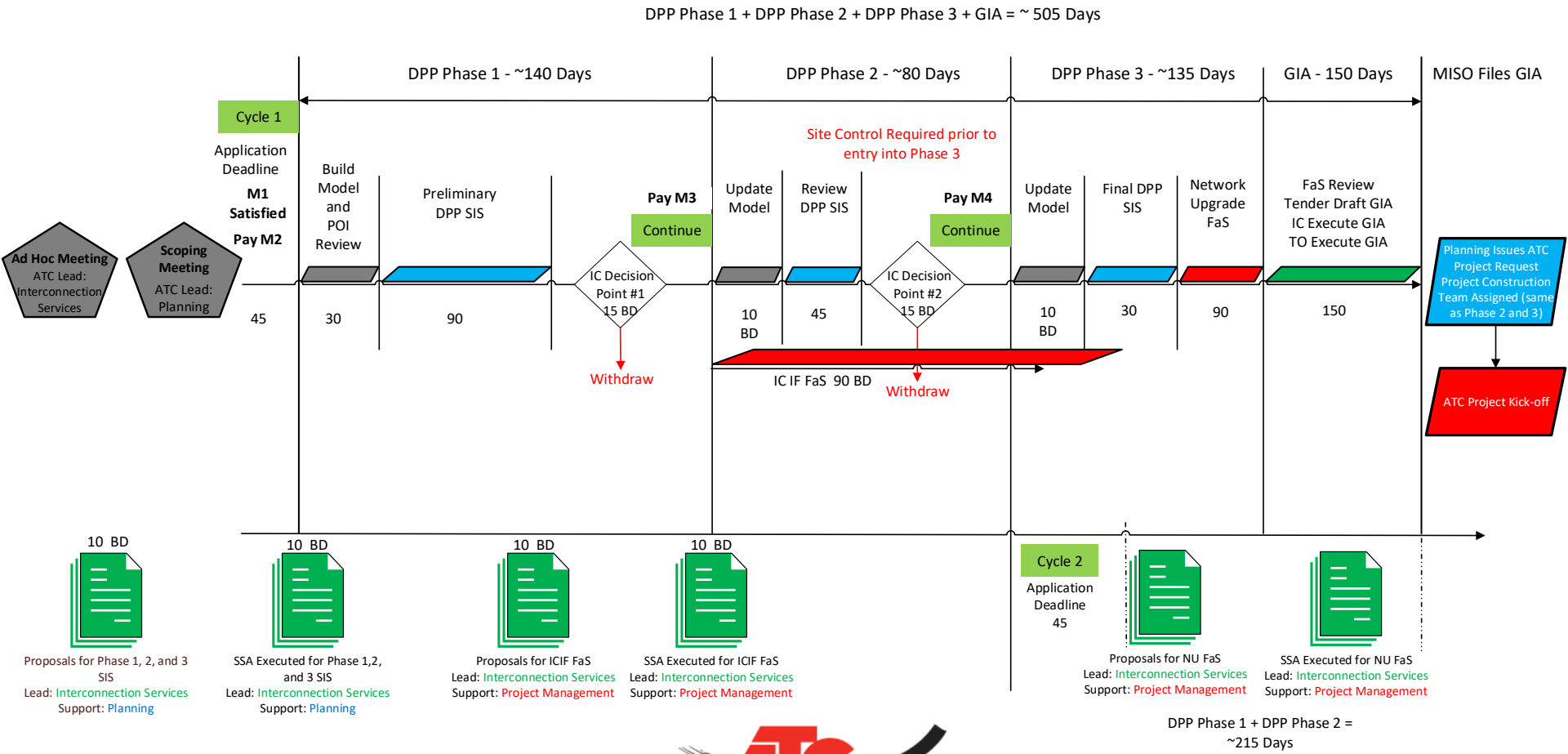
Note: Coal, diesel, and biofuel total less than 100 MW each for each chart.

Generation Interconnections MISO Process

Link to interconnection queue (CTRL + click to follow)

Link to Process Guide (CTRL + click to follow)

Generator Interconnection Process



G-T Dashboard

- Public Interconnection Services Power BI Dashboard

Generation Interconnection Summary

- G-T queue has increased significantly, with solar dominating it
  - If all of the solar in ATC's queue were developed, its nameplate capacity would equal almost half of ATC's peak load
- 2018 System Impact Study (SIS) study process changes are helping
  - 2018 queue cycle
  - 2017 queue cycle
- MANY changes in Point of Interconnection (POI)
- MANY changes in manufacturer data
- PSCAD studies (Inverter Control Stability Analysis)
  - Need
  - Developing stability projects
  - Understanding impacts during real-time operations

Distribution to Transmission (D-T) Interconnections

50+ requests per year

Governing documents

- FERC Tariff Attachment FF-ATCLLC
- NERC Standards
- FERC Filed D-T Interconnection Agreement (IA)
- ATC's Load Interconnection Guide
- ATC's Business Practices

Distribution to Transmission Interconnections

Best Value Planning (BVP)

- Collaborative planning assessment to determine the best value solution for all parties
- Types of requests
  - New distribution substation
  - Distribution substation equipment change
  - Distribution connected generation
  - Unforecasted load or change in load characteristics
  - Power quality issues
- Individual Project Timelines Vary Widely

D-T Dashboard

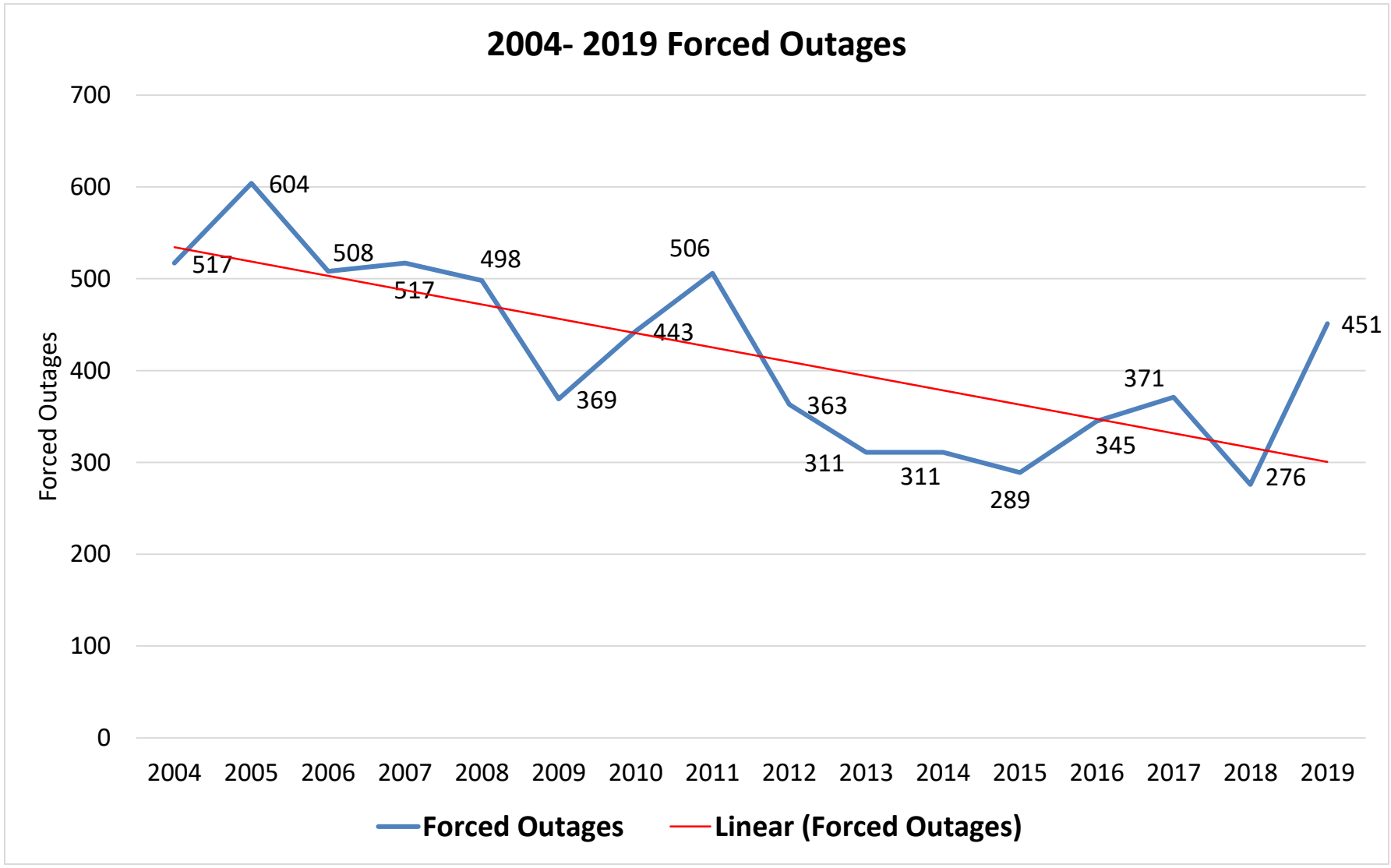
- Public Interconnection Services Power BI Dashboard

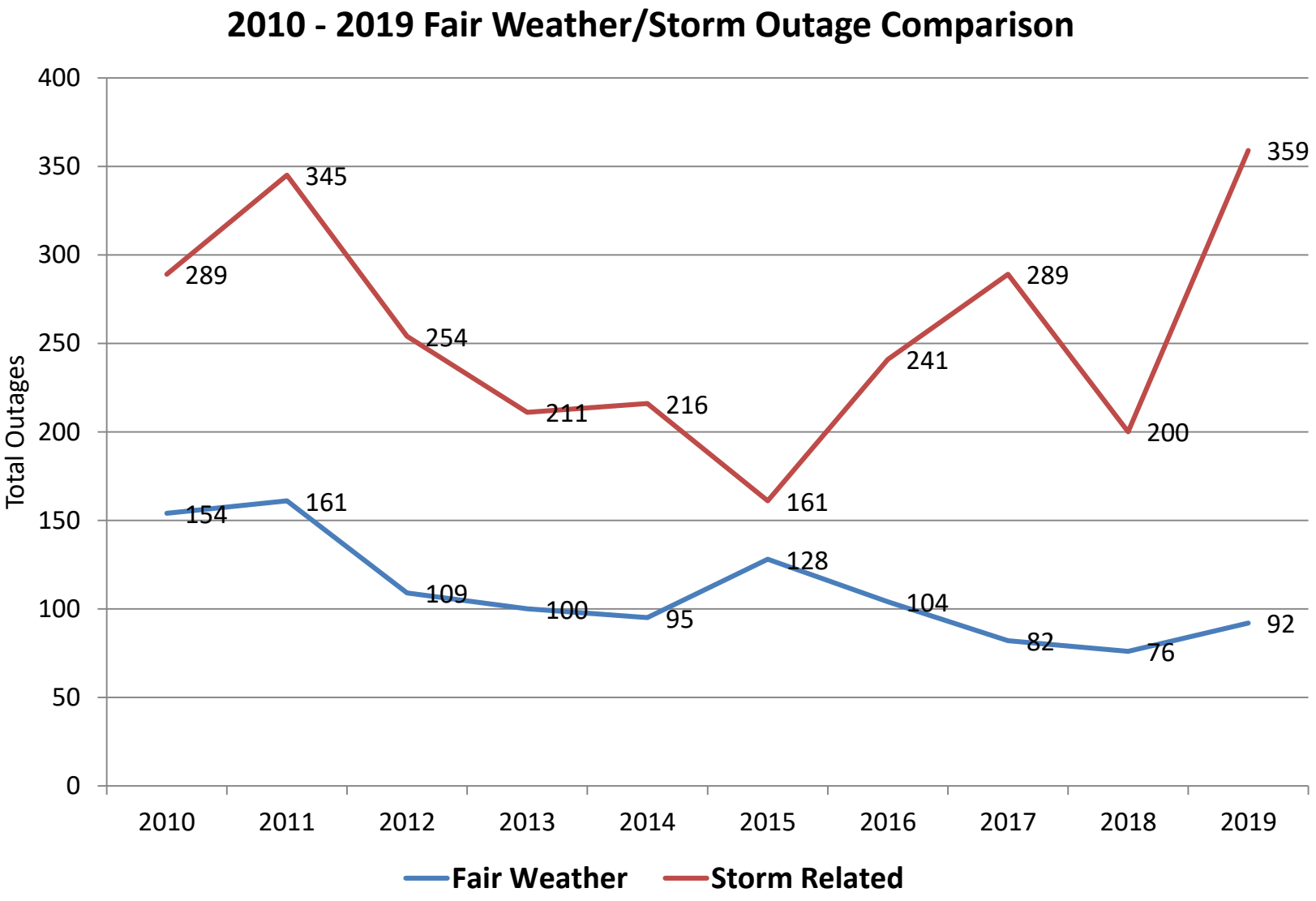
Asset Renewal Program Objectives

- Safety – public and worker
- Minimize total life cycle cost [Net Present Value of Revenue Requirements (NPV RR) from customer cost/rate perspective]
- Compliance
- Manage risk
- Reliability performance improvements
- Environmental performance improvements
- Coordination with Stakeholders

Asset Renewal Program Criteria

Condition	Obsolescence	Reliability	Compliance, Safety, Environmental
O&M Cost savings **Health indexing** **Performance and projected deterioration**	**Manufacturer and Field technical support** **Spare parts availability** **Application**	**Industry failure rates** **Known design issues** **Single element failure and testing exposure** **Outage reduction** **Poor lightning performance** **Relay system misoperations, security, dependability** **Human performance issues**	**Ratings methodology (FAC-008)** **NESC clearance from grade and other structures** **NESC working clearances in control houses** **NESC structure strength** **Environmental impacts** **Operational risk**

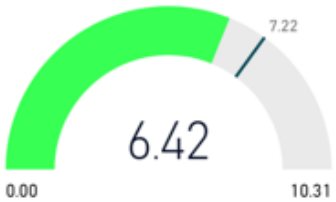

2004- 2019 Forced Outages
Forced Outages
700
600
500
400
300
200
100
0
517
604
508
517
498
369
506
443
363
311
311
289
345
371
276
451
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Forced Outages
Linear (Forced Outages)


2010 - 2019 Fair Weather/Storm Outage Comparison
Total Outages
400
350
300
250
200
150
100
50
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
289
345
254
211
216
161
241
289
200
359
154
161
109
100
95
128
104
82
76
92
Fair Weather
Storm Related

Reliability Performance: January - December 2019

Customer Impact

TSAIDI

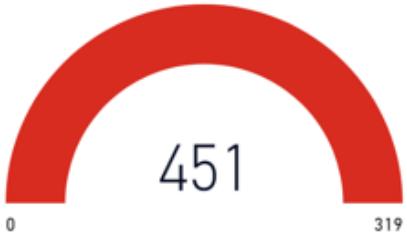


The 6.42 minute T-SAIDI YTD is .080 less than our YE five year average of 7.22 minutes.

TSAIFI

The 0.080 T-SAIFI YTD has exceeded our YE five year average of 0.057.

Total Forced Outages



The 451 total Forced Outages are 132 greater than our five year average of 319.

2019 Top impacting outages:

Weather and Lightning have accounted for 314 (70%) of the 451 forced outages in 2019.

The December 30th ice and snow storm accounted for 1.29 (20%) of the 6.42 minute T-SAIDI in 2019.

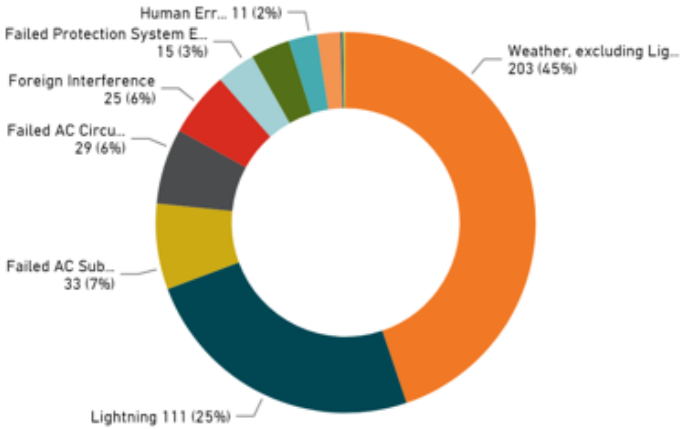
The Blount transformer failure accounted for 1.22 minutes (19%) of the 6.42 minute T-SAIDI in 2019.

An outage on a radial circuit in March accounted for .88 minutes (14%) of the 6.42 minute TSAIDI in 2019.

The 0.080 TSAIFI is mostly due to various weather related outages.

The customer impact data (TSAIDI & TSAIFI) from the July 19-20 storm are excluded from these metrics.

Total Circuit Outages by Cause Code



Asset Renewal – Preliminary 10 Year Forecast Substation Equipment Quantities

Location	2024	2025	2026	2027	2028	2029	2030	Grand Total	In Service Qty	Average Replaced Per Year	Average % Replaced Per Year
Arresters	32	6		12		18		68	7150	17	0.24%
Batteries and Chargers	35	18	21	12	24	18	14	142	330	20	6.06%
Breakers and Switchers	32	16	5	27	9	33	21	143	2530	20	0.79%
Capacitor Banks		1	1	1	3	6	10	22	219	2	0.91%
Control Houses	6	4	2	1	3	4	4	24	261	3	1.03%
Instrument Transformers	46	10	18	56	46	122	50	348	5609	50	0.89%
Power Transformers	3	5	3	3	4	3	3	24	198	4	1.77%
Reactors	5				3	1		9	440	3	0.68%
Relays	347	221	253	212	242	462	362	2099	6811	300	4.40%
SCADA	41	40	29	36	59	59	62	326	3099	47	1.52%
Switches	65	53	65	52	21	76	44	376	5694	54	0.95%
Grand Total	**612**	**374**	**397**	**412**	**414**	**802**	**570**	**3581**			

Asset Renewal Program

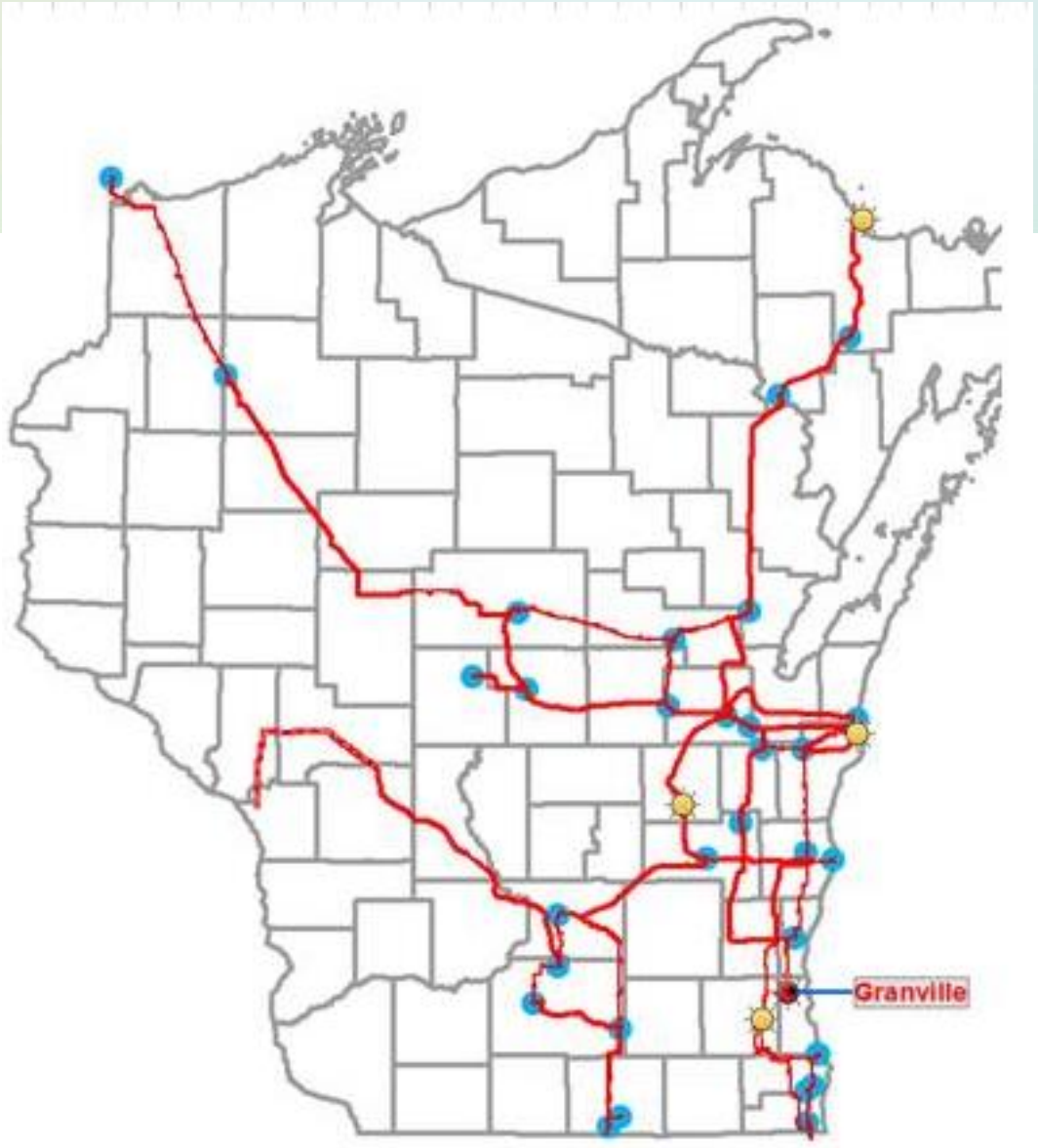
Asset Renewal Estimate - 10 Year Forecast ($000's)
In-Service Dates

	2024	2025	2026	2027	2028	2029	2030	Grand Total
Arresters	$280	$50	$0	$110	$0	$170	$0	$610
Batteries and Chargers	$3,400	$1,800	$2,170	$1,280	$2,630	$2,030	$1,630	$14,940
Breakers and Switchers	$8,590	$3,220	$1,030	$5,880	$1,860	$7,970	$4,630	$33,180
Capacitor Banks	$0	$420	$430	$440	$1,370	$2,820	$3,390	$8,870
Control Houses	$13,510	$9,270	$4,780	$2,460	$7,600	$10,440	$10,750	$58,810
Instrument Transformers	$1,380	$270	$530	$1,680	$1,480	$3,610	$1,670	$10,620
Physical Security	$20,330	$2,220	$2,500	$3,320	$6,030	$4,640	$2,090	$41,130
Power Transformers	$11,500	$13,550	$11,850	$12,260	$18,360	$13,010	$15,720	$96,250
Reactors	$250	$0	$0	$0	$420	$140	$0	$810
Relays	$20,920	$15,240	$17,490	$16,530	$19,340	$37,580	$30,470	$157,570
SCADA	$4,900	$5,170	$4,510	$5,310	$6,890	$9,910	$8,420	$45,110
Switches	$3,600	$2,810	$3,550	$2,980	$1,230	$4,620	$2,750	$21,540
Substation	**$88,660**	**$54,020**	**$48,840**	**$52,250**	**$67,210**	**$96,940**	**$81,520**	**$489,440**
IT/OT Equipment	$9,000	$4,640	$4,780	$3,690	$3,800	$3,910	$4,030	$33,850
OPGW Asset Renewal	$0	$0	$0	$3,690	$0	$0	$2,690	$6,380
IT/OT/Fiber	**$9,000**	**$4,640**	**$4,780**	**$7,380**	**$3,800**	**$3,910**	**$6,720**	**$40,230**
Transmission Line	**$64,000**	**$91,000**	**$120,000**	**$96,000**	**$100,000**	**$100,000**	**$100,000**	**$671,000**
Grand Total	**$161,660**	**$149,660**	**$173,620**	**$155,630**	**$171,010**	**$200,850**	**$188,240**	**$1,200,670**

Granville Substation – Overview

- 345kV to 138kV transformation and distribution
- Located in Milwaukee
- Constructed circa 1968
- Important station functions
  - Network hub serving Milwaukee Metro area
  - Key network switching station connecting north with south
- 3x 345kV Lines
- 7x 138kV Lines
- Project Cost $29M, 2024 In Service Date

345kV System



Asset Renewals

- 345kV
  - 4 Oil Breakers
  - 7 Disconnect Switches
  - 3 Arresters
- 138kV
  - 7 Oil Breakers
  - 12 Arresters
- Building and Equipment
  - Control House
  - 21 Relay Panels (not including remote end replacements)
  - 2 RTU's
  - 3 Batteries, 5 Chargers
- All asset renewals are based on performance and reliability

Breakers

- 345kV
  - 4 1970-vintage Westinghouse 3450-GW-25000 oil breakers
    - Breaker is in “obsolete” status per ABB, no longer supported for engineering or parts
    - Type “O” bushings are prone to leaks and have been problematic at this site
    - Large volumes (3,465 gallons) of oil per tank, three tanks, have tendency to leak due to their large physical size. No oil containment system for existing breakers.
    - Skill of the craft is diminishing for this asset type with only a few left on our system.
- 138kV
  - 7 1969 vintage Westinghouse 1380-GM-15000 oil breakers
    - Breaker is in “limited” status per ABB, minimal support for engineering or parts
    - Type “O” bushings are prone to leaks and have been problematic at this site
    - Gaskets and O-rings have a finite life, dresser fittings and control valves develop leaks over time, may prevent breaker from closing

Relay Panels

- 21 relay panels
  - Replacing obsolete technology with modern standardized schemes delivers superior protection, performance, redundancy, alarming, remote fault investigation, root cause analysis and restoration
  - 46 electromechanical relays
    - Parts are no longer available
    - Limited craft labor for maintenance
    - Originally installed in 1969 and 1970
    - Relays can fail without alarming and awareness by Operations
  - 27 microprocessor and solid state relays
    - Microprocessor relays have a 25-year life of power supply and internal capacitors which can lead to failure without awareness by Operations

Bus Design Upgrade for System Resiliency

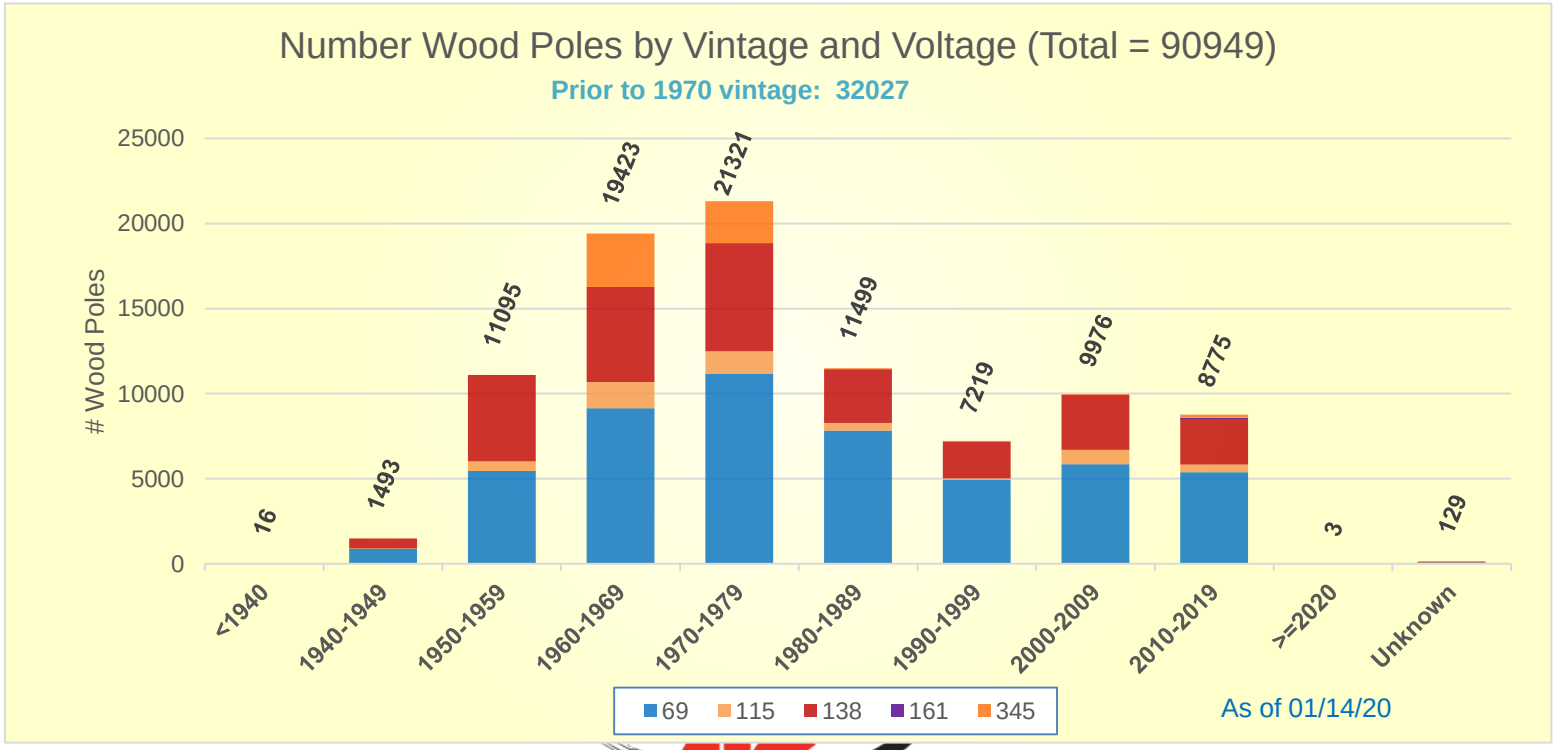
- The extent of the 345kV asset renewal work makes this an opportune time to revisit bus configuration needed for the next 50 years
- Reliable constructability plan is key!

Granville Substation Strategic Outlook

- Long Range (2024 and beyond) Strategic Outlook
  - High-priority local delivery role will continue
  - High-priority regional 345kV network facility for power transfer
  - Need for a robust bus configuration
  - Need to ensure station and equipment reliability

Wood Pole Transmission Lines – 20 year Outlook

- Objective is to manage condition and preserve reliability and safety as these assets reach end of life.
- Pre-1970 vintage wood poles are likely to be replaced in the next 20 - 25 years.



Asset Management Renewal Needs - T-Line

ATC will need to rebuild approximately 100 miles per year of original wood construction.

Future needs include;

- Rebuild of steel poles and lattice structures with some of the oldest vintages from early 1900's
- Asset renewal of line insulators and more minor hardware to ensure adequate performance

20 Year Outlook - Estimated Wood Poles Installed on ATC System Prior 1970

Voltage Class	Mono Wood Poles	Multi - Wood Pole Structures *	Number of Wood Poles on Multi-Wood Pole Structures	Grand Total Number of Wood Poles	Grand Total Number of Wood Structures	Average Span Length (ft.)	Number of Miles per Year Next 20 Year
69	14075	653	1428	15503	14728	300	42
115	7	1036	2135	2142	1043	650	6
138	964	4924	10280	11244	5888	650	36
345	0	1528	3146	3146	1528	950	14
Grand Total	**15046**	**8143**	**16989**	**32035**	**23189**		**101**

* Multi - Wood Pole Structure is comprised of two (H-Frame) or more wood pole structures. As of 1/20/2020.

Asset Renewal T-line Needs Example (past vs. project complete)

- Portage – Dam Heights 69kV Rebuild
  - Project Background
    - Approximately 25 of miles of rebuild
  - Past Needs
    - Condition and Performance Issues
    - Replace 1910's vintage lattice structures
    - Outages: One of the most frequently outage ATC lines
      - On average about 4 outages per year
      - Need to update to avian friendly design
      - Improved lightning performance
  - Current status
    - Project went in-service Fall of 2017
    - No outages since the new design went into service

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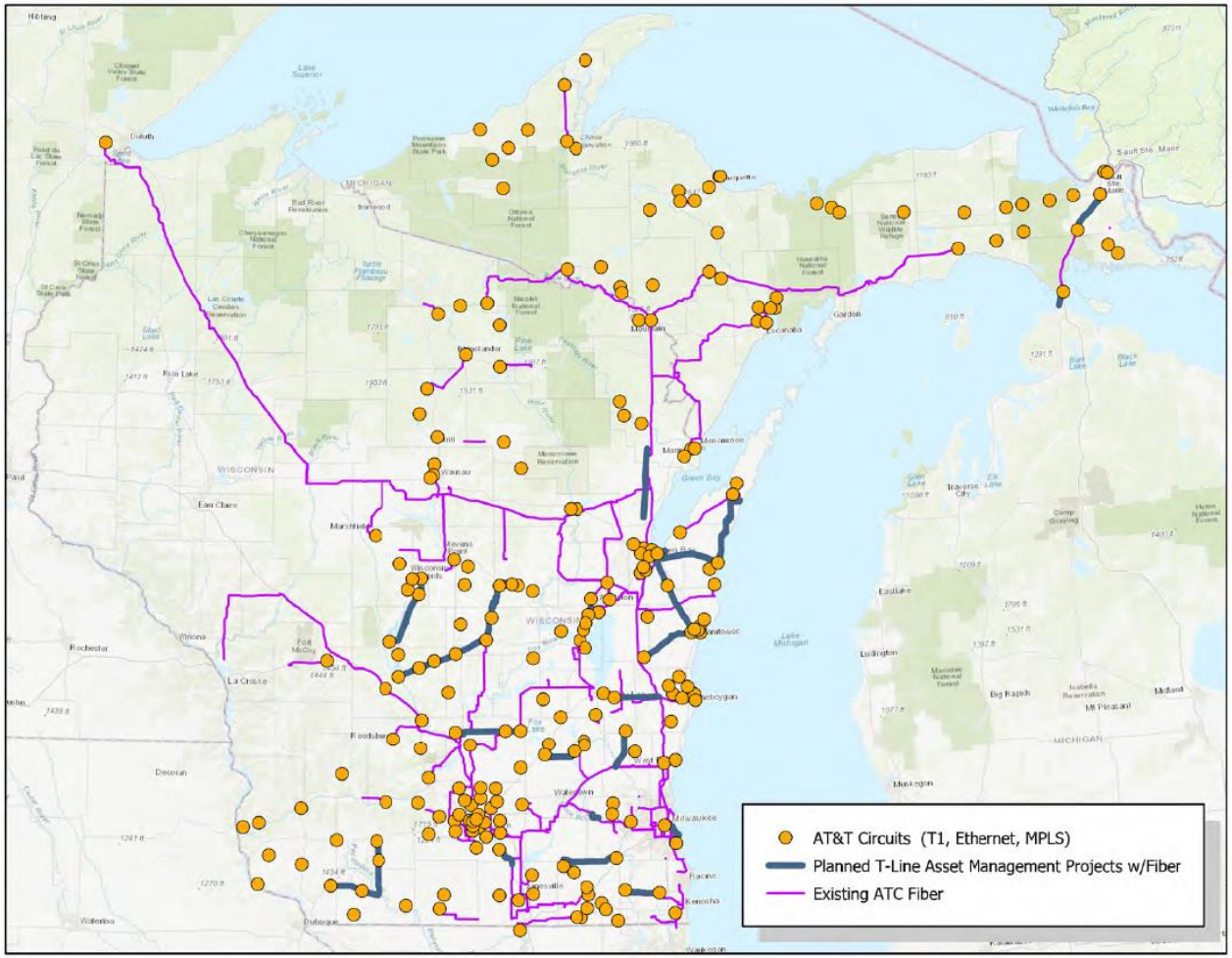
Communications Projects
-In Service and Active Projects



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Communications Projects - 2020 & Beyond

No New Communications Projects for the 2020 TYA

Challenges, Trends & Opportunities

- **AT&T Performance & Customer Service Challenges**
- **Substation Communication Demands**
- **T-Line Asset Management Alignment**
- **LDC Partnership – (Shared Communications)**

Non-Transmission Alternatives (NTAs)

- ATC and MISO work together in the TYA and MTEP processes to provide Stakeholders an opportunity to provide NTA Feedback on Projects
- MISO posted a listing of NTA eligibility for ATC's MTEP20 Target A Projects with the meeting materials for Subregional Planning Meeting (SPM) #1
  - Materials Posted with January 23, 2020 MISO meeting calendar
  - Feedback to MISO due before SPM#2 June 2, 2020
- ATC provided a full list of MTEP Appendix B and Target Appendix B projects during the pre-SPM#1 outreach conference calls.
  - ATC's latest TYA project list included with the meeting materials.

NTAs, cont.

- ATC can provide a summary of the Project need drivers
  - Provide feedback on NTA interest to ATC
  - Coordinate with MISO as needed

- NTA Attributes:
  - Must be timely in mitigating reliability needs
  - Must address the full range of needs/benefits
  - Must provide a “Best Value Plan” for customers

System Planning Assessment - Criteria and Practices Changes

- 2020 Assessment Criteria Changes
  - Clarified thermal emergency rating definition
  - Enhanced inverter-based stability criteria
  - Already posted as v19.5
- 2020 Assessment Practices Changes
  - none

Public Policy Requirements – Comments?

- Any public policy driven needs that may not be covered by the Assessment process?

Assessment Status

- Next Steps
  - Needs comments – due
  - Finalize needs – end of March
  - Preliminary solutions meeting/presentation – May 2
  - Finish sensitivity studies – May
  - Develop new or revised scope and cost estimates – June
  - Draft study write-up – July
  - ATC internal review/approval – August
  - 2020 Assessment publication – October

Questions?

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